

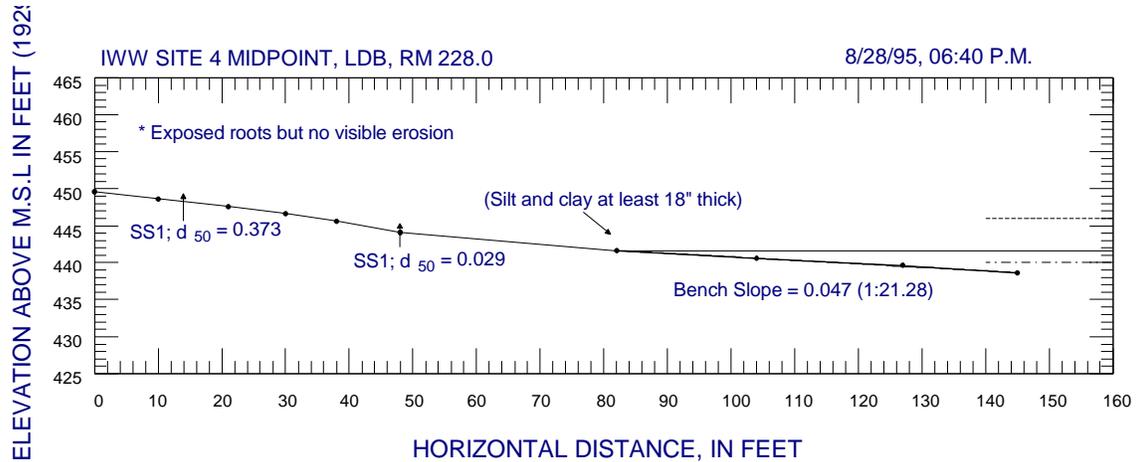
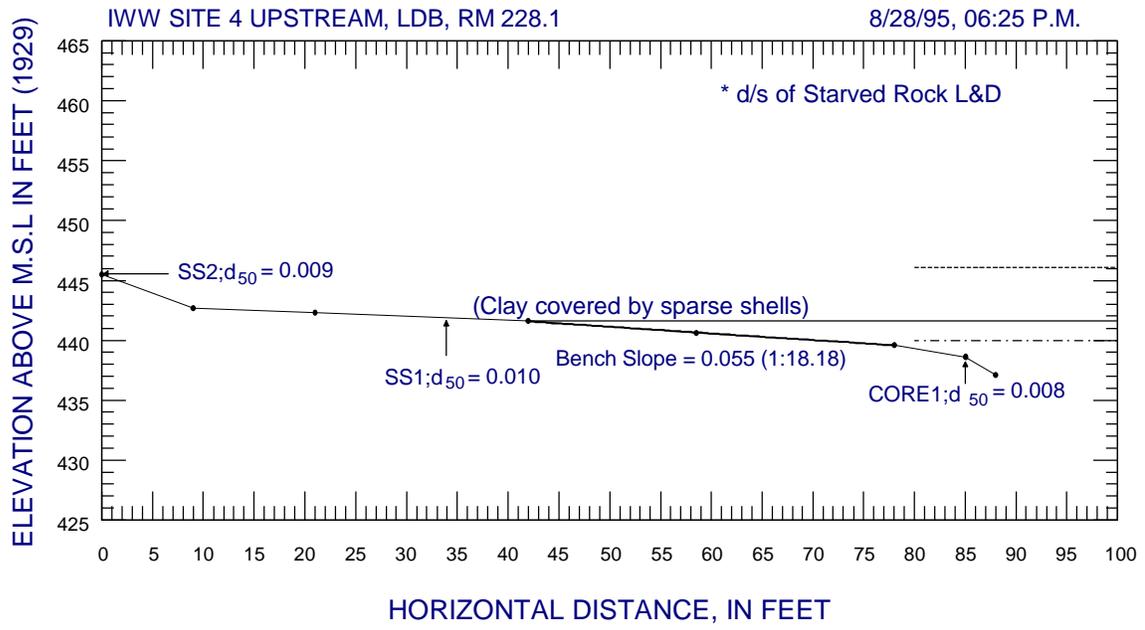
**Figure 6-54. Locations of sites 4 and 5 on the Illinois Waterway**



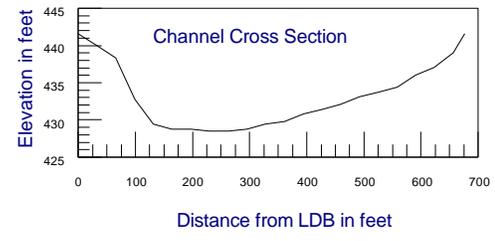
**Figure 6-55. Site 4 on the Illinois Waterway**

Figure 6-56 shows the three measured bank sections and a reduced cross section. Bank sections were fairly uniform at this site. The OHW is 446 feet and NP is 440 feet above msl. The range of fluctuation between the OHW and NP covers the entire bench.

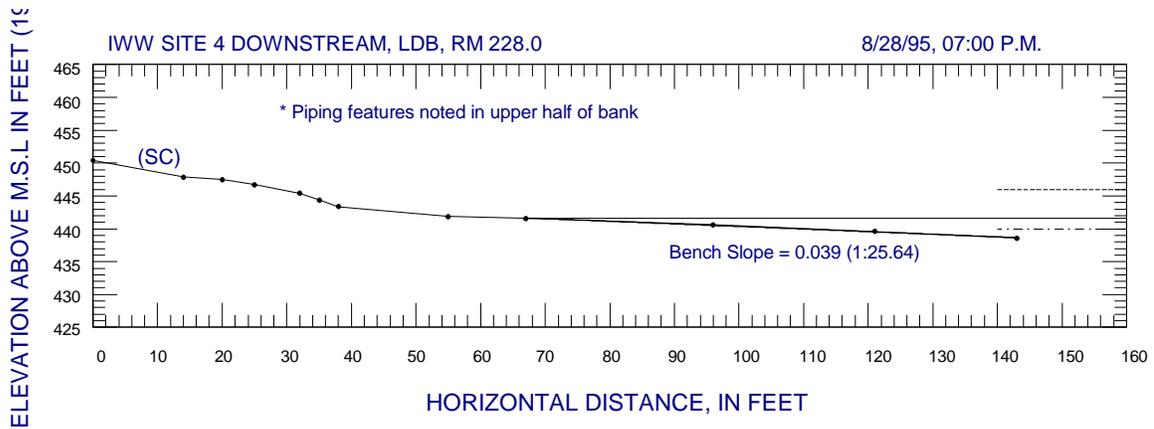
At the midsection, the  $d_{50}$  varied from 0.373 mm for materials on the scarp under the exposed tree roots of a mature tree to 0.029 mm on the bench. Mean particle size at the upstream section varied from 0.009 mm at the top surface of the bank to 0.008 mm for a core sample at a water depth of about 1 foot. Gradation plots of bank soils and nearshore sediment are presented in appendix F. The detailed cross section and coordinates are shown in appendix G.



- Measured Profile
- Ordinary High WS ELEV.
- - - Normal Pool ELEV.
- Regression Line



**Figure 6-56. Bank sections at site 4**



**Figure 6-56. Bank sections at site 4 (concluded)**

**Table 6-14. Site 4**

<i>Percentage of occurrence</i>	<i>Stage above msl, in ft</i>	<i>Topographical features</i>	<i>Bank/bed material, mm</i>
90	441.2	<ul style="list-style-type: none"> <li>• Bench (underwater)</li> <li>• Slope varied from 1V:25.6H to 1V:18.2H</li> </ul>	<ul style="list-style-type: none"> <li>• <math>d_{50}</math> varied (0.010-0.029)</li> </ul>
75	441.9	<ul style="list-style-type: none"> <li>• Bench</li> </ul>	
50	443.8	<ul style="list-style-type: none"> <li>• Scarp/bench</li> </ul>	
25	447.1	<ul style="list-style-type: none"> <li>• Bank with gentle slope</li> </ul>	<ul style="list-style-type: none"> <li>• <math>d_{50} = 0.373</math></li> </ul>
10	450.6	<ul style="list-style-type: none"> <li>• Bank with gentle slope</li> </ul>	
0-9	>450.6	<ul style="list-style-type: none"> <li>• Top of bank</li> </ul>	<ul style="list-style-type: none"> <li>• <math>d_{50} = 0.009</math></li> </ul>

Note: Tail water gage of Starved Rock Pool @ RM 231.0 was used for stage histogram. WSE = 441.6'; OHW = 446.0'; NP = 440.0'.

Bench slopes varied slightly from 1V:18.2H at the upstream section to 1V:25.6H at the downstream section. This site can be classified as type 5 (figure 6-22 and table 6-4). The bank seemed to be stable in 1995 but was an eroded site in 1978 (Bhowmik and Schicht, 1980). The elevation of the scarp was fairly high compared to NP or OHW stages where piping was noted. Erosion of bench soils or recently deposited sediments can occur during flow at stages higher than OHW.

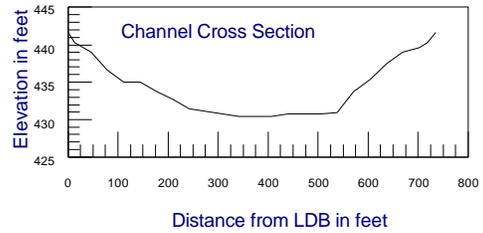
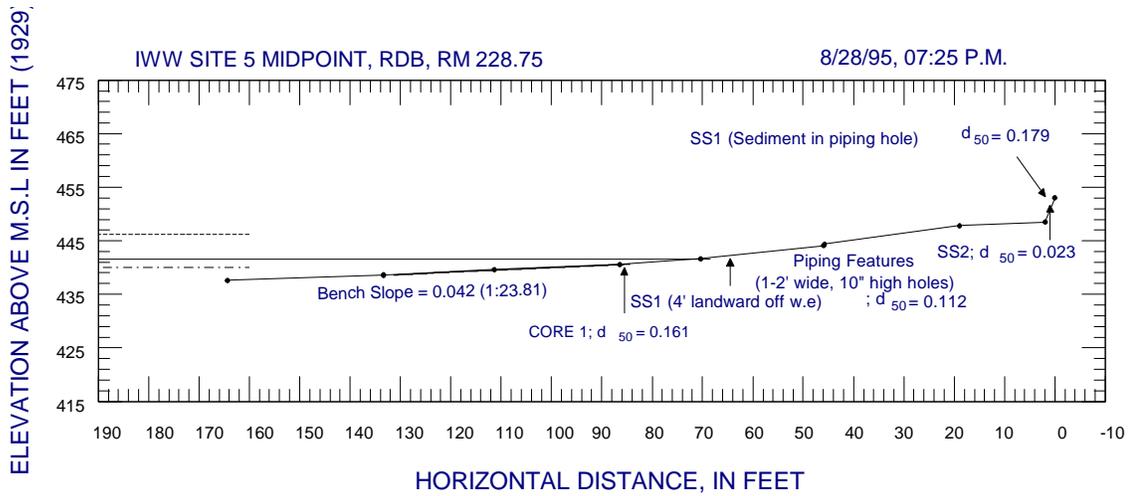
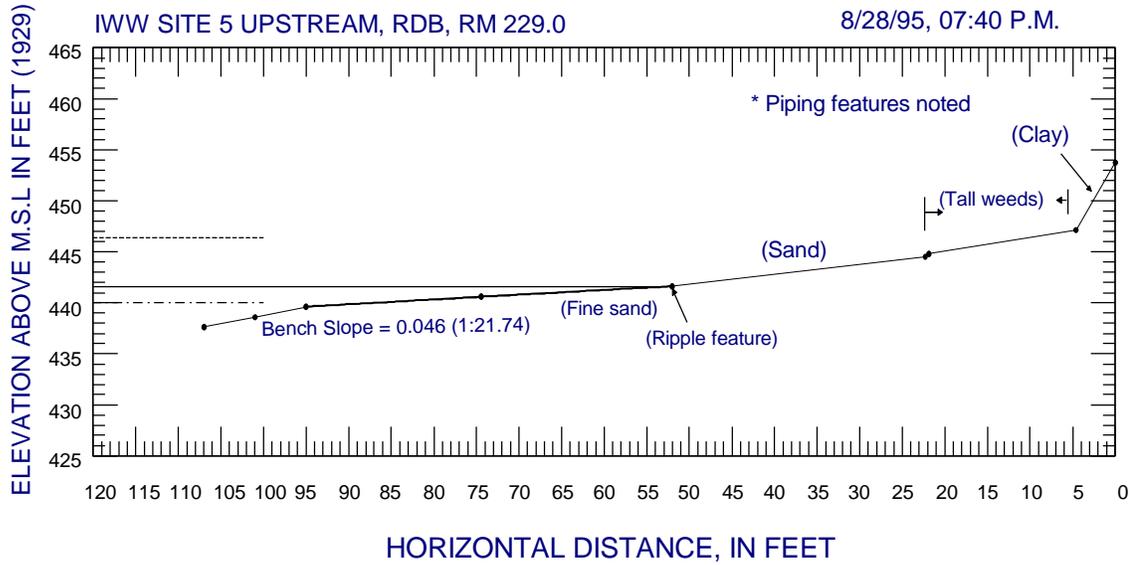
**Site 5, Peoria Pool, 8/28/95.** This site is located on the RDB at RM 228.5, slightly upstream from site 4 on the LDB. Figure 6-54 shows the position of the site on a GIS-based map of the Illinois navigation chart.

Site 5 is about 375 feet from the sailing line. No major tributary enters the IWW at this location, but there is a state highway bridge at RM 229.6. The upstream end of this reach is about 150 feet downstream from a barge terminal. Bank sections were similar to those for site 4, but the scarp at the upper part of the bank was higher and contained piping holes. Agriculture (corn) was the land use on top of the bank. Tall weeds were growing below the scarp on the sand-covered bench. The team dug a trench on the bench and seepage water filled the hole very quickly. Subaqueous sediment near the shore was mostly sand, and the bench slope was mild.

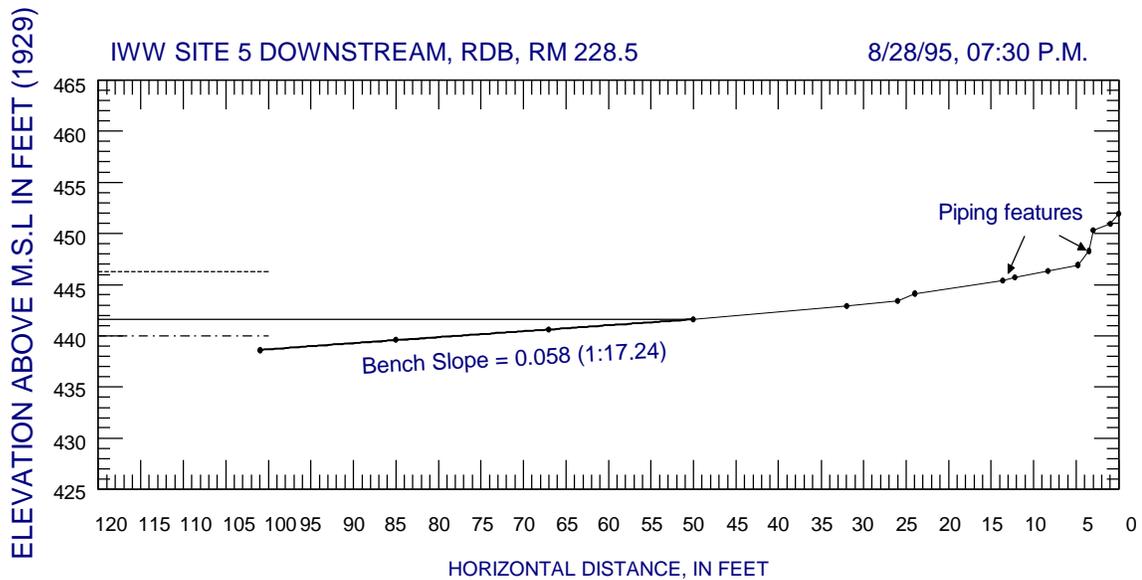
Figure 6-57 shows the three measured bank sections and a reduced cross section. The OHW is 446.2 feet and NP is 440.0 feet above msl. The OHW elevation was at the base of the scarp at all three sections, while the NP was at a break in the subaqueous slope at the upstream section. According to the stage analysis using 10-year data (see table 6-15), river stages with 25% or less occurrence frequency reach the scarp and stages with 10% or less occurrence frequency top the bank.

At the midsection, the  $d_{50}$  varied from 0.023 mm at the top surface of the bank to 0.161 mm for a core sample at a water depth of about 1 foot. Gradation plots of bank soils and nearshore sediment are presented in appendix F. The detailed cross section and coordinates are shown in appendix G.

Bench slopes varied slightly between 1V:23.8H and 1V:17.2H. With a scarp over a gentle bench slope, this site is classified as a combination of types 3 and 5 (figures 6-20 and 6-22, and table 6-4). The scarps have layered failure features and were initiated by piping and surface drainage. Waves and currents at OHW cause erosion of failed soil or recent sediments on the bench area.



**Figure 6-57. Bank sections at site 5**



**Figure 6-57. Bank sections at site 5 (concluded)**

**Table 6-15. Site 5**

<i>Percentage of occurrence</i>	<i>Stage above msl, in ft</i>	<i>Topographical features</i>	<i>Bank/bed material, mm</i>
90	441.2	<ul style="list-style-type: none"> <li>• Bench (underwater)</li> </ul>	<ul style="list-style-type: none"> <li>• <math>d_{50}</math> (core) = 0.161</li> <li>• <math>d_{50}</math> = 0.112</li> </ul>
75	441.9	<ul style="list-style-type: none"> <li>• Bench (slopes varied between 1V:23.8H and 17.2H)</li> </ul>	
50	443.8	<ul style="list-style-type: none"> <li>• Berm/bench slope = 1V:6.7H</li> </ul>	
25	447.1	<ul style="list-style-type: none"> <li>• Toe of scarp</li> </ul>	
10	450.6	<ul style="list-style-type: none"> <li>• Scarp slope (1V:0.69H)</li> <li>• Piping feature</li> </ul>	
0-9	>450.6	<ul style="list-style-type: none"> <li>• Scarp/Top of the bank</li> </ul>	<ul style="list-style-type: none"> <li>• <math>d_{50}</math> = 0.179</li> </ul>

Note: Tail water gage of Starved Rock Pool @ RM 231.0 was used for stage histogram. WSE = 441.6'; OHW = 446.2'; NP = 440.0'.

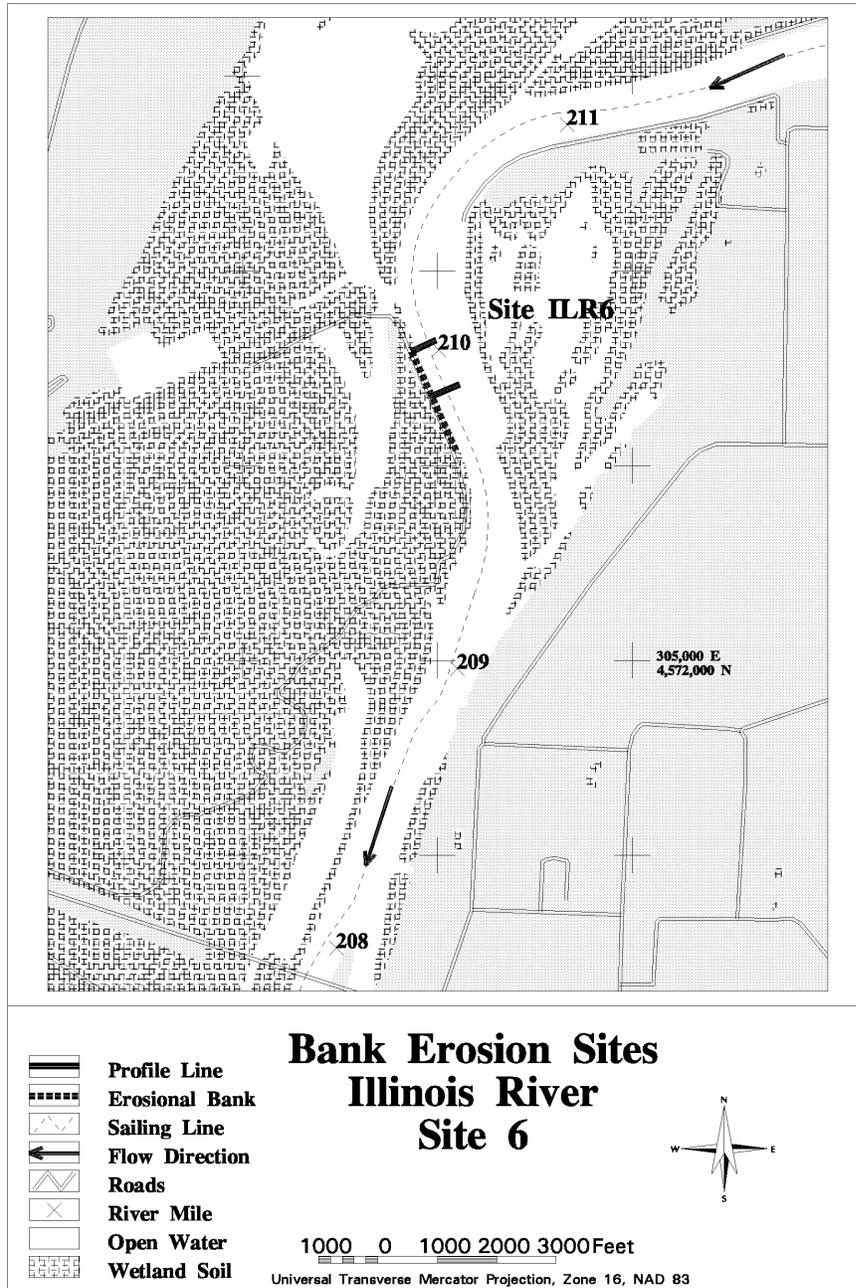
**Site 6, Peoria Pool, 8/29/95.** This site is located on the RDB at RM 210.0, immediately downstream of the outlet of Spring Lake. Figure 6-58 shows the position of the site on a GIS-based map of the Illinois navigation chart, and figure 6-59 shows one photograph of the site.

The site is about 310 feet from the sailing line. In plan form it is on the outer side of a bend. Bhowmik and Schicht (1980) observed erosion on both banks, while Hagerty (1988) noted erosion only on the RDB, but his site extended further upstream and downstream from the entrance of the lake. The bank contains small scarps, and the top of the bank is covered with some fine tree roots. Agriculture (corn) is the land use for the upstream section and woods cover the bank for the other two sections. At the most upstream end point of this reach (immediately downstream from the lake outlet), the subaqueous bench dropped more than 11 feet right off the water's edge, a feature not observed at the remaining sections. Judging from the plan form this truncation could be caused by tow-induced current passing through the bend. Small worm holes existed on the truncated bench face near the water's edge.

Figure 6-60 shows the three measured bank sections and two reduced cross sections. The thalweg was farther away from the water's edge downstream. The OHW is 443.2 feet and NP is 440.0 feet above msl. Mature trees were growing at the water's edge; the midsection and downstream section were measured between trees. Banks between the trees were eroded. The crown of the tree roots appeared to be higher than the bank top. A flood stage higher than 10% recurrence frequency will overtop the bank (see table 6-16). Standing (but dead) trees were in place in water at the NP level.

At the midsection, the  $d_{50}$  varied from 0.003 mm at the top surface of the bank to 0.012 mm on the bench. A core sample at a depth of about 1 foot of water on the downstream section had  $d_{50}$  equal to 0.025 mm. Gradation plots of bank soils and nearshore sediment are presented in appendix F. The detailed river cross-section and coordinates are shown in appendix G.

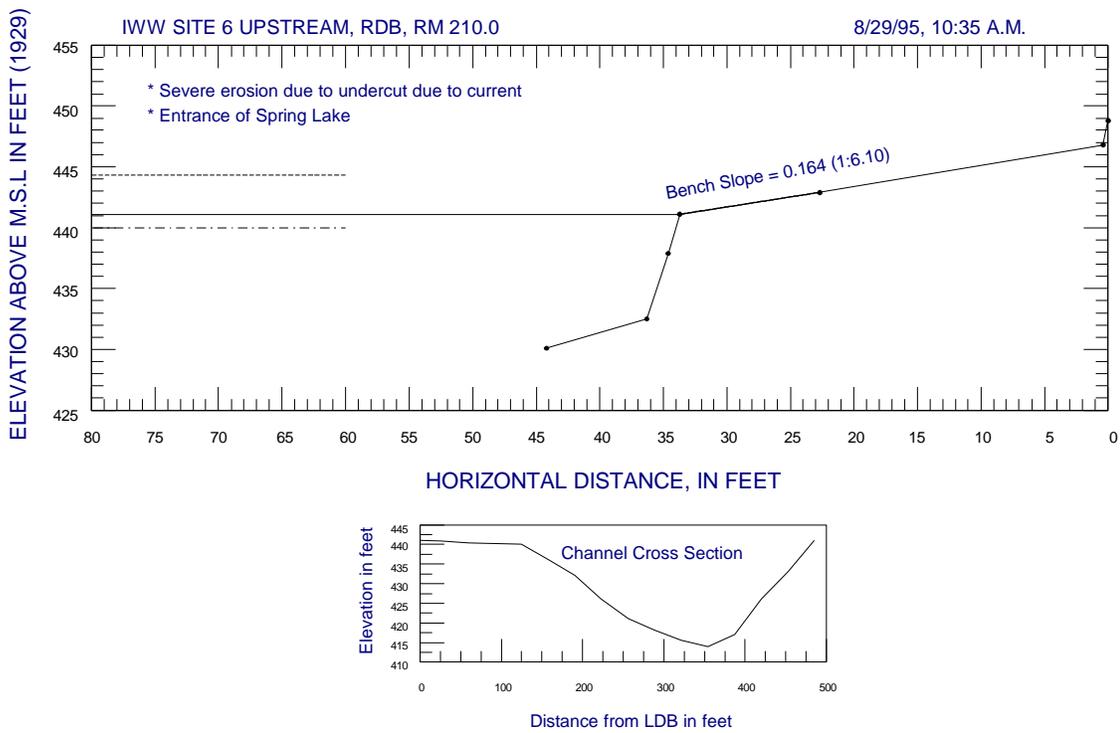
Bench slopes varied only slightly from 1V:16.1H at the midsection and downstream section. The three sections, from upstream to downstream, are classified as types 4, 5, and 6 (figures 6-21, 6-22, 6-23, and table 6-4). Traffic-induced currents appear to be a significant factor for the subaqueous scarp at the upstream section. Small worms nesting in the bank soils also will weaken the bank strength. Eddy currents, induced by fallen trees or nearshore land features, exist at the midsection and downstream section. These eddy currents can cause local scours. Other erosion mechanisms include surface drainage for the upstream section, piping, and floods for the whole reach.



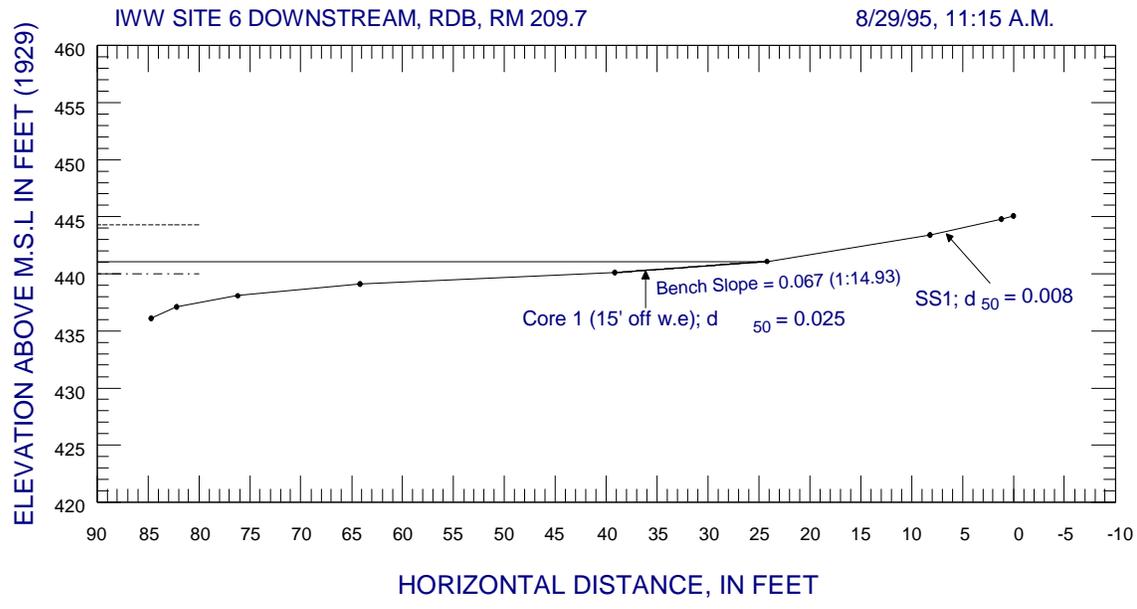
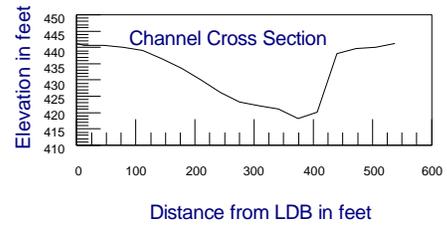
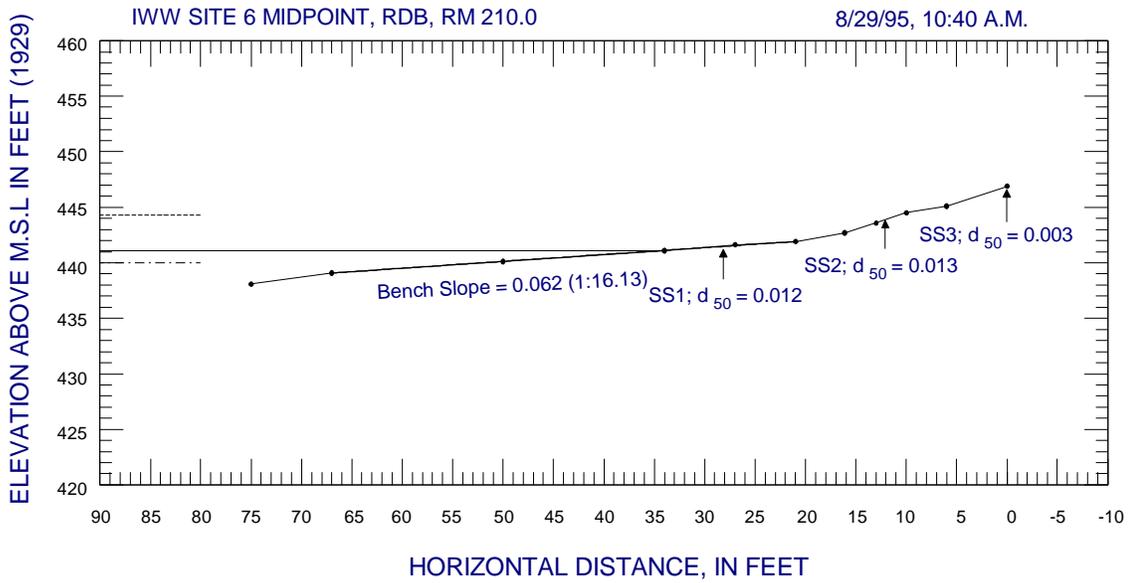
**Figure 6-58. Location of site 6 on the Illinois Waterway**



**Figure 6-59. Site 6 on the Illinois Waterway**



**Figures 6-60. Bank sections at site 6**



**Figures 6-60. Bank sections at site 6 (concluded)**

**Table 6-16. Site 6**

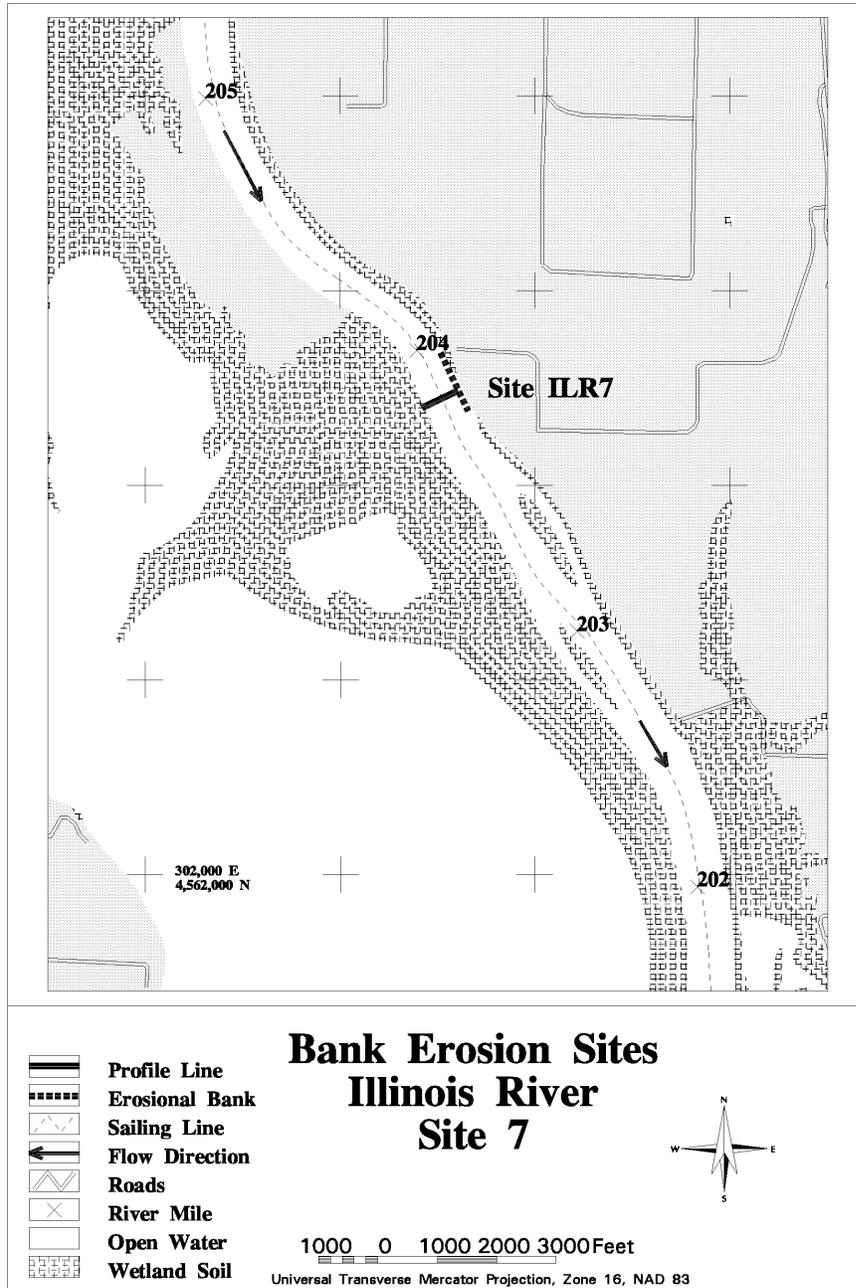
<i>Percentage of occurrence</i>	<i>Stage above msl, in ft</i>	<i>Topographical features</i>	<i>Bank/bed material, mm</i>
90	440.5	<ul style="list-style-type: none"> <li>• Steep subaqueous drop at upstream section</li> </ul>	<ul style="list-style-type: none"> <li>• <math>d_{50} = 0.025</math></li> </ul>
75	440.8	<ul style="list-style-type: none"> <li>• Bench (underwater)</li> <li>• Bench (underwater) slope varied between 1V:16.1H and 1V:6.1H</li> </ul>	
50	441.6	<ul style="list-style-type: none"> <li>• Bench</li> </ul>	<ul style="list-style-type: none"> <li>• <math>d_{50} = 0.012</math></li> </ul>
25	444.1	<ul style="list-style-type: none"> <li>• Bench/scarp</li> </ul>	<ul style="list-style-type: none"> <li>• <math>d_{50} = 0.008</math></li> </ul>
10	447.5	<ul style="list-style-type: none"> <li>• Scarp</li> </ul>	<ul style="list-style-type: none"> <li>• <math>d_{50} = 0.013</math></li> </ul>
0-9	>447.5	<ul style="list-style-type: none"> <li>• Top of the bank</li> </ul>	<ul style="list-style-type: none"> <li>• <math>d_{50} = 0.003</math></li> </ul>

Note: Gage on the Illinois River near Henry, IL @ RM 186.0 was used for stage histogram. Gage is 14 miles away from the site. WSE = 441.1'; OHW = 444.3'; NP = 440.0'.

**Site 7, Peoria Pool, 8/29/95.** This site is located on the LDB at RM 203.8 in a straight reach just downstream from a small bend. Upper Twin Sister Island is located at the downstream end between RM 203.1 and 203.3. Figure 6-61 shows the position of the site on a GIS-based map of the Illinois navigation chart, and figure 6-62 shows one photograph of the site.

Site 7 is at the Hennepin Levee System about 400 feet from the sailing line, and no tributaries enter the site. Bhowmik and Schicht (1980) noted almost the entire riverbank from the Upper Twin Sister Island to site 6 as eroding bank. Hagerty's observation (1988) was similar to that of Bhowmik and Schicht (1980), but the erosion reaches indicated by Hagerty (1988) were shorter and were shown mostly on the RDB. Hagerty (1988) also noted erosion on both the Upper and Lower Twin Sister Islands on the sides facing the channel. The back side (facing levee) of Upper Twin Sister Island also had a long reach of overhanging matted roots as noted by Hagerty (1988).

At the site, a scarp 3-5 feet high was located about 2 to 4 feet below the levee crown. Tall weeds were growing on the berm and many small scarps were observed on the bench. Figure 6-63 shows the three measured bank sections and a reduced cross section. The OHW is 443.9 feet and NP is 440.0 feet above msl. The OHW corresponded well with the lower edge of the weed zone on the shore where debris was found, in the bench area. Stages above 447.5 feet (about 10% recurrence frequency, see table 6-17), reach the base of the scarp near the top of the levee.



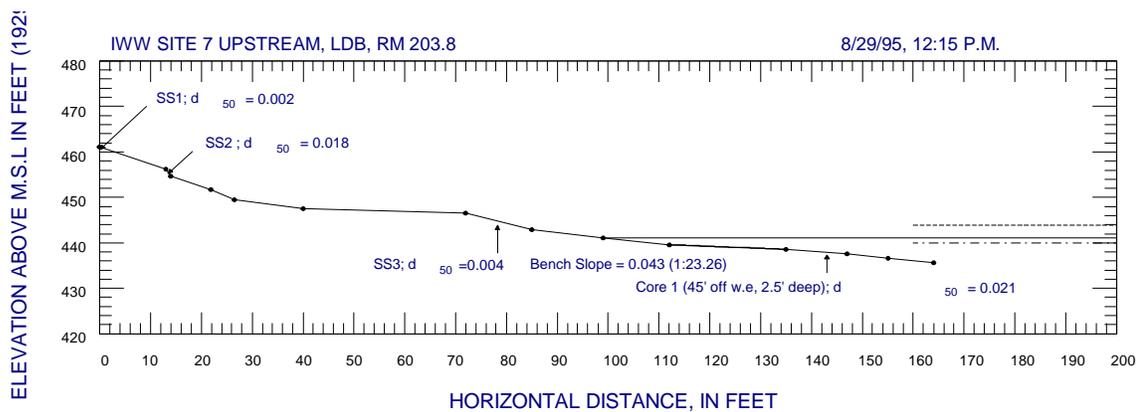
**Figure 6-61. Location of site 7 on the Illinois Waterway**



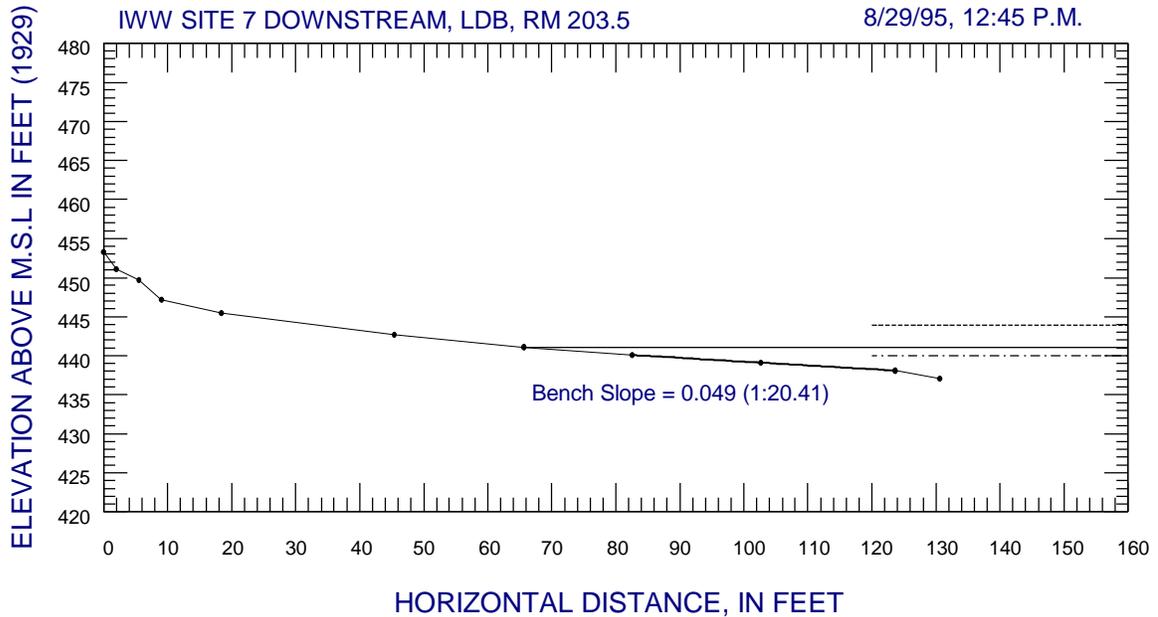
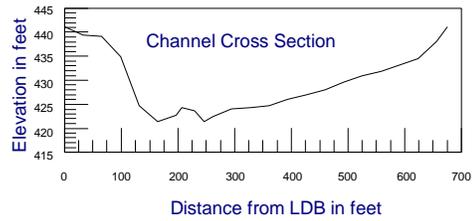
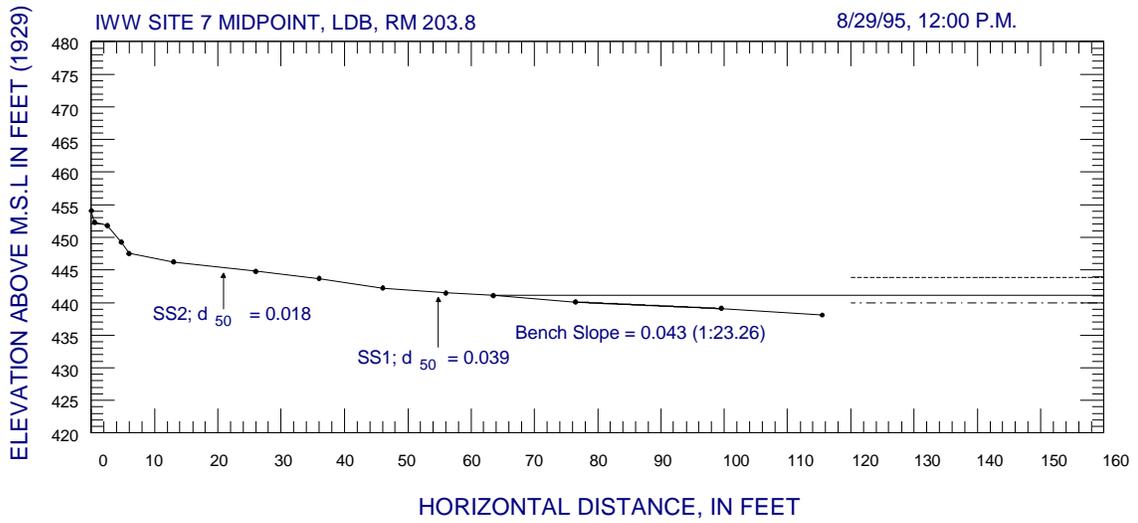
**Figure 6-62. Site 7 on the Illinois Waterway**

At the upstream section, the  $d_{50}$  varied from 0.018 mm at the surface of the scarp to 0.021 mm for a core sample at a water depth of about 1 foot. Gradation plots of bank soils and nearshore sediment are presented in appendix F. The detailed cross section and coordinates are shown in appendix G.

Bench slopes varied only slightly from 1V:23.3H. This site can be classified as type 5 (figure 6-22 and table 6-4). The scarp was located above most flood stages. Rework and transport by wave and currents are major factors in removing failed soil or recent sediments from the bench.



**Figure 6-63. Bank sections at site 7**



**Figure 6-63. Bank sections at site 7 (concluded)**

**Table 6-17. Site 7**

<i>Percentage of occurrence</i>	<i>Stage above msl, in ft</i>	<i>Topographical features</i>	<i>Bank/bed material, mm</i>
90	440.5	<ul style="list-style-type: none"> <li>Bench (underwater) (slope varied between 1V:23.2H and 1V:20.4H)</li> </ul>	<ul style="list-style-type: none"> <li>d<sub>50</sub> (core) = 0.021</li> </ul>
75	440.8	<ul style="list-style-type: none"> <li>Bench (underwater)</li> </ul>	
50	441.6	<ul style="list-style-type: none"> <li>Berm/bench</li> </ul>	<ul style="list-style-type: none"> <li>d<sub>50</sub> varied (0.039-0.004)</li> </ul>
25	444.1	<ul style="list-style-type: none"> <li>Berm (slope varied between 1V:8.3H and 1V:7.7H)</li> </ul>	
10	447.5	<ul style="list-style-type: none"> <li>Scarp (slope varied between 1V:1.4H and 1V:0.63H)</li> </ul>	<ul style="list-style-type: none"> <li>d<sub>50</sub> = 0.018</li> </ul>
0-9	>447.5	<ul style="list-style-type: none"> <li>Top of the bank</li> </ul>	<ul style="list-style-type: none"> <li>d<sub>50</sub> = 0.002</li> </ul>

Note: Gage on the Illinois River near Henry, IL @ RM 196.0 was used for stage histogram. Gage is 7.8 miles away from site. WSE = 441.1'; OHW = 443.9'; NP = 440.0'.

**Site 8, Peoria Pool, 8/29/95.** This site is located on the LDB at RM 184.8 on the lower end of Woodyard Island and upstream from the opening into Babbs Slough, in an inner bend reach. The slough opening was completely closed by historical deposits. Figure 6-64 shows the position of the site on a GIS-based map of the Illinois navigation chart, and figure 6-65 shows one photograph of the site.

The site is about 330 feet from the sailing line. Hagerty (1988) recorded this site as severely eroded, while Bhowmik and Schicht (1980) noted erosion at the opposite bank. The opposite bank had several moored barges at the time of the survey. The site had a steep scarp right on the edge of the water. The scarp is about 3 to 5 feet high and covered with fine roots on the top. These roots belonged to the mature trees inside the bank area, but the top of the bank is covered with tall seasonal vegetation. The scarp was composed of cohesive soil and contains piping holes or holes that riverine animals use, generally with a diameter of 1 to 4 inches. The subaqueous bench was gently sloping, extends far out, and was covered with silt and clay.

At the midsection, the d<sub>50</sub> varied from 0.005 mm at the surface of the top of the bank to 0.018 mm for a core sample at a water depth of about 1 foot. Gradation plots of bank soils and nearshore sediment are presented in appendix F. The detailed cross section and coordinates are shown in appendix G.

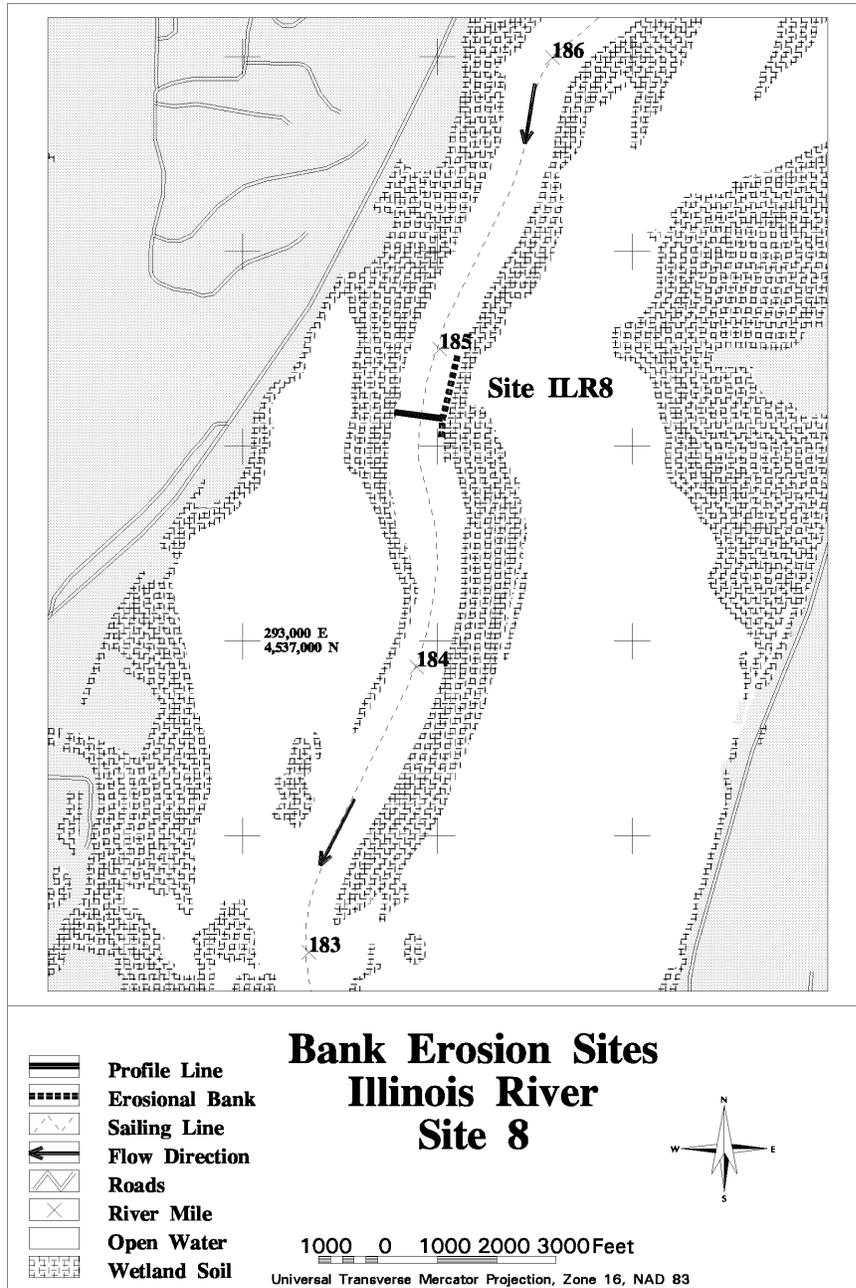
Figure 6-66 shows the three measured bank sections and a reduced cross section. The OHW is 442.6 feet and NP is 440.0 feet above msl. The OHW corresponds to the base of the scarp. Floods with stage higher than 447.5 feet (about 10% recurrence frequency) overtop the bank (table 6-18).

Bench slopes varied from 1V:83.3H to 1V:47.6H. This site is classified as a combination of types 4 and 5 (figures 6-21, 6-22, and table 6-4). Bank failures are initiated by piping or burrowing activities from riverine animals. Rework and transport of failed bank soils by wave action at NP appeared to be significant. Wave action probably was responsible for an erosion scarp at water's edge.

**Table 6-18. Site 8**

<i>Percentage of occurrence</i>	<i>Stage above msl, in ft</i>	<i>Topographical features</i>	<i>Bank/bed material, mm</i>
90	440.5	<ul style="list-style-type: none"> <li>Subaqueous bend (slope varied between 1V:83.3H and 1V:47.6H)</li> </ul>	<ul style="list-style-type: none"> <li><math>d_{50}</math> (core) = 0.018</li> </ul>
75	440.8	<ul style="list-style-type: none"> <li>Subaqueous bench</li> </ul>	
50	441.6	<ul style="list-style-type: none"> <li>Berm (slope varied between 1V:2.8H and 1V:2.5H)</li> </ul>	
25	444.1	<ul style="list-style-type: none"> <li>Scarp (slope varied between 1V:0.48H and 1V:0.07H)</li> </ul>	<ul style="list-style-type: none"> <li><math>d_{50} = 0.017</math></li> </ul>
10	447.5	<ul style="list-style-type: none"> <li>Top of the bank</li> </ul>	<ul style="list-style-type: none"> <li><math>d_{50} = 0.005</math></li> </ul>
0-9	>447.5		

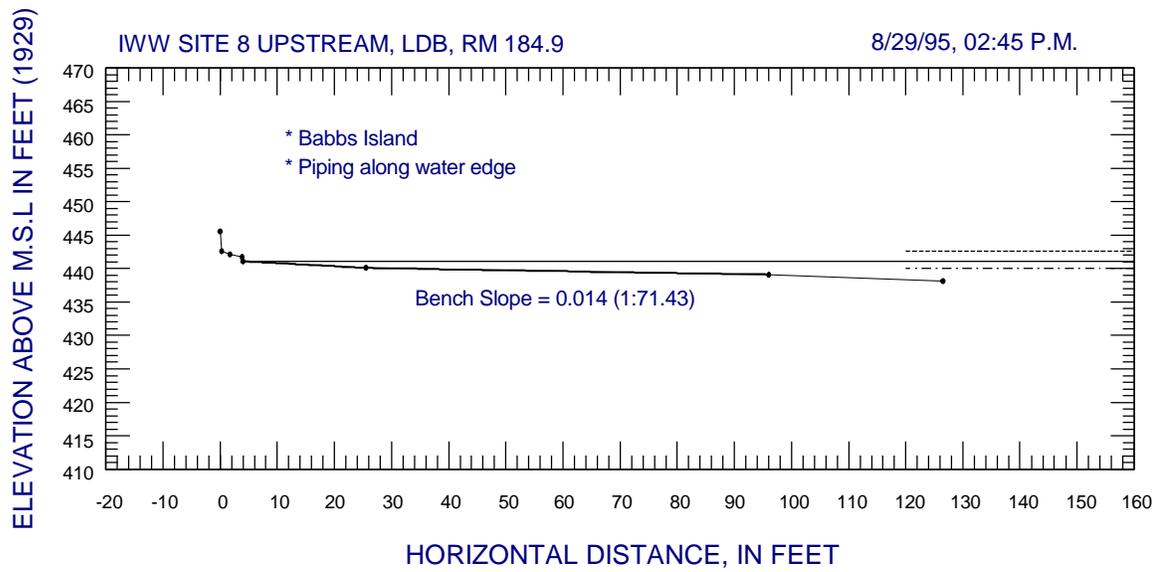
Note: Illinois River near Henry, IL Gage @ RM 196.0 was used for stage histogram. Gage is 11.2 miles away from the site. WSE = 441.1'; OHW = 442.6'; NP = 440.0'.



**Figure 6-64. Location of site 8 on the Illinois Waterway**



**Figure 6-65. Site 8 on the Illinois Waterway**

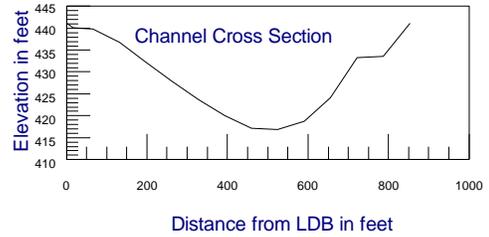
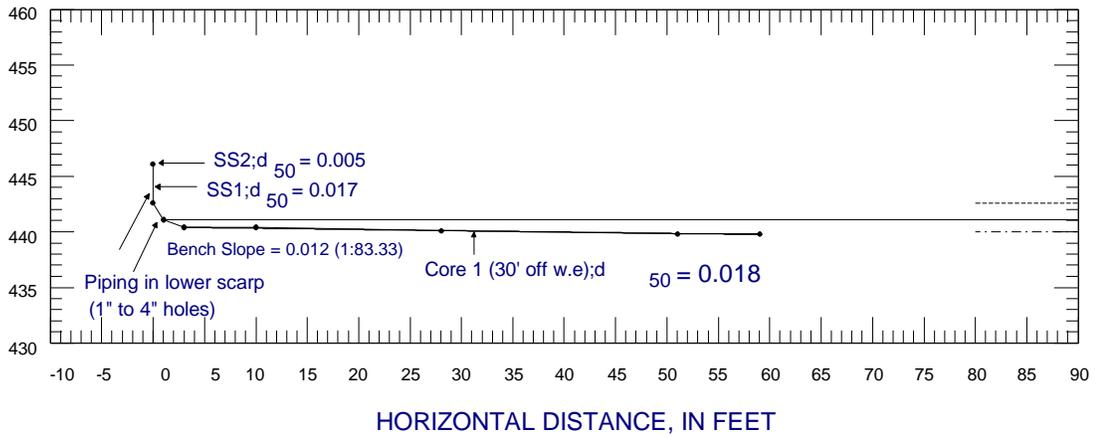


**Figure 6-66. Bank sections at site 8**

ELEVATION ABOVE M.S.L. IN FEET (1929)

IWW SITE 8 MIDPOINT, LDB, RM 184.8

8/29/95, 02:30 P.M.



ELEVATION ABOVE M.S.L. IN FEET (1929)

IWW SITE 8 DOWNSTREAM, LDB, RM 184.7

8/29/95, 03:05 P.M.

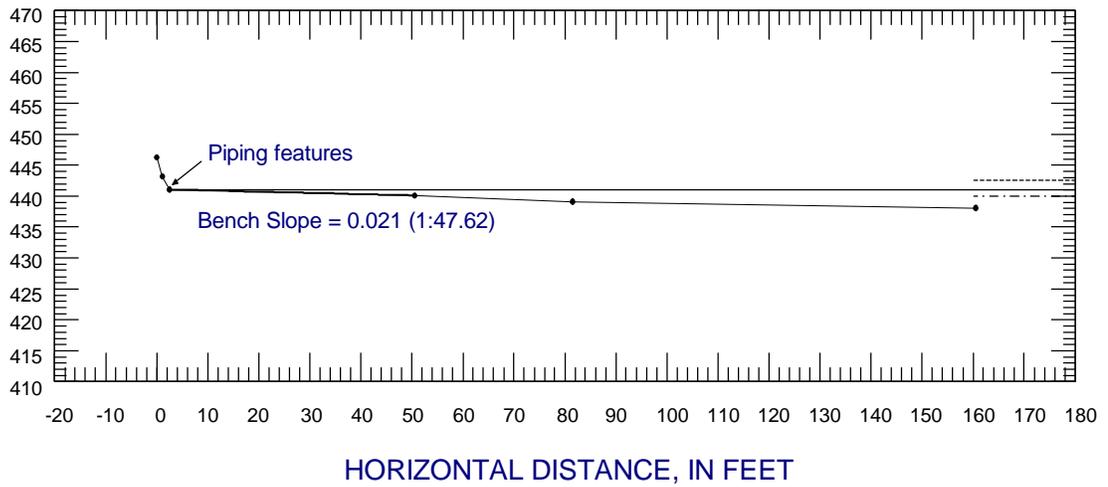


Figure 6-66. Bank sections at site 8 (concluded)

**Site 9, Peoria Pool, 8/29/95.** This site is located on the LDB at RM 179.8 on Chillicothe Island, immediately upstream of the opening into Peoria Lake. Figure 6-67 shows the position of the site on a GIS-based map of the Illinois navigation chart, and figure 6-68 shows a photograph of the site.

The site is about 310 feet from the sailing line, and the Chillicothe Sports & Marine Small Boat Harbor is located across the river. Bhowmik and Schicht (1980) and Hagerty (1988) marked this as an erosion site. The bank was mildly sloped and covered with weeds of medium density. The foundation of an old monument on shore was exposed for about a foot. A scarp about 0.3 feet high existed on the lower bank where the weed zone ends, above sandy bench. A scarp also existed at the water's edge. The wet bench did not support large weights. Submerged nearshore material, however, was hard clay mantled with sand.

Figure 6-69 shows the three measured bank sections and a reduced cross section. The OHW is 442.4 feet and NP is 440.0 feet above msl. The OHW corresponds well to the lower edge of the weed zone. Stage exceeding 447.5 feet (10% recurrence frequency, table 6-19) submerges the entire bank.

The  $d_{50}$  on the bench varied from 0.208 mm at the upstream section to 0.035 mm at the downstream section. Gradation plots of bank soils and nearshore sediment are presented in appendix F. The detailed cross section and coordinates are shown in appendix G.

Bench slopes varied from 1V:21.3H at the upstream section to 1V:14.1H at the downstream section. This site is classified as types 4 and 6 (figure 6-23, and table 6-4). The combinations of wave actions and seepage within bench near NP elevations could be the major causes of erosion at this site. Recreational and commercial traffic volumes are high at site 9. Traffic-induced waves and current can also be the cause of erosion at this site.

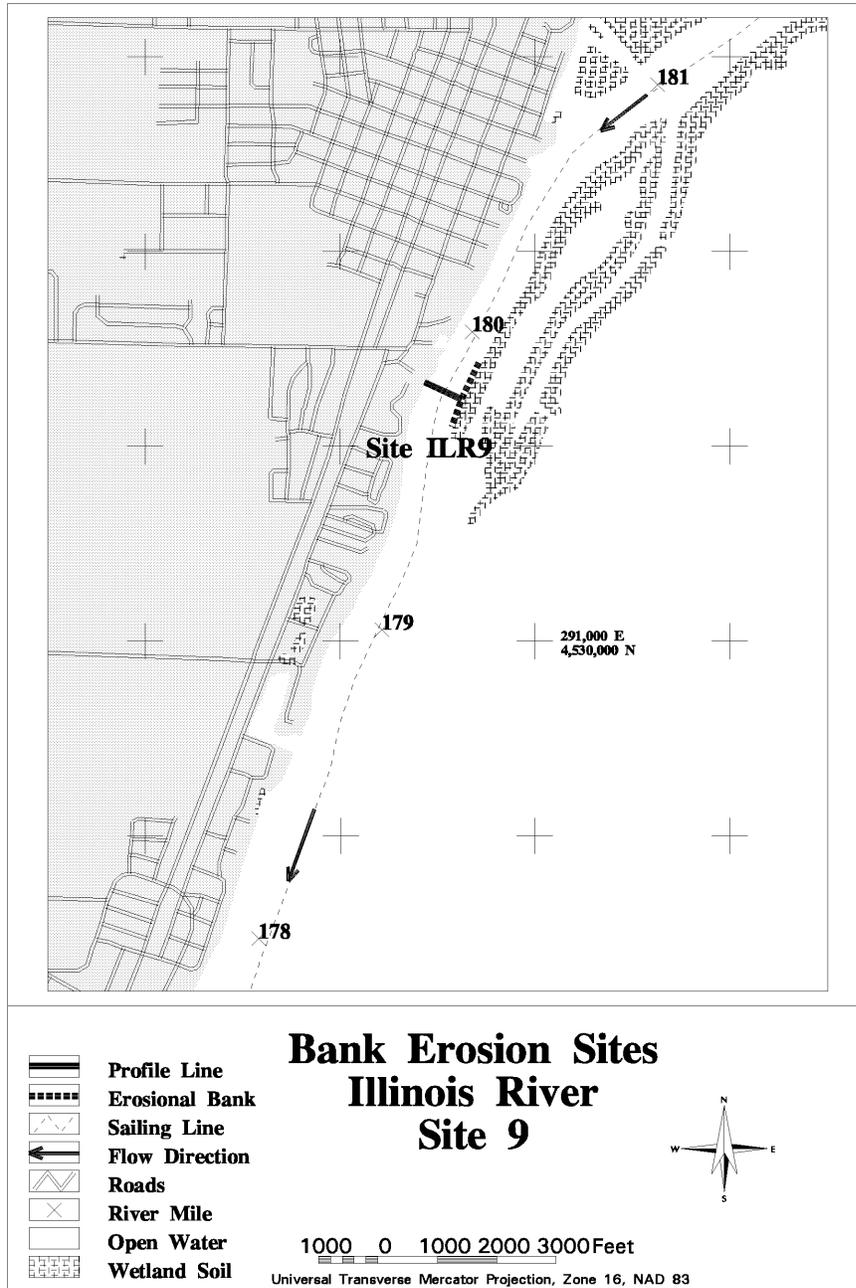
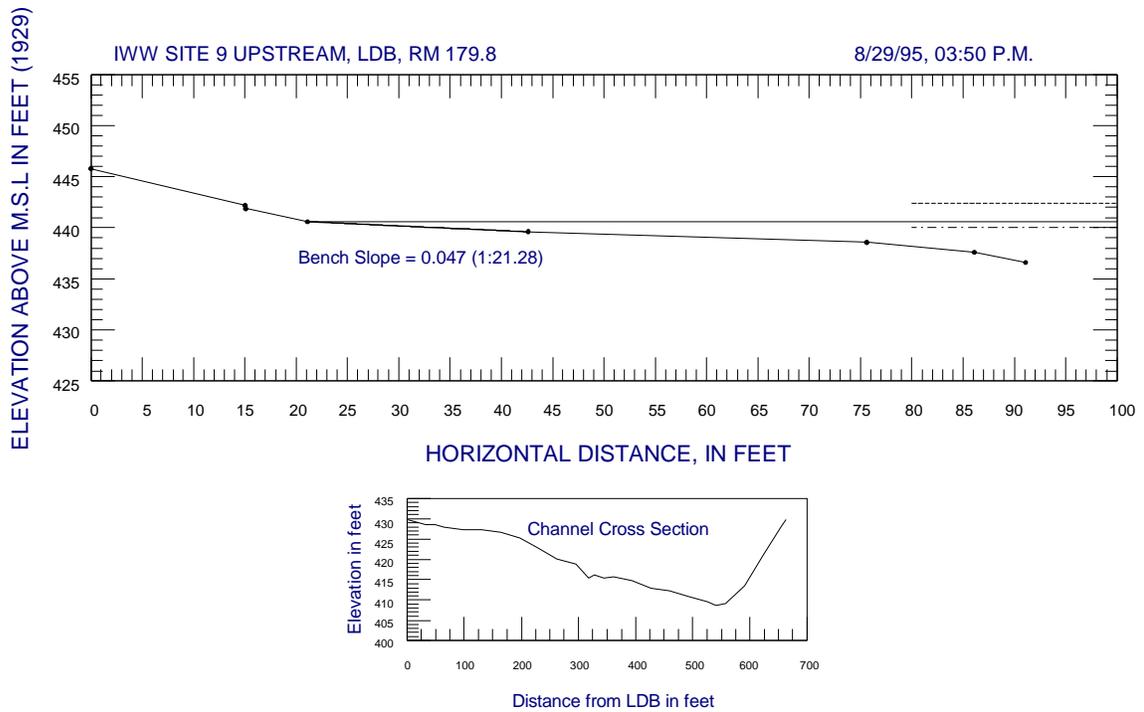


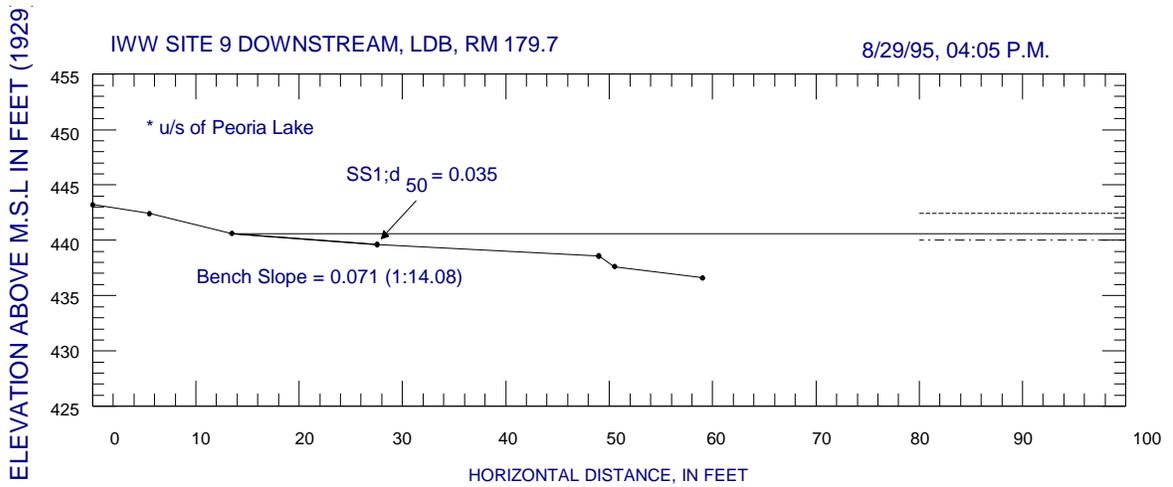
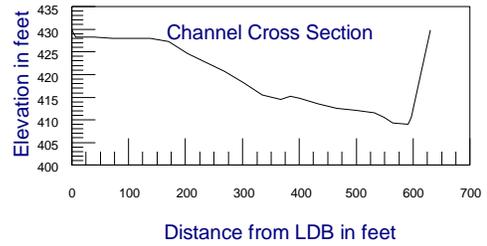
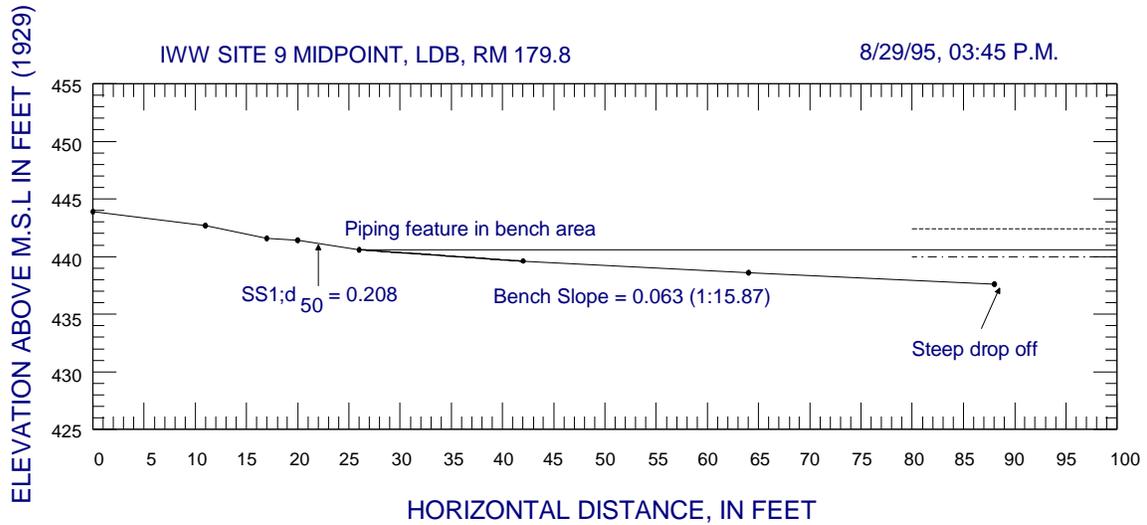
Figure 6-67. Location of site 9 on the Illinois Waterway



**Figure 6-68. Site 9 on the Illinois Waterway**



**Figure 6-69. Bank sections at site 9**



**Figure 6-69. Bank sections at site 9 (concluded)**

**Table 6-19. Site 9**

<i>Percentage of occurrence</i>	<i>Stage above msl, in ft</i>	<i>Topographical features</i>	<i>Bank/bed material, mm</i>
90	440.5	• Bench (underwater)	• $d_{50}$ (core) = 0.35
75	440.8	• Bench (slope varied between 1V:21.3H and 1V:14.1H)	• $d_{50}$ = 0.208
50	441.6	• Bench/berm	
25	444.1	• Scarp with gentle slope	
10	447.5	• Top of the bank	• $d_{50}$ = NA
0-9	>447.5		

Note: Gage on the Illinois River near Henry, IL @ RM 196.0 was used for stage histogram. Gage is 16.2 miles away from the site. WSE = 440.6'; OHW = 442.4'; NP = 440.0'.

**Site 10, Peoria Pool, 8/29/95.** This site is located on the RDB and at the outside of a sharp bend at RM 160.0. Peoria L&D is located downstream at RM 157.8. Figure 6-70 shows the position of the site on a GIS-based map of the Illinois navigation chart, and figure 6-71 shows a photograph of the site.

Site 10 is about 430 feet from the sailing line. Kickapoo Creek enters the IWW at RM 159.6 on the RDB. At the upstream end of the site a drawbridge is located at RM 160.8. Neither Bhowmik and Schicht (1980) nor Hagerty (1988) recorded the site as an erosion site. Parked barge fleets were noted on the LDB about 1,000 feet upstream from this site. This bank bore some resemblance to site 8, but trees were growing at the water's edge, and there was not much seasonal vegetation on top of the bank. A scarp 3 to 5 feet high and some piping holes were observed near the water's edge. The underwater bench extended four toward the channel, and a thick layer of fine materials was noted on the subaqueous bench. Strong currents were encountered near the bank.

Figure 6-72 shows the three measured bank sections and a reduced cross section. The OHW is 441.4 feet and NP is 440.0 feet above msl. Water surface elevation was at the base of the scarp. At stages corresponding to OHW, the scarp is mostly submerged. Floods of stage higher than 445.4 (10% recurrence frequency, table 6-20) overtop the bank crest. There was sediment deposition on top of the bank.