Town of WellFleet

STRUCTRES INSPECTION / EVALUATION REPORT

Tide Gates at Chequesset Neck Road over Herring River

Structure Number: W-14-007

Churchill Engineering, Inc.

EXECUTIVE SUMMARY

Churchill Engineering, Inc (CEI) inspected the tide gate assembly of the water control structure which is part of the bridge, structure number W-14-007, located on Chequesset Neck Road spanning the Herring River within the Town of Wellfleet, Massachusetts between September20 2011 and September 22, 2011. A previous Structures Field Inspection Report of June 6, 2008 and a letter from the Wellfleet Conservation Commission dated December 24, 2009 letter regarding the structure were available to Churchill Engineering, Inc. prior to conducting this inspection. The purpose of this inspection was to develop a conditions assessment of the tide gate assembly and identify deficiencies that may exist as noted in the above mentioned documents.

The bridge is a three barrel culvert with a total span of 21'-9" which is part of a water control structure restricting tidal flow from Wellfleet Harbor into the Herring River estuary. Flumes are located both upstream and downstream of the culvert barrels which make up a structure of over all length of 85 feet. Located on the downstream face of the North and Center barrels are located flapper type tide gates which are the subject of this report. Located at the downstream face of the South barrel is a sluice gate which is not considered within the scope of this report.

The tide gate assembly is comprised of 5 distinct components as follows:

- *Timber Tide Gate*
- *Hinge Assembly*
- *Tee Seal*
- *Timber Frame*
- *Grout Pad*

Each component of the tide gate assembly was inspected individually at each barrel. Failure of any one of the components or a combination of the components would result in adverse operation of the tide gate assembly.

Each tide gate assembly is considered in poor condition as a unit. The components are described in decreasing severity of the structural distress exhibited by each unit. For the purposes of this summary the condition of each component at each barrel are considered similar, although the assessment of each individual component is described in greater detail within the narrative of the report. Both the grout pads and the tee seals are considered in poor condition and are no longer serving the function they were intended. The timber tide gates and frames are considered in fair to poor condition as a result to the marine environment in which they are exposed and considered functionally deficient. The hinge assemblies are considered in fair condition exhibiting signs of wear resulting in gate misalignment.

Both the condition of the grout pads and tee seal are considered to result in the majority of flow of seawater past the tide gate assembly while in the closed position. The deterioration of both the tide gates and frames result in an ineffective seating surface for the tee seal. This condition is also considered to result in flow past the assembly but to a lesser extent than the grout pads and tee seals. The contribution of flow resulting from the misalignment of the tide gates due hinge wear is uncertain. However, any contribution from this source is considered relatively minor.

To reduce the flow past the tide gate assembly, CEI recommends the following remedial repairs. Each repair is presented to restrict the source of flow past the tide assembly from the greatest to least in descending order. Replacement of the grout pads and tee seals are expected to reduce the majority flow

PREFACE

The assessment of the general condition of the structure is based upon available data and visual inspections. Detailed investigations and analyses involving topographic mapping, subsurface investigations, testing and detailed computational evaluations are beyond the scope of this report unless reported otherwise.

In reviewing this report, it should be realized that the reported condition of the structure is based on observations of field conditions at the time of inspection, along with data available to the inspection team.

It is critical to note that the condition of the structure depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the structure will continue to represent the condition of the structure at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Authorized/Licensed Professional's Signature

Richard M. Churchill, P.E.
Massachusetts License No.: MA 40696
Principal
Churchill Engineering, Inc.

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SECTION 1

1.0 DESCRIPTION OF PROJECT

1.1 General

1.1.1 Authority

The Town of Wellfleet Massachusetts has retained Churchill Engineering, Inc. to perform a visual inspection and develop a conditions assessment report for the tide gates which restrict tidal flow to the Herring River. This water control structure is incorporated within a bridge / culvert which carry Chequesset Neck Road over the Herring River in Wellfleet, Massachusetts.

1.1.2 Purpose of Work

The purpose of this investigation is to inspect and assess the present condition of the tide gates and supporting assembly to control the tidal flow within the estuary of the Herring River. CEI is in possession of a letter from the Town of Wellfleet Conservation Commission, dated December 24, 2009, requesting the Wellfleet Department of Public Works to inspect the tide gates. This report is intended to satisfy this request, at least in part, concerning the tide gates.

The investigation is divided into three parts: 1) obtain and review available reports, investigations, and data previously submitted to the owner pertaining to the structure; 2) perform a visual inspection of the tide gate assembly; 3) prepare and submit a final report presenting a condition assessment of the tide gate assembly, including recommendations for potential remedial repairs.

1.2 Description of Project

1.2.1 Location

The bridge / water control structure is located on Chequesset Neck Road spanning Herring River, within the Town of Wellfleet, Massachusetts. The structure is at Latitude 41.9307 N degrees and Longitude -70.0641W degrees.

1.2.2 Owner/Maintainer

The owner of the bridge / water control structure is the Town of Wellfleet, Massachusetts. The point of contact concerning the structure is the Director of Public Works, Mr. Mark Vincent, and can be contacted at 220 West Main Street Wellfleet, MA 02667. The structure is maintained by the Town of Wellfleet's Department of Public Works and can be contacted at this same address.

1.2.3 Description of the Bridge / Water Control Structure

The bridge is a three barrel culvert supporting Chequesset Neck Road over the Herring River. The construction documents for the bridge and water control structure are dated 1973. The span of the bridge / water control structure is approximately 21'-9" over the Herring River. The length of the bridge / water control structure is approximately 85'-0" separating Wellfleet Harbor from the Herring River estuary. The date of construction of the structure is 1973 as noted by the date on the construction documents and recent bridge inspection report. The structure is constructed of

reinforced concrete with water control devices at the harbor side end of each barrel. The 3 barrels have height of 5'-0" with a width of 6'-7", 7'-2" and 6'-0" from north to south respectively. The water control devices consist of tide gates within the north and center barrels with a sluice gate within the south barrel. Inspection and condition assessment of this report are limited to the two tide gates of the north and center barrels.

The tide gates are wood structures, approximately 5'-11 ½" in height and 6'-9" in width, secured to the water control structure with bronze hinge assemblies. They are directional control flapper type devices which close as the tide rises on the harbor side restricting seawater from entering the Herring River. As the tide ebbs, the head resulting from the flow of the Herring River increases and forces the tide gates to open allowing the flow from the Herring River to enter Wellfleet Harbor.

The tide gate assembly consists of 5 elements as follows:

- Tide Gate
- Hinge Assembly
- Tee Seal
- Frame
- Grout Pads

Tide Gate

The 5'-11½" x 6'-9" tide gates are constructed of treated timbers fastened together with ¾" bronze tie rods. The gates are comprised of individual boards, 5 ¼" thick, joined with ½" x 1 ½" splines. Three 1'-2" x 1'-0" x ½" bronze weight plates are fastened along the lower edge of the gate to assist in closure. Four bronze eye bolts, two at the top of the gate and two located towards the lower edge, assist in installation and maintenance.

Hinge Assembly

Three bronze hinge assemblies hang the tide gates over the north and center barrels of the water control structure. Each assembly consists of two hinges and a hinge arm. The hinges are connected to both the water control structure and tide gate by ¾" diameter bronze anchor bolts and tie rods respectively.

Tee Seal

A neoprene tee seal is located between the frame and tide gate providing a seating surface for the gate. The seal is 3 ½" wide x 5/8" thick with a 1 ½" wide x 5/8" thick outstanding leg of the tee. The seal is connected to the frame by a ¾" wide x 1/8" thick stainless steel continuous plate fastened either side of the outstanding leg by 2" # 12 stainless steel screws.

Frame

The frame is comprised of treated timber 5 ¼ " x 5 ¼" with outside dimensions of 6'-11" in width x 5'-11 ¼" in height. The frame is fastened to the water control structure with ¾" bronze anchor bolts counter sunk to accept the bronze nut and washer. A sill of 1' difference in elevation between the inverts of the higher culvert barrel and the lower flume provides clearance for proper operation of the tide gates.

Grout Pad

A 1" non shrink grout pad is provided between the frame and face of the water control structure on all sides to ensure a water tight seal is provided.

SECTION 2

2.0 INSPECTION

2.1 Visual Inspection

The tide gates were inspected between September 20, 2011 and September 22, 2011. At the time of the inspection, the weather ranged from clear to rain with temperature between 70° and 80° F. Each culvert barrel was dewatered, to the extent possible; prior to inspection to facilitate visual observations. Stop logs where provided and installed within existing stop log guides to provide a cofferdam for each barrel. Divers also installed sealant between stop logs and guides to limit water infiltration. Three pumps, two rated at 350 gallons per minute and another submersible pump rated at 90 gallons per minute, provided a capacity of 790 gallons per minute to dewater each barrel. Marine growth was removed from areas of particular concern to assist in inspection. Areas where visual inspection was not possible, a tactile inspection was completed to ensure continuity of members and condition of seating surfaces. Chain falls supported on reaction beams were employed to actuate the gate during the inspection. The inspection was confined to 5 components of the tide gate assembly as outlined above. It is considered failure of any one of the components or a combination of failures by these components would result in adverse operation of the tide gates. Photographs to document the current conditions of the structure were taken both during the inspection. These photographs are included in Appendix A.

2.2 Tide Gates

North Barrel

Inspection of the tide gate yielded a gate exposed to a marine environment. The timber of the gate appeared sound based upon probing the surface with a putty knife. Significant irregularity of the timber surface, particularly at the seating surfaces at the perimeter of the gates, was noted. The lack of marine growth at these surfaces indicates some contact is made with the tee seal. However, the irregular surface is suspected to be a source of water infiltration between the gate and tee seal. Although, other irregularities were noted upon the surface of the gate it was not considered to contribute to the infiltration of water through the gate. Eye bolts could not be rotated by hand and the weight plates appeared securely fastened.

Center Barrel

The inspection results of the gate in the center barrel were similar to the north barrel. The timber appeared sound but exposure to the marine environment resulted in irregularities in the gate surface. The irregularities in the surface appear more acute towards the perimeter of the gate and the seating surface with the tee seal. The lifting hardware, eyebolts, could all be rotated by hand indicating potential shrinkage of the timber. Additionally, the center weight plate was loose indicating the back up nut was not adequately securing the plate to the threaded rod.

2.3 Hinge Assembly

North Barrel

Visual inspection of each of the 3 bronze hinge assemblies indicated each assembly was intact and securely fastened to the anchor bolts into the water control structure and tie rods into the timber gate securing the upper and lower hinges respectively. Some deterioration of the grout pad between the upper hinges and the water control structure were noted. It was noted the bushings at the hinge pins between the hinges and the hinge arm were missing at each assembly. Additionally, wear between the hinges and a hinge arm was observed resulting in slight misalignment of the gate. Actuation of the hinges, through movement of the gate assisted by chain falls and reaction beams, indicates the hinge assemblies allow free operation of the gates.

Center Barrel

Inspection of the hinge assembly of the Center barrel yielded findings similar to the North barrel with the exception all grout pads at the top hinges were intact. The hinges were actuated in the same manner as the with the North barrel. Our observations noted a lack of bushings and wear between the hinges and hinges arms at the hinge pin locations. This is expected to be the source of misalignment between the gate and frame.

2.4 Tee Seal

North Barrel

The presence of the neoprene tee seal was confirmed along the vertical sides and the header of the frame. Tactile examination, due to approximately 1 foot of water within the barrel, indicated the seal along the invert if the frame was missing. Hence, the resulting 1 ¼" gap between the gate and frame is considered a significant source of water infiltration. Along the remaining 3 sides of the seal the fasteners securing the stainless steel retaining plates either side of the outstanding leg of the tee were loose and in some cases missing. Probing with a putty knife between the seal and the frame yielded the two could be easily separated.

Center Barrel

The neoprene tee seal was observed or detected along all four sides of the frame. However, marine growth was detected along the seating surface of the gate suggesting the gate was not properly seating with the seal. Similar probing with a putty knife allowed the seal and stainless steel plates to be easily separated from the frame indicating a failure of the fasteners.

2.5 Timber Frame

North Barrel

Probing of the frame yielded the timber was generally sound and securely fastened to the water control structure by the anchor bolts. However, as with the gate, the frame exhibits signs of deterioration and surface irregularity along both the seating surface with the tee seal and interface with the grout pad. Evidence of marine growth between the frame and tee seal at various locations indicates improper contact is made to ensure against the infiltration of water through this interface.

Center Barrel

Inspection of the frame at the center barrel yielded findings similar to the North Barrel. Probing the frame indicated sound timber securely fastened to the water control structure. Similar signs of deterioration and surface irregularity observed at the tee seal and grout pad interface.

2.6 Grout Pad

North Barrel

Visual observations of the grout pad along the vertical interface of the frame and water control structure wall yielded locations were the grout was missing, up to approximately 12" in some locations. Further visual observations of the grout along the header yielded it appeared in tact. Further probing with a putty knife along the header indicated the grout was intact and generally sound. However, probing along the vertical interface yielded areas was the grout could be dislodged with little effort and generally considered unsound. Further probing between the invert slab and frame indicated large areas of grout were missing or otherwise considered unsound.

Center Barrel

Removal of marine growth along the header of the frame indicated grout was missing up to approximately 6" and 12" from the north and south end of the header respectively. Inspection from within the center barrel yielded daylight through the grout pad between the water control structure and frame at these locations. Further probing along the vertical grout pads of both walls indicated severely deteriorated grout within 1'-0" of the interface with the roof and invert slabs. Probing the remaining locations along this interface yielded fair to sound grout. Probing the grout pad along the invert slab yielded the grout was non-detected along the entire length.

2.7 Life Safety Issues

Access to the tide gates and associated assembly was accomplished by removal of the steel grating over the tide gates. Removal of the grating yielded L3x3 angles supporting the grating exhibiting advanced deterioration due to exposure to marine environment. During modification of the support angles to allow for stop log installation, the advanced deterioration of the angles supporting the grating was observed. The grating also exhibited deterioration due to exposure to the aggressive marine environment. The grating was only removed over the gates North and Center barrels. However, the condition of the grating and support at the South barrel is considered similar. The grating over the North and Center barrels along the Herring River did not show as advanced deterioration. However, it would be expected that the condition of this assembly will advance to a similar condition as the harbor side with time.

The deck slab spanning the North barrel flume downstream of the tide gate exhibited significant spalling. Over 3" of concrete, out a total slab thickness of 9", over an approximately 4' x 3' area had spalled exposing the bottom reinforcement. The exposed reinforcement exhibited advanced section loss with some bars completely deteriorated. A smaller spall was also noted at the headwall.

The railings and posts at both ends of the water control structure exhibit signs of structural distress, including checking and splitting due to impact rust. The anchor bolts appear intact and reasonable condition although some of the securing nuts are missing.

SECTION 3

3.0 ASSESSMENT & RECOMMENDATIONS

3.1 General Assessment

In general, the tide gate assemblies of the North and Center barrels are considered in poor condition. This assessment is controlled by the poor condition of the grout pad and tee seal similar to each barrel. The timber gates and frames of both barrels are each considered in fair – poor condition. The hinges are considered in fair condition. These assessments are considered functional deficiencies which affect the assembly to restrict seawater from the tidal estuary of Herring River.

The structural distress noted at the grating and underside of the deck slab is considered to present life safety issues which require attention within the Town's maintenance program. The distress of the railing and posts are considered to result in a less serious risk. We recommend former issue be prioritized and the later issue scheduled within the maintenance program since the structure is accessed regularly by the public for recreational activities.

3.2 Component Assessment

3.2.1 Tide Gates

The tide gates at both barrels are considered in fair to poor condition. This assessment is based upon exposure with the marine environment resulting in the irregular seating surface with the tee seal. It is expected the neoprene seal is unable to seat properly resulting in the infiltration of water. However, the inflow from this source is considered minor to the total inflow around the tide gate assemblies as a unit.

3.2.2 Hinge Assemblies

Wear in all hinge assemblies result in a fair assessment for this component. The lack of bushings and resultant wear on the assemblies result in misalignment of both tide gates. However, it is uncertain to the contribution of this misalignment to the total infiltration of water around the tide gate assemblies. Since the lack of marine growth at the seating surface, along the vertical sides and header, indicates the gate is making contact with the frame. The minor deterioration of the grout pads at the hinge supports to the structure are not considered to adversely affect the operation of the tide gates. Hence, remedial repairs to the grout pads are not considered necessary at this time.

3.2.3 Tee Seal

The tee seal assembly is considered in poor condition as a unit. Although the neoprene itself is in relatively good condition, the fasteners and fastening plates are failing to adequately secure the seal to the substrate. This condition is expected to allow water to infiltrate between the seal and frame. However, the lack of the seal at the invert slab of the North barrel is considered to result in a significant inflow of seawater past the closed tide gate assembly. Similarly the seal along invert slab of the Center barrel is not considered to seat properly allowing water to infiltrate when the tide gate is also closed.

3.2.4 Frame

The frame assemblies for both barrels appear sound and secure to the water control structure and as a result considered in fair to poor condition. However, this assessment also considers the fact that the surface of the frame to which the tee seal is fastened is irregular due to exposit to the marine environment. Additionally the failure of the tee seal fasteners to be secured properly into the frame is considered to result the inflow between the seal – frame interface. Hence the frame is considered to be functionally deficient.

3.2.5 Grout Pad

The grout pads are considered in poor condition due to the significant amount of grout missing. The lack of grout along the invert slab of both barrels is considered to significantly contribute to the amount of inflow past the tide gate assembly. Additionally, the missing grout from the vertical and header sides of the frame for the North and Center barrels respectively also results in a source of inflow.

3.3 Recommendations

3.3.1 Tide Gate Assemblies

The failure of the tide gate assemblies to prevent seawater from migrating upstream in the Herring River is a combination of failures of individual the components of the assemblies. The failures of the tee seals and grout pads are considered to represent the majority of the inflow past the tide gate assemblies. The irregular surface of both the tide gates and frames is expected to contribute, but to a lesser degree, to the total inflow past the tide gate assembly. We are uncertain to the amount of inflow, if any at all, resulting from to the misalignment of the tide gates due to the wear of the hinges.

It is our opinion, based upon the recent inspection, that corrective measures to reduce the inflow would require repairs to the grout pads, tee seals, frames and tide gates in that order. Replacement of the grout pads and tee seals are considered to provide the most effective measures to reducing inflow. Replacement of the frame is considered necessary to provide a secure substrate for the tee seal fasteners. Replacement of the frame would also provide the benefit of a smooth seating surface for the tee seal. In addition, it is considered necessary to remove the frame to adequately remove the existing grout pad and prepare the surface of the existing water control structure. Hence, replacement of the frame is not considered to add significant expense to the remedial repairs. This recommendation is based upon the assumption that the majority of bronze anchor bolts securing the frame are sound and that the nuts can be removed.

Due to the irregular surface of the tide gates, reuse of the existing gates would result in some level of inflow of water between the interface with the seal and gate. However, we also expect this inflow to be relatively minor. Perhaps the Town of Wellfleet would find this inflow acceptable. We suggest the Town of Wellfleet to consider a cost to benefit analysis prior to making this decision. We would also note that replacement of the gate at this time would more evenly match the life cycle of the gate with the other elements of the assembly. It should be noted that the mobilization and labor costs to remove and reinstall the gate would be incurred during the repair of the grout pads, frames and seals regardless if the gate is replaced. Therefore only the costs of the material and fabrication of the gate would be additional. Hence, it may be cost effective to replace the gate at this time as opposed to that in the future.

Replacement of the bushing at the hinge assemblies as recommended to improve the alignment of the tide gates. Replacement of the bushing may not solve the misalignment due to wear in its entirety. However, it is uncertain as to the contribution of the misalignment to the inflow although we suspect it is minimal if at all. Hence, we do not recommend replacement of the hinge assemblies.

Therefore CEI recommends remedial repairs to the tide gate assembly at a minimum would include the following:

Replacement of the Grout Pads
Replacement of the Timber Frames
Replacement of the Tee Seals
Replacement of bushings within the Hinge Assemblies

We recommend the Town of Wellfleet, based upon a cost benefit analysis, consider the following:

Replacement of the Tide Gates

CEI understands that the inspection and condition assessment of the tide gate assembly resulted from the concern for the ability of the water control structure to restrict or mitigate the tidal influence of Wellfleet Harbor upon the Herring River estuary. This concern was noted within a December 24, 2010 letter from the Town of Wellfleet's Conservation Commission to DPW Director Mark Vincent provided to CEI. The letter indicated a potential for a serious threat to upstream property owners due to leaking of the tide gates.

During the three days of our inspection the sluice gate of the South barrel of the water control structure remained in the open or near open position. Water from Wellfleet Harbor was allowed to flood the Herring River as the tide rose above the elevation of the water on the estuary side of the water control structure. We would like to suggest to the Town of Wellfleet that controlling the tidal influence of Wellfleet Harbor upon the estuary requires the sluice gate to be closed during the flooding tide. If the sluice gate was closed, the tide gates would close as the tide rose above the elevation of Herring River restricting the seawater from entering the estuary as the tide floods. Considering the recommended remedial repairs were completed and the sluice closed, the flow of seawater into the estuary would be greatly reduced but possibly not completely. Even as originally constructed in 1973, we expect some minor amount of seawater was allowed to pass the gate assemblies. Manual operation of the sluice coinciding with the tidal cycles or alternatively limited opening of the sluice during upstream extreme rain / flood events may address concerns of flooding to abutters noted in the Conservation Commission's letter of December 24, 2009. However, we caution closing the gates may also have adverse environmental impacts upon the estuary. These potential impacts are considered outside of the scope of this report.

3.3.2 Life Safety Issues

CEI also recommends action be taken to remediate the life safety issues noted during our inspection. Repairs to the grating and grating supports over the flume of all three barrels and the roof slab over the North barrel flume at the harbor side of the water control structure should be prioritized within the Town's maintenance program. Our observations of the grating and grating

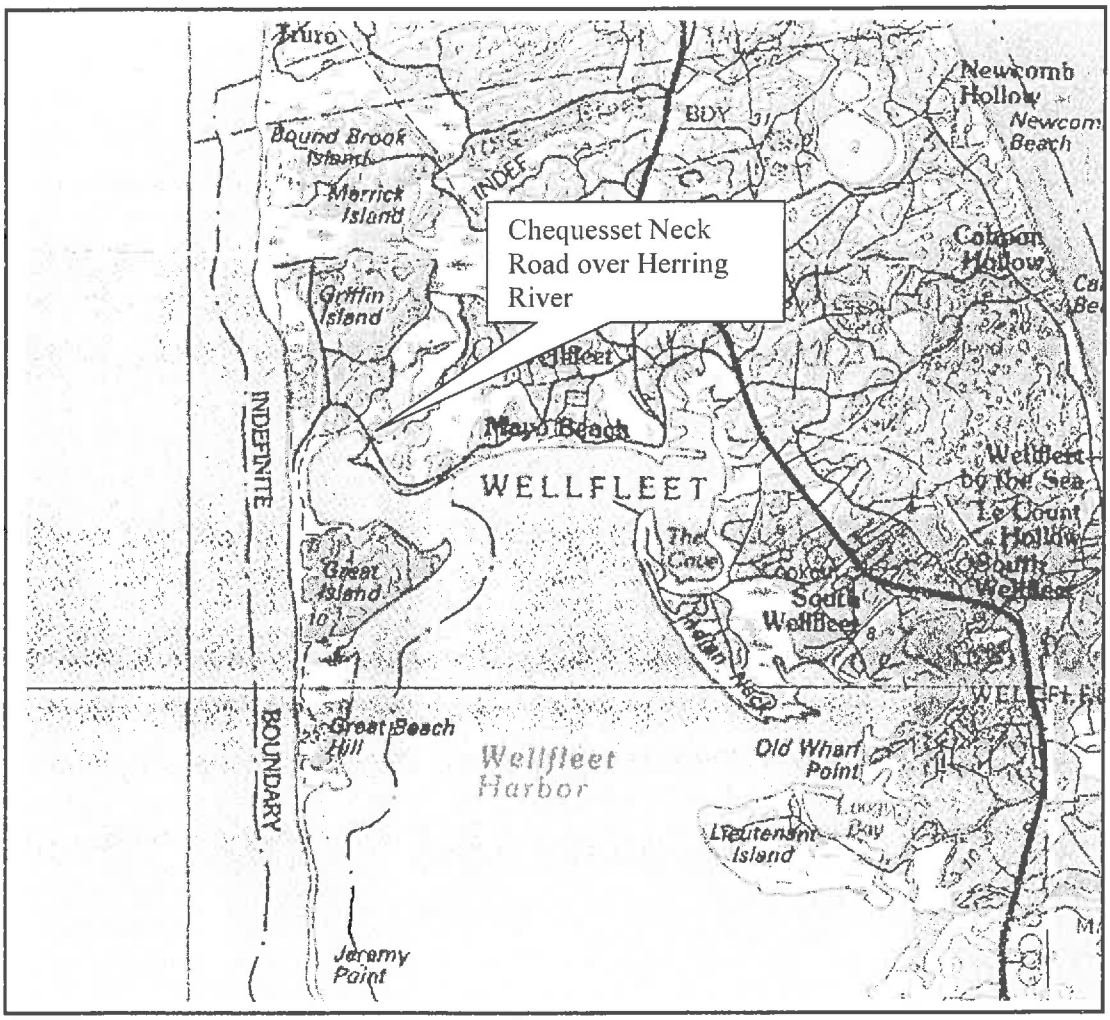
supports over the Herring River side of the water control structure did not display as advanced structural distress as the harbor side. However, we would recommend they also be repaired at this time. Although CEI did not enter the South barrel of the water control structure, we expect the condition of the grating and grating supports to be similar to the North and Center barrels and as a result suggest the same recommendations apply. We also recommend the replacement of the safety railings and posts protecting the harbor and estuary edges of the water control structure. We advise this deficiency does not present as significant a threat to life safety as the grating and slab spalling. However, we recommend repairs to the safety railing and posts be scheduled within the Town's ongoing maintenance program.

Hence, we recommend the following for remedial repairs be prioritized within the Town's maintenance program:

Remedial repair design, fabrication and replacement of grating supports
Remedial repair design, fabrication and replacement of grating

We recommend the following for remedial repairs be scheduled within the Town's maintenance program:

Remedial repair design, fabrication and replacement of safety railings and posts



CHURCHILL ENGINEERING, INC.
CONSULTING ENGINEERS

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Plymouth, MA 02360

FIGURE 1
Locus Plan
Chequesst Neck Road over Herring River
Wellfleet, Massachusetts

Figure 1 View Upstream Herring River

Figure 2: View Downstream Wellfleet Harbor

Figure 3: View Upstation Chequesset Neck Road

Figure 4: View Downstation Chequesset Neck Road

Figure 5: Herring River Side Flume

Figure 6: Wellfleet Harbor Side Flume

Figure 7 Dewatering North Barrel Harbor Side Flume

Figure 8: Stop Logs and Reaction Beams Center Barrel Harbor Side Flume

Figure 9: Rigging Tide Gates

Figure 10: Actuating Tide Gates

Figure 11: Removing Marine Growth

Figure 12: Deteriorated Tide Gate at Seating Surface South Edge Center Barrel

Figure 13: Deteriorated Tide Gate at Seating Surface North Edge Center Barrel

Figure 14: Deteriorated Tide Gate at Timber Frame Header

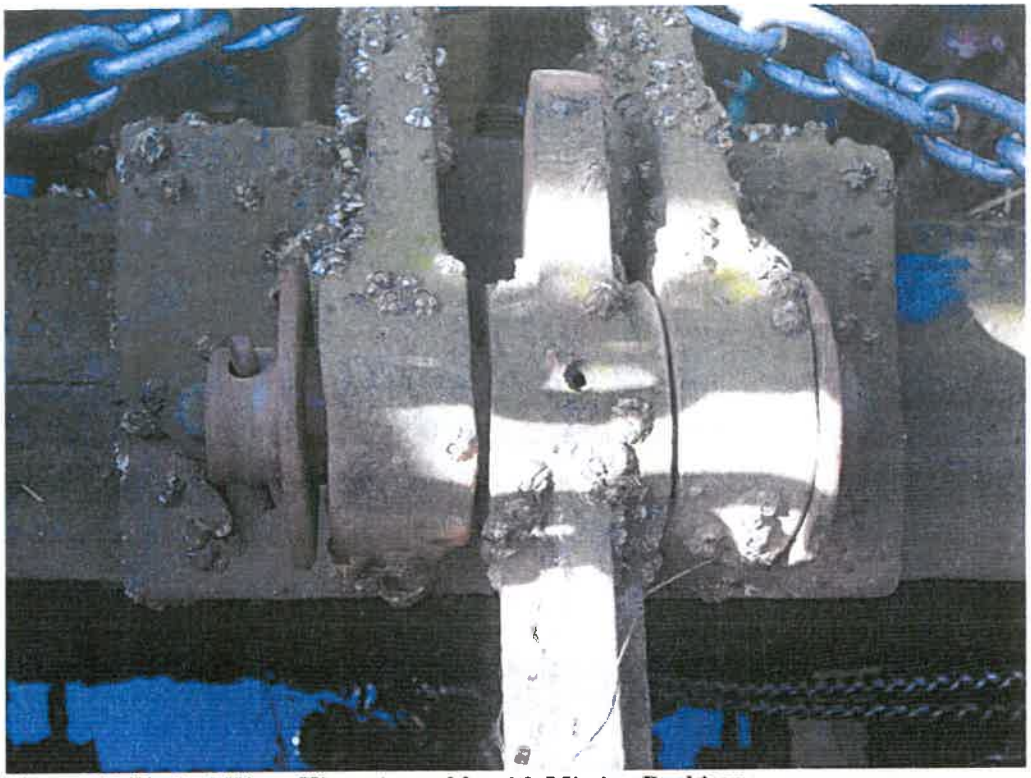

Figure 15: Typical Worn Hinge Assembly with Missing Bushings

Figure 16: Tee Seal Assembly at Header Center Barrel

Figure 17: Tee Seal Assembly at Timber Frame North Vertical Center Barrel

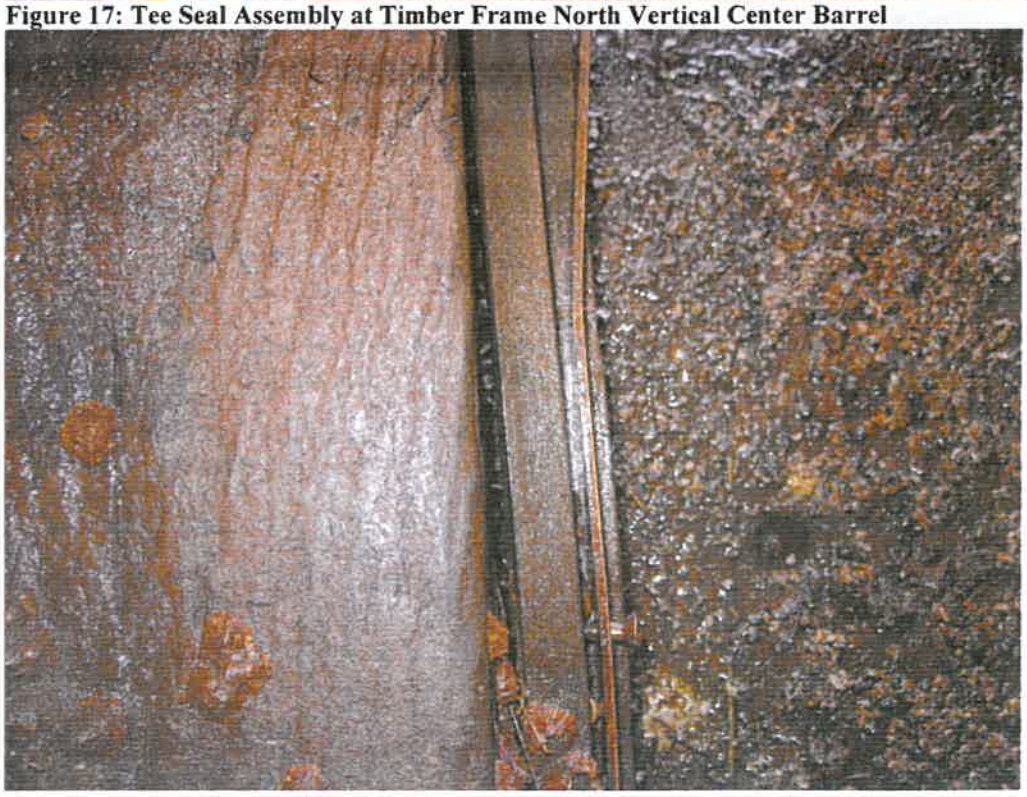

Figure 18: Tee Seal Assembly (inadequate seating and fastening to substrate)

Figure 19: Missing Grout North Barrel South Vertical

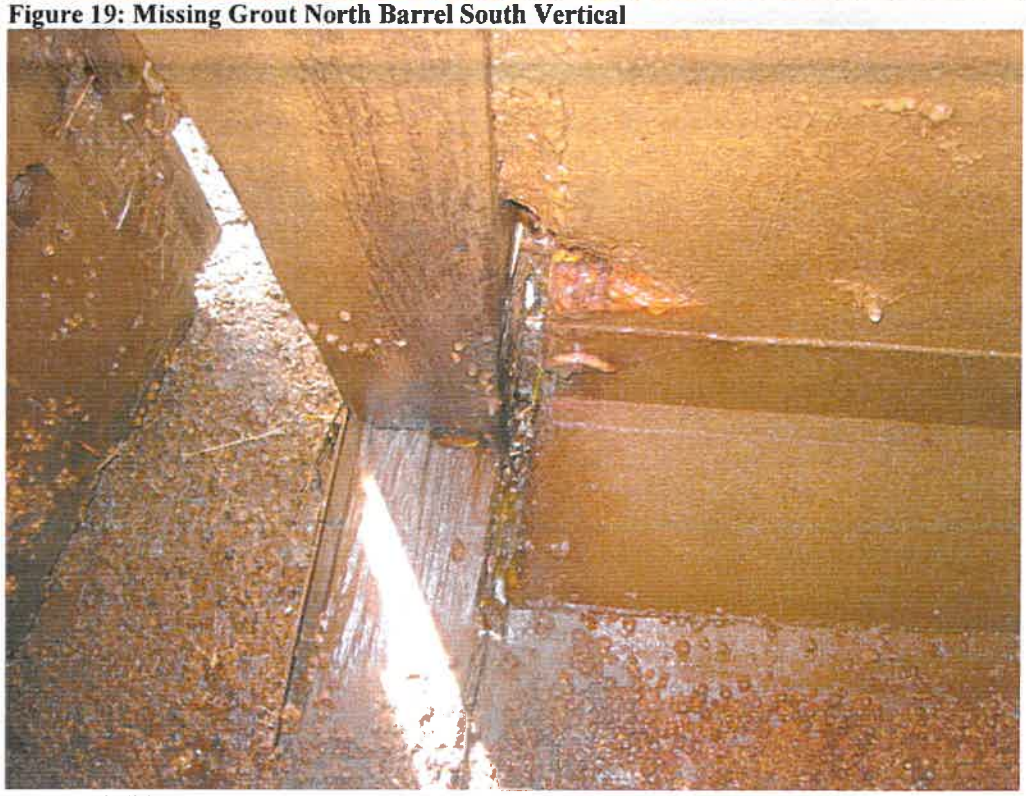

Figure 20: Missing Grout Center Cell at Roof Slab North (note: Spall at Roof Slab)

Figure 21: Missing Grout at Invert Slab Center Barrel

Figure 22: Missing Grout at Invert Slab Center Barrel

Figure 23: Advanced Structural Distress Grating Support

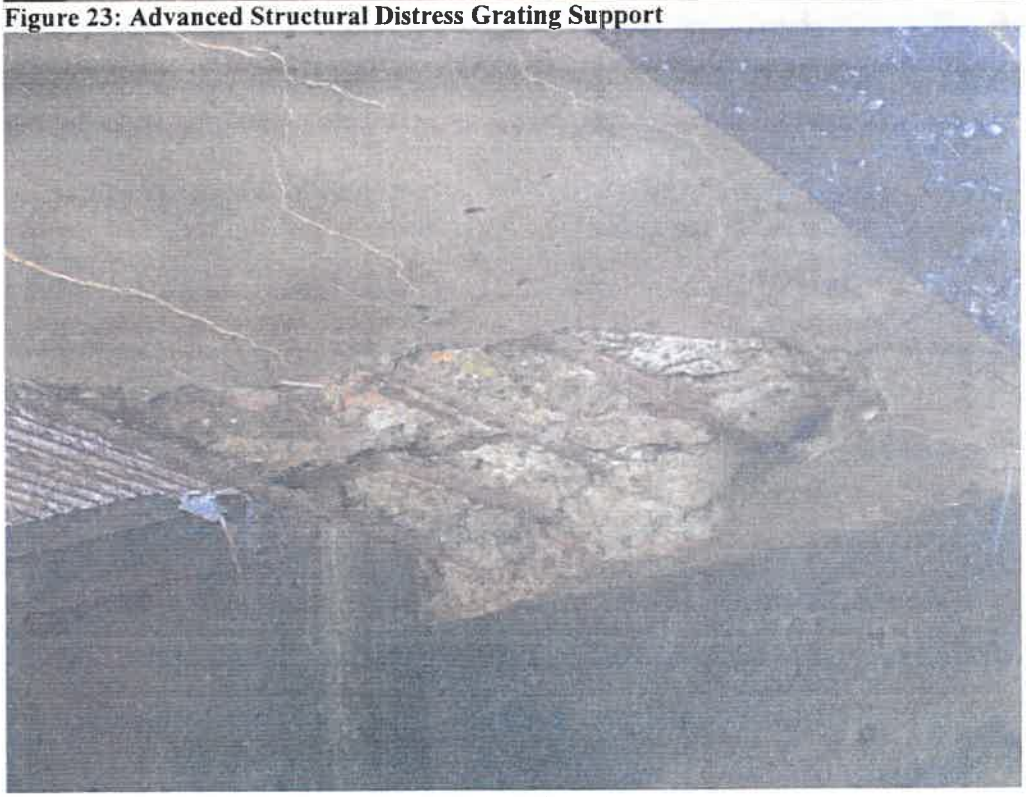

Figure 24: Deck Slab Spall over North Barrel Flume

Figure 25: Advanced Deterioration of Reinforcement at Deck Slab Spall over Flume

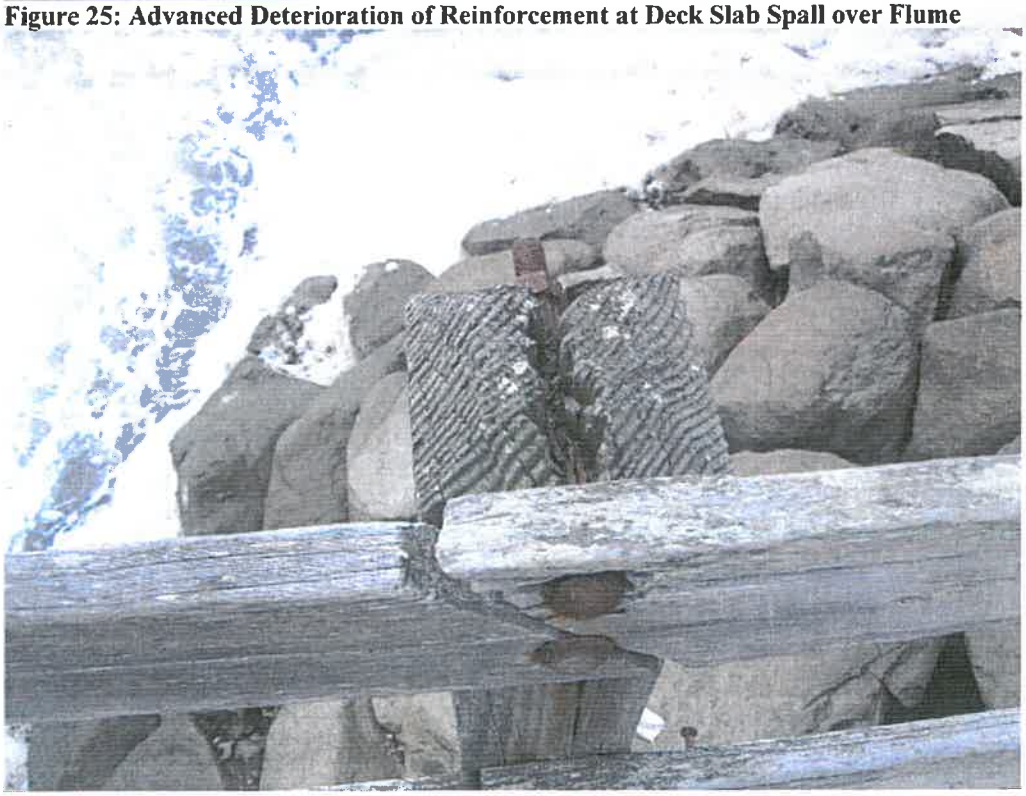

Figure 26: Typical Safety Railing and Post

APPENDIX B
Structures Inspection Field Report

MASSACHUSETTS HIGHWAY DEPARTMENT
STRUCTURES INSPECTION FIELD REPORT
CULVERT INSPECTION

2-DIST	B.I.N.	BR. DEPT. NO.
05	44B	W-14-007

CITY/TOWN	8-STRUCTURE NO	11-Mile POINT	41-STATUS	90-ROUTINE INSP. DATE
WELLFLEET	W14007-44B-MUN-NBI	000.483	A:OPEN	JUN 6, 2008
07-FACILITY CARRIED	**MEMORIAL NAME/LOCAL NAME**	**27-YR BUILT**	**106-YR REBUILT**	**YR REHAB'D (NON 106)**
HWY CHEQUSST NCK		1973	0000	0000
06-FEATURES INTERSECTED	**26-FUNCTIONAL CLASS**	**DIST. BRIDGE INSPECTION ENGINEER**		D. A. Palmer
WATER HERRING RIVER	Rural Local			
43-STRUCTURE TYPE	**22-OWNER**	**21-MAINTAINER**	**TEAM LEADER** W. Ferry	
119 : Concrete Culvert	Town Agency	Town Agency		
107-DECK TYPE	**WEATHER**	**TEMP. (air)**	**TEAM MEMBERS**	
N : Not applicable	Shwrs	19°C	W. J. COLLERAN	

TYPE OF CULVERT:

SHAPE:	RECTANGLE
MATERIAL	CONCRETE
COATING:	NONE

BARRELS: (In Meters)

SIZE:	NUMBER:
1.80mx1.50m	3

DEPTH OF COVER (To the nearest tenth of a meter) — E: 3.0 — W: 3.0

CURB REVEAL (in millimeters) — E: N — W: N

ITEM 62 CULVERT & RETAINING WALLS: 7

I62 (Dive Report): 7 — I62 (This Report): 7

	Dive This Rpt.	Rpt.	DEF		Dive This Rpt.	Rpt.	DEF		Dive This Rpt.	Rpt.	DEF
1. Roof	7	H	-	7. Protective Coating	N	N	-	13. Member Alignment	N	H	-
2. Floor	7	H	-	8. Embankment	7	7	-	14. Deformation	8	H	-
3. Walls	7	H	-	9. Wearing Surface	N	7	M-P	15. Scour	7	H	-
4. Headwall	7	7	-	10. Railing	N	5	-	16. Settlement	7	H	-
5. Wingwall	7	7	-	11. Sidewalks	N	N	-	17.	N	N	-
6. Pipe	N	N	-	12. Utilities	N	N	-	18.	N	N	-

UNDERMINING (Y/N) If YES please explain: N

COLLISION DAMAGE: *Please explain*
None (X) Minor ( ) Moderate ( ) Severe ( )

LOAD VIBRATION: *Please explain*
None (X) Minor ( ) Moderate ( ) Severe ( )

ITEM 61 CHANNEL & CHANNEL PROTECTION: 7

	Dive This Rpt.	Rpt.	DEF		Dive This Rpt.	Rpt.	DEF
1.Channel Scour	7	H	-	5. Utilities	N	X	-
2.Embankment Erosion	7	7	-	6. Rip-Rap/Slope Protection	7	7	-
3.Debris	8	7	-	7. Aggradation	7	H	-
4.Vegetation	8	7	-				

STREAM FLOW VELOCITY: Tidal (X) High ( ) Moderate ( ) Low ( )

ITEM 61 (Dive Report): 7

ITEM 61 (This Report): 7

93b-U/W INSP DATE: 08/30/2006

APPROACH CONDITION

		DEF
a. Appr. pavement condition	7	M-P
b. Appr. Roadway Settlement	7	-
c. Appr. Sidewalk Settlement	N	-
d.	N	-

WEIGHT POSTING

Not Applicable: X

	H	3	3S2	Single
Actual Posting	N	N	N	N
Recommended Posting	N	N	N	N

Waived Date: 00/00/00 — EJDMT Date: 00/00/00

Signs In Place (Y=Yes, N=No, NR=Not Required)

Legibility/ Visibility

	At bridge		Advance	
	N	S	N	S
Signs In Place				
Legibility/ Visibility				

ITEM 36 TRAFFIC SAFETY

	36	COND	DEF
A. Bridge Railing	N	N	-
B. Transitions	N	N	-
C. Approach Guardrail	1	7	-
D. Approach Guardrail Ends	0	7	-

ACCESSIBILITY (Y/N/P)

	Needed	Used		Needed	Used
Ladder	N	N	Other:		
Boat	N	N	DIVE REQUIRE	Y	Y
Waders	N	N			

TOTAL HOURS: 6

PLANS (Y/N): N

(Y.C.R.) (Y/N): N

TAPE#:

RATING

Rating Report (Y/N): Y

Date: 02/01/1999

Inspection data at time of existing rating
I62: 7 Date: 06/21/1996

(To be filled out by DBIE)
Request for Rating or Rerating (Y/N): N

If YES please give priority: HIGH / MEDIUM / LOW

REASON:

X=UNKNOWN N=NOT APPLICABLE H=HIDDEN/INACCESSIBLE R=REMOVED

CITY/TOWN	B.I.N.	BR. DEPT. NO.	S. STRUCTURE NO.	INSPECTION DATE
WELLFLEET	44B	W-14-007	W14007-44B-MUN-NBI	JUN 6, 2008

REMARKS, PHOTOS & SKETCHES

BRIDGE ORIENTATION

Chequesset Neck Road / Herring River has north/south abutments.

GENERAL REMARKS

This 3 barrel hydraulic control structure has directional control flappr gates found at the west end of the center and north barrels.

The interior of the full culvert is not accessible by above water inspection techiques and was inspected in cooperation with the dive team.

The current changed abrutly at this inspection almost 3 hrs after Wellfleet harbor low tide.

ITEM 62 - CULVERT

Item 62.4 - Headwall

Previously reported spall in the west headwall at the north pier, 1.6' long by 8" wide by 3" deep. (Photo 10)

Item 62.9 - Wearing Surface

Minor full width cracks in the bit. concrete - mostly sealed.

CONDITION RATING GUIDE

	CODE	CONDITION	DEFECTS
	N	NOT APPLICABLE	Use if structure is not a culvert.
G	9	EXCELLENT	No deficiencies
G	8	VERY GOOD	No noticeable or noteworthy differences which affect the condition of the culvert. Insignificant scrape marks caused by drift.
G	7	GOOD	Shrinkage cracks, light scaling, and insignificant spalling which does not expose reinforcing steel. Insignificant damage caused by drift with not misalignment and not requiring corrective action. Some minor scouring has occurred near curtain walls, wingwalls, or pipes. Metal culverts have a smooth symmetrical curvature with superficial corrosion and no pitting.
F	6	SATISFACTORY	Deterioration or initial disintegration, minor chloride contamination, cracking with some leaching, or spalls on concrete or masonry walls and slabs. Local minor scouring at curtain walls, wingwalls, or pipes. Metal culverts have a smooth curvature, non-symmetrical shape, significant corrosion or moderate pitting.
F	5	FAIR	Moderate to major deterioration or disintegration, extensive cracking and leaching, or spalls on concrete or masonry walls and slabs. Minor settlement or misalignment. Noticeable scouring or erosion at curtain walls, wingwalls, or pipes. Metal culverts have significant distortion and deflection in one section, significant corrosion or deep pitting.
P	4	POOR	Large spalls, heavy scaling, wide cracks, considerable efflorescence, or opened construction joints permitting loss of backfill. Considerable settlement or misalignment. Considerable scouring or erosion at curtain walls, wingwalls, or pipes. Metal culverts have significant distortion and deflection throughout, extensive corrosion or deep pitting.
P	3	SERIOUS	Any condition described in Code 4 but which is excessive in scope. Severe movement or differential settlement of the segments, or loss of fill. Holes may exist in walls or slabs. Integral wingwalls nearly severed from culvert. Severe scour or erosion at curtain walls, wingwalls, or pipes. Metal culverts have extreme distortion and deflection in one section, extensive corrosion, or deep pitting with scattered perforations.
C	2	CRITICAL	Advance deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored it may be necessary to close the bridge until corrective action is taken.
C	1	"IMMINENT" FAILURE	Bridge closed. Corrective action may put back in light service.
	0	FAILED	Bridge closed. Replacement necessary.

DEFICIENCY REPORTING GUIDE

DEFICIENCY: A defect in a structure that requires corrective action.

CATEGORIES OF DEFICIENCIES:

M= Minor Deficiency - (Examples include but are not limited to: Spalled concrete, minor to moderate corrosion to steel culverts, minor settlement or misalignment, minor scouring, minor damage to guardrail, etc.)

S= Severe/Major Deficiency- (Examples include but are not limited to: Large spalls, wide cracks, moderate to major deterioration in concrete, considerable settlement, considerable scouring or undermining, extensive corrosion and deflection in steel culverts, etc.)

C-S= Critical Deficiency - A deficiency in a structural component or element of a bridge that poses an extreme hazard or unsafe condition to the public. (Report as Critical Deficiency. Report must be submitted separately.)

URGENCY OF REPAIR:

I = Immediate- (Inspectors stay at the bridge until the District Maintenance crew or the responsible Agency crew (if not a State bridge) show up and corrective action is taken.)

A = ASAP- (Action will be taken by the District Maintenance Engineer or the Responsible Agency, (if not a State owned bridge) upon receipt of the Inspection Report.)

P = Prioritize- (Shall be prioritized by District Maintenance Engineer or the Responsible Party, (if not a State owned bridge) and repairs made when funds and/or manpower is available.)

CITY/TOWN	B.I.N.	BR. DEPT. NO.	S-STRUCTURE NO.	INSPECTION DATE
WELLFLEET	44B	W-14-007	W14007-44B-MUN-NBI	JUN 6, 2008

REMARKS

Item 62.10 - Railing

The 7th timber post from the south on the west side has heavy rot and the bottom bolt is missing. (Photo 7) The railings are firmly attached but most of the posts are split near the top, some with full height splits most likely to pack rust on the bolts. (Photo 8)

ITEM 61 - CHANNEL AND CHANNEL PROTECTION

Item 61.3 - Debris

There was a large amount of dead sea grass over the gratings at the west side indicating the extent of high tide. The sea grass removed to facilitate the inspection.

APPROACHES

Approaches a - Appr. pavement condition

Minor cracks in the bit. concrete, some full width transverse , some longitudinal, and some map cracks. Most have been sealed. (Photo 6)

TRAFFIC SAFETY

Item 36a - Bridge Railing

No bridge rail at roadway. Type W guard rail.

Item 36b - Transitions

No transitions

Item 36c - Approach Guardrail

Type W guard rail, standard. Beyond that cable & post railing with loose cables - non-standard.

Item 36d - Approach Guardrail Ends

Gloved ends, nonstandard.

Photo Log

Photo 1 : General Underside
Photo 2 : South Barrel - looking west
Photo 3 : Center Barrel - looking west
Photo 4 : North Barrel (right) with extension looking west.
Photo 5 : North barrel looking west
Photo 6 : Wearing Surface
Photo 7 : Railing post missing bolt - west side over south barrel.
Photo 8 : All railing posts are split (this one full hieght) most likely to pack rust of mounting bolts
Photo 9 : NW barrel roof spall and delaminaton exposed rebar.
Photo 10 : Spall over NW pier at headwall.
Photo 11 : South barrel east end - roof with map cracking
Photo 12 : Flapper gate (found on the west end of north and center barrels)
Photo 13 : Mostly blocked drains leading to culvert
Photo 14 : Alternative drainage to original drains provided.

CITY/TOWN	B.T.N.	BR. DEPT. NO.	S-STRUCTURE NO.	INSPECTION DATE
WELLFLEET	44B	W-14-007	W14007-44B-MUN-NBI	JUN 6, 2008

PHOTOS

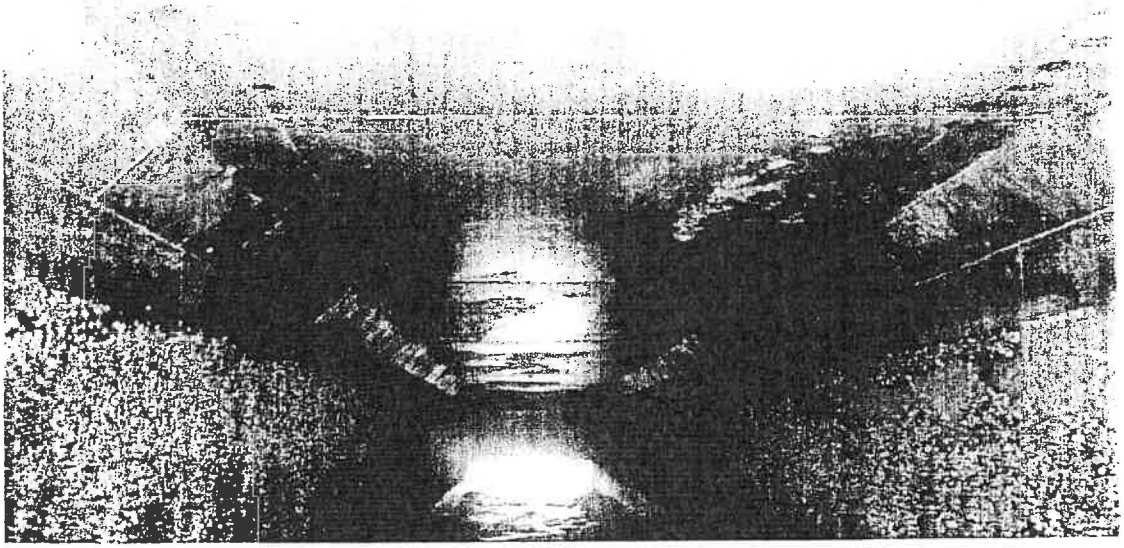

Photo 1: General Underside

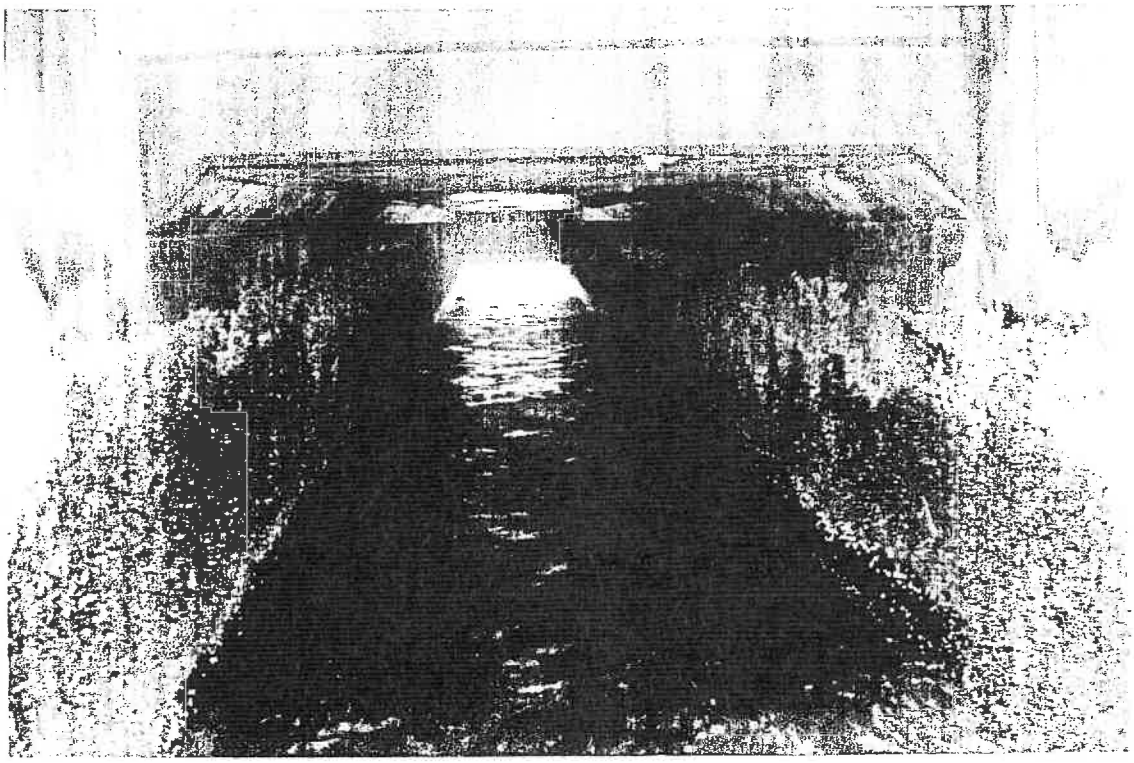

Photo 2: South Barrel - looking west

CITY/TOWN	B.I.N.	BR. DEPT. NO.	S. STRUCTURE NO.	INSPECTION DATE
WELLFLEET	44B	W-14-007	W14007-44B-MUN-NBI	JUN 6, 2008

PHOTOS

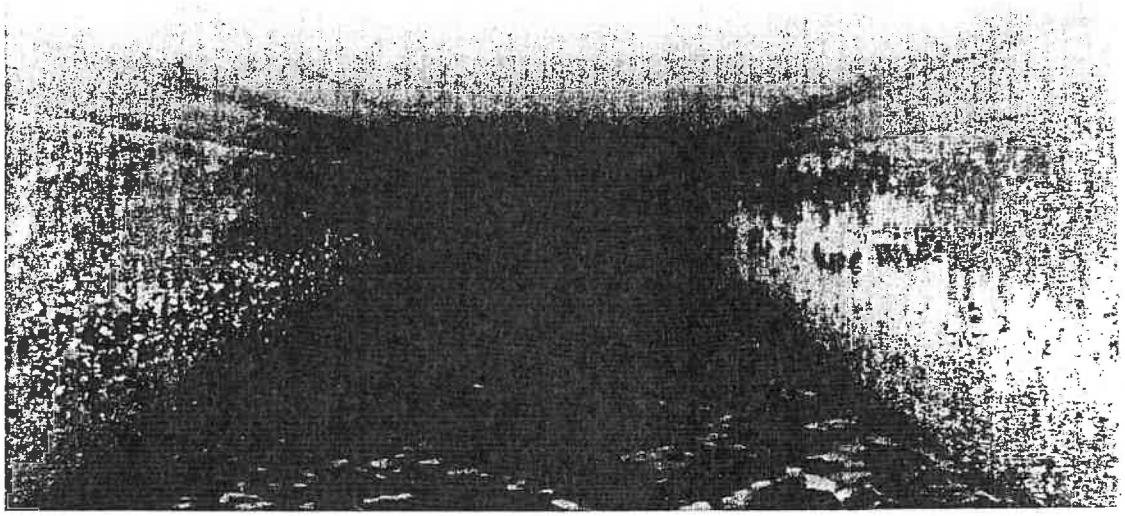

Photo 3: Center Barrel - looking west

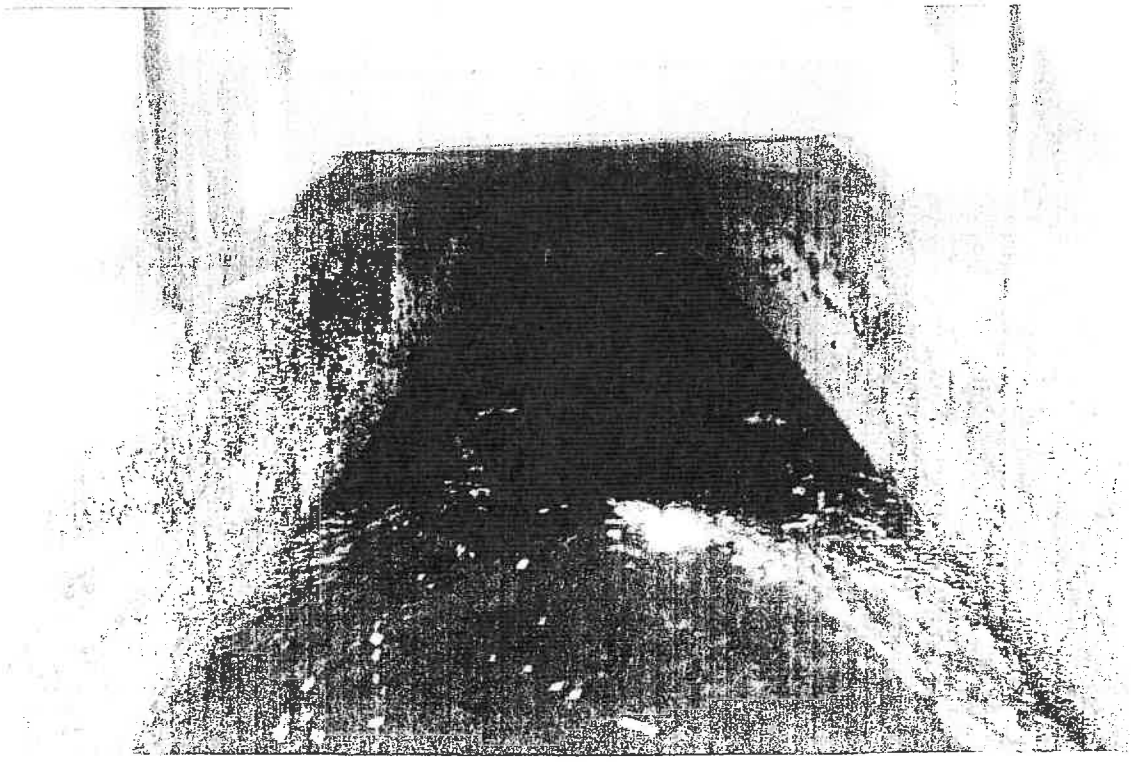

Photo 4: North Barrel (right) with extension looking west.

CITY/TOWN	B.I.N.	BR. DEPT. NO.	S.-STRUCTURE NO.	INSPECTION DATE
WELLFLEET	44B	W-14-007	W14007-44B-MUN-NBI	JUN 6, 2008

PHOTOS

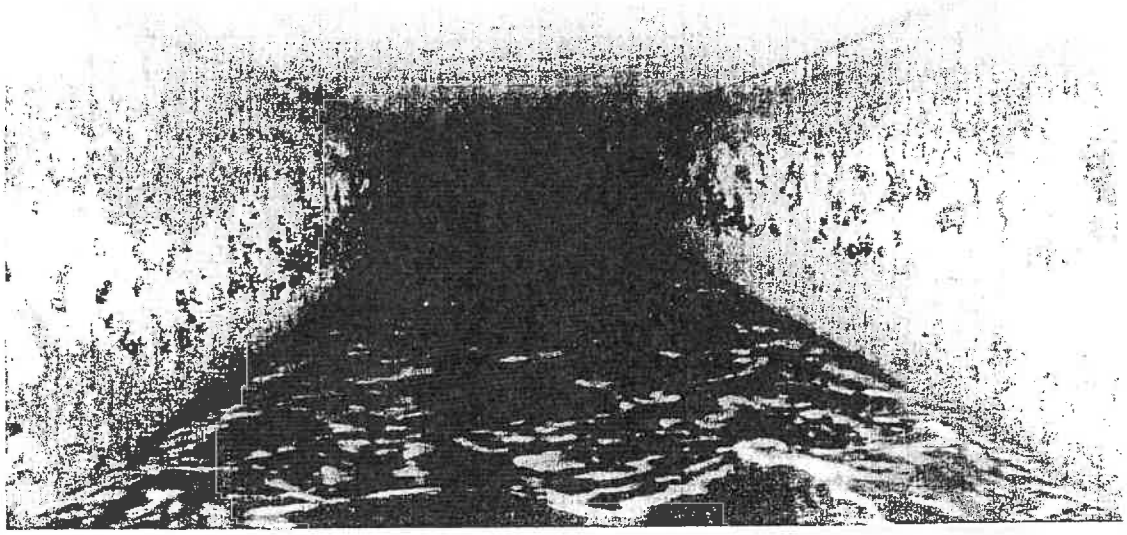

Photo 5: North barrel looking west

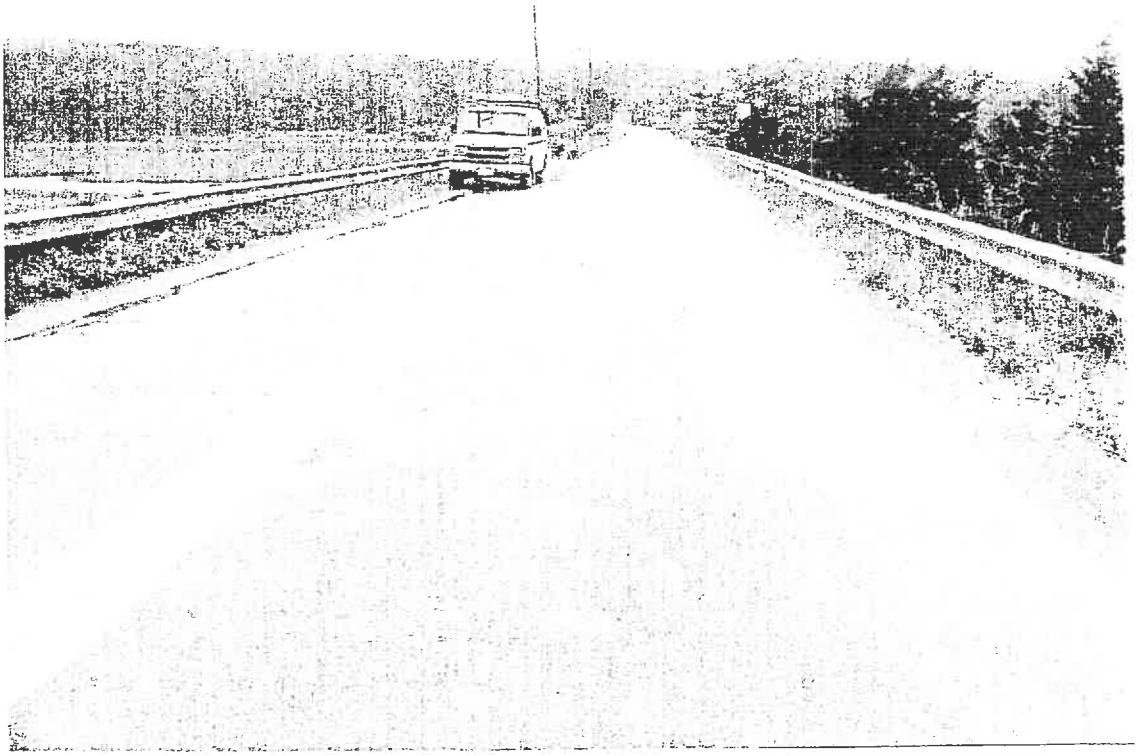

Photo 6: Wearing Surface

CITY TOWN	B.I.N.	BR. DEPT. NO.	S-STRUCTURE NO	INSPECTION DATE
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PHOTOS

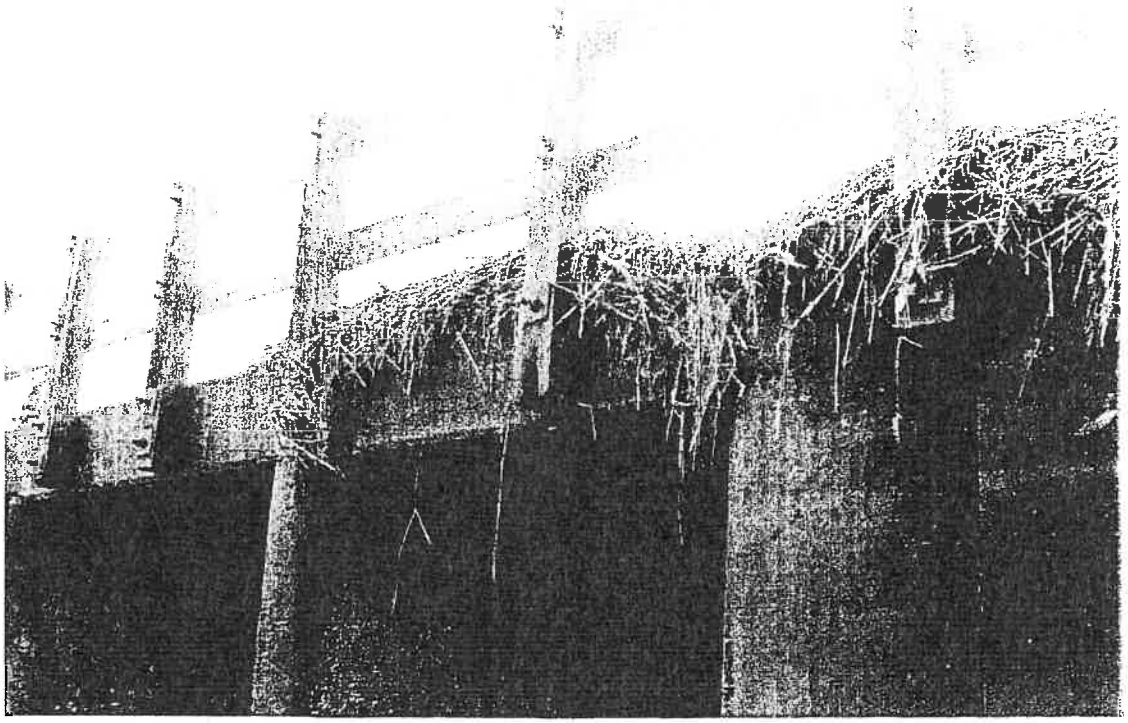

Photo 7: Railing post missing bolt - west side over south barrel.

Photo 8: All railing posts are split (this one full hieght) most likely to pack rust of mounting bolts

CITY/TOWN	B.I.N.	BR. DEPT. NO.	S-STRUCTURE NO.	INSPECTION DATE
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PHOTOS

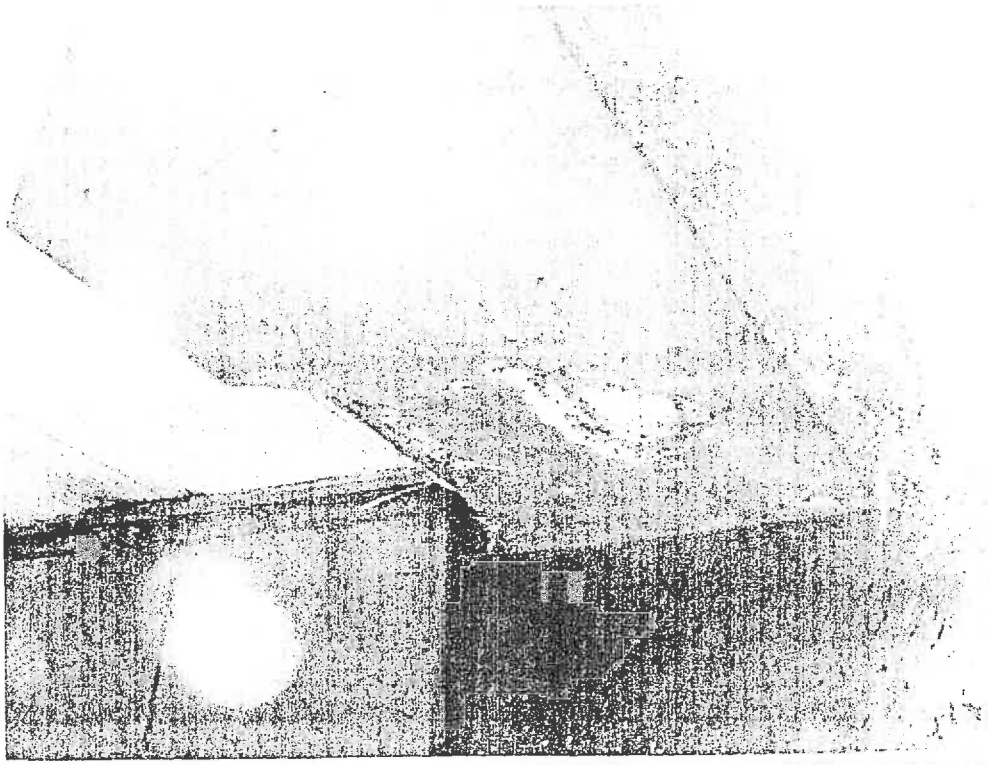

Photo 9: NW barrel roof spall and delaminaton exposed rebar.

Photo 10: Spall over NW pier at headwall.

CITY/TOWN	B.I.N.	BR. DEPT. NO	S-STRUCTURE NO.	INSPECTION DATE
WELLFLEET	44B	W-14-007	W14007-44B-MUN-NBI	JUN 6, 2008

PHOTOS

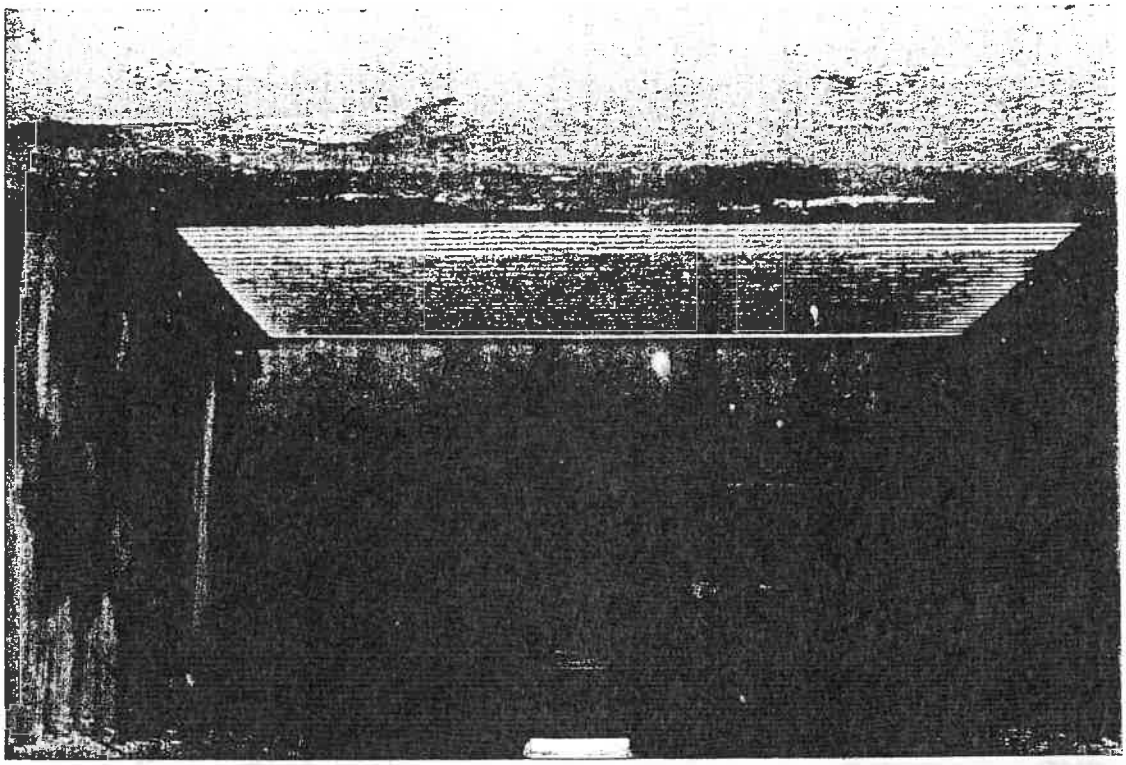

Photo 11: South barrel east end - roof with map cracking

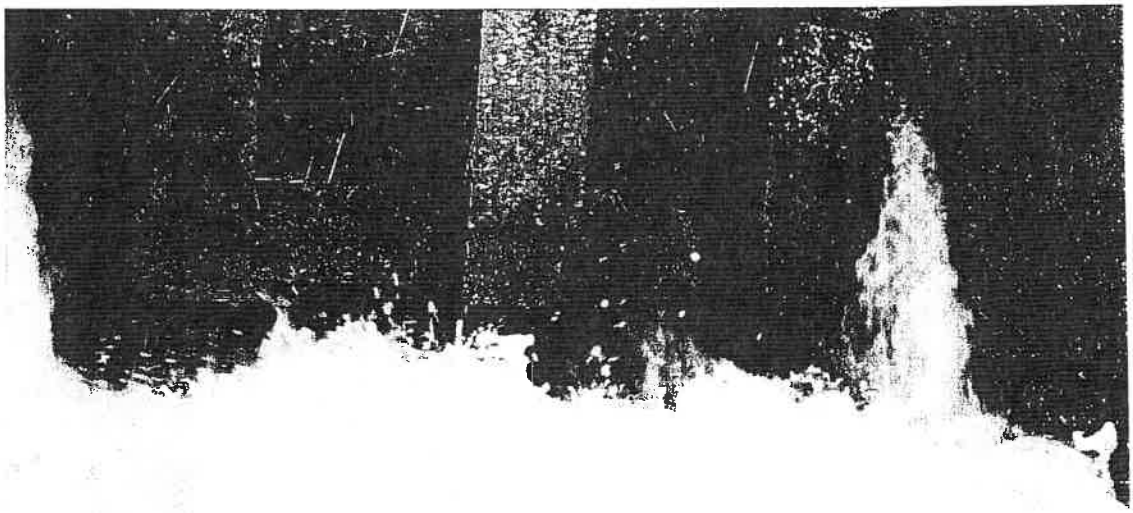

Photo 12: Flapper gate (found on the west end of north and center barrels)

CITY TOWN	B.I.N.	BR. DEPT. NO.	S-STRUCTURE NO.	INSPECTION DATE
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PHOTOS

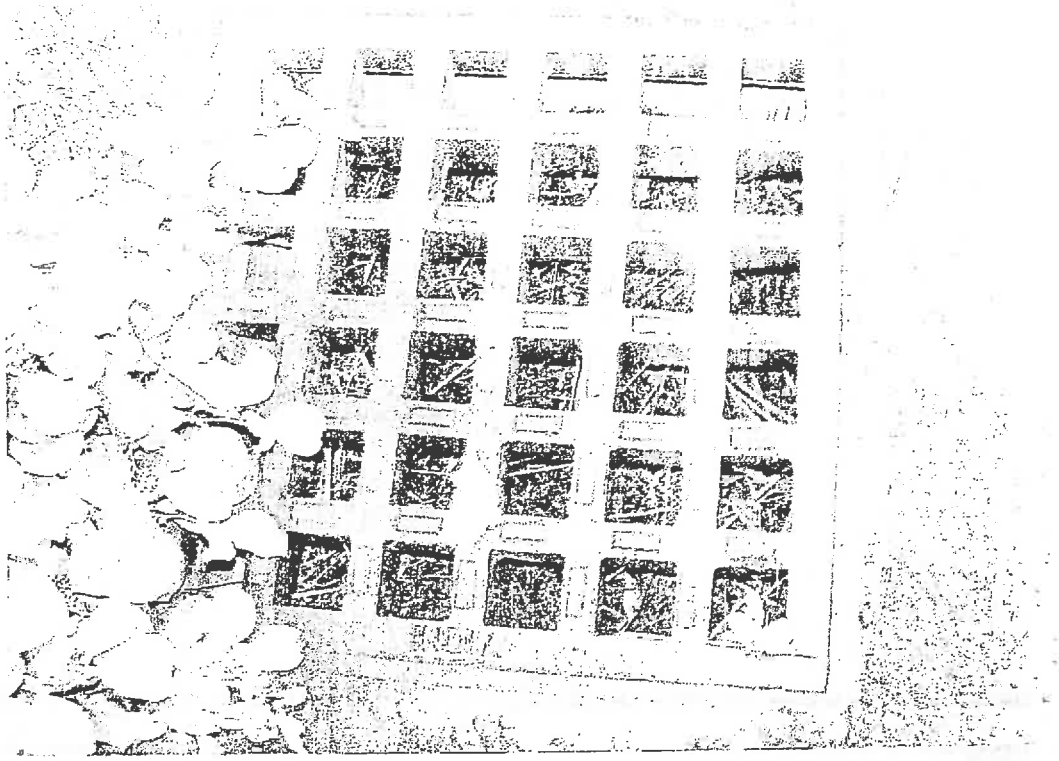


Photo 13: Mostly blocked drains leading to culvert

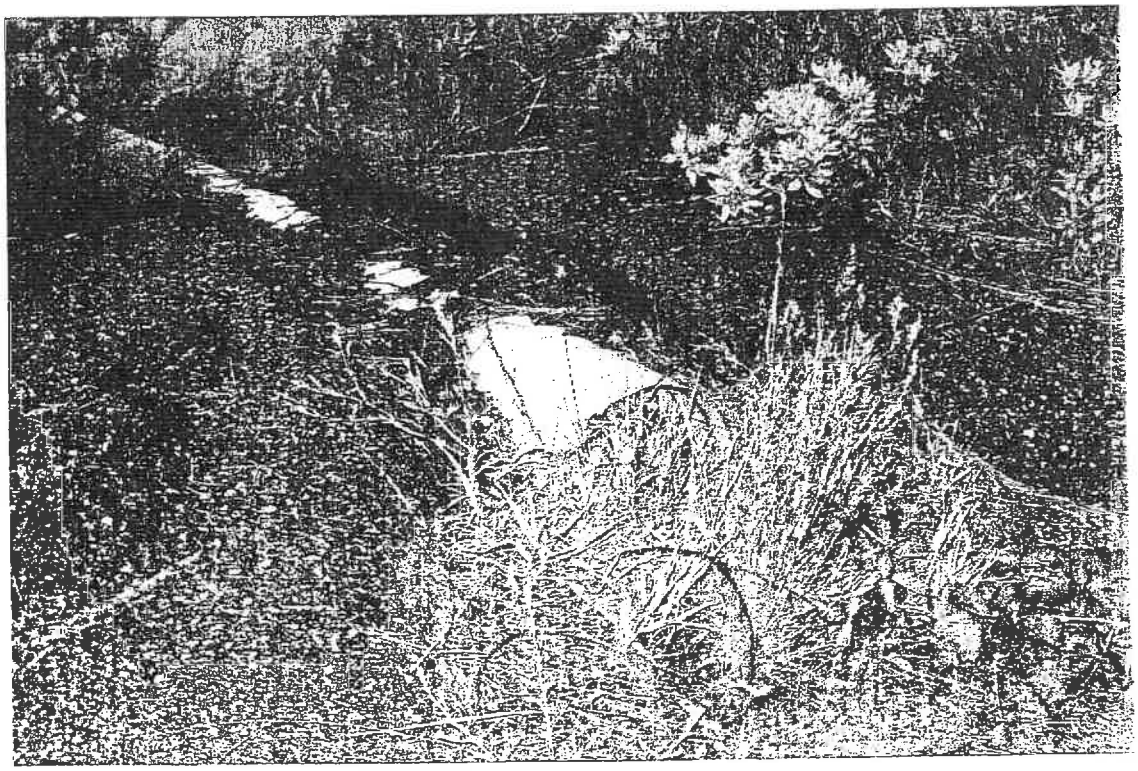


Photo 14: Alternative drainage to original drains provided.

MASSACHUSETTS HIGHWAY DEPARTMENT

UNDERWATER OPERATIONS TEAM
ROUTINE UNDERWATER INSPECTION REPORT

2-DIST	B.I.N.	BR. DEPT. NO.
05	44B	W-14-007

CITY/TOWN	S-STRUCTURE NO.	LEVEL OF INSPECTION	9SB-DATE INSPECTED
WELLFLEET	W14007-44B-MUN-NBI	II	JUN 6, 2008

07-FACILITY CARRIED	ACCESS TO BRIDGE	UNDERWATER OPERATIONS ENGINEER
HWY CHEQUSST NCK	EMBANKMENT	JOHN B. DESMOND

06-FEATURES INTERSECTED	DEPTH	VISIBILITY	TEAM LEADER (DIVE MASTER)	Report submitted by:
WATER HERRING RIVER	1 m	1 m	RANDI E. BONICA	

BOTTOM CONDITION	CURRENT	TEAM MEMBERS
SHELLS/CONC. FLOOR	TIDAL/SWIFT	W. FERRY, B. FITZGERALD, W. J. COLLERAN

ITEM 60 SUBSTRUCTURE — N

		DEF
1. Abutments	N	
a. Pedestals	N	-
b. Bridge Seats	N	-
c. Backwalls	N	-
d. Breastwalls	N	-
e. Wingwalls	N	-
f. Slope Paving/Rip-Rap	N	-
g. Pointing	N	-
h. Footings	N	-
i. Piles	N	-
j. Scour	N	-
k. Settlement	N	-
l.	N	-
2. Piers or Bents	N	
a. Pedestals	N	-
b. Caps	N	-
c. Columns	N	-
d. Stems/Webs/Pierwalls	N	-
e. Pointing	N	-
f. Footing	N	-
g. Piles	N	-
h. Scour	N	-
i. Settlement	N	-
j.	N	-
k.	N	-
3. Pile Bents	N	
a. Pile Caps	N	-
b. Piles	N	-
c. Diagonal Bracing	N	-
d. Horizontal Bracing	N	-
e. Fasteners	N	-
UNDERMINING (Y/N)		N

ITEM 61 CHANNEL & CHANNEL PROTECTION — 7

		DEF
1. Channel Scour	7	-
2. Embankment Erosion	7	-
3. Debris	8	-
4. Vegetation	8	-
5. Utilities	N	-
6. Rip-Rap/Slope Protection	7	-
7. Aggradation	7	-
8. Fender System	N	-
a. Piles	N	-
b. Diagonal Bracing	N	-
c. Horizontal Bracing	N	-
d. Wales	N	-
e. Fasteners	N	-
f. Ladders	N	-
9.	N	-

ITEM 59 SUPERSTRUCTURE

		DEF
	N	-
	N	-
	N	-

ITEM 62 CULVERTS — 7

		DEF
1. Roof	6	-
2. Floor	7	-
3. Walls	7	-
4. Headwall	7	-
5. Wingwall	7	-
6. Pipe	N	-
7. Protective Coating	N	-
8. Embankment	7	-
9. Wearing Surface	N	-
10. Railing	N	-
11. Sidewalks	N	-
12. Utilities	N	-
13. Member Alignment	N	-
14. Deformation	N	-
15. Scour	7	-
16. Settlement	7	-
17.	N	-
18.	N	-
UNDERMINING (Y/N)		N

DEFICIENCY REPORTING GUIDE

DEFICIENCY: A defect in a structure that requires corrective action

CATEGORIES OF DEFICIENCIES:

M= Minor Deficiency- Deficiencies which are minor in nature, generally do not impact the structural integrity of the bridge and could easily be repaired. Examples include but are not limited to: Spalled concrete, Minor scouring, etc.

S= Severe/Major Deficiency- Deficiencies which are more extensive in nature and need more planning and effort to repair. Examples include but are not limited to: Moderate to major deterioration in concrete, Exposed and corroding rebars, Deteriorated timber piles, Considerable settlement, Considerable scouring or undermining, etc.

C-S= Critical Structural Deficiency- A deficiency in a structural element of a bridge that poses an extreme unsafe condition due to the failure or imminent failure of the element which will affect the structural integrity of the bridge.

C-H= Critical Hazard Deficiency- A deficiency in a component or element of a bridge that poses an extreme hazard or unsafe condition to the public, but does not impair the structural integrity of the bridge. Examples include but are not limited to: Any part of piles or fender system which are projecting outward and may become a safety hazard for the navigational traffic, etc.

URGENCY OF REPAIR:

I=Immediate- [Inspector is immediately contact District Bridge Inspection Engineer (DBIE) to report the Deficiency and to receive further instruction from him/her.]

A=ASAP- [Action/Repair should be initiated by District Maintenance Engineer or the responsible party (if not a State owned bridge) upon receipt of the Inspection Report.]

P=Prioritize- [Shall be prioritized by District Maintenance Engineer or the Responsible Party (if not a State owned bridge) and repairs made when funds and/or manpower is available.]

CITY/TOWN	B.I.N.	BR. DEPT. NO.	S.-STRUCTURE NO.	INSPECTION DATE
WELLFLEET	44B	W-14-007	W14007-44B-MUN-NBI	JUN 6, 2008

REMARKS

GENERAL REMARKS

The structure is a three span concrete box culvert. Spans are numbered from left to right, looking downstream. Sta 1+00 is at the upstream end.

Tide Gates:
There is a water flow device at the downstream end of each span. In the left span there is an adjustable vertical gate. The flood and ebb tides flow through this span. In the right and center spans there are one-way flapper gates, hinged at the top. The force of the outgoing tide causes the gates to partially swing open, allowing water to flow through. The force of the incoming tide holds these solid gates in a closed position to prevent water flow through these spans. There is some water flow around the gates when they are closed during an incoming tide.

Note to Divers: The flow through the culvert is extremely swift at all phases of the tide except for a short interval of slack tide. It should be noted that slack tide at this structure occurs approximately 1 1/2 to 2 hours after Wellfleet harbor. Due to the high velocity of the water and low clearance at high tide, inspection should be planned for slack low tide.

ITEM 62 - CULVERT

Item 62.1 - Roof
The roof is in good condition except at the right downstream extension. The area is delaminated with two spalls, each with rebar exposed:

Right Downstream Extension
One spall adjacent to the roof grating is 3' L x 1' W x 0.4' P.
Downstream 2' of first spall and located 1' off the left pier wall, the second spall is 1.5' L x 1' W x 0.4' P.

At Sta 1+62 there is a hairline crack across the width of the left span. The crack coincides with separate poured concrete sections. There appears to be three poured sections along the entire length of the culvert. The roof in the left span upstream extension, adjacent to the steel grate, has light cracking and moderate delamination with rust stains (3.3' L x 6.0' W).

Item 62.2 - Floor
The concrete floor in all spans is partially exposed. There is marine growth on the floor.

Item 62.3 - Walls
The concrete walls appear to be in good condition, with barnacle growth.

Left Span - The downstream corner of the left span has abrasion approximately 6.5' below the roof. Abrasion extends 2.5' high and is approximately 0.5' long. Maximum penetration is 0.2'.
There is a 1/8" maximum width vertical crack extending from the roof to the area of abrasion. There is minor deterioration around the crack.
The downstream face of the right wall has some minor deterioration with exposed reinforcing steel beginning approximately 2' below the roof. Maximum height is 3.6', maximum penetration is 0.1'.

Item 62.4 - Headwall
The bottom face at the upstream left span and downstream center and right spans have hairline cracks.

Item 62.5 - Wingwall
All wingwalls are displaced outward approximately 0.1'.

CITY TOWN	B.I.N.	BR. DEPT. NO.	S-STRUCTURE NO.	INSPECTION DATE
WELLFLEET	44B	W-14-007	W14007-44B-MUN-NBI	JUN 6, 2008

REMARKS

Item 62.15 - Scour

Upstream

Left span: The lip of the concrete floor exposed across the entire left span. Maximum exposed height is 1.5'.

Center span: The lip is exposed at the left side of the center span 3.0' long. Maximum exposed height of 1.3'.

Right span: The lip is also exposed across the entire right span. Maximum exposed height is 0.6'.

Downstream

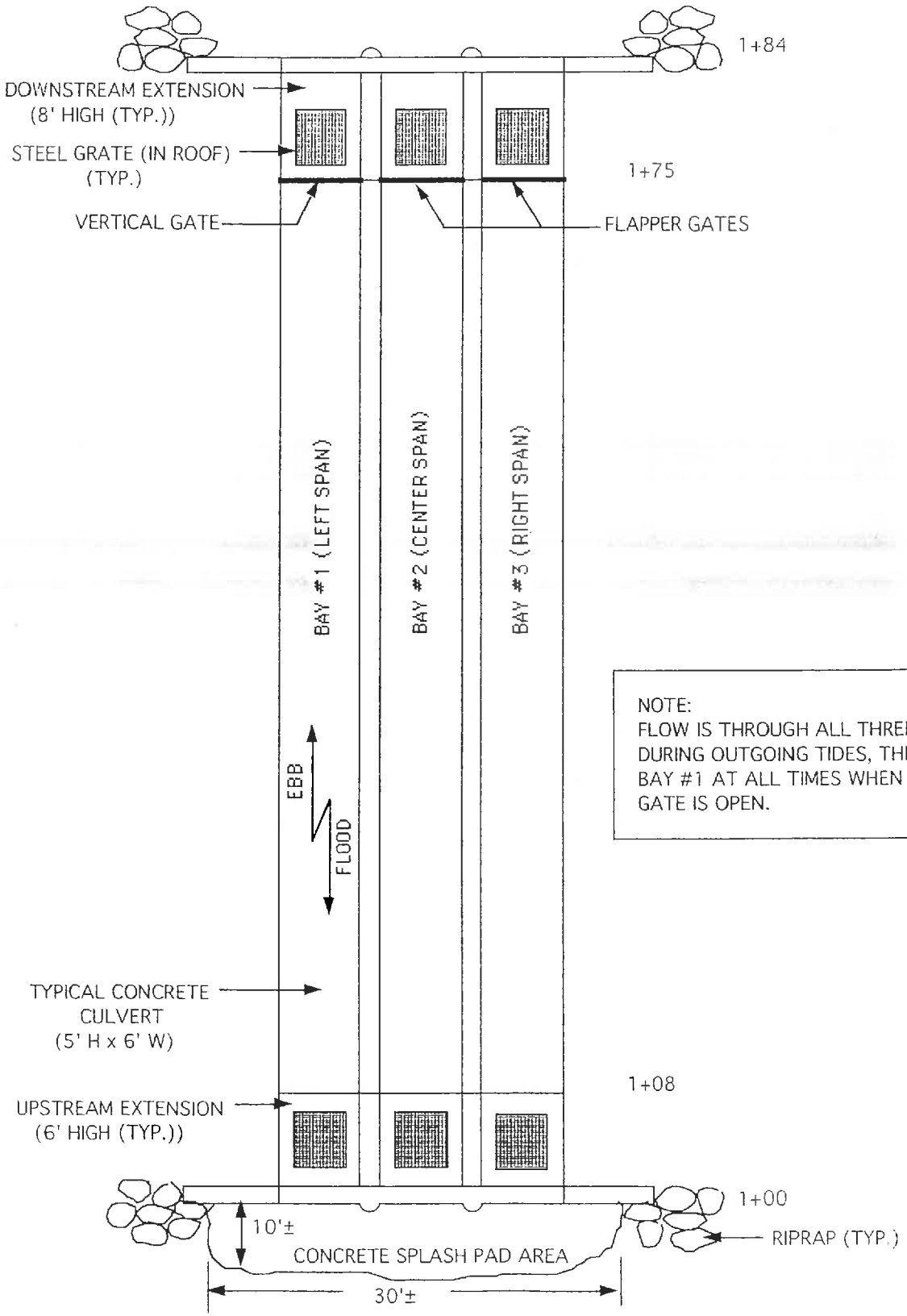
Center span: The lip is exposed in the middle of the span for a length of 2'. Maximum exposed height of 0.4'.

Sketch Log

Sketch 1 : PLAN VIEW - NOT TO SCALE

CITY/TOWN	B.I.N.	BR. DEPT. NO.	S-STRUCTURE NO.	INSPECTION DATE
WELLFLEET	44B	W-14-007	W14007-44B-MUN-NBI	JUN 6, 2008

SKETCHES



Sketch 1: PLAN VIEW - NOT TO SCALE

CITY/TOWN	B.I.N.	BR. DEPT. NO.	S. STRUCTURE NO.	INSPECTION DATE
WELLFLEET	44B	W-14-007	W14007-44B-MUN-NBI	JUN 6, 2008

REMARKS

GENERAL REMARKS

The structure is a three span concrete box culvert. Spans are numbered from left to right, looking downstream. Sta 1+00 is at the upstream end.

Tide Gates:

There is a water flow device at the downstream end of each span. In the left span there is an adjustable vertical gate. The flood and ebb tides flow through this span. In the right and center spans there are one-way flapper gates, hinged at the top. The force of the outgoing tide causes the gates to partially swing open, allowing water to flow through. The force of the incoming tide holds these solid gates in a closed position to prevent water flow through these spans. There is some water flow around the gates when they are closed during an incoming tide.

Note to Divers: The flow through the culvert is extremely swift at all phases of the tide except for a short interval of slack tide. It should be noted that slack tide at this structure occurs approximately 1 1/2 to 2 hours after Wellfleet harbor. Due to the high velocity of the water and low clearance at high tide, inspection should be planned for slack low tide.

ITEM 62 - CULVERT

Item 62.1 - Roof

The roof is in good condition except at the right downstream extension. The area is delaminated with two spalls, each with rebar exposed:

Right Downstream Extension

One spall adjacent to the roof grating is 3' L x 1' W x 0.4' P.
Downstream 2' of first spall and located 1' off the left pier wall, the second spall is 1.5' L x 1' W x 0.4' P.

At Sta 1+62 there is a hairline crack across the width of the left span. The crack coincides with separate poured concrete sections. There appears to be three poured sections along the entire length of the culvert. The roof in the left span upstream extension, adjacent to the steel grate, has light cracking and moderate delamination with rust stains (3.3' L x 6.0' W).

Item 62.2 - Floor

The concrete floor in all spans is partially exposed. There is marine growth on the floor.

Item 62.3 - Walls

The concrete walls appear to be in good condition, with barnacle growth.

Left Span - The downstream corner of the left span has abrasion approximately 6.5' below the roof. Abrasion extends 2.5' high and is approximately 0.5' long. Maximum penetration is 0.2'.
There is a 1/8" maximum width vertical crack extending from the roof to the area of abrasion. There is minor deterioration around the crack.
The downstream face of the right wall has some minor deterioration with exposed reinforcing steel beginning approximately 2' below the roof. Maximum height is 3.6', maximum penetration is 0.1'.

Item 62.4 - Headwall

The bottom face at the upstream left span and downstream center and right spans have hairline cracks

Item 62.5 - Wingwall

All wingwalls are displaced outward approximately 0.1'