

UNDERWATER BRIDGE INSPECTION REPORT

STRUCTURE NO. 4654

TRUNK HIGHWAY NO. 36

OVER THE

ST. CROIX RIVER

DISTRICT METRO – WASHINGTON COUNTY



OCTOBER 30, 2008

PREPARED FOR THE

MINNESOTA DEPARTMENT OF TRANSPORTATION

BY

COLLINS ENGINEERS, INC.

JOB NO. 5473

MINNESOTA DEPARTMENT OF TRANSPORTATION
UNDERWATER BRIDGE INSPECTION

REPORT SUMMARY:

The substructure units inspected at Bridge No. 4654, Piers 2 through 8, were found to be mostly in satisfactory condition with no defects of immediate structural significance noted. The concrete of the piers typically exhibited moderate to at times heavy scaling with exposed reinforcing steel located at and around the waterline. Concrete section loss related to the heavy scaling included up to 6 inches of penetration and exposed reinforcing bars, was present around the entire perimeter of Pier 8. The channel bottom was typically covered with scattered construction debris consisting of concrete rubble and discarded reinforcing steel. Overall, comparison of the existing channel bottom configuration with the previous underwater inspection findings in 2004 revealed no significant changes to the streambed. Minor scour depressions noted during previous inspection around the upstream nose of Piers 3 through 5 did not increase in extent and are continue to be no significant concern. Pier footing exposure was noted at Pier 3, 5, 6, 7, and 8, which is consistent with the 2000 inspection findings. Generally, the footing and seal exposures have not increased appreciably in the extent, except for Pier 8, where up to 6 inches of vertical undermining was noted around the upstream end of the pier. Light to moderate timber debris accumulations were observed at the upstream nose of Piers 2, 7, and 8. A moderate timber debris accumulation was located at the upstream end of Pier 4.

INSPECTION FINDINGS:

- (A) The natural channel bottom material around the piers was typically covered with scattered construction debris consisting of concrete rubble and reinforcing steel.
- (B) Concrete of inspected piers exhibited moderate to heavy scaling with penetrations of 1 to 4 inches between 1 foot and 3 feet below the waterline.

- (C) Scour depressions, up 3 feet deep with 15 foot radius, were noted at the upstream end of Piers 3 through 5.
- (D) There was a small area of top of footing exposure at the upstream nose of Pier 3 with no vertical exposure noted.
- (E) A 3 foot wide area of heavy scaling with up to 5 inches of penetration was noted at the downstream quarter point on the west face of Pier 4, from 1 to 5 feet below the waterline.
- (F) An 1/8 wide vertical crack was observed at the upstream quarter point on the west face of Pier 4 extending from 10 feet below the waterline to the channel bottom.
- (G) Moderate timber debris accumulation, consisting of three 1 foot diameter logs, was located at the upstream nose of Pier 4.
- (H) The footing at Pier 5 was fully exposed around the entire perimeter of the pier with 4 feet (full footing height) of vertical exposure. In addition, the seal was exposed around nearly the entire pier perimeter with a maximum of 2 feet of vertical exposure.
- (I) The footing at Pier 6 was fully exposed around the entire perimeter of the pier with 4 feet (full footing height) of vertical exposure. The seal was exposed at the upstream most end of the pier with a maximum of 2 feet of vertical exposure.
- (J) A 4 foot by 4 foot area of poor concrete consolidation with 1/2 inch of penetration was observed at the midpoint on the west face of Pier 7.
- (K) The footing at Pier 7 was fully exposed around the entire perimeter of the pier with 4 feet (full footing height) of vertical exposure. The seal was exposed across the entire upstream face and the upstream half of the east face with a maximum of 1 foot of vertical exposure.

- (L) Areas of scaling with related heavy concrete section loss and with up to 6 inches of penetration and exposed reinforcing steel were observed around the entire perimeter of Pier 8, from 4 feet above to 2 feet below the waterline.
- (M) The footing at Pier 8 was fully exposed around the entire perimeter of the pier with 4 feet (full footing height) of vertical exposure. The seal was exposed and undermined across the upstream most end of the pier. The undermined area exhibited a 6 inch high cavity with minimal horizontal penetration and no piles exposed.

RECOMMENDATIONS:

- (A) The amount of footing and seal exposure at Piers 3, 5, 6, and 7, as well as the minor undermining cavity under the seal at Pier 8, is currently not a significant structural concern given the current extent and the fact that piers are pile supported. It is therefore only recommended that the foundation exposures and/or undermining at these piers continue to be monitored during future underwater inspections. Should the inspections reveal that the condition have significantly progressed; corrective actions may then be required at that time.
- (B) The moderate to heavy scaling at all of the inspected substructure units, as well as the heavier related concrete section loss, especially at Pier 8 are not structural concerns at this time given their size compared to the overall pier size; however, consideration should be given to repairing these areas to prevent corrosion of the exposed steel reinforcement from accelerating the rate of deterioration of the surrounding concrete, and consequently, leading to more detrimental condition. Repairs would include removal of all unsound concrete, cleaning and replacing reinforcing steel as required, and placing concrete designed to provide high durability with low permeability.

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

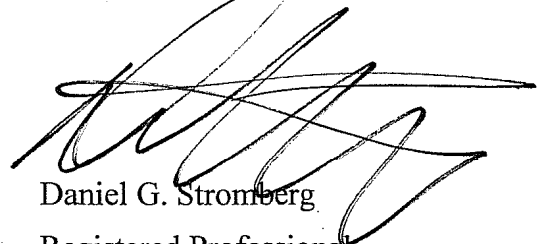
Respectfully submitted,

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

COLLINS ENGINEERS, INC.



Daniel G. Stromberg

Registered Professional

Engineer, State of Minnesota

MINNESOTA DEPARTMENT OF TRANSPORTATION
UNDERWATER BRIDGE INSPECTION

1. BRIDGE DATA

Bridge Number: 4654

Feature Crossed: St. Croix River

Feature Carried: Trunk Highway No. 36

Location: District Metro – Washington County

Bridge Description: The superstructure consists of a reinforced concrete deck over seven spans of steel through truss spans supported by two reinforced concrete abutments and seven reinforced concrete piers. The substructure units are designated as West Abutment, Piers 2 through 8, and East Abutment.

2. INSPECTION DATA

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

Dive Team: Nicholas R. Triandafilou, Piotr Sawulski

Date: October 30, 2008

Weather Conditions: Sunny, 65° F

Underwater Visibility: 3.0 feet

Waterway Velocity: 0.5 ft/s

3. SUBSTRUCTURE INSPECTION DATA

Substructure Inspected: Piers 2 through 8

General Shape: Each pier consists of two round reinforced concrete columns connected by a webwall founded on a common pile supported rectangular reinforced concrete footing.

Maximum Water Depth at Substructure Inspected: Approximately 17.0 feet.

4. WATERLINE DATUM

Water Level Reference: Top of pier cap at Pier 4.

Water Surface: The waterline was approximately 9.6 feet below reference.
Waterline Elevation = 682.7

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 N/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
215	Reinforced Concrete Pier Wall	234	LF		100	134		
220	Reinforced Concrete Footing	5	EA	5				
985	Slopes & Slope Protection	2	EA	2				
361	Scour Smart Flag	3	EA	3				



Photograph 1. View of Pier 2, Looking Southwest.



Photograph 2. View of Pier 3, Looking Southeast.



Photograph 3. View of Pier 4, Looking Southeast.



Photograph 4. View of Pier 5, Looking Southeast.



Photograph 5. View of Pier 6, Looking Southeast.



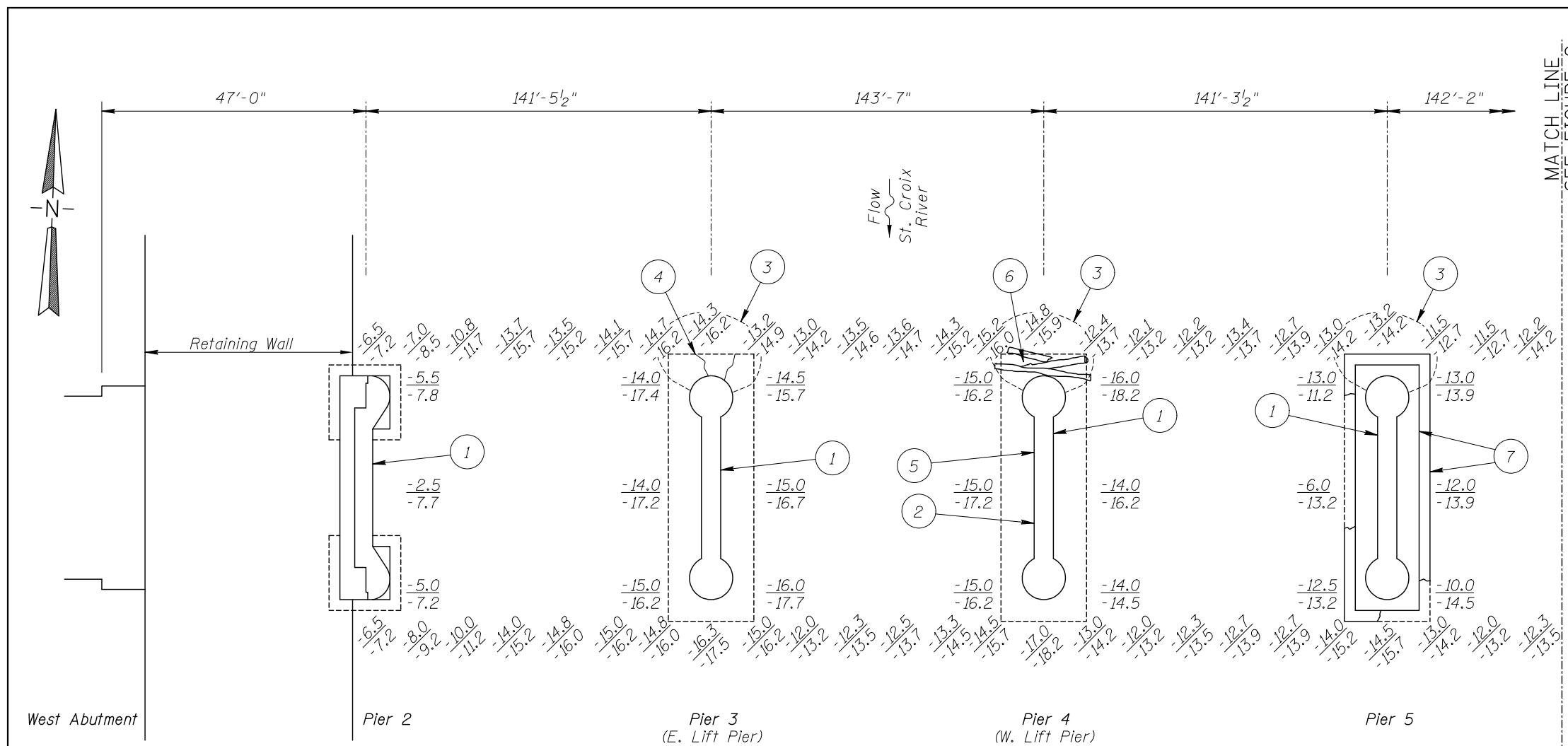
Photograph 6. View of Pier 7, Looking Southeast.



Photograph 7. View of Pier 8, Looking Southeast.



Photograph 8. View of the Concrete Section Loss on the West Face of Pier 8, Looking Southeast.



INSPECTION NOTES:

- 1 Moderate to heavy scaling with exposed reinforcing around the perimeter of Piers 2 through 5 from 1 to 3 feet below the waterline with penetration of 1 to 4 inches.
- 2 A 3 foot wide area of heavy scaling from 1 to 5 feet below the waterline with 4 to 5 inches of penetration at Pier 4 at the downstream 1/4 point on the west side.
- 3 A scour depression, with a radius of 15 feet and a depth of 1 to 3 feet, at the upstream nose of Piers 3, 4, and 5.
- 4 There was a small area of footing exposure at the upstream nose of Pier 3 with no vertical exposure.
- 5 An 1/8 inch wide crack from 10 feet below the waterline to the channel bottom at the upstream 1/4 point on the west side of Pier 4.
- 6 Moderate timber debris accumulation, consisting of three 1 foot diameter logs, was located at the upstream nose of Pier 4.
- 7 The footing at Pier 5 was fully exposed around the entire perimeter of the pier. The seal at Pier 5 was partially exposed for 3 feet downstream from the northwest corner, across the upstream face down to the centerline of the downstream column along the east face. In addition, the seal was exposed for 12 feet north and 5 feet east from the southwest corner. The exposures were 1.5 foot at the southwest corner and 1 and 2 feet at the northwest and northeast corners, respectively.

SOUNDING PLAN

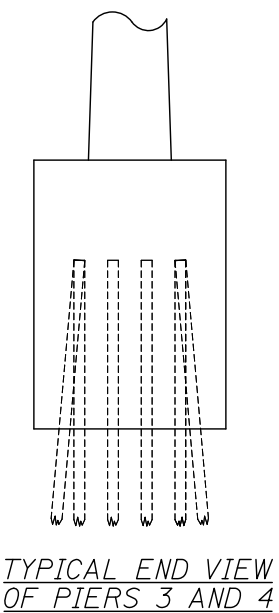
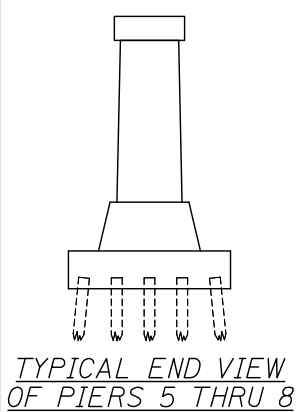
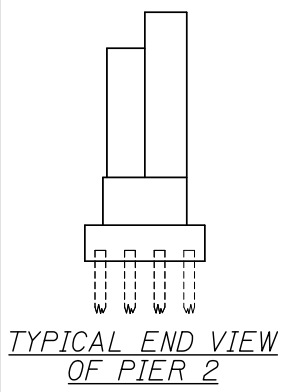
Legend

-12.7	Sounding Depth from Waterline (10/30/08)
-10.3	Sounding Depth from Waterline (10/19/00)

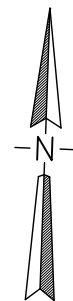
Note
All soundings based on 2008 waterline location.

GENERAL NOTES:

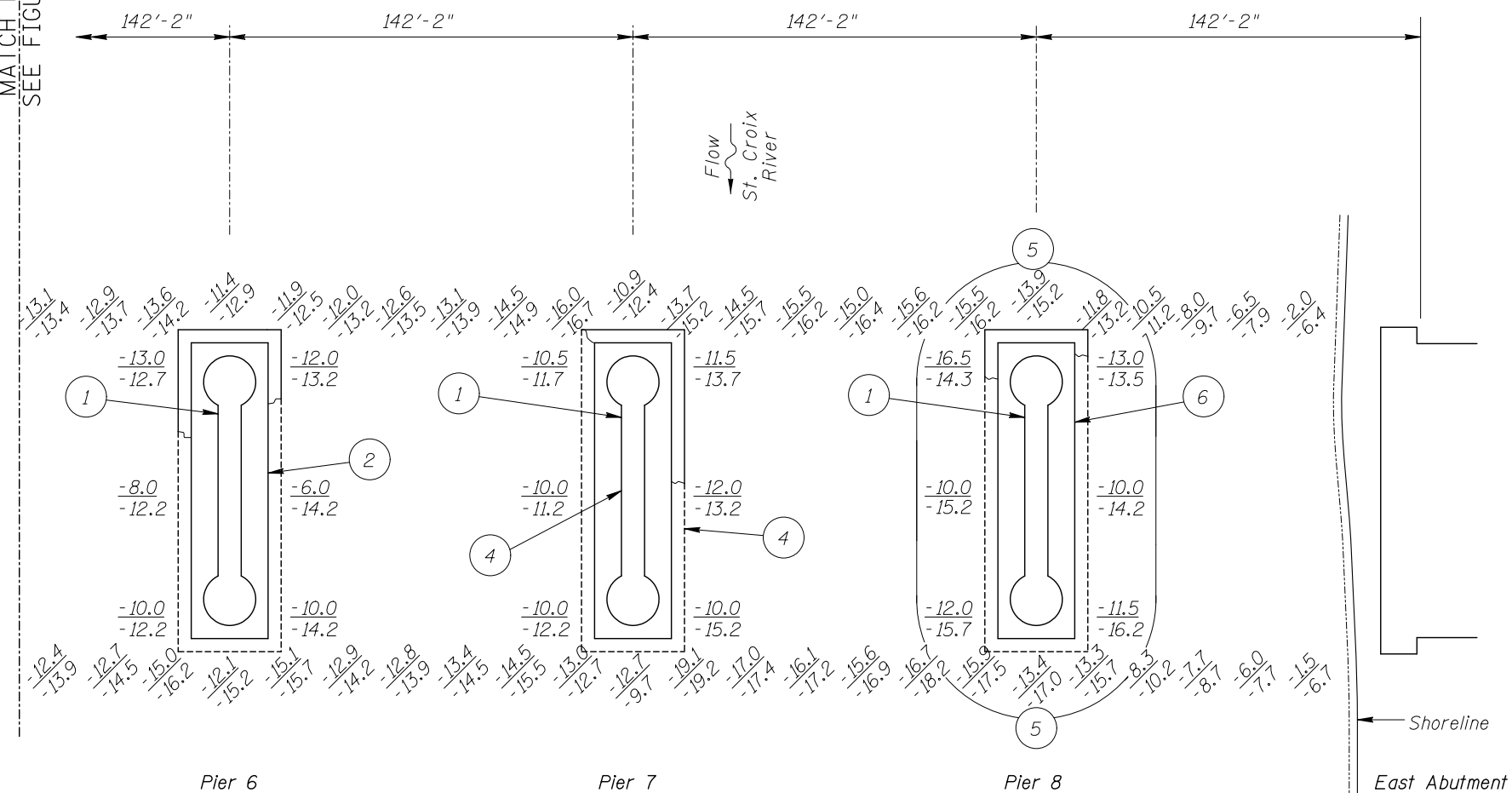
1. Piers 2 through 8 were inspected underwater.
2. At the time of inspection on October 30, 2008, the waterline was located approximately 9.6 feet below top of pier cap at Pier 4. This corresponds with a waterline elevation of 682.7 feet based on previous report dated October 19, 2000.
3. Soundings indicate the water depth at the time of inspection and are measured in feet.
4. Soundings were taken parallel to the bridge at truss panel points between the substructure units.



MINNESOTA DEPARTMENT OF TRANSPORTATION UNDERWATER BRIDGE INSPECTION		
STRUCTURE NO. 4654 OVER THE ST. CROIX RIVER DISTRICT METRO, WASHINGTON COUNTY		
INSPECTION AND SOUNDING PLAN		
Drawn By: PS	COLLINS ENGINEERS <small>123 North Wacker Drive Suite 300 Chicago, IL 60606 (312) 704-9300 www.collinsengr.com</small>	Date: OCT. 2008
Checked By: DGS		Scale: NTS
Code: 54734654		Figure No.: 1



MATCH LINE
SEE FIGURE 1



SOUNDING PLAN

INSPECTION NOTES:

- ① Moderate to heavy scaling with exposed reinforcing around the perimeter of Piers 6 through 8 from 1 to 3 feet below the waterline with penetration of 1 to 4 inches.
- ② The footing at Pier 6 was fully exposed around the entire perimeter of the pier. The seal was exposed at the upstream most end of the pier, for 10 feet along the west face and 5 feet along the east face from the upstream end of the pier. The exposure ranged from 1 foot at the northeast corner to 2 feet at the northwest corner.
- ③ The footing at Pier 7 was fully exposed around the entire perimeter of the pier. The seal was exposed along the entire upstream face with 6 inches of vertical exposure and along the east face to the midpoint with 1 foot of maximum vertical exposure.
- ④ A 4 foot by 4 foot area of poor consolidation with 1/2 inch penetration at the midpoint on the west side of Pier 7.
- ⑤ Areas of scaling related heavy section loss from 4 feet above to 2 feet below the waterline with 2 to 6 inches of penetration and exposed reinforcing steel around the entire perimeter of Pier 8.
- ⑥ The footing at Pier 8 was fully exposed around the entire perimeter of the pier with 4 feet (full footing height) of vertical exposure. The seal at Pier 8 was exposed for 12 feet and undermined for 10 feet across the upstream nose from the northeast corner as well as exposed for 5 feet and undermined for 4 feet along the west side. The undermining exhibited 6 inch high cavity with minimal penetration and no piles exposed.

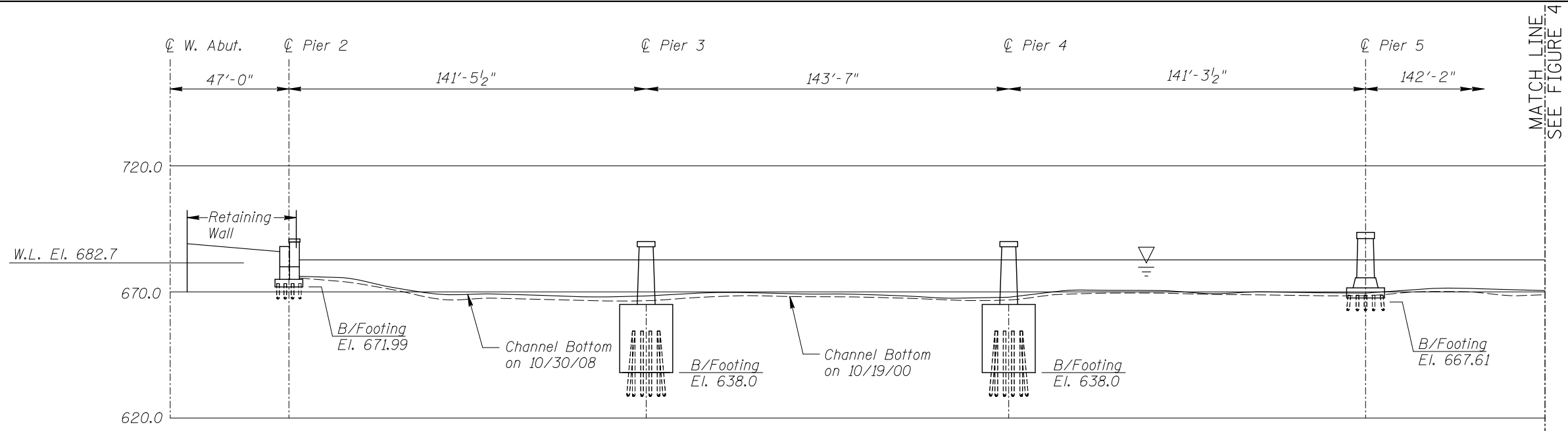
Legend

- 12.7 Sounding Depth from Waterline (10/30/08)
- 10.3 Sounding Depth from Waterline (10/19/00)

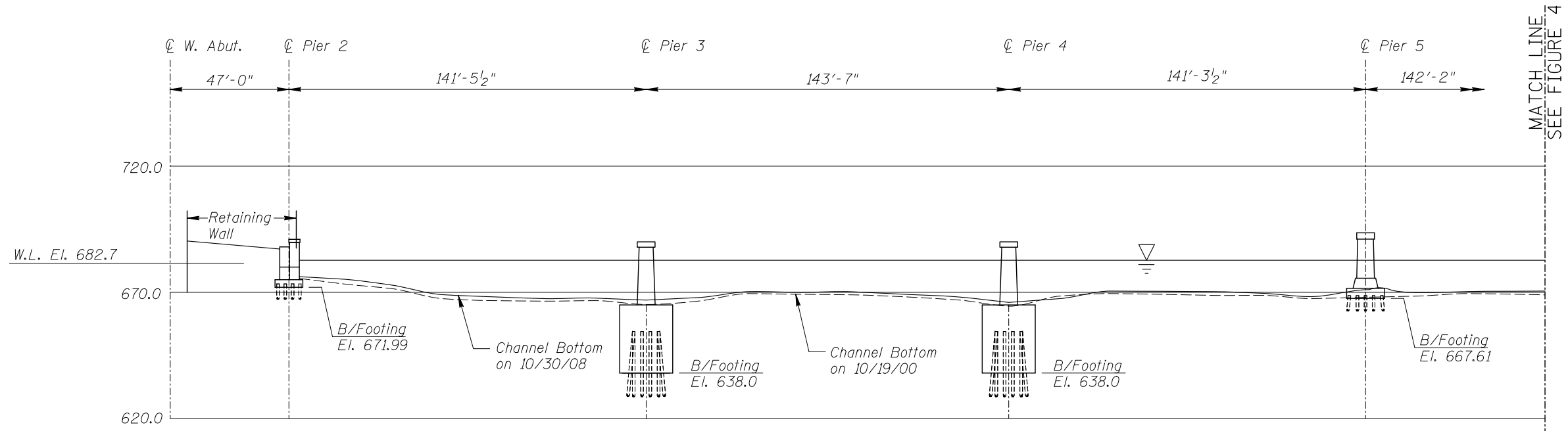
Notes

Refer to Figure 1 for General Notes.
All soundings based on 2008 waterline location.

MINNESOTA DEPARTMENT OF TRANSPORTATION UNDERWATER BRIDGE INSPECTION		
STRUCTURE NO. 4654 OVER THE ST. CROIX RIVER DISTRICT METRO, WASHINGTON COUNTY		
INSPECTION AND SOUNDING PLAN		
Drawn By: PS	COLLINS ENGINEERS <small>123 North Wacker Drive Suite 300 Chicago, IL 60606 (312) 704-9300 www.collinsengr.com</small>	Date: OCT. 2008
Checked By: DGS		Scale: NTS
Code: 54734654		Figure No.: 2



UPSTREAM FASCIA PROFILE

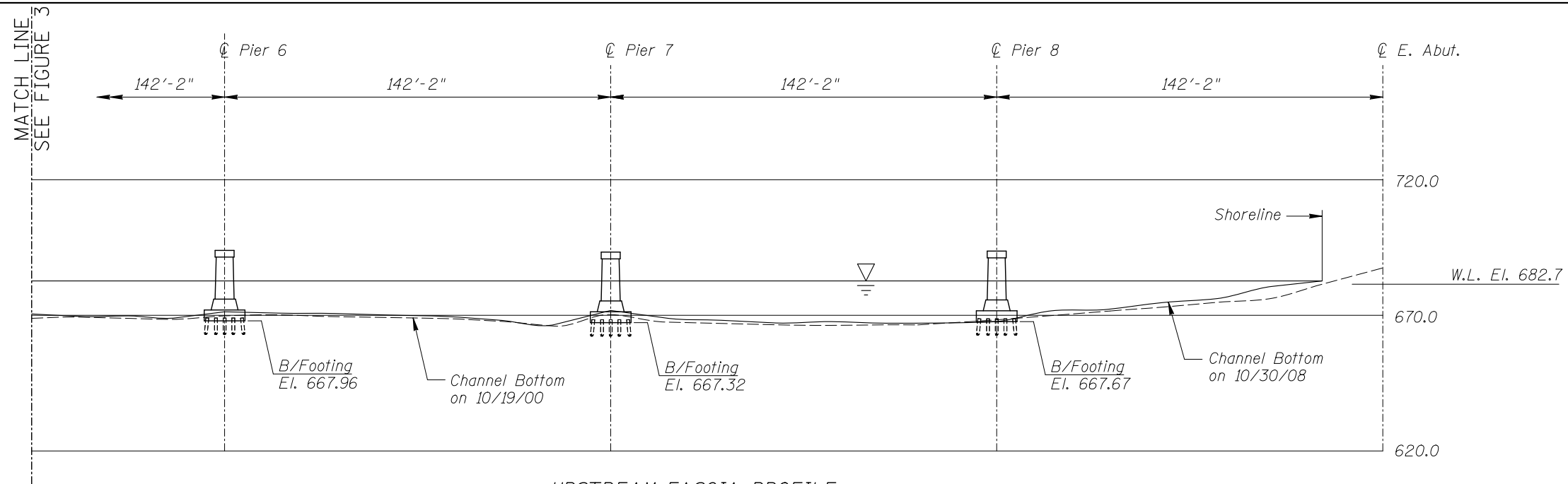


DOWNSTREAM FASCIA PROFILE

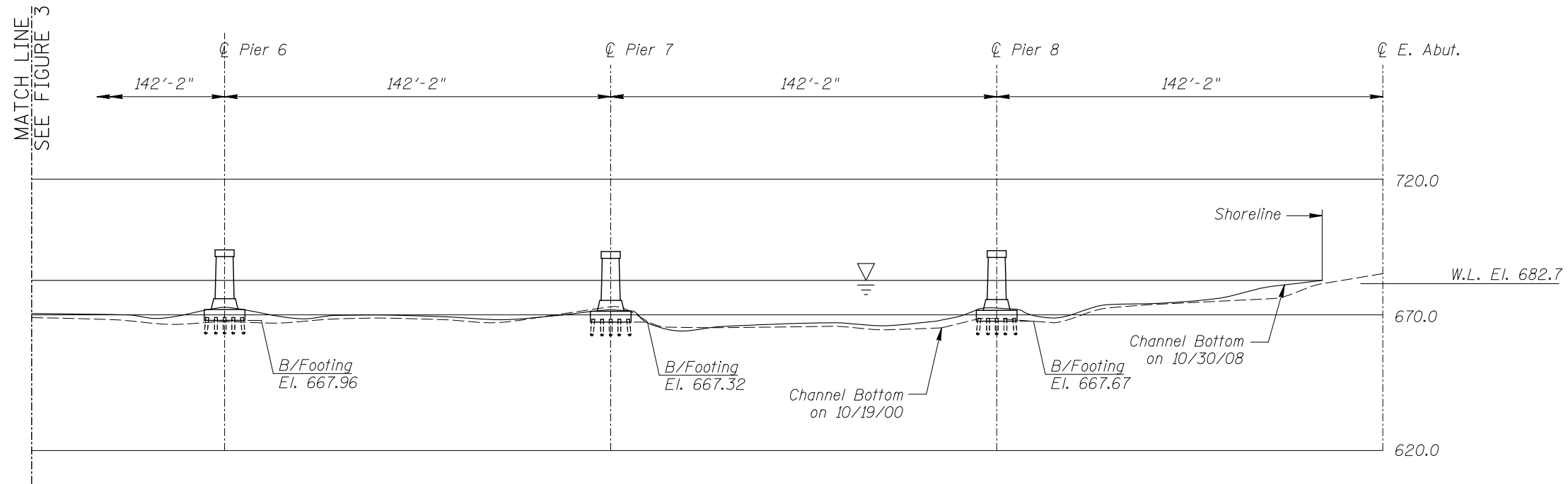
Note:
Refer to Figure 1 for General Notes.

MINNESOTA DEPARTMENT OF TRANSPORTATION UNDERWATER BRIDGE INSPECTION		
STRUCTURE NO. 4654 OVER THE ST. CROIX RIVER DISTRICT METRO, WASHINGTON COUNTY		
UPSTREAM AND DOWNSTREAM FASCIA PROFILES		
Drawn By: PS	COLLINS ENGINEERS	Date: OCT. 2008
Checked By: DGS		Scale: 1"=50'
Code: 54734654		Figure No.: 3

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Suite 300
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www.collinsengr.com



UPSTREAM FASCIA PROFILE



DOWNSTREAM FASCIA PROFILE

Note:
Refer to Figure 1 for General Notes.

MINNESOTA DEPARTMENT OF TRANSPORTATION UNDERWATER BRIDGE INSPECTION		
STRUCTURE NO. 4654 OVER THE ST. CROIX RIVER DISTRICT METRO, WASHINGTON COUNTY		
UPSTREAM AND DOWNSTREAM FASCIA PROFILES		
Drawn By: PS	COLLINS ENGINEERS <small>123 North Wacker Drive Suite 300 Chicago, IL 60606 (312) 704-9300 www.collinsengr.com</small>	Date: OCT. 2008
Checked By: DGS		Scale: 1"=50'
Code: 54734654		Figure No.: 4

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

INSPECTORS: Collins Engineers, Inc. DATE: October 30, 2008

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

BRIDGE NO: 4654 WEATHER: Sunny, 65° F

WATERWAY CROSSED: St. Croix River

DIVING OPERATION: SCUBA SURFACE SUPPLIED AIR
 OTHER

PERSONNEL: Nicholas R. Triandafilou, Piotr Sawulski

EQUIPMENT: Scuba, Camera, Sounding Rod, Tending Line, Boat w/motor, hand
sonder

TIME IN WATER: 4:30 P.M.

TIME OUT OF WATER: 5:40 P.M.

WATERWAY DATA: VELOCITY 0.5 ft/s

VISIBILITY 3.0 feet

DEPTH 17.0 feet maximum at Pier 4

ELEMENTS INSPECTED: Piers 2 through 8

REMARKS: Piers 2 through 8 were found to be mostly in satisfactory condition with
no defects of immediate structural significance noted. The concrete of the piers typically
exhibited moderate to at times heavy scaling with exposed reinforcing steel located at and
around the waterline. Concrete section loss related to the heavy scaling with up to 6
inches of penetration and exposed reinforcing bars was noted around the entire perimeter
of Pier 8. The natural channel bottom was typically covered with scattered construction
debris consisting of concrete rubble and steel rebar. Minor scour depressions up to 3 feet
deep were noted at the upstream nose of Piers 3 through 5. Pier footing exposure was
noted at Pier 3, 5, 6, 7, and 8, with minor footing undermining at Pier 8. Moderate timber
debris accumulation was observed at the upstream nose of Piers 4.

FURTHER ACTION NEEDED: _____ YES _____ X _____ NO

The amount of footing and seal exposure at Piers 3, 5, 6, and 7, as well as the minor undermining cavity under the seal at Pier 8, is currently not a significant structural concern given the current extent and the fact that piers are pile supported. It is therefore only recommended that the foundation exposures and/or undermining at these piers continue to be monitored during future underwater inspections. Should the inspections reveal that the condition have significantly progressed; corrective actions may then be required at that time.

The moderate to heavy scaling at all of the inspected substructure units, as well as the heavier related concrete section loss, especially at Pier 8 are not structural concerns at this time given their size compared to the overall pier size; however, consideration should be given to repairing these areas to prevent corrosion of the exposed steel reinforcement from accelerating the rate of deterioration of the surrounding concrete, and consequently, leading to more detrimental condition. Repairs would include removal of all unsound concrete, cleaning and replacing reinforcing steel as required, and placing concrete designed to provide high durability with low permeability.

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. 4654
 INSPECTORS Collins Engineers, Inc.
 ON-SITE TEAM LEADER. Daniel G. Stromberg, P.E.
 WATERWAY CROSSED St. Croix River

INSPECTION DATE October 30, 2008
 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

UNIT REFERENCE NO.	UNIT DESCRIPTION	MAXIMUM DEPTH OF WATER	SUBSTRUCTURE					CHANNEL					GENERAL						
			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 2	6.5'	N	6	N	8	N	6	N	8	8	N	7	6	N	N	6	N	N
	Pier 3	16.3'	N	6	N	8	N	6	7	N	N	N	6	6	N	N	6	N	N
	Pier 4	17.0'	N	6	N	8	N	6	7	N	N	6	6	6	N	N	6	N	N
	Pier 5	14.5'	N	6	N	8	N	6	7	N	N	N	6	6	N	N	6	N	N
	Pier 6	13.0'	N	6	N	8	N	6	N	N	N	N	6	6	N	N	6	N	N
	Pier 7	12.7'	N	6	N	8	N	6	N	N	N	N	6	6	N	N	6	N	N
	Pier 8	16.5'	N	5	N	8	N	5	N	8	7	N	6	5	N	N	5	N	N

*UNDERWATER PORTION ONLY

REMARKS: Piers 2 through 8 were found to be mostly in satisfactory condition with no defects of immediate structural significance noted. The concrete of the piers typically exhibited moderate to at times heavy scaling with exposed reinforcing steel located at and around the waterline. Concrete section loss related to the heavy scaling with up to 6 inches of penetration and exposed reinforcing bars was noted around the entire perimeter of Pier 8. The natural channel bottom was typically covered with scattered construction debris consisting of concrete rubble and steel rebar. Minor scour depressions up to 3 feet deep were noted at the upstream nose of Piers 3 through 5. Pier footing exposure was noted at Pier 3, 5, 6, 7, and 8, with minor footing undermining at Pier 8. Moderate timber debris accumulation was observed at the upstream nose of Piers 4.

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.