

UNDERWATER BRIDGE INSPECTION REPORT

---

STRUCTURE NO. 7766

CSAH 108

OVER THE

PALEFACE RIVER

ST. LOUIS COUNTY

---



---

SEPTEMBER 20, 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. 7766, the East and West Abutments, were found to be in poor condition, with several defects of structural significance. The concrete of all the wingwalls and tapered concrete columns typically exhibited heavy scaling, unsound concrete substrate, and concrete delaminations typically 1 inch thick. The backwall concrete was in satisfactory condition with random vertical and horizontal cracks up to 1/8 inch wide and moderate scaling with up to 1/2 inch of penetration. The concrete caissons were exposed at most columns and were sound.

INSPECTION FINDINGS:

- (A) The channel bottom material typically consisted of gravel and silt with a maximum probe rod penetration of 1 foot.
- (B) The southwest and northeast wingwalls and the southwest and northeast concrete tapered columns exhibited heavy scaling with up to 4 inches of penetration. Reinforcing steel was exposed with a maximum loss of section of approximately 15 percent. The exposed concrete substrate was typically unsound and exhibited delaminations up to 1 inch thick.
- (C) The concrete backwalls were generally sound with random vertical and horizontal cracks up to 1/8 inch wide and moderate scaling with up to 1/2 inch of penetration. The backwalls (between the caissons) were typically undermined a maximum of 1 foot horizontally and 1 foot vertically at the West Abutment and 1.5 feet horizontally and 1 foot vertically at the East Abutment.
- (D) The center tapered concrete column of the East and West Abutments was generally sound exhibiting scaling with up to 1/2 inch of penetration extending from the top of the column to the caisson.
- (E) The northwest wingwall exhibited delaminations and unsound concrete over its entire surface area.

- (F) A area of heavy scaling measuring 2 feet wide was observed on the northwest corner of the north tapered concrete column of the West Abutment extending from the channel bottom to 3 feet above the waterline with a maximum penetration of 3 inches. The concrete substrate is very unsound with cracking and typically 1 inch thick delaminations.
- (G) The southeast wingwall and southeast concrete tapered column exhibited heavy scaling with up to 8 inches of penetration. Reinforcing steel was exposed with a maximum loss of section of approximately 15 percent. The exposed concrete substrate was typically unsound and exhibited delaminations up to 1 inch thick.

#### RECOMMENDATIONS:

- (A) The heavy scaling, unsound concrete and associated concrete delaminations at all wingwalls are not significant structural concerns at this time, however, they should be repaired or replaced to prevent further, more detrimental deterioration. Prior to making any repairs, insitu concrete testing should be preformed to establish the suitability of repairs. If repaired, the repairs should include removal of concrete to a minimum of 1 inch behind the reinforcing steel, cleaning and replacing reinforcing steel as required, and placing concrete designed to provide high durability with low permeability.
- (B) The heavy scaling, unsound concrete and associated concrete delaminations at all the tapered concrete columns and concrete backwall are not significant structural concerns at this time; however, they should be repaired to prevent further deterioration. Prior to considering any repairs, concrete core samples of the concrete should be taken and petrographic analysis to determine the cause of the heavy concrete deterioration and depth of unsound concrete should be performed. If repairs are deemed appropriate, they should include removal of concrete to a minimum of 1 inch behind the reinforcing steel, cleaning and replacing reinforcing steel as required, and placing concrete designed to provide high durability with low permeability.

- (C) In light of the considerable deterioration at the bridge, an overall evaluation of bridge replacement options should be conducted, including taking in the results of any existing concrete condition testing.
  
- (D) Reinspect the submerged substructure at the normal maximum recommended (NBIS) interval of sixty (60) months.

Respectfully submitted,

Inspection Team Leader:

*Nicholas R. Triandafilou*

Nicholas R. Triandafilou, 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*  
Daniel G. Stromberg

Registered Professional

Engineer, State of Minnesota

MINNESOTA DEPARTMENT OF TRANSPORTATION  
UNDERWATER BRIDGE INSPECTION

1. BRIDGE DATA

Bridge Number: 7766

Feature Crossed: Paleface River

Feature Carried: CSAH 108

Location: St. Louis County

Bridge Description: The superstructure consists of a concrete deck supported by steel I-Beams. The superstructure is supported by two concrete abutments consisting of three tapered concrete columns founded on 4.5 foot diameter concrete caissons. There is a 1.5 foot thick concrete backwall that runs between the columns and extends down to the concrete caissons.

2. INSPECTION DATA

Professional Engineer Diver: Nicholas R. Triandafilou, P.E.

Dive Team: Marc B. Parker, Clay G. Brookins

Date: September 20, 2012

Weather Conditions: Raining, 50° F

Underwater Visibility: 1 foot

Waterway Velocity: None / Negligible

3. SUBSTRUCTURE INSPECTION DATA

Substructure Inspected: The East and West Abutments

General Shape: The East and West Abutments consist of three tapered concrete columns founded on 4.5 foot diameter concrete caissons. There was a 1.5 foot thick concrete backwall between the columns that extends down to the concrete caissons.

Maximum Water Depth at Substructure Inspected: Approximately 4.8 feet.

4. WATERLINE DATUM

Water Level Reference: Top of the bearing seat at the south end of the West Abutment.

Water Surface: The waterline was approximately 1.8 feet below the reference.

Waterline Elevation 98.2

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 7

Item 92B: Underwater Inspection: Code B/09/12

Item 113: Scour Critical Bridges: Code I/12

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
205	Concrete Columns	6	EA	0	2	4	0	n/a
215	Concrete Abutments	46	LF	0	32	14	0	n/a
220	Concrete Footing	6	EA	0	6	0	0	n/a
387	Concrete Wingwalls	4	EA	0	0	0	4	n/a
361	Scour	1	EA	1	0	0	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 South.



Photograph 2. View of the East Abutment, Looking Northeast.



Photograph 3. View West Abutment, Looking Northwest.



Photograph 4. View of the Typical Wingwall Concrete Substrate and Exposed Reinforcing Steel, Looking East.



Photograph 5. View of the Southeast Wingwall, Looking Northeast.



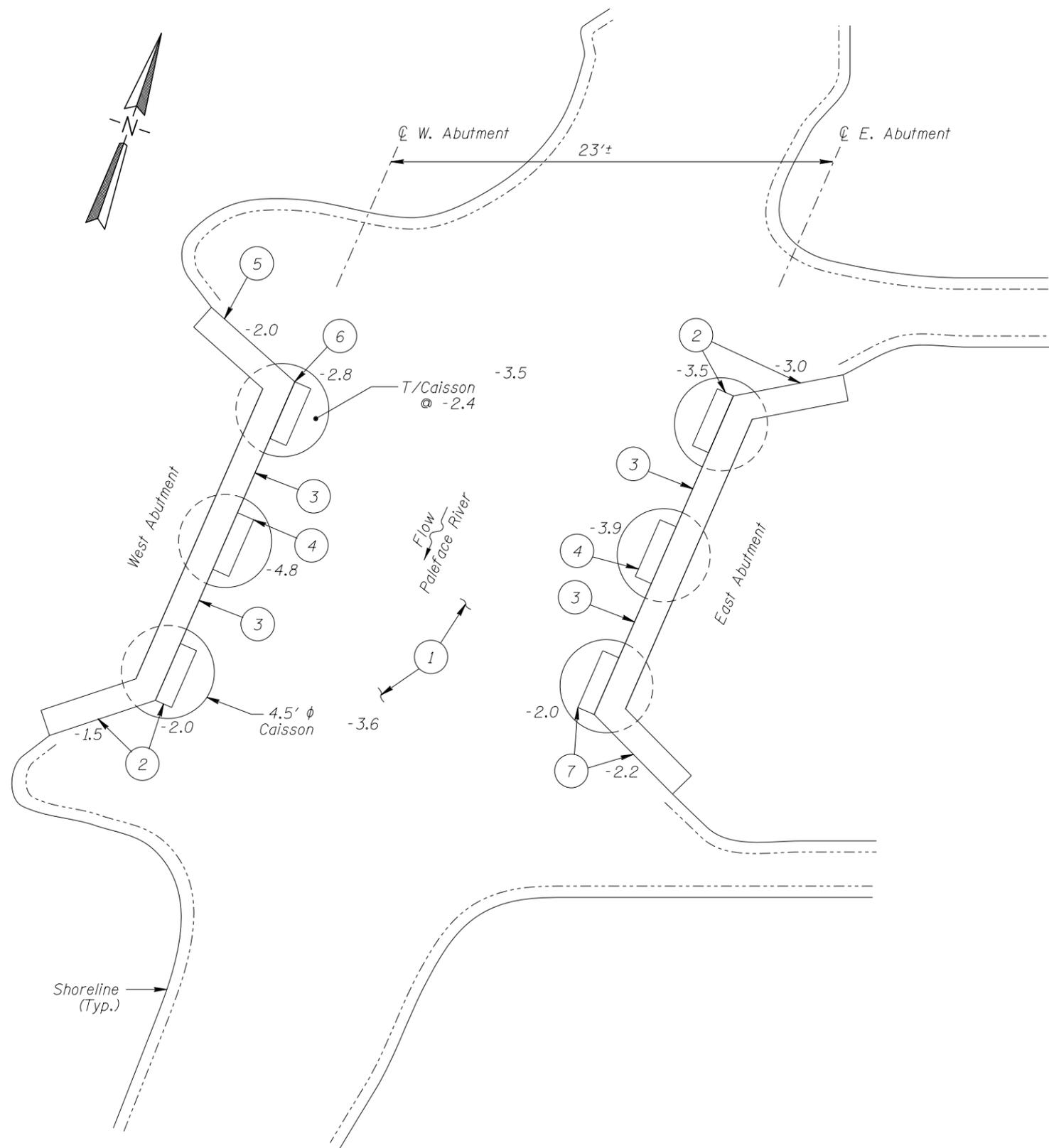
Photograph 6. View of the Southwest Wingwall, Looking Northwest.



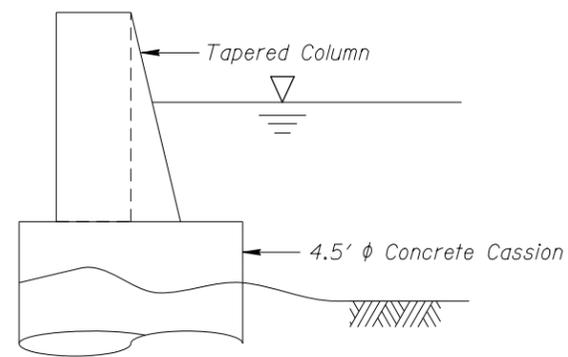
Photograph 7. View of the Northeast Wingwall, Looking East.



Photograph 8. View of the Northwest Wingwall, Looking West.



SOUNDING PLAN



TYPICAL END VIEW OF ABUTMENTS

INSPECTION NOTES:

- ① The channel bottom material typically consisted of gravel and silt with a maximum probe rod penetration of 1 foot.
- ② The southwest and northeast wingwalls and the southwest and northeast concrete tapered columns exhibited heavy scaling with up to 4 inches of penetration. Reinforcing steel was exposed with a maximum loss of section of approximately 15 percent. The exposed concrete substrate was typically unsound and exhibited delaminations up to 1 inch thick.
- ③ The concrete backwalls were generally sound with random vertical and horizontal cracks up to 1/8 inch wide and moderate scaling with up to 1/2 inch of penetration. The backwalls (between the caissons) were typically undermined a maximum of 1 foot horizontally and 1 foot vertically at the West Abutment and 1.5 feet horizontally and 1 foot vertically at the East Abutment.
- ④ The center tapered concrete column of the East and West Abutments was generally sound exhibiting scaling with up to 1/2 inch of penetration extending from the top of the column to the caisson.
- ⑤ The northwest wingwall exhibited delaminations and unsound concrete over its entire surface area.
- ⑥ A area of heavy scaling measuring 2 feet wide was observed on the northwest corner of the north tapered concrete column of the West Abutment extending from the channel bottom to 3 feet above the waterline with a maximum penetration of 3 inches. The concrete substrate is very unsound with cracking and typically 1 inch thick delaminations.
- ⑦ The southeast wingwall and southeast concrete tapered column exhibited heavy scaling with up to 8 inches of penetration. Reinforcing steel was exposed with a maximum loss of section of approximately 15 percent. The exposed concrete substrate was typically unsound and exhibited delaminations up to 1 inch thick.

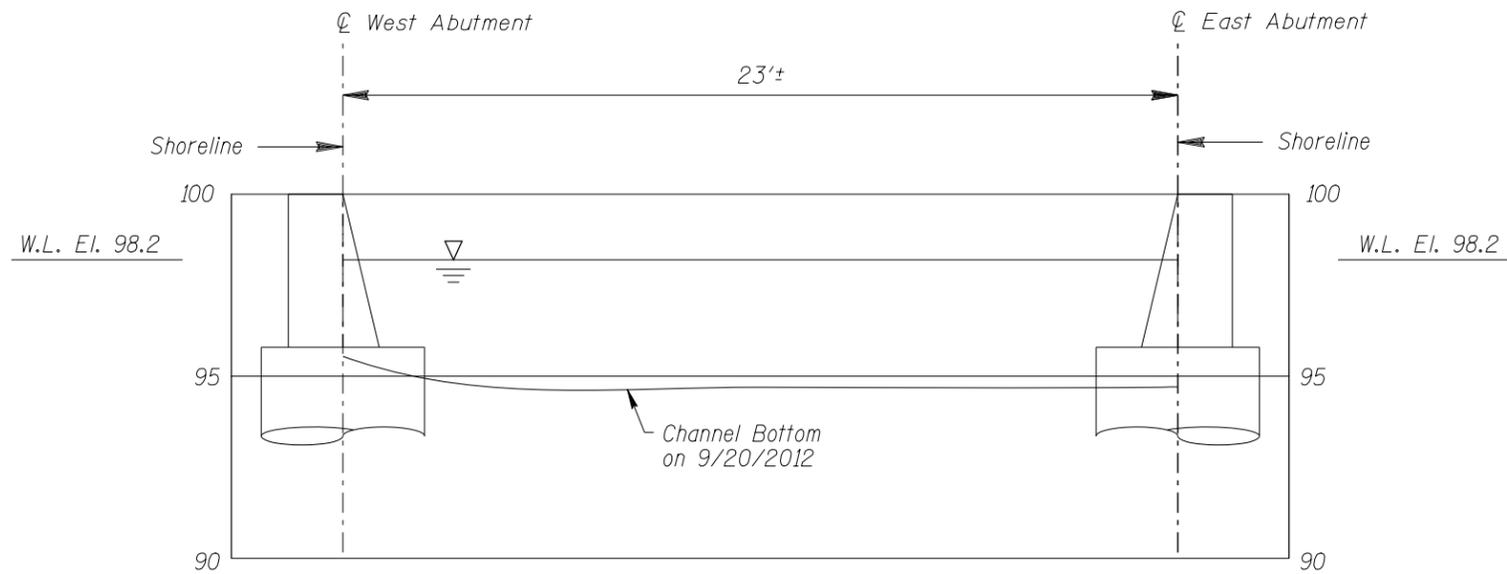
GENERAL NOTES:

1. The East and West Abutments were inspected during the underwater inspection.
2. At the time of inspection on September 20, 2012, the waterline was located approximately 1.8 feet below the bearing seat at the south side of the West Abutment. Since elevation information was not available a reference elevation of 100.0 was assumed. Based on the assumed reference the waterline elevation was 98.2.
3. Soundings indicate the water depth at the time of inspection and are measured in feet.

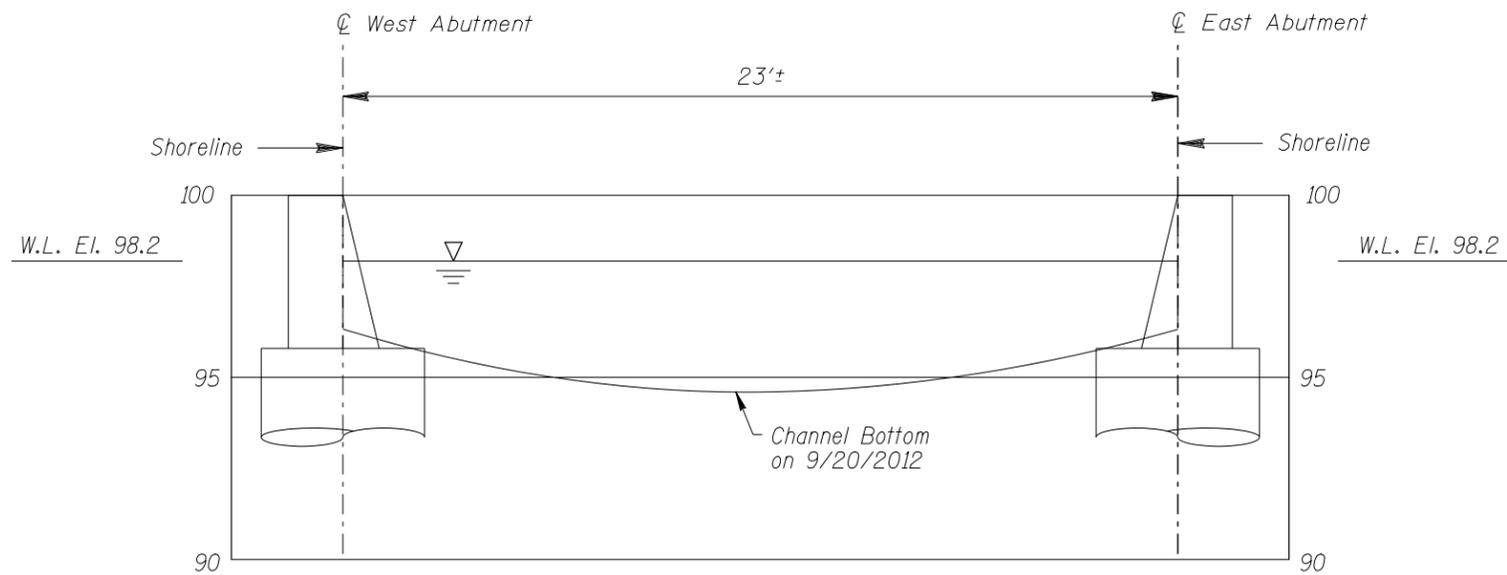
Legend

- 1.0 Sounding Depth from Waterline (9/20/2012)
- ① Inspection Note Number

<b>MINNESOTA DEPARTMENT OF TRANSPORTATION UNDERWATER BRIDGE INSPECTION</b>		
STRUCTURE NO. 7766 CSAH 108 OVER THE PALEFACE RIVER ST. LOUIS COUNTY		
<b>INSPECTION AND SOUNDING PLAN</b>		
Drawn By: MBP	<b>COLLINS ENGINEERS</b>	Date: NOVEMBER, 2012
Checked By: LJ	<small>123 North Wacker Drive Suite 900 Chicago, IL 60606 (312) 704-9300 www.collinsengr.com</small>	Scale: NTS
Code: 74237766		Figure No.: 1



UPSTREAM FASCIA PROFILE



DOWNSTREAM FASCIA PROFILE

Note:  
Refer to Figure 1 for General Notes.

<b>MINNESOTA DEPARTMENT OF TRANSPORTATION UNDERWATER BRIDGE INSPECTION</b>		
STRUCTURE NO. 7766 CSAH 108 OVER THE PALEFACE RIVER ST. LOUIS COUNTY		
<b>UPSTREAM AND DOWNSTREAM FASCIA PROFILES</b>		
Drawn By: MBP	<b>COLLINS ENGINEERS</b>	Date: NOVEMBER, 2012
Checked By: LJ		Scale: 1"=5'
Code: 74237766		Figure No.: 2

MINNESOTA DEPARTMENT OF TRANSPORTATION  
OFFICE OF BRIDGES AND STRUCTURES

DAILY DIVING REPORT

INSPECTORS: Collins Engineers, Inc. DATE: September 20, 2012

ON-SITE TEAM LEADER: Nicholas R. Triandafilou, P.E.

BRIDGE NO: 7766 WEATHER: Raining, 50° F

WATERWAY CROSSED: Paleface River

DIVING OPERATION:  SCUBA  SURFACE SUPPLIED AIR  
 OTHER

PERSONNEL: Marc B. Parker, Clayton G. Brookins

EQUIPMENT: Commercial Scuba, Probe Rod, Camera, Hand Tools

TIME IN WATER: 9:40 A.M.

TIME OUT OF WATER: 10:40 A.M.

WATERWAY DATA: VELOCITY None / Negligible

VISIBILITY 1 foot

DEPTH 4.8 feet maximum

ELEMENTS INSPECTED: The East and West Abutments

REMARKS: Overall, the substructure units inspected underwater were found to be in poor condition, with several defects of structural significance. The concrete of all the wingwalls and tapered concrete columns typically exhibited heavy scaling, unsound concrete substrate, and concrete delaminations typically 1 inch thick. The backwall concrete was in satisfactory condition with random vertical and horizontal cracks up to 1/8 inch wide and moderate scaling with up to 1/2 inch of penetration. The concrete caissons were exposed at most columns and were sound.

FURTHER ACTION NEEDED:      X   YES               NO

The heavy scaling, unsound concrete and associated concrete delaminations at all wingwalls are not significant structural concerns at this time, however, they should be repaired or replaced to prevent further, more detrimental deterioration. Prior to making any repairs, insitu concrete testing should be performed to establish the suitability of repairs. If repaired, the repairs should include removal of concrete to a minimum of 1 inch behind the reinforcing steel, cleaning and replacing reinforcing steel as required, and placing concrete designed to provide high durability with low permeability.

The heavy scaling, unsound concrete and associated concrete delaminations at all the tapered concrete columns and concrete backwall are not significant structural concerns at this time; however, they should be repaired to prevent further deterioration. Prior to considering any repairs, concrete core samples of the concrete should be taken and petrographic analysis to determine the cause of the heavy concrete deterioration and depth of unsound concrete should be performed. If repairs are deemed appropriate, they should include removal of concrete to a minimum of 1 inch behind the reinforcing steel, cleaning and replacing reinforcing steel as required, and placing concrete designed to provide high durability with low permeability.

In light of the considerable deterioration at the bridge, an overall evaluation of bridge replacement options should be conducted, including taking in the results of any existing concrete condition testing.

Reinspect the submerged substructure at the normal maximum recommended (NBIS) interval of sixty (60) months.

MINNESOTA DEPARTMENT OF TRANSPORTATION  
OFFICE OF BRIDGES AND STRUCTURES

UNDERWATER INSPECTION CONDITION RATING FORM

BRIDGE NO. 7766  
 INSPECTORS Collins Engineers, Inc.  
 ON-SITE TEAM LEADER Nicholas R. Triandafilou, P.E.  
 WATERWAY CROSSED Paleface River

INSPECTION DATE September 20, 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

UNIT REFERENCE NO.	UNIT DESCRIPTION	MAXIMUM DEPTH OF WATER	SUBSTRUCTURE					CHANNEL					GENERAL						
			PILING	COLUMNS, SHAFTS, OR FACES*	FOOTINGS	DISPLACEMENT	OTHER (BACKWALLS + WINGWALLS)	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
	East Abutment	3.9'	N	4	6	N	3	4	8	N	8	N	8	4	N	5	4	N	N
	West Abutment	4.8'	N	4	6	N	3	4	8	N	8	N	8	4	N	5	4	N	N

\*UNDERWATER PORTION ONLY

REMARKS: Overall, the substructure units inspected underwater were found to be in poor condition, with several defects of structural significance. The concrete of all the wingwalls and tapered concrete columns typically exhibited heavy scaling, unsound concrete substrate, and concrete delaminations typically 1 inch thick. The backwall concrete was in satisfactory condition with random vertical and horizontal cracks up to 1/8 inch wide and moderate scaling with up to 1/2 inch of penetration. The concrete caissons were exposed at most columns and were sound.

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.