

UNDERWATER BRIDGE INSPECTION REPORT

STRUCTURE NO. 2440

TRUNK HIGHWAY NO. 3rd Avenue/Central Avenue

OVER THE

MISSISSIPPI RIVER

DISTRICT M – HENNEPIN COUNTY



PREPARED FOR THE

MINNESOTA DEPARTMENT OF TRANSPORTATION

BY

COLLINS ENGINEERS, INC.

JOB NO. 5473

MINNESOTA DEPARTMENT OF TRANSPORTATION
UNDERWATER BRIDGE INSPECTION

REPORT SUMMARY:

The structure units inspected at Bridge No. 2440, Piers 1 through 8, were found to be generally in satisfactory to fair condition. The concrete of Piers 1 and 2 exhibited widespread deterioration and loss of section with penetrations of up to 2 feet. Similarly, the concrete of Piers 5 through 8 exhibited light to moderate scaling and deterioration with 3 inch maximum penetrations. Piers 3 and 4 generally exhibited lesser amounts of deterioration. The footings at Piers 1, 2, 5, 6, and 7 were partially exposed with vertical exposure limits varying from 1 to 4 feet. Additionally, the footing at Pier 5 was undermined (undercut) at the upstream nose of the pier, with undermining cavity measuring up to 2 feet high with 2 to 3 feet penetration. The footing step at Pier 8 was also partially exposed with up to 3.5 of maximum vertical exposure. The foundation exposure and undermining extent and limits were generally comparable to what was reported during the 2000 and 2004 inspections.

INSPECTION FINDINGS:

- (A) The concrete of Piers 1 and 2 exhibited widespread spalling and loss of section with typical penetrations of 6 inches to 1 foot and maximum penetrations at times reaching 2 feet. The deterioration was typically concentrated from 2 feet below to 4 feet above the waterline.
- (B) The footing at Pier 1 was exposed along the west face of the pier with 2 to 3 feet of vertical exposure. The concrete of the footing also exhibited moderate to heavy deterioration with 6 inch to 2 foot penetrations.
- (C) The footing at Pier 2 was exposed around the upstream and downstream nose with 3 to 4 feet of vertical exposure.
- (D) The concrete of Pier 5 exhibited random minor deterioration with 2 to 3 inch penetration.

- (E) The concrete of Piers 7 and 8 exhibited a 1 to 1.5 foot high band of light to moderate scaling at the waterline with 1 to 3 inch penetrations.
- (F) An area of section loss, measuring 5 feet wide by 3 feet high with 2 to 3 foot penetration, was located on the east side of Pier 5 near the downstream 1/4 at approximately 3 feet below the waterline.
- (G) The footing at Pier 5 was exposed around the upstream 1/3 of the pier with 3 to 4 feet of typical vertical exposure. At the upstream nose of the pier, the footing was undermined (undercut from section loss) with a cavity measuring up to 2 feet in height with 2 to 3 foot penetration. The concrete of the footing also exhibited heavy deterioration with 2 to 3 foot penetration.
- (H) The footing at Pier 6 was exposed around the upstream nose with a maximum vertical exposure of 4 feet.
- (I) The footing at Pier 7 was exposed along the west side of the pier with 1 to 3 feet of vertical exposure. The footing exhibited a 20 foot wide area of section loss and undercutting with 6 inch to 1 foot penetrations.
- (J) The footing step at Pier 8 was exposed along the west face of Pier 8 with up to 3.5 feet of vertical exposure.
- (K) Heavy accumulation of timber debris, consisting of up to 2 foot diameter drift pieces, was observed along the downstream half of the west face of Pier 5, extending from the channel bottom to 3 feet above the waterline.
- (L) Pier 3 and 4 continue to be adequately founded in the concrete construction of the adjoining spillway.

RECOMMENDATIONS:

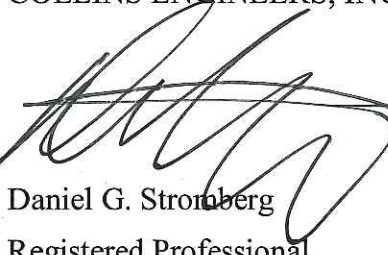
- (A) The extent of concrete deterioration at Piers 1 and 2 does not pose an immediate threat to the structural integrity of those piers at this time, given the overall size of the piers. However, consideration should be given to repairing the deteriorated areas by removing all unsound concrete and replacing with new concrete designed to provide high durability and low permeability.
- (B) Monitor timber debris accumulation at Pier 5 during future inspections, and consider removal operations if debris is found to be increasing to an excessive extent.
- (C) Consideration should be given to implementation of scour countermeasures to address the undermined (undercut) foundation at Pier 5. The countermeasures could include the placement of riprap and/or pumped grout around the undermined/exposed footing.
- (D) Monitor footing exposures at Piers 1, 2, 6, and 7 during future inspections, and if exposure is found to be increasing to a detrimental extent, implementation of scour countermeasures may become warranted at that time.
- (E) Reinspect the submerged substructure units at the normal maximum recommended (NBIS) interval of five (5) years.

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota.

Date 6/30/2010 **Registration No.** 21491

Respectfully submitted,

COLLINS ENGINEERS, INC.


Daniel G. Stromberg
Registered Professional
Engineer, State of Minnesota

MINNESOTA DEPARTMENT OF TRANSPORTATION
UNDERWATER BRIDGE INSPECTION

1. BRIDGE DATA

Bridge Number: 2440

Feature Crossed: Mississippi River

Feature Carried: Trunk Highway No. 3rd Avenue/Central Avenue

Location: District M – Hennepin County

Bridge Description: The superstructure consists of a concrete deck over multiple arched spans supported by eight concrete piers and two end units. The substructure units in the waterway are designated as Piers 1 through 8 and are numbered starting from the west.

2. INSPECTION DATA

Professional Engineer/Team Leader: Daniel G. Stromberg, P.E.

Dive Team: Clayton G. Brookins, Lukas Janulis

Date: October 23, 2008

Weather Conditions: Rainy, 40° F

Underwater Visibility: 2 feet

Waterway Velocity: 2.0 ft/s

3. SUBSTRUCTURE INSPECTION DATA

Substructure Inspected: Piers 1 through 8

General Shape: Each pier consists of a concrete shaft connected to concrete superstructure arches and supported by a sloping concrete foundation/footing.

Maximum Water Depth at Substructure Inspected: Approximately 14.5 feet.

4. WATERLINE DATUM

Water Level Reference: Springline at the upstream end of Pier 5

Water Surface: The waterline was approximately 6.0 feet below reference.

Waterline Elevation = 798.75 (Upper pool elevation per ACOE)

5. NBIS CODING INFORMATION (Minnesota specific codes are used for 92B and 113)

Item 60: Substructure: Code 6

Item 61: Channel and Channel Protection: Code 6

Item 92B: Underwater Inspection: Code B/10/08

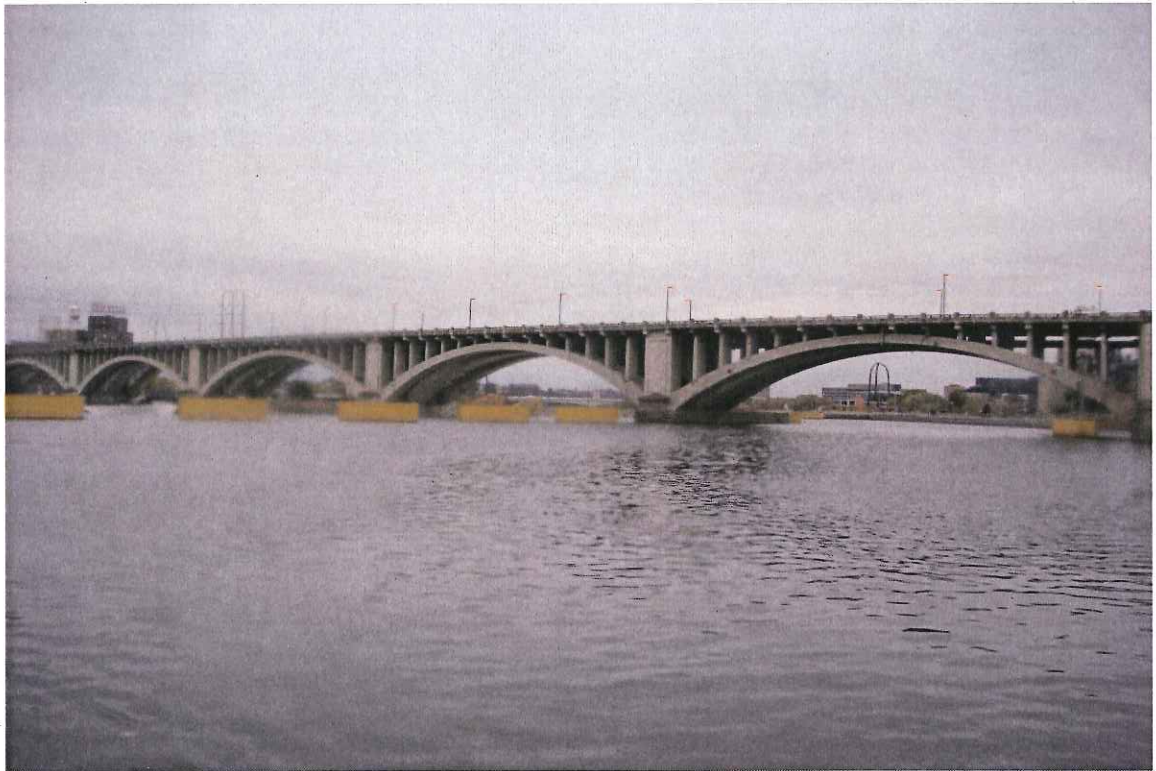
Item 113: Scour Critical Bridges: Code L/04

Bridge is scour critical because abutment or pier foundation is rated as unstable due to observed scour at bridge site.

 Yes X No

6. PONTIS CODING INFORMATION

Item #	Element Description	Quantity	Unit	Conditions				
				1	2	3	4	5
210	Reinforced Concrete Culvert	1726	LF		1294	432		
220	Reinforced Concrete Footing	5	EA		3	2		
985	Slopes and Slope Protection	1	EA		1			



Photograph 1. Overall View of Piers 1 through 5, Looking East.



Photograph 2. Overall View of the Upstream Fascia, Looking West.



Photograph 3. View of Pier 1, Looking Southeast.



Photograph 4. View of Pier 2, Looking Southeast.



Photograph 5. View of Pier 3, Looking Southwest.



Photograph 6. View of Pier 5, Looking East.



Photograph 7. View of Pier 6, Looking Southwest.



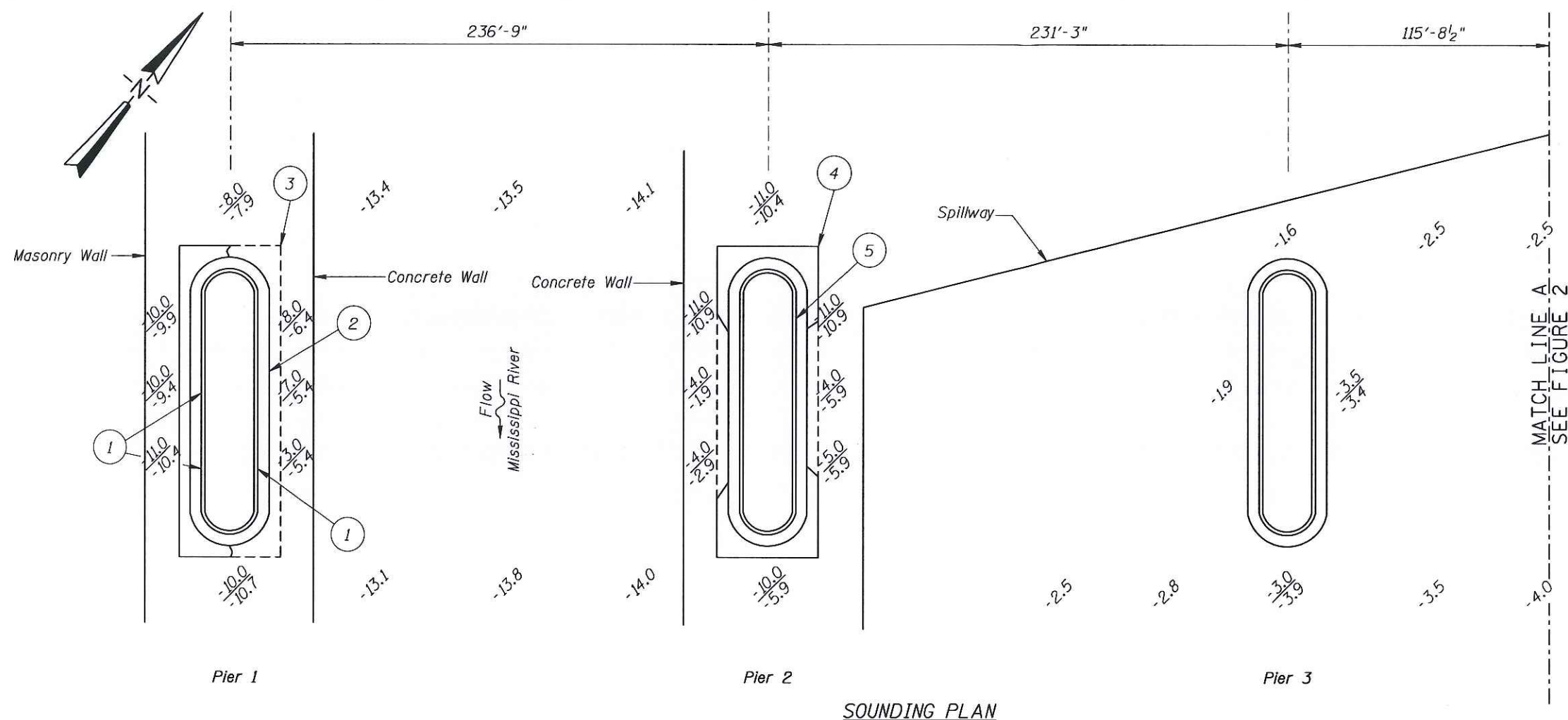
Photograph 8. View of Pier 7, Looking Southwest.



Photograph 9. View of Pier 8, Looking East.

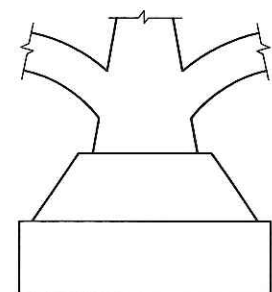


Photograph 10. View of typical concrete deterioration on the East face of Pier 1, Looking Northwest.



INSPECTION NOTES:

- 1 Up to 1/4 inch wide vertical cracks were observed at the midpoint and the downstream 1/4 point on the west face and near the 1/4 point on the east face of Pier 1, typically extending from 5 to 10 feet above the waterline to the top of the footing.
- 2 The concrete of Pier 1 exhibited widespread spalling and loss of section with typical penetrations of 6 inches to 1 foot and maximum penetrations of 2 feet, typically extending from 2 feet below to 4 feet above the waterline.
- 3 At Pier 1, the footing was exposed from the middle of the upstream nose, along the entire west face to the middle of the downstream nose. The vertical footing exposure ranged from 2 feet at the upstream corner to 3 feet at the downstream corner. The concrete of the footing exhibited moderate to heavy spalling and deterioration with 6 inch typical and up to 2 feet maximum penetration.
- 4 At Pier 2, the footing was exposed around the upstream 1/4 and the downstream 1/4 of the pier. The vertical footing exposure at both ends of the pier typically varied from 3 to 4 feet.
- 5 The concrete of Pier 2 exhibited widespread spalling and loss of section with 6 inches to 1 foot deep penetrations, typically extending from 2 feet below to 4 feet above the waterline.



TYPICAL END VIEW OF PIERS

GENERAL NOTES:

- 1 Piers 1 through 8 were inspected underwater.
- 2 At the time of inspection on October 23, 2008, the waterline was located approximately 6.0 feet below the springline at Pier 5. The waterline elevation of the upper pool was 798.75 feet based on information provided by the Army Corps of Engineers at a nearby St. Anthony's Dam.
- 3 Soundings indicate the water depth at the time of inspection and are measured in feet.
- 4 Soundings were taken parallel to the bridge at 1/4 point intervals between the substructure units.

Legend

- 11.2 Sounding Depth from Waterline (10/23/08)
- 11.2 Sounding Depth from Waterline (12/16/04)

Note:

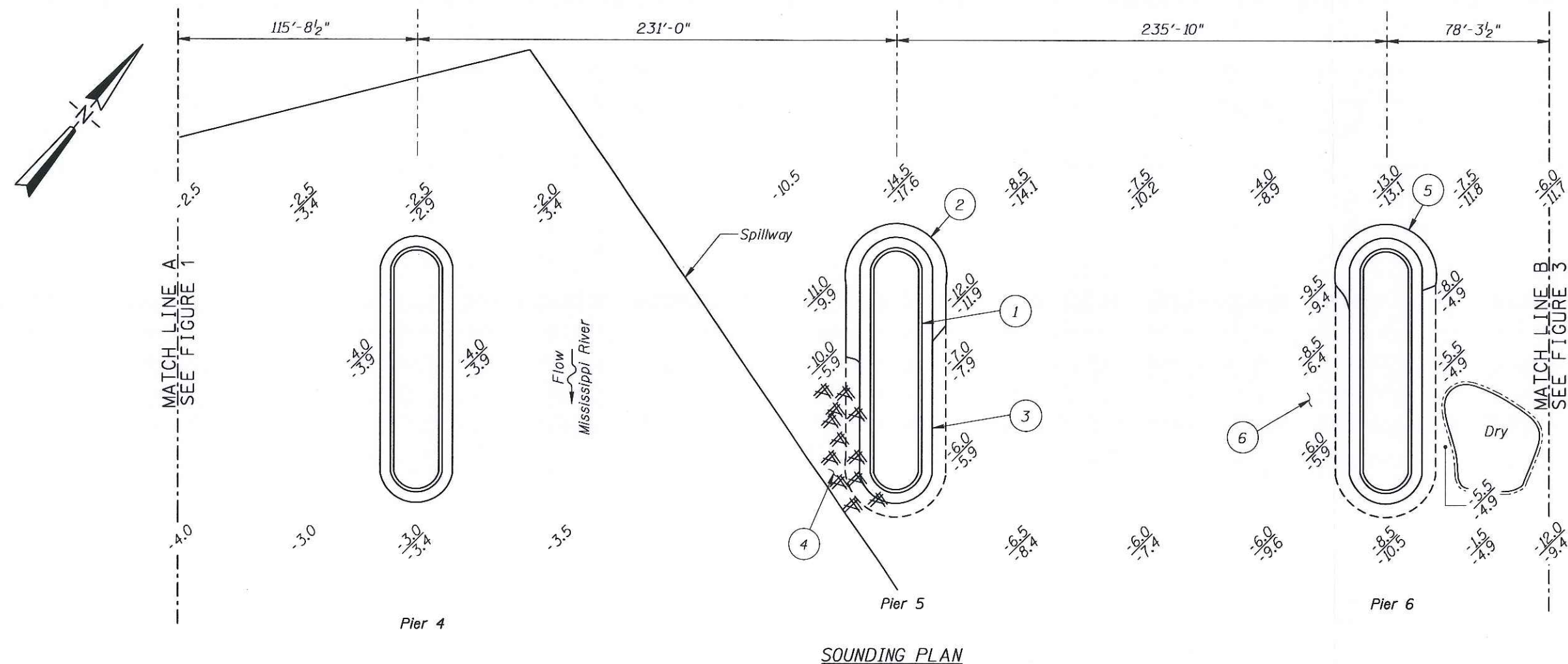
All soundings based on 2008 waterline location.

MINNESOTA DEPARTMENT OF TRANSPORTATION UNDERWATER BRIDGE INSPECTION

STRUCTURE NO. 2440
OVER THE MISSISSIPPI RIVER
DISTRICT M, HENNEPIN COUNTY

INSPECTION AND SOUNDING PLAN

Drawn By: LJ	COLLINS ENGINEERS	123 North Wacker Drive Suite 300 Chicago, IL 60606 (312) 704-9300 www.collinsengr.com	Date: OCT. 2008
Checked By: DGS			Scale: NTS
Code: 54732440			Figure No.: 1

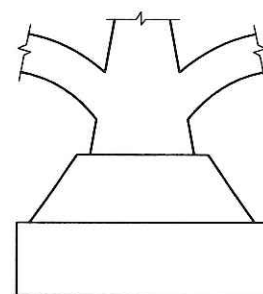


INSPECTION NOTES:

- 1 The concrete of Pier 5 shaft exhibited random minor deterioration around the perimeter of the pier with 2 to 3 inch penetrations.
- 2 The footing at Pier 5 was exposed around the upstream 1/3 of the pier with typical vertical exposure of 3 to 4 feet. The footing was also undermined (undercut) at the upstream nose of the pier with vertical cavity height of 2 feet and typical penetration of 2 to 3 feet deep. The concrete of the footing at the upstream end exhibited deterioration with typical penetrations of 2 feet and maximum penetration of 3 feet.
- 3 A 5 feet wide by 3 feet high area of section loss was observed along the east side near the downstream 1/4 point of Pier 5, with penetration of 2 to 3 feet located approximately 3 feet below the waterline.
- 4 Heavy accumulation of timber debris, consisting of up to 2 foot diameter drift pieces, was observed at the downstream nose to the downstream 1/4 point along the west side of Pier 5, extending from the channel bottom to 3 feet above the waterline.
- 5 The footing at Pier 6 was exposed around the upstream nose of the pier with a maximum vertical exposure of 4 feet.
- 6 The channel bottom around the perimeter of Pier 6 was covered with concrete rubble.

Note:

Refer to Figure 1 for General Notes.



TYPICAL END VIEW OF PIERS

MINNESOTA DEPARTMENT OF TRANSPORTATION UNDERWATER BRIDGE INSPECTION

STRUCTURE NO. 2440
OVER THE MISSISSIPPI RIVER
DISTRICT M, HENNEPIN COUNTY

INSPECTION AND SOUNDING PLAN

Drawn By: LJ

Checked By: DGS

Code: 54732440

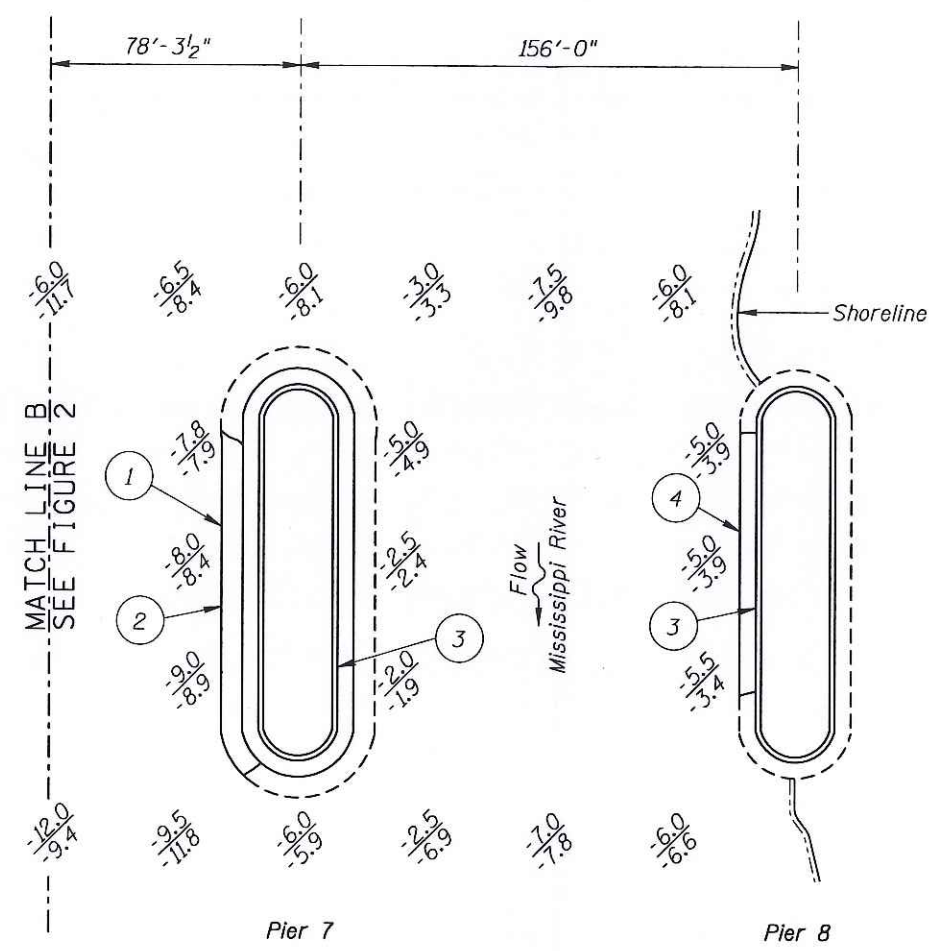
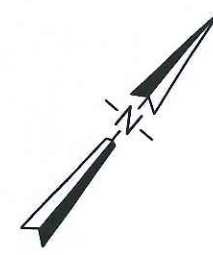
COLLINS
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Date: OCT. 2008

Scale: NTS

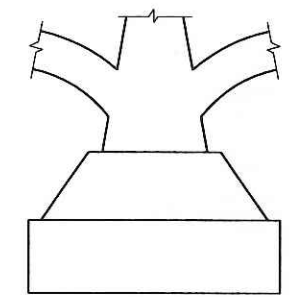
Figure No.: 2



SOUNDING PLAN

INSPECTION NOTE:

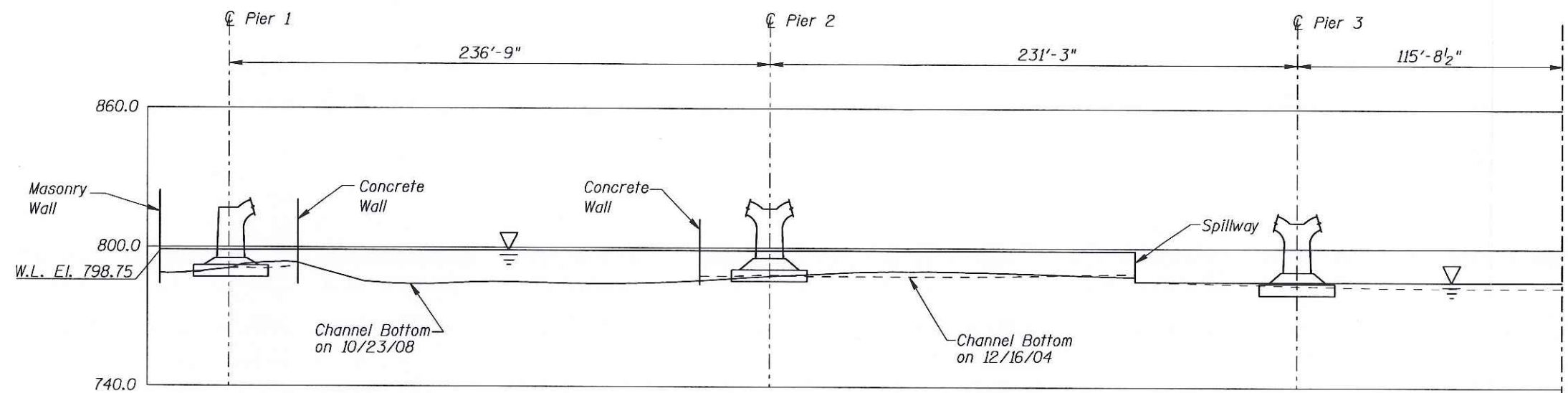
- 1 The footing at Pier 7 was exposed along the west face of the pier, with vertical exposure ranging from 1 foot at the upstream end to 3 feet at the downstream end.
- 2 The exposed footing at Pier 7 exhibited an approximately 20 foot wide area of section loss with undercutting and 6 inch to 1 foot deep penetrations.
- 3 Band of light to moderate scaling, 1 to 1.5 foot high with 1 to 3 inch penetration, was present at the waterline around perimeter of Piers 7 and 8.
- 4 At Pier 8, the footing (shaft step) was exposed along the west face of the pier with 3 to 3.5 feet of vertical exposure.



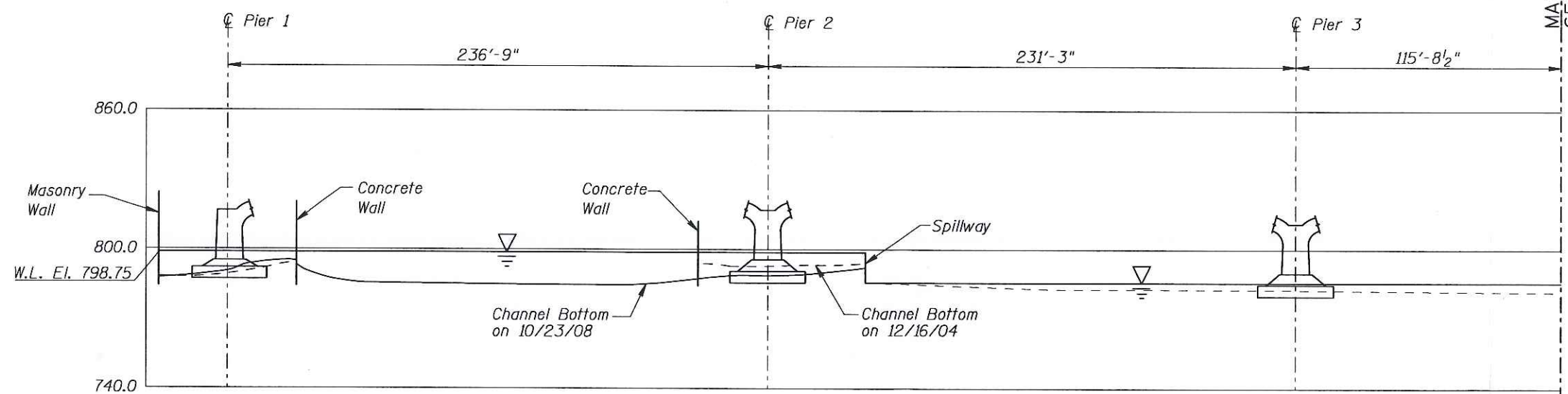
TYPICAL END VIEW OF PIERS

Note:
Refer to Figure 1 for General Notes.

MINNESOTA DEPARTMENT OF TRANSPORTATION UNDERWATER BRIDGE INSPECTION		
STRUCTURE NO. 2440 OVER THE MISSISSIPPI RIVER DISTRICT M, HENNEPIN COUNTY		
INSPECTION AND SOUNDING PLAN		
Drawn By: LJ	COLLINS ENGINEERS 123 North Wacker Drive Suite 300 Chicago, IL 60606 (312) 704-9300 www.collinsengr.com	Date: OCT. 2008
Checked By: DGS		Scale: NTS
Code: 54732440		Figure No.: 3



UPSTREAM FASCIA PROFILE



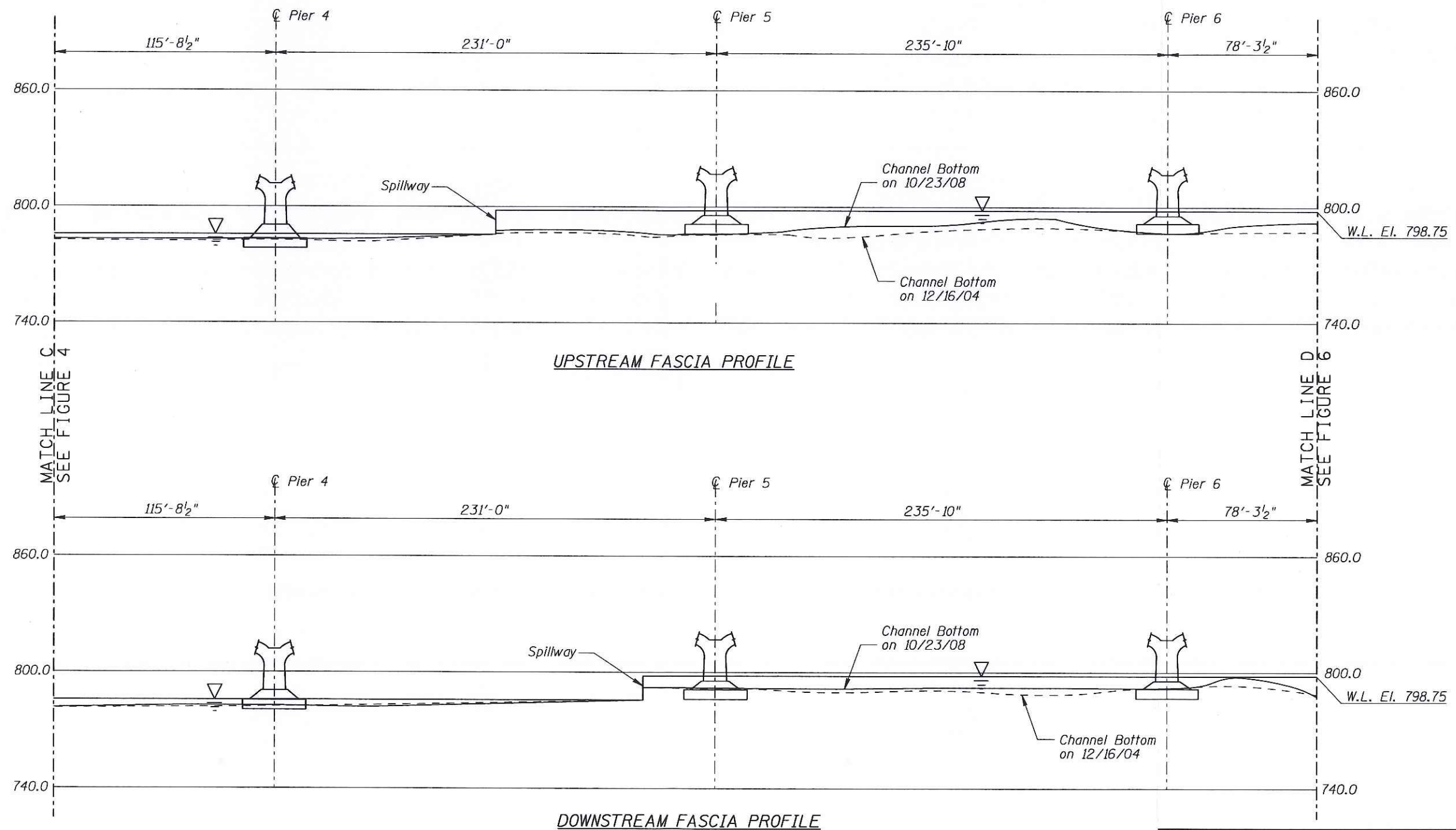
DOWNSTREAM FASCIA PROFILE

MATCH LINE C
SEE FIGURE 5

**MINNESOTA
DEPARTMENT OF TRANSPORTATION
UNDERWATER BRIDGE INSPECTION**

STRUCTURE NO. 2440
OVER THE MISSISSIPPI RIVER
DISTRICT M, HENNEPIN COUNTY
UPSTREAM AND DOWNSTREAM
FASCIA PROFILES

Drawn By: LJ	COLLINS ENGINEERS 123 North Wacker Drive Suite 300 Chicago, IL 60606 (312) 704-9300 www.collinsengr.com	Date: OCT. 2008
Checked By: DGS		Scale: 1"=60'
Code: 54732440		Figure No.: 4



UPSTREAM FASCIA PROFILE

DOWNSTREAM FASCIA PROFILE

Note:

Refer to Figure 1 for General Notes.

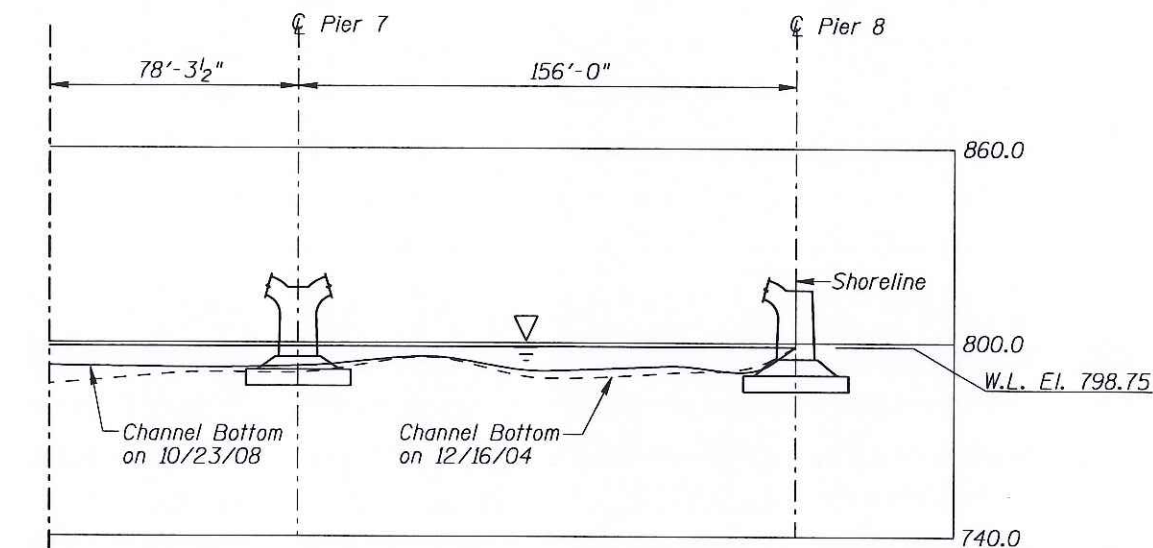
MINNESOTA
DEPARTMENT OF TRANSPORTATION
UNDERWATER BRIDGE INSPECTION

STRUCTURE NO. 2440
OVER THE MISSISSIPPI RIVER
DISTRICT M, HENNEPIN COUNTY
UPSTREAM AND DOWNSTREAM
FASCIA PROFILES

Drawn By: LJ
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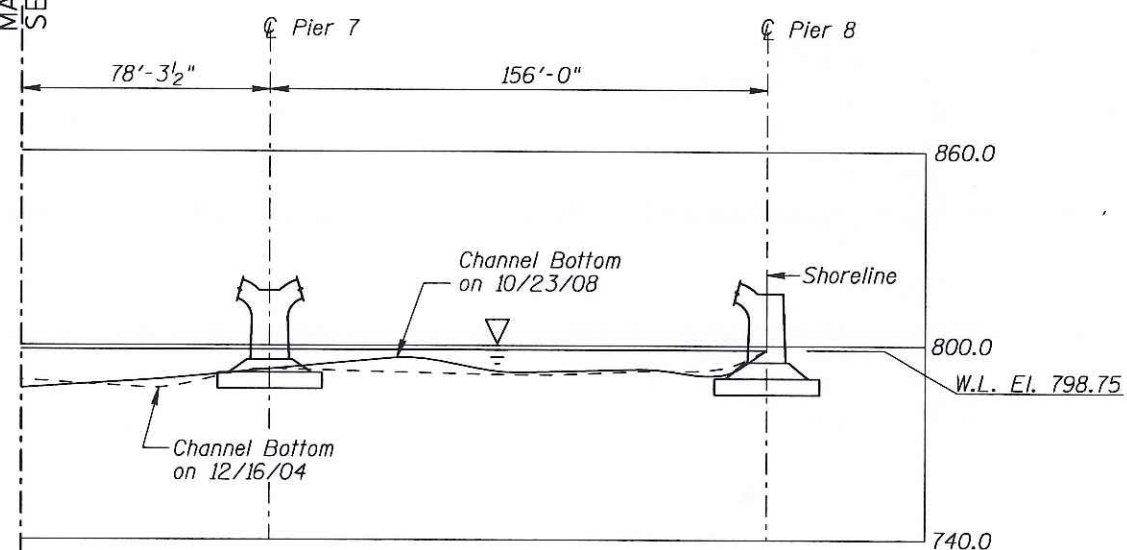
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Chicago, IL 60606
(312) 704-9300
www.collinsengr.com

Date: OCT. 2008
Scale: 1"=60'
Figure No.: 5



UPSTREAM FASCIA PROFILE

MATCH LINE D
SEE FIGURE 5



DOWNSTREAM FASCIA PROFILE

Note:

Refer to Figure 1 for General Notes.

**MINNESOTA
DEPARTMENT OF TRANSPORTATION
UNDERWATER BRIDGE INSPECTION**

STRUCTURE NO. 2440
OVER THE MISSISSIPPI RIVER
DISTRICT M, HENNEPIN COUNTY
**UPSTREAM AND DOWNSTREAM
FASCIA PROFILES**

Drawn By: LJ
Checked By: DGS
Code: 54732440

**COLLINS
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Suite 300
Chicago, IL 60606
(312) 704-9300
www.collinsengr.com

Date: OCT. 2008
Scale: 1"=60'
Figure No.: 6

MINNESOTA DEPARTMENT OF TRANSPORTATION
OFFICE OF BRIDGES AND STRUCTURES
DAILY DIVING REPORT

INSPECTORS: Collins Engineers, Inc. DATE: October 23, 2008

ON-SITE TEAM LEADER: Daniel G. Stromberg, P.E.

BRIDGE NO: 2440 WEATHER: Rainy, 40° F

WATERWAY CROSSED: Mississippi River

DIVING OPERATION: X SCUBA SURFACE SUPPLIED AIR
 OTHER

PERSONNEL: Clayton G. Brookins, Lukas Janulis

EQUIPMENT: Scuba, Camera, Tending Line, Hand Sounder, 22 foot Boat w/motor

TIME IN WATER: 2:30 P.M.

TIME OUT OF WATER: 3:30 P.M.

WATERWAY DATA: VELOCITY 2.0 ft/s

VISIBILITY 2 feet

DEPTH 14.5 feet maximum at Pier 5

ELEMENTS INSPECTED: Piers 1 through 8

REMARKS: The concrete of Piers 1 and 2 exhibited widespread deterioration from 2 feet below to 4 feet above the waterline with typical penetrations of 6 inches to 1 foot and maximum penetrations of 2 feet. The footings were partially exposed at Piers 1, 2, 5, 6, and 7 with vertical exposures varying from 1 to 4 feet. Additionally, the footing at the upstream nose of Pier 5 was undermined (undercut), with a cavity measuring 2 feet high with penetrations of 2 to 3 feet. The footings at Piers 1 and 5 also exhibited deterioration and loss of section with up to 2 foot penetrations. A heavy accumulation of timber debris was observed at a downstream end of Pier 5. The footing step at Pier 8 was also partially exposed with up to 3.5 of maximum vertical exposure. The foundation exposure and undermining extent and limits were generally comparable to what was reported during the 2000 and 2004 inspections.

FURTHER ACTION NEEDED: X YES NO

The extent of concrete deterioration at Piers 1 and 2 does not pose an immediate threat to the structural integrity of those piers at this time, given the overall size of the piers. However, consideration should be given to repairing the deteriorated areas by removing all unsound concrete and replacing with new concrete designed to provide high durability and low permeability.

Monitor timber debris accumulation at Pier 5 during future inspections, and consider removal operations if debris is found to be increasing to an excessive extent.

Consideration should be given to implementation of scour countermeasures to address the undermined (undercut) foundation at Pier 5. The countermeasures could include the placement of riprap and/or pumped grout around the undermined/exposed footing.

Monitor footing exposures at Piers 1, 2, 6, and 7 during future inspections, and if exposure is found to be increasing to a detrimental extent, implementation of scour countermeasures may become warranted at that time.

Reinspect the submerged substructure units at the normal maximum recommended (NBIS) interval of five (5) years.

MINNESOTA DEPARTMENT OF TRANSPORTATION
OFFICE OF BRIDGES AND STRUCTURES

UNDERWATER INSPECTION CONDITION RATING FORM

BRIDGE NO. 2440 INSPECTION DATE October 23, 2008
 INSPECTORS Collins Engineers, Inc. NOTE: USE ALL APPLICABLE CONDITION DEFINITIONS AS DEFINED IN THE MINNESOTA RECORDING AND CODING GUIDE INCLUDING GENERAL, SUBSTRUCTURE, CHANNEL AND PROTECTION, AND CULVERTS AND WALL DEFINITIONS TO COMPLETE THIS FORM.
 ON-SITE TEAM LEADER Daniel G. Stromberg, P.E.
 WATERWAY CROSSED Mississippi River

CONDITION RATING

			SUBSTRUCTURE						CHANNEL					GENERAL						
UNIT REFERENCE NO.		MAXIMUM DEPTH OF WATER	PILING	COLUMNS, SHAFTS, OR FACES*	FOOTINGS	DISPLACEMENT	OTHER	OVERALL SUBSTRUCTURE CONDITION CODE*	SCOUR	EMBANKMENT EROSION	EMBANKMENT PROTECTION	OTHER (DRIFT/DEBRIS)	OVERALL CHANNEL & PROTECTION CONDITION	CONCRETE	STEEL	TIMBER	LOSS OF SECTION	PREVIOUS REPAIR OR MAINTENANCE	OTHER	
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	UNIT DESCRIPTION	11.0'	N	6	6	7	N	6	6	N	N	N	7	5	N	N	5	N	N	
		11.0'	N	6	7	7	N	6	6	N	N	N	7	7	N	N	5	N	N	
		3.5'	N	7	N	7	N	N	7	N	N	N	N	7	7	N	N	7	N	N
		4.0'	N	7	N	7	N	N	7	N	N	N	N	7	7	N	N	7	N	N
		14.5'	N	6	6	7	N	N	6	6	N	N	5	6	5	N	N	5	N	N
		9.5'	N	6	7	7	N	N	6	6	N	N	N	7	6	N	N	6	N	N
		9.0'	N	6	7	7	N	N	6	6	N	N	N	7	6	N	N	6	N	N
		5.5'	N	6	7	7	N	N	6	7	7	6	N	7	6	N	N	6	N	N

REMARKS: The concrete of Piers 1 and 2 exhibited widespread deterioration from 2 feet below to 4 feet above the waterline with typical penetrations of 6 inches to 1 foot and maximum penetrations of 2 feet. The footings were partially exposed at Piers 1, 2, 5, 6, and 7 with vertical exposures varying from 1 to 4 feet. Additionally, the footing at the upstream nose of Pier 5 was undermined (undercut), with a cavity measuring 2 feet high with penetrations of 2 to 3 feet. The footings at Piers 1 and 5 also exhibited deterioration and loss of section with up to 2 foot penetrations. A heavy accumulation of timber debris was observed at a downstream end of Pier 5. The footing step at Pier 8 was also partially exposed with up to 3.5 of maximum vertical exposure. The foundation exposure and undermining extent and limits were generally comparable to what was reported during the 2000 and 2004 inspections.

NOTES: ATTACH SKETCHES AS NEEDED, IDENTIFY REMARK BY REFERRING TO UNIT REFERENCE NO. AND REMARK NO. USE GENERAL SECTION TO IDENTIFY OVERALL PRESENCE OF SPALLS, CRACKS, CORROSION, ETC.