UNDERWATER BRIDGE INSPECTION REPORT

STRUCTURE NO. 89859

CSAH NO. 31

OVER THE

REDWOOD RIVER

DISTRICT 8 – REDWOOD COUNTY

OCTOBER 24, 2012

PREPARED FOR THE

MINNESOTA DEPARTMENT OF TRANSPORTATION

BY

AYRES ASSOCIATES & COLLINS ENGINEERS, INC.

JOB NO. 7423

MINNESOTA DEPARTMENT OF TRANSPORTATION
UNDERWATER BRIDGE INSPECTION

REPORT SUMMARY:

The substructure units inspected below water at Bridge No. 89859, the South and North Abutments and Piers 1 through 8, were typically found to be in satisfactory to fair condition. Pier 9, however, was found to be in serious condition with extensive loss of stone masonry and a significant reduction of pier load bearing capacity. The loss bearing was estimated at approximately 75 percent of the pier cross sectional area. Additionally, Piers 1 and 7 had voids / areas of undercutting at the streambed with 6 inches to 1 foot of horizontal penetration. Piers 5 and 6 had areas of missing masonry stones. The streambed material was composed of large rocks / bedrock and appeared stable.

INSPECTION FINDINGS:

(A) Piers 2, 3, 6, and 8, as well as the North Abutment were encased in concrete from approximately 1.7 feet below the waterline to the channel bottom.

(B) Area of undercutting / void due to possible loss of masonry section and/or erosion of rock channel bottom was observed at the upstream nose of Pier 1 located near the streambed. The cavity measured 4 feet long by 3 inches high with up to 6 inches of horizontal penetration.

(C) Loss of masonry stones was observed across the upstream nose of Pier 1 located near the waterline and measuring approximately 2.8 feet high.

(D) One masonry stone was missing at the downstream nose of Pier 5 at 1 foot above the waterline.

(E) One masonry stone was missing near the downstream nose of Pier 6 at 1 foot below the waterline.

(F) Area of undercutting / void was observed at the streambed near the upstream nose of Pier 7. The cavity measured 2 feet wide by 6 inches high with up to 2 feet of horizontal penetration.

(G) Extensive loss of masonry stones and/or erosion of the river bottom was observed along the length of Pier 9 measuring up to 8 inches high and often exhibiting full pier width penetration. The total loss of bearing at the pier due to the above mentioned loss of section was estimated to be approximately 75 percent of the total pier cross sectional area. Above the voided area the pier masonry was intact with no displaced stone blocks and no significant loss or cracking of joint mortar.

(H) Moderate accumulation of timber debris was observed along the South Abutment extending from the channel bottom to approximately 1 foot above the waterline.

RECOMMENDATIONS:

(A) The void/loss of section at Pier 9 should be repaired at this time to restore full design bearing capacity of the pier. The repair could include (but is not limited to) encasing the entire pier in concrete and pumping grout into the voided area of the pier.

(B) Additionally, the numerous areas of masonry loss of section and missing stone blocks should be repaired/replaced in order to avoid further, more detrimental deterioration of the affected substructure units.

(C) Until the above mentioned repairs are implemented, it is recommended that the bridge remains closed to any traffic and it is reinspected after periods of high flow.

(D) If the bridge is to be repaired and reopened to traffic, reinspect the submerged substructure units following the implementation of repair measures, and if found to be structurally adequate, reinspect again at a reduced maximum underwater inspection interval of twenty four (24) months.

Inspection Team Leader:

Ayres Associates, Inc.

Brian K. Schroeder
Registered Professional Engineer
State of Minnesota

Respectfully submitted,

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: 89859

Feature Crossed: The Redwood River

Feature Carried: CSAH No. 31

Location: District 8 – Redwood County

Bridge Description: The superstructure consists of a ten span reinforced concrete slab. The superstructure is supported by two stone masonry abutments and nine stone masonry piers. The 1933 plans for the structure indicate concrete spread footings keyed into bedrock (footing were not observed during inspection). The piers are numbered 1 through 9 starting from the south end of the bridge.

2. INSPECTION DATA

Professional Engineer/Team Leader: Brian K. Schroeder, P.E.

Dive Team: Ricardo S. Narvaez, Adam J. Enderby

Date: October 24, 2012

Weather Conditions: Cloudy, 48ºF

Underwater Visibility: 6 inches

Waterway Velocity: Negligible/None

3. SUBSTRUCTURE INSPECTION DATA

Substructure Inspected: South and North Abutments and Piers 1 through 9.

General Shape: South and North Abutments and Piers 1 through 9 are of stone masonry construction. Piers 2, 3, 6, and 8 and the North Abutment are partially encased in concrete below the waterline.

Maximum Water Depth at Substructure Inspected: Approximately 6.1 feet.

4. WATERLINE DATUM

Water Level Reference: The top of the curb at the downstream end of Pier 4.

Water Surface: The waterline was approximately 6.2 feet below reference.
Estimated Waterline Elevation = 92.9.

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

Item 60: Substructure: Code 3

Item 61: Channel and Channel Protection: Code 5

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

Item 113: Scour Critical Bridges: Code R

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

X Yes _____ No

6. STRUCTURAL ELEMENT CONDITION RATING

Item #	Element Description	Quantity	Unit	Conditions				
				1	2	3	4	5
211	Masonry Pier Wall	180	LF		140	20	20	
217	Masonry Abutment	39	LF		39			
361	Scour	1	EA		1			
964	Critical Finding	1	EA		1			

Photograph 1. Overall View of the Structure, Looking Southwest.

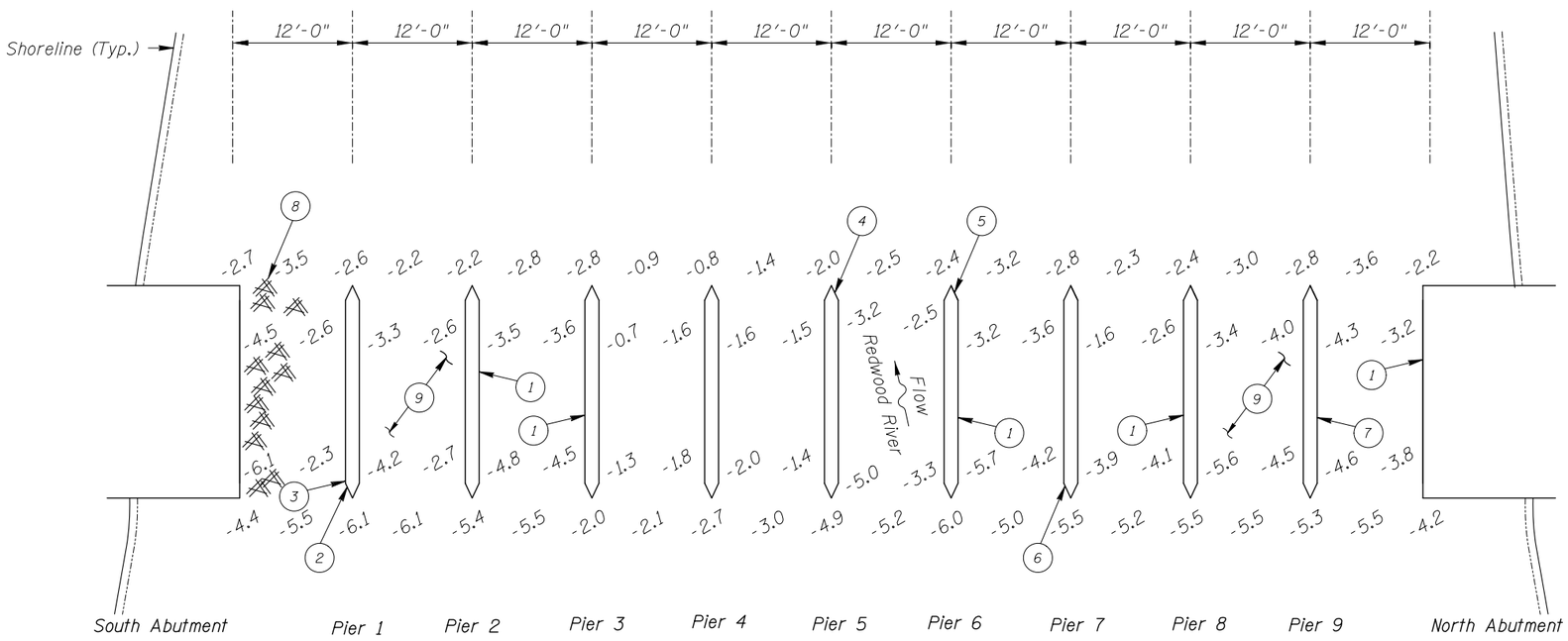
Photograph 2. View of South Abutment, Looking East.

Photograph 3. View of North Abutment, Looking East.

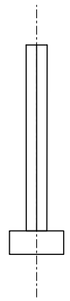
Photograph 4. View of Pier 8, Typical Pier Condition, Looking Southeast.

Photograph 5. View of Pier 6 Downstream Nose with Missing Stones, Looking Southeast.

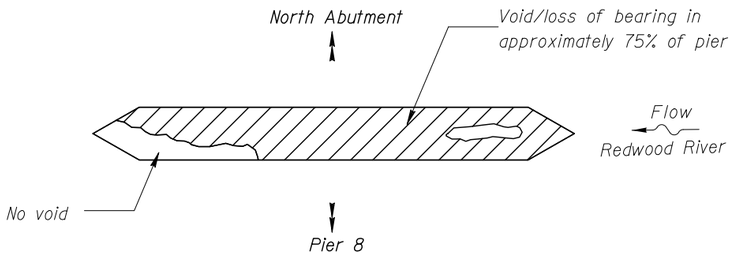
Photograph 6. View of Bridge Deck, Looking South.



SOUNDING PLAN



TYPICAL END VIEW OF PIERS



PIER 9 VOIDS

GENERAL NOTES:

1. North and South Abutments and Piers 1 through 9 were inspected at this bridge.
2. At the time of inspection on October 24, 2012, the waterline was located approximately 6.2 feet below the top of the curb at the downstream end of Pier 4. This corresponds with a waterline elevation of 92.9 based on the bridge plans dated April 5, 1933.
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 1/2 point intervals between the substructure units.

INSPECTION NOTES:

(1) Piers 2, 3, 6, and 8, as well as the North Abutment were encased in concrete from approximately 1.7 feet below the waterline to the channel bottom.

(2) Area of undercutting / void due to possible loss of masonry section and/or erosion of rock channel bottom was observed at the upstream nose of Pier 1 located near the streambed. The cavity measured 4 feet long by 3 inches high with up to 6 inches of horizontal penetration.

(3) Loss of masonry stones was observed across the upstream nose of Pier 1 located near the waterline and measuring approximately 2.8 feet high.

(4) One masonry stone was missing at the downstream nose of Pier 5 at 1 foot above the waterline.

(5) One masonry stone was missing near the downstream nose of Pier 6 at 1 foot below the waterline.

(6) Area of undercutting / void was observed at the streambed near the upstream nose of Pier 7. The cavity measured 2 feet wide by 6 inches high with up to 2 feet of horizontal penetration.

(7) Extensive loss of masonry stones and/or erosion of the river bottom was observed along the length of Pier 9 measuring up to 8 inches high and often exhibiting full pier width penetration. The total loss of bearing at the pier due to the above mentioned loss of section was estimated to be approximately 75 percent of the total pier cross sectional area. Above the voided area the pier masonry was intact with no displaced stone blocks and no significant loss or cracking of joint mortar.

(8) Moderate accumulation of timber debris was observed along the South Abutment extending from the channel bottom to approximately 1 foot above the waterline.

(9) The channel bottom material around Piers 1 through 9 typically consisted of rock and large cobbles.

Legend

-6.5 Sounding Depth from Waterline (10/24/12)

Timber Debris

MINNESOTA
DEPARTMENT OF TRANSPORTATION
UNDERWATER BRIDGE INSPECTION

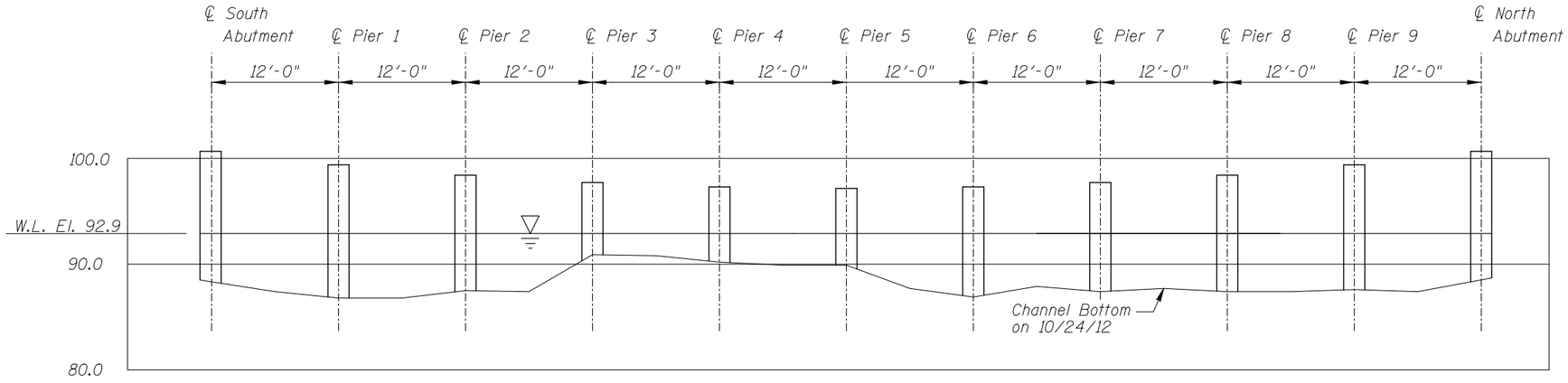
STRUCTURE NO. 89859
OVER THE REDWOOD RIVER
REDWOOD COUNTY

INSPECTION AND SOUNDING PLAN

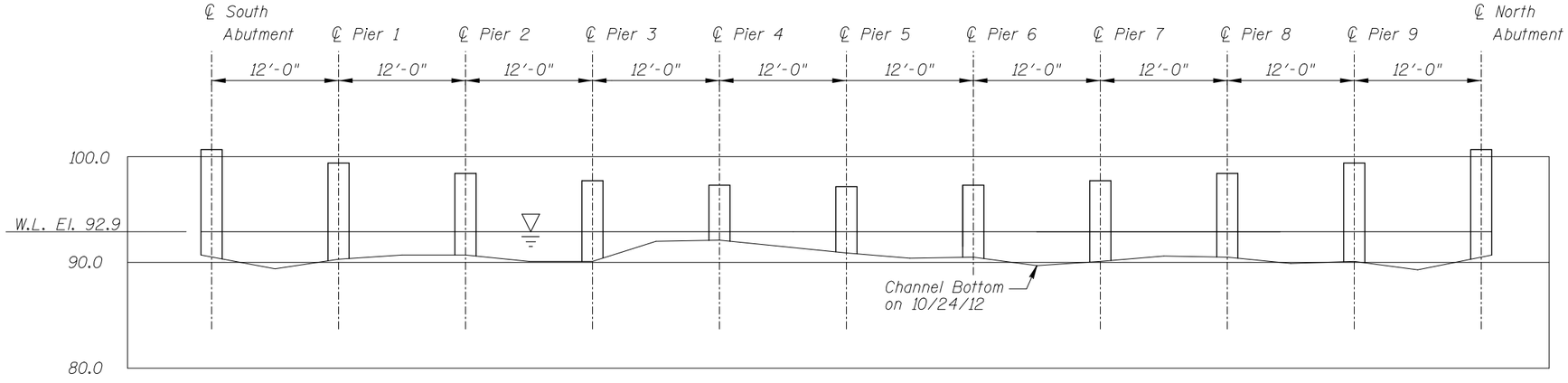
COLLINS ENGINEERS INC
123 North Wacker Drive
Suite 900
Chicago, IL 60606
(312) 704-9300
www.collinsengr.com

AYRES ASSOCIATES
3433 Oakwood Hills Parkway
Eau Claire, WI 54701
www.AyresAssociates.com

Drawn By: JAC	Date: OCT. 2012
Checked By: BKS	Scale: NTS
Code: 742389859	Figure No.: 1



UPSTREAM FASCIA PROFILE



DOWNSTREAM FASCIA PROFILE

Note:

Refer to Figure 1 for General Notes.

MINNESOTA
DEPARTMENT OF TRANSPORTATION
UNDERWATER BRIDGE INSPECTION

STRUCTURE NO. 89859
OVER THE REDWOOD RIVER
REDWOOD COUNTY

UPSTREAM AND DOWNSTREAM FASCIA PROFILES

COLLINS ENGINEERS INC
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Drawn By: JAC	Date: OCT. 2012
Checked By: BKS	Scale: NTS
Code: 742389859	Figure No.: 2

AYRES ASSOCIATES
3433 Oakwood Hills Parkway
Eau Claire, WI 54701
www.AyresAssociates.com

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

INSPECTORS: Ayres Associates DATE: October 24, 2012

ON-SITE TEAM LEADER: Brian K. Schroder, P.E.,

BRIDGE NO: 89859 WEATHER: Cloudy, 48ºF

WATERWAY CROSSED: Redwood River

DIVING OPERATION: X SCUBA _____ SURFACE SUPPLIED AIR

_____ OTHER

PERSONNEL: Ricardo S. Narvaez, Adam J. Enderby

EQUIPMENT: Commercial Scuba, Hammer, Sounding Pole, Probe Rod, Camera

TIME IN WATER: 3:45 PM

TIME OUT OF WATER: 4:30 PM

WATERWAY DATA: VELOCITY Negligible/None

VISIBILITY 6 inches

DEPTH 6.1 feet maximum at Pier 1

ELEMENTS INSPECTED: North and South Abutments, Piers 1 through 9.

REMARKS: The condition of the inspected substructure units ranged from satisfactory to serious. Pier 9 had an extensive void / loss of section along the length of the pier measuring up to 8 inches high with the horizontal penetration of up to full pier width, in total jeopardizing approximately 75% of pier cross section. Pier 1 had a void at the streambed at the upstream nose, 4 feet long by 3 inches high by 6 inches of penetration, and was missing masonry stones at the waterline 2.8 feet high by full width of the pier. Pier 5 was missing one stone at the downstream nose located 1 foot above the waterline. Pier 6 was also missing a stone 4 feet from the downstream nose at 1 foot below the waterline. Pier 7 had a void at the streambed at the upstream nose with the cavity measuring 2 feet long by 6 inches high with up to 2 feet of horizontal penetration. Concrete encasements were observed at approximately 1.7 feet below the waterline around Piers 2, 3, 6, and 8 and the North Abutment.

FURTHER ACTION NEEDED: ___X____ YES _____ NO

The void/loss of section at Pier 9 should be repaired at this time to restore full design bearing capacity of the pier. The repair could include (but is not limited to) encasing the entire pier in concrete and pumping grout into the voided area of the pier.

Additionally, the numerous areas of masonry loss of section and missing stone blocks should be repaired/replaced in order to avoid further, more detrimental deterioration of the affected substructure units.

Until the above mentioned repairs are implemented, it is recommended that the bridge remains closed to any traffic and is reinspected after period of high flow.

If the bridge is to be repaired and reopened to traffic, reinspect the submerged substructure units following the implementation of repair measures, and if found to be structurally adequate, reinspect again at a reduced maximum underwater inspection interval of twenty four (24) months.

MINNESOTA DEPARTMENT OF TRANSPORTATION
OFFICE OF BRIDGES AND STRUCTURES

UNDERWATER INSPECTION CONDITION RATING FORM

BRIDGE NO. 89859
INSPECTORS Ayres Associates
ON-SITE TEAM LEADER Brian K. Schroeder, P.E.
WATERWAY CROSSED The Red Wood River

INSPECTION DATE October 24, 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
	South Abutment	6.1’	N	7	N	N	N	7	7	8	7	8	7	N	N	N	7	N	N
	Pier 1	6.1’	N	5	N	N	N	5	6	N	N	6	6	N	N	N	5	N	N
	Pier 2	5.4’	N	6	N	N	N	6	7	N	N	8	7	N	N	N	7	N	N
	Pier 3	4.5’	N	6	N	N	N	6	7	N	N	8	7	N	N	N	7	N	N
	Pier 4	2.0’	N	7	N	N	N	7	7	N	N	8	7	N	N	N	7	N	N
	Pier 5	5.0’	N	5	N	N	N	5	7	N	N	8	7	N	N	N	5	N	N

*UNDERWATER PORTION ONLY

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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.

MINNESOTA DEPARTMENT OF TRANSPORTATION
OFFICE OF BRIDGES AND STRUCTURES

UNDERWATER INSPECTION CONDITION RATING FORM

BRIDGE NO. 89859
INSPECTORS Ayres Associates
ON-SITE TEAM LEADER Brian K. Schroeder, P.E.
WATERWAY CROSSED The Red Wood River

INSPECTION DATE October 24, 2012

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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 6	6.0	N	5	N	N	N	5	7	N	N	8	7	N	N	N	5	N	N
	Pier 7	5.5	N	5	N	N	N	5	6	N	N	8	6	N	N	N	5	N	N
	Pier 8	5.6	N	6	N	N	N	6	7	N	N	8	7	N	N	N	7	N	N
	Pier 9	5.3	N	3	N	N	N	3	5	N	N	8	5	N	N	N	3	N	N
	North Abutment	4.2	N	6	N	N	N	6	7	8	7	8	7	N	N	N	8	N	N

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