

2017 UNDERWATER BRIDGE INSPECTION REPORT



BRIDGE # 89478 CR 140 over WATKINS LAKE OUTLET

DISTRICT: District 7

COUNTY: Martin

CITY/TOWNSHIP: ELM CREEK

STATE: Minnesota

Date of Inspection: 04/05/2017

Equipment Used:

Owner: County Highway Agency

Inspected By: Stuber, Cory

Report Written By: Garrett Owens

Report Reviewed By:

Final Report Date:



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UNDERWATER INSPECTION

REPORT SUMMARY

The substructure units inspected at Bridge 89478, single steel arch barrel, was in overall poor condition with evidence of scour and footing exposure of the east side of the barrel and settlement of the wingwalls observed. Scour was observed along the north half of the eastern side of the barrel. Footing exposure was observed along the entire eastern side of the barrel. The three concrete wingwalls are rotated toward the channel and the northeast wingwall was replaced with grouted riprap. This is the first underwater inspection for this structure, a comparison with past soundings levels could not be completed.

INSPECTION FINDINGS

- (A) The channel bottom consisted of riprap covered with silty sand allowing up to 12 inches of probe rod penetration.
- (B) Scour observed along the north half of the eastern side of the barrel, extending up to 12 inches into the barrel and ranging from 6 to 12 inches in depth.
- (C) Footing exposure observed along entire eastern side of the barrel, with up to 1.1 feet of vertical exposure noted on the north end. No undermining noted.
- (D) The three wingwalls are rotated toward the channel; the southeast wingwall is rotated approximately $\frac{3}{4}$ inches, the northwest wingwall is rotated 1 inch, and the southwest wingwall is rotated $\frac{1}{4}$ inch from each wingwall's adjacent surface.
- (E) Northeast wingwall was replaced with grouted riprap.

RECOMMENDATIONS

- (A) Monitor footing exposure on east side during periods of high flow. Consider installing scour countermeasures if extents of exposure increase over time.
- (B) Reinspect the submerged substructure units at the normal maximum recommended (NBIS) interval of sixty (60) months.

Contractor: Collins Engineers, Inc.

Contractor Job Number: 9687

UNDERWATER INSPECTION

1. BRIDGE DATA

Bridge #: 89478
Feature Intersected: WATKINS LAKE OUTLET
Facility Carried: CR 140
District: District 7
County: 046 - Martin

Bridge Description:

This structure consists of a single steel barrel steel arch culvert.

2. INSPECTION DATA

Professional Engineer/Team Leader: Garrett Owens, P.E.
Inspection Diver: Cory Stuber, P.E.
Date of Underwater Inspection: 04/05/2017
Weather Conditions: Cloudy, 43°F
Underwater Visibility (feet): 1.0
Waterway Velocity (ft/sec): 1.0

3. SUBSTRUCTURE INSPECTION DATA

Substructure(s) Inspected: Steel Arch Culvert Barrel

General Shape:

The barrel consists of a 20 foot wide by 8.5 foot high arch culvert, supported on reinforced concrete footings

Maximum Water Depth at Substructure(s) Inspected (feet): 1.7

4. WATERLINE DATUM

Water Level Reference: Top of the headwall.
Waterline Elevation (feet): 89.6
Description: The waterline was approximately 10.4 feet below reference.

5. NBIS CODING INFORMATION

(Minnesota specific codes are used for 92B and 113)

Item 60: Substructure: Code:
Item 61: Channel and Channel Protection: Code: 4
Item 62: Culvert: Code: 4
Item 92B: Underwater Inspection: Code: Y 48 04/2017

Item 113: Scour Critical Bridge:

Code: E

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

Yes

No

(Mark your selection with an X)

6. STRUCTURAL ELEMENT CONDITION RATING

ELEM #	Element Description	Quantity	Unit	Conditions			
				CS1	CS2	CS3	CS4
220	Reinforced Concrete Footing	20	LF		20		
870	Culvert End Treatment	2	EA				2
885	Scour	1	EA			1	

UNDERWATER INSPECTION

INSPECTION PROCEDURES

The routine underwater inspection of Bridge 89478 (CR 140 over the Watkins Lake Outlet) was completed on April 5, 2017. The underwater inspection was conducted from shore. The inspection was conducted by a team consisting of a PE-Diver with a valid MnDOT Team Leader certification, a backup diver and a dive tender. Due to waterway conditions at the time of inspection, the inspection could be accomplished by wading in accordance with OSHA regulations. Profiles were taken along the upstream and downstream faces of the bridge and around the periphery of substructure units to determine the presence, location, and area of scour.

The bridge elements inspected consisted of a single barreled steel arch culvert. According to the bridge inventory or design drawings, the barrel was supported on unknown reinforced concrete footings. Inspection procedures followed FHWA guidance and the MnDOT Bridge and Structure Inspection Program Manual with channel bottom probing to search for foundations. The routine underwater inspection frequency is recommended to remain at a maximum of 60 months based on those findings and risk factors. Also, inspection procedures should continue to follow the above approach and standard guidance with 100% Level I and 10% Level II intensity effort.

MINNESOTA BRIDGE INSPECTION REPORT

07/05/2017

BRIDGE 89478 CR 140 OVER WATKINS LAKE OUTLET

County: Martin	Location: 1.1 MI W OF JCT CSAH 7	Length: 20.0 ft.
City:	Route: 07 - CNTY 140 Ref. Pt.: 001+00.860	Deck Width: 0.0 ft.
Township: 46004 - ELM CREEK	Control Section:	Rdwy. Area/ Pct. Unsnd: sq. ft. / %
Section: 8 Township: 103N Range: 33W Maint. Area:		Paint Area/ Pct. Unsnd: sq. ft. / %
Span Type: 3 - Steel 19 - Culvert (includes frame culverts)	Local Agency Bridge Nbr.:	Culvert: 20'X8'6"
List:		Postings:
NBI Deck: N Super: N Sub: N Chan: 4 Culv: 3		
	Open, Posted, Closed: A - Open	
	MN Scour Code: E - CULVERT	

Appraisal Ratings - Approach: 8 Waterway: 6	Unofficial Structurally Deficient Y
Required Bridge Signs - Load Posting: 0 - Not Required	Unofficial Functionally Obsolete N
Horizontal: 1 - Object Markers	Unofficial Sufficiency Rating 41.0
Traffic: 0 - Not Required	
Vertical: N - Not Applicable	

ELEM NBR	ELEMENT NAME	REPORT TYPE	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4
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141	Steel Arch	Underwater	04/05/2017	30 LF	0	0	30	0
		Routine	10/27/2016	30 LF	0	0	30	0

Notes: A NUMBER OF NUTS HAVE BROKEN AWAY FROM THE TOP OF STEEL MULTI- PLATE WHERE COUPLED TOGETHER. [11-6-2012] SOME NUTS HAVE BROKEN AWAY DOWN THE SIDES OF THE CULVERT ON THE INSIDE.[9-10-2013]- CONNECTIONS HAVE BECOME LOOSE DO TO THE N.E. WINGWALL BEING UNDERMINED AND PULLING AWAY FROM THE STRUCTURE. [10-7-2014] - REMAINS THE SAME. [9/28/2015] - NO CHANGE.

515 - Steel Protective Coating	Underwater	04/05/2017	1036 SF	1036	0	0	0
	Routine	10/27/2016	1036 SF	1036	0	0	0

Notes: [10-27-2016] - PROTECTIVE COATING IS IN GOOD CONDITION.

220	Reinforced Concrete Pile Cap/Footing	Underwater	04/05/2017	60 LF	0	50	10	0
		Routine	10/27/2016	60 LF	0	50	10	0

Notes: MAP CRACKING AND DELAMINATION TAKING PLACE APPROXIMATELY TWO FT. IN FROM ALL FOUR CORNERS. [2011]- THERE IS EFFLORESCENCE EMINATING FROM THE CRACKS [11-6-2012] ON BOTH CONCRETE FOOTINGS THE CONCRETE HAS SPALLED OFF AND IS DELAMINATED NOW APPROX. 2" AT EACH END OF FOOTING NO REINFORCING STEEL IS SHOWING YET. [9-10-2013]- CONCRETE CONTINUES TO SCALE OFF THE CONCRETE FOOTINGS. [9/28/2015] - CONCRETE CONTINUES TO SCALE OFF. ON THE WEST FOOT AT THE NORTH END, THE HEADWALL HAS TIPPED DOWN SPALLING OFF THE CONCRETE, EXPOSING REINFORCING STEEL. STEEL IS CORRODED DOWN IN THE WATER, WITH MINOR SECTION LOSS. [10-27-2016] - REINFORCING STEEL CONTINUES TO CORRODE AT THE WATERLINE. [2017] Underwater Inspection - Footing exposure observed along entire eastern side of the barrel, with up to 1.1 feet of vertical exposure noted on the north end. No undermining noted.

800	Critical Deficiencies or Safety Hazards	Underwater	04/05/2017	1 EA	1	0	0	0
		Routine	10/27/2016	1 EA	1	0	0	0

Notes: NO CRITICAL DEFICIENCY WAS FOUND

BRIDGE 89478 CR 140 OVER WATKINS LAKE OUTLET

ELEM NBR	ELEMENT NAME	REPORT TYPE	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4
870	Culvert End Treatment	Underwater	04/05/2017	2 EA	0	0	0	2
		Routine	10/27/2016	2 EA	0	0	1	1
<p>Notes: THERE ARE SMALL CRACKS ON THE HEADWALLS ON EACH END OF THE CULVERT AND THEY APPEAR TO BE APPROX. 1/16" WIDE. ALSO THERE ARE CRACKS WHICH EXTEND FROM THE BOTTOM OF THE FOOTING DIAGONALLY AND APPROX. CENTERED TO THE TOPS OF ALL FOUR WINGS. THESE CRACKS RANGE FROM 1/4" WIDE ON THE NORTHWEST & SOUTHWEST WINGWALLS. TO APPROX. 1/2" ON THE SOUTHEAST AND APPROX. 1/8" ON THE NORTHEAST WINGWALL. THREE WINGWALLS ARE ALSO PUSHING OUTWARD. THE SOUTHEAST WINGWALL IS PUSHING OUT APPROX. 1/4" FROM THE ADJACENT SURFACE. THE NORTHWEST & SOUTHWEST WINGWALLS ARE PUSHING OUTWARD APPROX. 1/16" FROM ADJACENT SURFACES. ALSO AT THE 90 DEGREE CORNERS WHERE HEADWALLS & WINGWALLS JOIN THERE IS SPALLING AND MINOR DELAMINATION OCCURRING. [11-6-2012] THE NORTHEAST WINGWALL IS PUSHING INWARD APPROX. 1.5" TO 2" THE NORTHWEST WINGWALL IS PUSHING INWARD APPROX. 1/8" ALL WINGWALLS HAVE CRACKS THAT RUN FROM THE CONCRETE FOOTING, DIAGONALLY TO THE CENTER OF THE WINGWALL. LOOKS LIKE THE ENDS OF THE WINGWALLS HAVE SETTLED, CREATING 1/4" TO 1/2" CRACKS IN THE WINGS AT THE TOP OF THE CONCRETE HEADWALLS, THERES APPROX. 1/2" CRACKS THAT RUN VERTICALLY TO THE STEEL CULVERT. THE NORTHWEST WINGWALL HAS AN AREA WHERE THE CONCRETE HAS BROKEN OFF AND HAS A SMALL HOLE THAT HAS FORMED, NO REINFORCING STEEL IS EXPOSED YET. NEED TO MONITOR THE WINGWALLS FOR MOVEMENT. [9-10-2013]- FLOODING IN THE SPRING UNDERMINED THE N.E. WINGWALL FURTHER CAUSING IT TO BREAK OFF AND FALLING INTO THE CHANNEL. THE N.W. WINGWALL HAS SETTLED MORE. THE END OF THE WINGWALL IS DIPPING DOWN FURTHER. CRACKS HAVE GOTTEN WIDER, WHILE REBAR IS PRESENT BETWEEN THE CONCRETE FOOTING AND WINGWALL IN THE N.W. CORNER. COUNTY DUMPED ROCK BEHIND THE S.E. WINGWALL AND THE AREA WHERE THE N.E. WINGWALL USE TO BE. TRYING TO STABILIZE THE STREAM AND PROTECT THE STRUCTURE FROM FURTHER SETTLEMENT. [10-7-2014] - N.E. WING IS STABILIZED WITH GROUTED RIPRAP. [9/28/2015] - CRACKS HAVE GOTTEN WIDER ON THE N.W, S.W, & S.E. WINGWALLS DUE TO SCOUR TAKING PLACE UNDERNEATH THEM. PROBED THE S.E. & S.W. WINGS AND FOUND MATERIAL UNDER THEM. CONTRACTION SCOUR IS TAKING PLACE. UNDER THE N.W. WINGWALL, THERE'S SCOUR BELOW THE WING FOOTING, FOR THE FULL LENGTH OF THE WING, MEASURING 6" TO 12" IN DEPTH AND APPROX. 12" WIDE. [10-27-2016] - CRACK ON THE EAST HEADWALL, SOUTH END MEASURES 0.03', CRACK IN THE WEST HEADWALL MEASURES 0.02'. THIS IS DUE TO THE SETTLEMENT GOING ON UNDER THE HEADWALLS. THERE IS MAP CRACKING WHERE THE CULVERT AND THE HEADWALL JOIN. SETTLEMENT IS CAUSING STRESS ON THE CONCRETE. [2017] Underwater Inspection: The three wingwalls are rotated toward the channel; the southeast wingwall is rotated approximately 3/4 inches, the northwest wingwall is rotated 1 inch, and the southwest wingwall is rotated 1/4 inch from each wingwall's adjacent surface.</p>								
871	Roadway Over Culvert	Underwater	04/05/2017	1 EA	1	0	0	0
		Routine	10/27/2016	1 EA	1	0	0	0
<p>Notes: 24" COVER OVER THE CULVERT</p>								
885	Scour	Underwater	04/05/2017	1 EA	0	0	1	0
		Routine	10/27/2016	1 EA	0	0	1	0
<p>Notes: [9/28/2015] - THERE'S SCOUR THAT IS TAKING PLACE UNDER THE EAST FOOTING, THE NORTH HALF. SCOUR MEASURES 6" TO 12" UNDER THE FOOTING AND 6" TO 12" WIDE FOR THE FULL LENGTH. IF FLOODING IS TAKING PLACE ROADWAY SHOULD BE CLOSED. AFTER WATER RECEDES, FOOTING SHOULD BE CHECKED FOR SCOUR. [2017] Underwater Inspection - Scour observed along the north half of the eastern side of the barrel, extending up to 12 inches into the barrel and ranging from 6 to 12 inches in depth.</p>								
891	Other Bridge Signing	Underwater	04/05/2017	1 EA	1	0	0	0
		Routine	10/27/2016	1 EA	1	0	0	0
<p>Notes: THERE ARE FOUR DELINEATORS [2011]-STILL IN GOOD SHAPE. [11-6-2012] THE NORTHEAST DELINEATOR IS LEANING TO THE NORTH. [9-10-2013]- ALL DELINEATORS ARE UP AND FUNCTIONING FINE.</p>								
892	Slopes & Slope Protection	Underwater	04/05/2017	1 EA	1	0	0	0
		Routine	10/27/2016	1 EA	1	0	0	0
894	Deck & Approach Drainage	Underwater	04/05/2017	1 EA	1	0	0	0
		Routine	10/27/2016	1 EA	1	0	0	0
899	Miscellaneous Items	Underwater	04/05/2017	1 EA	1	0	0	0
		Routine	10/27/2016	1 EA	1	0	0	0
<p>Notes: [2011]-THERE IS A WASHOUT BEHIND THE NORTHEAST WINGWALL. [11-6-2012] STILL REMAINS THE SAME. [9-10-2013]- COUNTY DUMPED ROCK AROUND THE CULVERT ENDS. TRYING TO PROTECT THE STRUCTURE.</p>								

BRIDGE 89478 CR 140 OVER WATKINS LAKE OUTLET

ELEM NBR	ELEMENT NAME	REPORT TYPE	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4
900	Protected Species	Underwater	04/05/2017	1 EA	1	0	0	0
		Routine	10/27/2016	1 EA	1	0	0	0

Notes: [10-27-2016] - NO NESTS.

General Notes: CONCRETE ON THE ENDS OF THE CONCRETE SUB STRUCTURE IS WATER SATURATED AND HAS MAP CRACKING WITH EFFLORESCENCE. MINOR AT THIS POINT. NO PLAN AVAILABLE (BUILT IN 1938).[10-27-2016]- Lowered the NBI ratings on the Culvert, Channel and Waterway Adequacy do to the scouring of the East Concrete Footing of the culvert and the flood events are more often than pass years.

58. Deck NBI:

36A. Brdg Railings NBI:

36B. Transitions NBI:

36C. Appr Guardrail NBI:

36D. Appr Guardrail Terminal NBI:

59. Superstructure NBI:

60. Substructure NBI:

61. Channel NBI: [10-27-2016]- Channel scoured the backside of the SW wingwall out in 2013. Riprap was placed behind the wingwall. Over a period of time channel is starting to scour our behind the riprap that was placed back in 2013. Channel continues to migrate to the west during large flooding events.

62. Culvert NBI: Minor distortion at connections about halfway down on the inside of the culvert, for the full length. [10-27-2016]- Culvert headwalls have settled do to scour. The NE wings was scoured out and broke off and is laying in the channel. East footing has severe scour under it during high flows.

71. Waterway Adeq NBI: [10-27-2016]- Flooding has caused the roadway to be closed more often during large rain events.

72. Appr Roadway Alignment NBI:

Inspector's Signature

Reviewer's Signature

Pictures



Photo 1 - South Elevation, Looking North.



Photo 2 - North Elevation, Looking South.

Pictures



Photo 3 - Upstream View, Looking South.



Photo 4 - Downstream View, Looking North.

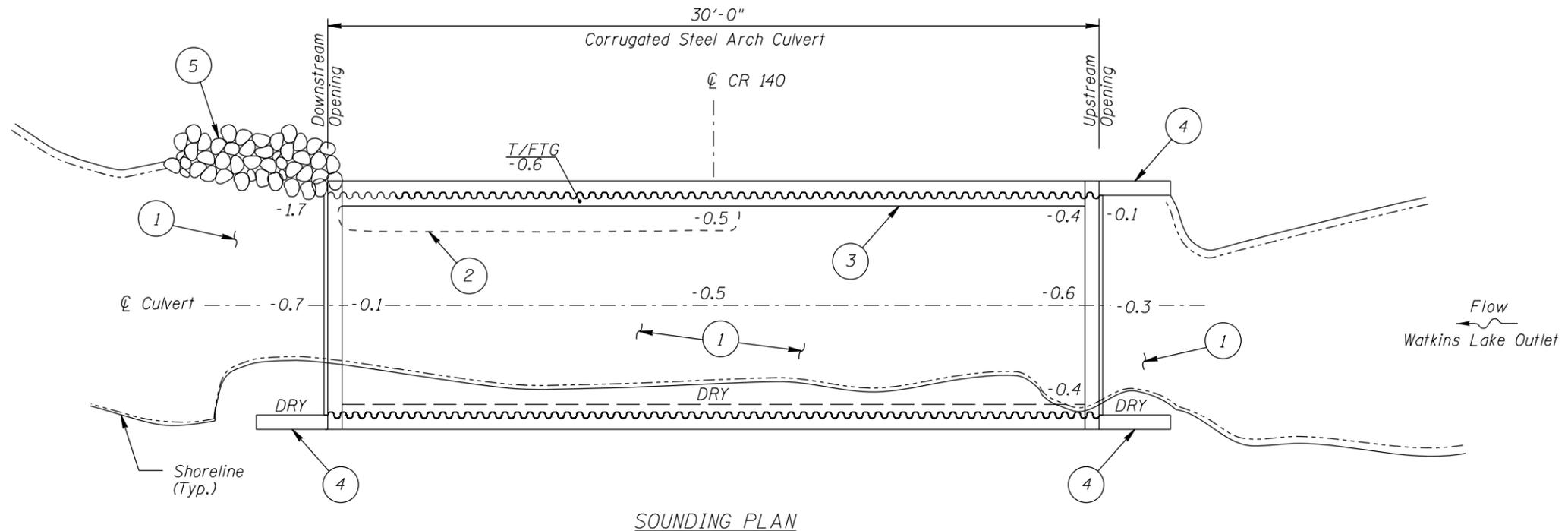
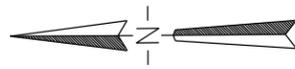
Pictures



Photo 5 - Grouted Riprap and East Barrel Interior, Looking Southeast.



Photo 6 - Northwest Wingwall and Typical Barrel Interior, Looking Southwest.



SOUNDING PLAN

GENERAL NOTES:

1. The barrel and headwalls of the corrugated steel arch culvert were inspected underwater.
2. At the time of inspection on April 5, 2017, the waterline was located approximately 10.4 feet below the top of the headwall and 8.8 feet below the bottom of the headwall at the downstream opening. Due to a lack of design plans a reference elevation of 100 feet, beginning at the top of the headwall, was assumed. Based on the assumed reference the waterline elevation was 89.6.
3. Soundings indicate the water depth at the time of inspection and are measured in feet.
4. Soundings were taken parallel to the culvert at midpoint intervals at the upstream and downstream ends.

INSPECTION NOTES:

- 1 The channel bottom consisted of riprap covered with silty sand allowing up to 12 inches of probe rod penetration.
- 2 Scour observed along the north half of the eastern side of the barrel, extending up to 12 inches into the barrel and ranging from 6 to 12 inches in depth.
- 3 Footing exposure observed along entire eastern side of the barrel, with up to 1.1 feet of vertical exposure noted on the north end. No undermining noted.
- 4 The three wingwalls are rotated toward the channel; the southeast wingwall is rotated approximately 3/4 inches, the northwest wingwall is rotated 1 inch, and the southwest wingwall is rotated 1/4 inch from each wingwall's adjacent surface.
- 5 Northeast wingwall was replaced with grouted riprap.

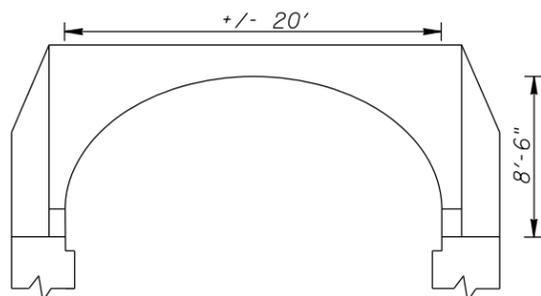
Legend

-3.8 Sounding Depth (4/5/2017)

Riprap

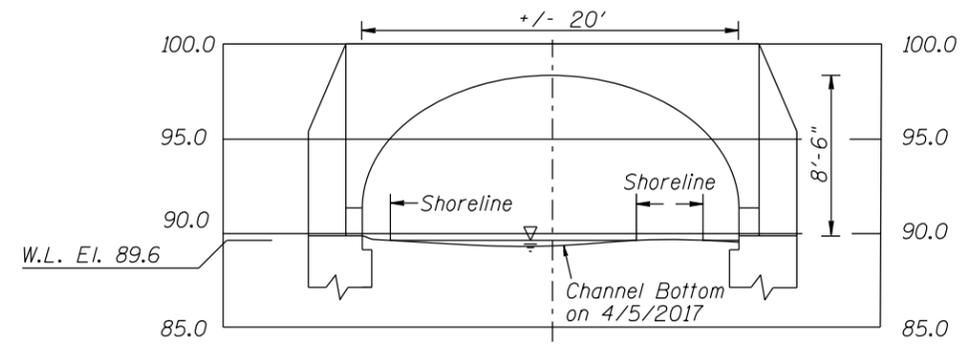
Note:

All soundings based on 2017 waterline location.

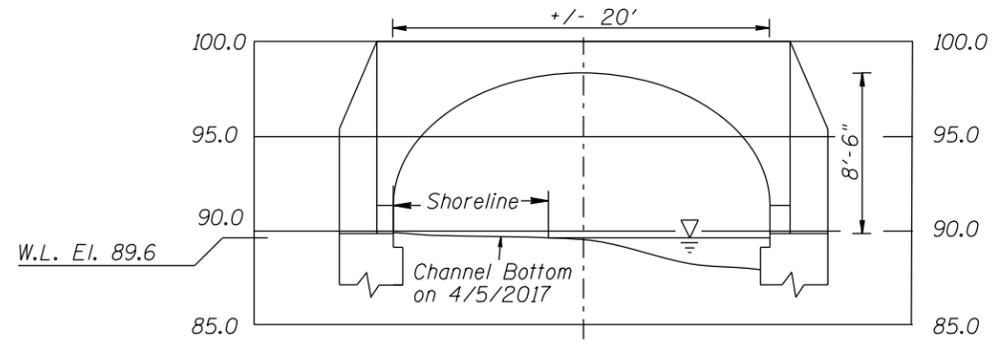


TYPICAL END VIEW OF CULVERT

MINNESOTA DEPARTMENT OF TRANSPORTATION UNDERWATER BRIDGE INSPECTION		
STRUCTURE NO. 89478 OVER WATKINS LAKE OUTLET DISTRICT 7, MARTIN COUNTY		
INSPECTION AND SOUNDING PLAN		
Drawn By: JMF	COLLINS ENGINEERS <small>1599 Selby Avenue Suite 206 St Paul, MN 55104 (651) 646-8502 www.collinsengr.com</small>	Date: APRIL 2017
Checked By: CRS		Scale: NTS
Code: 63-9687		Figure No.: I



UPSTREAM OPENING PROFILE



DOWNSTREAM OPENING PROFILE

Note:
Refer to Figure 1 for General Notes.

MINNESOTA DEPARTMENT OF TRANSPORTATION UNDERWATER BRIDGE INSPECTION		
STRUCTURE NO. 89478 OVER WATKINS LAKE OUTLET DISTRICT 7, MARTIN COUNTY		
UPSTREAM AND DOWNSTREAM OPENING PROFILES		
Drawn By: JMF	COLLINS ENGINEERS <small>1599 Selby Avenue Suite 206 St Paul, MN 55104 (651) 646-8502 www.collinsengr.com</small>	Date: APRIL 2017
Checked By: CRS		Scale: 1"=10'
Code: 63-9687		Figure No.: 2