PIASA CHUTE INVESTIGATION
UPPER MISSISSIPPI RIVER MILES 208.0 – 216.0

By
Jasen L. Brown

U.S. ARMY CORPS OF ENGINEERS
ST. LOUIS DISTRICT
HYDROLOGIC AND HYDRAULICS BRANCH
APPLIED RIVER ENGINEERING CENTER
FOOT OF ARSENAL STREET
ST. LOUIS, MISSOURI 63118

Sponsored by and Prepared for:
U.S ARMY CORPS OF ENGINEERS – ST. LOUIS DISTRICT
RIVERS PROJECT OFFICE

Final Report – August 2007

1. INTRODUCTION

The U.S. Army Corps of Engineers, St. Louis District initiated a study of the Upper Mississippi River between Miles 208.0 and 216.0, approximately eight miles upstream of Mel Price Locks and Dam in Alton, IL.

An analysis of existing rock structure data, survey data, anecdotal evidence, and field visits to the area were used to evaluate present and historical sediment transport conditions.

Mr. Jasen L. Brown, under direct supervision of, Mr. David C. Gordon, hydraulic engineer and Mr. Robert D. Davinroy, Chief of River Engineering, conducted the study between April 2007 and August 2007.

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2. BACKGROUND

According to the members of the local boat club, Piasa Motor Boat Club, Piasa Chute was once a thriving area for fishing and recreation with a deep channel extending both upstream and downstream of the mouth of Piasa Creek (located approximately midway in Piasa Chute). Presently, Piasa Chute becomes unnavigable, even by small vessels, during low water periods. The deep channel within the chute no longer exists.

3. STUDY REACH

The study reach was located approximately eight miles upstream of Mel Price Locks and Dam in Alton, Illinois. The reach investigated was approximately 8 miles of the Upper Mississippi River, between River Miles (RM) 208.0 and 216.0. PLATE 1 contains a set of georeferenced 2006 aerial photos of the study reach. The study area was located in Jersey County, Illinois, and St. Charles County in Missouri. Piasa Chute is located on the Illinois side of the river.

The right and left descending banks (RDB, LDB) in the Piasa Chute reach are both made of typical alluvial flood plain material. The banks are in good condition with little erosion and are comprised of clay and silt. The river channel as well as the side channel thalweg is composed primarily of course sand.

There have been two closure structures constructed within Piasa Chute historically. However, both of these structures are constructed primarily of wooden piles that have been eroded and silted in over a long period of time. Because of this, their effect on the bathymetry appears to be minimal. However, should the flow conditions within the side channel change (more energy / velocity / depth), these structures may scour out and have a greater impact on the side channel bathymetry.

At the time of this study, the entire study reach had a total of 15 dikes, all 15 being remnant pilings. Also worthy of note is the 2005 placement of a substantial amount of revetment around the head of Elsa Island. At the time of this investigation, there were no construction plans for this reach of river. See Table 1.

Table 1: Existing River Training Structures

Structure Name	Length (feet)	Top Elevation (feet)	Height Above LWRP (Nearest half foot)
		Dikes	
209.3L	1260	Underwater	
208.9L	1060	Underwater	
208.5L	1250	Underwater	
208.3L	250	Underwater	
209.2R	680	Underwater	
212.0L	1330	Underwater	
212.1R	150	Underwater	
212.4R	150	Underwater	
212.3L	300	Underwater	
212.7L	850	Underwater	
212.9R	1000	Underwater	
213.9	850	421.0	4.0
214.7R	400	Underwater	
		Side Channel Closure Structures	
210.0L	2200	Underwater	
209.2L	970	Underwater	

4. STUDY GOALS

The primary purpose of the study was to evaluate this existing conditions as well as the historical dike and survey records in an attempt to understand the fluvial processes leading to the shallowing of Piasa Chute. The secondary purpose of this study is to recommend what further investigation and considerations may be needed to provide additional depth to Piasa Chute.

5. BATHYMETRIC ANALYSIS

Plates 2, 3, 4, 5, 6, 7, and 8 show hydrographic surveys of the 6 mile reach of the Mississippi River upstream of Piasa Chute. These surveys are from 2004, 1998,

1987, 1983, 1977, 1971, and 1956 respectively. The bathymetry of this reach of river shows a classic sinusoidal bathymetric pattern (deep scour hole followed by a shallow crossing, which is then followed by another deep scour hole). The river channel upstream of Piasa Chute has largely remained unchanged for the period of record used in this investigation (1956 through 2004). The lack of bathymetry change in this reach of river can be explained by it's location within the Mel Price pool as well as the minimal construction that has taken place in the time period considered for this investigation. This reach has little need for any channel maintenance dredging as it tends to have adequate width and depth for the navigation industry (even in crossings). Plates 10, 11, 12, 13, 14, and 15 show the changes in bathymetry between the different hydrographic surveys. In all comparative surveys, the dominant color coding is yellow, which, given the color scale used, indicates the change in bathymetry from one survey to the next is minimal.

However, while the overall bed configuration immediately upstream of Piasa Chute has not undergone any great changes, some subtle changes can be noted. One change worthy of note is the scour hole between Mile 213.0 and Mile 214.0. While all other scour holes in this reach remained in a relatively constant location, the location of this scour has switched back and forth from the Right Descending Bank to the Left Descending Bank between 1956 and 2004. Because this scour hole is of substantial size (~40 ft. deep, ~1 mile long, ~1000 wide) and located only 2 miles upstream of the entrance to Piasa Chute, it's characteristics can be considered to have direct consequences to the bathymetry of Piasa Chute.

Plate 16 shows a cross sectional comparison that was done on a line from the Illinois bank extending to the Missouri bank at Mile 211.0. This comparison shows that the river depth (at the location of the line used for these cross sections) along the Missouri bank has been steadily decreasing in depth between 1956 and 2004. However, other than the Missouri bank, the cross section shows minimal change in

depth between 1956 and 2004. No observed shoaling is evident at the entrance to the side channel.

A high resolution bathymetric survey of Piasa Chute was performed in 2006. Plate 9 shows this survey. In this survey, a line of scour was observed near the North side of Eagle Island. This line of depth suggests that a substantial amount of the energy entering into the Piasa Chute complex goes out between Piasa Island and Eagle Island, leaving less energy to pass through the remainder of Piasa Chute. Also, a high sandbar can be observed immediately upstream of the mouth of Piasa Creek. This sandbar, according to members of the Piasa Motor Boat Club, has had a large impact on boater's ability to access the Mississippi River through Piasa Chute.

6. FIELD OBSERVATIONS

Personnel from the Applied River Engineering Center inspected Piasa Chute as well as Piasa Creek. At drawdown conditions at Mel Price Locks and Dam, a heavy concentration of woody debris can be seen within Piasa Chute. This debris has hung up on the shallow bed, and can be a significant hazard to recreational boaters as well as act to increase sediment deposition within the chute.

Piasa creek was inspected to investigate the condition of the creek's banklines. Investigating the condition of the banklines was necessary to determine if heavy erosion was present and thus contributing large quantities of sediment to the sediment load passing through Piasa Chute. No substantial bankline erosion was observed in the field inspection.

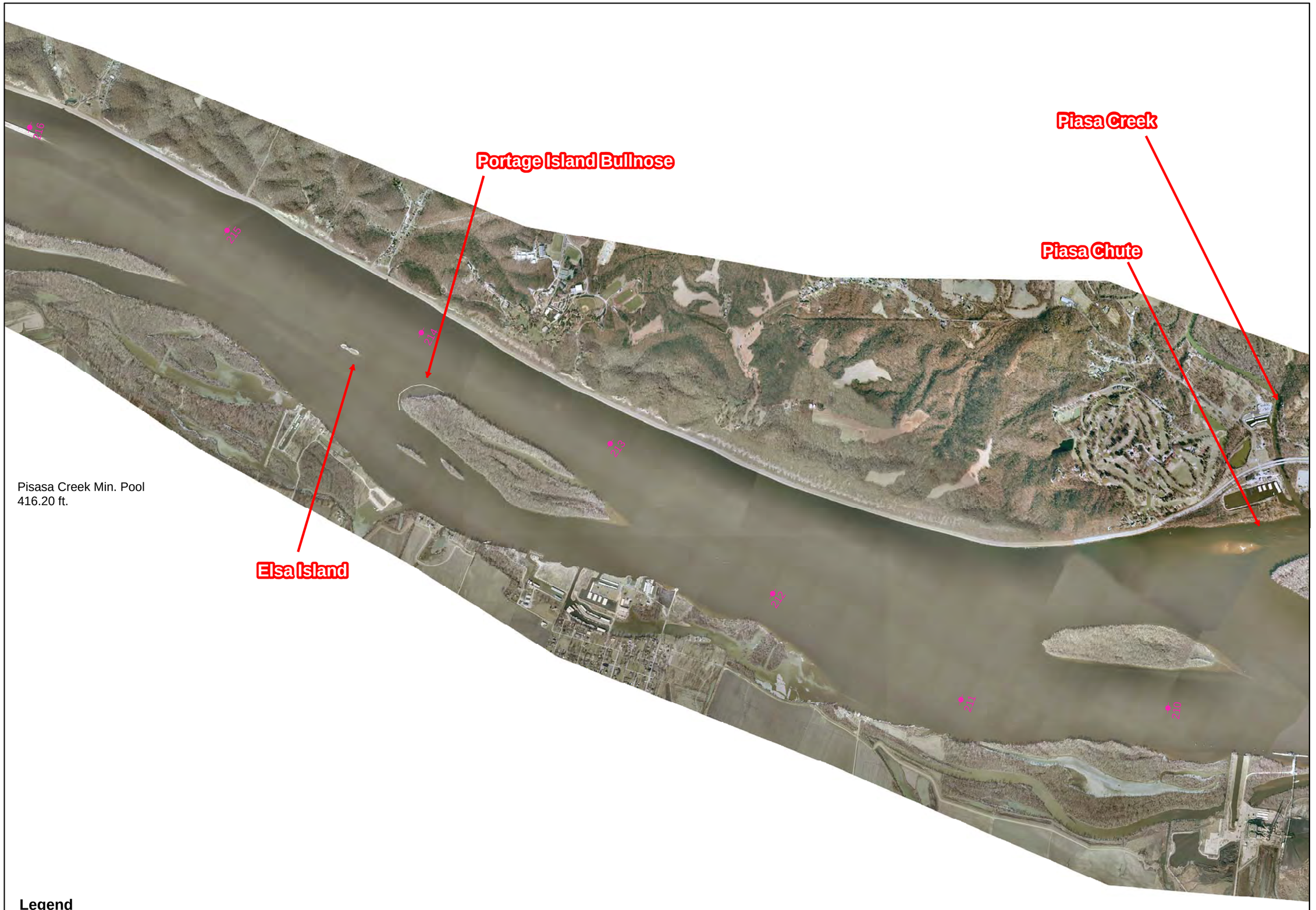
7. RECOMMENDED INVESTIGATIONS

An additional high resolution (~100 ft range lines) bathymetric survey of Piasa Chute would give a better understanding of any changes in depth within the chute since the 2006 Piasa Chute survey. Also, Acoustic Doppler Current Profiler (ADCP) data would be valuable information in determining how much of the flow through Piasa

Chute is being undermined or influenced by flow between Piasa Island and Eagles Nest Island. A request for both the high resolution bathymetric data and the ADCP data has been submitted to the survey section of the Geospatial Branch of the St. Louis District.

A main channel low resolution (~500 ft. range lines) hydrographic survey would be helpful in determining what changes in river bathymetry have occurred since the last main channel survey in 2004.

With this additional information, it may be possible for the river engineers to recommend a solution involving the implementation of rock structures upstream of or possibly within Piasa Chute that would increase the depth within the chute without negatively impacting the navigation industry and / or other industries or recreations at or near this reach. Should river engineers decide that the cost and / or risks involved are too great to implement river structures without additional study, a Hydraulic Sediment Response model study (small scale physical model) may be warranted.



Pisasa Creek Min. Pool
416.20 ft.

Legend

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DESIGNED BY: J Brown	SURVEY DATE: 2006		
DRAWN BY: J BROWN	REVIEWED BY: E BRAUER	CHECKED BY: D GORDON	
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FILE NAME: XX.MXD		PLOT DATE: XX/XX/200X	

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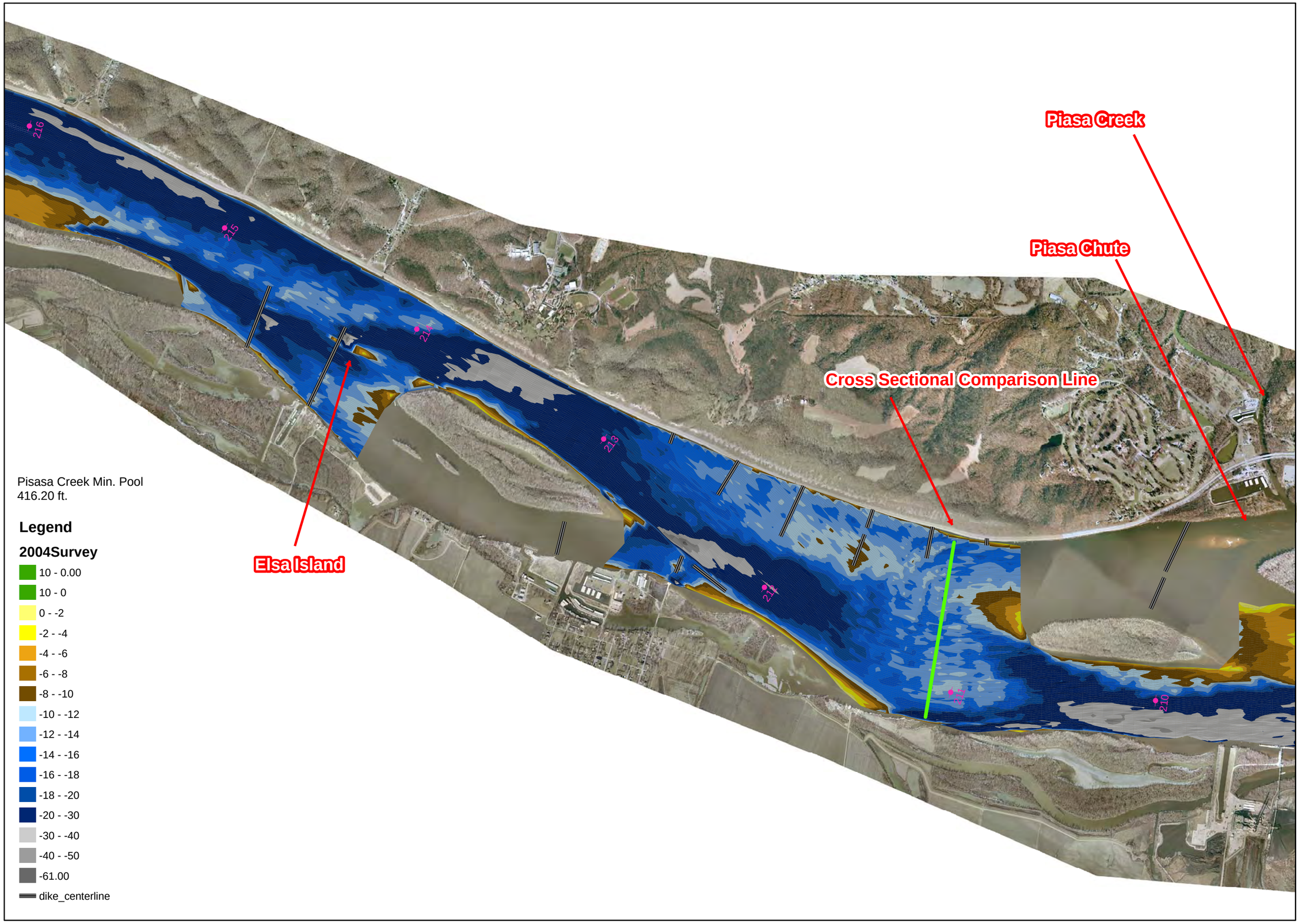
MIDDLE MISSISSIPPI RIVER BASIN

0 500 1,000 2,000 3,000 4,000 Feet

Piasa Chute Investigation
Upstream River Bed Change
Aerial Photo

PLATE
NUMBER

1



Pisasa Creek Min. Pool
416.20 ft.

Legend

2004Survey

- 10 - 0.00
- 10 - 0
- 0 - -2
- -2 - -4
- -4 - -6
- -6 - -8
- -8 - -10
- -10 - -12
- -12 - -14
- -14 - -16
- -16 - -18
- -18 - -20
- -20 - -30
- -30 - -40
- -40 - -50
- -61.00
- dike_centerline

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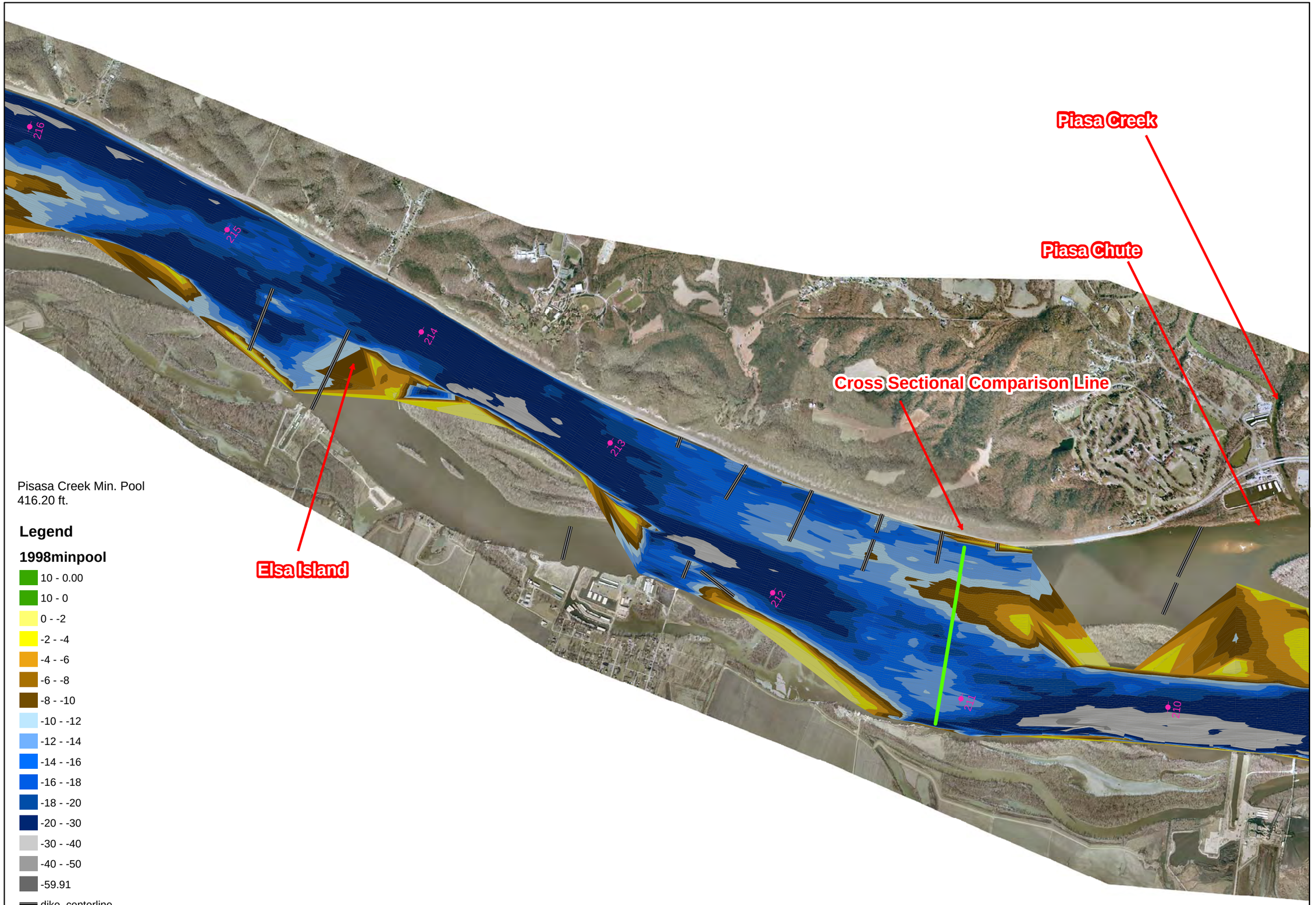
MIDDLE MISSISSIPPI RIVER BASIN

0 500 1,000 2,000 3,000 4,000 Feet

Piasa Chute Investigation
Upstream River Bed Changes
2004 Survey

PLATE NUMBER

2



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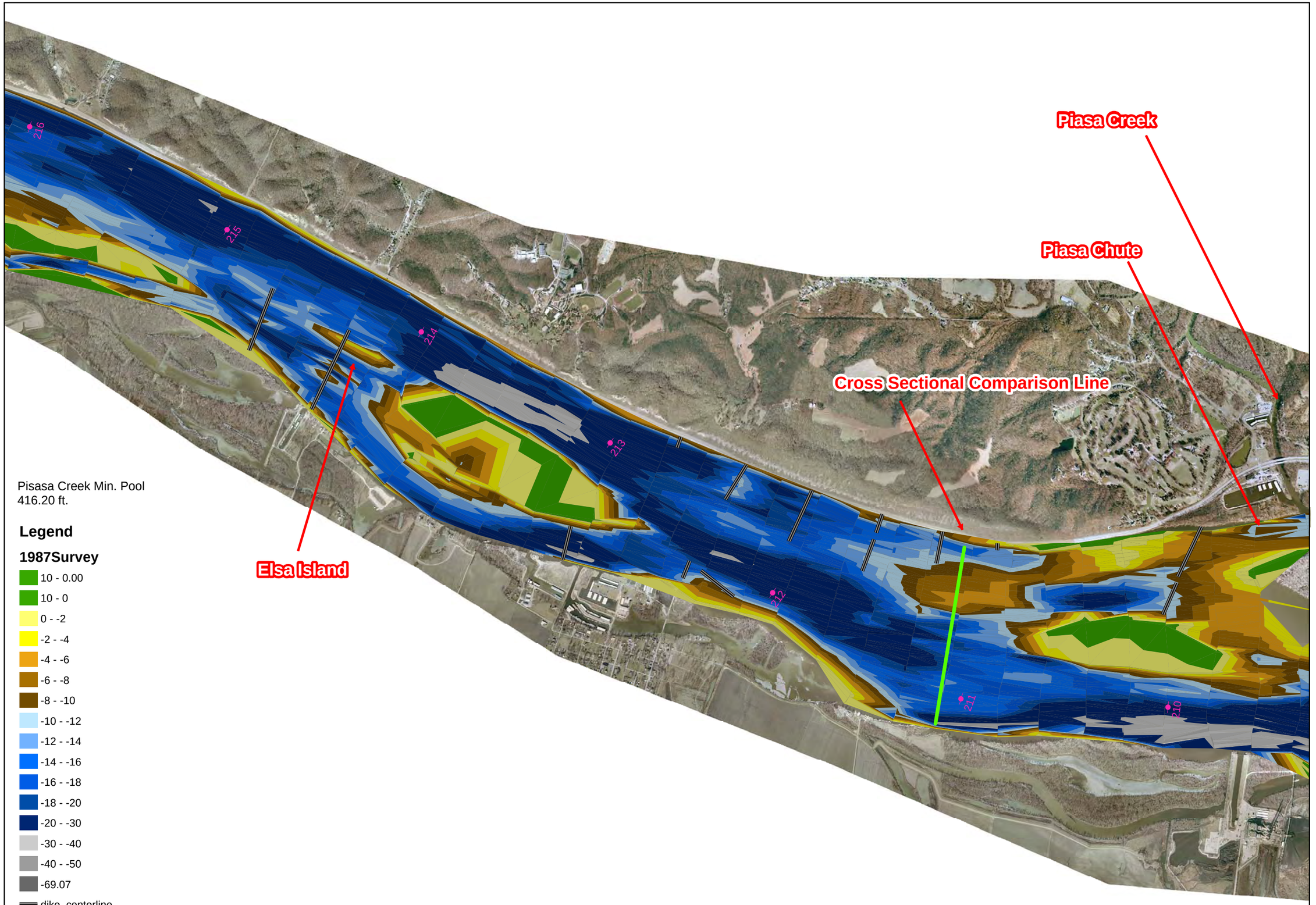
MIDDLE MISSISSIPPI RIVER BASIN

0 500 1,000 2,000 3,000 4,000 Feet

Piasa Chute Investigation
Upstream River Bed Changes
1998 Survey

PLATE NUMBER

3



Pisasa Creek Min. Pool
416.20 ft.

Legend

1987Survey

- 10 - 0.00
- 10 - 0
- 0 - -2
- -2 - -4
- -4 - -6
- -6 - -8
- -8 - -10
- -10 - -12
- -12 - -14
- -14 - -16
- -16 - -18
- -18 - -20
- -20 - -30
- -30 - -40
- -40 - -50
- -69.07
- dike_centerline

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0 500 1,000 2,000 3,000 4,000 Feet

Piasa Chute Investigation
Upstream River Bed Changes
1987 Survey

PLATE NUMBER

4

Piasa Creek

Piasa Chute

Cross Sectional Comparison Line

Elsa Island

216
215
214
213
212
211
210

Pisasa Creek Min. Pool
416.20 ft.

Legend

Elevation

- 10 - 0.00
- 10 - 0
- 0 - -2
- -2 - -4
- -4 - -6
- -6 - -8
- -8 - -10
- -10 - -12
- -12 - -14
- -14 - -16
- -16 - -18
- -18 - -20
- -20 - -30
- -30 - -40
- -40 - -50
- -51.20
- dike_centerline

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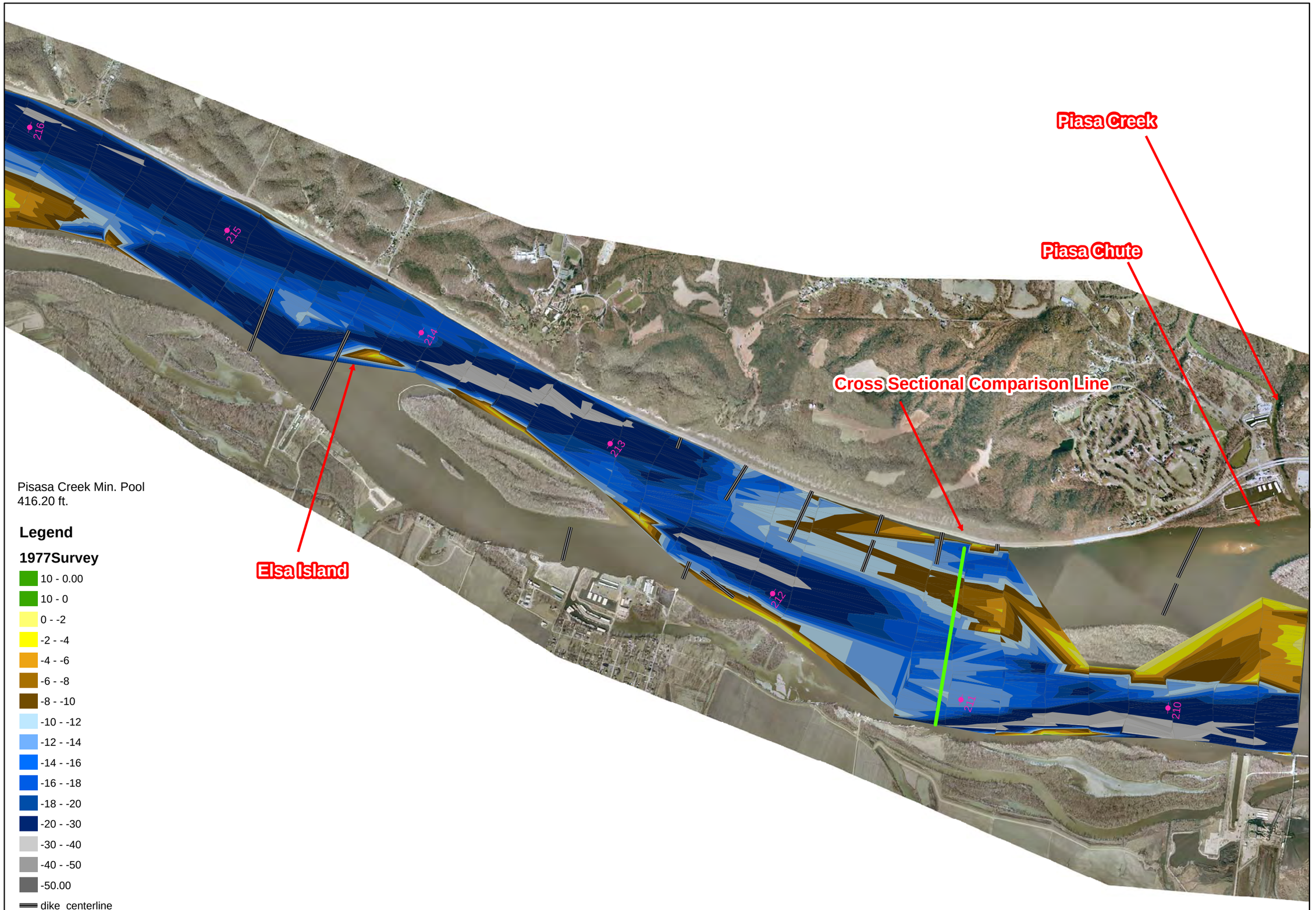
MIDDLE MISSISSIPPI RIVER BASIN

0 500 1,000 2,000 3,000 4,000 Feet

Piasa Chute Investigation
Upstream River Bed Changes
1983 Survey

PLATE NUMBER

5



Pisasa Creek Min. Pool
416.20 ft.

Legend

1977Survey

- 10 - 0.00
- 10 - 0
- 0 - -2
- -2 - -4
- -4 - -6
- -6 - -8
- -8 - -10
- -10 - -12
- -12 - -14
- -14 - -16
- -16 - -18
- -18 - -20
- -20 - -30
- -30 - -40
- -40 - -50
- -50.00
- dike_centerline

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MIDDLE MISSISSIPPI RIVER BASIN

0 500 1,000 2,000 3,000 4,000 Feet

Piasa Chute Investigation
Upstream River Bed Changes
1977 Survey

PLATE NUMBER

6

Piasa Creek

Piasa Chute

Cross Sectional Comparison Line

Elsa Island

216

215

214

213

212

211

210

Pisasa Creek Min. Pool
416.20 ft.

Legend

1971Survey

- 10 - 0.00
- 10 - 0
- 0 - -2
- -2 - -4
- -4 - -6
- -6 - -8
- -8 - -10
- -10 - -12
- -12 - -14
- -14 - -16
- -16 - -18
- -18 - -20
- -20 - -30
- -30 - -40
- -40 - -50
- -56.20
- dike_centerline

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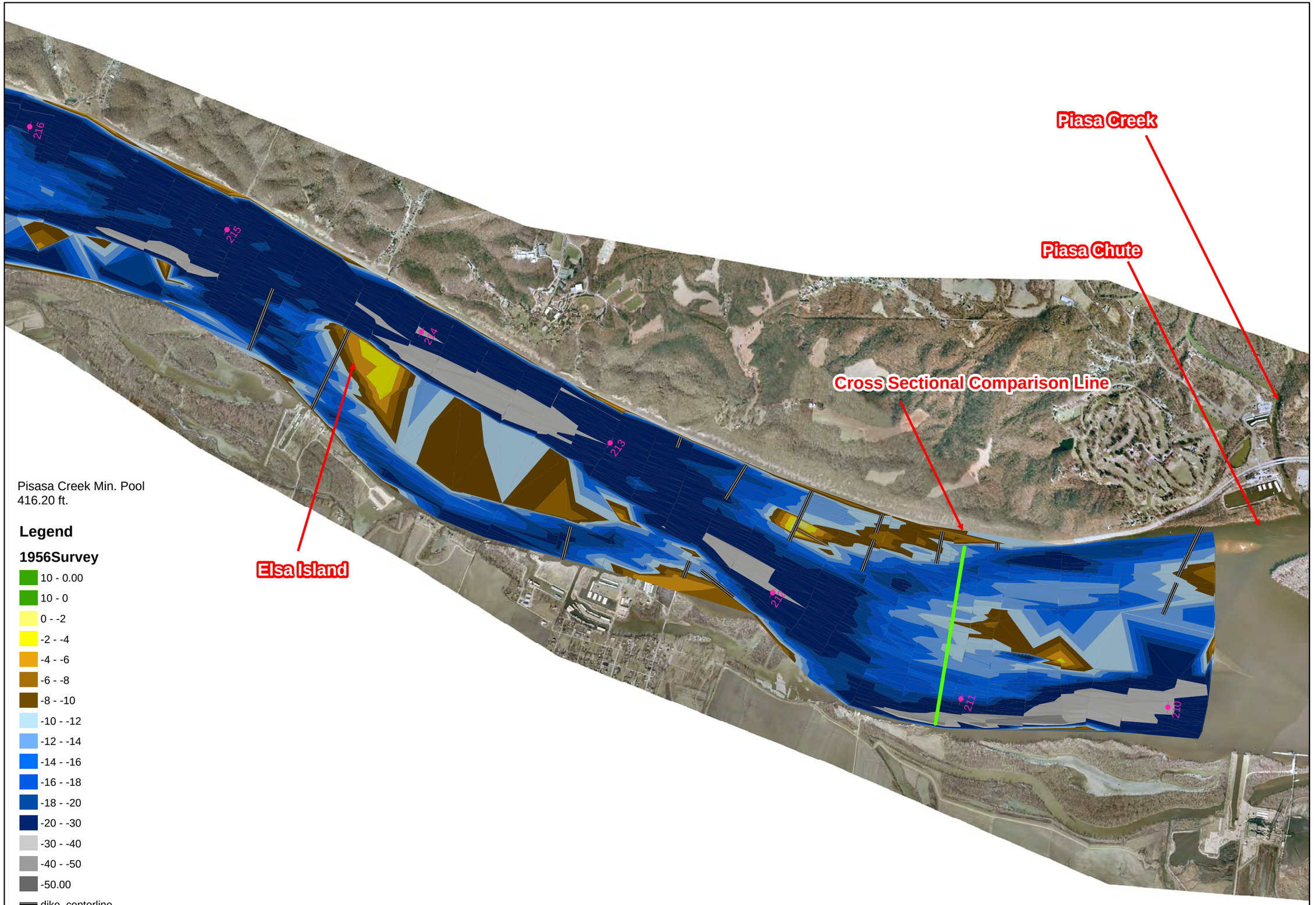
MIDDLE MISSISSIPPI RIVER BASIN

0 500 1,000 2,000 3,000 4,000 Feet

Piasa Chute Investigation
Upstream River Bed Changes
1971 Survey

PLATE NUMBER

7



Pisasa Creek Min. Pool
416.20 ft.

Legend

1956Survey

- 10 - 0.00
- 10 - 0
- 0 - -2
- -2 - -4
- -4 - -6
- -6 - -8
- -8 - -10
- -10 - -12
- -12 - -14
- -14 - -16
- -16 - -18
- -18 - -20
- -20 - -30
- -30 - -40
- -40 - -50
- -50.00
- dike_centerline

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MIDDLE MISSISSIPPI RIVER BASIN

0 500 1,000 2,000 3,000 4,000 Feet

Piasa Chute Investigation
Upstream River Bed Changes
1956 Survey

PLATE NUMBER

8

Pisasa Creek Min. Pool
416.20 ft.

Piasa Creek

Piasa Island

Eagle Island

210

209

208

Legend

- 426 - 0.00
- 426 - 416
- 416 - 414
- 414 - 412
- 412 - 410
- 410 - 408
- 408 - 406
- 406 - 404
- 404 - 402
- 402 - 400
- 400 - 398
- 398 - 396
- 396 - 386
- 386 - 376
- 376 - 366
- 366.20

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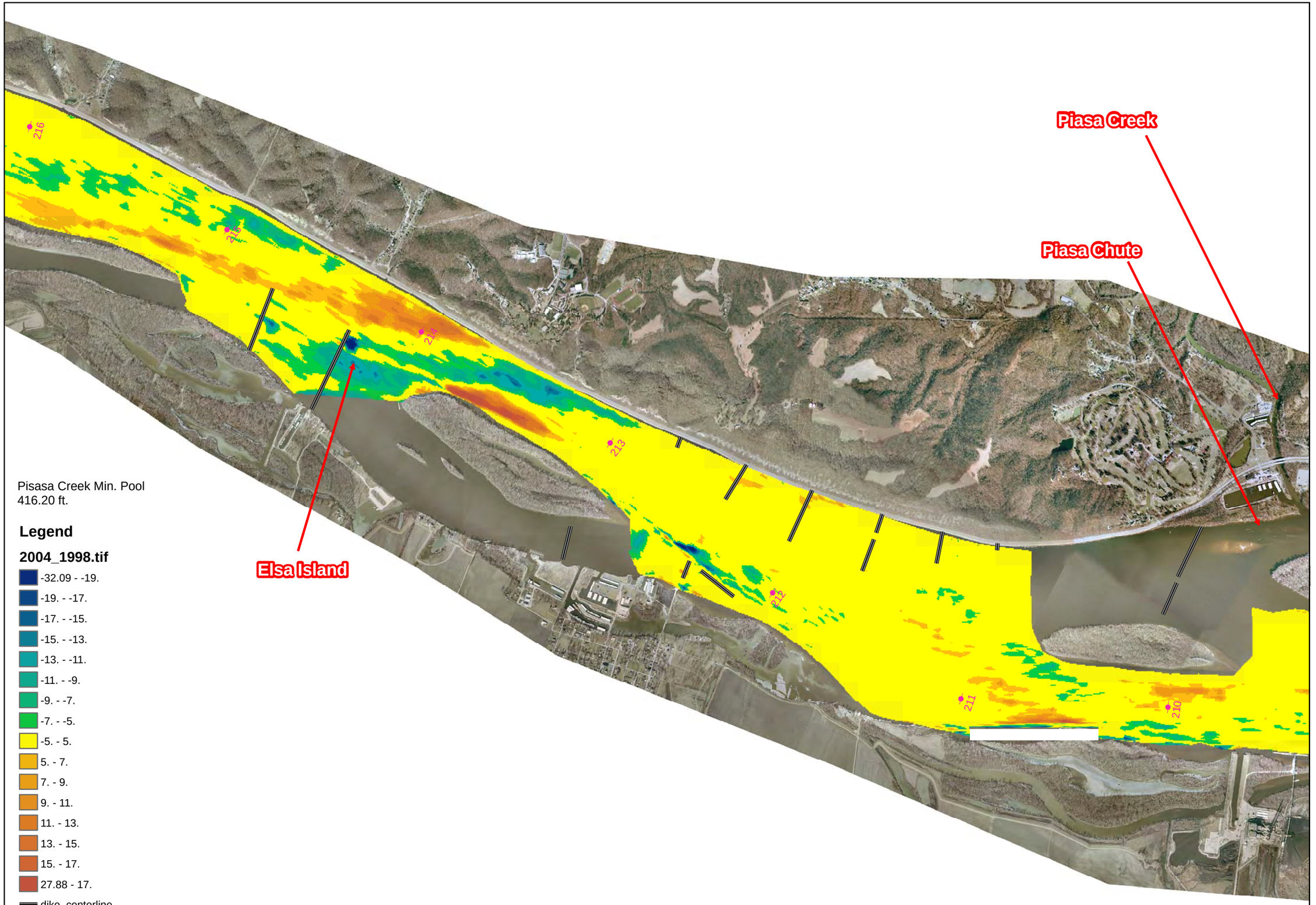
MIDDLE MISSISSIPPI RIVER BASIN

0 250 500 1,000 1,500 2,000 Feet

Piasa Chute Investigation
Upstream River Bed Change
2006 Side Channel Survey

PLATE NUMBER

9



Pisasa Creek Min. Pool
416.20 ft.

Legend

2004_1998.tif

- -32.09 - -19.
- -19. - -17.
- -17. - -15.
- -15. - -13.
- -13. - -11.
- -11. - -9.
- -9. - -7.
- -7. - -5.
- -5. - 5.
- 5. - 7.
- 7. - 9.
- 9. - 11.
- 11. - 13.
- 13. - 15.
- 15. - 17.
- 27.88 - 17.
- dike_centerline

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MIDDLE MISSISSIPPI RIVER BASIN

0 500 1,000 2,000 3,000 4,000 Feet

Piasa Chute Investigation
Upstream River Bed Changes
2004 to 1998 Bathymetry Changes

PLATE NUMBER

10

Piasa Creek

Piasa Chute

Elsa Island

Pisasa Creek Min. Pool
416.20 ft.

Legend

1998_1987.tif

- -38.14 - -19.
- -19. - -17.
- -17. - -15.
- -15. - -13.
- -13. - -11.
- -11. - -9.
- -9. - -7.
- -7. - -5.
- -5. - 5.
- 5. - 7.
- 7. - 9.
- 9. - 11.
- 11. - 13.
- 13. - 15.
- 15. - 17.
- 35.85 - 17.
- dike_centerline

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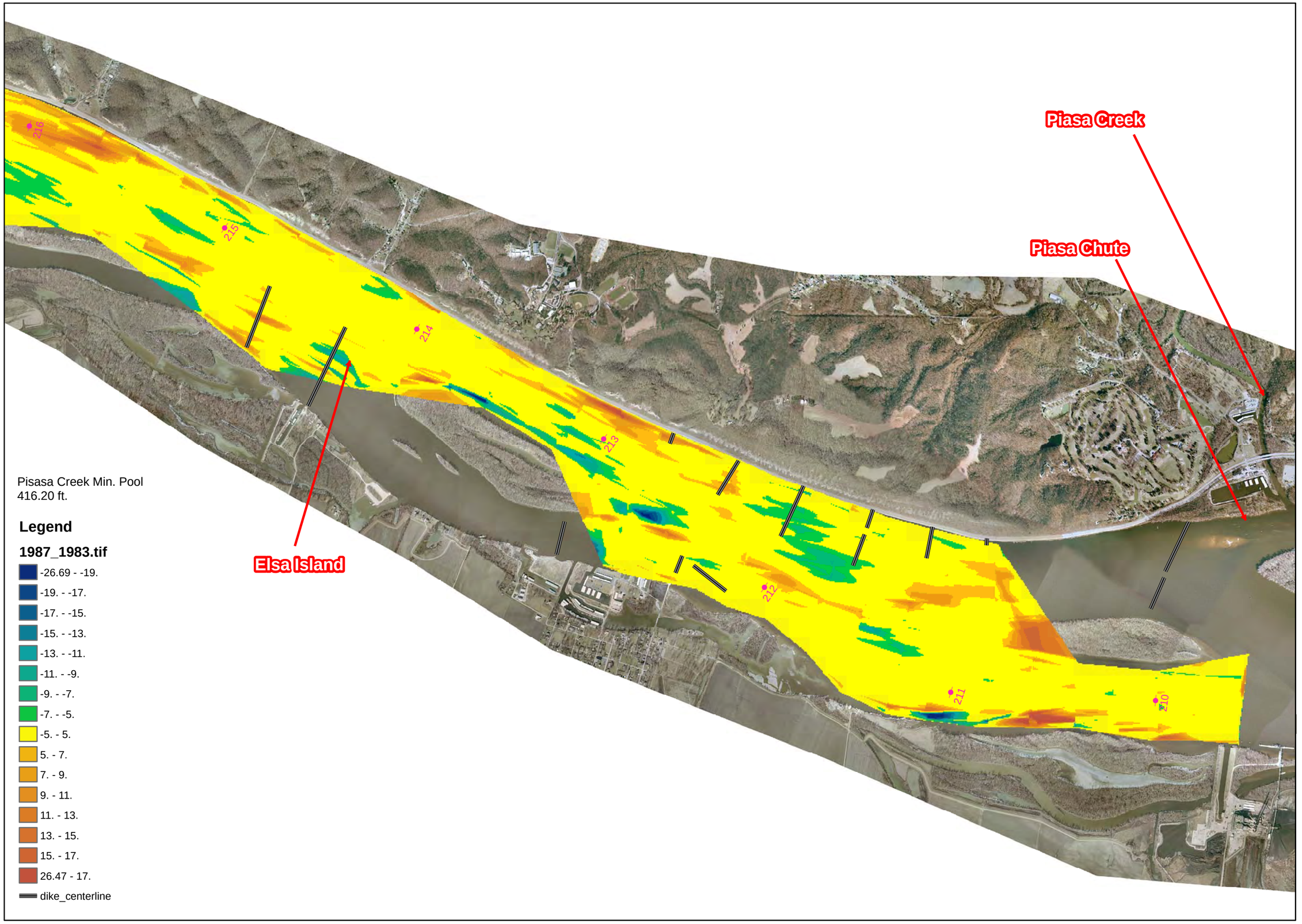
MIDDLE MISSISSIPPI RIVER BASIN

0 500 1,000 2,000 3,000 4,000 Feet

Piasa Chute Investigation
Upstream River Bed Changes
1998 to 1987 Bathymetry Changes

PLATE NUMBER

11



Pisasa Creek Min. Pool
416.20 ft.

Legend

1987_1983.tif

- -26.69 - -19.
- -19. - -17.
- -17. - -15.
- -15. - -13.
- -13. - -11.
- -11. - -9.
- -9. - -7.
- -7. - -5.
- -5. - 5.
- 5. - 7.
- 7. - 9.
- 9. - 11.
- 11. - 13.
- 13. - 15.
- 15. - 17.
- 26.47 - 17.
- dike_centerline

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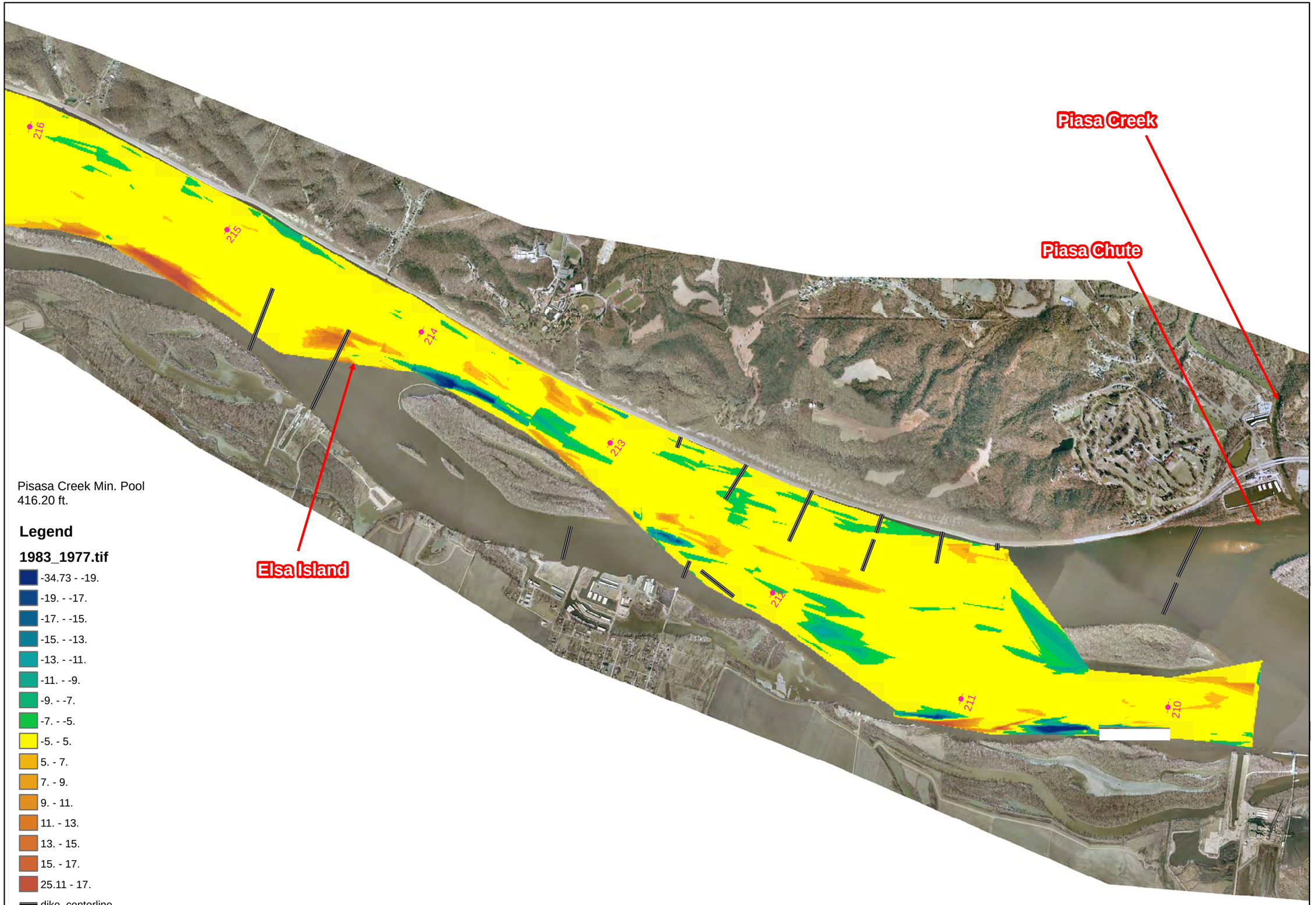
MIDDLE MISSISSIPPI RIVER BASIN

0 500 1,000 2,000 3,000 4,000 Feet

Piasa Chute Investigation
Upstream River Bed Changes
1987to 1983 Bathymetry Changes

PLATE NUMBER

12



Pisasa Creek Min. Pool
416.20 ft.

Legend

1983_1977.tif

- -34.73 - -19.
- -19. - -17.
- -17. - -15.
- -15. - -13.
- -13. - -11.
- -11. - -9.
- -9. - -7.
- -7. - -5.
- -5. - 5.
- 5. - 7.
- 7. - 9.
- 9. - 11.
- 11. - 13.
- 13. - 15.
- 15. - 17.
- 25.11 - 17.
- dike_centerline

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FILE NAME: XX.MXD		PLOT DATE: XX/XX/200X	

U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

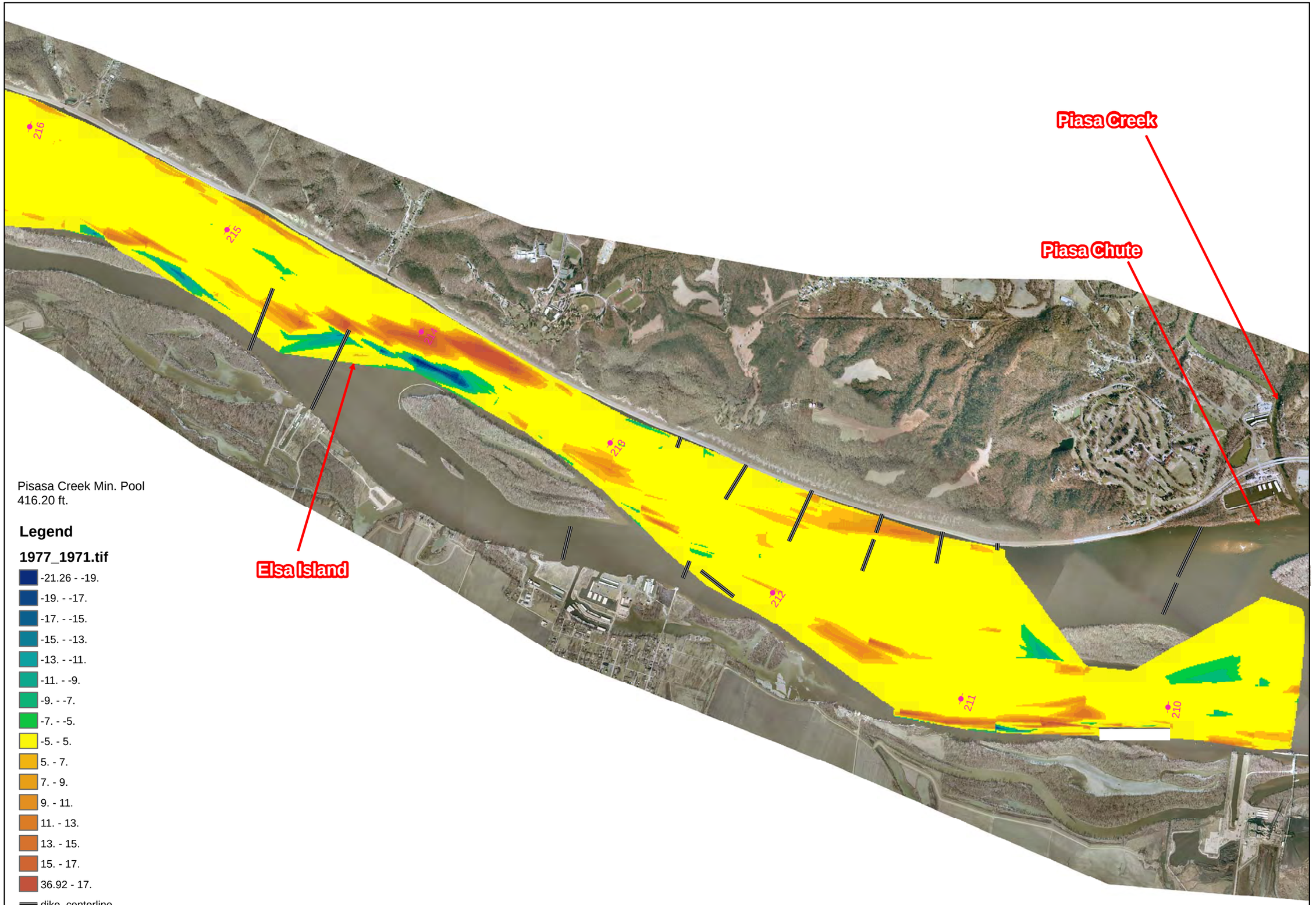
MIDDLE MISSISSIPPI RIVER BASIN

0 500 1,000 2,000 3,000 4,000 Feet

Piasa Chute Investigation
Upstream River Bed Changes
1983 to 1977 Bathymetry Changes

PLATE NUMBER

13



Pisasa Creek Min. Pool
416.20 ft.

Legend

1977_1971.tif

- -21.26 - -19.
- -19. - -17.
- -17. - -15.
- -15. - -13.
- -13. - -11.
- -11. - -9.
- -9. - -7.
- -7. - -5.
- -5. - 5.
- 5. - 7.
- 7. - 9.
- 9. - 11.
- 11. - 13.
- 13. - 15.
- 15. - 17.
- 36.92 - 17.
- dike_centerline

US Army Corps of Engineers
St. Louis District

APPLIED RIVER ENGINEERING CENTER

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DESIGNED BY: J Brown	SURVEY DATE: 2006		
DRAWN BY: J BROWN	REVIEWED BY: E BRAUER	CHECKED BY: D GORDON	
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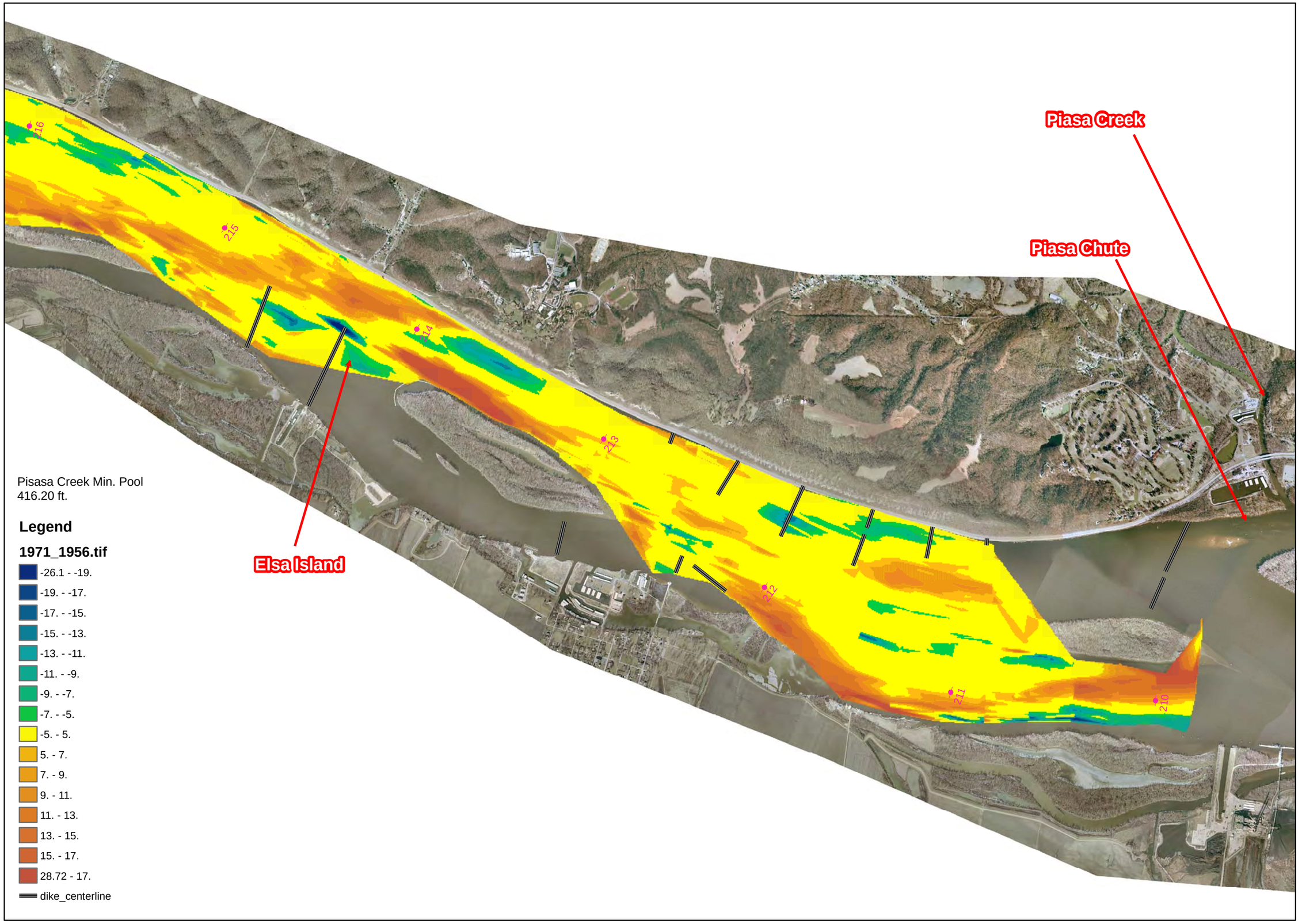
MIDDLE MISSISSIPPI RIVER BASIN

0 500 1,000 2,000 3,000 4,000 Feet

Piasa Chute Investigation
Upstream River Bed Changes
1977 to 1971 Bathymetry Changes

PLATE NUMBER

14



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ST. LOUIS, MISSOURI

MIDDLE MISSISSIPPI RIVER BASIN

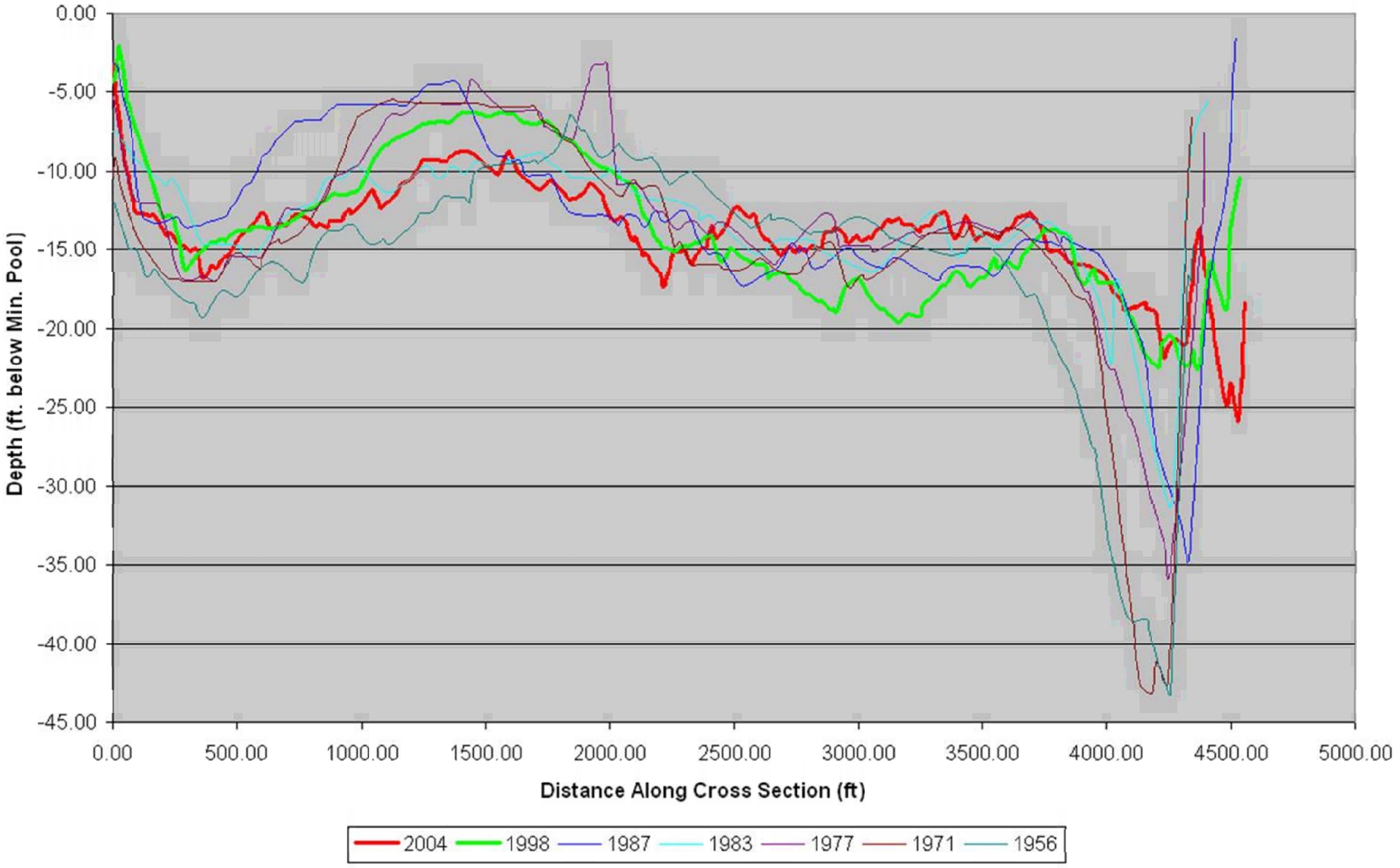
0 500 1,000 2,000 3,000 4,000 Feet

Piasa Chute Investigation
Upstream River Bed Changes
1971 to 1956 Bathymetry Changes

PLATE NUMBER

15

Piasa Chute Entrance Cross Sections



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St. Louis District

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FILE NAME: XX.MXD		PLOT DATE: XX/XX/200X	

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MIDDLE MISSISSIPPI RIVER BASIN

Piasa Chute Investigation
Upstream River Bed Changes
2004 to 1956 Cross Sections

PLATE NUMBER

16