UNDERWATER BRIDGE INSPECTION REPORT

STRUCTURE NO. 2440

TRUNK HIGHWAY NO. 3rd Avenue/Central Avenue

OVER THE

MISSISSIPPI RIVER

DISTRICT M – HENNEPIN COUNTY

OCTOBER 28, 2012

PREPARED FOR THE

MINNESOTA DEPARTMENT OF TRANSPORTATION

BY

COLLINS ENGINEERS, INC.

JOB NO. 7423

MINNESOTA DEPARTMENT OF TRANSPORTATION
UNDERWATER BRIDGE INSPECTION

REPORT SUMMARY:

The substructure units inspected at Bridge No. 2440, Piers 1 through 8, were generally found to be in satisfactory to fair condition with the exception of Pier 5 which was in poor 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 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, and 6 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 end of the pier, with a cavity measuring up to 3 feet high with a maximum penetration of more than 14 feet. The footing step at Pier 8 was also partially exposed with up to 3.5 feet of maximum vertical exposure. The foundation exposure and undermining (undercut) extent and limits at Pier 5 have increased significantly compared to what was reported during the 2004 and 2008 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 of 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 point at approximately 3 feet below the waterline.

(G) The footing at Pier 5 was exposed down to the bedrock around the upstream 1/3 of the pier. The footing was also undermined (undercut) at the upstream nose of the pier. The concrete of the footing at the upstream end exhibited deterioration and a cavity into the footing with typical penetrations of 6 feet and maximum penetrations of approximately 14 feet. The vertical cavity height was typically 1 foot with a maximum of 3 feet.

(H) The footing at Pier 6 was exposed around the upstream nose with a maximum vertical exposure of 4 feet.

(I) The footing step at Pier 8 was exposed along the west face of Pier 8 with up to 3.5 feet of vertical exposure.

(J) 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.

(K) 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) Presently, given the overall massive size of Pier 5 (compared to the cavity in/under the footing) and the fact that there was no notable deflection/settlement of the structure at the time of inspection, Pier 5 appears to be stable. The cavity that was in/under the pier footing appears to be related to erosion of rather old concrete, and this condition has progressed significantly since the previous inspection. Consequently, it is recommended that serious consideration be given to addressing the conditions at Pier 5. The recommended corrective measures should include a structural analysis of the pier, and the analysis should consider the estimated loss of bearing under the footing. Based on the analysis, the above mentioned defects will most likely warrant countermeasures/repairs. The countermeasures could include the placement of riprap around the undermined/exposed footing and filling the cavity with pumped grout. The Pier 5 foundation should be closely monitored until a structural analysis and warranted repairs are implemented.

(D) Monitor footing exposures at Piers 1, 2, and 6 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) Until a structural analysis and necessary repairs are implemented at Pier 5 the structure should be closely monitored and placed on a reduced underwater inspection interval of twenty four (24) months.

Respectfully submitted,

Inspection Team Leader:

Lukas Janulis

Lukas Janulis, P.E.

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

Daniel G. Stromberg

Date 6/30/14 License # 21491

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: Lukas Janulis, P.E.

Dive Team: Barritt Lovelace, Marc B. Parker

Date: October 28, 2012

Weather Conditions: Rainy, 40° F

Underwater Visibility: 6 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 15.1 feet.

4. WATERLINE DATUM

Water Level Reference: Springline at the upstream end of Pier 7

Water Surface: The waterline was approximately 6.2 feet below reference.
Waterline Elevation = 799.1 (Upper pool elevation per ACOE)

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

Item 60: Substructure: Code 4

Item 61: Channel and Channel Protection: Code 4

Item 92B: Underwater Inspection: Code B/10/12

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. STRUCTURAL ELEMENT CONDITION RATING

Item #	Element Description	Quantity	Unit	Conditions				
				1	2	3	4	5
210	Concrete Pier	1008	LF	0	748	260	0	n/a
220	Concrete Footing	5	EA	0	3	1	1	n/a
360	Scour	1	EA	0	0	1	n/a	n/a
985	Slopes and Slope Protection	1	EA	0	1	0	n/a	n/a

Photograph 1. Overall View of Structure, Looking Southeast.

Photograph 2. View of Pier 1, Looking South.

Photograph 3. View of Pier 2, Looking South.

Photograph 4. View of Pier 3, Looking Southeast.

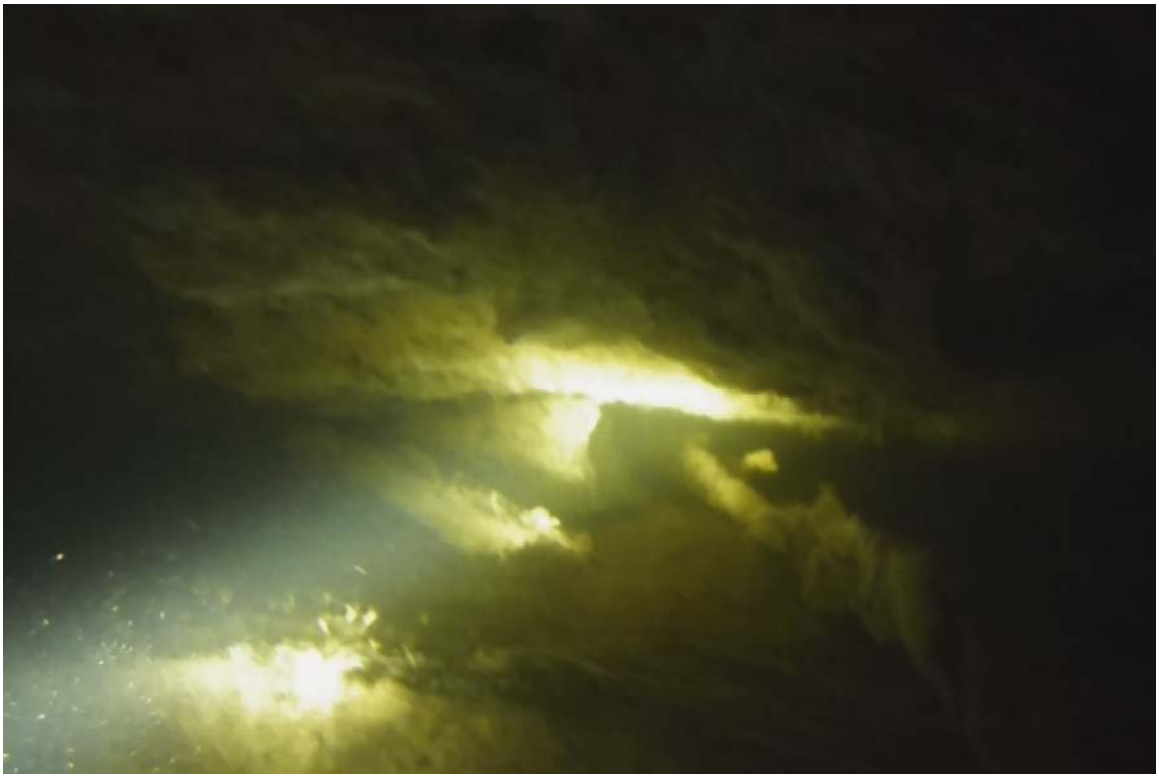
Photograph 5. View of Pier 4, Looking West.

Photograph 6. View of Pier 5, Looking West.

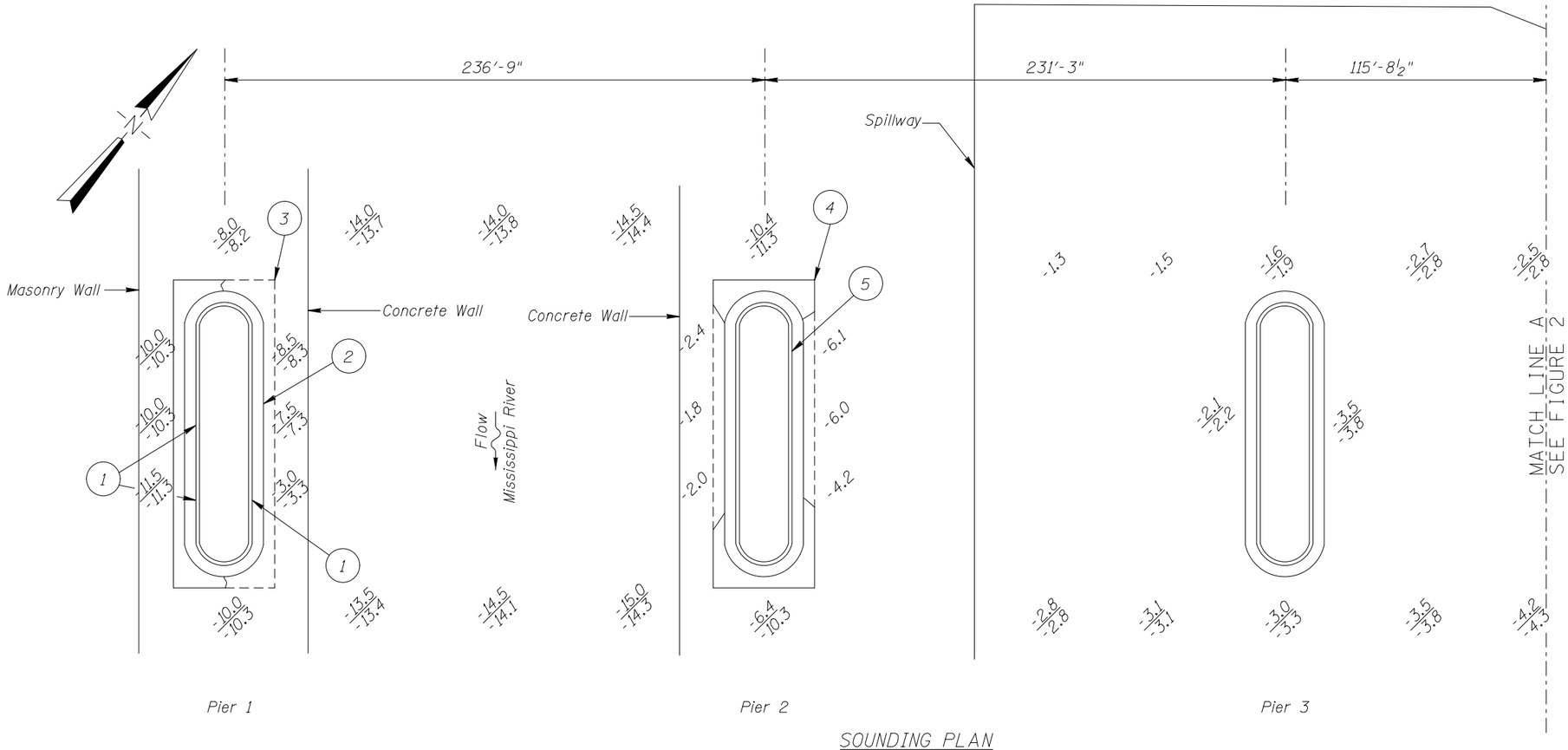
Photograph 7. View of Pier 6, Looking West.

Photograph 8. View of Pier 7, Looking Southwest.

Photograph 9. View of Pier 8, Looking Southeast.

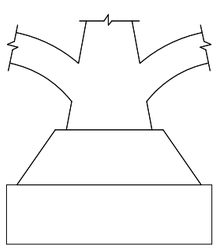


Photograph 10. View of Undermined (Undercutting) cavity at Pier 5, Looking South.



Pier 1 Pier 2 Pier 3

SOUNDING PLAN



TYPICAL END VIEW OF PIERS

GENERAL NOTES:

1. Piers 1 through 8 were inspected underwater.
2. At the time of inspection on October 28, 2012, the waterline was located approximately 6.2 feet below the springline at Pier 7. The waterline elevation of the upper pool was 799.1 feet based on information provided by the Army Corps of Engineers at a nearby Upper 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 (10/28/12)
-11.2	Sounding Depth from Waterline (10/23/08)

Note:

All soundings based on 2012 waterline location.

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 and the downstream end of the pier. The vertical footing exposure at both ends of the pier typically varied from 3 to 4 feet.

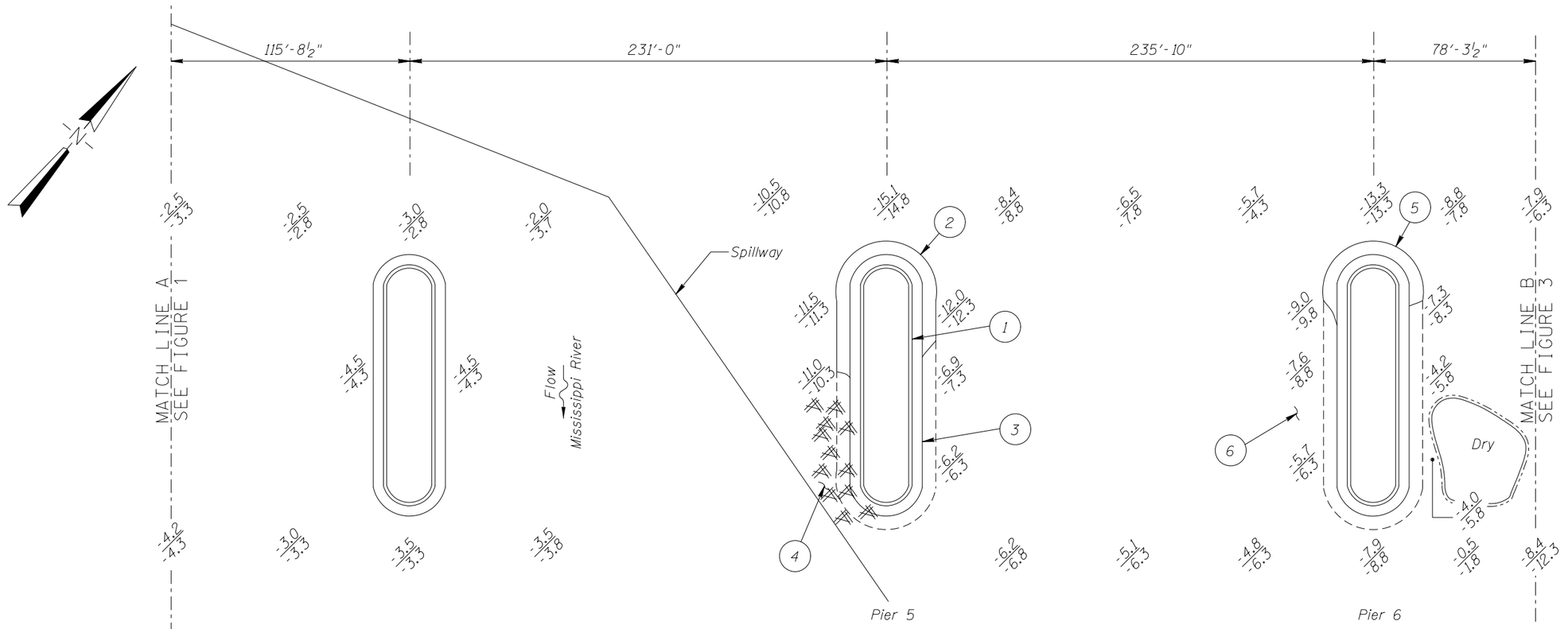
(5) The concrete of Pier 2 exhibited widespread spalling and loss of section with 6 inches to 1 foot deep penetrations, typically extending from 2 feet below to 4 feet above the waterline.

MINNESOTA
DEPARTMENT OF TRANSPORTATION
UNDERWATER BRIDGE INSPECTION

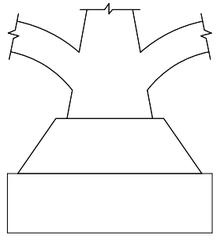
STRUCTURE NO. 2440
U.S. 3rd OVER THE MISSISSIPPI RIVER
DISTRICT M, HENNEPIN COUNTY

INSPECTION AND SOUNDING PLAN

Drawn By: MBP	COLLINS ENGINEERS INC 123 North Wacker Drive Suite 300 Chicago, IL 60606 (312) 704-9300 www.collinsengr.com	Date: NOV. 2012
Checked By: LJ		Scale: NTS
Code: 74232440		Figure No.: 1



SOUNDING PLAN



TYPICAL END VIEW OF PIERS

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 down to the bedrock around the upstream 1/3 of the pier. The footing was also undermined (undercut) at the upstream nose of the pier. The concrete of the footing at the upstream end exhibited deterioration and a cavity into the footing with typical penetrations of 6 feet and maximum penetration of approximately 14 feet. The vertical cavity height was typically 1 foot with a maximum 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.

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INSPECTION AND SOUNDING PLAN

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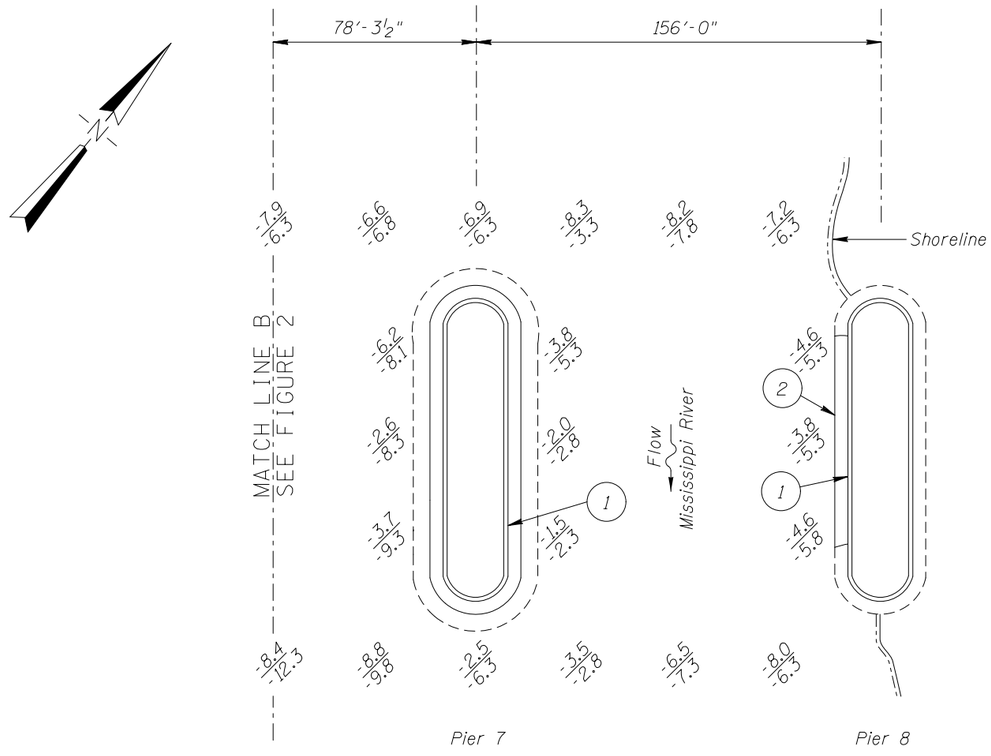
Checked By: LJ		Scale: NTS
Code: 74232440		Figure No.: 2

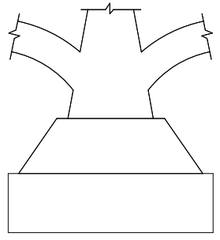


SOUNDING PLAN

INSPECTION NOTE:

(1) *A band of moderate to heavy 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.*

(2) *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

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U.S. 3rd OVER THE MISSISSIPPI RIVER
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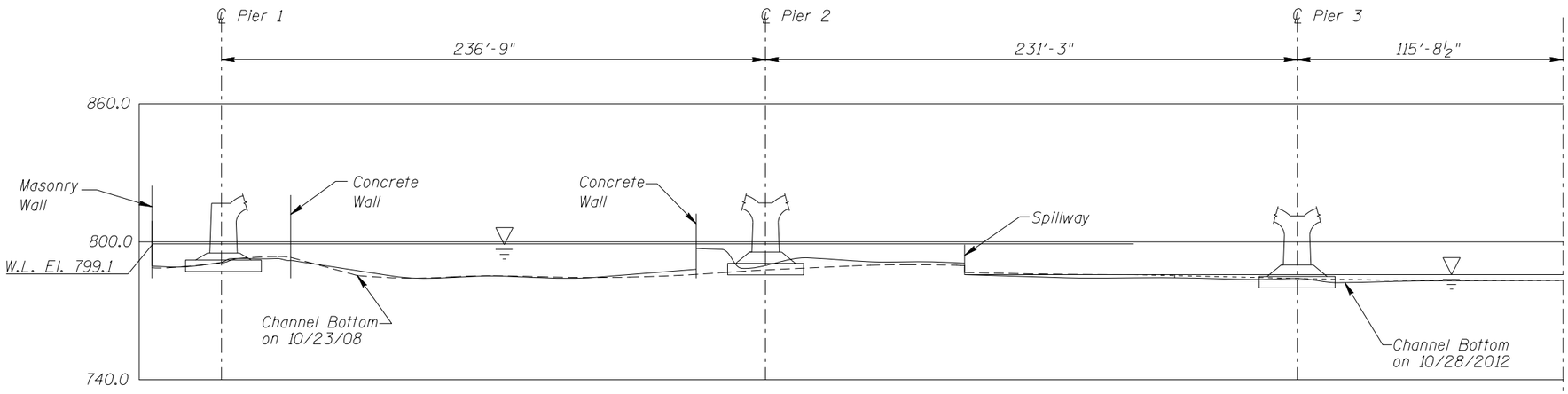
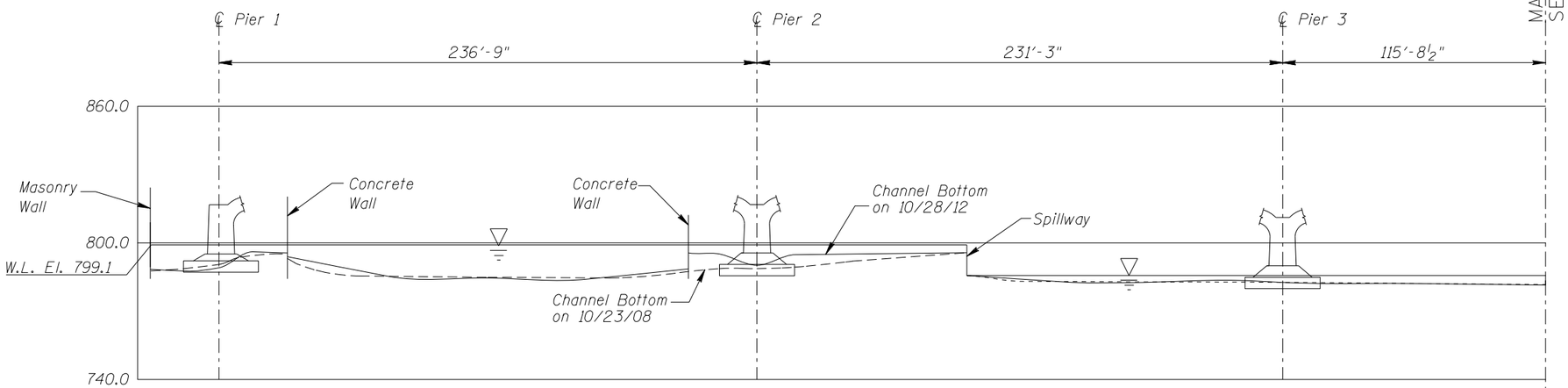
INSPECTION AND SOUNDING PLAN

Drawn By: MBP	COLLINS ENGINEERS INC 123 North Wacker Drive Suite 300 Chicago, IL 60606 (312) 704-9300 www.collinsengr.com	Date: NOV. 2012
Checked By: LJ		Scale: NTS
Code: 74232440		Figure No.: 3



UPSTREAM FASCIA PROFILE



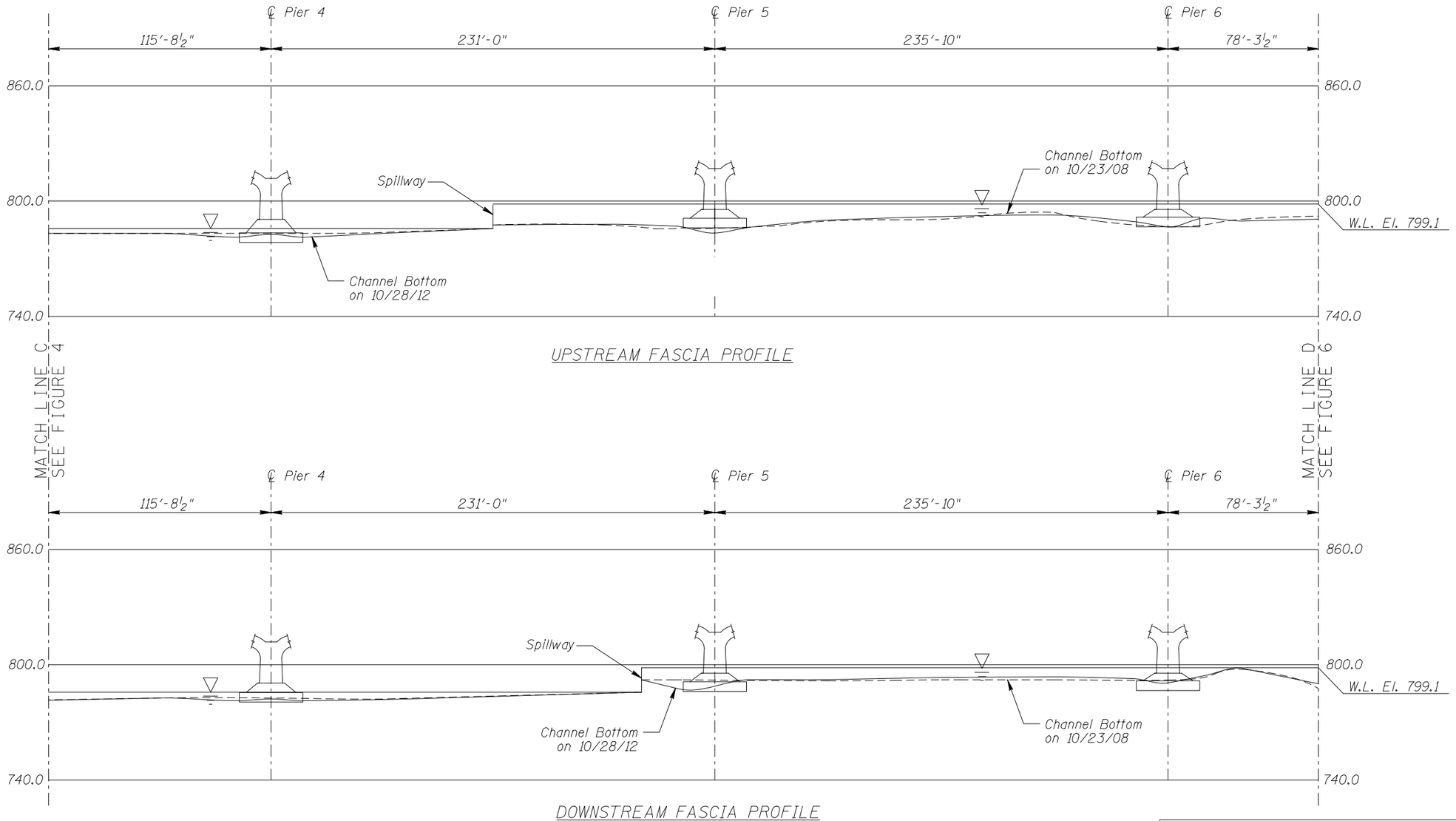
DOWNSTREAM FASCIA PROFILE

MINNESOTA
DEPARTMENT OF TRANSPORTATION
UNDERWATER BRIDGE INSPECTION

STRUCTURE NO. 2440
U.S. 3rd OVER THE MISSISSIPPI RIVER
DISTRICT M, HENNEPIN COUNTY

UPSTREAM AND DOWNSTREAM FASCIA PROFILES

Drawn By: MBP	COLLINS ENGINEERS INC 123 North Wacker Drive Suite 300 Chicago, IL 60606 (312) 704-9300 www.collinsengr.com	Date: NOV. 2012
Checked By: LJ		Scale: 1"-60'
Code: 74232440		Figure No.: 4



UPSTREAM FASCIA PROFILE

DOWNSTREAM FASCIA PROFILE

Note:

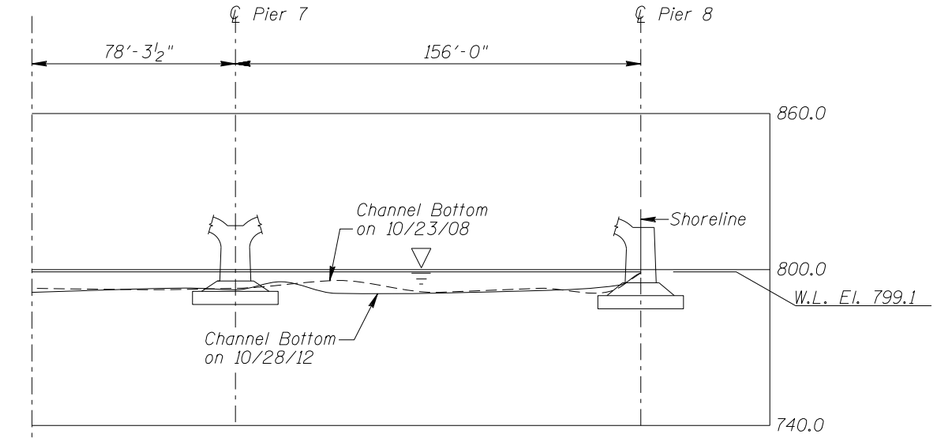
Refer to Figure 1 for General Notes.

MINNESOTA
DEPARTMENT OF TRANSPORTATION
UNDERWATER BRIDGE INSPECTION

STRUCTURE NO. 2440
U.S. 3rd OVER THE MISSISSIPPI RIVER
DISTRICT M, HENNEPIN COUNTY

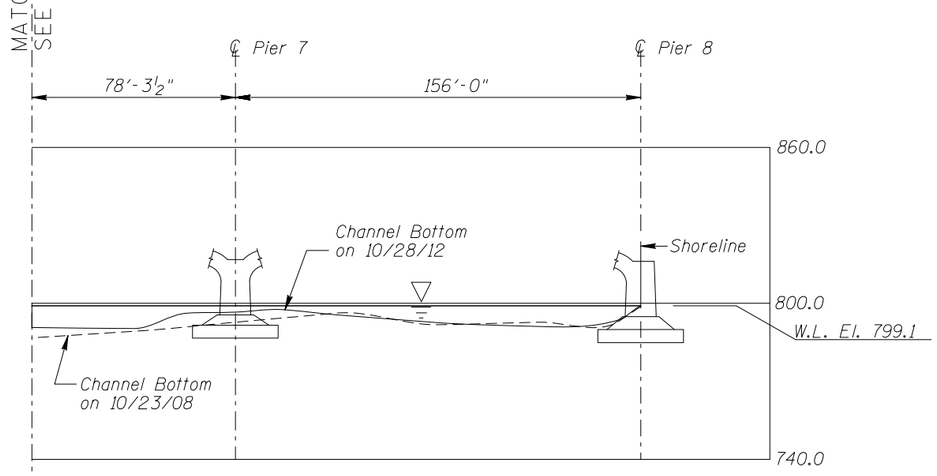
UPSTREAM AND DOWNSTREAM FASCIA PROFILES

Drawn By: MBP	COLLINS ENGINEERS 123 North Wacker Drive Suite 300 Chicago, IL 60606 (312) 704-9300 www.collinsengr.com	Date: NOV. 2012
Checked By: LJ		Scale: 1"=60'
Code: 74232440		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
U.S. 3rd OVER THE MISSISSIPPI RIVER
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UPSTREAM AND DOWNSTREAM FASCIA PROFILES

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Checked By: LJ		Scale: 1"=60'
Code: 74232440		Figure No.: 6

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

INSPECTORS: Collins Engineers, Inc. DATE: October 28, 2012

ON-SITE TEAM LEADER: Lukas Janulis, P.E.

BRIDGE NO: 2440 WEATHER: Rainy, 40° F

WATERWAY CROSSED: Mississippi River

DIVING OPERATION: X SCUBA _____ SURFACE SUPPLIED AIR

_____ OTHER

PERSONNEL: Barritt Lovelace, Marc B. Parker

EQUIPMENT: Commercial Scuba, Camera, Hand Sounder, 14 foot Boat w/motor

TIME IN WATER: 4:00 P.M.

TIME OUT OF WATER: 5:30 P.M.

WATERWAY DATA: VELOCITY 2.0 ft/s

VISIBILITY 6 feet

DEPTH 15.1 feet maximum at Pier 5

ELEMENTS INSPECTED: Piers 1 through 8

REMARKS: Overall, the substructure units inspected underwater were generally found to be in satisfactory to fair condition with the exception of Pier 5 which was in poor 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 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, and 6 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 end of the pier, with a cavity measuring up to 3 feet high with a maximum penetration of more than 14 feet. The footing step at Pier 8 was also partially exposed with up to 3.5 feet of maximum vertical exposure. The foundation exposure and undermining (undercut) extent and limits at Pier 5 have increased significantly compared to what was reported during the 2004 and 2008 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.

Presently, given the overall massive size of Pier 5 (compared to the cavity in/under the footing) and the fact that there was no notable deflection/settlement of the structure at the time of inspection, Pier 5 appears to be stable. The cavity that was in/under the pier footing appears to be related to erosion of rather old concrete, and this condition has progressed significantly since the previous inspection. Consequently, it is recommended that serious consideration be given to addressing the conditions at Pier 5. The recommended corrective measures should include a structural analysis of the pier, and the analysis should consider the estimated loss of bearing under the footing. Based on the analysis, the above mentioned defects will most likely warrant countermeasures/repairs. The countermeasures could include the placement of riprap around the undermined/exposed footing and filling the cavity with pumped grout. The Pier 5 foundation should be closely monitored until a structural analysis and warranted repairs are implemented.

Monitor footing exposures at Piers 1, 2, and 6 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.

Until a structural analysis and necessary repairs are implemented at Pier 5 the structure should be closely monitored and placed on a reduced underwater inspection interval of twenty four (24) months.

MINNESOTA DEPARTMENT OF TRANSPORTATION
OFFICE OF BRIDGES AND STRUCTURES

UNDERWATER INSPECTION CONDITION RATING FORM

BRIDGE NO. 2440
INSPECTORS Collins Engineers, Inc.
ON-SITE TEAM LEADER Lukas Janulis, P.E.
WATERWAY CROSSED Mississippi River

INSPECTION DATE October 28, 2012

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.

CONDITION RATING

			SUBSTRUCTURE						CHANNEL					GENERAL					
UNIT REFERENCE NO.	UNIT DESCRIPTION	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
	Pier 1	11.5’	N	6	6	7	N	6	6	N	N	N	7	5	N	N	5	N	N
	Pier 2	10.4’	N	6	7	7	N	6	6	N	N	N	7	5	N	N	5	N	N
	Pier 3	3.5’	N	7	N	7	N	7	N	N	N	N	7	7	N	N	7	N	N
	Pier 4	4.5’	N	7	N	7	N	7	N	N	N	N	7	7	N	N	7	N	N
	Pier 5	15.1’	N	6	4	7	N	4	4	N	N	5	4	4	N	N	4	N	N
	Pier 6	13.3’	N	6	7	7	N	6	6	N	N	N	7	6	N	N	6	N	N
	Pier 7	6.9’	N	6	7	7	N	6	6	N	N	N	7	6	N	N	6	N	N
	Pier 8	4.6’	N	6	7	7	N	6	7	7	6	N	7	6	N	N	6	N	N

*UNDERWATER PORTION ONLY

REMARKS: Overall, the substructure units inspected underwater were generally found to be in satisfactory to fair condition with the exception of Pier 5 which was in poor 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 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, and 6 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 end of the pier, with a cavity measuring up to 3 feet high with a maximum penetration of more than 14 feet. The footing step at Pier 8 was also partially exposed with up to 3.5 feet of maximum vertical exposure. The foundation exposure and undermining (undercut) extent and limits at Pier 5 have increased significantly compared to what was reported during the 2004 and 2008 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.