Chapter 4

Archaeology of the *Eastport* and the *Ed F. Dix*

Introduction

The archaeological examination of the USS *Eastport* and the *Ed. F. Dix* presented a unique challenge. The initial study of the presumed location of the wrecks had produced strong evidence that both boats were buried beneath many feet of sediment immediately adjacent to the banks of the Red River, one of the largest rivers in North America (Birchett and Pearson 1995). This setting made the excavation of the boats a complex engineering, as well as archaeological, endeavor and it was determined early on by archaeologists and engineers at the Vicksburg District that the investigation of the buried vessels would require a two-phased approach using expertise in both fields. The first phase would, in essence, be an engineering project that would use heavy equipment to remove the approximately 33 ft (10 m) or so of overburden and expose the boats, making them accessible for archaeological examination. The second phase of research would be archaeological in nature and would involve the final excavation and recording of the exposed wrecks.

Relying on the known geology of the site and its soil conditions, the archaeological needs of the project and, above all, safety factors, geotechnical engineers with the Waterways Experiment Station (WES), U.S. Army Corps of Engineers, Vicksburg, proposed several methods for conducting the initial excavations to expose the boats (Albertson and Hennington 1992). These involved two major approaches, one requiring dewatering the site and one without dewatering, with several excavation techniques proposed for each approach. The excavation techniques put forth were wide-ranging and included using pneumatic caissons; freezing the sediment around the wreck; surrounding the remains with sheetpile; and the straight-forward approach of removing the overburden above the wreck, allowing the hole to fill with water and then using divers to examine the exposed remains (Albertson and Hennington 1992). Several of the proposed excavation methods were considered totally inappropriate at the outset and all had some engineering, safety, and economic disadvantages. Relying on an analyses of the feasibility of the alternatives, and the relative cost of the procedures, the WES study determined that dewatering the site was not practicable because of a variety of factors. Among the most important of these was that the porosity of the soils at the site would require a tremendous number of well points to keep any excavated hole dry and the cost of such an operation was prohibitive. In addition, geotechnical engineers determined that the sides of a “dry excavation” dug to the required depth of about 40 ft (12 m) would be unstable and unsafe. In particular, they were concerned about the nearness of the Red River to any large and deep hole excavated over the wreck sites. Once such a hole was dug and dewatered, the bottom would actually be below the level of the river and there was a very good chance that the river would break through the narrow space between it and the excavation.

Ultimately, it was concluded that the most feasible technique for exposing the boats would be to conduct a wet excavation that would involve removing sediment from the hole, but allowing it to remain filled with water. This approach eliminated most of the worry about caving sides because the weight of the water in the hole would maintain pressure on the sides, helping keep them stable. Additionally, the cost of this excavation method was less than all of the others considered. Heavy equipment would be used to dig down to the depth of the boats, at which point the archaeologists would become involved and conduct their excavations in what, essentially, would be a large swimming pool. Details on the excavations to expose the two boats are discussed below; but first some discussions concerning the site as it was known at the start of this project are presented. Much of this information is drawn from the report on the initial discovery and assessment of the site by Birchett and Pearson (1995).

The Search for and Discovery of the USS Eastport *and* Ed. F. Dix

Birchett and Pearson (1995) present a comprehensive discussion on the discovery of the wrecks of the *Eastport* and the *Ed. F. Dix*, and that information is only summarized here. The successful search for the vessels entailed historical research; a reconstruction of the position of historic channels of the Red River in the area of the presumed wreck; several remote-sensing surveys using proton precession magnetometers; and a program of augering and coring to locate, identify, and delineate the buried remains of the two vessels.

No concerted efforts to find either the *Eastport* or the *Ed. F. Dix* seem to have been attempted prior to the work by the Vicksburg District as reported in Birchett and Pearson (1995). As discussed earlier, the available evidence suggests that the wrecks may have become covered by sediment fairly soon after each was lost. Dr. Milton Dunn reports that the steamboat *Hesper* snagged on the *Eastport* in November 1872 (Dunn n.d.). If this is true, then that wreck was still exposed in the river channel at that date and someone knew it was the *Eastport*. However, there is no mention of either wreck in the extensive reports dealing with navigation improvements undertaken by the Corps of Engineers along the Red. Beginning in the 1870s, Corps of Engineers reports commonly mention steamboat wrecks that were hazards to navigation or were removed or were, simply, just seen by Corps personnel. This suggests that the two wrecks did not present an obvious hazard to boats traveling on the river and, possibly, that they were entirely or mostly covered by sediment by the time these reports were being made. Thus, it would appear that by 1880 the wrecks were covered by sediment, or the river had shifted to such an extent that they were no longer in the navigable channel.

However, the wreck of the *Eastport*, at least, was not entirely forgotten. Several cultural resources studies undertaken along the Red River have mentioned the *Eastport* and some have noted that the boat was known to have been abandoned and destroyed near Montgomery. In fact, several magnetometer surveys designed specifically to locate sunken boats have been conducted along the Red River, including the area where the *Eastport* was supposedly lost. None of these surveys located targets that were associated with the *Eastport* (Pearson and Wells 1999). The events of the loss of the gunboat have always been known by some local residents and stories exist that the remains of the boat have been visible within living memory. Among these accounts is that of Mr. Darryle LaCour, of Pineville, Louisiana, who reported that he found a "squarish" structure formed of upright wooden posts and boards in the river during a period of very low water in 1969. These were immediately adjacent to the large magnetic anomaly identified in this study. Mr. LaCour also found brick fragments, pieces of coal, glass, a large iron nut, a metal "seat-like" object and iron chain scattered around the wooden structure (Darryle LaCour, personal communication, letter dated February 20, 1994). He, also, indicated that he found some "large wooden timbers" some distance downstream of these materials. Mr. LaCour noted that the wooden structure and the other items disappeared when the Corps of Engineers constructed the rock-filled revetment at this location in 1980 (Darryle LaCour, personal communication, letter dated February 20, 1994).

In March 1965, a Winnfield, Louisiana, newspaper, *the Enterprise-News American*, contained an article about a piece of "rusted armor plate from the Eastport" that had been donated to the proposed Winn Parish Museum (*Enterprise-News American* March 4, 1965). The piece of armor is reported to have belonged to a Richard Briley and had been donated to the museum by a former mayor of Montgomery, Loyd Harrison. The article says nothing about when or how the piece of armor was obtained by Richard Briley and there is no Winn Parish Museum in existence today. The fact that the piece was donated

by a former mayor of Montgomery lends credence to the story that it came from the *Eastport*.

When archaeologists with the Vicksburg District initiated their search for the wreck of the *Eastport*, a principal concern was the probability that a steamboat lost on Red River would be preserved and remain today as a recognizable archaeological site. At that time, no steamboat wreck had been found on Red River, but well-preserved steamboat remains had been discovered on other western rivers and a few had been subjected to some amount of archaeological research. Among these were the sidewheel steamer *Homer*, sunk during the Civil War on the Ouachita River, a tributary of Red River (Pearson and Saltus 1993), and the *Bertrand*, lost on the Missouri River in 1865 (Petsche 1974). In both of these cases, essentially, the entire hull of each steamboat was found to be intact and well preserved. The initial assumption by the Vicksburg District was that boats sunk on the Red River, also, could be similarly preserved under a variety of circumstances. As is discussed below, the Red is an extremely active river whose course experiences constant changes and shifts over time. As the river shifts, it leaves behind fluvial sediments which, eventually, can entirely fill former channels. This characteristic of the Red River can result in the quick and rapid burial of objects, including steamboats, helping preserve those objects by removing them from the physical impacts of river current as well as from the damaging effects of weathering and oxidation (Pearson et al. 1981). The sequence of events that can lead to the burial and preservation of sunken boats on the Red River is modeled in Figure 4-1. It was presumed that similar events could have occurred at the wrecks of the *Eastport* and the *Ed. F. Dix*, meaning the one or both could exist as a well preserved archaeological site.

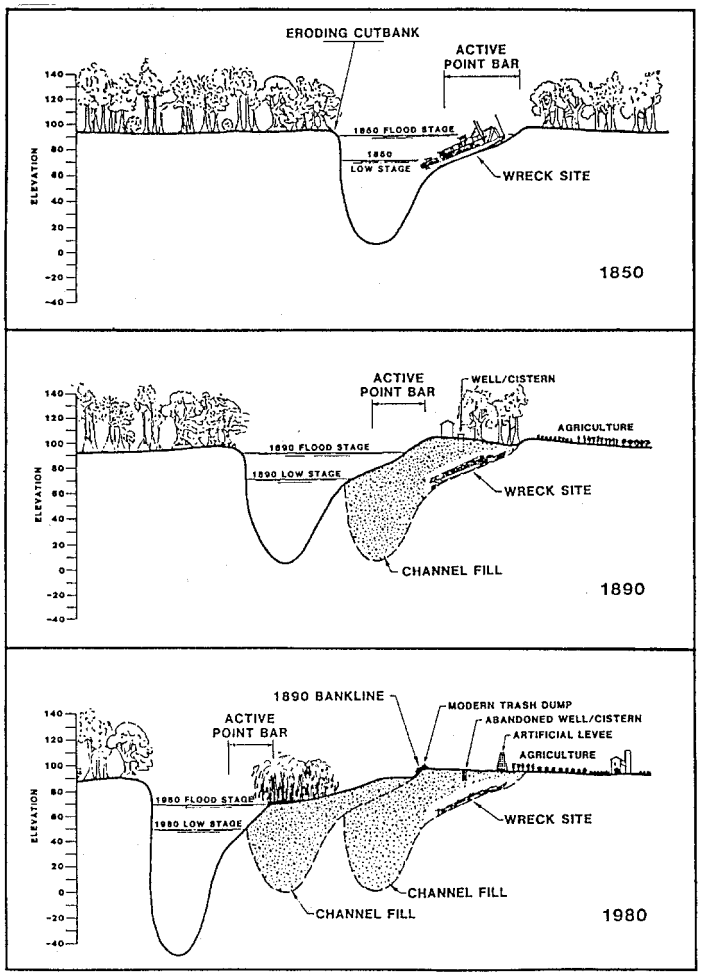

Figure 4-1. Model of processes of boat loss and preservation on Red River (source: Pearson et al. 1981).

Historical records, all of which have been mentioned in foregoing chapters, provided substantive information that the *Eastport* and the *Ed. F. Dix* had sunk at or just below the small river town of Montgomery, Louisiana. To more precisely identify the location of the wreck of the *Eastport*, a day-by-day comparative examination of the log books of three boats, the *Eastport*, *Cricket* and *Fort Hindman* was conducted. This examination not only provided information on the location of the *Eastport*, but also its position and lay in the river when it was scuttled. This information aided in the interpretation and analysis of the results of the archaeological excavations, as is discussed later. Entries from the deck logs of the three vessels for April 25 and 26, 1864, are provided below:

April 25:

12 to 4 am — *U. S. S. Eastport* — 12:30 got the Champion No. 5 pulling at a hawser to Juliet up the stream. Parted hawser after three or four attempts. 2 am run a 6 inch hawser ashore from her bow to a tree and back on board and took it to the Champion No. 5 capstan and have a strain

upon it.

U. S. S. Cricket — Eastport aground off Montgomery.

4 to 8 am *U. S. S. Eastport* — At 6:30 got a spar astern and have our stern out from the Fort Hindman at the same time having her head in shore. At 7:40 got the ship afloat. 8:00 pumps at work.

U. S. S. Fort Hindman — 6:16 steamer New Champion took a line from stern of USS Eastport pulling her up stream. We heaving at capstan. 7:45 USS Eastport afloat.

8 to 12 am *U. S. S. Eastport* — Cast loose and steamed down river. And short time after got aground on the bar. Got out lines. All hands assisted by the Fort Hindman, New Champion engaged in getting the ship afloat.

U. S. S. Fort Hindman — Brought off our men from USS Eastport. Also our 9 inch line left on bank. 10:50 made fast to the Champion No. 3 and commenced taking on rails, USS Eastport again aground. Flag Ship signaled...cast off our lines and dropped down astern of the Eastport. 11:55 ran two lines ashore took one from stern of the Eastport to our capstan and commenced heaving in.

12 to 4 pm *U. S. S. Eastport* — Succeeded in getting afloat 2:15. 3:30 took on board a large quantity of rails...3:50 got underway for down river.

U. S. S. Fort Hindman — At 1 Eastport afloat dropped down short distance and tied up to bank. Sent men to Eastport to take on rails.

U. S. S. Cricket — Champions 3 and 5 pumping Eastport.

4 to 6 pm *U. S. S. Eastport* — At 4 grounded on 5 1/2 feet water. 4:15 put our two 6 inch hawsers on board the Fort Hindman.

U. S. S. Fort Hindman — At 4:15 Eastport again aground ran up and made fast to her...At 5:40 ran along side bank and made fast.

U. S. S. Cricket — Cast loose and steamed down river followed by Fort Hindman, Eastport and Transports Champion No 3 and 5, 5:20 came to anchor 3 miles below Montgomery.

6 to 8 pm *U. S. S. Eastport* — All hands engaged in trying to get the ship afloat.

U. S. S. Fort Hindman — Crew at work getting Eastport afloat.

8 to 12 pm *U. S. S. Fort Hindman* — At 10:30 pulled bow of USS Eastport off. 11:20 cast off our lines from the bank. Dropped down the stream and made fast our 9 inch hawser to the stern of USS Eastport.

April 26:

12 to 4 am *U. S. S. Eastport* — 12:15 put out a line to the Champion No. 3 from our bow for the purpose of pulling her around. We did not succeed. 2 o'clock called all hands to Muster and informed them that the ship must be destroyed by blowing her up.

U. S. S. Fort Hindman — At 2 commenced taking on board all the equipments and officers baggage from the Eastport.

4 to 8 am *U. S. S. Cricket* — Received from Eastport 3 battle lanterns and one engineers [lantern ?].

8 to 12 am *U. S. S. Eastport* — Finished transferring all that we save from the ship.

U. S. S. Fort Hindman — Took crew and officers of USS Eastport aboard...At 10 am guerrillas fired into USS Cricket, Juliet and Champion No. 5. We fired our stern guns and they retreated.

U. S. S. Cricket — Received from Eastport 1 cook stove. 9:00 weighed anchor and made fast to the bank. 10:30 the Rebels fired several volleys of musketry and attempted to board us but did not succeed.

12 to 4 pm *U. S. S. Eastport* — Fired trails of cotton leading to the Powder...1:30 Capt. Phelps fired and shoved off and at 1:55 the ship

	blew up setting her on fire completely destroying her.
	U. S. S. Fort Hindman — 12:40 steamed up to Eastport and made fast to her stern.
	U. S. S. Cricket — 2:10 blew the US Steamer Eastport up.
4 to 6 pm	*U. S. S. Fort Hindman*— At 5 the fleet attacked by a battery of 12 and 24 pounder guns from the left bank of the river. The Cricket ran by the battery and proceeded on down the river.

The various logs, plus other accounts, all indicate that the *Eastport* was scuttled a short distance below the town of Montgomery. The boat had run aground on a bar or shallow that had only 5.5 ft of water and seems to have extended across the river. Admiral Porter's statement that the boat came to rest with "a bed of logs under her," suggests that the bar had, also, trapped logs and other debris carried by the river (ORN I:26:73-74). The reports reveal that the boat lay across the river channel; the gunboat's stern was at the west bank and the bow was out in the channel, pointing toward the east bank of the Red. As will be seen in following sections, these assumptions about the lay and condition of the wreck as derived from the historical record became critical in understanding and interpreting the physical remains recorded during archaeological investigations of the *Eastport*.

Relying on this information about the probable location of the *Eastport*, a first step was to determine the position(s) of the channel of the Red River in this area when the two boats were lost. As noted, the Red River is characterized by frequent changes and shifts in its course. As depicted in the model presented as Figure 4-1, the preservation of the *Eastport* and *Dix* as archaeological sites relied on the assumption that the Red River had shifted course in the area where the sinkings had occurred. Assessing these course changes is, generally, considered a prerequisite to most archaeological research along Red River, because it can lead to the identification of the relative ages of various river valley landforms and, as in the present instance, can often be used to identify the locations of former courses of the river. For over 30 years, archaeologists and geologists working in the Red River valley have recognized the active nature of the river and numerous studies have been undertaken that rely on geological, archaeological and cartographic sources to assess river movements over space and time (Pearson and Hunter 1993).

In order to identify the circa 1864-1865 position of the Red River below Montgomery, Birchett and Pearson (1995:39-41) utilized a series of historic maps that show the river course. Because the Red River has been so important to navigation, numerous maps of the river have been made, however, the most accurate of these have been produced since the 1870s, when the Corps of Engineers began its principal work along the river. Figure 4-2 presents a detail of an 1889-1890 Army Engineer map of that portion of the Red River in the vicinity of Montgomery that demonstrates the great detail found on many of these engineering maps. Of additional interest is the hydrographic information on this map, indicating that the shallowest portion of the river in this area was between 1 and 1.5 miles below Montgomery (between river miles 347 and 348 in Figure 4-2). It is impossible to know if this is exactly reflective of the hydrology of 1864, but it is suggestive of shallow water conditions along this stretch of the river. Importantly, this is the area where all of the historic evidence indicates the *Eastport* ran aground for the last time. As it turned out, this, also, is the area where the wrecks of the *Eastport* and *Ed. F. Dix* were found.

Earlier maps of the river exist, but are less accurate. Among the most pertinent maps to this study are what are known as the "Captured Confederate Maps," a series made during the Civil War and acquired by the Union that portray a great deal of information on the locations of roads, ferries, houses, etc. These maps, also, often show the locations of military positions, fortifications, troops and the like. A detail of the 1865 captured Confederate map for the Montgomery area of what was then Winn Parish is shown as Figure 4-3. This map contains the notation that there is a "Good Boat" (i.e., a ferry) at Montgomery Landing, and it also shows the location of the "Old Ferry" (with "No boat") and road to Cloutierville a little over 2 miles below the town of Montgomery (National Archives 1865). One feature of interest shown on this map is the road running south from Montgomery to the Cloutierville Road Ferry. The map shows that the road runs immediately adjacent to the Red River from the middle of Section 29 south. The road was almost certainly placed on the upland formations of the area, suggesting that the river was adjacent to or very close to the highlands in Sections 29 and 32. It should be noted that the course of the river shown on this map

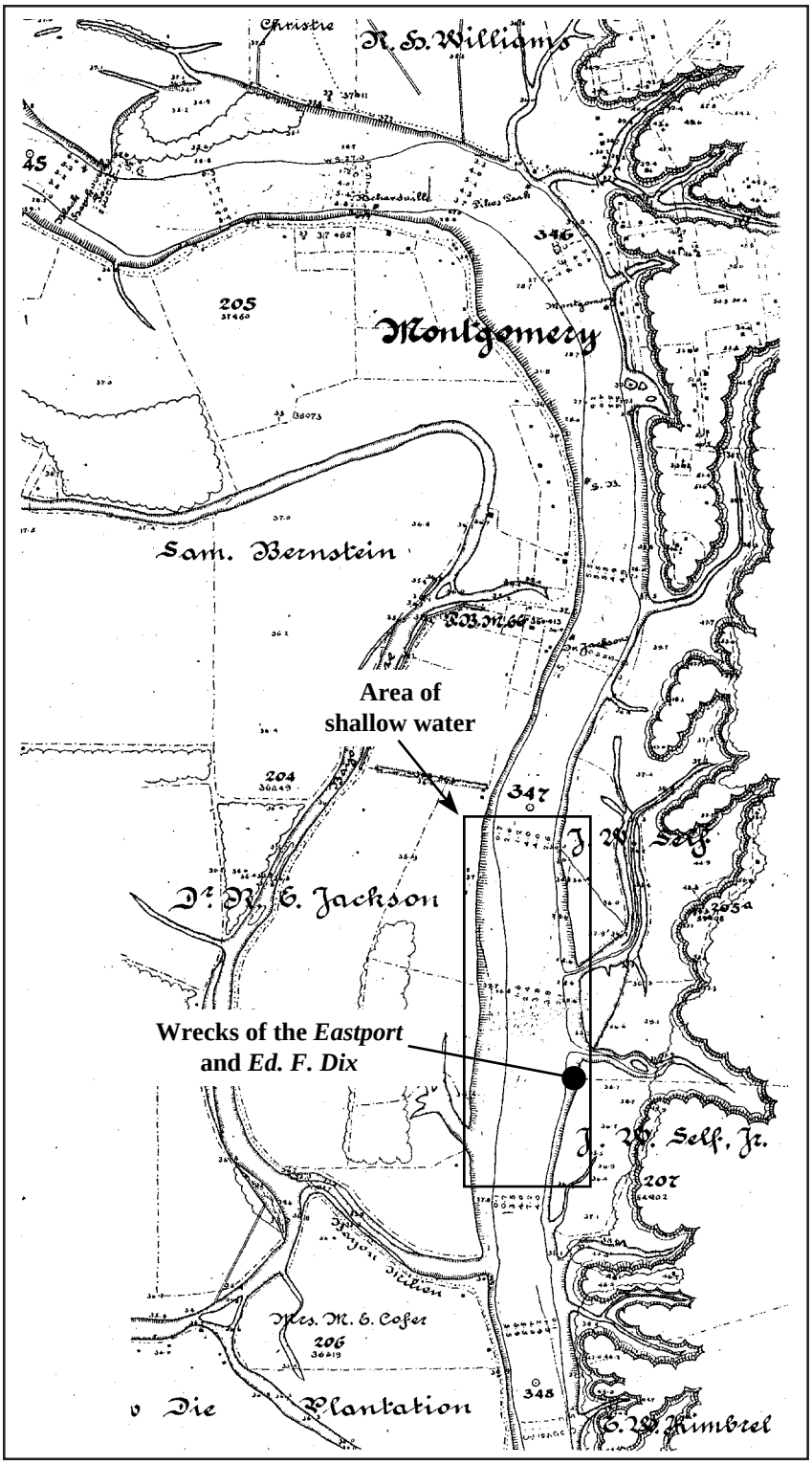

Figure 4-2. Detail of 1889-1890 U.S. Army Engineer map of the Red River below Montgomery, Louisiana. The area of shallowest water is outlined and the location where the wrecks of the *Eastport* and *Ed. F. Dix* were ultimately found is shown (source: U.S. Engineer Department 1892:Sheet 38).

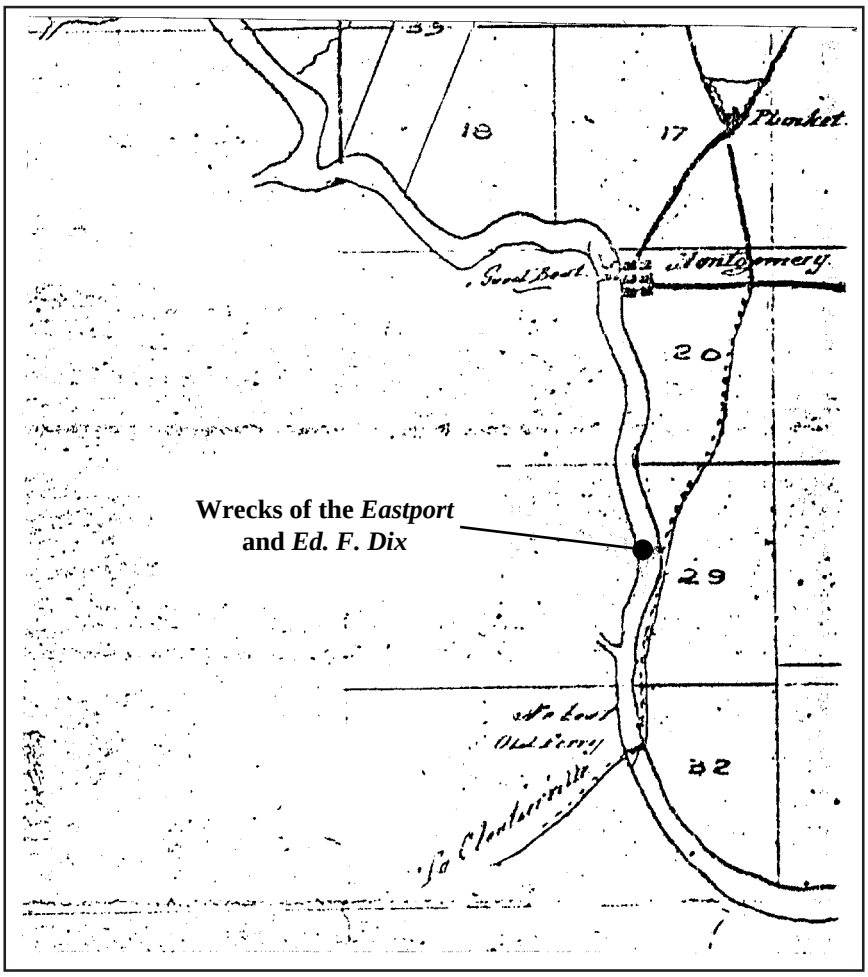

Figure 4-3. Detail of 1865 "Captured Confederate Map" of Winn Parish, Louisiana, showing the Red River near Montgomery. The river course is taken from the circa 1829 federal land survey plat map of Winn Parish. The location of the wrecks of the *Eastport* and *Ed. F. Dix* is shown (source: National Archives 1865).

is certainly derived from earlier plat maps and probably portrays the channel position of about 1829-1830. Today, the channel of the river is almost one-quarter of a mile away from (west of) the edge of the uplands in this same area. Even though there are likely to be inaccuracies in this map, it did appear that the river had shifted to the west in the area a mile or so south of Montgomery, the same area that historic accounts report the *Eastport* was abandoned and scuttled.

As is evident, this map lacks the detail of the later Army Engineer maps, but the land section information can be correlated with features found on the Engineer maps of the late nineteenth century and on more recent topographic quadrangles. Using these two maps, as well as later ones, Birchett and Pearson (1995) were able to reconstruct the channel chronology of the Red River below Montgomery and demonstrate conclusively that the river along much of this area has shifted continuously to the west since the mid-nineteenth century. Figure 4-4 presents a simplified version of the map overlay developed by Birchett and Pearson showing the present course of the Red, the course based on the late 1820s public land survey maps as portrayed in the Captured Confederate Map series, and the circa 1890 course derived from Army Engineer maps. This figure, also,

shows the area where the search for the two wrecks was conducted and the location of the large magnetic anomaly that proved to be the remains of the *Eastport* and *Ed. F. Dix*. As can be seen in Figure 4-4, where the river impinges upon the Tertiary and Pleistocene uplands immediately adjacent to the town of Montgomery it has occupied almost the same position for the past 170 years or so. However, beginning about 1.5 miles below Montgomery, the river has shifted to the west, and this shift increases with distance down river. The *Eastport* is reported to have been abandoned between 1 and 2 miles below Montgomery in the main channel of the Red, in fact, the hulk supposedly blocked a major portion of the 1864 river channel. This means that the remains of the *Eastport*, and those of the *Ed. F. Dix* that sank on top of it, if they existed, would be on the eastern side of the present course of the river. Relying on the model of preservation portrayed in Figure 4-1, it was hypothesized that as the Red moved to the west it would have deposited large quantities of silt, sand, and clay over the wreck sites, eventually covering the remains of the two boats and, possibly, preserving them.

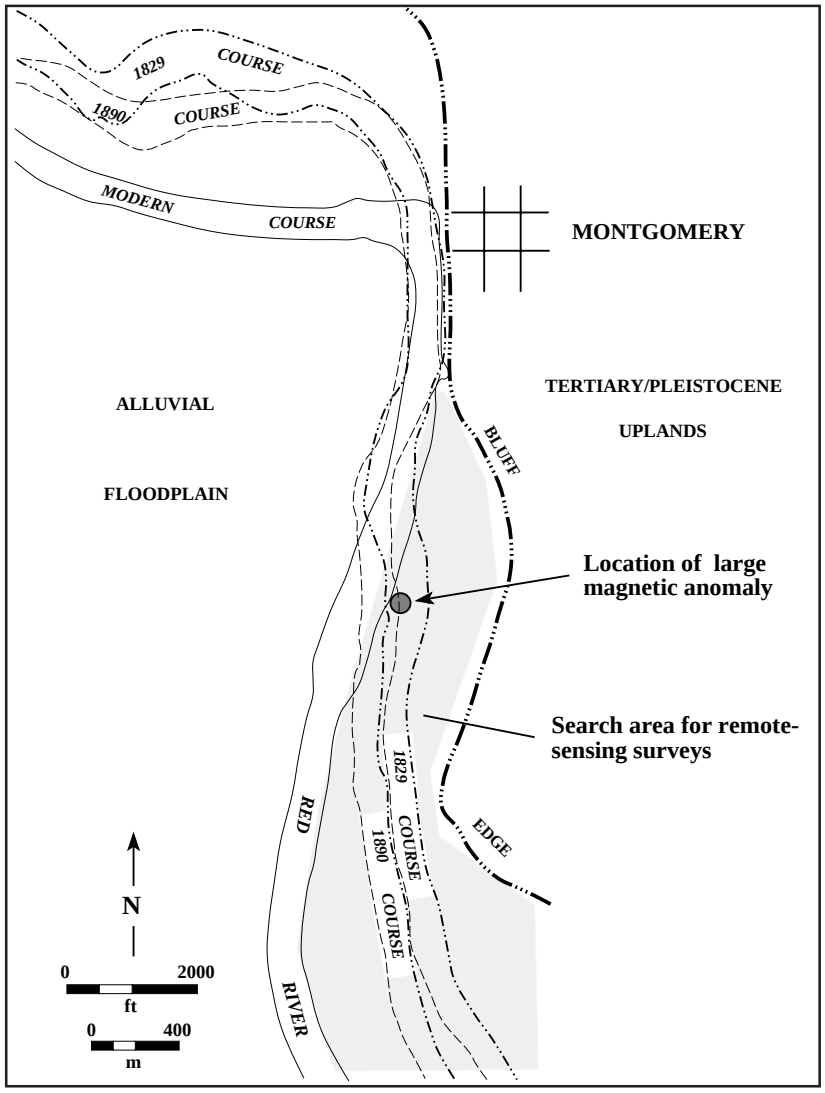

Figure 4-4. Reconstructed historic Red River channel courses near Montgomery. The area within which the search for the *Eastport* and *Ed. F. Dix* was conducted is shaded and the location of the large magnetic anomaly recorded during the search is shown.

The Natural Setting of the Search Area

The channel reconstructions and the historical information on the sinkings of the two vessels allowed the delineation of a relatively small area within which to initiate a search for the wrecks. This area consisted of the modern floodplain on the east side of the Red River below Montgomery between the present channel of the river and the Pleistocene and Tertiary age uplands that border the river valley (Figure 4-4). Upriver of what was eventually identified as the site of the two wrecks, at what is known as Montgomery Landing, the Red River is cutting into these uplands producing bank exposures of, mainly, Tertiary deposits up to 10 m high. Paleontological and geological research conducted at this outcrop has collected samples of numerous fossil animals, as well as an almost complete skeleton of a whale and one of the finest examples of an Eocene Basilosaurus skull known (Schiebout and van den Bold 1982).

The lowest stratum in these exposures consists of dark gray lignitic clays, known as the Cockfield

Formation, the lower parts of which are covered by river mud during low water (Figure 4-5). Above the lignitic clays is a fossiliferous, glauconitic marl bed (the Moodys Branch Formation), topped by a thin calcareous ledge. Above this calcareous bed are a series of beds consisting of greenish-gray clays, known as the Yazoo Formation, which, in places is very fossiliferous (Schiebout and van den Bold 1982). These deposits are highest at, and just below, the town of Montgomery, where they form the immediate river bank. The deposits slope downward to the south (i.e., downstream) such that they disappear and are covered by modern alluvium less than 2 miles below Montgomery. The Cockfield Formation consists of relatively hard and durable sediments and produces "shallows" in the Red River below Montgomery (Albertson and Hennington 1992). These are almost certainly the shallows on which the *Eastport* lodged in late April 1864.

In most of the designated search area, these earlier geologic formations are covered by a mantle of recent floodplain deposits of varying thickness. The surface of these deposits is relatively flat, although shallow depressions of former channel courses can be seen, plus, in places the floodplain surface is cut by gullies produced by runoff from the uplands. These features are particularly evident in Figure 4-2.

Remote-Sensing Efforts

Pedestrian Magnetometer Survey

In 1989, one of the authors, Tommy Birchett, at the time an archaeologist with the Vicksburg District, initiated a remote-sensing survey of the selected search area using a magnetometer. As shown in Figure 4-4, this search area extended from the bluffs just below Montgomery south for a distance of about 3 miles and included all of the floodplain between the modern course of the Red and the edge of the uplands to the east. The initial phase of the search involved the examination of selected locales in areas encompassed by the projected circa 1864 channel course. This selection was made on the basis of the configuration of the Red River channel as reconstructed from various historic maps.

The magnetometer used in this pedestrian survey was a Geometrics 856 portable proton preces-

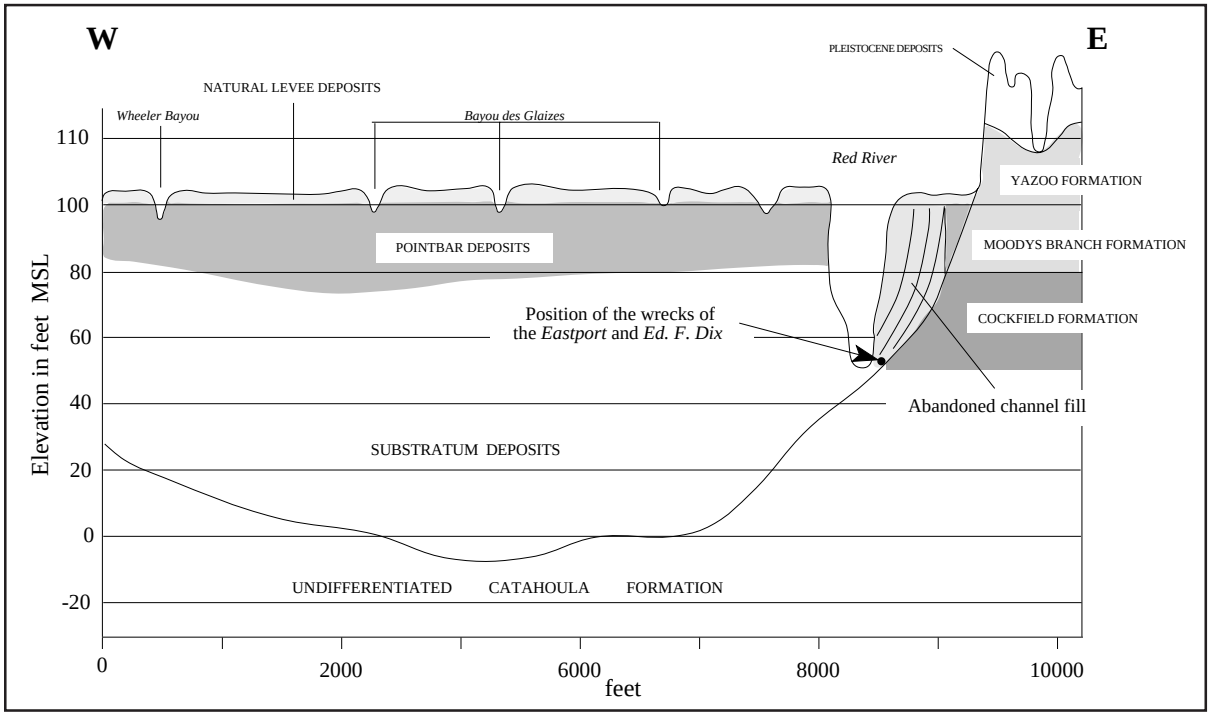

Figure 4-5. Geologic cross section of the Red River valley just below Montgomery. The position of the wrecks of the *Eastport* and *Ed. F. Dix* relative to geological features is shown (after: Albertson and Hennington 1992; Smith and Russ 1974).

sion magnetometer. This model is easy to operate with push button controls and can store up to 1500 magnetic readings. It can be programmed to record the time, date, station number and gamma readings and can be linked with a computer to download data for processing. With a software package known as MAG-PAC, collected magnetic data can be corrected for time variations, filtered, smoothed, and averaged and magnetic profiles can be produced.

The success of the proton magnetometer in locating cultural resources, specifically submerged or buried vessels, has been amply demonstrated by other research. Because of the large amounts of iron they contain, steamboat wrecks, generally, can be expected to produce magnetic readings in the hundreds of gammas, well above background levels, particularly, in an area that is basically pasture and river bank deposits. Some geologic formations do occur in the project area that could affect the magnetic readings, but these influences would be expected to be quite small; not enough to mask the typical magnetic signature of a steamboat.

One concern of this first survey centered around the depth of burial of the wrecks of the *Eastport* and *Dix*, as this would have a great influence on the magnetic signature recorded at the ground surface. This is because of the rapid "fall-off" rate, or the change in magnetic amplitude with distance. For a typical iron object, the intensity of its magnetic signature (i.e., anomaly) is inversely proportional to the cube of the distance. One pound of iron, for example, would produce an anomaly of 100 gammas at a distance of 2 ft. At a distance of 10 ft the same pound of iron would produce an anomaly of only 1 gamma. A 1000-ton ship could produce a 700-gamma anomaly at 100 ft and a barely discernible 0.7-gamma anomaly at 1000 ft. In the instance of an ironclad warship, such as the *Eastport*, the armor cladding, machinery, iron construction elements and ship's fittings (nails, spikes, chain, etc.), add up to a tremendous mass of ferrous material. With the magnetometer sensor located near the ground surface, it was anticipated that the wreck of the *Eastport* would produce a magnetic signature of several hundred gammas or greater covering an area at least 150 ft across if the vessel was buried 30 ft or so below the ground surface. This distance represented the presumed maximum depths that sediment had accumulated in the delineated search area since the time of the sinkings. Further, if the wreck of the *Ed. F. Dix* lay on or adjacent to the *Eastport*, the magnetic signature should be even larger. It was anticipated that wrecks the size of the *Dix* and *Eastport* would produce an easily detectable magnetic anomaly (i.e., greater than 25 gammas) even at a distance of 100 ft or so (Birchett and Pearson 1995).

This preliminary pedestrian search was conducted by Birchett between May 15 and June 1, 1989. This survey was a true reconnaissance and concentrated on the identified circa 1864 river channel location as determined from historic maps. In addition, the survey was confined to easily accessible areas; primarily, roadways and fields that fell within these older channel locations. As a result, most of the pedestrian examination was confined to areas in the lower, or southern, part of the search area, where open field areas were concentrated. Coverage in the larger open areas was achieved by parallel transects spaced about 75 ft apart. Some of the easily traversed, open wooded areas, also, were examined during this survey.

Several small magnetic anomalies were located by this survey. Most of these were situated along the edges of fields. Careful examination of these targets revealed that many were associated with modern agricultural trash and debris, which is commonly concentrated along field edges. All of the other magnetic anomalies appeared to be too small to be considered as likely candidates for the *Eastport* and *Ed. F. Dix*.

All of these readily accessible areas were explored with negative results. By this time, the Red River was rising and the sloughs and low portions of the search area were filling with water and additional pedestrian survey was either impossible or would be extremely time consuming. It was decided that examination of the remainder of the search area could best be accomplished by aerial survey.

Aerial Remote-Sensing Survey

The purpose of the aerial survey was to cover as much of the search area as possible in hopes of obtaining a magnetic "hit" which could later be more carefully examined with pedestrian magnetometer survey. The aerial survey was considered feasible in view of the large magnetic signature expected from the combined wrecks of the *Eastport* and *Ed. F. Dix*. The survey was accomplished using a standard Vietnam-era Huey helicopter. This particular helicopter had a seating capacity for 6 people. It was detailed from the Louisiana National Guard as a low level training mission and was commanded by a crew of three individuals: pilot, co-pilot and a crew chief. J. Barto Arnold, III, at the time the Texas Marine Archae-

ologist, was contacted for suggestions on how to implement the aerial survey. He had undertaken several successful aerial magnetic surveys in the search for shipwrecks in marine settings and his recommendations proved valuable in this project.

The magnetometer used was the same one employed in the pedestrian survey, the Geometrics model G-856. The sensor was suspended by a 75-ft-long ski rope to remove it from the magnetic interference of the helicopter. Initially, a Styrofoam fuselage and wing from a toy airplane was attached to the magnetometer sensor to provide stability, but this was quickly torn apart by the down draft of the helicopter. It was then decided to just suspend the sensor upside down on the rope with no stabilizer. For a few records the sensor rotated, but quickly stabilized once the rope stretched tight. The sensor was lowered by hand when survey began and trailed slightly at an angle almost directly below the helicopter.

The magnetometer was set on automatic mode to take a reading every 3 seconds. The helicopter was flown at the slowest speed possible while maintaining a straight and steady flight path. This represented a speed of approximately a 3 to 5 miles per hour, meaning that one magnetic reading would be taken about every 18 to 20 ft on the ground. This was deemed a sufficiently small interval between readings, because it was considered likely that the magnetic signature produced by the combined *Eastport* and *Dix* wrecks should cover an area over 150 ft across. The G-856 magnetometer does not produce a hard-copy strip chart such that the operator in the helicopter had to visually observe and manually take notes of the readings produced during the flight. However, readings were stored in the instrument's memory for later analysis.

At the search area, several practice runs were conducted to assess and organize the equipment and the procedures for the survey. The rope with the sensor was hung out the right side of the helicopter and tied to floor straps at the back seat. The magnetometer console was supported on the floor between the legs of the operator who faced outside in order to observe the sensor as it passed over the search area. Another individual lay on the floor of the helicopter and kept watch on the sensor and provided information to the pilot as to its elevation above the trees, which covered a large portion of the search area. The pilot tried to keep the sensor as close to the tops of the trees as possible, placing it 100 ft (30.5 m) or so above the ground. In a few instances the helicopter flew too low and the sensor hit the tree tops.

Coverage of the project area was achieved with several aerial traverses, derived from a preliminary flight plan designed prior to the start of the survey. First, a series of transects were placed parallel to the river bank, extending from the Creola Cemetery, located adjacent to the Red River just below Montgomery, for about 3.5 miles (2.2 km) downstream. These lines were paced about 50 ft (15 m) apart and were positioned entirely on visual observations of the magnetometer operator and compass bearings maintained by the pilot. The Red River runs generally north/south in the search area which helped in maintaining the positions of survey lines. Second, a series of transects running perpendicular to the river were run across the project area. Again, positioning was based entirely on observation of visual landmarks and compass headings.

The initial transect was flown down the center of the river, principally to test if all of the equipment was functioning properly. During the flight along the next transect, which followed the east bank of the river, a magnetic anomaly with a total amplitude of 45 gammas was recorded just over a mile south of Montgomery (see Figure 4-4). This anomaly was recorded on five readings, representing a distance of about 90 ft (27.4 m) on the ground. No other magnetic anomalies were recorded along the several other transects run parallel to the river and at increasing distances to the east. It was then decided to fly several more passes over the location of the 45-gamma anomaly, all of which confirmed its existence. It was estimated that the sensor was about 100 to 125 ft above the ground surface at the location of this anomaly. As noted earlier, the magnetic intensity of an object drops off rapidly with distance, such that a 45 gamma reading at 125 ft would yield a very large magnetic reading at about 30 ft, the presumed approximate depth that the two vessels would be buried. Relying on a nomogram for estimating magnetic intensities at various distances from various objects presented in Breiner (1973:43), it was estimated that an object producing 45 gammas at 125 ft should produce an anomaly somewhat greater than 3000 gammas at 25 ft (i.e., near the ground surface). This magnetic intensity was certainly in the range expected for the wrecks of the *Eastport* and *Dix*.

The airborne survey proved extremely productive in light of the conditions that existed in the project area and the object(s) being sought. Of particular

importance was the large amount of magnetic material (i.e., iron) contained by the target of interest; an ironclad gunboat and a steamboat. Because of the trees in the project area and the need to keep the sensor at a height of 100 to 125 ft above the ground, objects containing smaller amounts of iron than large wrecks such as the *Eastport* and *Ed. F. Dix* would be difficult, if not impossible, to find. Objects with smaller amounts of iron would simply not produce detectable or recognizable magnetic signatures at these great distances.

Refined Magnetic Survey

Once the large anomaly was identified from aerial survey, a ground-based magnetic survey of the location was conducted. The objective was to develop a map of the magnetic signature that could be used to estimate the position, size, and orientation of the source object. This information would then be used to direct a coring program to gather information on the depth, configuration, composition, etc., of the source(s) (Birchett and Pearson 1995).

The anomaly lay immediately adjacent to the east bank of Red River, in an area generally free of trees that extended about 200 ft (61 m) back from the river. A rock-fill revetment had been constructed along this section of the river in 1980, and the anomaly lay within the bounds of the revetment, near its down river end. In fact, one of the concerns of Tommy Birchett at the time was that the construction of the revetment had accidentally impacted the wrecks of the two boats. These concerns were heightened by the discovery of several fractured pieces of iron along the bank of the river near the position of the magnetic anomaly. These pieces of iron were fairly small and could not be positively identified, but they looked like they were from machinery of some sort and there was no doubt that the pieces were in an area that had been disturbed by the earlier revetment construction. However, no Corps of Engineer records indicated that the 1980 construction had encountered any buried boat remains.

The terrestrial magnetic survey of the anomaly location was undertaken by Birchett on November 8, 1989. This survey was conducted with the Geometrics model G-856 magnetometer with the sensor mounted on a staff 8 ft (2.4 m) above the ground surface. This survey was not precisely controlled; all measurements were made by pacing, as time did not permit the establishment of a surveyed grid. Magnetic readings were taken approximately every 33 ft (10 m) along transects spaced an estimated 33 ft (10 m) apart. The transects paralleled the river and were oriented roughly north-south.

The data from this initial survey were used to produce a magnetic contour map using the mapping program SURFER (Figure 4-6). As seen in Figure 4-6, the magnetic signature consisted of a principal dipole signature (i.e., a signature consisting of a paired high and low reading) immediately adjacent to the river bank with the magnetic high to the south and the low toward the north. Another magnetic high was situated just east of the major one and another low appeared to the northeast of the primary signature. This low was picked up at the edge of the woods where the survey was stopped because of tree cover and undergrowth and because the ground began sloping down into an area that held standing water.

The magnetic anomaly recorded by Birchett was oriented in a generally east-west direction and covered an area about 250 by 360 ft (76 by 110 m). The principal dipole stopped abruptly at the river bank where the survey ended and it appeared as if the source object may extend into the river. The total magnetic deviation across the low and high of the major dipole was about 800 gammas. This signature can be classified as complex in that it consists of multiple highs and lows, although most of area occupied by the signature is composed of the single dipole. Complex magnetic signatures are considered characteristic of shipwrecks (Garrison et al. 1989) and the size and magnetic intensity of this signature seemed reasonable for the wrecks of vessels the size of the *Eastport* and *Dix*.

The initial assumption was that the wrecks would be buried by about 25 to 30 ft of modern alluvium. One technique for assessing the depth or distance to the source of a magnetic anomaly is known as the "half-width rule." "The half-width is the horizontal distance between the principal maximum (or minimum) of the anomaly (assumed to be over the center of the source) and the point where the value is exactly one-half the maximum value" (Breiner 1973:31). Breiner (1973:30) indicates that application of the rule varies according to the shape of the source object, but, in general, it can be assumed that the distance to a source object will range from the computed half-width to 2 times the half-width. Application of this formula to the magnetic signature shown in Figure 4-6, suggested that the source object lay from approximately 60 to 120 ft below the ground surface. At the time, it was thought that this

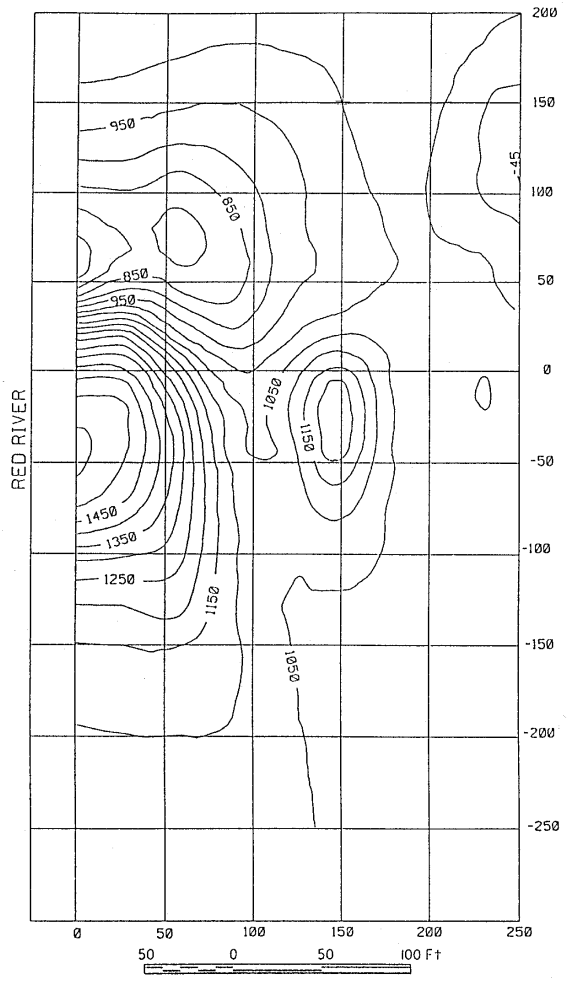

Figure 4-6. Initial magnetic contour map of the suspected wrecks of the *Eastport* and *Ed. F. Dix* (source: Birchett and Pearson 1995:Figure 19).

estimated depth was too great for the wrecks of the *Eastport* and *Ed. F. Dix*. Breiner (1973:31) does note that there can be a considerable amount of error in these depth computations, plus the computations tend to project a maximum depth. Thus, the half-width computation could be interpreted to indicate that the source object lay close to, but possibly less than 60 ft deep.

A derivation of the half-width rule, which can be applied to archaeological exploration, is a simple rule of thumb for use in the field to make quick calculations of depths for the sources of dipole signatures. This method estimates depths by calculating half the distance between the center of the high and the center of the low readings in a dipole signature. This method indicates a depth of about 50 ft for the source object of the signature in Figure 4-6. This estimate was closer to the presumed depths of the two wrecks, but still deeper than was anticipated.

Coring the Target Location

The information derived from this magnetic survey was used to direct an extensive program of augering and coring intended to locate, delineate and, hopefully, identify the source of the large magnetic anomaly (Birchett and Pearson 1995). The augering and boring effort was conducted intermittently between 1989 and 1991 under the direction of Paul Albertson, geologist with the Vicksburg District and the Waterways Experiment Station. In December 1989, immediately after the completion of the magnetometer survey, the USACE took a trailer-mounted auger to the site and drilled 13 auger holes across the center of the magnetic anomaly. Numbered 1 through 13, the locations of these augers were plotted relative to the grid established by pacing during the magnetometer survey, as shown in Figure 4-7. The augers reached a maximum depth of 30 ft (9 m) below the surface and none encountered buried material, indicating that the source object lay at a greater depth (Albertson and Hennington 1992:12).

In February 1990, a series of 14 fishtail borings were drilled at the site by the Vicksburg District under the direction of Tommy Birchett. These borings, labeled 15 through 28 in Figure 4-7, reached a greater depth than the previously-used auger and several of them encountered wood, coal, or metal at depths ranging from 38 to 51 ft (11.5 to 15.5 m) below the surface. The locations of these borings are shown in Figure 4-8. Some of the pieces of wood recovered were burned and some showed definite saw marks. These materials were thought to be associated with the remains of the *Eastport* and/or the *Ed. F. Dix*. Three borings (Numbers 18, 19 and 28 in Figure 4-7) encountered wood identified as natural driftwood.

To more precisely delineate the buried remains, a cone penetrometer was used at the site in September 1990. The sensor on the penetrometer was set so that the hydraulic probe would record only a "refusal" when the probe hit anything solid. Probes were taken on a paced 25-ft-grid over most of the area of the magnetic signature and depths to refusal were recorded. It was determined that refusals occurred when the probe struck wood, metal, coal, or the compact Tertiary surface. These data were re-

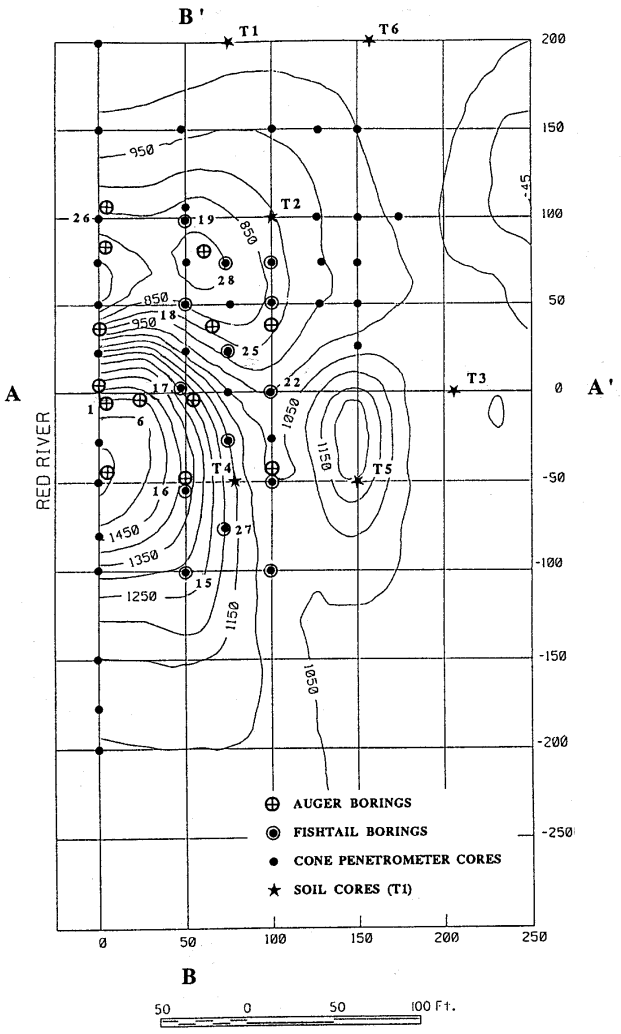

Figure 4-7. The locations of augers, boring, and soil cores at the suspected wrecks of the *Eastport* and *Dix* (source: Birchett and Pearson 1995:Figure 20).

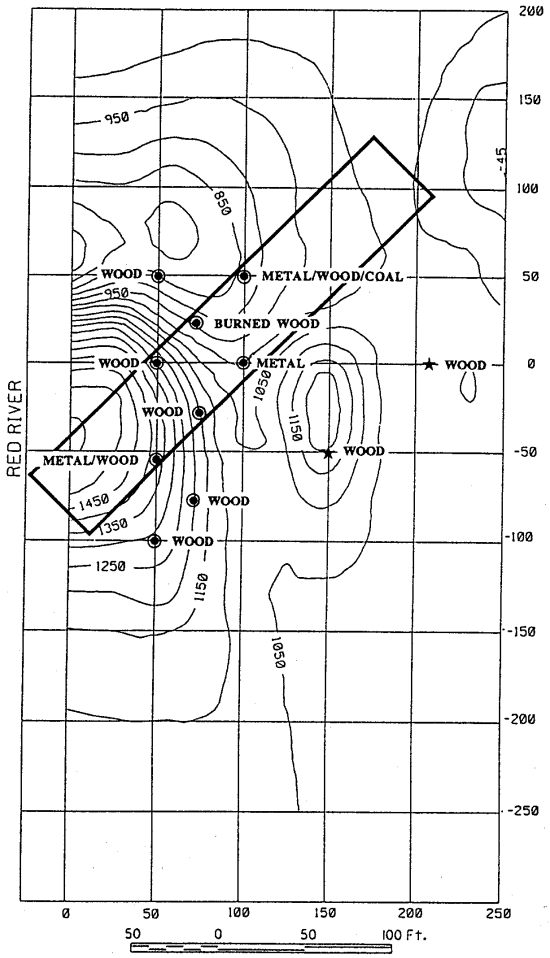

Figure 4-8. The locations of borings producing artifacts at the suspected wrecks of the *Eastport* and *Dix*. A rectangle the approximate size of the *Eastport* is shown (source Birchett and Pearson 1995:Figure 21).

corded as "hits" or "misses" and were used to refine the configuration of the buried material thought to represent vessel remains. A rectangle the approximate size of the *Eastport* was found to encompass most of the cone penetrometer "refusals" and the earlier borings that struck wood, metal or coal, as shown in Figure 4-8. Birchett and Pearson (1995:53) note that while this position seems reasonable for the wreck, it was not absolutely confirmed with the data collected. For example, borings numbered 15 and 27 hit wood presumed to be from a buried vessel, but these borings fall outside of the hypothetical wreck configuration. It was assumed that some of the corings had struck the *Ed. F. Dix*, whose position relative to the *Eastport* was unknown, or that portions of one or both wrecks were displaced and scattered downstream of the principal area of wreckage i.e., in the area of borings 15 and 27 (Birchett and Pearson 1995:51-52).

By this time, it was considered very likely that the buried remains did, indeed, represent portions of a large boat or boats of some sort, and a site form was prepared and filed with the Division of Archeology at the Louisiana State Historic Preservation Office. The site was identified as the location of the wreck of the *Eastport* and was given the site number 16 GR 33.

In November 1991, a final set of borings was taken at the site. These consisted of 6 undisturbed sample borings denoted as T-1 through T-6 in Figure 4-7. These borings, taken by the Vicksburg District's Foundations and Material Branch, were to obtain soil samples for determining the engineering properties of the sediments at the site and to aid in refining geological interpretations. Two of these borings, T-3 and T-5, yielded sawn board fragments at depths of 35 (10.6 m) and 48 (14.6 m) ft, respectively, supplying additional information on the position of the buried vessel(s). Again, these two borings fell outside of the originally hypothesized *Eastport* outline shown in Figure 4-8. Both borings were somewhat downstream of the identified major concentration of buried material, where scattered wreckage was most likely to occur, or where the *Ed. F. Dix* might lie.

Figures 4-9 and 4-10 present profiles across the site derived from the several types of borings as interpreted in Albertson and Hennington (1992). The locations of these cross sections are shown in Figure 4-7. The east-west cross section (Figure 4-9) extends from the revetment at the river bank across the site area. As shown in Figure 4-9, the ground surface lay at 100 to 106 ft NGVD (National Geodetic Vertical Datum) and dense claystone or sandstone Tertiary deposits were encountered at an elevation of 52 ft NGVD, or about 52 ft (15.8 m) below the ground surface. The hypothesized remains of the presumed *Eastport* and/or *Dix*, as derived from cone penetrometer probes and soil borings, are shown resting directly on the Tertiary surface; the surface presumed to have formed the "bar" that the *Eastport* had grounded on. Several cores and probes encountered the inferred wreck, indicating that the remains rose as much as 15 ft (4.5 m) above the Tertiary base. The highest (shallowest) parts of the suspected vessel, based on cores striking wood or metal, were encountered at an elevation of 68 ft NGVD, equivalent to a depth of 36 ft (11 m) below the surface. As shown in Figure 4-9, no cores encountered remains immediately adjacent to the river, however, the contoured magnetic data shown in Figure 4-7 suggested that the remains of a vessel could extend into or under the present river channel.

Soil boring T-3, which encountered sawn wood at a depth of about 35 ft (10.6 m) below the surface, was somewhat east of the other cores striking wood or metal (Figures 4-8 and 4-9). This suggested that

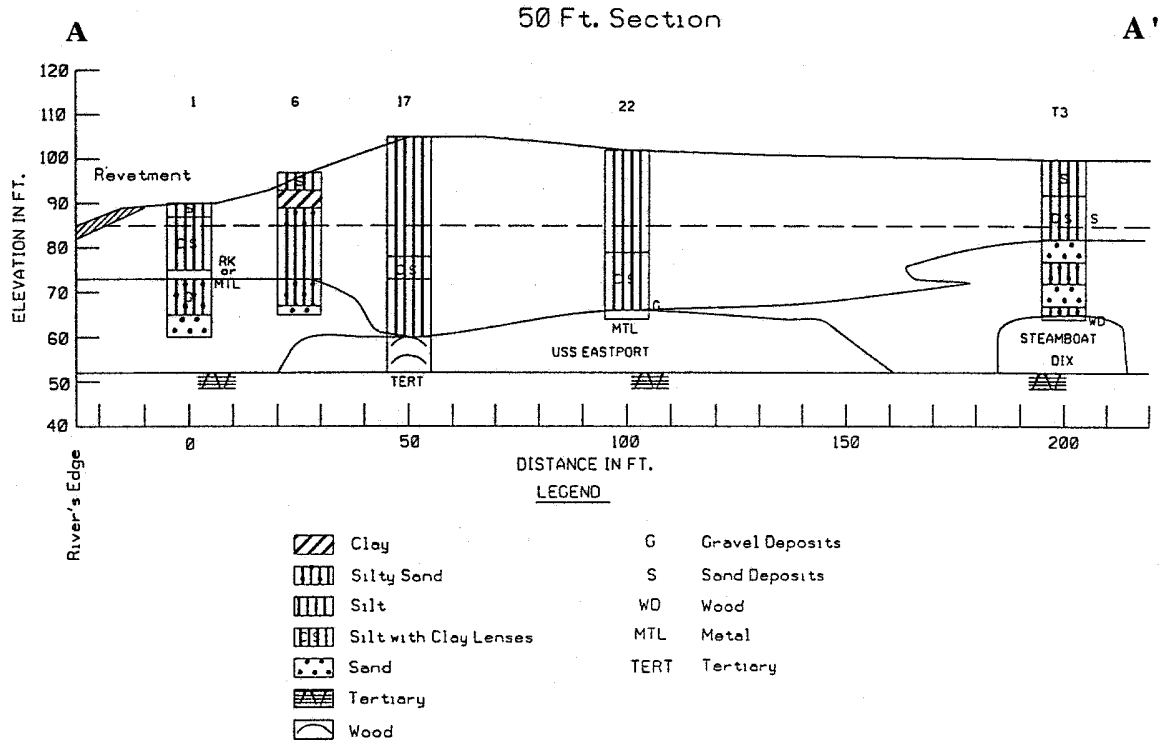

Figure 4-9. East-west cross section across the suspected wrecks of the *Eastport* and *Dix*. See Figure 4-7 for core locations (source: Albertson and Hennington 1992:20).

it might have struck a separate entity, hypothesized at the time to be the remains of the other steamboat thought to be at this location, the *Ed. F. Dix* (Albertson and Hennington 1992:20). This inference is depicted in Figure 4-9, however, it was impossible to identify with certainty any of the remains encountered in the corings. Further, as is discussed below, because the positions of the corings were determined by pacing, inaccuracies in the plotted locations of several borings were later discovered. This brought into question the reliability of the spatial relationships of objects depicted in the cross sections shown as Figures 4-9 and 4-10.

The north-south cross section shown as Figure 4-10 passes across what was identified as the remains of the *Eastport*. This section shows what was interpreted as a fairly extensive layer of drift wood lying above and upstream of the identified wreck. Several cores penetrated through this layer and the recovered wood was easily distinguished as natural, quite distinct from the wood encountered on the presumed wreck. This bank of drift wood was positioned upstream of the identified wreck; a reasonable location for river-borne wood and debris to accumulate as it washed against a large barrier produced by the likes of the *Eastport* and the *Ed. F. Dix*.

The sediments lying above the presumed vessel remains are, primarily, silty clays, silty sands and some clay lenses. This overburden material typifies modern fluvial sediments and had been deposited as the river shifted westward across the wrecks.

Recovered Cultural Material

As noted, several borings recovered pieces of wood and coal from the presumed wreck(s) and, also, encountered impenetrable metal (iron ?) in a number of locations (see Figure 4-8). Several pieces of retrieved wood contained burned areas and/or exhibited distinctive saw marks. One of these pieces was identified as a species of white oak (*Quercus alba*), a type of wood commonly used in boat construction in the Ohio River valley area, where both the *Eastport* and the *Ed. F. Dix* were built. [4] However, white oak, also, is a tree native to northern Louisiana, so its presence could not be considered positive verification of an Ohio River-built vessel (Harrar and Harrar 1962). Several pieces of coal were recovered from three corings, providing more substantial evidence that the buried objects could be steamboats (Birchett and Pearson 1995:56).

Controlled Topographic and Magnetometer Surveys

The initial magnetic survey, and the placement of the various borings, had relied on pacing as a means of determining position. This was done for expediency, however, once buried remains were found, it was obvious that more precise survey control was needed if reliable interpretations about the spatial distribution of buried remains were to be made. In June 1992, Coastal Environments, Inc., under contract to the Vicksburg District, made a topographic map of the site area and conducted a controlled magnetometer survey. This work was considered particularly important because the Vicksburg District had determined that identification of the buried remains was necessary and precise location data would be required to undertake this effort, particularly if it encompassed excavation. The 1992 surveys involved establishing a permanent datum and extending a survey grid over the site, conducting a systematic magnetometer survey on the land and in the river, and producing a precise and accurate topographic and bathymetric map. Additionally, an effort was made to tie the earlier survey and coring data to the newly-collected information. The results of this work are reported fully in Birchett and Pearson (1995).

In developing a survey grid over the site, a baseline was established along the top bank of the Red River (also, corresponding to top of the bankline of the revetment) and roughly parallel to the channel. This grid approximated the orientation of the initial grid used by the USACE during their magnetometer survey and coring program. Three iron rods were placed along this baseline to serve as survey control points and permanent datums. This line, subsequently, served as the baseline for the grid used in the excavations at the site. A Hewlitt-Packard 3810 Total Station with an EDM was used to establish a 10-ft-square grid over the entire site area and to make the topographic map. A Geometrics 801 portable, proton precession magnetometer was used for the magnetometer survey. The magnetometer sensor was placed on a staff 8 ft (2.4 m) above the ground and readings were taken every 10 ft (3 m) along the transects spaced 10 ft apart. Periodic readings were taken at a base station located at the southern end of the site

[4] All wood samples were identified by the Center for Wood Anatomy Research at the U.S. Department of Agriculture's Forest Products Laboratory in Madison, Wisconsin.

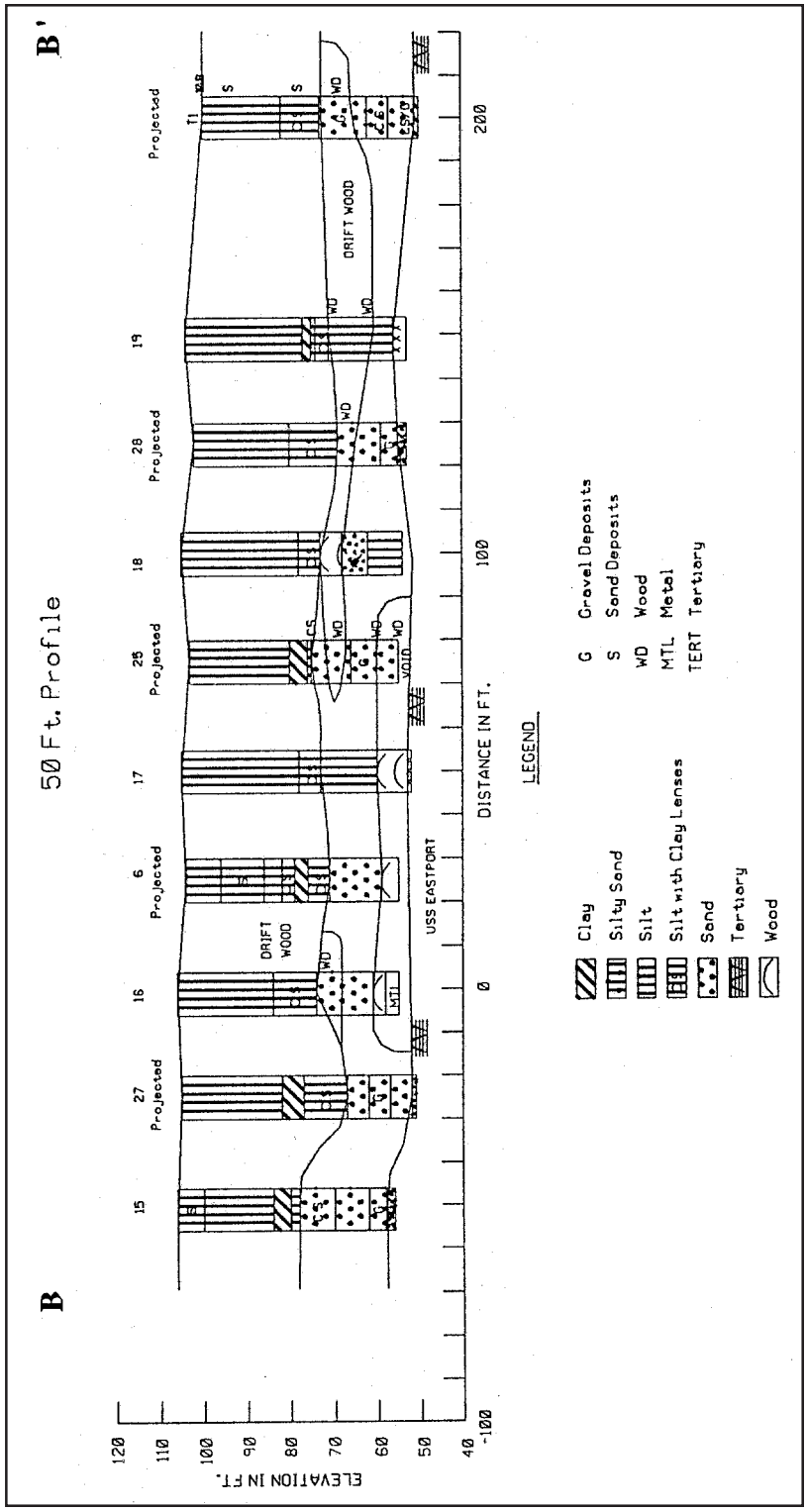

Figure 4-10. North-south cross section across the suspected wrecks of the *Eastport* and *Dix*. See Figure 4-7 for core locations (source: Albertson and Hennington 1992:21).

away from the known magnetic anomaly in order to collect data to correct for diurnal variation. Survey coverage extended for a distance of about 500 ft (152 m) parallel to the river bank, stopping when it was apparent that the limits of the magnetic signature had been reached. The surveyed area extended a distance of about 225 ft (68.5 m) away from, or east, of the river.

The river was surveyed by boat using a Geometrics 866 proton precession magnetometer. The magnetometer sensor was extended on a pole forward of the 16-ft-long aluminum survey boat, beyond the boat's magnetic influence. Bathymetric information was collected with a King Model 1060 fathometer. Survey control was obtained with the Hewlitt-Packard Total Station sighting on mirrors stationed on the survey boat. Coverage of the river area involved running a series of survey lines in a "ray" pattern away from or toward the total station set up on the riverbank.

The magnetic data were corrected for diurnal fluctuation and, with the topographic data, were contoured using the program SURFER. The map produced with these data is shown as Figure 4-11. During the survey, several of the earlier USACE coring locations were discovered. These, also, are shown on Figure 4-11 and those few that had identifiers of some sort are so designated.

The magnetic signature derived from the controlled survey covers an area measuring about 400 ft (122 m) north-south and 275 ft (84 m) east-west. The principal magnetic feature is a large dipole with, as anticipated, the magnetic low is to the north and the high to the south, as was the case with the anomaly recorded during the original survey. The maximum magnetic deflection across this dipole is approximately 800 gammas, about the same obtained during the original survey (Figure 4-11). As can be seen in Figure 4-11, however, the configuration of the contoured magnetic signature obtained with the controlled, systematic survey is slightly different from the one obtained in the original survey, shown in Figure 4-6. The highest readings of the principal dipole signature are located immediately adjacent to the river, as in the original survey, but the orientation of this major dipole, in particular the magnetic low, trends slightly north of east, while in the original survey it was more east-west. It is also quite apparent that the magnetic signature (and possibly the source object) extends into the river, although for only a short distance.

An isolated magnetic high is situated just to the east of the major dipole, immediately adjacent to the location of Boring T-3, that struck wood at a depth of about 35 ft. This boring location was one of the few core positions still marked when the controlled survey was conducted (see Figure 4-11). The original survey, also, had produced an isolated, monopole high slightly east of the main dipole, however, the center of that high fell about 50 ft to the riverside (west) of Boring T-3, as can be seen in Figure 4-7. The position of Boring T-3 was estimated to be about 200 ft from the river in the original survey, which is close to its actual position as plotted in the controlled survey. It would appear that the monopole high recorded near Coring T-3 in the controlled survey is not the one recorded during the original survey. However, in light of the obvious positioning problems of the original magnetometer survey this cannot be accepted without question. It is likely that the magnetic contours produced from the originally collected data and the various auger and bore locations shown in Figure 4-7 are not accurately correlated with one another. In addition, there is some question about the relative accuracy of the individually plotted auger and core locations. In trying to correlate the few core locations discovered during the controlled survey with their originally plotted positions as shown in Figure 4-7, it became apparent that several of the core holes had been inaccurately plotted or misidentified during the development of the initial map of the site. For example, a faded pinflag with the number 27 was found toward the northern side of the magnetic signature, about 90 ft from the river bank (see Figure 4-11). This was thought to represent the location of boring number 27, but the plotted position of this fishtail boring in the original survey shows it toward the southern edge of the magnetic signature (see Figure 4-7). It is possible that this core was misnumbered and should be number 28, which does fall, approximately, in the correct location, or the very faded number on the flag was misread entirely. Thus, as it turned out, while the corings proved very useful in indicating the depth to buried vessel remains and the general spatial distribution of these remains, it was difficult to tie most of them with any precision to the magnetic signature derived from the controlled magnetic survey. Further, the lack of accurate spatial control during the original magnetometer survey and during the collection of the cores, means that it is difficult to correlate these two data sets with one another with great precision. However, as noted below, the projected vessel locations developed by Albertson and Hennington (1992), as shown in Figure 4-9, proved

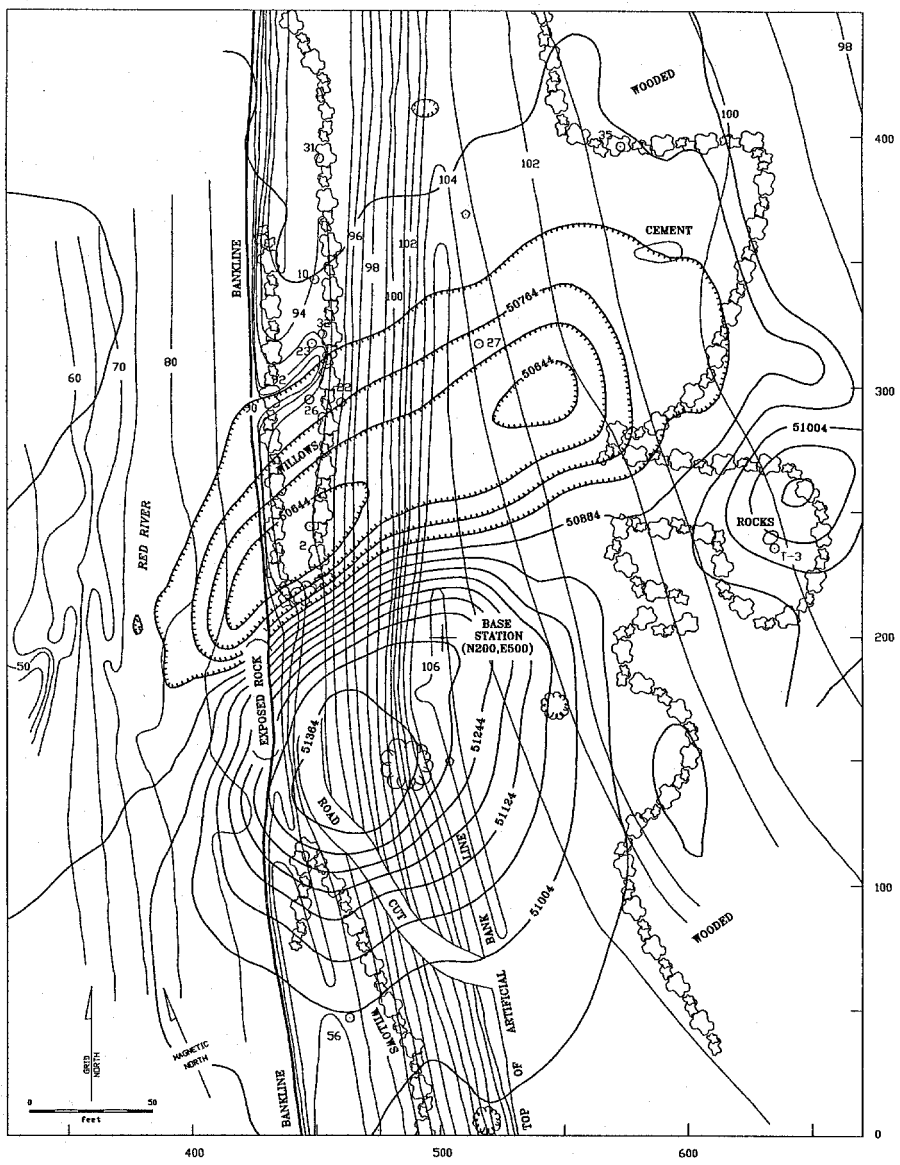

Figure 4-11. Magnetic and topographic contour map from the 1992 controlled survey at the wreck site of the *Eastport* and *Ed. F. Dix*. The locations of some borings taken by the USACE in 1989-1991 are shown.

to be remarkably accurate, suggesting that many core locations were accurately plotted in relationship to one another, even if they were not accurately tied to the magnetometer data.

The bathymetric data shown in Figure 4-11 do show a convolution in the river bottom immediately west of the magnetic anomaly. This was thought be related to the buried vessel remains, but this could not be confirmed, particularly in light of the disturbances produced when the rock filled revetment was constructed here in 1980. Of interest is the fact that the revetment seems to have had little effect on the magnetics recorded at the site.

The magnetic data collected during the controlled survey served as the principal guide for positioning the archaeological excavations reported below. The data from the various borings were most useful in providing information on the depth of burial of the

suspected vessels. Relying on the general theoretical relationships of source objects and their magnetic signatures (Breiner 1973) and on practical experience gained from examining the sources of many magnetic signatures in the field, including steamboat wrecks, it was hypothesized that the largest source object lay along the "trough" between the high and the low seen in the principal magnetic dipole (see Figure 4-11). The configuration of this dipole suggests that the source object is elongated and stretches from the river bank, or from a point slightly inside of the river channel, to the east-northeast for a distance of about 250 ft. The most intense magnetic readings seen in the principal dipole are close to the edge of the river, which, ordinarily, would indicate that the major mass of ferrous material (or other material producing the anomaly) is in this area. However, it is certain that the increase in intensity of the magnetics toward the river is a product of the significant drop in elevation at the bank and not necessarily to any characteristics of the source object. The steep, rock covered river bank here, an artificial product of revetment construction, rises 15 to 16 ft (4.5 m) above the river, meaning that readings taken adjacent to the river would be 15 ft closer to the source object than those taken at the top of the bank (see Figure 4-11). In light of the geometric change in magnetic intensity with distance, it is understandable that high magnetic readings would be obtained near the river's edge, where corings revealed that the distances to the source object(s) would be almost half of those found at the top of the bank.

The exact relationship of the isolated magnetic monopole recorded adjacent to Coring T-3 to a source was more difficult to assess. The preliminary assumption was that it reflected a source object lying at its northwestern edge, again, in the "trough" between it and the larger magnetic low (see Figure 4-11).

Excavation of the "Pool"

The excavation to expose the two suspected wrecks was a very complex undertaking, involving the removal of about 35 ft of overburden from an approximately 250-ft-square area. The large hole ultimately dug came to be called the "pool." In addition, a large containment pond had to be constructed to hold the dredged material removed from the excavation, plus an access road had to be built to the site. The construction contract was awarded to Dillard Construction Company of Nashville, Tennessee, and it specified four phases of work. The first phase involved the initial excavation of the "pool" to an elevation of 67 ft NGVD, which corresponded to a depth of 34 ft below the ground surface, the shallowest depth at which coring had encountered presumed boat remains. At this 67-ft elevation, the footprint of the bottom of the excavation was to measure 110 by 110 ft (33.5 by 33.5 m). The side slopes of the excavation were to be 1 vertical to 2 horizontal; the low slope deemed necessary to prevent sloughing of the side walls. With this slope, the pool measured about 235 ft (71.6 m) square at the ground surface. The placement of the excavation was guided by the results of the controlled magnetometer survey (see Figure 4-11) and the various borings, but excavations could not be conducted too close to the bank of the Red River because of the danger of bank collapse. As shown in Figure 4-12, the excavation was positioned over the "trough" of the magnetic signature as close to the Red as possible, with the western edge of the pool at the top bank of the river. An overflow channel was constructed on the western edge of the pool to allow water to flow out and into the river.

As noted previously, because of the nearness to the river, a dry excavation was deemed impractical by engineers in the Vicksburg District, and the excavation was allowed to fill with water as the digging proceeded. In fact, the contract required that the contractor maintain a water level in the pool that was 3 ft above that of the Red River, up to an elevation of 95 ft. During the project, the water level in the pool was constantly kept at 95 ft. The intent of this was to maintain a "head" on the pool that would help to minimize the danger of collapse of the sides of the excavation. Phase 1 of the construction contract, also, required the building of a large, dredged material containment area adjacent to the pool, plus the construction of an access road. The containment area measured 368 ft by 278 ft and was surrounded by a 10-ft-high dike. The containment area had an outlet control structure and spillway that allowed water to flow into the Red River after sediments had settled out (Figure 4-13).

As previously noted, the placement of the pool was guided by the results of the earlier magnetic surveys and coring programs. As shown in Figure 4-12, the floor of the excavated pool, ultimately, was situated toward the eastern end of the large, magnetic dipole anomaly recorded at the site and incorporated the western half of the smaller, isolated magnetic high. It appeared that the major part of the source object(s) creating the principal anomaly actually fell between

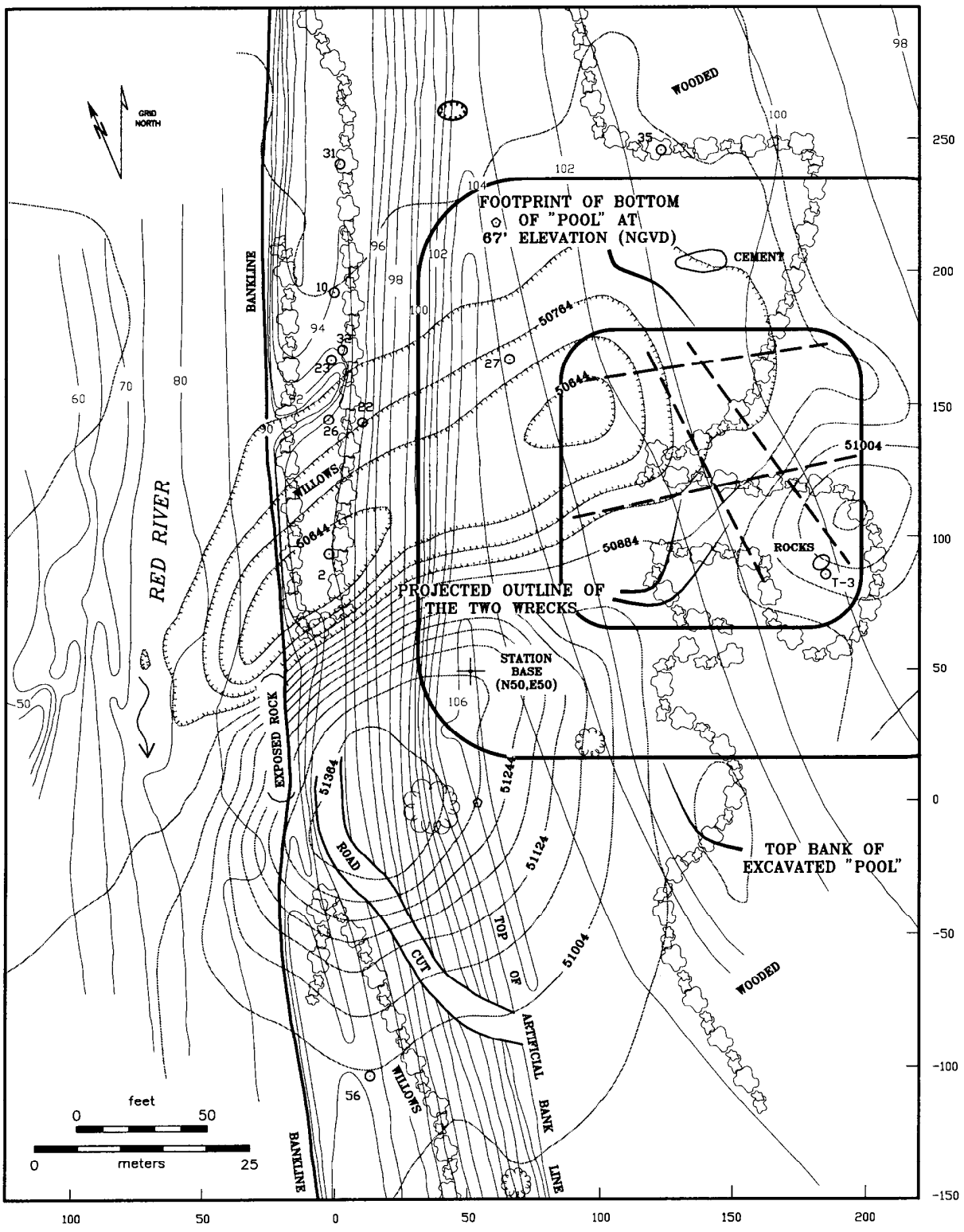

Figure 4-12. The excavated "pool" in relationship to the topography and the magnetics recorded at the site. The projected outlines of the wrecks of the *Eastport* and *Ed. F. Dix* as determined by probing are depicted (see Figure 4-15). The locations of some of the corings made by the USACE in 1989-1991 are shown.

the bottom of the pool and the Red River, in an area which was impossible to examine.

Phase II of the construction contract stipulated that the contractor would maintain the required pool level over the course of the archaeological excavations. Phase III dealt with additional excavations should they be required after the initial archaeological research was conducted. This phase of the contract was not implemented. The final phase of the construction contract related to site restoration and required that the contractor fill the excavation, drain and remove the containment area and return the site to its original condition upon the completion of the archaeological investigations.

Initially, the contractor attempted to dig the "pool" with trackhoes and a dragline; however, the high water table and the high sand content of the soils quickly turned the fill into a fluid, soupy mixture that was impossible to remove with dragline or trackhoe buckets. After only a few days of work, the contractor brought in a 10-in hydraulic dredge unit, driven by an electric motor, which, ultimately, proved to be the ideal piece of equipment for the job. The dredge head was suspended by a cable from the dragline crane so that it could be easily moved around the excavated hole as required. The outflow from the dredge was piped directly into the adjacent containment pond where sediments were allowed to settle and the water was diverted into the Red River. The excavation of the hole itself took over two months to complete, while the entire project, including the construction of the access road and containment pond and the excavation extended over a period of 7 months, from October 4, 1994, to April 17, 1995. Ultimately, the excavation of the pool resulted in the removal of 39,629 yards of overburden. During this period there was a considerable amount of rain that slowed and, at times, stopped work.

During the course of these excavations, one of the authors (Pearson) made periodic visits to the site to monitor progress. The boring data had suggested that the highest portion of the buried wrecks were at a true elevation of about 67 ft, or about 34 ft below the ground surface. The initial plan, thus, was that excavations would be stopped at about 67 ft, at which time the archaeologists would begin their work. However, when excavations reached about 32 ft (9.7 m) below the ground surface (69 ft true elevation), which was slightly above the depth of wreckage as indicated in the borings, a number of pieces of sawn wood that appeared to come from a boat were brought to the surface. These pieces were recovered and were examined by Pearson who determined that they almost certainly came from articulated boat structure and had been broken off by the hydraulic dredge. Most of the pieces were freshly broken, and several were partially coated with what appeared to be tar. Several pieces were identified as probable deck planking. In light of this, the excavations with the hydraulic dredge were halted to prevent any more damage to the presumed boat wreck. As a result, the depth of excavations over much of the pool was thought to be at about 32 ft below the ground surface, slightly above the planned depth of 34 ft.

Archaeological Procedures

Diving Operations

Diving Personnel and Equipment

The archaeological fieldwork for the identification and evaluation of the suspected wrecks was conducted between April and June 1995 and was undertaken jointly by two cultural resources management firms, Coastal Environments, Inc., of Baton Rouge, and Panamerican Maritime, LLC., of Memphis, Alabama. The field crew consisted of eight underwater archaeologists and one equipment operator. The archaeologists were: Charles Pearson (Principal Investigator), Stephen James, Jr. (Dive Supervisor), Tommy Birchett, Bob Adams, Mike Tuttle, Amy Mitchell, Norrene Carroll, and Mark Gagliano. During the first several days of the project another underwater archaeologist, Greg Cook, also, was present. Tim Johnson served as the equipment operator during the project. He was responsible for the operation and maintenance of the onshore jet pumps and, when necessary, operated a trackhoe that Dillard Construction Company had left on site. Archaeological fieldwork was initiated on April 12, 1995, and was ended on June 13, 1995. A total of 63 days were spent in the field; 53.5 representing work days, 6 representing off days, and 3.5 days were lost to bad weather. Two of the off days were taken at the start of the project to allow the construction company to build an access ramp on the south side of the pool. This ramp allowed launching of the dive barge and it served as the point of access into the pool throughout the project.

All of the diving was conducted from a small, 10-by-14-ft barge floating in the pool. Ropes from the dive barge were attached to several posts placed around the perimeter of the pool so that the barge

Figure 4-13 oversize FRONT

Figure 4-13 oversize BACK

could be maneuvered around the pool as required by personnel on board. Underwater visibility during the entire project was zero, due to the suspended sediment in the water, and all diving was conducted using surface-supplied air and surface-to-diver radio communication. As stipulated by Navy Manuals, and by Corps of Engineers Diving Requirements, a minimum five-person dive team was utilized. The basic dive team consisted of a Diving Supervisor, a Diver, a Stand-by Diver, a Tender and a Radio Operator. During most of the diving operations, a single diver was down at a time. However, on several occasions, two divers were down simultaneously at which time an additional Stand-by Diver and Tender were used.

The dive team members all met the certification, training and qualification requirements established in the Corps of Engineers Safety Manual (ER 385-1-86), and most had considerable experience in using surface-supplied air systems in zero visibility conditions. The personnel were rotated through the various dive team positions over the course of the project, however, Stephen James, Charles Pearson, and Bob Adams were the only individuals to serve in the Diving Supervisor position. Prior to the start of the diving operations a Dive Safety Plan was submitted to Mac Wimbash, the Safety Officer at the Vicksburg District, and he visited the site prior to the start of diving to inspect equipment and procedures.

The surface-supplied air system consisted of a bank of two, 300 cubic ft "T" bottles of breathing air connected together and to the diving hoses via a manifold system. Pressure gauges, and check valves were included in the air supply system as appropriate and as required. Each bottle contained 3,000 pounds of air which, under the diving conditions at the site, would last from 2 to 4 hours. As one bottle was emptied, the other would be turned on and the empty bottle would be replaced with a fully charged one, thus always keeping a spare bottle attached to the air hose to serve as an emergency backup. In addition, a standard SCUBA tank was hooked into the air line as an additional emergency source of air should it be required. Also, each diver carried a bail out bottle as an emergency air supply.

The dive helmets used were Heliox-18 band masks. The dive hoses consisted of two, 200-ft-long Gates hoses containing the air hose, pneumo gauge hose, and communication wire. The air line served as the life line and had a breaking strength in excess of 500 pounds. The dive masks and the dive hoses were under current certifications and copies of these certifications were provided to the Vicksburg District Dive Safety Officer prior to diving. The communication wire provided radio communication between the diver and the dive platform. Given the zero visibility conditions, radio communication was essential in transmitting information, since it was impossible for divers to make any notes or drawings while under water. Divers wore a safety harness with a quick release attachment connected to the air line.

The safety of divers was of primary concern during all aspects of this project. The diving conditions on this site were extremely difficult and potentially dangerous. Underwater visibility was essentially zero during the entire project, such that divers had to work entirely by feel. Excavations proved to be extremely laborious, principally, because so much sediment (from 3 to 10 ft) had to be removed to reach the major components of boat structure, as is discussed fully below. In addition, excavated areas tended to quickly fill with sediment flowing into the hole or from sloughing sides. In many cases, sediment flowed into excavated units so rapidly that the hand-held dredge used for excavations became entirely buried and had to be abandoned by the diver. A considerable amount of time, subsequently, was spent in digging out the buried dredge. On a few occasions, the sides of excavation units collapsed rapidly, creating potentially dangerous situations where a diver could be partially or entirely buried. However, divers were always alert to this possibility and the sides of excavated units were cut back as much as possible to try to eliminate this potentially dangerous occurrence.

In order to enhance safety, briefings were held daily to discuss the day's planned dives and to review and emphasize safety procedures. Additionally, all of the equipment used during the diving operations was inspected on a daily basis. As noted, during all periods of diving, a fully equipped Stand-by Diver was prepared to dive in the event of an emergency. A small, 12-ft aluminum jon boat was kept on site to ferry personnel back and forth from the dive barge to the shore and to be used in the event of an emergency. Also, a cellular telephone was kept on the dive platform at all times. The Dive Safety Plan developed for this project identified the locations and telephone numbers of the nearest hospital, hyperbaric chamber, and ambulance service and all of these organizations were notified prior to the start of work. A copy of the Safety Plan was maintained on site at all times and

emergency numbers were prominently displayed on the dive barge.

Water depths at which divers worked ranged from about 20 ft to a maximum of 42 ft. Most of the dives took place in depths that were less than 32 ft, meaning that a diver could, theoretically, remain underwater for an indefinite period of time with no requirements for decompression. However, the laborious working conditions, particularly when operating the venturi dredge under water, tended to exhaust divers fairly quickly. As a result, most individuals worked underwater for periods of from 1 to 2 hours at a time. With eight divers available, this meant that most individuals dove every other day. Sometimes, however, an individual diver would make two or more dives in a day, principally, when trying to collect or record information with which they were most familiar. The water temperature during most of the diving operations was about 75 degrees Fahrenheit. Divers wore wet suits, but, after a couple of hours underwater, individuals could became chilled, at which time they were brought to the surface.

A dive log on which pertinent information was recorded was maintained for each dive. This information included the names of the diver, standby diver and timekeeper, plus data on the objective of the dive, the results of the dive, environmental conditions, tank pressures, the maximum depth reached and the time spent underwater. Over the course of the project, a total of 153 individual dives were made, constituting a total of 264 hours and 13 minutes of underwater time.

Because of the zero visibility conditions, divers often became disoriented underwater, particularly, during the early stages of the project. As a result, directions for movement were provided by those on the dive barge by following the diver's bubbles. Normally, the diver was directed to face the dive hose and move to their left or right, move back or come forward. The Tender and Dive Supervisor on the surface followed the bubbles to position the diver in the desired location. As boat structure was uncovered and divers became familiar with it, disorientation became less of a problem. Additionally, several buoys were attached to key pieces of boat structure and these were used by divers to determine their position on the site and by those on the surface to direct the diver as necessary. The dive barge was moved as needed to place divers as close as possible to their designated work area.

The zero visibility conditions, also, precluded any attempts to sketch or write underwater. Additionally, it was impossible for divers to read measuring tapes. Therefore, all measurements were made with pieces of knotted twine. Knots were placed at various intervals corresponding to standard scantling and timber sizes used on nineteenth century steamboats, e.g., 2 inches, 4 inches, 6 inches, 8 inches and 12 inches. Divers would extrapolate for any intermediate measurements. During the course of a dive, the diver would communicate what was found to the surface as clearly as possible, providing measurements as necessary. Immediately after each dive, the diver would review the information recorded at the surface and would make alterations, additions, or entirely new drawings as deemed necessary.

The initial plan was to conduct underwater excavations using a submersible hydraulic dredge powered by a shore-based motor. The dredge pump would be suspended in the pool from a float and would power two, 6-in-diameter dredge heads attached to long flexible hoses. Divers would operate the dredge heads and the outflow would be pumped up out of the pool and into the adjacent spoil disposal area where it could be screened as desired. This piece of equipment quickly proved to be ineffective. The floating segment was extremely large and difficult for divers to move around the pool. Additionally, the vanes in the pump quickly became clogged and jammed with small items and artifacts such as sticks and nails and spikes which were inadvertently drawn into the dredge head. Clearing the pump involved pulling the heavy dredge to shore, picking it up with a trackhoe, and then taking it apart, a process which took 2 to 3 hours. Screens were placed over the mouths of the dredge intakes to try to prevent the passing of small artifacts, but the screens immediately became clogged with clay, sticks, roots, and artifacts, making them ineffective. It was obvious that the submersible dredge would not work and it was discontinued after 2 days.

Subsequently, excavations were conducted with 4-in-diameter, hand held venturi dredges. The intake hoses for these dredges were sufficiently long and limber to give divers flexibility of movement when working. The outflow could not be directed outside of the pool and into the adjacent disposal pond because the vertical lift was too great. As a result, the outflow was kept in the pool but directed to areas well away from the identified wreck locations. Large, 3-ft-long, 18-in-diameter plastic bags made from 0.50- and 0.25-in-mesh were placed over the ends of outflow hoses when screening of exca-

vated material was desired. Normally, screening was conducted only when excavations were taking place upon or within identified boat structure. It was not feasible to screen all of the excavated material because the large numbers of roots and sticks in the sediment covering the wrecks quickly filled the screening bags, requiring their constant emptying. Initially, the venturi dredges were powered with a 2-in-diameter, 7-horsepower pump, but this proved to be ineffectual and a larger, 5-in-diameter jet pump was brought in to power the dredges. This large pump was stationed on the shore and proved to be ideally suited for the job.

Divers, also, used hydraulic jets to dig into and wash away sediment. The sediments covering the wrecks were often stiff and tenacious and required an extremely powerful flow of water to break them up. These jets were operated by the same 5-in-diameter jet pump that ran the venturi dredges. Through trial and error it was found that the optimum excavation technique was to initially jet an area to break up the sediments and to remove some of them, and then use the venturi dredges to clear out the jetted hole.

Another piece of equipment used at the site was a hydraulic probe. The probe consisted of a 10-ft-long, 1.5-in-diameter metal pipe attached to several segments of fire hose through which water was pumped. A diver would push the probe into the sediments and the water flow would act as a jet to help dig the probe downward. A metal pipe was used because it, often, can aid in distinguishing between materials such as metal and wood. For example, a metal probe strikes wood with a deadened "thud," while it strikes metal with a crisp "ping." The hydraulic probe was operated with the 7-horsepower pump.

The diving operations consisted of two major phases of work. The first of these consisted of systematically probing the entire bottom of the pool with the hydraulic probe to locate and delineate buried remains. The second phase of work consisted of underwater excavations at several locations where probing indicated they would be fruitful. Each of these phases of work is discussed in detail below. Prior to instituting either of these activities, however, an investigation of the bottom of the pool was conducted by several divers to ascertain general diving conditions and to determine if any vessel structure was exposed. This was considered probable in light of the several pieces of wood brought up during the initial construction dredging.

These initial reconnaissance dives revealed that the bottom of the pool was not flat, as had been thought, but was very irregular, with numerous holes measuring 3 to 4 ft deep and 6 to 7 ft across. The individual holes were obviously cut by the large, hydraulic dredge head as it was lowered into the sediment. Even though the contractor thought the dredge was cutting a fairly flat surface, it was obvious that it was not. Several depth measurements made to the bottom of some of the deeper holes indicated that the maximum water depth was about 27 ft (8.2 m). During all diving operations, depth measurements were made in reference to the surface of the water, which was maintained at a constant 95-ft true elevation. This meant that the very deepest parts of the pool were at a true elevation of 68 ft, somewhat higher than it was thought the vessels actually lay. As is discussed later, much of the bottom of the pool lay at elevations several feet above this, at true elevations of 70 to 75 ft.

An examination of the entire bottom of the pool located no identifiable vessel remains. This was somewhat confusing because the several pieces of freshly broken planking recovered during the dredging indicated that the dredge head had struck something, presumably, one of the wrecks. A six-foot-long iron probe was used to probe around the area where most of the identified boat structure had been recovered. Initial probing revealed the presence of a solid and, apparently, fairly flat wooden structure near the center of the northern edge of the pool. At its shallowest point the wooden structure was covered by about 3 ft (1 m) of overburden, but continued probing indicated that most of the structure was buried by 5 ft or more of sediment. Ultimately, it was estimated that the buried wooden structure occupied approximately the northern one-third of the pool and seemed to angle across it from the northeast to the southwest.

This initial probing revealed that the shallowest part of the wooden structure thought to be one of the wrecks lay at a true elevation of about 63 ft, the depth indicated by the contractor when dredging was stopped. However, it was apparent that up to 3 ft of sediment had recovered the areas where the dredge had struck the presumed vessel remains. Where all of this sediment had come from could not be determined. Some probably came from minor sloughing of the sloping walls of the pool and some from the high ridges left on the bottom of the pool as the dredge head dug its numerous holes. In addition, it is thought that a considerable amount of the sediment had simply settled out of the water when

the dredging and the constant turbulence it created had ended. Whatever the cause, these few feet of overburden created a considerable obstacle to divers and required a great deal of effort to remove to reach the wrecks.

Hydraulic Probing

The first phase of underwater work involved probing the bottom of the pool with a hydraulic probe to try to locate and fully delineate the buried remains discovered in the reconnaissance dives. The 10-ft-long metal probe powered by the 7-horsepower water pump was used. The probes were positioned using the grid put in place by the construction company for their activities. This grid actually used the baseline established during the controlled topographic mapping and magnetometer survey of the site in 1994 (see Figure 4-11). The original datum established by that survey had been assigned an arbitrary value of N200/W500; the construction contractors had used this same datum as their base station, but had assigned it an arbitrary value of N50E50. This base station lay near the river bank at the southwest corner of the pool, placing the excavated area within the northeast quadrant of the grid. The E250 gridline ran along the eastern edge of the pool and the N00 line ran along the southern edge. Flagged stakes were placed at 10-ft-intervals along these lines and they became the baselines for all measurements made in the pool. The bottom of the pool as completed extended from approximately E85 to E200 and from N70 to N180 (Figure 4-14); this was the area within which all diving took place.

During the hydraulic probing and all of the subsequent excavations, depth measurements were made with a pneumo gauge in reference to the surface of the pool. Thus, the pool surface served as the vertical datum for all activities. As discussed, during the course of the project a pump was used to keep the water level in the pool at a constant elevation, equivalent to a true elevation of 95 ft. This elevation was checked periodically and it varied less than 4 in over the course of the project. In the following discussions, all depth measurements are in reference to the surface of the pool. When deemed necessary, these measurements are equated with true elevation.

To achieve systematic coverage of the pool, probing began by positioning probe locations along the east-west gridlines at 20-ft-intervals. Because of the zero visibility conditions and the very contorted bottom, it was often difficult to place the diver exactly at the desired coordinates without expending a considerable amount of time. Therefore, many probes were positioned as close to the desired location as possible. The final positions of probes were determined by referencing the bubbles of the diver with the baselines established along the edges of the excavation. Although the probe was only 10 ft long, it could be extended to a much deeper depth by using the stiff fire hose to push the probe down. This was done in several instances, mainly to verify that no structure was buried deeper than 10 ft below the bottom of the pool. The initial phase of hydraulic probing was conducted over a period of three days. The data collected over these three days serve as the basis for the discussions presented below. However, over the entire course of the project, hydraulic probing was conducted intermittingly as the need arose to delineate specific buried features at the site.

As shown in Figure 4-15, the entire bottom of the "pool" was generally well covered during the initial phase of probing, although a few gaps existed. Subsequently, additional probing or excavations revealed that this first stage of hydraulic probing provided a fairly accurate picture of the locations and positions of the buried wrecks. As necessary to refine discovered structure, probings were placed at closer intervals. The probing, also, was used to gain some idea of the character of the sediments covering the wrecks. As probing progressed, a map was developed on which was recorded a variety of information, including when a solid object was hit, what the struck object felt like (wood or metal), the depth of the object below the bottom of the pool, the depth below the water surface, and the character of the sediment through which the probe passed. This latter observation was subjective, but divers generally could determine such things as the general nature of the sediments (e.g., sand or clay), its consistency (e.g., stiff, soft, variable, etc.), whether lenses of various consistencies existed, and whether or not trees, roots, or branches were encountered.

The probing provided a fairly good idea of the distribution and depth of wreckage and, also, enabled a distinction between wood and metal materials. Figure 4-15 provides information on the probe locations, the type of material struck with the probe and the depth of that material below the water surface at many locations. It should be noted that the water depths across the bottom of the pool ranged from about 22 ft to 28 ft, such that all of the structure encountered was covered by several feet of overburden. (As noted, the surface of the pool lay at a true elevation of 95

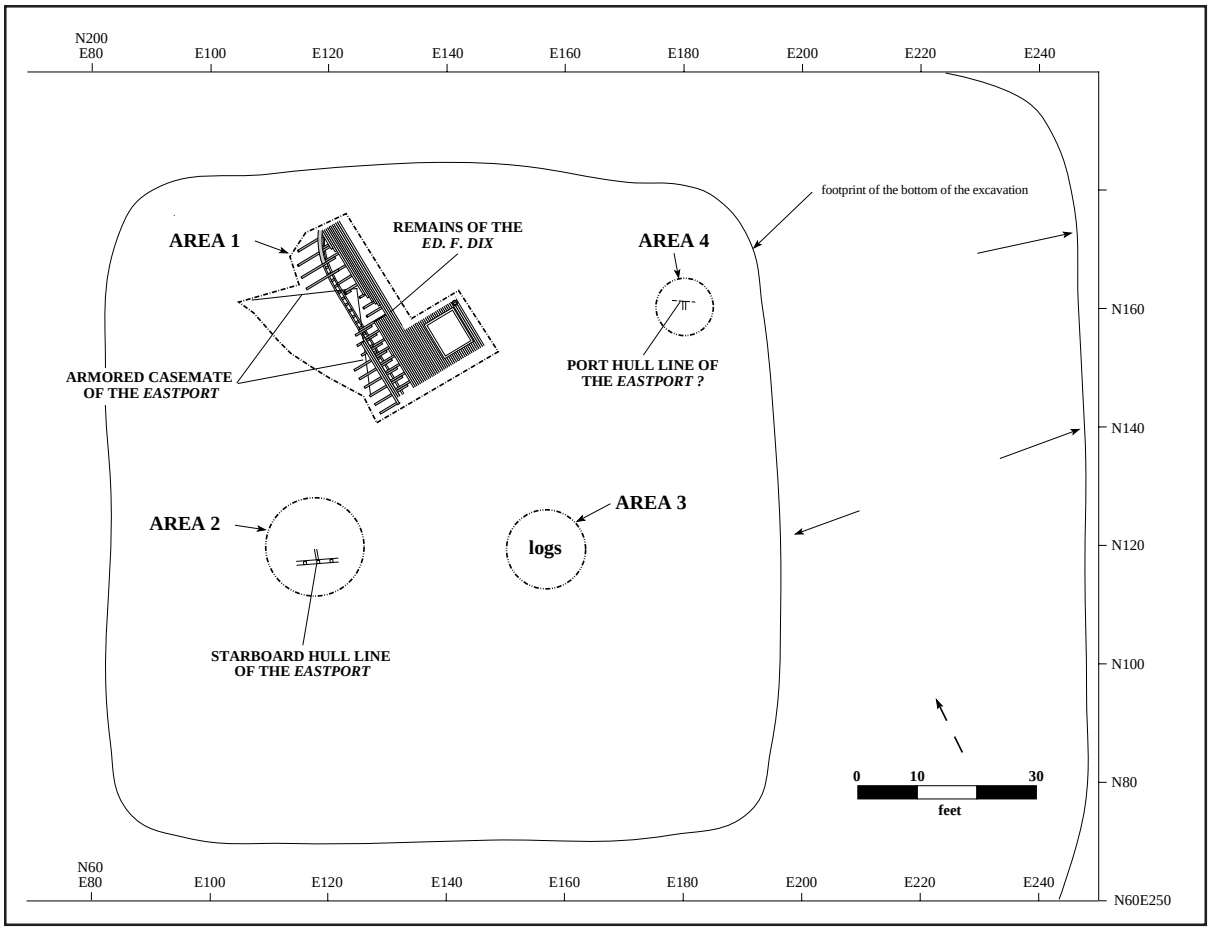

Figure 4-14. Site plan showing the bottom of the "pool," the areas excavated and the critical features mapped.

ft, such that all depths were measured from that point.) The probing revealed two major masses of wooden structure, believed to represent boat wreckage, as shown in Figure 4-15. These two features were oriented almost at right angles to one another. One of the presumed wrecks extended in a north-south direction across the pool and probing indicated that much of the solid wood component lay between 29 and 34 ft below the water surface (see Figure 4-15). The shallowest portion of this structure was located in the area of grid coordinate N157E128, where probes indicated that intact wooden structure lay at a depth of 29 ft below the water surface. At this location, the wooden structure was covered by about 3 ft of sediment, the least amount of overburden encountered anywhere in the pool. Probing indicated that both ends of this structure extended an undetermined distance into the sloping walls of the pool. Additionally, probing revealed the presence of a number of buried trees and tree limbs in the southeastern quadrant of the pool, particularly in the area from N100 to N135 and from E150 to E185. This debris was lying on top of the presumed boat structure and made it difficult to obtain an accurate assessment of the depth and condition of the wreckage in this area.

The probing revealed that another long segment of, apparently, intact wooden structure extended in a roughly east-west direction across the northern half of the pool. Most of this structure lay at a depth of 33 to 37 ft below the water surface, slightly deeper than the other presumed wreck. Consequently, this structure was buried by up to 6 to 10 ft of overburden across most of the bottom of the pool. Probing also indicated that this wreckage extended beyond the limits of the pool, maybe well into the Red River as suggested by the magnetic signature shown in Figure 4-12.

Figures 4-16 and 4-17 presents a series of profiles of the hydraulic probe data taken across selected transects. The locations of these profiles are shown

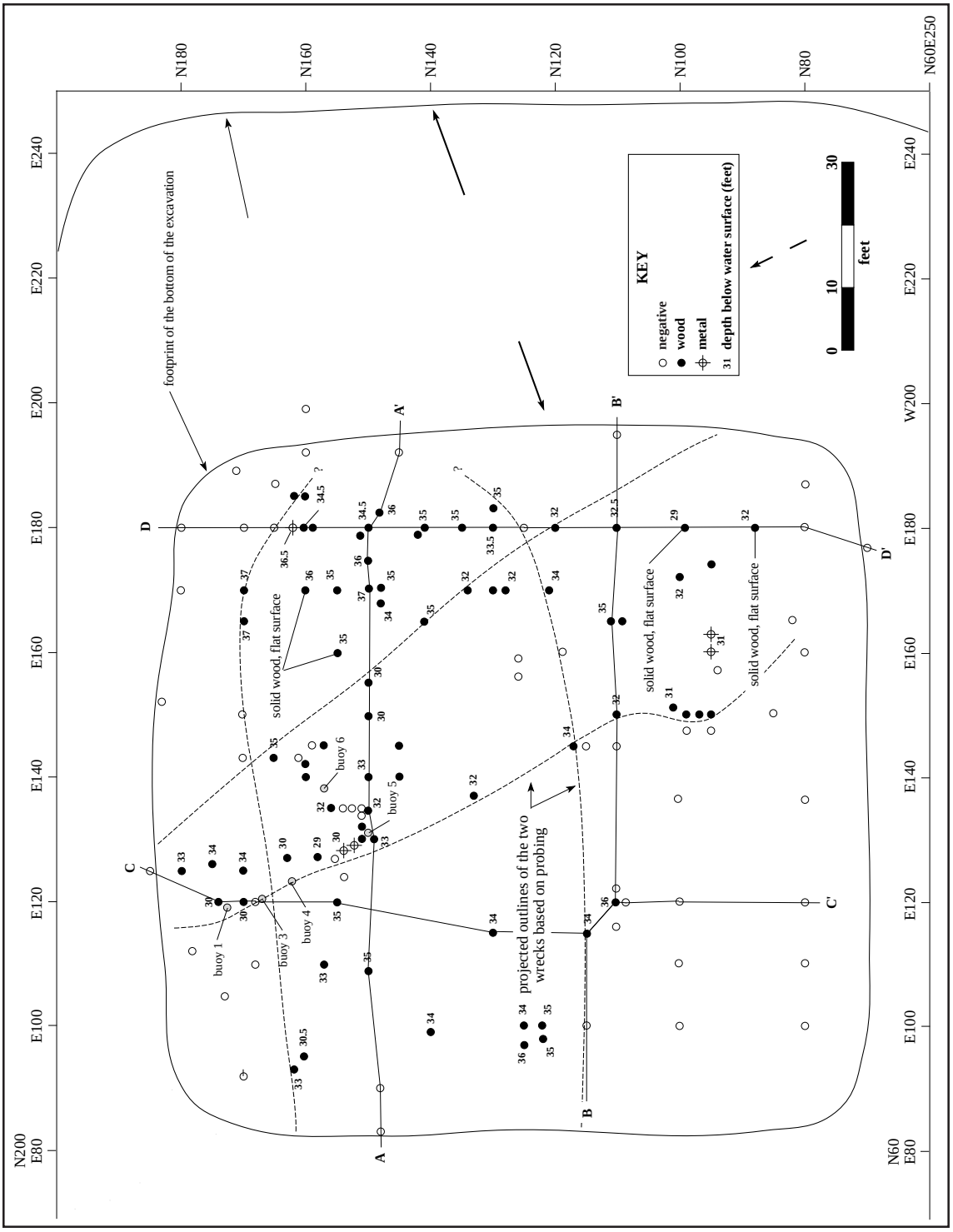

Figure 4-15. Results of the hydraulic probing. The approximate outlines of the hulls of the two vessels as indicated by the probing are shown

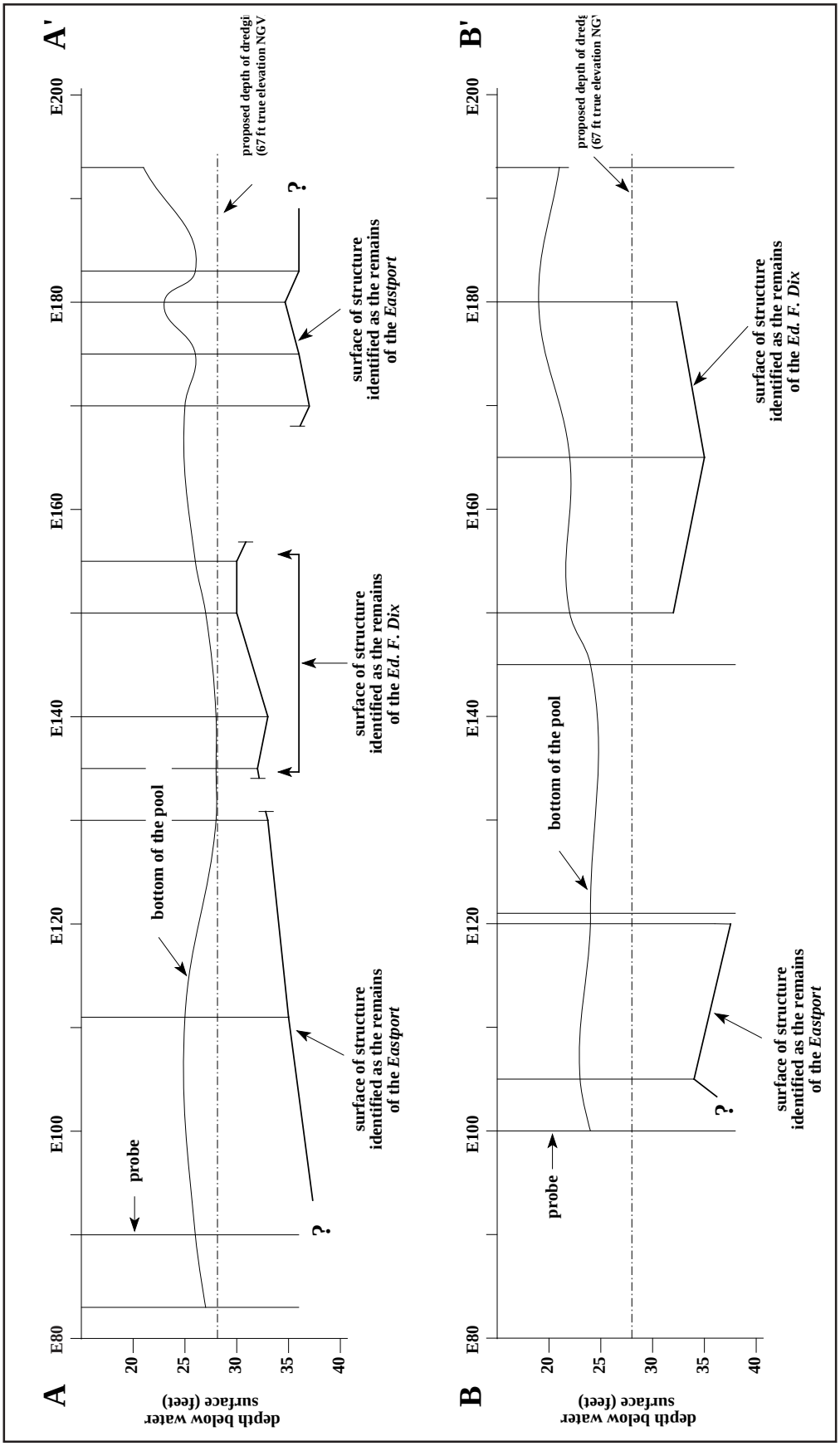

Figure 4-16. East-west profiles showing the interpreted results of the hydraulic probing. See Figure 4-15 for profile locations.

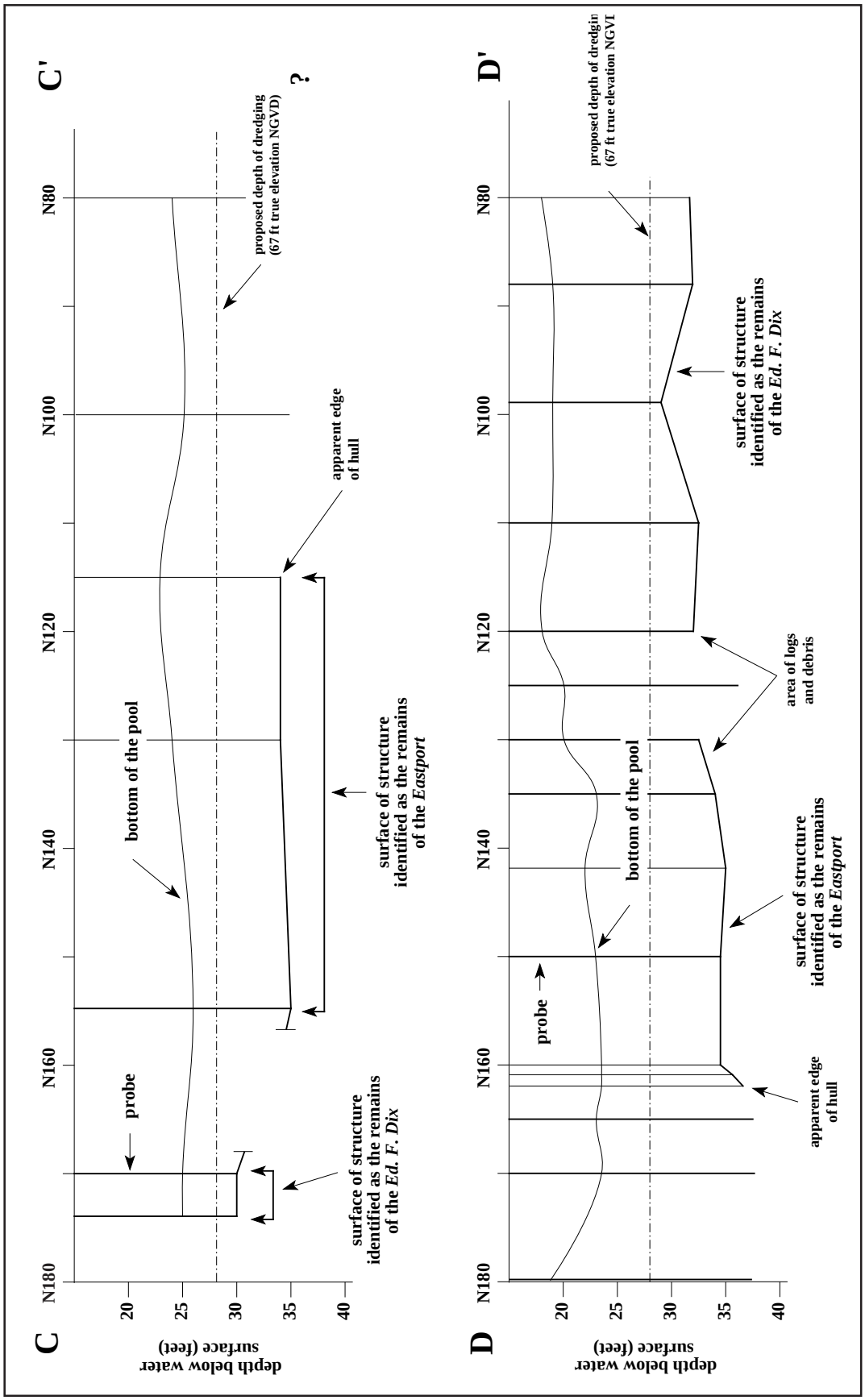

Figure 4-17. North-south profiles showing the interpreted results of the hydraulic probing. See Figure 4-15 for profile locations.

in Figure 4-15. All of the profiles clearly demonstrate the consistent differences in elevations of the two buried features thought to represent boat remains, even though the difference is on the order of only a few feet. Evaluation of these profiles and the plan map developed from the probing led to the presumption that the vessel extending in a north-south direction across the pool was the steamer *Ed. F. Dix*, and that it lay on top of the remains of the *Eastport*, represented by the structure lying in an east-west direction. As shown in the B-B' profile, the intact portion of the structure identified as the *Ed. F. Dix* measured about 30 ft across. Additionally, subsequent probing across the presumed wreck of the *Dix* in the vicinity of profile A-A' (see Figure 4-16) indicated that a level surface existed in this area and that it sloped down toward the east. This level surface was believed to be a deck, probably the main deck of the steamboat. Because the deck was tilted down toward the east, it was difficult to distinguish between the structures where the east side (e.g., the lower side) of the wreck of the presumed *Dix* rested on top of the presumed *Eastport*. The west side of the identified *Dix*, however, seemed to be tilted up such that it was 3 to 4 ft higher than the surface identified as the *Eastport*, making it much easier to distinguish between the two wrecks at this particular location.

Profile C-C' suggests the maximum width of the remains identified as those of the *Eastport* measure close to 40 ft across (see Figure 4-17). This profile, also, reveals that the intact structure of the presumed *Eastport* in this area consists of a very flat surface, possibly an intact deck. Both of the north-south profiles shown (C-C' and D-D', see Figure 4-17) encountered what were believed to be edges of the wreckage of the *Eastport*, as depicted in Figure 4-15.

These interpretations of the probe data were considered reasonable in light of the historic accounts concerning the circumstances surrounding the losses of the two boats. The USS *Eastport* was reportedly blown up as she lay roughly perpendicular to the flow of the Red River, corresponding to the generally east-west orientation of the lowermost of the identified wrecks. The *Dix* reportedly struck and sank on top of the wreck of the *Eastport* as she was heading upriver. This conforms with the position and lay of the other presumed wreck identified during probing. Also, the estimated breadth of the structure identified as the *Eastport* was very close to her known breadth of 43 ft. The 30 ft obtained for the breadth of the presumed *Ed. F. Dix* was somewhat less than her breadth of 39 ft, but this could be explained by a collapsed or damaged hull, plus the difficulty in delineating the eastern side of the hull of the *Dix* because of her apparent list in that direction, as discussed above.

The probing suggested that much of the wooden structure of both of the identified wrecks was in good condition. Several fairly large areas of flat wooden structure were found where the probe would literally "bounce" off of the wood, indicating a dense and hard surface. The specific identity of these surfaces could not be determined, but they were thought to represent areas of intact deck planking. Surprisingly, only a relatively few probes encountered what could be identified as metal, although it was thought that a considerable amount of metal, primarily iron armor, would be found in association with the *Eastport*. The few areas where metal was encountered during probing are shown in Figure 4-15. The largest expanse of metal (iron ?) was in the vicinity of grid coordinate N153E130 where initial probing encountered metal at a depth of 32 ft, slightly deeper than some immediately adjacent wooden structure (see Figure 4-15 and Figure 4-16, Profile A-A'). Extensive probing in this area suggested that the metal consisted of a flat piece (or pieces) of thin plate resting edge up, making it very difficult to delineate. Subsequent excavations in this area revealed that these plates represented intact portions of the *Eastport's* armored casemate. In addition, probes struck a small area of metal toward the eastern side of the pool, at coordinate N161E180 (see Figure 4-15). This material was thought to be on the wreck of the *Eastport*. A small area of metal also was encountered in the southeastern quadrant of the pool, in the area of grid coordinate N95E160. This metal was thought to be associated with the *Ed. F. Dix*, possibly in the area of her engines or side paddlewheels, assuming the bow of the boat was at the northern end of the pool (see Figure 4-15)

Figure 4-12 shows the interpreted positions of the two buried wrecks in relation to the magnetic data from the site. As can be seen, the vessel tentatively identified as the *Eastport* is oriented approximately along the long axis of the large, magnetic low extending across the site. The vessel assumed to be the *Ed. F. Dix* seems to correlate with the eastern end of this low and with the isolated magnetic high located at the eastern edge of the signature. As discussed earlier, when the controlled topographic and magnetic surveys were conducted, it was found that the positions of many of the corings taken dur-

ing previous examinations could not be correlated with the maps developed (Birchett and Pearson 1995:57). Most of those that could be correlated with the controlled survey data fell close to the Red River and outside of the excavated pool. One of the soil cores (designated T-3 in Birchett and Pearson [1995:Figures 22 and 24]) falls within the southeastern corner of the pool. This soil core struck solid wood at a true elevation of 67 ft and, based on the data derived from the hydraulic probing, it would appear that this core hit the wreck of *Ed. F. Dix*. This was, in fact the interpretation provided by Albertson and Hennington (1992:20) when they developed their assessment of the cores and borings taken at the site.

Underwater Excavations

The results of the hydraulic probing provided the basis for initiating underwater excavations. The probing revealed that the shallowest segment of what was interpreted as intact boat structure lay in the north-central portion of the pool, in the vicinity of grid coordinate N153E130 (see Figure 4-15). It was determined that wooden structure lay at depths of 29 to 32 ft below the water surface at this location and was covered by only 2 to 3 ft of overburden. In fact, divers had discovered one possible boat timber lying at the bottom of the pool in this area. This piece of wood had, apparently, been pulled up by the hydraulic dredge when it was working there.

Excavations were begun at this location on April 24, 1995, using a 4-in-diameter, hand-held venturi dredge powered by a 5-horsepower Honda water pump. This pump provided insufficient water pressure to efficiently drive the venturi dredge so it was replaced by a larger, 7-horsepower water pump. Approximately one foot of the sediment covering the wreck at this location consisted of loose silty clay, believed to represent sediment that had settled out of the water and recovered the bottom. However, beneath this loose fill the soil consisted of stiff, hard packed silt and silty clay which, often, was very difficult to remove. The dredge suction was unable to break this soil loose and it had to be broken up by hand and fed into the mouth of the dredge. It was found that a sharp tool, such as a large knife or a short piece of rebar, was needed to break up the stiff sediment before it could be sucked out by the dredge.

Although the venturi dredge worked well, it tended to clog with roots, wood and sand because the 7-horsepower pump did not produce a powerful enough water flow to keep it clear. After the first three days of excavations, a submersible hydraulic dredge was brought in to replace the venturi dredge, however, as noted above, this machine proved to be impractical for the job and, after two days of use, it was replaced with a larger 5-in jet pump that powered the venturi dredge and the water jet. This combination of powerful jet pump, venturi dredge, and water jet proved to work best. It was soon found that using the strong water jet to break up the clay before sucking it out with the venturi was much more efficient than trying to break the clay up by hand. Subsequently, most excavations were conducted using the combination of water jet and venturi dredge. The water jet would be used to jet out sediment covering the vessel remains as well as to break up sediment which would then be sucked away by the dredge. Once it was determined the excavations were close to intact boat structure, the jet was used sparingly or not at all.

It is important to emphasize the difficulty of the diving conditions on this project. Underwater visibility was zero during the entire undertaking, thus all work had to be done by feel and all information had to be transmitted between divers and the surface by radio. The zero visibility made it, essentially, impossible to conduct carefully controlled excavations. Plus, the looseness of the sediments once they were disturbed by jetting meant that jetted or excavated areas were continually refilling such that maintaining any semblance of a regular excavation unit was impossible. For example, on the first day of excavations, divers were able to jet and dredge a "unit" about 5 ft wide and 6 ft deep. This "unit," which actually was a roughly circular hole, exposed a segment of articulated boat structure (the *Ed. F. Dix*) at approximately N155E130. The locations of the unit and the structure was determined by sighting on a buoy from the gridlines extending along the sides of the pool; the depth was determined with a pneumo gauge, and the size and configuration were determined by the diver. On the following day, the first diver in the water found that overnight this hole had been almost entirely refilled with loose sediment. It required several hours to re-excavate the hole and reach the structure that had been identified the day before. These conditions were typical. Most of the excavated areas tended to partially or entirely fill overnight and would have to be re-excavated the following day; a process that took up a considerable amount of time over the course of the study. However, it was found that once areas of intact boat structure were uncovered, if the excavated area was

large enough, at least the central portions of the area remained fairly clear of sediment.

Ultimately, the excavations in the vicinity of N153E130 were expanded to cover an irregularly-shaped area measuring approximately 40 ft long (roughly north-south) by 40 ft wide. The entire area was not kept clear of sediment, but portions were allowed to refill as boat structure in those locations was recorded. As shown in Figure 4-14, this area of excavation is designated Area 1 and within it were found portions of the intact hulls of both the *Ed. F. Dix* and the *Eastport*. The majority of the excavation efforts were expended on Area 1 and, ultimately, a total of 34.5 days of diving were spent on this area. Excavations were conducted in three other areas of the pool, as shown in Figure 4-14. Areas 2 and 4 were opened to examine what were thought to be opposite sides of the hull of the *Eastport*, while Area 3 was placed to examine the edge of the hull of the *Ed. F. Dix*. Five days of diving and excavation were expended on Area 2, one-half day on Area 3, and four days on Area 4. Excavations in these three areas were much more difficult than those in Area 1, primarily, because the overburden covering the wrecks at these areas was on the order of 8 to 10 ft, much deeper than that occurring in Area 1. Excavations in Areas 2 and 4 did encounter what are identified as the edges of the hull of the *Eastport*, confirming the expectations. However, numerous tree limbs and trunks were encountered in Area 3 and hadn excavations here never reached the hull of the *Dix*, although hydraulic probes did. The results of the excavations in all four areas are discussed below.

The Remains of the Ed. F. Dix

Excavations in Area 1

As noted, articulated boat structure was discovered in Area 1 on the very first day of excavations. By the second day, it was determined that the remains represented the gunwale of a boat (later verified as the *Ed F. Dix*) consisting of deck beams, upper hull planking and a possible deck clamp. Probing adjacent to one of the presumed deck beams indicated the presence of an intact layer of wood 3 to 4 ft below the deck beam. This was assumed to represent the hull or ceiling planking at the bottom of the boat. On the second day of excavations, one-half of a wooden cask head was recovered from below the deck beams within what was thought to be the hull of the boat. Subsequently, the water jet was used sparingly within the identified hull for fear of damaging or disturbing artifacts. Fortunately, the sediments inside of the hull tended to have a fairly high sand content and, for the most part, were relatively easy to remove by breaking them up by hand and sucking them out with the venturi dredge. Additionally, a small, hand-held water jet operating at very low pressure was devised which the diver could use to delicately break up and remove sediment. During some of the excavations inside of the hull, a 0.5-in-mesh plastic bag was fitted over the outflow of the dredge to catch any small objects that passed through. The intake of the dredge, also, had a grill over it to prevent objects larger than about 3 in across from being sucked up.

Once the edge of the hull of the vessel was positively identified, excavations were, first, extended along the line of the hull (e.g., the gunwale) and, later, away from the edge of the hull and across the main deck toward the east. A curvature was soon noted in the edge of the hull and it was estimated that the bow of the vessel lay toward the north side of the pool, meaning that the excavations were positioned on the port side of the vessel. Excavations were extended northward following the edge of the hull, toward the presumed bow. However, this was into the sloping side of the pool such that the depths of overburden deepened quickly. Ultimately, it was possible to follow the hull into the edge of the pool to approximately grid coordinate N172.5E119, where a buoy was attached and its position recorded with a transit. At this point, the excavations had created a vertical wall about 12 ft high in the sloping side of the pool and it was determined too dangerous to continue digging in this direction. Hydraulic probing was conducted north of the excavated area to try to locate the very bow of the boat. Probing was difficult because of the depth of overburden, however, the bow was estimated to be at about grid coordinate N180E120.

During the course of clearing the hull line of the vessel, several other buoys were attached to specific points and their positions were recorded with a transit. These buoys provided orientation to divers and enabled the positioning of the various drawings made as excavations were conducted.

As the boat structure in Area 1 was cleared it became obvious that the wood of the vessel was in very good condition and that the various elements represented the articulated and, apparently, intact portside hull and main deck of a steamboat. By the fifth day of excavations it was clear the remains were almost certainly those of the *Ed. F. Dix*, and not those

of the *Eastport*. The exposed structure consisted of identified deck beams, overhanging guard, hull and main deck planking, and deck clamp; all consistent with what is known about nineteenth century steamboat construction. Additionally, probing across the beam of the hull indicated a maximum hold depth of just over 5 ft, consistent with the known depth of the *Ed. F. Dix* of 5.5 ft. Further, there was a complete lack of iron armor of any sort on the remains and the wood showed no evidence of burning, both expected for the *Eastport*. Ultimately, excavations were expanded eastward across the intact main deck of the presumed *Dix* and a deck hatch was discovered. Excavations were taken down through the hatch into the hold of the vessel where numerous fragments of boxes and barrels were found and recovered. Many of these containers exhibit stenciled lettering indicating contents and some are marked with "U.S. Gov. Sub. Dept., Jeffersonville, In." and dated April 1865 or May 1865. This stencil refers to the Quartermaster Department supply depot at Jeffersonville, Indiana, and the 1865 date eliminates the *Eastport*, which was lost in 1864, as a possibility. The dates on the containers, plus the fact they held government stores, substantiate the identity of the wreck as the *Ed. F. Dix*, which sank in June 1865 while carrying soldiers and their equipment and supplies. No remains of any superstructure above the main deck were found and it is presumed that all of the relatively flimsy upper works of the *Dix* were removed by the river's current, probably soon after the sinking.

Once it was determined that the structure encountered in Area 1 was the hull of the *Ed. F. Dix*, a series of probes were placed along the outside of the hull in the area where the first phase of probing had encountered metal. Here, at a depth of about 32 ft below the water surface, a line of vertical iron plates was found. The tops of these plates were 2 to 3 ft below the top edge of the hull of the *Ed. F. Dix*. The line of plates extended westward at almost a right angle to the hull line of the *Dix*. Probing followed this line of plates for a distance of about 25 ft westward, well into the sloping, western edge of the pool. Excavations were conducted down onto these plates and it was concluded that they represented the port side of the armored casemate of the *Eastport*. It, also, was determined that the remains of the *Dix* rested directly on top of this identified casemate and that several plates of the iron armor had penetrated the hull planking of the *Dix*. In the following discussions the results of the excavations of each of the vessels are considered separately.

Ultimately, a considerable portion of the portside, forward main deck area and hull of the steamboat *Ed. F. Dix* was uncovered and recorded. As shown in Figure 4-18, the structural elements found in this area were, for the most part, intact and articulated. Initial excavations were concentrated along the port edge of the hull and here were exposed the upper portion of the hull planking, frames, deck beams, guard beams (or "sponsons"), and planking of the main deck. Later, as excavations were extended to the east across the main deck, a hatchway was found and excavations were continued down into the hold of the boat. The first deck beam encountered and identified by divers was designated Deck Beam 0, and the other beams were numbered consecutively from this point; those to the north were assigned a negative number, while those to the south were given a positive number, as shown in Figure 4-18. This numbering system was instituted simply for convenience.

The construction of the *Ed. F. Dix*, generally, conforms with what is known about nineteenth century steamboats. The deck beams are composed of 4-by-6- to 4-by-7-in timbers of a species of white oak (*Quercus* sp.) which extend across the width of the boat. The ends of the deck beams rest into notches cut into the uppermost hull plank (the sheer strake) and the ends of the beams are squared off and flush with outside of the hull planking (Figures 4-18 and 4-19). Immediately below the deck beams on the inside of the hull are two "stringers" identified as deck clamps or top wale strakes (Petsche 1974:74). Both of these planks are 3 in thick and the upper piece is 12 in wide, while the lower one is 8 in wide (Figure 4-19). These deck clamps support the deck beams and, also, give longitudinal strength to the top edge of the hull. The uppermost deck clamp, which is about 4 in lower than the uppermost hull plank, is notched out 2 in to accept the deck beams. The spacing between deck beams varies from 10 to 18 in, averaging about 15 in. The size and spacing of these deck beams are consistent with what information is available on steamboats of similar size of the period. The *Homer*, a 148-ft long sidewheeler built in 1859 at Parkersburg, Virginia (now West Virginia), was scuttled on the Ouachita River at Camden, Arkansas, during the Civil War. Like the *Ed. F. Dix*, almost the entire hull of the *Homer* has been preserved, despite the fact that she lies in the main channel of the Ouachita. Deck beams on the *Homer* measured 4 by 8 in and were spaced on about 14-in centers (Pearson and Saltus 1993:50, 76). Petsche (1974) provides no dimensions for the deck beams

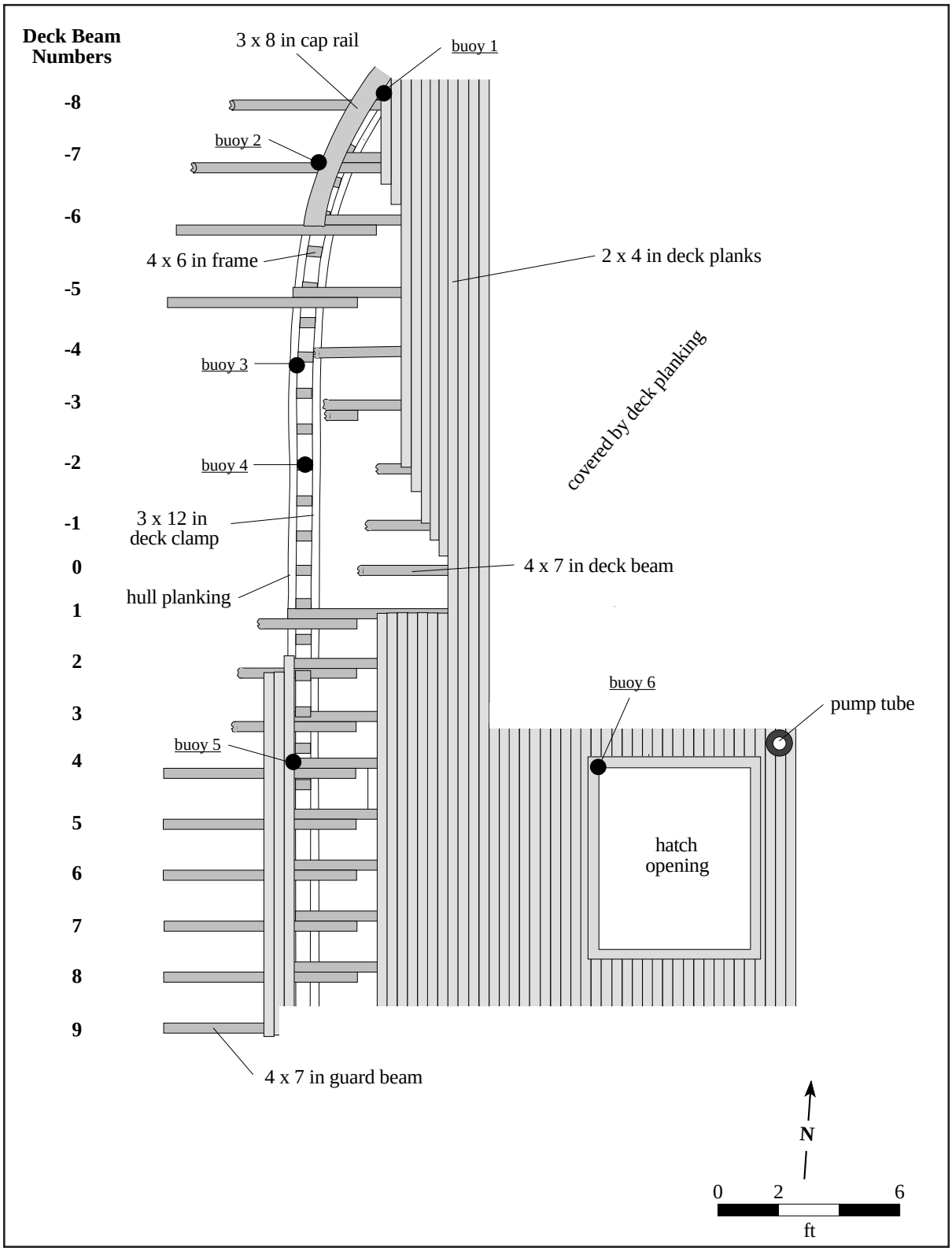

Figure 4-18. Plan of the mapped remains of the *Ed. F. Dix*.

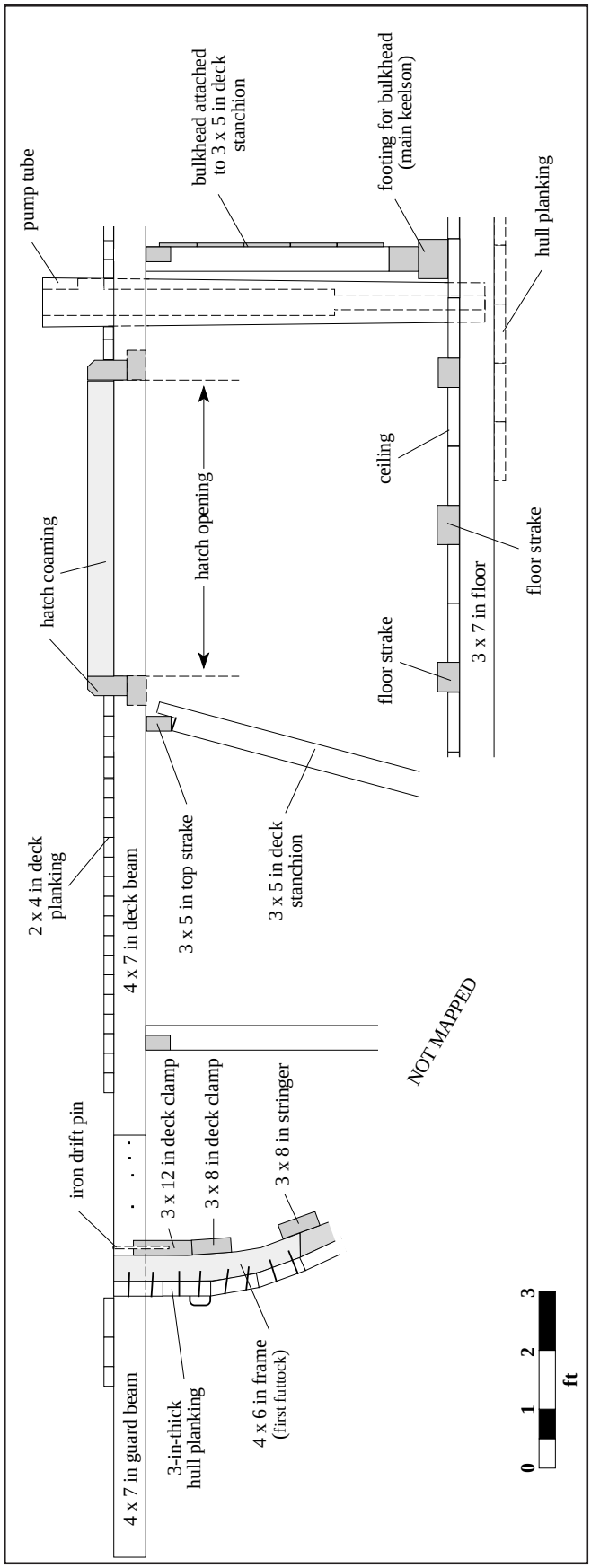

Figure 4-19. Cross section of the hull of the *Ed. F. Dix* at the forward end of the hatch opening (at Deck Beam 4).

of the 161-ft long sternwheeler *Bertrand,* but his illustrations suggest that the spacing of deck beams was approximately 24 to 28 in, slightly greater than on the *Dix* or the *Homer*. The deck beams on the *Bertrand*, like those on the *Dix,* were white oak (Petsche 1974:75-76).

Typically, sidewheel western river steamboats were built with overhangs that extended the main deck beyond the edge of the hull. These extensions, known as guards, were originally built to protect the side paddlewheels from injury and to provide an outboard support for the wheels (Hunter 1949:91). Also, the guards provided additional deck space for the storage of cargo. The guards were widest at the paddlewheels and narrowed somewhat as they approached the ends of the vessel. Hunter (1949:93) notes that the overall width of the main deck provided by the guards exceeded the width of the hull by 50 to 75 percent (see Figure 3-3). A number of the beams (or outriggers or "sponsons" as they, also, were called) that supported the port guard on the *Dix* were exposed, as shown in Figures 4-18 and 4-19. Like the deck beams, the guard beams measured 4-by-6 to 4-by-7 inches in section. Several of these guard beams were complete and revealed that the guard along this section of the boat extended about 4 ft, 4 in out from the hull. This guard width is narrow for a 166-ft boat like the *Ed F. Dix* which probably would have had paddlewheels, and thus guards, on the order of 8 to 10 ft wide. The narrowness of the guard in the excavated area is certainly reflective of the location near the bow of the steamer; the guards would become wider aft of this point, reaching their greatest width at the paddlewheels.

Where present, guard beams are attached to the aft side of deck beams and extend inboard of the hull for 24 in (see Figure 4-18). The guard beams are nailed to the deck beams with 7-in-long spikes, as revealed by portions of three guard beams that were recovered. Like the deck beams, the guard supports are constructed of white oak and are set into notches cut into the upper deck clamp and the upper strake of hull planking (see Figure 4-19). On several of the guard beams, a round iron drift bolt (or drift pin), measuring approximately 0.75 inches in diameter, was found extending down through the beam and into the underlying deck clamp. It is assumed that all of the beams had similar fastenings, plus, it is possible that drift bolts also attached the deck and guard beams to the upper hull plank, although this was not observed by divers. Commonly, the guards on steamboats sloped inboard slightly, giving them an upward cant (Bates 1968:23; see Figure 3-3). No indication of this cant was observed on the guards of the *Dix*, however, in light of the difficulty of obtaining precise measurements at the site, this is not surprising. The fact that the guard beams are separate from the deck beams indicates that the guards could have been constructed with such a cant.

Near the center of the area excavated along the hull line of the *Ed. F. Dix*, several guard beams and portions of deck beams are missing (see Figure 4-18). This area corresponds to the very shallowest portion of the wreck and it is certain that some, if not all, of these missing pieces were broken off and removed by the hydraulic dredge during the excavation of the pool, prior to the start of the archaeological work. Main deck and guard planking, also, is missing from this area. In fact, no deck planks were found in situ immediately adjacent to the hull along most of the excavated portion of the *Dix*. Some of these may have been removed by the recent dredging, but others could have been torn loss when the wreck was exposed to the river's current. Excavations and probing did reveal that most of the steamer's main deck planking is intact away from the port side of the hull, as shown in Figure 4-18. Measurements of several deck planks indicated they are made of 1.75- to 2-in-thick boards. These deck planks are 4 in wide; however, some wider planking was used as evidenced by several loose pieces of deck planking recovered during the hydraulic dredging and the excavations. As shown in Table 4-1, several pieces of the loose deck planking were found that measured up to 6 in wide. Some of the recovered pieces of planking contain tar residue on their upper and side surfaces. The single sample of deck planking submitted for identification is a species of the white pine group (*Pinus*); the other deck planks are presumed to be the same type of wood. Pine was typically used for decking, as well as cabin construction, on steamboats, in part because it was light in weight (Hunter 1949:80-82). The deck planking on the *Bertrand*, like that on the *Ed. F. Dix*, was made of white pine (Petsche 1974:76), while that on the *Homer* was yellow pine (Pearson and Saltus 1993:80).

Several pieces of guard planking were in situ from the vicinity of Buoy 5 and extending aft on the boat (see Figure 4-18). These, also, consisted of 2-in-thick boards, however, unlike the several pieces of in-place planking measured on the main deck, the widths of the boards used for decking the guard varied. Of the three planks measured along Deck/Guard Beam

Table 4-1. Artifacts from the *Ed. F. Dix* and *Eastport*.

Artifact Number	Provenience[1]	Description[2]
1	Floated up/No Tag	broken deck plank (loosened by dredge): 1.75x4.5x26.5 in-2 spike holes 21.5 in apart
2	5/5/95—Eastport/Dix	broken deck plank: 1.75x6x20 in—ends broken—evidence of tar on edge—impression of deck beam at one end
3	4/27/95—SJ, 32', N157 W120	broken deck plank: 1.75x4.5x24 in—(from dredge)—deck beam impression at one end with 2 spike holes 2.5 in apart—1 spike
4	5/3/95—N 140 W?, Jetted Up	fragment of deck plank: 1.75x3.25x15 in—has deck beam impression
5	5/9/95—at Deck Beam 1	fragment of deck plank: 1.75x6x17 in—tar on edge of top
6	Floated Up	fragment of deck plank: 1.75x3.5x20 in
7	Floated up/No Tag	deck plank fragment (complete width): 1.75x4.5x13 in
8	5/4/95—Eastport/Dix	deck plank fragment: 1.75x3x8 in
9	5/4/95—Eastport/Dix	broken board: 3/4x5 3/8 (complete)x14 in—tongue and groove
10	Floated up/No Tag	broken board: 3/4x5 (complete)x25.5 in—tongue and groove (tongue
11	5/21/95 Dive #97—Jetted Up	broken board: 1/2x5 1/8 (complete)x30 in—tongue and groove—has support impressions 22 in apart—1 in wide support impression with
12	5/9/95	broken deck plank from Ed. F. Dix: 1.75x4 (complete)x26 in—1 deck beam impression with 2 spike holes
13	6/3/95—Dix—34 BS (below surface) (Floated up)	board: 1.5x4.25x27 (incomplete) in—burned?
14	Floated up/No Tag	deck plank: 1.5x3 5/8 (complete)x20 (broken) in—1 end burned
15	5/9/95—At Deck Beam	deck plank from Ed. F. Dix: 1.75x5 3/8 (complete)x18 (broken)
16	Floated up/No Tag	board: 1.5x5 (complete)x34 (broken) in—contains support impression measuring 2 3/8 in wide (not deck beam) and circular saw
17	Floated up/No Tag	board: 5/8x5 (complete)x24.5 (broken) in—tongue and
18	Floated up/No Tag	board: 5/8x5 (complete)x24 (broken) in—tongue and groove—contains1 in wide support impression
19	Floated up/No Tag	board: 3/4x3 (complete)x24 (broken) in—tongue and groove—smooth and rough side (identified as white pine)
20	Floated up/No Tag	deck plank fragment: 1 3/8x3.5x27 (broken) in
21	5/31/95, Dive 118, MT, orange buoy under guard beams	deck plank fragment from Ed. F. Dix: 1.5x3.5x34 (broken) in
22	5/30/95, Dive 117, AM, from frame just above deck at Eastport beneath OJB, 1' west of casemate	plank: heavily weathered, tapered—5 in wide (incomplete)
23	5/5/95—TB, 6' north of white buoy—deck clamp	board: 2 1/4x6 (complete)x38 in; has 8 1/2 in long x 1/2 in square drift pin through width—1 end beveled (45 degrees) and 1 end burnt
24	5/18/95; MT; Guard Beam 1	guard support from Ed. F. Dix: heavily water worn—no distinct
25	Floated up/No Tag	guard support from Ed. F. Dix: 2 3/4x6x20 in, contains 4 spikes—1 end burnt—(identified as white oak)
26	5/15/95 MG 35' BS E.W.. Dix on Casemate	board: 3/4x4 1/4 (incomplete) x29 in-tongue and groove, groove missing, contains impression of 1 in diameter drill bit
27	Floated up/No Tag	deck plank: 1 3/4" (complete)x5 (incomplete)x16 (broken) in—contains impression of 4 3/8 in wide deck beam, contains one
28	5/9/1995, Jetted Up near DB 1	plank: 1 3/4 (complete) x6 (complete) x 24 (incomplete) in, contains two spikes 4 1/2 in apart
29	5/5/95	board-tongue and groove: 1/2x3 3/4 (incomplete) x19 (broken) in; has bead on tongue and both edges
30	6/2/1995, #126 CP.. Dix 34' BS, where Dix meets Casemate	board: all dimensions incomplete-2 1/4x6 3/8x31 in

(continued)

Table 4-1. Continued.

Artifact Number	Provenience[1]	Description[2]
31	5/4/95 Beam 0	portion of guard beam from Ed. F. Dix- 3 3/4 (complete) x6 (complete)x37 (one end complete) in; contains 4 spikes; appears to be
32	Floated up/No Tag	Deck plank from Ed. F. Dix: 1 1/2 (complete) x5 1/2 (incomplete) x20 (incomplete) in, has beveled end; contains 1 spike and impression of deck beam on bottom
33	Floated up/No Tag	part of deck beam or guard from Ed. F. Dix, all dimensions incomplete: 5 3/4 (incomplete)x35 (incomplete) in, contains 3 spike
34	Floated up/No Tag	board: roughly finished-2 3/4x1 3/4 (beveled) x4 3/8 (width, broken) x28 (length) in
35	5/4/95	deck plank fragment: 1 3/4 (complete)x4 1/2 (complete)x18 (broken) in, contains two spike holes
36	5/4/95	deck plank fragment: 1 3/4x4 3/4x12 (incomplete) in, contains
37	Floated up/No Tag	deck plank fragment: 1 1/2 x 4 1/2 x21 1/2 (incomplete) in; burned
38	5/6/95 N 173 W130, Jetting	deck plank: 1 3/4x6x29 (broken) in; contains 2 spikes in one end and 2 deck beam impressions 20 in apart, deck beam impression 4 in
39	5/4/1995, Jetted	deck plank (?) fragment: 1 3/8x 4x13 1/2 (broken) in, burned at one
40	6/1/95 Dive #122 TB (see Dive #121), wedged between iron plates of N/S casemate, Jetted Up	wood: wedge shaped (pie shaped), maybe slightly rounded, rough hewn, both ends are axe cut, measures 6x4 5/8x61/2 in, length is 53 in, has one large hole 15 in from end
41	5/9/95, Jetted Up near Deck Beam #1	deck plank from Ed. F. Dix: 1 3/4x5 5/8x32 (broken) in—tar on edge and top, evidence of one deck beam impression, has nail holes
42	4/27/95 31'depth N157 W120	deck plank from Ed. F. Dix: 1 3/4x5 1/2x17 (broken) in, has tar/pitch one edge and impression of one deck beam 4 in wide.
43	5/7/95 N170 W125	deck plank from Ed. F. Dix: 1 3/4x 5 5/8x 40 1/2 (broken) in; contains two deck beam impressions 20 in apart, one deck beam has no nail holes, other deck beam impression has 2 spike holes with one
44	Floated up/No Tag	deck plank (?): 1 5/8x4 1/2x44 (broken) in; contains one deck beam impression (3 1/4 in wide) in middle
45	5/17/95 Top Decking Adjacent Drift Pins S of Casemate	timber fragment from Eastport: top burned and charred, dimensions are 2 1/2x8x37 (incomplete?) in, end is angled 1 foot back where piece
46	tied with 47 and 48	wood fragment from Eastport: charred, no complete dimensions, maximum extant dimensions are 3x5 1/2x23 in, has angled edge and 2
47	tied with 46 and 48	wood from Eastport: heavily burned and no complete dimensions, extant dimensions are 1 1/2x3 1/2x12 in; has one intact side and
48	tied with 46 and 47, 5/30/95 TB Dive #116, on deck of Eastport and below orange buoy	wood piece from Eastport: all dimensions incomplete, extant dimensions are14 3/8x 8 1/2 in, has pinhole, is heavily rounded on bottom and charred
49	6/2/95 Dive #124, TB 34' near where metal plates protruded	guard beam from Ed. F. Dix: 3 3/4x6x27 1/2 (incomplete), contains 4 spikes; identified as oak
50	6/2/95 CP.. Dive #126 34'	wood piece: 2 1/4 (complete)x7 1/2 (complete)x11 1/4 (incomplete ?) trapezoidal shape, one end is cut, has 5 in long spike
51	5/14/95 N.C. Dive #77, 34' south side of casemate	wood piece: wedge shaped, 2 3/8x5 1/4 (at top) x10 in, width is 1 1/2 in at bottom
52	6/2/95, Dive #126 CP.. 34' BS	futtock (frame) from Ed. F. Dix: 3x3 in at upper end, 3x5 1/2 in at lower end, x33 (incomplete) in long, contains spike 5 in from end.
53	5/13/95 MT Eastport planking	plank from Eastport: heavily worn—1 1/2 (possibly complete) x4 3/8x27 (incomplete), appears to be a hardwood
54	Floated up/No Tag	tongue and groove board: 3/4 (complete) x3 1/2 (complete) x7 (broken) in; smooth inside/rough outside

(continued)

Table 4-1. Continued.

Artifact Number	Provenience[1]	Description[2]
55	5/30/95 TB Dive #116, just above deck of Eastport, below orange buoy	barrel stave fragment: 5/16 (complete)x2 3/4"(complete)x24 1/2" broken, end of stove has groove and one nail
56	5/5/95	barrel stave fragment: 1/4" (complete)x4 5/16" (complete)x 18 3/4" broken, has groove at one end
57	6/6/95, Dive #137, #138, in hatch	board from Ed. F. Dix: 3/4x3 (complete), 30 broken, tongue and groove, rough and smooth—2 pairs nails—15 1/2" apart. 1" wide
58	Floated up/No Tag	board: 5/8x 3 1/8(complete)x23 broken, tongue and groove, smooth and rough, 2 nails, possible white paint
59	Dives #137 and #135	almost complete barrel stave: 3/8"x4 1/8" (widest)x28" (white oak)
60	6/7/95, Dive #141 TB, beneath forward end of hatch	9 pieces of wood:
		1) 3/4"x 3" (complete)x 38 (broken), tongue and groove—smooth
		2) 7/8"x 4" (complete)x 31.5 (broken), tongue and groove—smooth
		3) 1 3/8" (complete)x 5x 15 (broken)—3 nail holes along edge 5"
		4) half pound, 3/4" thick, 3" wide (complete), 21" long (broken)
		5) molding 1 1/2" wide (complete), 14" (broken), nailed to piece 6
		6) 3/4"x 3" (complete)x 23" (broken), tongue and groove, has head—molding nailed along grooved side [photo]
		7) 7/8"x 5" (complete)x 19 3/4" (complete), tongue and groove, smooth both sides—white paint one side
		8) barrel stave fragment—5/16" x 3" (complete)x 19 1/2"
		9) 1 1/4"(complete)x 3" (broken), with 3 nails on edge—5" apart, fits
61	6/8/95, Dive #146, BA—Dix, inside hatch	box parts: apparently a single box—this box seems to have had a central horizontal divider and possibly another withe around center
		1) box part (side)—5/8"x 12"x 27"—complete dimensions—pieces missing—both sides, circular saw marks—nail holes at end and middle
		2) almost complete box end—5/8"x 11 1/2"x 12 1/4"—has lettering ["LBS NETT/,,,FROM...1865"]
		3) complete box end—3/4"x 12"x 12 1/4"—with attached to edge—has stenciled lettering ["S.T. CUSHING/JEFFERSONVILLE,
		4) box end fragment—1/2" thick—has stenciled letters
		5) part of side—2 pieces of tongue and groove—grooved centered—tongue offset—1st board=28"x 1/4" thick), groove on both sides, 2nd board=4 5/8"—3/8" thick, 3rd board missing
		6) part of side—1/4"—ridge rises 1/8" above rest of board, i.e. rest of board planned down—ridge seems to be on outside
		7) box side—1/4"—this portion thinner (3/16"), creates ledge on which divider may have rested
		8) box side fragments—8
62	6/7/95—Dive #147, BD—NE corner hatch around pump shaft—Photo	3 barrel parts:
		1) stave-1/4"x 4 3/4"x 28 (complete)—grooves at both ends—nails at 7" and 8" from one end
		2) stave-1/4"x 3"x 29" (complete)—grooves at both ends—nail at
		3) barrel head piece—1/2" (complete)x 6 3/8" (complete)x 8 1/2" (broken)—one end beveled—has lettering—indecipherable

(continued)

Table 4-1. Continued.

Artifact Number	Provenience[1]	Description[2]
63	6/7/95—Dive #140, BA—NE corner hatch at pump shaft—d=37-38'	several wooden box pieces:
		1) 1 1/2" (complete)x 5" (broken)x 25" (broken)—has nail holes 3 and 4" apart on edge (3 nails and 5 nail holes)—this piece fits to end of
		2) box side fragment—1/2" (complete)x 9"x 28 1/4" (complete)—nail holes at each end—piece of 1/2" wide "withe" at one end—smooth on 1 side—circular saw marks—rough inside—residue caked on inside
		3) 1/4"x 5"(broken)x 14" (broken)—possible barrel piece
64	6/10/95—Dive #151, SJ—SW corner in hatch	parts of 1 or more boxes: end fragments=12 (2 complete ends and at least 1 more), side fragments=60 (6 withe fragments)
		1) box end with writing—1/2" thick; 12" wide, 12" high—nails round
		a) 10"high 12" long, writing "...DEPT [arch]"
		b) nails are 1 5/8" tapered cut nails, box sides are 1/4" thick—some are 3/8"; stenciled: "GOVT BAKERY (3/4"
		2) barrel head (2 pieces) almost complete—17" diam—has wooden
		3) portion of barrel head—3/8" thick, 5 3/4", 15" long (not complete
65	6/9/95—Dive #148, TB, 38'—sample of content from inside of box marked "US GOVT BAKERY"	contents
66	5/31/95—Dive #121, CP, 33', 5' SOT OJ Buoy—on Eastport	2 spikes: 7" long (rose-headed, "boat spike"), square shank, 1/4" wide
67	6/2/95—Dive #125, MT, 34'—guard beam spike from Dix, and nails from hull planks	spikes from Ed. F. Dix: from guard support: 1-1/2" square-14 1/4" (complete); from hull plank: 1=1/4"x 4 7/8" (complete), 1=1/2"x 6 1/4" (complete), 1 fragment=1/4"x 3/8"x 2" (complete)
68	5/30/95—Dive #116, TB, 34'BS—from deck of Eastport, beneath orange buoy—Photo	2—6" chiseled rivets
69	6/8/95—Dive #144, MG—Dix barrel parts—Photo	1) barrel stave 3/8"x 2 1/2" (end) (complete)x 10.5 (broken), nail at groove
		2) barrel head (1/2)—3/8"x 17"x 7 3/4"—has writing: "PILOT BREAD [arch-1.5" high]/ US GOVT BAKERY [1/5" high]"
		3) 1/2 barrel head—3/8"x 17" (max diam)x 7 1/2" (broken), has
		4) 1/2 barrel head—3/8"x 9 3/4"x 17" (max diam)—indecipherable
70	6/8/95—Dive #144, MG—Dix—mainly box parts	1)box part- 7/8"x 3" (complete)x 11" (complete) tongue and groove—one end burned
		2) 1"x 2 1/2" (broken)x 18 1/2" (broken)
		3) box ends—5 pieces—at least 3 boxes (yellow poplar)
		a) 1/2"x 12"x 7" (broken)—may have lettering
		b) 3/8"x 12 1/2"x 7" (broken)—no lettering
	Photo	c) 3/8"x 12 1/2"x 11 5/8"—complete end—no lettering
		d) 5/8"x 11 1/2"x 10" (broken)—no lettering
		e) 7/16"x 10" (broken)x 10 3/4" (broken)—has lettering "...SUBS[arch]/...BAKERY/...JEFFERSON"
		4) box sides—1/4" thick to 3/8" thick—34 pieces
		5) 3/4"x 3 3/4" (broken)x 10" (broken)—has nail
		6) 3/4"x 3 1/2" (broken)x 13" (broken)—has nail
		7) 3/4"x 3"x 12" (broken)—tongue and groove with bead on both
		8) 3/4"x 3"x 21" (broken)—tongue and groove with bead on both
71	6/6/95—Dive #137-#138, 37'—in hatch—Photo	2 box ends:
		1) 5/8"x 12 1/2"x 6 1/2" (bottom)—has writing
		2) 1/2"x 12 3/8"x 9 1/2" (bottom)—has writing: "...NETT/US.../JEFFERSONVILLE, IND/ MAY 1865"

(continued)

Table 4-1. Continued.

Artifact Number	Provenience[1]	Description[2]
72	6/9/95—Dive #144, MT, 38'—SW corner inside hatch—N of stanchion	1 barrel stave, plus box fragments, plus 1 barrel head
		1) 1/4"x 3"x 29"—barrel stave complete—3 pieces
		2) barrel head fragment—1/4"x 8"x 1 1/2"
		3) 1/2" barrel head—3/8"x 16" (diam)x 7" has "BEANS" 1" high
		4) 3 box fragments (1 end—5/8"x 5" (broken)x 3" (broken)—2 sides (1/4" thick)
73	6/9/95—Dive #148, TB, 37' BS—from just N of stanchion in SW corner	box fragments:
	Photo	1) one complete end—5/8"x12"x 12 1/4"—nails around edge—has writing: piece 1: "US SUBS DEPT [arch]/.../JEFFERSONVILLE,
		2) 4 withe fragments 1/2" wide
		3) 1 spike—1/2" shank 5 1/2" long
		4) 1 barrel head fragment—1/4" thick, 2x 9 1/2"—double bevel edge
		5) 6 box end parts—1/2"—9 1/16" thick (2 have nails on edge)
		6) 8 box side fragments 1/"—3/8" thick
	Photo	7) 1 complete box end—3/8"x 11"x 11 1/4"—complete nails around edges—writing: "...BREAD/50 LBS NETT/ FROM/ US GOVT BAKERY/ JEFFERSONVILLE, IND/MAY 1865"
74	6/7/95—Dive #143, MY, 38' BS—NW ceiling plank—1 ft from stanchion	1) 1 fragment of ceiling plank—7/8"x 4" (broken)x 8 3/4" (broken)—cut end soft wood (white pine group)
		2) fragment of wood—3/8"x 2 1/2"x 21 1/4"—has white and tan (?)
75	6/7/95—Dive #141, TB, 38' BS—"crate with content" forward end of hatch	box fragments many with organic residue on one side
		1) ends—2 pieces
		a) 5/8"x 8" (broken)x 7" (broken)—no writing—6 nails around edge
		b) 5/8"x 12 1/4"x 9" (broken)—no writing
		c) sides—26 fragments—1/4"—1/2" thick—2 pieces with withe
		d) sides—7 fragments—1/16"—18"—very thin
		2) 1 piece of molding—1 1/2"x 5/8"
		3) 1 broken spike 3 1/2" long
76	6/7/95—Dive #141, TB, 38'—Dix—forward end of hatch	barrel parts
		1) part of head (1/3)—3/8"x 15"x 4" (broken)—has stenciling (1" high)—runs off board "USG...[arch]/27.7 [handwritten 1 3/4" high]"
		2) 1/2 barrel head—1/2"x 16 1/2"x 7"—no writing
		3) 1/2 barrel head—center portion—3/8"x 17" (max width = 7 1/4"—has lettering—indecipherable
77	6/7/95—Dives #140 and #141, 37-38' BS—from 1/2" outflow bag—bow side of hatch	7 bone fragments
		7 nail and spike fragments
		50 seeds/snails (possibly intrusive)
		1 coal
		1 hematite
		93 pieces box fragments
78	6/7/95—Dive #140, c 37'—NE hatch to pump shaft	1 wooden auger handle—16" long, 2 1/2" wide, 2 18" side—hole in center—1" diam—keyhole slot in side 7/8"x 3/8"

(continued)

Table 4-1. Continued.

Artifact Number	Provenience[1]	Description[2]
79	6/7/95—Dive #140, BA, c 37'—NE hatch to pump shaft	box fragments
		1) complete box end—1/2"x 11 1/4"x 11 3/8"—no visible lettering—circular saw marks inside
		2) almost complete box end—1/2"x 12 1/4"x 11 1/2" (complete ?)—has lettering: "..../....T.../JEFFERSONVILLE, IND/ MAY
		3) complete box end—5/8"x 12 1/2"x 11 3/4"—has indecipherable
		4) end fragments—2 5/8" thick
		5) side fragments—44—most 3/8" thick, some 1/2", some 1/4" (1
		6) one possible barrel head fragment—1/4" thick 1 1/2" (broken)x 2"
		7) piece of wood— 1 1/4"x 6" (broken)x 2 1/2" (broken)
		8) piece of wood—1 1/4"x 5" (broken)x 3" (broken)
		9) piece of wood—3/4"x 5" (broken)x 1 1/2" (broken)
		10) 3 nail fragments [1—2 3/8"; 1- 1 1/2"; 1-head-1"]
80	6/6/95—Dive #139—inside hatch	mainly box parts
		1) 3/4 of a box end—5/8"x 11" (broken)x 10 1/2" (broken)—no
		2) box end fragments—2 [1-5/8"; 1- 1/2"]
		3) 1 barrel head fragment—oak?—1/4"x 3 1/2" (broken)x 2 1/2"
		4) 1 coal
		5) 1 acorn
		6) 2 nail fragments [1/8" shank, 3/4" long]
		7) box side fragments—39—1/4"—3/8" thick—some organic residue—one side fragment has dadoed edge to connect to other side
81	No Tag—material from inside of hatch	1—1/2" barrel head—3/8"x 17" (max width)x 7 3/4"—no visible writing—thinned along middle—may have been hinged
		2) 1—almost complete stave—3/8"x 3" (widest)x 27 1/2" (4 pieces)
		3) 2 box end fragments [1—5/8" thick—has lettering; 1-3/4"x 12"x 5"
		4) 43—box side fragments—1/4" to 3/8"—some with withes attached
82	6/4/95—Dive #132-#133, c 34'—inside hatch	4 pieces coal
83	6/5/95—Dive #135, 34'—inside hatch of Dix	1 piece of bone
84	6/6/95—Dives #137-#138—inside hatch—wood bag	box fragments; 2 box end fragments—5/8" and 1/2"; box side fragments—46 1/4," 3/8,"1/2"
85	No Tag—possibly Dillard's	3 coal, 2 brick fragments, 1 tooth—incisor (horse/cow?)
86	6/8/95—Dive #143, MT, 38-39'—from below N end of hatch	1) barrel head—1 (2 fragments) 1/2"x 15 3/4" (complete)x 3"—has lettering "PILOT BREAD[arch, 1 1/8"]/ FROM (3/4"]"
		2) barrel stave—almost complete 1/2"x 2 1/2"x 22 1/2" (broken)
		3) barrel stave—1/4"x 3 1/2"x 12 1/2" (broken)—notch with nail
		4) 3 pieces 1/2 round—3" wide—52" wide—nails spread 20" apart
		5) board piece 7/8"x 9 1/4"x 8" (broken)
		6) i-board—2" thick 6 1/4"x 12 1/2"
		7) box side fragments—29—1/8" (very thin) most 1/4" to 1/2"; box end fragments 3—1/2" thick
87	5/1/95—N163 W121, 29'; from 4x6 beam	1 spike, 1/4"x 3 3/4"
88	5/5/95—Dive #48, CP—beneath deck beam 1,	3 pieces coal
89	5/1/95—CP 30'—N163 W121	1 part barrel stave—3/16"x 4 1/8"x 16" (broken)
90	5/16/95—BA, 35' BS—5-6' S of casemate	1 part barrel head—3/4"x 19 3/8" (barrel diam)x 4 1/8"—double beveled, two nail holes in edge—4 3/4" from ends

(continued)

Table 4-1. Continued.

Artifact Number	Provenience[1]	Description[2]
91	5/17/95—Dive #86, AM, 35'—adjacent to Dix hull along casemate	1 barrel stave piece—1/4"x 3 5/8" (broken)x 17" (broken)—groove at 1 end, 2 nail holes in middle
		1 barrel stave fragment—5/16"x 4 1/4"x 12 1/4" (broken)—groove at
92	4/27/95—32'—N157 W120	1 barrel head fragment—5/16"x 4" (broken)x 17 1/4" (barrel diam)
93	4/26/95—elev. 64.8—N157 W120	4 fragments of 1 barrel head—5/16"x 17" (diam)x 8 3/4"—has bung hole—1 edge beveled—nail hole on 1 edge
		1 piece tongue and groove—5/8"x 2 3/4"x 22" (broken)—has bead on both sides
94	5/20/95—jetted down from near E-W iron casemate—possibly from Eastport	2 fragments timber—fit together 29 1/2" long
95	5/22/95—Dive #101, BA, 34'—jetted, N119 W138	6 fragments from 1 piece of multiple angled cut block
96	6/5/95—Dive #136, BA, 34-38'—inside hatch	1) wood block—2"x 6 1/2"—tar on it
		2) coal—4 pieces
		3) 1 spike and 2 small nails—1=3/16" 2 1/2"; 1=1/2"; 1=1/4"x 4 1/4"
		4) 1 fragment barrel stave—3/8"x 2 3/4" (broken)x 10 1/2"
		5) 1 tongue and groove, beaded both sides 5/8"x 2 3/4"x 16"
		6) 1 tongue and groove, 3/4"x 3 18"x 17 1/2" (broken)—smooth and rough—possible black paint
		7) 1 box end (3 fragments)—3/4"x 11 3/4"x 10 1/2" (broken)—very warped board—stenciled lettering "PILOT BREAD [1"]/ 50 LBS
97	6/6/95—Dives #137 and #138—in hatch wood bag	1) 3 pieces thin plank—3/8"x 2 1/2" (broken)x 32" (broken)—has row of nail holes
		2) 1 piece wood—1 3/8"x 3 1/4" (broken)x 12" (broken)—45 degree angle at one end—oak—spike hole
		3) 1 piece soft wood—7/8"x 2 7/8"x 9 3/4"
		4) 1 box end fragment 5/8"
		5) 59 box side fragments—1/4" and 3/8"
98	6/8/95—Dive #146, BA—S 1/2 of hatch, 1/2" outflow bag	1) 1 nail—3 1/2" long
		2) 2 green bottle glass—lip fragments—string lip
99	6/7/95—Dive #40, BA—Misc. floating from NE quad in hatch to bulkhead	1) barrel head—1 piece—9/16"x 6 1/2" (complete)x 10" (broken)
		2) 1 wood piece—7/8"x 7 1/2"x 11" (broken)
		3) 1 box end—5/8"x 11 1/2"x 10" (broken)—has lettering
		4) 20 box side fragments—3/8"
100	6/2/95—Dive #123, TB—floated up while pulling casemate	3x 3 1/2"x 17 1/2" (apparently complete)—hole but spike missing—4 1/2" spike
101	6/2/95—Dive #125, MT—near striped buoy where Dix impacted casemate	1 piece oak timber—3"x 6"x 27" (broken) has 2 spikes in it
102	No Tag	1) 1 piece deck plank—1 5/8"x 3 1/2" (broken)x 21" (broken)has 4 3/8" wide deck beam impression
		2) 1 piece deck plank—1 1/2"x 4 1/4"x 16" (broken)

(continued)

Table 4-1. Concluded.

Artifact Number	Provenience[1]	Description[2]
102	5/22/95—Dive #102, MT—N117 W138—removed from structure 35BS from Eastport	1) oak timber fragment—3"x 5 1/2" (broken)x 28" (broken)—has 2 spikes centered 8" apart (white oak)
		2) 2 pieces tongue and groove—a) 2 1/2"x 4 3/4"x 25 3/4" (broken); b) 1/2"x 4 1/2" (broken)x 26" (broken)—nail holes at ends and more
103	5/22/95—Dive #101, BA—located @ 5' above Eastport wreck in S end of hole	1 piece tongue and groove—1/2"x 5 3/4"x 23 1/2"—nail holes at end—and other at 21 1/2" and 22 5/8"
104	No Tag	1 complete barrel stave—1/4"x 2"x 29 3/4"—grooves at both ends
105	5/17/95—Dive #85, TB—3-5' S of Casemate 35' BS (off deck of Eastport)	1 piece of charred timber 3"x 3 1/2" (broken)x 14" (broken)—has large 7" (3/8" shank) spike through it
106	dredged up	1) 1 shoe heel fragment 3"x 2 3/4"—1 row of thread holes
		2) 2 fragments of shoe leather
107	From just to NE corner of hatch on Ed. F. Dix	7.5-ft-long pump tube or shaft (white pine group)
108	5/14/95, Dive 77, TB, south side of Eastport casemate, circa 34 to 35 ft BS	Irons spikes: 1 - 8 in long; 2 - 7 in; 2 - 6 in; 1 5 in; 1 fragment of burnt wood.
109	5/14/95, Dive 78, NC, south side of Eastport casemate, circa 34 to 35 ft BS	Iron spikes: 1 - 8 in long; 1 iron drift pin fragment
110	5/15/95, dive 81, MT, 2-3 ft south of Eastport casemate, 3 ft west of Dix, 34 to 35 ft BS	Iron spikes: 1 - 3 in long; 1 - 4 in; 3 - 5 in; 8 - 6 in; 15 - 7 in; 14 - 8 in; 4 iron spike fragments; 6 pieces of iron drift bolts, three 6 in long chisel-pointed iron rivets; 1 fragment of large chiseled-pointed
		1 iron plating fragment; 15 pieces of burnt wood, 2 fragments of
111	5/15/95, Dive 82, MG, 3 to 4 ft so of Eastport casemate, 6 ft west of Dix, 34-35 ft BS	Iron drift pins: 4 - 1 ft long; 1 - 1 ft, 10 in long; one sq. iron drift 1 ft, 9 in long; 2 drift bolts with clinch rings; Iron spikes: 14 - 8 in long, 16 - 7 in long; 28 - 6 in long; 4 spike fragments;
		one 9 in long chiseled rivet, two 6 in long chiseled rivets; 4 fragments of soft coal, 4 fragments of sandstone
112	no provenience	Irons spikes: 1 - 8 in long; 1 - 5 in long, 1 - 3 in long
113	5/16/95, Dive 84, BA, 5 to 6 ft south of Eastport casemate, west of Dix, circa 35 ft BS	1 barrel stave; 2 wood fragments; Iron spikes: 1 - 11 in long; 7 - 8 in long; 4 - 7 in long; 10 - 6 in long; Chiseled rivets: 1 - 6 in long; 1 - 4 in long
114	5/17/95, Dive 85, TB, 3 to 5 ft south of Eastport casemate, west of Dix, circa 35 ft BS	7 - 2 ft long round iron drift pins; 1 - 1 ft 1 in long iron spike; 5 - 1..5 to 11 in long iron spikes; 12 - 8 in long spikes; 2 - 5.5 to 6 in long spikes; 1 burnt wood fragment with 8 in long spike, 1 wood
115	5/17/95, Dive 86, AM,	one barrel stave; 1 iron barrel strap, 1 bone fragment,
116	5/20/95, Dive 94, TB, at N120, W142, circa. 30 to 31 ft BS, possibly dredged from near casemate (in dredge spoil)	Iron spikes: 2 - 8 in long; 6 - 7 in long; 2 - 5.5 in long
117	5/26/95, Dive 114, CP; at N161, W170, circa 33-34 ft BS (below surface)	1 piece of metal wire
118	5/31/95, dive 119, MG, circa 33-34 ft BS, from casemate deck of Eastport	1 iron drift pin
119	5/31/95, Dive 121, CP, circa 33-34 ft BS, 5 ft south of orange buoy on Eastport	two 6-in long iron spikes
120	6/2/95, dive 125, MT, circa 33-34 ft BS (below surface), on Dix below striped buoy	1 - 14 in long iron spike from guard beam, 1 - 5 in long spike from planking, 1 - 7 in long spike from planking, 1 - 3 in long nail

1. Provides information on location, date and the dive on which object was found, plus the initials of the diver. Many artifacts floated up prior to or during the excavations and these are listed as such.
2. Sizes are given in inches.

4 near Buoy 5, one was 8 in wide, one was 6 in wide and one was 4 in wide.

Structural elements of the hull of the *Ed. F. Dix* consist of upright frames (also called futtocks or ribs); horizontal floors, exterior hull planking, interior ceiling planking, several longitudinal timbers or "stringers," interior stanchions and a bulkhead (see Figures 4-18 and 19). The frames on the *Dix* are composed of white oak timbers measuring 4 by 6 inches in section. Spacing between frames is approximately 10 in (see Figure 4-18). The tops of all of the frames that could be mapped are cut off flat and are flush with the top edge of the upper strake of hull plank, except where frames are crossed by deck and guard beams. In these instances, the tops of the frames are cut off or notched out like the upper strake to accommodate the beams. One complete frame piece from the vicinity of Buoy 4 (see Figure 4-18) was recovered. This piece (Artifact 52) measures 33 in long and represents only the upper end of the frame, or what would be called the first futtock (see Figure 4-19). This frame piece shows a slight curvature, characteristic of those found near the bow and stern of steamboats to accommodate the curvature of the hull in these areas. The frames found along approximately the central one-third of the hull of a typical western river steamboat would have been relatively straight. It was difficult to accurately measure the shape of the in situ frames found on the *Dix*, but it appeared as if most were slightly curved, suggesting that the straight sided portion of the boat (the "dead flat" area) was farther aft.

Three-inch-thick hull planking is attached to the outside of the frames. The hull was carvel-built, with planks meeting flush at the seams. As noted, the top edge of the uppermost hull plank (or "sheer strake") is flush with the tops of frames. This uppermost hull plank is 10 in wide, as is the one immediately below it. The third hull plank seems to be slightly narrower, measuring only about 8 in wide. Remnants of fasteners in the recovered futtock indicate that two spikes were used to attach a hull plank to each frame. Approximately 15 in down from the top of the hull, a 4-in-wide piece of timber was found attached to the outside of the hull. This piece was slightly rounded and projected about 2 in out from the hull planking (see Figure 4-19). This timber was tentatively identified as a rub wale or rub rail of some sort, however, what purpose it would serve in view of the overhanging guards is unknown. No information on the exterior of the hull was obtained below the possible rub rail. No sample of hull planking was recovered for identification, but steamboat hulls typically were planked with white oak. On the *Bertrand*, hull planking and hull frames were both made from white oak (Petsche 1974:75-76).

As noted, two horizontal timbers identified as deck clamps are attached to the inside of the vertical frames (Petsche [1974:Figure 74] refers to a deck clamp as a "top wale strake," and, often, it is referred to as a "deck shelf"). On steamboats, deck clamps extended the entire length of the boat and served as support and points of attachment for deck beams, in addition to providing longitudinal strength to the hull. The uppermost deck clamp on the *Dix* measures 3 by 12 in while the one below it is slightly smaller, measuring 3 by 8 in. The top of the uppermost deck clamp is about 5 in beneath the tops of the frames, as shown in Figure 4-19. This upper clamp is notched out about 2 in to receive deck beams and guard supports. Some nineteenth century steamboats were constructed with only a single deck clamp, as Petsche (1974:Figure 77) found on the 161-ft-long sternwheeler *Bertrand*. Similarly, the wreck of a small nineteenth century sidewheeler on the Pearl River, Louisiana, thought to be about 110 ft long, is built with a single, 3-by-10-in deck clamp (Pearson n.d.). However, Bates (1968:30), in an illustration of the internal components of a typical western river steamer, shows paired deck clamps similar to those found on the *Dix*. If the *Dix* had originally been built with a single deck clamp, as was the *Bertrand*, a second may have been added in May 1865, when the steamer was rebuilt with added strength to allow her to work in the Mobile trade (*Missouri Democrat* May 25, 1865).

Several inches below the deck clamps is another longitudinal timber attached to the inside of the frames. Identified as a "strake" in Figure 4-19, this 3-by-8-in timber extended along the entire portion of the hull that was cleared. As depicted in Figure 4-19, this side strake (also called a "stringer" or a clamp) was positioned about 12 in below the lower deck clamp. However, as the incurvature of the side of the hull increased toward the bow, the distance between the lower deck clamp and this strake decreased somewhat. In the vicinity of Buoy 2, the strake was only about 8 in below the bottom deck clamp. This side strake is located only about 30 in below the level of the main deck, suggesting it was still up on the side of the hull, which was over 5 ft deep. In the vicinity of Deck Beams -1 and -2, this strake is broken, as were several pieces of hull planking, caused by the penetration of pieces of the *Eastport's* iron

armor through the *Dix's* hull in this area. It is probable that at least one more strake is located farther down the side, although excavations did not extend this deep. One certainly would have been attached at the juncture of the side of the boat with the bottom (i.e., the chine). The strake attached at this junction was commonly called the bilge keelson (Bates 1968:30; Petsche 1974:Figure 76).

Ultimately, excavations were extended eastward across the main deck of the *Dix*, with the intention of locating the starboard side of the boat. These excavations revealed that the main deck of the boat was mostly intact and extremely well preserved. Also, depth readings taken on the deck verified the findings from probing that the wreck rested at an angle, tilting down toward the east. Because of this, the overburden on the wreck increased in depth in that direction, making excavations more and more difficult as divers proceeded across the deck. Approximately 12 ft from the port side of the boat a hatch opening was encountered, first evidenced by its raised coaming (see Figure 4-19). At the hatch, the sediment covering the deck was close to 5 ft thick. Because of the increasing difficulty of continuing excavations across the deck, it was decided to explore the hatch opening and the underlying hold of the vessel. Also, by this time several wooden barrel staves and heads had been recovered from the interior of the hull near the port side and it was suspected that other similar material would be found in the hold.

Excavations through the hatch opening reached the bottom of the hull and cleared a fairly large area in the vicinity of the opening. These excavations collected critical information on the interior structure of the steamer, plus recovered a number of items of cargo. Ultimately, an area was cleared within the hold of the boat that extended 3 to 5 ft from all sides of the hatch opening. It was determined that excavations should proceed no farther than this because of the potential danger of collapse of the main deck as sediment was removed from the vessel's interior.

The hatch opening itself measures 5 ft wide (athwartship) by 6 ft long (fore-and-aft) and is surrounded by a coaming rising about 3 in above the deck. The exterior rim of the hatch coaming is beveled and a series of rectangular notches are cut into the interior of the port and starboard coaming pieces, as shown in Figure 4-20. These notches, identified as strongback mortises, were to accommodate bat-

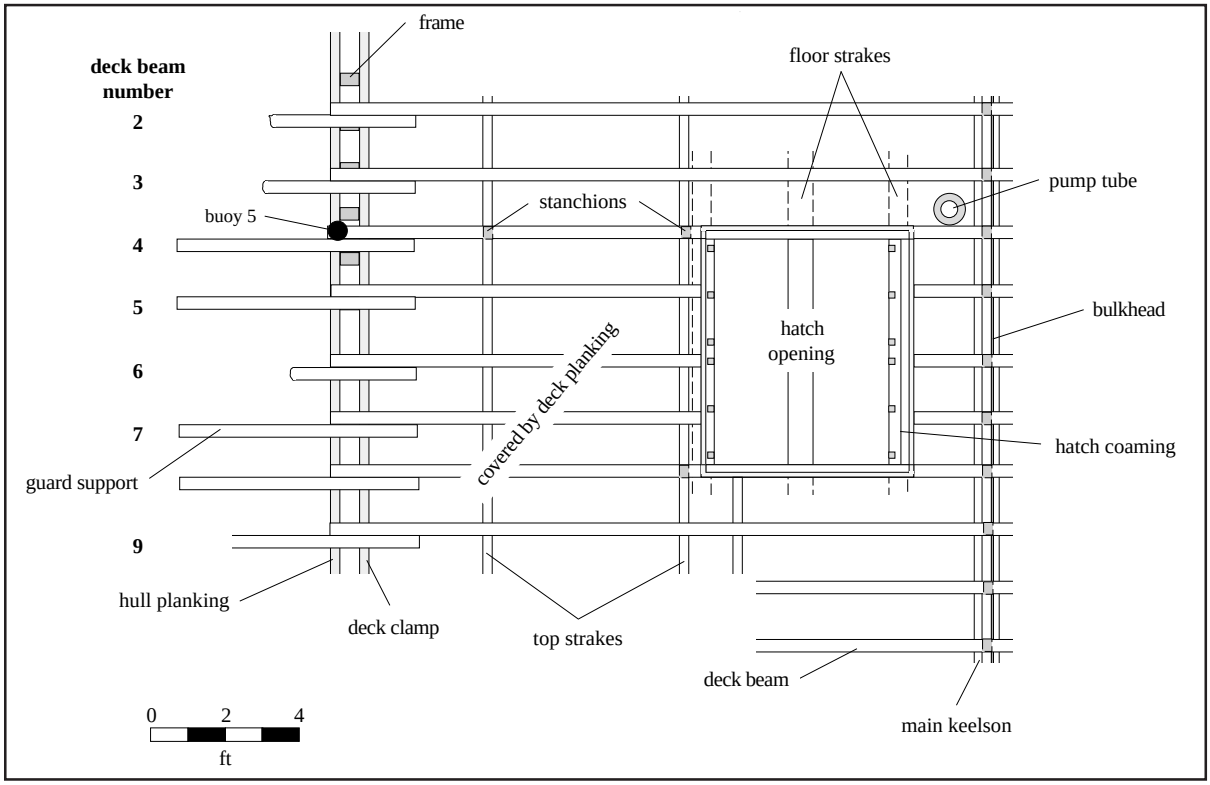

Figure 4-20. Plan view of the internal features of the *Ed. F. Dix* mapped in the area of the hatch opening.

tens (or strongbacks) on the underside of the hatch cover, helping hold it in place. The hatch cover was not found. The excavations down into the hatch provided the best opportunity for recording stratigraphy at the site because the surrounding boat structure acted as a barricade, preventing the constant slumping found almost everywhere else on the site. Figure 4-21 presents the stratigraphy recorded in the hatch excavations, plus it shows the tilt of the wreck of the *Dix* as it was measured on the main deck. As can be seen, the hull lists downward to the east, or toward the starboard side, at an angle of approximately 6 degrees. In addition, the hull slopes down toward the stern at a somewhat lesser angle. The tilting derives from the circumstances of the *Dix's* striking and lodging on the wreck of the *Eastport*. The actual point of impact was found and is located immediately below Deck Beams -1 to -3 near the port side of the *Dix*. Here, the iron casemate of the *Eastport* penetrated the bottom of the *Dix* and, also, seems to have held it fast. As a result, the *Dix* was forcibly tilted over toward the starboard side as well as down at the stern. It appears that the starboard side of the *Dix* came to rest on the forward main deck of the *Eastport*. The results of the hydraulic probing support this interpretation.

Subsequent examinations of the point of impact of the armor plates of the *Eastport* with the hull of the *Ed. F. Dix* revealed that several plates penetrated the hull and some of these extended a foot or more inside of the *Dix*. It appears as if the gash through the hull, while not very wide, was, in total, several feet long, certainly large enough to flood the *Ed. F. Dix* quickly. As is noted below, the impact also appears to have broken or displaced some major structural pieces of the hull, such as bottom strakes and floors. It is presumed that many seams were opened in the bottom planking of the *Dix* when she struck the *Eastport*, allowing even more water in.

The top of the hatch opening is located at about 34 ft below the water surface. The upper 18 in or so of fill within the hold consisted of a stratum of fairly loose sand and sandy silt containing numerous pieces of sticks, tree branches, and small logs, as well as leaves (see Figure 4-21). Most of the pieces of wood appeared to be heavily water worn. This material was probably deposited as a sandbar was developing around the wreck, or soon after one had formed, and when swirling water could carry sand and river debris into the hold. Evidence for a sand bar forming around the wrecks was found elsewhere on the site. For example, a fairly thick stratum of medium to coarse sand was discovered during the excavations of Area 4 (see Figure 4-14). In this area, the sand stratum covers the remains of the *Eastport* and, possibly, extends up onto the wreck of the *Dix*. Additionally, the coring program undertaken by the Vicksburg District identified a fairly thick stratum of sand covering much of the correctly presumed remains of the *Eastport*, plus it identified an extensive layer of naturally deposited "drift wood" concentrated on the upstream side of the wrecks. This bank of driftwood probably accumulated as river-born debris washed against the large barrier created by the two wrecks (Birchett and Pearson 1995:54).

As recorded in the excavations through the hatch, beneath this sand deposit is a stratum consisting of hard-packed silty sand. This deposit extends from about 35.5 ft to 37.5 ft below the pool surface (see Figure 4-21) and is presumed to have accumulated prior to the formation of a sandbar on the wrecks, at a point in time when the remains of the *Dix* were exposed directly to the force of the Red River's current. It is impossible to estimate how long it took this deposit to form. Although it could have taken several years for this stratum to accumulate, it is more likely that it was formed within a much shorter period of time, possibly a matter of months, if not weeks. Also, it is believed that deposition of this stratum began very soon after the sinking. This rapid filling of the hold of the boat is assumed because of the very heavy sediment load carried by the Red River. A number of disarticulated pieces of wooden boxes and barrels were found in the lower couple of inches of this stratum. These containers represent some of the cargo carried by the *Ed. F. Dix* and, based on stenciled lettering on several fragments, most held United States government stores consisting of foodstuffs such as pilot bread (hard tack), flour and beans.

The hard-packed stratum of silty sand was underlain by a layer composed almost entirely of these container remains. This bed of concentrated box and barrel pieces was almost 1 ft thick (see Figure 4-21). Many of the container parts were disarticulated, probably meaning that water swirling around in the hold soon after the sinking had broken them up. However, it was also apparent that some of the boxes were intact and possibly in place, stacked one on top of the other. The box remains were thoroughly saturated and extremely fragile and it was very difficult in the zero visibility conditions to remove them intact. Ultimately, however, large portions of several boxes were recovered. These containers are discussed in detail below.

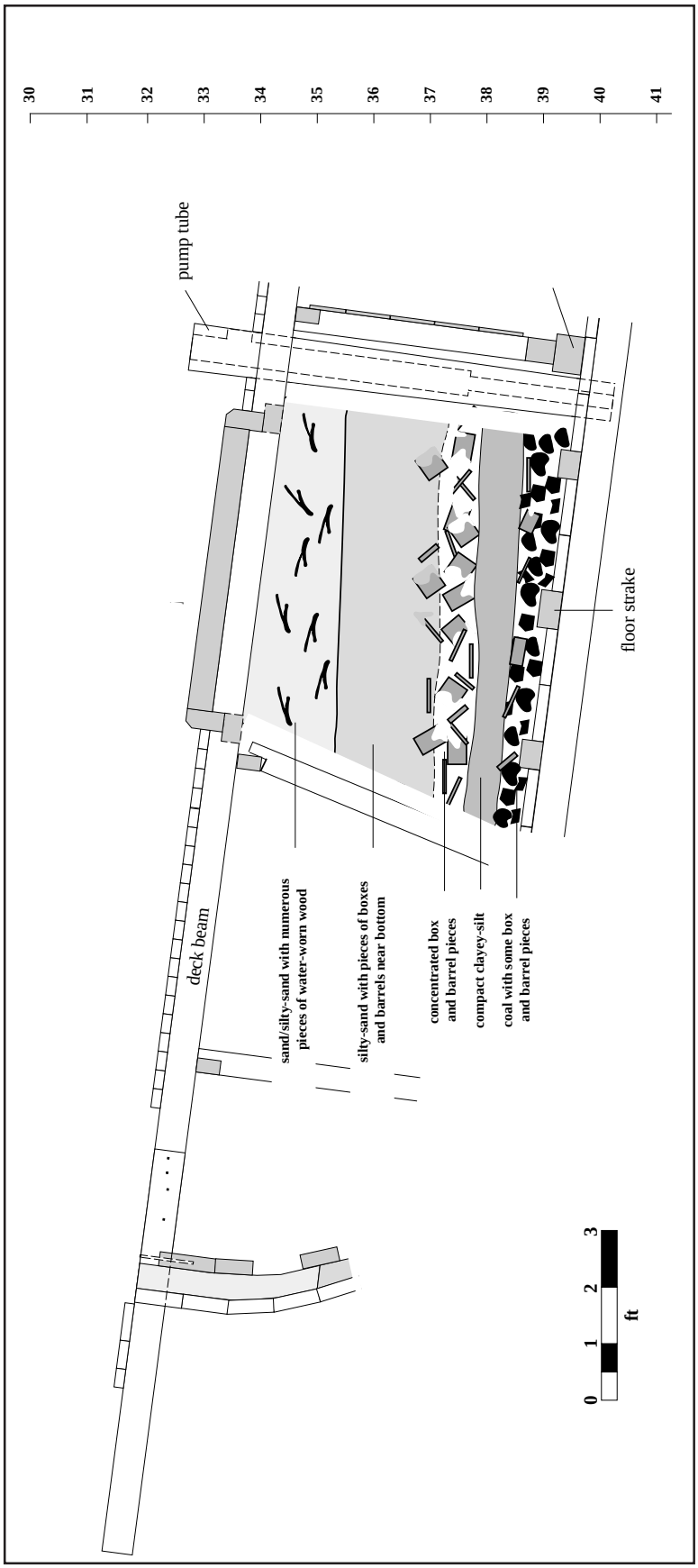

Figure 4-21. Profile along Deck Beam 4 of the *Ed. F. Dix* showing angle of list and the stratigraphy recorded in the hold below the hatch opening.

Immediately below the stratum of concentrated box parts was a fairly thin lens of compact silty clay (see Figure 4-21). It is possible that this was not a continuous stratum, but rather a small deposit of clayey material, because it was not noted by all of the divers when excavating at this depth. The origins of this stratum are unknown, although it had to have been deposited very soon after the sinking, before the cargo began to shift around within the hold.

At the bottom of the hold of the *Ed. F. Dix* was a layer of coal within which were mixed some pieces of wooden boxes and barrels. The pieces of coal varied greatly in size, but most were fairly large, measuring from 4 to 6 in across. No detailed analysis of the recovered coal has been conducted, but on the whole it is extremely hard with a shiny surface, suggesting a good quality anthracite coal. The layer of coal was about 10 in thick on the eastern side of the hatch opening, several inches more than on the western side, and it appeared as if the coal had settled toward the starboard (i.e., eastern) side of the steamer when it listed in that direction. Coal may have been used as fuel for the *Ed. F. Dix*, although wood, which was plentiful and cheap, seems to have been most commonly used by steamboats on the Red River (Pearson and Wells 1999). It is possible that few wood yards were operating along the river at the time the *Dix* sank because of the great disruptions brought about by the Civil War, forcing the steamer to use coal. However, if coal had been used as fuel it would have been stored on the main deck convenient to the boiler furnaces, not in the hold of the boat. The coal in the hold of the *Dix* may represent spillage or it could represent part of the cargo, but this later idea seems unlikely.

It was initially thought that the deck hatch was amidships in the boat, however, this does not appear to be the case. Excavations within the hold located an intact, longitudinal bulkhead just over 2 ft east of the hatch, as seen in Figures 4-19 and 4-20. Fore-and-aft bulkheads were constructed within the holds of steamboats, primarily, to provide longitudinal strength and stiffness to the hull. For example, the 161-ft-long *Bertrand*, a boat similar in size to the *Ed. F. Dix*, was built with a single bulkhead extending down the center of the hull from bow to stern (Petsche 1974:77). Other western steamboats, particularly larger ones, were built with multiple bulkheads (Bates 1968:30; Hunter 1949:97), although a bulkhead seems to have almost always run down the center of the hull (Hall 1884:189). The bulkhead in the *Dix* is presumed to be in the center of the hull, plus it is thought to extend the entire length of the boat. As shown in Figure 4-19, excavations within the hold stretched from the hatch almost all of the way to the port side of the hull and no other bulkhead was found, supporting the interpretation that the steamer contained only a single, central bulkhead. The distance from the bulkhead to the outside of the hull on the port side was measured as 17 ft, 3 in (see Figure 4-19). Assuming the bulkhead is in the center of the hull, this would mean that the beam of the *Dix* at this location is 34 ft, 6 in. As noted earlier, enrollment records indicate that the beam of the *Ed. F. Dix* was 35 ft, slightly more than that measured here. However, the maximum beam on a sidewheeler was at the paddlewheels, and the hull narrowed toward the bow and the stern. Because of this, one would expect the beam of the *Dix* in the area of the hatch, which was well forward on the boat, to be less than the maximum beam, in fact somewhat less than the measurement obtained here. For example, the 1851 plans of the sidewheeler *Buckeye State* show that the hull beam at the boat's forward hatch was 94 percent of the maximum beam at the paddlewheels. Using this ratio, it is expected that the beam of the *Ed. F. Dix* at a similar location (i.e., the forward hatch) would be about 33 ft. While the difference between this number and the measurement obtained from the wreck is not great, it is suspected that the 17 ft, 3 in-distance between the vessel' side and the bulkhead shown in Figure 4-19 is incorrect and the actual distance should be slightly less. Given the very difficult diving conditions at the site, particularly the zero visibility, it is not surprising that some measuring errors occurred. Also, distortions in the hull of the *Dix* could exist, resulting from when she slammed into the *Eastport* and/or from various natural forces acting on her since sinking.

Since it is assumed that the bulkhead is in the center of the boat, then the hatch has to be slightly offset to the port side. Steamboats certainly had to have hatches, because cargo and supplies were commonly stored in the hold below the main deck and access to the bilges was necessary. Relatively little detailed information is available on the placement of hatches on nineteenth century steamboats. The plans for the large sidewheeler *Buckeye State* show a forward hatch, about half way between the bowstem and the boilers, and an aft hatch, located just a few feet forward of the stern. Both of these hatches are centered on the main deck. However, the plans of the *Buckeye State*, show that the boat, also, had a central bulkhead, meaning the hatches would have

opened on top of the bulkhead. If the plans are accurate as to the position of the *Buckeye State's* hatches, it is unknown how the central bulkhead and the centrally located hatches were accommodated to one another. Petsche (1974:77) notes that the *Bertrand* had at least 5 hatches on the main deck leading into the holds; two forward hatches about 33 ft from the bow, two main loading hatches 38 ft forward of the transom, and a small bilge hatch near the stern to permit access into the bilges. The area around the forward hatches on the *Bertrand* had been disturbed by earlier salvage activities, such that Petsche, apparently, was unable to measure the size of the openings. However, their position on the boat is approximately the same as the hatch on the *Dix*. Because a central bulkhead effectively divided the hull in half, access to both holds necessarily required two hatches, one on either side of the bulkhead. It is presumed that the hatch found on the *Dix* is one of a pair; the other hatch would be located on the starboard side of the central bulkhead. Unfortunately, no information on the probable existence of the other hatch was obtained during the fieldwork.

The bulkhead in the *Dix* extends from the bottom of the hold to the bottom of the main deck and is built of 0.75-in-thick horizontal planks nailed to upright 3-by-5-in stanchions. The stanchions rest on top of two, 5-in-thick timbers. The lowermost of these timbers is estimated to be about 8 in wide and the upper timber 3 in wide. Together, these timbers form the main keelson on the boat (see Figure 4-19). The upright stanchions are notched out at their tops to accommodate a 3-by-5-in top strake which is attached to the underside of the deck beams, as shown in Figure 4-19. Approximately 15 ft of the bulkhead was exposed and mapped and it was noted that stanchions were positioned at every deck beam (see Figure 4-20). Toward the bow, at the extreme end of the portion of bulkhead that was exposed, it appeared as if the bulkhead is either partially collapsed or is beginning to curve toward the port side of the boat. This part of the bulkhead could not be further examined because of the danger of deck collapse. However, the bulkhead may be damaged and distorted in the area forward of the hatch because this is that part of the boat that was damaged from striking the *Eastport*. As noted earlier, in addition to a number of hull planks, the lower side strake is broken where the iron armor of the *Eastport* penetrated the hull of the *Dix*. It is likely that additional structural pieces, such as floors, also were broken from the impact and broken or dislocated floor timbers easily could have displaced parts of the bulkhead.

Several other deck stanchions were found during the excavations in the hold. Two are positioned just to the port side of the hatch opening, one near either end of the hatch (see Figure 4-20). The deck stanchion located near the northwestern corner (i.e., forward, port side) of the hatch is severely tilted, possibly having been dislodged when the *Dix* struck the *Eastport* or after she sank and settled to her starboard side (see Figure 4-19). These two, 3-by-5-in stanchions are about 6 ft apart and may represent elements in a line of stanchions that stretched along the entire length of the boat. It is suspected that a matching line of stanchions are located on the starboard side of the hull. Petsche (1974:Figure 78) shows two rows of deck stanchions on the *Bertrand*, each located about 7 ft from the central bulkhead, almost identical to their placement on the *Dix*. On the *Bertrand*, stanchions were spaced about 5 ft apart.

Many steamboats were built with more than two rows of deck stanchions (Bates 1968:30) and this could have been the case for the *Dix*. About 5 ft toward the port side of the leaning stanchion, another 3-by-5-in upright timber was found that is thought to be a deck stanchion (see Figure 4-19). It was not positively determined if this stanchion is one of a row of similar pieces, although it is likely that it is.

All three of these deck stanchions, like those on the bulkhead, are notched at the top to receive a 3-by-5-in timber that is nailed to the bottom of the deck planks (see Figure 4-19). This longitudinal timber is identified as a "top strake," although Bates (1968:30), in his depictions of typical steamboat construction, shows top strakes in association with bulkheads only, not with deck stanchions. On the *Bertrand*, stanchions, apparently, were attached directly to deck beams and no longitudinal top strakes like those found on the *Dix* are illustrated (Petsche 1974:75-77). Whether or not the *Ed. F. Dix* was unique in having these top strakes is unknown. It is possible that these pieces were installed when the boat was rebuilt in 1865 to provide added strength needed for the Mobile trade, as reported in the *Missouri Democrat* on May 25, 1865.

At the bottom of the hold of the *Dix* several longitudinal floor strakes and ceiling planks were exposed. Three fore-and-aft strakes were discovered in the area excavated. The central one lies almost directly beneath the center of the hatch opening and

when first discovered was thought to represent the central keelson of the boat. However, it is now identified as one of the several strakes running the length of the hull. This central strake is 8 in wide (see Figure 4-19). Two smaller, 6-in-wide strakes are found 24 in either side of the central strake. Twelve-inch-wide ceiling planks are between the strakes. Ceiling consists of planks nailed to the interior of frames and floors and forms the inside "skin" of a boat. Near the forward end of the hatch, a piece of ceiling planking was loose and was recovered. This piece of ceiling is a species of the white pine group (*Pinus*), as is the deck planking. Several floor timbers were partially exposed in the area of the loose ceiling planks. These thwartship timbers measured 3 by 7 inches in section, approximately the same size as the deck beams. The fore-and-aft ceiling planks and bottom strakes are attached directly to the underlying floor timbers (see Figure 4-19).

Just forward of the hatch, between it and the bulkhead, was a hollow pump tube or shaft, extending from the bilge to above the main deck (see Figures 4-19 and 4-20). When originally discovered, before it was found to be hollow, this piece was thought to be the remnants of an upright boom. However, after some examination, it was verified as a hollow, slightly tapered tube, measuring 10.2 inches in diameter at the top and 7.8 inches in diameter at the bottom. The bottom of the tube extended through a hole cut in the ceiling planks, and the top projected through a similar hole cut through the main deck planking. The piece was recovered and there is no doubt that it is a pump tube. The 7.5-ft-long pump tube consists of a white pine log whose center has been bored out. The central bore hole is in two parts; the lower portion measures 3 inches in diameter and extends 30 in up from the bottom of the tube while the upper 5 ft of the bored hole has a diameter of 5.4 in (see Figure 4-19). A horizontal opening, also measuring 5.4 inches in diameter, is located 11.4 in from the top. The tube was fitted into the boat so that the bottom of this opening was level with the main deck (see Figure 4-19), allowing water pulled up the tube to spill directly onto the deck. Two small, 2-in-diameter holes are drilled through the side of the tube near its top, opposite the large opening, and remnants of a 0.5-in-diameter iron bolt extends from the side of the tube, just below its top. These holes and the bolt are thought to have been where the pump handle was attached.

This tube is no doubt part of a simple, hand-operated plunger pump, consisting of an arm or lever at the top that moved a plunger rod up and down within the tube. One or several leather, metal, or wooden cups would have been attached to the plunger rod, which, on the upstroke pulled the column of water up and out of the pump. Hand pumps were common on steamboats, however, they seem to have always been situated aft of the boilers where they could be used to fill the boilers, as well as pump the bilges. No reference to a bilge pump similar to that found on the *Dix* has been found in the published literature on steamboats and authorities on western river steamboat construction have never heard of such pumps (Alan Bates personal communication 1997; Jack Custer personal communication 1997). It is presumed that this pump was installed on the *Ed. F. Dix* when she was rebuilt for the Mobile trade. If, as is believed, this meant the New Orleans to Mobile trade, then the steamer would have been operating in the nearshore, open waters of the Gulf of Mexico where the danger of taking on water was much greater than it was on inland rivers. The installation of an extra bilge pump near the forward hatches seems a reasonable precaution to combat this potential danger.

Excavations in Area 3

The excavations conducted in Area 1 revealed that the forward 20 percent or so of the hull of the *Ed. F. Dix* was intact and in very good condition. As discussed earlier, the results of the hydraulic probing suggested that much of the remaining hull of the boat, also, is intact. In order to collect more information on the condition and structure of the vessel, an effort was made uncover a portion of the *Dix's* hull farther toward the stern. The location selected, identified in Figure 4-14 as Area 3, was in the vicinity of grid coordinate N120E155, where it was thought excavations would encounter the port side hull of the boat. It would have been more desirable to position the excavations farther toward the stern of the boat, in the presumed vicinity of the paddlewheels. But, as can be seen in profile B-B' in Figure 4-16, the depth of the water in the southern one-third or so of the pool was only 20 to 25 ft, meaning that 10 ft or more of overburden would have to be dug through to reach the wreck. Experience had shown that this would be virtually impossible, so excavations were conducted in Area 3, where the overburden was estimated to be about 5 to 7 ft thick.

Unfortunately, excavations in Area 3 failed. Several divers spent most of a day trying to excavate down to the wreck using the venturi dredge and

the water jet, but about 5 ft below the bottom of the pool they encountered several large logs, in addition to numerous smaller pieces of limbs and branches. Also, the sediment here was very sandy and the excavated hole was continually collapsing and filling. It became evident that it would be impossible to reach the boat at this point and the excavations in Area 3 were abandoned. Although the wreck was not reached, the excavations indicated that a considerable quantity of river-born debris (logs, tree limbs and branches, etc.) had accumulated over the central portion of the wreck of the *Dix* before it was covered by bank line accretion. The quantity of sand encountered in Area 3, further suggests that this debris had accumulated on or in a sandbar.

Although the archaeological research indicated that the superstructure of the *Ed. F. Dix* was not intact, a number of pieces of tongue and groove planking were recovered which are thought to have come from some of the above deck structure of the steamer. Many of these pieces floated up and were collected during the hydraulic dredging of the pool, prior to the start of the archaeological work, and others were jetted loose during the excavations such that their exact position on the wreck is unknown. As shown in the list of recovered artifacts presented as Table 4-1, numerous pieces of tongue and groove boards measuring 0.75 to 0.625 in thick were found. These tended to occur in two widths, 3 in and 5 in, and several show circular saw marks on their unfinished sides. Nail holes and staining indicate that many of the tongue and groove boards were nailed to 1-in-wide framing pieces and one of the larger board fragments revealed that these 1-in pieces were spaced about 22 in apart. Several pieces of tongue and groove board contain remnants of white paint on their exteriors. A sample from one of the 3-in-wide tongue and groove boards has been identified as a species of white pine (*Pinus* sp.), and the other pieces recovered appear to be made of similar wood.

It is almost certain that this tongue and groove boarding is derived from the superstructure of the *Ed. F. Dix*. The cabins, paddlewheel housings, and other elements of superstructure on steamboats were normally of the very lightest and flimsiest construction; reflective of the efforts made to reduce weight. The walls of the upper works of even the larger steamers were commonly constructed of 0.25- and 0.5-in-thick boards fastened to very light framing. White pine and poplar, both light-weight and inexpensive woods, came to be used almost exclusively in the construction of the superstructure (Hall 1884:179-180; Hunter 1949:82). The several pieces of wood thought to come from the superstructure of the *Ed. F. Dix* generally conform to what would be expected for mid-nineteenth steamboat construction.

Artifacts Recovered From the Ed. F. Dix

The principal objective of this archaeological study was to ascertain the identity and condition of the two vessels buried adjacent to the Red River. It was anticipated that artifacts would be collected from the wrecks, but from the outset of the project it was decided that artifact collection would not be a major objective. Objects were recovered only as necessary to aid in the identification of the vessels, to enhance interpretation of the mapped structural remains, or as required to expose segments of the wrecks. The proper conservation of any recovered artifacts was of critical concern to the Vicksburg District and to the archaeologists working on the project. To accommodate the necessary artifact conservation, the Vicksburg District entered into a Cooperative Agreement with Northwestern State University in Natchitoches, Louisiana, prior to the start of the excavation of the two boats. Under this agreement, an archaeological conservation laboratory was established at Northwestern State University to conserve and temporarily curate all artifacts recovered during the present study. Dr. Tommy I. Hailey of the Cultural Resource Office of Northwestern State University organized the conservation laboratory and directed the conservation of recovered material. As artifacts were collected in the field, they were tagged, recorded and, as necessary, photographed and then placed in containers of fresh water. Periodically over the course of the project, artifacts were turned over to the conservation laboratory at Northwestern State.

The conservation of artifacts from underwater sites is commonly a time-consuming and complicated undertaking. Also, complete analysis of some classes of artifacts cannot be performed until the objects are cleaned and conserved. In the present instance, it was not until the spring of 2000 that treatment of many artifacts from the *Ed. F. Dix* and USS *Eastport* had reached a point where the descriptions presented here were possible. The treatment of these materials followed generally accepted conservation practices. Discussions on the various procedures employed in the conservation of these artifacts are provided in Appendix B. Information on the ownership and permanent curation of the recovered artifacts is provided in Chapter 5.

As noted in previous discussions, a variety of materials were recovered from the *Ed. F. Dix*. These included a number of structural elements, most of which have already been discussed, in addition to the remains of numerous wooden containers from inside the boat's hull that originally held government stores. Table 4-1 provides a list of all the artifacts collected during the excavations, including those from both the *Dix* and the USS *Eastport*.

Containers

The remnants of a large number of wooden containers were recovered from inside the hull of the *Ed. F. Dix*, all of which constituted some of the vessel's original cargo. Two types of containers are represented in this collection, casks and rectangular boxes. No complete casks were recovered, only staves and portions of cask heads. Several apparently complete and intact boxes were discovered by divers during the excavations below the hatch opening, but the wood was so soft and fragile that no box could be recovered whole. However, the disarticulated remains of several complete boxes were raised, in addition to several hundred fragments representing an unknown number of boxes. The box pieces recovered suggest that all were small, rectangular containers of the same size. These boxes measure 12 in high, 12 in wide and 28 in long. The ends of the boxes are made of yellow popular (*Liriodendron tulipifera*) boards, most of which are 0.5 in thick, although a few are slightly thicker (see Table 4-1). The sides of the boxes are constructed of 0.25-to-0.5-in-thick pieces of sycamore (*Platanus* sp.). Some of the sides are formed of a single board, however, in a few instances two or three narrow boards are used. When more than one board is used, the boards are tongue and grooved to achieve a tight fit. The sides of the boxes are rebated at their ends to accept the end pieces and the sides are attached to the ends with 1.625-in-long cut nails. On most of the boxes it appears that these nails extended through narrow strips or "withes" of split wood, measuring about 0.5 in wide, that were wrapped around the outside ends of the boxes. These withes, which apparently provided added strength to the boxes, have been tentatively identified as oak (*Quercus* sp.). They are flat on one side and rounded on the other, suggesting they were made from small oak branches or shoots that were split in two. Many of the end and side pieces display distinctive circular saw marks. In addition, several side pieces contain vertical grooves cut into the interior, as if internal partitions existed in some boxes.

Stenciled lettering is extant on a number of the end pieces of boxes that provides information on the contents. These marked boxes all held bakery goods produced or packed at the United States Quartermaster Depot located in Jeffersonville, Indiana. One complete box end contains the following in 1-in-high letters: "BREAD/50 LBS NETT/FROM/US GOVT BAKERY/JEFFERSONVILLE, IND/MAY 1865." Another end piece is stenciled with "PILOT BREAD/ 50 LBS NETT/MAY 18??" (the date is illegible), one is stenciled with "US SUBS DEPT/ JEFFERSONVILLE, IND," while another reads "S.T. CUSHING/JEFFERSONVILLE, IND." On most of the box ends with stenciled lettering, portions are illegible, as seen in Figure 4-22a, but comparisons with other boxes shows that most contain similar information. "Pilot Bread" refers to a hard biscuit or cracker made only with flour and water and more commonly known as "hardtack." Hardtack normally came in the form of crackers about 3 in square by 0.5 in thick (Coggins 1983:121). The meaning of the words "S.T. CUSHING" on one of the boxes is unknown, although it might refer to the individual supplying the merchandise. None of the box sides contain any observable markings.

It is apparent that these boxes held bread or pilot bread representing some of the government stores carried aboard the *Ed. F. Dix* for the First Louisiana Cavalry. The boat probably carried a considerable quantity of food for the cavalrymen, because they had to have sufficient supplies to make the march into Texas, far from extant supply lines. A few boxes exhibit some dark residue on the interior sides, but otherwise none of the contents survived the over 130 years of submersion and burial. Since the contents appear to have been bread or hardtack, it is presumed that most of it dissolved and dispersed soon after the hull of the boat was flooded.

The point of origin of the boxes found on the *Ed. F. Dix*, Jeffersonville, Indiana, is located on the Ohio River, just across the river from Louisville, Kentucky. During the Civil War, Jeffersonville, because of its location on the Ohio and its position at a railhead from Indianapolis, was, along with Louisville, an ideal point for disembarking troops and supplies to Union armies operating in the trans-Mississippi West. Several supply facilities were established at Jeffersonville by the Quartermaster Department during the war, originally housed in a number of building scattered around the town. The duties of the Quartermaster Department during the Civil War were extensive. The department was respon-

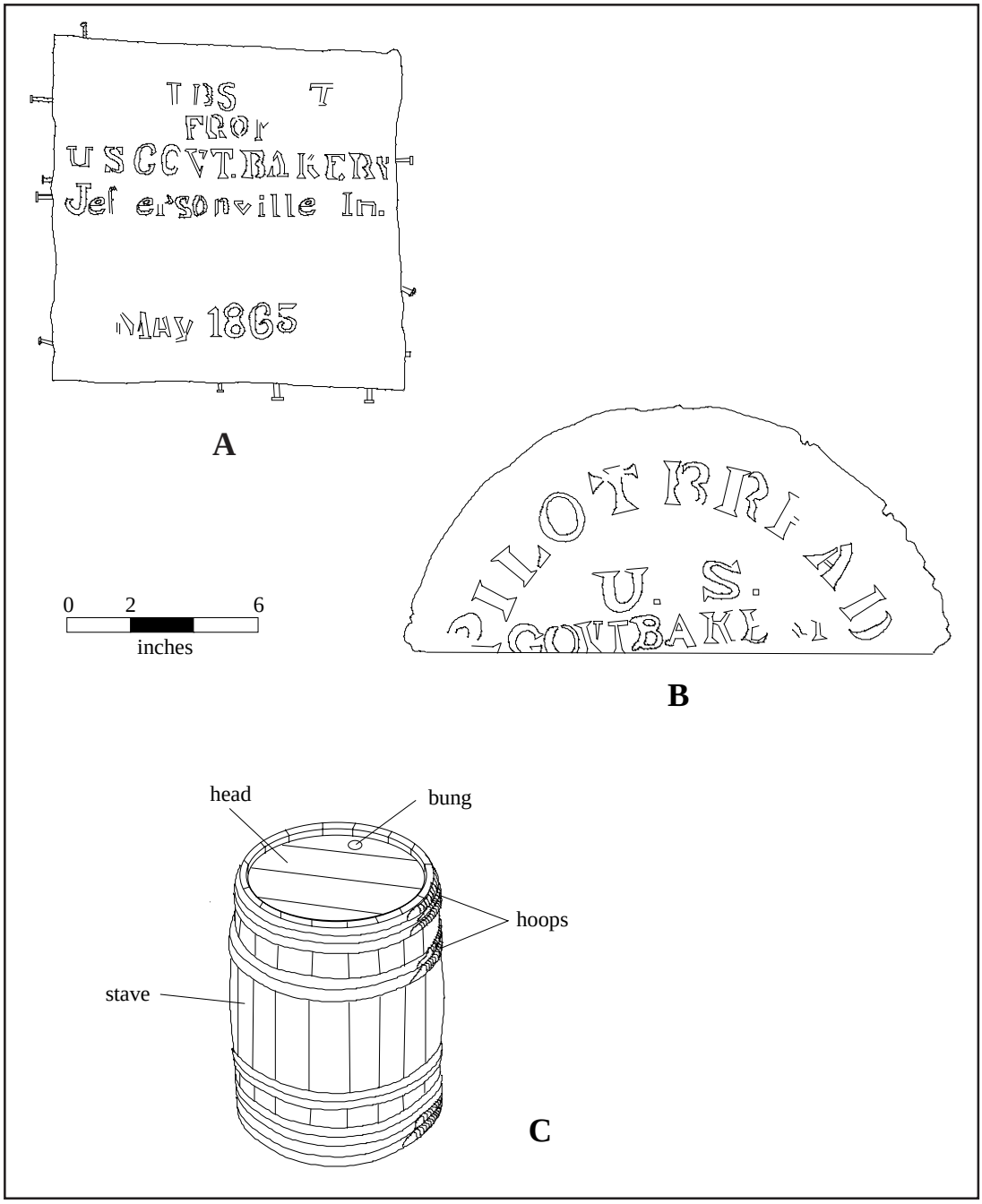

Figure 4-22. Container pieces recovered from the *Ed. F. Dix*. a. end of a box from the Jeffersonville Quartermaster Depot; b. piece of head of a barrel that contained pilot bread (hard tack); c. typical cask of the type carried by the *Ed. F. Dix*.

sible for supplying and clothing troops, providing shelter for them in the form of tents or barracks and transporting them by land or water. The Quartermaster Department provided the horses, mules, wagons and vessels (such as the *Ed. F. Dix*) needed to move the armies. Wagons and boats were obtained under contract or, in many instances, were built by the department. For example, one of the Quartermaster divisions in Jeffersonville oversaw the acquisition and distribution of vehicles, harnesses and other supplies, plus, there was a facility that manufactured uniforms.

The Jeffersonville complex also included a hardtack factory and bakery that produced most of the hardtack made for the Union Army during the war. These bakery facilities actually were operated by the Commissary General of Subsistence, the other great supply department in the Union Army (Coggins 1983:121). Often referred to as the "Subsistence Department," the Commissary General of Subsistence was responsible for feeding the many thousands of men in the army. This meant acquiring or manufacturing the necessary foodstuff, plus getting it to the troops, a task which often required shipments of hundreds of miles to locations far distant from supply depots. The lettering "US SUBS DEPT/ JEFFERSONVILLE, IND," on one of the box pieces from the *Ed. F. Dix* is a reference to the Subsistence Department's facilities in Jeffersonville, most likely the bakery.

Immediately after the Civil War, the Jeffersonville facility became even more important as a major supplier of the Union Army of Occupation in the South as well as of western outposts. In 1867, Congress appropriated $150,000 for the construction of a new Quartermaster building in Jeffersonville. Construction, conducted under the supervision of Major General M.C. Meigs, Quartermaster General of the Army, began in 1871 and was completed in 1874. The depot was constructed in the form of a hollow square with each side containing a large gate. When opened in 1874, the facility was officially known as the "Western Arsenal of the Quartermaster Department," however, it was more commonly known as the Jeffersonville Quartermaster Depot. The Jeffersonville Depot became one of the larger quartermaster complexes in existence and supplied the army through the Korean War. The Depot was deactivated in 1958 and in 1960, was sold to private concerns. Portions of the original Quartermaster Depot building, built in 1871, are still standing and are on the National Register of Historic Places.

The boxes from the hull of the *Ed. F. Dix* represent some of the government stores the steamer was carrying up the Red River to Shreveport. Boxes of this type have rarely been reported in the archaeological literature, mainly because they will only survive under special conditions, such as on sunken vessels. A number of similar Civil War-era boxes and barrels have been recovered from the wreck of the sidewheel steamer *Maple Leaf*, which sank in the St. Johns River in Florida on April 1, 1864. The *Maple Leaf* was loaded with the personal effects and camp equipment for three Union regiments when she went down (Cantelas 1993:3). Archaeological work on the wreck in the early 1990s by the Program in Maritime History and Nautical Archaeology, East Carolina University, recovered a large variety of these stores, including a number of boxes and barrels (Cantelas 1993, 1994). Final analyses of the artifacts from the *Maple Leaf* have not been published, but Cantelas (1994) describes several wooden boxes found on the boat. Among these is a wooden box containing the stenciled label "ARMY BREAD" which had been reused to pack personal items. This box measured 25.25 in long, 18.5 in wide and 10 in high. Another similarly marked box measured 26 in long, 18.5 in wide and 19.5 in high. While not exactly the same size as the boxes from the *Dix*, they are roughly similar. It is not known if the boxes from the *Maple Leaf* were manufactured in the same way as those from the *Ed. F. Dix*, since these details have yet to be published.

Other government goods on the *Dix* were carried in barrels or casks, as revealed in the recovery of a large number of cask staves and heads. The term "cask" is the general term normally used to refer to wooden-staved containers that includes barrels, hogsheads, tierces, firkins, etc. Each of these latter named containers represents casks of a specific size having a specific capacity. As shown in Table 4-1, 19 pieces or complete cask staves were recovered and 24 pieces of cask heads (Figure 4-22c). All of these cask parts came from within the hold of the *Dix*, most during the excavations within the hatch opening and a few from the excavations along the port side of the hull. Only four of the staves are complete and have croze (or croe) grooves at both ends. These are the grooves at each end of the interior of a stave within which the cask head was seated. These complete staves measure 28 to 29.75 in (72 to 76 cm) long, indicating containers of this height. All of the broken pieces of staves are shorter than this, suggesting that all of the casks represented were this height or less. Wood samples from two of the staves were submitted for analysis. One (Artifact 59), is made from a species of white oak (*Quercus* sp.), and the other (Artifact 62) is identified as a type of red oak. All of the other stave pieces appear to be made of similar types of wood.

Most of the head pieces are incomplete, but many are large enough to provide information on the original diameter of casks. The 11 pieces of cask head that do provide this information ranged from 15 to 19.375 inches (31 to 49 cm) in diameter, with most having a diameter of about 17 in (44 cm). The cask heads

range from 0.25 in to 0.75 in (0.6 to 1.9 cm) thick. It is believed that most of the pieces of cask head recovered come from containers of about the same size, although the two head fragments that measure only 0.25 in thick may come from casks that are smaller than the rest. Further, it is presumed that the head pieces go with the staves recovered, meaning that most, if not all, of the casks represented in the material from the *Ed. F. Dix* were about 28 or 29 in high and had end diameters of about 17 in.

Several of the head pieces recovered contain lettering, only some of which is decipherable. Most of the lettering was stenciled, but some appears to be written freehand. For example, a fragment consisting of one-half of a cask head contains the words "PILOT BREAD" arched above the words "US GOVT BAKERY," all in 1.5-in-high stenciled letters (Figure 4-22b). Another fragment contains the same stenciled "PILOT BREAD" over the stenciled letters "FROM," but the rest of the label is missing. Another fragment is stenciled with the word "BEANS," while another contains the partially stenciled word "USG. . .," beneath which is hand written the number "27.7." The letters "USG" are assumed to represent part of the word "USGOVT," while the number is thought to indicate a weight. One portion of a cask head has a bung hole with the bung still in it. One sample of cask head (Artifact 69) was submitted for analysis and has been identified as a species of white oak (*Quercus* sp.). The others appear to be of a similar wood. Like the wooden boxes, the casks represented in the collection from the *Ed. F. Dix* carried foodstuff destined for troops involved in the Texas expedition.

These casks would have closely resembled the example shown in Figure 4-22c and are reflective of what is known as "dry cooperage" (Staniforth 1987:21). Dry cooperage was that branch of cooperage that produced casks intended to hold dry products, rather than liquids, which were the product of "wet cooperage." Casks produced by dry cooperage were wooden-hooped and were of two types: the "dry tight cask" used to hold powdery or semi-liquid products like flour or salted provisions and the "dry slack cask" used to hold items such as nails, fruit, biscuits, etc. (Staniforth 1987:21). The marked cask heads from the *Ed. F. Dix* suggest that some of the containers can be classified as "dry slack casks" in that they carried items such as beans and pilot bread. It is probable that most, if not all, of the casks represented in the collection from the *Dix* were hooped with wooden "hoop poles," wooden splints, commonly made of white oak, that were wrapped around the barrel (Figure 4-22c). No pieces of hoop poles were identified in the material recovered from the hold of the steamer, but these may have been mistakenly identified as naturally deposited branches or roots which were numerous.

Containers the size of those from the *Dix*, about 28 in long with head diameters of about 17 in, would have had capacities of about 30 gallons and can be most closely associated with true barrels, which held from 31 to 42 gallons. Flour was commonly shipped in barrels, in fact, a container specifically for flour with the capacity of a barrel was known as a "quarter of flour."

Numerous barrel parts, similar to those recovered from the *Ed. F. Dix*, were found on the sunken transport *Maple Leaf* (Cantelas 1993, 1994). A number of staves from the *Maple Leaf* measured just over 20 in between croze grooves. The total lengths on these staves is on the order of 22 to 23 in, slightly shorter than the complete staves from the *Ed. F. Dix*. The barrel heads believed to be associated with these staves measured 13.75 inches in diameter and 0.5 in thick (Cantelas 1993:63), again, somewhat smaller than the measurable barrel heads from the *Dix*, which had diameters of about 17 in. A few shorter staves, from small casks and buckets, also, were found on the *Maple Leaf*.

Fasteners

A small number of fasteners were recovered in the excavations of the *Ed. F. Dix*, all of which are iron nails and spikes used in the construction of the boat or of wooden containers recovered from the hold (Figure 4-23). Most of these fasteners were still imbedded in pieces of wood when recovered and have not been removed. When possible, the length of these fasteners was measured and is so noted in previous discussions. A few fasteners were removed from in situ boat structure during diving and could be examined in greater detail. The few fasteners found or observed on the *Ed. F. Dix* conform to what would be expected for mid-nineteenth century steamboat construction. These consist of iron nails, spikes and drift pins or drift bolts. Nails and spikes are differentiated on the basis of size; those longer than about 4.5 in (11.5 cm) have been classified as spikes, primarily because fasteners of this size and larger are commonly referred to as spikes in the literature (e.g., Curtis 1919; Davis 1918). A recovered frame futtock from the *Dix* indicates that two spikes were used

to attach each piece of hull planking to it. This pattern of using two spikes per hull plank per futtock was probably generally followed throughout the boat. The two complete spikes (Artifact Number 67, Table 4-1) removed from the futtock are of slightly different sizes. One measures 4.9 in (12.5 cm) long and the other is 6.25 in (16 cm) long (see Figure 4-23a). Both have square shanks measuring .25 in (0.6 cm) thick and both have flattened heads. It is expected that similar 5-to-6-in-long spikes were used elsewhere to fasten the 3-in-thick hull planks to the frames.

A very large spike, measuring 14.25 in long (36.5 cm) with a 0.5-in-square (1.28 cm) shaft was taken out of a recovered portion of guard beam (Artifact Number 67, Table 4-1). This spike had apparently been drive down through the guard beam into the underlying deck clamp or upper hull plank (the sheer strake). Generally, most fasteners of this length would have been drift pins or drift bolts; round iron rods driven into pre-drilled holes of slightly smaller diameter. In fact, divers did find what they thought were 0.75-in-diameter drift pins driven through the ends of deck beams into the underlying deck clamp. Given the zero visibility on the wreck, it is possible that what the divers actually felt were the heads of large, square spikes similar to the one from the recovered guard beam. Alternatively, it is possible that the guard beams were attached to the hull with spikes, while drift bolts were used for the deck beams. Even so, it is likely that these long spikes were driven into pre-drilled holes to prevent splitting of the wood, as well as to make driving the spike easier.

Although none were removed, 7-in-long (17.9 cm) spikes were used to attach the outboard guard beams to deck beams. These spikes have square shanks that are just slightly thicker than the hull plank spikes noted above.

These spikes, certainly the larger ones, are probably too thick to have been cut from a flat iron plate by machine, as smaller nails were at the time the *Dix* was constructed. Spikes of this size were commonly

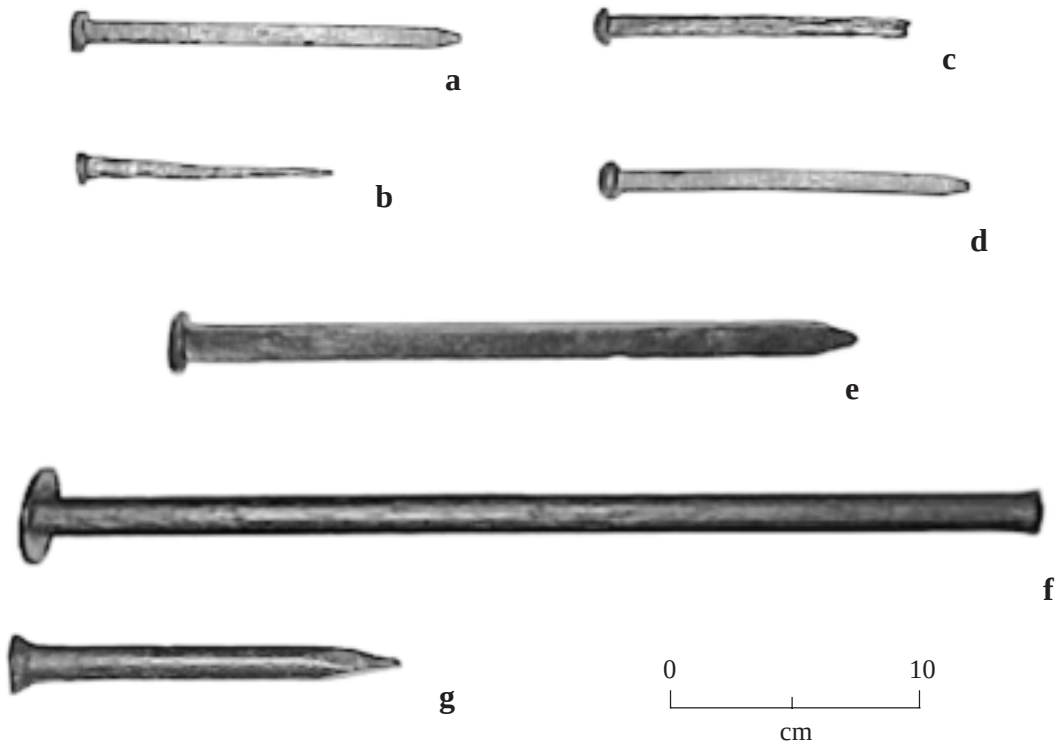

Figure 4-23. Examples of fasteners recovered from the *Ed. F. Dix* and *Eastport*. a) Hull plank spike from the *Ed. F. Dix;* b) machine-made nail from the *Eastport*; c-d) "Boat spikes" from the *Eastport*; e) Large spike from the *Eastport*; f) Drift bolt with "clinch ring" from the *Eastport*; g) "Chisel-pointed" rivet from the *Eastport.*

made from bar stock of the appropriate thickness which was, first, cut into the desired length, then hammered on two sides to achieve a tapered point and hammered on the top of the other end to form the head. By the time the *Ed. F. Dix* was built in the 1860s, the manufacture of spikes, like nails, was largely done by machine.

The few spikes recovered were used to fasten larger planks and timbers on the boat. Nails would have been used to fasten thinner wooden pieces together. No individual nails were recovered during the diving on the *Dix*, or they have not been removed from recovered structural pieces. When the *Dix* was built, the manufacture of nails was largely mechanized and the type used would have been cut by machine from thin iron plates and then headed in another machine. These nails typically show a "pinched" shaft just beneath the head where the nail was gripped in a vice-like machine while it was headed. Nails of this type were produced from about 1835 to 1885 (Edwards and Wells 1993:56).

Even though few fasteners were recovered from the *Ed. F. Dix*, it is possible to estimate with reasonable accuracy the types used in building the steamer, because there were, and still are, fairly rigid stipulations as to the size of fasteners to be used in particular situations in boat construction. Normally, spikes were to be about 1/8 in square and 2 in long for each inch of thickness of planking (Curtis 1919:179). These rules commonly applied to oak, a very dense wood, and spikes used in softer wood, such as pine, were to be slightly larger (Anonymous 1876:60). It is impossible to know how rigidly these common rules were followed during the initial construction and the subsequent repairs to the *Ed. F. Dix*, but it is presumed that they were generally applied. The circa 5-to-6-in-long spikes used to attach the 3-in-thick hull planks on the *Dix*, do conform to this rule. It is expected that the 2-in-thick pine deck planking on the boat would have been attached with spikes measuring 4.5 to 5 in long. Pearson and Saltus (1996:151) report that spikes of this size were used to fasten the 2-in-thick, pine deck planking on the steamboat *Arrow*, constructed in 1856.

A number of nail holes were observed in the numerous pieces of circa 0.75-in-thick tongue and groove boards recovered. As noted, these boards are believed to have come from the superstructure of the *Dix*. It is probable that these boards would have been attached with nails measuring 2.25 to about 2.5 in long, essentially equivalent to modern 8-penny nails, a size commonly used in general house construction. Large numbers of machine cut nails of this size were recovered from the wreck of the *Arrow*; most of which were believed to have come from that steamer's cabin structure (Pearson and Saltus 1996:151).

Although not from the structure of the *Ed. F. Dix*, a number of very small nails were found still attached to several of the wooden box ends recovered within the hull of the steamer (see Figure 4-22a). These cut nails measure 1.625 in (4.2 cm) long, have square shanks and flattened heads that are square with slightly rounded corners. These small nails were used to attach the thin, 0.25-to-0.5-in-thick sides of the boxes to the somewhat thicker end pieces.

Round iron drift bolts (also called drift pins) were used in boat construction to join together large pieces of timber and to connect hull, and sometimes deck, planking to frames and beams. No examples of drift bolts were recovered that could definitely be associated with the *Ed. F. Dix*, but they were commonly used in steamboat construction. For example, divers reported that it appeared that round drift bolts were used to attach the deck beams to the hull. The typical drift bolt was non-threaded and was used, essentially, as a giant nail. The bolts were driven into pre-drilled holes of the same or slightly smaller diameter. In some instances, the bolts were driven completely through the pieces being fastened together and both ends were flattened or "upset" to secure it in place. Often, the ends were flattened over a washer or "clinch ring" to gain added holding power. Drift bolts could be quite long, particularly on large sailing vessels where they had to penetrate several feet of deadwood. The longest drift bolts on river steamers would normally have been those used to connect the engine timbers together and to the hull.

Miscellaneous Artifacts

One wooden handle believed to be for an auger was recovered from a depth of 37 ft below the pool's surface beneath the northeast corner of the hatch opening. This handle is 16 in long, 2.5 in wide at its center and tapers slightly toward each end. There is a 1-in-diameter hole in the center of the handle and a 0.875-in-long slot on the side, possibly for a key to lock the auger bit into place. The handle appears to be unused and, possibly, had never been fitted with an auger bit.

During the final days of fieldwork, the excavations in the hatch opening encountered the ends of a ladder-shaped object about 2 ft aft of the hatch. Some dimensional information on this object was obtained, but it could not be fully excavated because of the fear of collapse of the main deck if excavations continued too far beyond the hatch opening. The object consists of two parallel timbers spaced about 10 in (26 cm) apart connected together by cross pieces (Figure 4-24). Each timber measures 9 in (23 cm) high and 3.5 in (9 cm) wide. A 0.25-in-thick iron strap is attached to the edges of each timber. Divers were able to clear and/or feel back along the two timbers for about 5 ft and determined that the straps extend back about 18 in along the tops of the timbers. It is not known how far back these straps projected along the bottoms of the timbers. The iron straps extend slightly beyond the ends of the timbers and their ends curve downward. The two timbers are connected by 3-in-wide boards nailed across their bottoms. Three of these cross pieces were exposed. No similar cross pieces were found extending across the tops of the two side timbers. Two 3-in-wide boards are attached to the bottom cross pieces in the space between the two main timbers. The cross pieces and the 3-in-wide boards running between the two side timbers are all thought to measure 1-in-thick, however, this measurement was not confirmed.

This object was lying directly on top of the layer of coal at the bottom of the hold and a number of pieces of wooden boxes were resting on top of it. It is not known how long the object is, but even with 5 ft of it cleared off it was impossible to move, despite a concerted effort to recover it. It is possible that the object is a loading ramp of some sort, assuming that the curved iron straps at the end were used to hook over a gunwale. Photographs of steamboats often show landing stages used for loading and unloading, but they all appear to have a solid surface, unlike the object found on the *Ed. F. Dix*. Initially, it was thought that the object could be a portion of a carriage for a small artillery piece as it somewhat resembles the rear of the stock and lunette of a gun carriage. However, gun carriage stocks generally consisted of a single timber, not two. The position of the object, in line with and directly aft of the deck hatch opening, may indicate that it was specifically placed for easy access should it be needed, seeming to support the hypothesis that it was a loading ramp of some sort.

The Remains of the USS Eastport

Excavations in Area 1

As noted earlier, excavations in Area 1 located and uncovered part of the casemate and gun deck of the *Eastport*. During the earlier phase of hydraulic probing, several probes in the vicinity of grid coordinate N153/E130 had encountered metal at depths of 32 to 33 ft below the pool's surface. Once it was

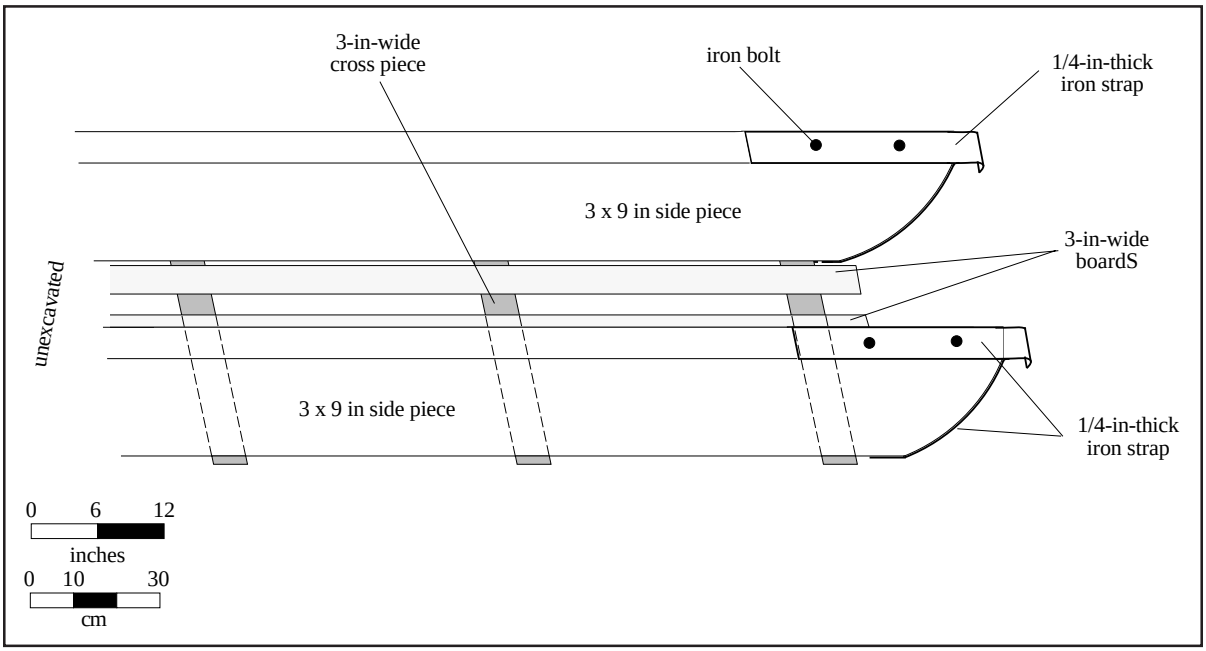

Figure 4-24. Possible loading ramp found in the hold of the *Ed. F. Dix*.

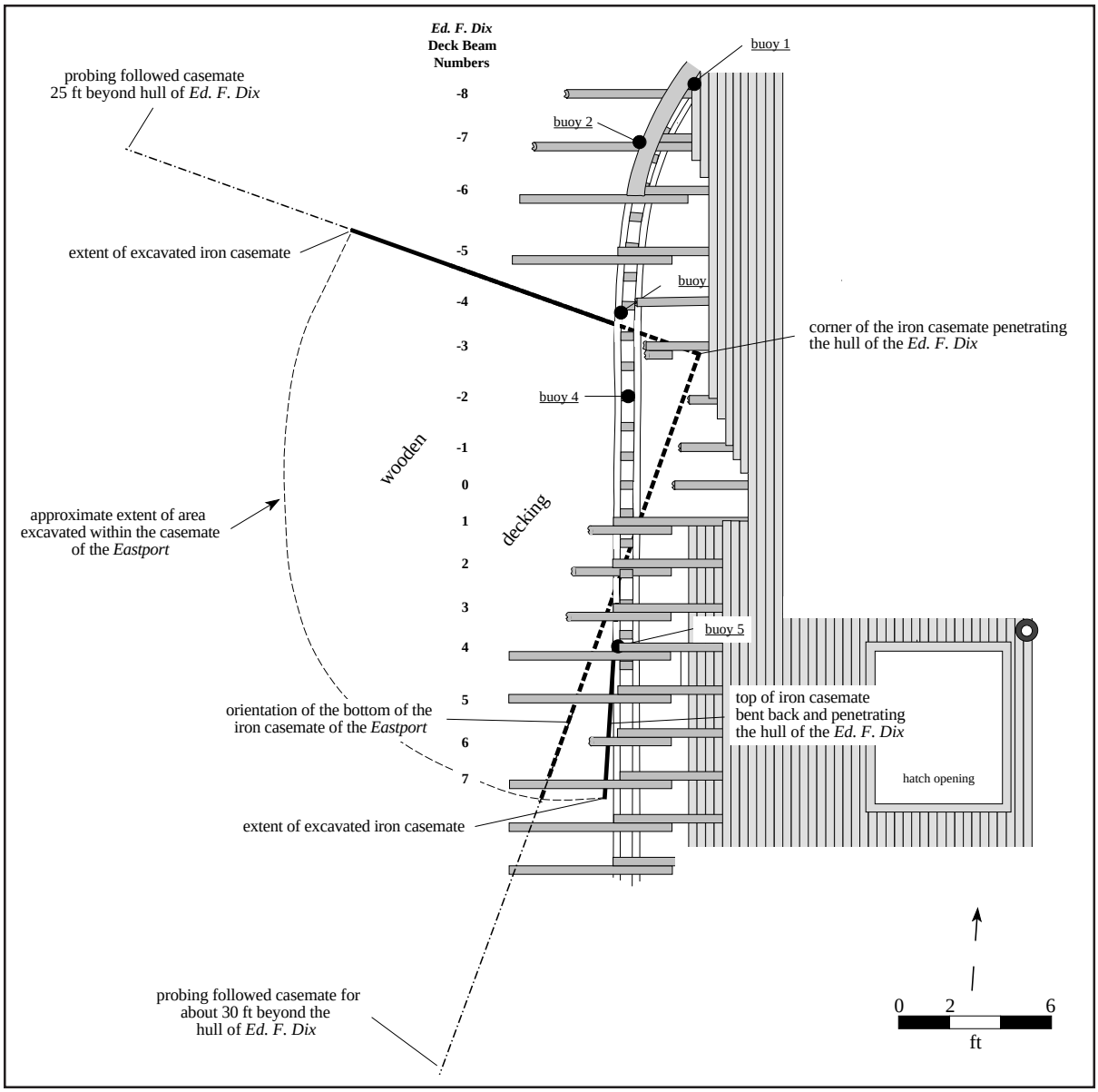

Figure 4-25. Plan view of the mapped remains of the *Ed. F. Dix* shown resting on top of the armored casemate of the *Eastport*.

determined that the uppermost boat structure encountered in Area 1 was the *Ed. F. Dix*, another series of probes was placed along the outside of the hull in the area where the metal had been struck earlier. Here, at a depth of 2 to 3 ft below the top of the hull of the *Dix*, and immediately adjacent to Buoy 3, a thin line of metal plating (assumed to be iron) was found. The line of plating extended westward at almost a right angle to the hull line of the *Dix* (Figure 4-25). This plating was followed with probings for a distance of about 25 ft westward toward Red River, well into the sloping edge of the pool. After excavations had cleared the port side of the hull of the *Ed. F. Dix*, they were extended down onto the line of metal to identify it. It quickly became apparent that the line of metal was formed by the upper edges of thin, iron plates measuring about 0.75 to 1 in (1.9 to 2.5 cm) thick and from 8 to 12 in (20.5 to 30.8 cm) wide. Probing on the north side of the line of iron plates revealed that the plates were attached vertically and extended down into the sediment about 9 ft. The top of the line of plates slanted to the south at an

angle of almost exactly 45 degrees. It was obvious that these iron plates were not structurally associated with the remains of the *Ed. F. Dix* and that they represented armor plating of the USS *Eastport*.

Hydraulic probing revealed no structural remains on the north side of the line of iron plates; however, solid wooden structure was encountered on the south side of the plates. Here, probes initially encountered a stratum with a "crunchy" feel at a depth of about 34 to 34.5 ft below the pool surface, or about 2 ft below the tops of the iron plates. The probe could be pushed through this stratum with some effort before striking a solid floor of wood at a depth of 35 ft below the surface. It was thought that the iron plates represented remains of some element of the armor of the *Eastport* and that the solid wood surface represented an intact deck or, possibly, the ceiling planking in the interior of the hull. Thus, excavations were conducted down to this intact wooden floor in order to identify it. As shown in Figure 4-25, these excavations cleared a 15-ft-long segment of the east-west line of iron plating and a portion of the intact wooden decking. Additionally, another line of upright iron plates was found extending from beneath the hull of the *Ed. F. Dix* at a right angle to the original line of plates. Excavations were extended under the hull of the *Dix* and it was found that the two lines of armor plates joined about 3 ft east of the *Dix's* port gunwale and almost directly beneath the deck beam designated Deck Beam -3 (see Figure 4-25). As the area beneath the *Dix* was cleared, it became obvious that the plating at the corner of the two walls of armor, plus several pieces along the north-south line, penetrated through the hull of the *Dix*, obviously the cause of the sinking of the vessel. It was apparent that the two lines of armor plating, as well as the intact wooden floor located at 35 ft below the surface, were the remains of the *Eastport* and that the excavations had exposed the actual point of impact of the 1865 collision.

Excavations were then extended down in the area enclosed by the two lines of armor plating to expose the more deeply buried structural remains identified by hydraulic probing. It should be noted that the remains of the *Eastport* lie 2 to 3 ft deeper than those of the *Dix*, and removal of the greater amount of overburden proved to be extremely difficult. The hull of the *Dix* acted as a barrier to inflowing sand from the east such that excavations close to the *Dix* could be kept relatively clear. However, as excavations extended to the west, away from the *Dix*, the western and southern walls of the excavation began to collapse and sand began to continuously flow into cleared areas. Eventually, excavations had to be halted because of the danger created by inflowing sediment. Divers were able to expose about 15 ft of both lines of armor plating and approximately 100 square ft of intact decking which lay between the two lines of plates (see Figure 4-25).

These two lines of iron plates represent two sides of the armored main casemate of the *Eastport* and the intact wooden floor is part of the casemate's interior deck on which the guns were mounted. The timber backing and interior supports of the armor plating are mostly gone, only charred fragments of timbers survive, and the remaining heavy timber decking of the casemate also is extensively burned. The burning probably occurred when the *Eastport* was "blown up" in 1864. Ultimately, it was determined that the section of casemate exposed represents the forward, port side corner of the *Eastport's* gun deck. This accords with historic accounts that indicate that the bow of the *Eastport* was pulled out into the Red River before she was finally abandoned. Thus, the bow of the gunboat is pointed east and the archaeological evidence indicates that the *Ed. F Dix*, when she was steaming upriver in 1865, struck the forward end of the *Eastport's* still partially intact casemate.

The armor on the casemate consists of vertical, 0.75-to-1-in-thick sheets of iron measuring 8 to 12 in wide and of undetermined length. In places, about 4 ft of individual plates were exposed and probing revealed that armor extended 9 ft down on the north side of the casemate; however, it is not known if individual plates extended this entire distance. Consequently, it can only be said that individual plates were between 4 ft and 9 ft long. At least one photograph of the *Eastport* (see Figure 2-23) shows what looks like narrow, vertical armor plates on the casemate, corresponding to these plates. Also, photographs of other river gunboats indicate that long, narrow, vertical iron plates were commonly used for casemate armor. These include the *Essex*, *Benton*, *Lafayette*, and *Choctaw*, all of which, like the *Eastport*, were converted from river steamers (Canney 1993). The City-Class ironclads, designed by S. M. Pook and built by J. B. Eads, also, used long, narrow iron armor plating. On the *Cairo*, the iron armor along the sides of the casemate consisted of long, narrow plates (or "strakes") placed vertically. These plates measured "13 inches wide and up to 8 feet 1 1/2 inches long. The plates were tied together by overlapping lips–2 inches wide and 1/2 inch thick, with 1 1/8-

inch bolts passing through the laps" (Canney 1993:51). It appears that the iron plates on the *Eastport* were similar in length and width to those used on the *Cairo*.

The east-west line of armor represents the forward part of the port side casemate wall of the *Eastport*. As this line of iron plates was being exposed, it was first thought that some plates may have been overlapped to produce a "board-and-batten" effect. However, more careful examination of the plates suggested that some had been displaced from their original position and that their edges had originally been either butted up against one another or they had overlapping lips, such as described for the *Cairo*. The apparent displacement of some of these plates may have been caused by the explosion that scuttled the *Eastport* in 1864 or by the collision of the *Ed. F. Dix*, or a combination of the two. The thickness of the armor plating was actually quite difficult to determine accurately because of zero visibility and corrosion on the plates. Divers made several measurements of thickness that varied between 0.75 and 1 in; the greater value has been accepted in light of the historic accounts indicating that the casemate of the *Eastport* was covered with 1-in-thick iron.

As excavations extended under the *Dix*, it was found that the iron plates in the corner produced by the two lines of armor were attached in a horizontal, rather than vertical position. The horizontal plates in the east-west line of armor were estimated to be about 3 ft long and 8 in wide; those in the north-south wall are the same width, but closer to 4 ft long (Figure 4-26).

Twelve vertical iron plates were exposed along the north-south wall of armor which represents a portion of the forward casemate wall of the *Eastport*. These plates, also, measured 1 in thick and from 8 to 12 in wide. No length on these plates was obtained be-

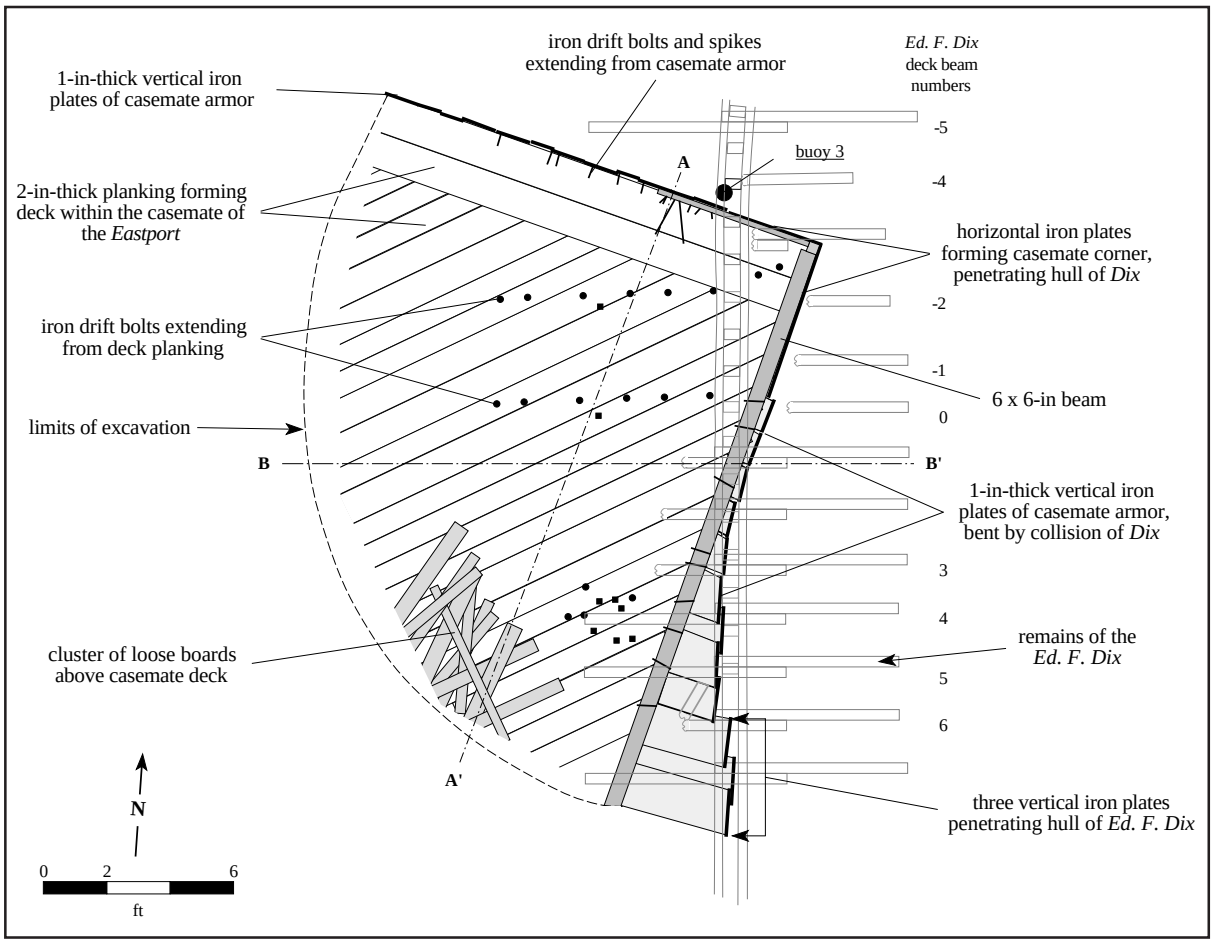

Figure 4-26. Plan view of the features excavated within the casemate of the *Eastport*.

cause the hull of the *Dix* prevented any probing on the outside (i.e., to the east) of the line of armor. Like the plates in the east-west line, some were overlapping, believed to be the result of displacement and twisting. In fact, as shown in Figures 4-25 and 4-26, most of the vertical plates exposed along the north-south line of armor were bent toward the east at a considerable angle; probably as a result of the collision of the *Ed. F. Dix*. As noted, several of these vertical iron plates were found to have penetrated completely through the hull of the *Dix* .

The tops of the two lines of armor are both fairly level, discounting the effects of the twisting and bending of plates. In addition, the tops of individual iron plates felt relatively flat and smooth. The lack of jagged and torn tops suggests that the iron plates represent complete pieces. However, it is believed that an additional row, or additional rows, of plates would have been attached to the tops of the ones that remain. The casemate of the *Eastport* reportedly rose 8 ft above the main deck, but, as shown in Figures 4-27 and 4-28, the top of the extant armor plating rises only about 3 ft above the intact decking, which is assumed to be the gundeck. The level of the main deck would have been fairly close to that of the gundeck, meaning that up to 5 ft of the reported 8-ft-high casemate are missing. Furthermore, although gunboats were notoriously cramped, there would have been at least 5 ft, and probably closer to 6 or 7 ft of headroom on the gundeck to enable handling of the guns. Figure 4-27 shows the projected length of missing casemate side needed to obtain the reported 8-ft height of the casemate. This represents about 7 ft of casemate siding and armor, all of which is presumed to have been removed, either when the *Eastport* was first blown up, or later by river current or purposeful salvage. No loose armor plating was found anywhere on the *Eastport*, despite Admiral Porter's report that pieces of the *Eastport's* casemate collapsed back inside of the vessel after the explosion (ORN I:26:74). It is suspected that any loose metal on the gunboat would have been salvaged by Confederate authorities or local citizens shortly after the scuttling. One of those who collected pieces of iron from the wreck of the *Eastport* was Milton Dunn, who wrote that he had placed a piece of armor from the wreck in the fireplace of the "congo cabin" at his plantation south of Natchitoches.

No openings were found along either of the two lines of casemate armor that could represent gunports. This suggests that the gunports were positioned higher than the tops of the extant armor plates or they are located beyond the area of casemate wall exposed. The former assumption seems most likely, because two guns were placed at the forward casemate on the *Eastport*, meaning that the forward gunports would almost certainly have been within 10 to 12 ft of either side of the casemate, as shown in Figure 2-24.

One-inch-diameter holes were noted at the upper corners of several of the armor plates. These, presumably, are holes through which rivets or bolts connected armor plates together or attached the armor to the thick wooden walls of the casemate.

Excavations in the area between the two lines of armor extended down to the intact and solid wooden deck located at a depth of 35 ft below the surface. Above this deck is the approximately 12-in-thick stratum that exhibited a "crunchy" feel when probed. This stratum, which covered the whole of the deck area excavated, consisted entirely of charred wood, and iron nails, spikes, and bolts (see Figures 4-27 and 4-28). This material obviously represents portions of the burned and collapsed upper casemate walls and roof that accumulated when the *Eastport* was destroyed and as she burned. A cluster of loose boards was found resting on top of this stratum at the southern end of the area excavated (see Figures 4-26 and 4-27). Several of these were recovered and proved to be tongue and groove boards measuring 0.75-to-0.625-in thick, identical to those found elsewhere and thought to be from the cabin structure of the *Ed. F. Dix*. These boards, also, are though to be from the *Ed. F. Dix* and not the *Eastport*.

Just above the level of the intact deck, some of the wooden structure of the casemate that served as support and backing for the iron armor is preserved. As shown in Figure 4-27, remnants of horizontal, 2-in-thick boards are still attached to the east-west line of iron armor (i.e., the portside casemate wall) just above the intact deck. These planks felt burned in places and are extant only at the eastern end of the wall of armor plating. However, numerous iron spikes and drift pins project from the armor plating toward the interior of the casemate (see Figures 4-26 and 4-27) indicating the former existence of wooden framework and backing for the armor along the entire section cleared. All of these spikes are located within a foot or so of the deck, beneath the top of the stratum of burned construction debris. Similar spikes and drift pins would have existed above this level, but these all have been displaced by the explosion and/or the burning. Some were probably hurled away from the

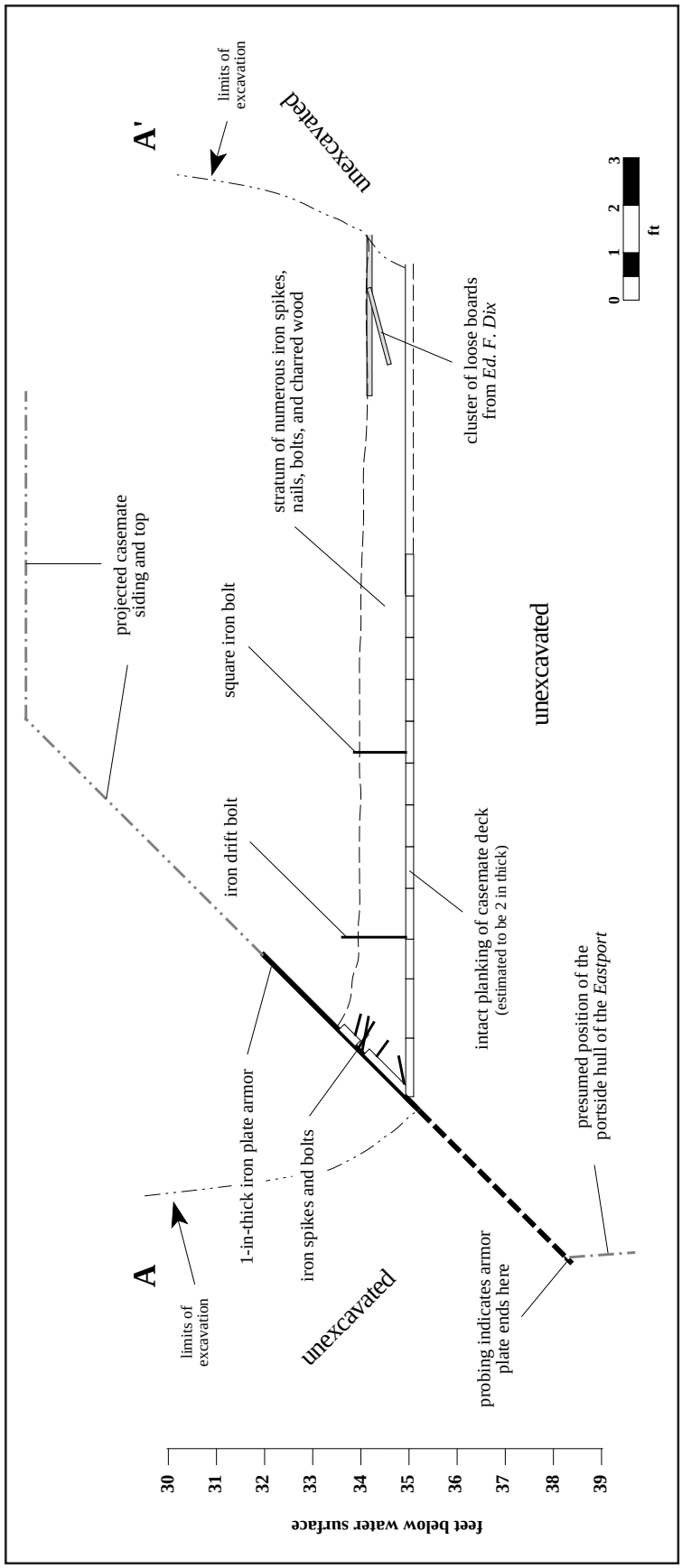

Figure 4-27. Thwartship cross section of the excavated portion of the casemate of the *Eastport*, looking toward the bow. See Figure 4-26 for location of section.

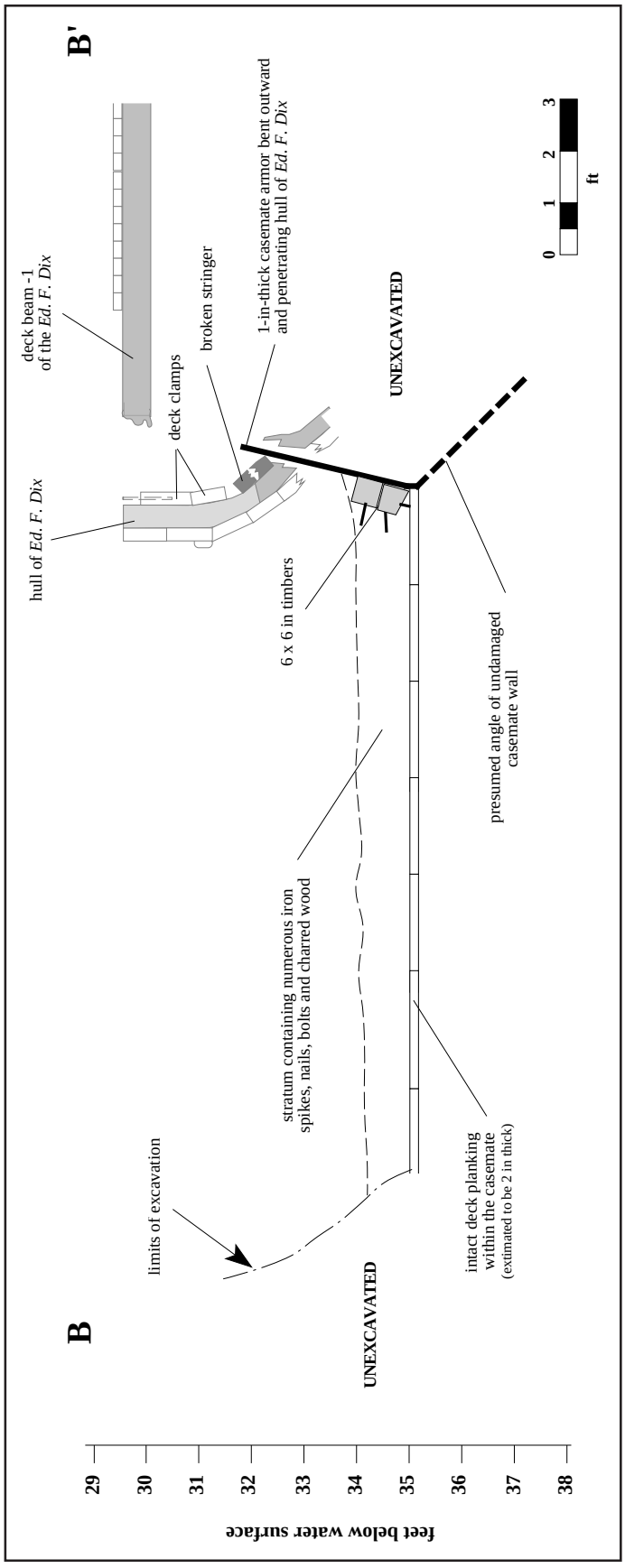

Figure 4-28. Fore-and-aft section of the excavated portion of the casemate area of the *Eastport* showing the armor plate of the forward casemate wall penetrating the hull of the *Ed. F. Dix*. Looking toward the port side of the *Eastport* and toward the bow of the *Ed. F. Dix* along her port side. See Figure 4-26 for location of section.

wreck, but others, no doubt, are found in the mass of debris on top of the casemate deck. The longest drift pins along this portside casemate wall are about 14 to 16 in long, meaning that the wood into which they were driven was at least that thick. The exact thickness of the "heavy gum timber" of the *Eastport's* casemate is not reported, but information from other gunboats suggests what it may have been. The gunboats probably most similar to the *Eastport* in construction were the other packet steamers converted into gunboats, such as the *Lafayette* and *Choctaw*. The casemate on the *Lafayette* is reported to have been 21 in thick on the sides and 30 in at the ends, while that on the *Choctaw* was similar. Both of these boats, however, had 2.5-in-thick iron armor, apparently, thicker than that on the *Eastport* (Canney 1993:101-103). Other vessels had thinner wooden backing, but tended to have thicker armor. For example, the *Tuscumbia* and the *Indianola* both had 12-in-thick wooden backing on the sides of their casemates, covered with 3-in-thick armor. The casemate of the gunboat *Chillicothe* was framed of 12-in-square timbers overlaid with a 9-in thickness of wood. This was covered with 3 in of iron armor. The wood used on the *Chillicothe* was white pine which was criticized as being too soft and when struck by shot interior bolts were started loose, flying around the interior of the casemate (Canney 1993:96-100). The gunboat *Essex*, converted from the ferry *New Era*, had a casemate with 16-in-thick timber sides covered by armor plating measuring 0.75 in thick. At the forward end, the wooden casemate backing on the *Essex* was 30 in thick and was covered with armor plating that was 1.75 in thick (Canney 1993:39).

Compared to most of these boats, the *Eastport* had very thin armor on her casemate, if the 1-in-thick iron plates found on her represent the complete thickness when the gunboat was in use. The thin armor would seem to call for a thicker wooden backing on the casemate. The *Cincinnati Daily Commercial* did report that the *Eastport* had "heavy gum timber of great thickness, sufficient to repel any ordinary cannon shot," but the exact thickness could not be reported for security reasons (*Cincinnati Daily Commercial* August 23, 1862). No complete sections of casemate wooden backing were discovered on the *Eastport*, so direct evidence of the thickness of casemate walls is unavailable. However, the lengths of several complete drift bolts recovered from the casemate area indicates that they penetrated wood that was at least 24 in thick. One piece of heavily charred board, measuring 2.5 in thick, 8 in wide and 37 in long was recovered from the top of the identified casemate deck adjacent to a line of drift pins protruding up out of the deck (see Figure 4-26). This burned board is yellow poplar (*Liriodendron tulipifera*), however, it is not known if it represents part of the casemate backing or some displaced decking.

Two, 6-x-6-in timbers were found attached to the base of the north-south (forward) casemate wall, as shown in Figures 4-26 and 4-28. These timbers extend across the entire area excavated, and they may continue across the entire width of the casemate. Several iron spikes and/or drift pins extend out from these timbers, some as far as 6 to 8 in, meaning that at least this thickness of wood is missing. It was along this forward casemate wall that several plates of armor were found penetrating the hull of the *Ed. F. Dix*. As shown in Figure 4-28, immediately below Deck Beam -1 armor plates penetrated through the hull of the boat, producing a fairly large hole, and extended into the hold of the steamboat several inches. Other iron plates just forward of this point extended even farther into the hull of the *Dix*.

As the thick layer of nails, spikes and charred wood was removed from the intact deck of the casemate, a number of round iron pins and square bolts were found extending up from the deck. The diving conditions made it difficult to map the precise locations of these pins, but as shown in Figure 4-26, two rows of pins seem to extend from the northern end of the north-south casemate at an angle across the deck, while a cluster of pins and square bolts is located near the north-south casemate, toward the southern end of the area excavated. The two rows of pins were each about 8 ft long. The height of the pins varies from about 6 to 14 in. Presumably, these pins once attached timbers of some sort to the deck and these timbers were 14 in or more thick. These timbers may have formed supports for a strengthened or thickened deck that covered all or part of the interior of the casemate, but which is now missing. Such a deck may have been necessary to support the weight of the heavy guns carried by the *Eastport*. Alternatively, the pins may mark the former positions of individual timbers that formed part of the carriage system for the guns mounted in the forward part of the casemate. This assumption seems to be the most likely and would mean that the required supports for the guns lie beneath the still intact decking.

As shown in Figure 4-26, it was determined that most of the in situ decking inside of the casemate was laid at a 45 degree angle relative to the two lines

of armor plating, which are thought to mark the forward and port sides of the casemate. However, two planks were laid parallel and adjacent to the east-west line of armor. An effort was made to pry some of this planking loose, but this proved impossible because the wood was very hard and tightly attached. It was determined, however, that the planking measured about 2 in thick and it was fairly wide; the diagonally laid planks were on the order of 10 or 12 in wide, while the two planks paralleling the casemate wall seemed to be slightly wider (see Figure 4-26). Steamboat deck planking was typically laid parallel to the long axis of the hull, as seen on the *Ed. F. Dix* in Figure 4-18. This probably means that the diagonal planking inside of the *Eastport's* casemate represents construction related to her conversion into a gunboat.

Excavations in Area 2

It was hoped that excavations could be extended across the casemate deck, following the north-south line of armor plating to the presumed starboard side of the *Eastport*. However, as divers began to dig in that direction they found that the overburden became thicker and, also, sediments started to flow rapidly into any area excavated, eventually making it impossible to keep any area cleared. These excavations were abandoned and the hydraulic probe was used to follow the identified casemate deck to the starboard side of the gunboat, where it was hoped excavations could expose and identify the starboard edge of the hull. Probing was conducted along a line roughly 10 ft west of the north-south line of armor and parallel to it. This probing was able to follow the wooden casemate deck from the excavated area south to about gridline N120, a distance of about 45 ft from the identified port side casemate armor. The probes revealed that the casemate deck over this distance is level (at a depth of approximately 35 ft below pool level) and in good condition. As in the area excavated, many of these probes encountered the "crunchy" layer just above the hard wood surface of the deck. This layer is presumed to be a continuation of the stratum of burned and collapsed structural debris exposed in the Area 1 excavations. At about gridline N120, probes began to hit what felt like metal. This surface seemed to slope down to the south and ended by gridline N115, where it was last hit at a depth of about 37 ft. Probes beyond this point encountered no buried structure within 15 ft of the bottom of the pool and it is believed that this location represents the starboard edge of the *Eastport*.

Excavations were started at grid coordinate N120/E110, at the point where probing indicated the casemate deck ended and metal, possibly the armor on the starboard side of the casemate, seemed to begin. This area was designated Area 2 (see Figure 4-14). Probes at this point indicated that wooden structure and, possibly, metal lay at a depth of 34 to 35 ft below the pool surface and was covered by about 10 ft of sediment. Excavations in Area 2 proved to be extremely difficult because the overburden was so thick, plus these sediments were fairly sandy and the excavation filled rapidly and collapsed several times, completely burying the venturi dredge. Ultimately, only 5 days of work were conducted at Area 2 before it was abandoned. The excavations here did, however, reach the remains of the *Eastport*.

At a depth of 34 ft below the pool surface, excavations in Area 2 encountered a number of pieces of 0.5-in-thick, broken and fragmented tongue and groove boards. These boards are identified as pieces of cabin structure from the *Ed. F. Dix* and are believed to be equivalent to the cluster of loose boards found just above the casemate deck in Area 1 (see Figure 4-26). Excavations continued below the boards and at a depth of 35 ft below the surface several large wooden timbers, plus pieces of iron were encountered. By this time, the excavated area was continually filling, and the re-digging was expanding the hole toward the south and east such that these timbers and iron were later found to be located at grid coordinate N117/E118, several feet away from where the excavations had started (see Figure 4-14). Eventually, divers were able to clear an area about 5 ft across at this point and an effort was made to record what was found. Several divers examined the cleared structure and all had slightly different interpretations. In general, it appears that the structure exposed consists of several vertical timbers, each measuring about 6 in square and spaced about 8 to 10 in apart with iron plate attached to the south side and wooden planks attached to the north side. The tops of one of the 6-in uprights felt crumbly, as if it was burned. This entire structure slopes slightly toward the north, or toward the interior of the boat, as shown in Figure 4-29. The iron plates are attached on the outside of the boat in a horizontal position, adjacent and parallel to one another. It was roughly estimated that the plates are about 10 in wide and at least 5 ft long, although this length represents the area which could be cleared and the plates extend beyond this. While the measurements of the iron plates are inexact, they appear to be about the same size as those found in Excavation Area 1 on the opposite side of

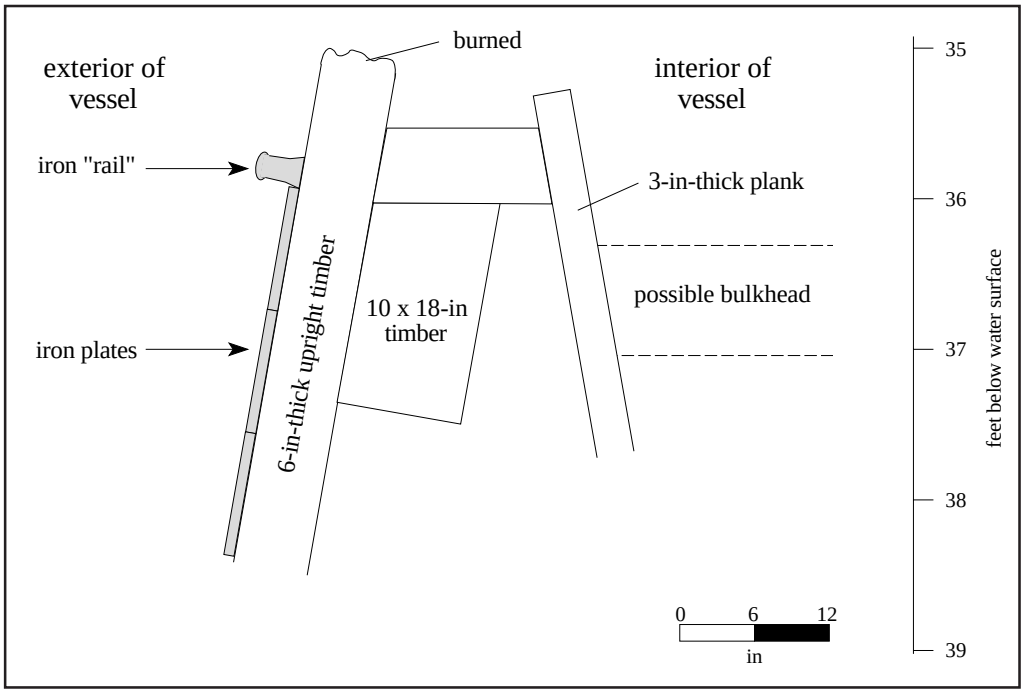

Figure 4-29. Cross section of the structure recorded in Area 2 thought to be at the starboard hull line of the *Eastport*. Looking west toward the stern of the *Eastport*.

the boat. Several fasteners, possibly rivets, could be felt protruding from the iron plates. These are spaced about 6 in apart along the long axes of the plates. Two divers reported finding what felt like a "railroad track" or iron "rail" attached horizontally to the outside of the upright frames and near the upper edge of the iron plates; however, others could not find this piece.

Attached to the north side of the upright 6-x-6-in timbers is a large, horizontal timber, measuring about 10 x 18 inches in section. Resting on top of this large timber are short blocks, about 1 ft long, extending away from the uprights. The 3-in-thick planking, originally thought to be attached directly to the 6-in uprights, was determined to be attached to the end of these short blocks, as shown in Figure 4-29. It was not ascertained if this is a single wide plank or if a series of horizontal planks continue downward. It is presumed that other framing pieces exist that support this interior plank, or planks, but these were not observed. Another diver, also, found what appeared to be a wooden bulkhead extending perpendicular to this structure toward the north, or toward the port side of the *Eastport*. This "bulkhead" seems to be a composite structure formed of two, 2.5-in-thick planks attached to either side of a circa 6-in-wide timber. Unfortunately, the walls of Area 2 collapsed and filled before this feature could be fully examined and before observations on the rest of the structure could be completed and verified. At this point it was determined it was becoming too dangerous to continue work in Area 2 and the location was abandoned.

The information gathered on the structure found in Excavation Area 2 is, at best, sketchy, and difficult to identify and interpret with certainty. It is possible that the structure is at the starboard gunwale of the gunboat where the bottom edge of the armored casemate meets and overlaps the hull, an area referred to as the "knuckle" in some of the historic documents. However, it is suspected that the knuckle should be at a slightly deeper depth than the structure recorded in Area 2. Alternatively, it is possible that this structure represents a portion of the side casemate wall, just above the gundeck, as was found in Area 1. Whereas all of the interior wooden structural elements of the casemate are burned away in Area 1, they may be preserved in Area 2. The difficulty with this interpretation is that the iron plates in Area 2 are definitely laid horizontally, rather

than vertically, as was the case on the port and forward sides of the casemate. Divers were certain that the structural elements recorded in Area 2 were articulated and they were not loose or otherwise thought to be out of position. However, it is possible that the structure shown in Figure 4-29 is part of a much larger piece of the gunboat that has been displaced, meaning that all of the interpretations presented here could be wrong.

While the structural elements in Area 2 are difficult to interpret, there is good evidence that they mark the starboard side of the hull of the *Eastport*. Additional hydraulic probing was conducted south of this point after the collapse of the excavation unit and no intact structure was found within 15 ft of the pool bottom, equivalent to a depth from surface of about 40 ft (see Figures 4-15 and 4-17). This presumed edge of the hull is slightly less than 50 ft from the east-west line of iron armor believed to represent the port side of the *Eastport's* casemate and hull. This is somewhat greater than the 40-ft-breadth reported for the gunboat (*Cincinnati Daily Commercial* August 23, 1862), but not out of line given the distortions and displacements likely to have occurred to the vessel's hull as a result of the efforts to destroy her and the impacts of natural forces while the wreck lay in the river and as it was buried.

Excavations in Area 4

In order to more thoroughly examine and accurately delineate the hull of the *Eastport*, an effort was made to reach the wreck in the area of her presumed bow. To do this, excavations were conducted toward the eastern side of the pool at a point thought to be close to the port side of the hull, as shown in Figure 4-14. The selection of this location was based on several factors. First, excavations and probing had revealed that quantities of river-borne debris consisting of numerous logs, branches, etc., were buried throughout the southeastern quarter of the pool, including the area where the starboard edge of the hull of the *Eastport* forward of the casemate was projected to be. Additionally, it was apparent that the wreck of the *Ed. F. Dix* covered a large portion of the *Eastport* forward of the casemate. These two factors essentially eliminated any attempts to examine the starboard hull line of the gunboat east of Excavation Area 2, as can be seen in Figure 4-14. In essence, the only area left where it was thought possible to reach the *Eastport* was in the extreme northeastern corner of the pool. The excavations conducted here, designated Area 4, were positioned on what was thought to be the port edge of the hull, determined by alignment with the port side of the casemate, as identified in Excavation Area 4, and by the results of probing (see Figure 4-15). Additionally, these excavations were placed far enough east to be beyond the remains of the *Ed F. Dix*.

Excavation Area 4 was positioned at grid coordinate N161/E180 where hydraulic probing seemed to indicate the edge of the hull. Additionally, one probe had struck metal at this point at a depth of 36.5 ft (see Figure 4-15). This position was about 40 ft forward of the projected forward end of the iron casemate, as recorded in excavation Area 1. The most complete description of the *Eastport*, given in the *Cincinnati Daily Commercial*, indicated that the main deck of the boat was "open forty feet" from the bow back to the casemate (*Cincinnati Daily Commercial* August 23, 1862) meaning that Excavation Area 4 should be very close to the bow of the boat. However, probing seemed to indicate that the boat structure extended several feet farther than this. As shown in Figure 4-15, probes struck solid wood, thought to be part of the boat, as far east as gridline E183. It was originally thought that the remains of the *Eastport* extended some distance east of this point and simply could not be reached with the hydraulic probe because of the increasing depth of overburden in that direction. However, it is now believed that the hull of the gunboat extends only a short distance east of gridline E183. Relying on the two known photographs of the *Eastport*, it appears as if the distance from the front of the casemate to the bow is closer to 50 ft than the 40 ft given in the newspaper account. This would place the bow of the boat near gridline E190, right at the eastern edge of the bottom of the pool (see Figure 4-15). This would place excavation Area 4 about 9 or 10 ft aft of the bow.

Excavations in Area 4 proved to be extremely difficult because of the thickness and characteristics of the sediment overburden. Probing revealed that the wreck lay beneath 12 or 13 ft of sediment and it was recognized that digging through this would be difficult, but there was no other place where it was believed the bow area of the *Eastport* could be reached. The upper 7.5 ft of sediment in Area 4 consisted of fairly compact silts with some clay lenses and numerous tree roots and small branches. This material was fairly easy to clear and remove with the water jet and venturi dredge. However, at a depth of about 32 ft below surface (7.5 ft below the bottom of the pool) a fairly thick mass of roots was encountered beneath which was a stratum of medium

to coarse sand. This sand began to flow into the excavation unit, undermining the over 7 ft of silt resting above it, resulting in serious sloughing and collapsing of the walls of the excavated hole. Probing into the bottom of the excavation indicated that the sand stratum was about 3 ft deep and rested directly on top of boat structure, which could be felt at a depth of 35 ft below surface. The sand deposit is identified as a sand bar that initially developed on the upriver side of the *Eastport* and, ultimately, deepened to cover the main deck at the bow.

Water jets were used to expand the hole at Area 4 to lessen the danger of collapsing walls and, finally, after 4 days of work, the hole was cleared to a depth of just over 35 ft. At this point, a single, squared timber, measuring about 5 to 6 in across was felt, before the walls of the excavation unit collapsed. It was determined that continued excavation in Area 4 was too dangerous and work here was discontinued.

The single timber found in Excavation Area 4 was horizontal and appeared to be oriented in a north-south direction, meaning it would be running athwartship, or across, the hull of the *Eastport*. If so, it could represent a deck beam. However, the diver only guessed at the orientation and it could never be confirmed. There seems to be no doubt, however, that the timber is part of the *Eastport's* structure and it lies at or very near the edge of the hull on the port side and fairly close to the bow. This assumption is supported by the results of the hydraulic probing conducted in this area. Additionally, this timber lies at a depth of 35 ft below the surface, the same depth that the intact casemate deck lies. If this timber is at or close to the level of the main deck, as is suspected, it indicates that the hull of the *Eastport* is resting on a fairly even keel.

Artifacts Recovered From the Eastport

A small number of artifacts were recovered from the *Eastport*. The majority of these consist of a variety of iron fasteners collected from above the deck of the casemate in Area 1. These include nails, spikes, items identified as rivets and drift bolts. In addition, several pieces of burned wood were collected from this same area and several were recovered from the excavations in Area 2.

Wood

The few pieces of wood recovered from the *Eastport* (see Table 4-1) provide very little information on the boat. Most of the pieces recovered in Area 1 consist of heavily burned fragments from which no complete dimensions could be obtained. One of these charred pieces, measuring 2.5 x 8 inches in section and 37 in long, is a piece of yellow poplar, as noted earlier. This fragment of plank came from the stratum of burned debris on top of the casemate deck in Area 1. The only other piece of wood from the *Eastport* which has been identified as to type is a piece of white oak (*Quercus alba*) recovered from Excavation Area 2. This consists of a broken piece of plank measuring 3 in thick, 5.5 in wide and 28 in long. The thickness is the only complete dimension on the piece. Two iron spikes, spaced 8 in apart, project through the plank. This fragment of wood is a piece of the 3-in-thick planking shown on the interior side of the structure in Figure 4-29. The spacing of the spikes indicates framing pieces of some sort set about 8 in apart, however, these were not recorded in the limited amount of time spent at Area 2.

Fasteners

A number of well preserved fasteners were recovered from the *Eastport*, almost all from the burned debris layer above the casemate deck. It is believed that all of this material came from the upper casemate sides and roof (top deck) as they burned and collapsed when the explosives were set off on April 26, 1864. Three basic types of fasteners are represented in the collection from the casemate: 1) iron nails and spikes of various sizes; 2) round and square iron drift pins and bolts and 3) distinctively shaped iron fasteners described as "chisel-pointed" rivets occurring in three lengths.

A total of 163 individual nails and spikes were recovered from the casemate area of the *Eastport*, plus several additional spikes were found still embedded in pieces of wood. These latter examples have been left in place and are not included in the following discussions. Also, several fragments of fasteners identified as spikes were found. As noted for the *Ed. F. Dix*, nails and spikes are differentiated on the basis of size; those longer than about 4.5 in (11.5 cm) are classified as spikes. It is presumed that the common rules relating to fastener length and plank thickness noted above were generally applied to the *Eastport* during her initial construction and her later conversions and repairs. Thus, a 6-in-spike, a number of which were recovered from the *Eastport*, would be used, primarily, to fasten planks about 3 in thick if used with oak, or as thin as about

2 in if used to fasten softer woods, such as pine, or the gum reportedly used on the *Eastport.*

Only two of the fasteners collected from the *Eastport* are classified as nails, in that they measure only 4 in (10.3 cm) long. Both nails come from the casemate of the gunboat. The shanks of these nails are 0.12 in (0.3 cm) thick and square in cross section and the heads are flattened and rectangular in shape (see Figure 4-23b). These nails are identified as machine cut and machine headed and they display the typical "pinched" shaft just beneath the head where the nail was gripped while it was headed. Nails of this type were produced during the period from about 1835 to 1885 (Edwards and Wells 1993:56). This nail type would have been used with relatively thin planking (less than 2 in thick). The recovery of only two nails in the casemate area suggests that boards thin enough to be attached with nails were uncommon in the casemate construction.

A total of 161 complete spikes are identified in the *Eastport* artifacts, in addition to 8 fragments presumed to be from spike-sized fasteners. All of these spikes are square in cross-section with shanks measuring from 0.33-to-0.5-in (0.8 to 1.3 cm) thick. The majority of the spikes range in length from 5 in to 8 in (12.8 to 20.5 cm). Of the spikes falling in this length range, five are 5 in (12.8 cm) long; 54 are 6 in (15.4 cm) long, 43 are 7 in (10.3 cm) long, and 52 are 8 in (20.5 cm) long (see Table 4-1). The fact that most of the spikes are 6 to 8 in long indicates the common use of 3-to-4-in-thick boards. Planks of this thickness may have been used to cover the inside of the framework of the casemate or it is possible that several 3-to-4-in-thick planks were fastened together to produce the thickness desired for the backing of the armor plating.

A number of these 5-to-8-in-long spikes have a distinctive 4-sided, tapered head (see Figure 4-23c,d). Spikes with this type of head are commonly referred to as "boat spikes" and they have been used in boat construction since, at least, the mid-nineteenth century (Curtis 1919:74). Boat spikes were normally driven into recessed holes cut into a plank and, if a smooth surface was desired, the hole was filled, usually with a wooden plug. This technique was commonly used in deck construction and in attaching hull planks. Boat spikes are not often specifically identified in the archaeological literature, but a large number of these distinctive spikes were recovered from the wreck of the steamboat *Arrow*, a low-pressure sidewheeler constructed in 1856 and scuttled in the West Pearl River, Louisiana, during the Civil War (Pearson and Saltus 1996:151). James et al. (1991:101) report on the recovery of a number of 8-in-long boat spikes from the wreck of the United States Army Corps of Engineers hopper dredge *Gen. C. B. Comstock* which was built in 1895 and sank in the Gulf of Mexico just off the mouth of the Brazos River, Texas, in 1913.

Seven of the fasteners classified as spikes are much longer than those noted above. Six of these measure 10.8 in (27.6 cm) long (see Figure 4-23e) and one is 13 in (33.3 cm) long. These very long spikes have square shanks, short tapered points, and flattened heads. They would have been used to attach fairly thick pieces of wood together, such as two, 6-in-thick timbers. With spikes of this length it may have been necessary to drill a hole deep enough to get the spike started, making it easier to drive.

Thirteen complete round iron drift pins or drift bolts and a number of fragments were recovered from within the casemate of the *Eastport*. These bolts are made of wrought iron and diameters range from .64 to .94 in (1.65 to 2.4 cm), although all are corroded to some extent and thicknesses could not always be accurately measured. Seven of the complete drift bolts from the *Eastport* are just under 24 in (60 cm) long, and all of these have diameters of 0.94 in, presumably, manufactured as a 1-in-diameter bolt. A single, complete round drift bolt measures 21 in (54 cm) long, one is 15.2 in long (39 cm), and four are 12 in (30.8 cm) long. The four 12-in-long bolts are 0.6 inches (1.5 cm) in diameter. Both ends of most of these drift bolts have been slightly flattened, suggesting that both ends were exposed to be hammered after they were driven. Also, several of the bolts contain clinch rings; large washers used at one, or sometimes both, ends of a bolt to keep it from pulling out (see Figure 4-23f).

Assuming that these drift bolts came from the sides or roof of the casemate, they do provide some information on its construction. Because both ends would have been exposed to be "peened," or flattened, the longest bolts penetrated wood that was 24 in thick, while the shortest bolts were driven into wood that was one foot thick. If the 24-in-long bolts represent the thickest section of wood incorporated into the casemate construction, then it may be that this measurement reflects the maximum thickness of, at least, portions of the wooden backing of the *Eastport's* casemate. In light of the information presented earlier about the thickness of the wood on casemates of other gunboats, this 2-ft-thickness does

not seem unreasonable. For example, the large, 292-ft-long gunboat *Lafayette* had a full-length, sloping-walled casemate very similar in appearance to that on the *Eastport*. The *Lafayette's* wooden casemate walls were reportedly 30 in thick at the ends and 21 in thick along the sides and were covered by 2.5 in of iron plating (Canney 1993:101-102). The amount of iron armor on the *Lafayette* was considered "excessive," and this created some problems, just as had occurred with the heavily armored *Eastport*. The stoutly built casemate of the *Lafayette*, however, was not impervious to shot. When passing the batteries at Vicksburg in 1863, her casemate sides were completely penetrated by 100-pounder shot and 32-pounder shot broke iron plating (Canney 1993:102). Another of the large, armored river gunboats, the *Chillicothe*, had a casemate "framed with 12-inch-square pine, overlaid with 9 inches of the same wood" (Canney 1993:96).

One square iron bolt, measuring 21 in (53.8 cm) long, is included in the collection from the casemate area of the *Eastport*. It is not known how this bolt would have been used, however, several long, square iron bolts were found projecting up from the casemate deck, as is shown in Figure 4-26.

Among the iron fasteners recovered from the casemate deck of the *Eastport* are several that are identified as "chisel pointed" rivets. These rather unusual looking fasteners combine a flattened, rivet-like head with a round shank or body (see Figure 4-23g). Eight complete specimens and one fragment which may be one of these types of fasteners were found. Five examples measure 6 in (15.4 cm) long and have round shafts measuring 0.47 to 0.50 inches (1.2 to 1.3 cm) in diameter. The top of the shank flares outward to produce a flat, circular head with an average diameter of 0.9 in (2.3 cm). The points on these fasteners have a very distinctive "chisel" shape, apparently created by simply flattening opposite sides of the shank. Three other complete example of these fasteners are in the collection, two measuring 4 in long while the other is 9 in long. The shaft and head dimensions on these two fasteners are approximately the same as those that measure 6 in long. This suggests that all of these fasteners were made out of similar, 0.5-in-diameter bar stock that was cut into varying lengths. Also recovered from the casemate area of the *Eastport* was the point portion of a broken fastener with a similar, chisel-like point. The diameter of this piece of fastener, however, is 1.25 in (3.2 cm), much greater than the complete specimens and it is possible that this fragment does not come from the same type of fastener.

The distinctive shape of these fasteners suggests a specialized purpose. The flared and flattened head indicates that they were counter sunk into a pre-drilled hole. The shank diameter is much greater in relation to the shaft length than is found in typical spikes, so it is unlikely that they were used to simply attach pieces of wood together. It is believed that these fasteners, with their typical "rivet-shaped" heads and stout shafts, were used like rivets to help attach armor plate to the wooden casemate walls. Countersunk holes drilled into the armor plating would have allowed the face of these rivets to lie flush with the surface of the armor. While this presumption seems reasonable, no information on similar fasteners has been found in the archaeological or historical literature.

It is unlikely that these rivet-like fasteners were used alone to attach the *Eastport's* armor. A shell or ball striking the armor plating might have easily forced these rivets loose. Admiral David Porter noted that the "4-in-long drift bolts" used to fasten the armor plating to the gunboat *Tuscumbia* tended to be "drawn out" when struck by shot. Porter might very well have been referring to the rivet-like fasteners found on the *Eastport* when he wrote that every shot that "hits [the *Tuscumbia*] starts a plate and in some instances jarred out the bolts in the adjacent plates" (quoted in Canney 1993:99). To securely fasten the armor plates, bolts that completely penetrated the armor and the wooden backing and were secured on the interior with either a clinch ring or, if threaded, with a nut, would almost certainly have been used in conjunction with the rivet-like fasteners.