

## **KODIAK STORM DRAIN INSPECTION REPORT**

**PREPARED FOR DOWL HKM**

**KODIAK, AK**



February 2014

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Inspection Date(s): February 12-13, 2014

Lead Inspector



Scott Hibbs

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## **KODIAK STORM DRAIN INSPECTION REPORT**

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### **1. INTRODUCTION**

#### **1.1. Purpose and Scope**

The *Kodiak Storm Drain Inspection Report* contains the results of the detailed drainage system inspection completed by Extreme Access, Inc. on February 12-13, 2014. The scope included ultrasonic wall thickness sampling, wall condition examination, coating examination, hammer sounding for missing fill and seam condition examination. The report also includes information on sediment buildup where applicable.

#### **1.2. General Description**

The two drain lines in this system traverse the commercial area between Center Ave and W Marine Way before emptying into St. Paul Harbor. The drain lines run parallel to one another; with the northern line designated Drain A and the southern line designated Drain B. The corrugated pipes



that comprise the lines are sealed with a very effective tar type coating, and have manhole covers for access at various intervals. A sample of the coating was submitted to Dowl HKM at the close of the inspection. At high tide, salt water from the harbor flows into the sections of pipe closest to the outfall.

## **2. INSPECTION PROCEDURES**

### **2.1. Inspection Team**

The inspection was performed by the following:

- Inspection Team Leader:

Scott Hibbs, PE, Certified FHWA Bridge Inspection Team Leader

- Inspectors:

Chris Lowry, Certified FHWA Lead Bridge Inspector

John Gonzales, Certified FHWA Inspector

Mike Coleman, Certified FHWA Inspector

### **2.2. Inspection Methods and Techniques**

For inspection purposes the drainage system was accessed using dry suit and confined space methods. An OSHA certified Confined Space Attendant was on hand at each end of the drain. These attendants monitored air quality every 30 minutes and contacted the other Attendant or the interior crew with those results.

The Authorized Entrants always worked in pairs to affect a rescue if required. During the inspection, the crew was in the drainage system inspecting for 5.0 hours for each drain. An Entry Supervisor was on hand at all times, overseeing the Confined Space in accordance with the Confined Space permit. All visible surfaces and members of the drainage system were subject to inspection with particular attention being paid to all seams, coatings, areas of corrosion, observed deformations and damaged components.

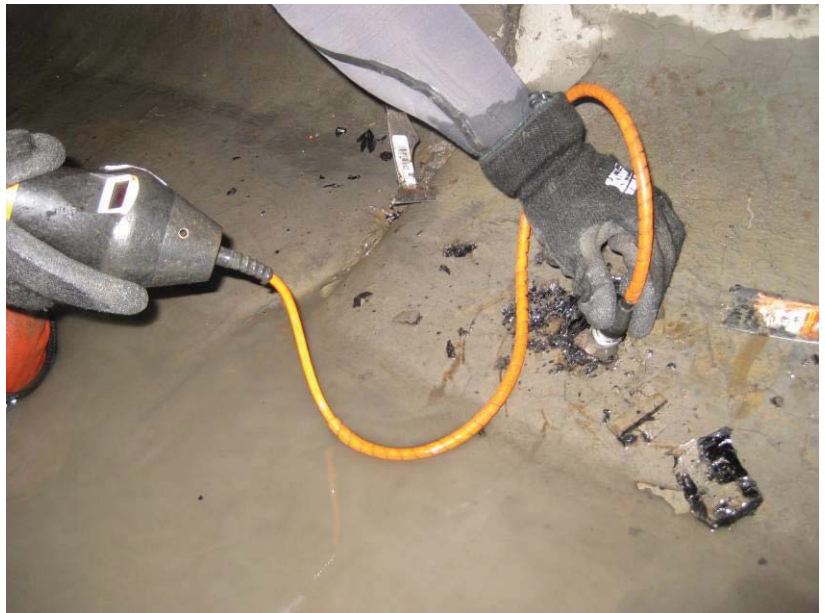
All members/components were checked for evidence of irregular loadings (out-of-plane bending, distress at connections, etc.). Inspection techniques included the use of UT, magnification, headlamps, cleaning, grinding and sounding. Ultrasonic wall thickness testing was performed at four points around the circumference of the pipe where possible, at a spacing of roughly fifty feet where conditions allowed. Measurements were taken regarding the width and height (ovality) of the pipe at these locations as well.

Sediment depth measurements and characteristic assessments were performed where possible to provide information for possible future cleanup operations.

### **3. WALL THICKNESS FINDINGS**

#### **3.1. Test Process**

Four UT areas were chosen at each location during the inspection. The locations were specified with respect to distance from the start of the drain. The UT areas were designated based on clock positions facing downstream, with measurements typically being taken at 12 o'clock, 9 o'clock, 3 o'clock, and some position as close to 6 o'clock as possible depending on the presence of sediment. At each bottom UT location, the coating was removed



prior to testing. The upper 3 measurements were taken through the relatively thin coating and were verified at the entrance to confirm accuracy. The material thickness was measured using the handheld underwater UT and the measurements were recorded in millimeters. In addition to the scope between Marine and Center, the drains downstream of Marine Drive were visually examined to the incoming salt water line but the crew was too hypothermic to take UT measurements.

### 3.2. Drain A

The wall thickness measurements for Drain A were in the normal range, from 3.5mm to 3.6mm.

Distance	9:00	12:00	3:00	6:00	Width	Height	Sediment
0'	3.5mm	3.5mm	3.6mm	n/a	71-1/2"	35"	10" deep sand w/ 1"
50'	3.5mm	3.6mm	3.5mm	n/a	74"	33-1/2"	9" deep sand w/ 1-1/2"
125'	3.6mm	3.6mm	3.6mm	n/a	72-1/2"	31-3/4"	10" deep sand w/ 3/4"
150'	3.6mm	3.6mm	3.6mm	n/a	73"	31-1/2"	8" deep sand w/ 3/4"
200'	3.6mm	3.6mm	3.6mm	n/a	73-3/4"	31-1/2"	10" deep sand w/ 1/2"
250'	3.6mm	3.6mm	3.6mm	n/a	74-1/2"	31-1/2"	3-1/2" deep sand w/ 1-1/2"
300'	3.6mm	3.6mm	3.6mm	3.6mm	73-1/2"	41"	None
350'	3.6mm	3.6mm	3.6mm	3.6mm	73"	42-1/4"	None
400'	3.6mm	3.6mm	3.6mm	3.6mm	73"	43"	None
450'	3.5mm	3.5mm	3.5mm	3.5mm	75"	40"	None
500'	3.6mm	3.6mm	3.6mm	3.6mm	74"	39"	None
550'	n/a	3.6mm	3.6mm	n/a	-	-	None

### 3.3. Drain B

The wall thickness measurements for Drain B were in the normal range, from 3.4mm to 3.7mm.

Distance	9:00	12:00	3:00	6:00	Width	Height	Sediment
0'	3.6mm	3.6mm	3.5mm	n/a	72-1/2"	37"	Sandy soil
25'	3.7mm	3.6mm	3.5mm	n/a	72-1/2"	34-1/4"	11" deep sand w/ 1-1/2"
50'	3.6mm	3.5mm	3.5mm	n/a	74"	38"	10" deep sand w/ 2-1/2"
90'	3.6mm	3.6mm	3.6mm	n/a	71-1/2"	33"	10" deep sand w/ 2-1/2"
150'	3.5mm	3.5mm	3.5mm	n/a	72-3/4"	39"	sand
200'	3.4mm	3.4mm	3.4mm	n/a	72-1/2"	32"	10" deep sand w/ 2-1/2"
250'	3.6mm	3.4mm	3.4mm	n/a	73-1/4"	35"	Sand and rock
300'	3.5mm	3.5mm	3.6mm	n/a	72.5"	41"	Sand and minor silt
312'	3.7mm	3.6mm	3.6mm	3.6mm	72-1/2"	42"	3" deep fine silt
336'	3.7mm	3.6mm	3.6mm	3.6mm	72"	43"	Fine silt
375'	3.7mm	3.7mm	3.6mm	3.6mm	72-1/2"	42-1/2"	Light silt
424'	3.5mm	3.6mm	3.5mm	3.5mm	73"	41"	1" deep silt
475'	3.6mm	3.6mm	3.6mm	3.5mm	74-1/2"	39"	None
484'	3.6mm	3.6mm	3.7mm	3.6mm	74 1/2"	38-1/2"	None

#### **4. PIPE WALL AND SEAM CONDITION**

##### **4.1. PIPE WALL CONDITION**

The pipe walls are generally in good condition. The areas of interest related to the walls are in Drain A at 282' where a 2' x 4' area is caved or pressed in 3-1/2" (Photo 19), Drain A at 288' where a 2' x 2' area is pressed in 2" (Photo 20), and Drain A at 497' where a 3' x 2' area is pressed in 2" (Photo 34). There is a horizontal void behind the wall in Drain B at 484' that is 12" deep.

##### **4.2. SEAM CONDITION**

The pipe seams are in fair condition. Many of the seams have gaps and offsets in excess of 1", some with corrosion on the edges. Two of the seams were found to have water leakage. The seam in Drain B at 290' has a gap open to 1-1/2" with water flowing out of the drain pipe into the surrounding soil at a rate of approximately 2 gpm from the 7 o'clock position (Photo 67) at this water level. The seams in Drain B at 312' and 336' also have apparent leakage (Photo 69 and Photo 70).

##### **4.3. OVALITY**

Height and width measurements were taken regularly during the inspection to determine the ovality of the pipe. The measurements were in a generally acceptable range. There were some points with significant variation in width, with the Drain A width ranging from 71-1/2" to 75", and the Drain B width ranging from 71-1/2" to 74". The Drain A height was between 31-1/2" and 43", while the Drain B height was between 32" and 43". Vertical measurements in Drain A from 0' to 250' were difficult to get completely accurate due to soil depth. Variation of 3/4" is expected in those measurements. The same is true for Drain B from 0' to 200'.

Distance	Width	Height
0'	71-1/2"	41"
50'	74"	39"
125'	72-1/2"	42"
150'	73"	42"
200'	73-3/4"	41-1/2"
250'	74-1/2"	39"
300'	73-1/2"	41"
350'	73"	42-1/4"
400'	73"	43"
450'	75"	40"
500'	74"	39"
550'	-	-

Drain A

Distance	Width	Height
0'	72-1/2"	42"
25'	72-1/2"	42"
50'	74"	39"
90'	71-1/2"	41"
150'	72-3/4"	42"
200'	72-1/2"	42"
250'	73-1/4"	41"
300'	72.5"	41"
312'	72-1/2"	42"
336'	72"	43"
375'	72-1/2"	42-1/2"
400'	72-1/2"	42"
424'	73"	41"
475'	74-1/2"	39"
484'	74"	38-1/2"

Drain B

#### 4.4. COATING AND CORROSION

The coating on the pipe is generally in good condition, and in most locations has protected the pipe from corrosion very well. The exceptions to this are in areas where holes have been cut to accommodate the ingress of other pipes (Photo 48, 60, 62, 63), at some of the seams (Photo 9, 22, 23, 26, 36, 54), and at the outfall end of both drains (Photo 42, 43, 44, 78, 79, 80) at Marine Street. There is a section in Drain A at 218' where the coating is peeling (Photo 14). There is an area of failed paint in Drain A at 510' (Photo 37). The average coating thickness between 7:30 through 12:00 to 4:30 is 3/16". Between 4:30 and 6:00, the coating progressively gets as thicker to as much as 1" at 6:00, then back to 3/16" at 7:30.

#### 4.5. BACKFILL VOIDS

In Drain B the floor of the pipe seems unsupported from 300' to 475'. The inspectors used steel hammers to sound the side walls and the floor. There were few void locations identified except along the bottom. There is a horizontal void behind the wall in Drain B at 484' that is 12" deep.

## 5. SEDIMENT

The sediment in the drainage system typically consists of sandy soil with some gravel mixed in. At the outfall end of the drains some silt is present. There are some sizable soil deposits in Drain A between 350' and 358' (Photo25). Sediment type and depth was observed where possible during ultrasonic testing.

Distance	Sediment
0'	10" deep sand w/ 1"
50'	9" deep sand w/ 1-1/2"
125'	10" deep sand w/ 3/4"
150'	8" deep sand w/ 3/4"
200'	10" deep sand w/ 1/2"
250'	3-1/2" deep sand w/ 1-1/2"
300'	None
350'	None
400'	None
450'	None
500'	None

Drain A

Distance	Sediment
0'	Sandy soil
25'	11" deep sand w/ 1-1/2"
50'	10" deep sand w/ 2-1/2"
90'	10" deep sand w/ 2-1/2"
150'	sand
200'	10" deep sand w/ 2-1/2"
250'	Sand and rock
300'	Sand and minor silt
312'	3" deep fine silt
336'	Fine silt
375'	Light silt
424'	1" deep silt

Drain B

## 6. SUMMARY & RECOMMENDATION

Overall, the drain system is in fair condition. The coating is intact in most locations, and the seams are preventing the infiltration of material for the most part. The ultrasonic testing completed indicated that no significant deterioration has occurred.

The hollow sounding bottom of both drains should be investigated by drilling 3-5 small 1/8" pilot holes in each 175' section and probing with a light welding wire. The holes should be sealed with epoxy, silicone or with self sealing sheet metal screws. This recommendation is a moderate to high priority.

The seam in Drain B at 290' should be sealed. This is a high priority.

The coating in Drain A at 218' and 510' should be replaced. This is a low priority.



# APPENDIX A

## Photos and Inspection Findings



Photo 1

Drain A - 9'  
Seam at 9 o'clock with gap to 1".



Photo 2

Drain A - 9'  
Seam at 10 o'clock with gap to 1-1/4".



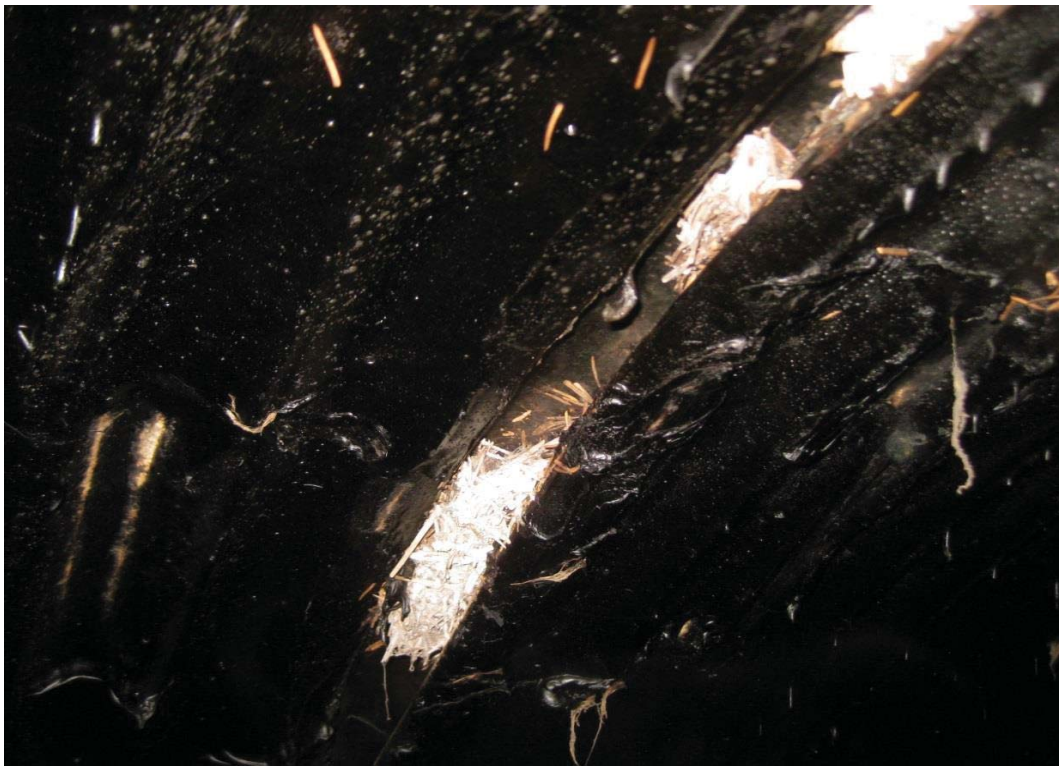


Photo 3

Drain A - 40'

Seam at 3 o'clock with gap to 1-1/4" and offset of 1". No corrosion.



Photo 4

Drain A - 69'

Seam at 3 o'clock with gap to 3/4" and offset of 1/2". No corrosion.



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Photo 5

Drain A - 92'  
Seam at 9 o'clock with gap to 1-1/4". No corrosion or offset.



Photo 6

Drain A - 113'  
Seam at 9 o'clock with gap to 1/2" and offset of 1-1/2". Minor corrosion on edge.





Photo 7

Ultrasonic testing location for Drain A at 125'.



Photo 8

View of 12 o'clock position. 46" torch cut hole with moderate surface rust on the edges. View is looking up at cast iron manhole cover. This manhole is at the bend in the drain. No significant deficiency.



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Photo 9

Drain A - 139'  
 Seam at 3 o'clock with gap to 2" and offset up to 1". Moderate corrosion.

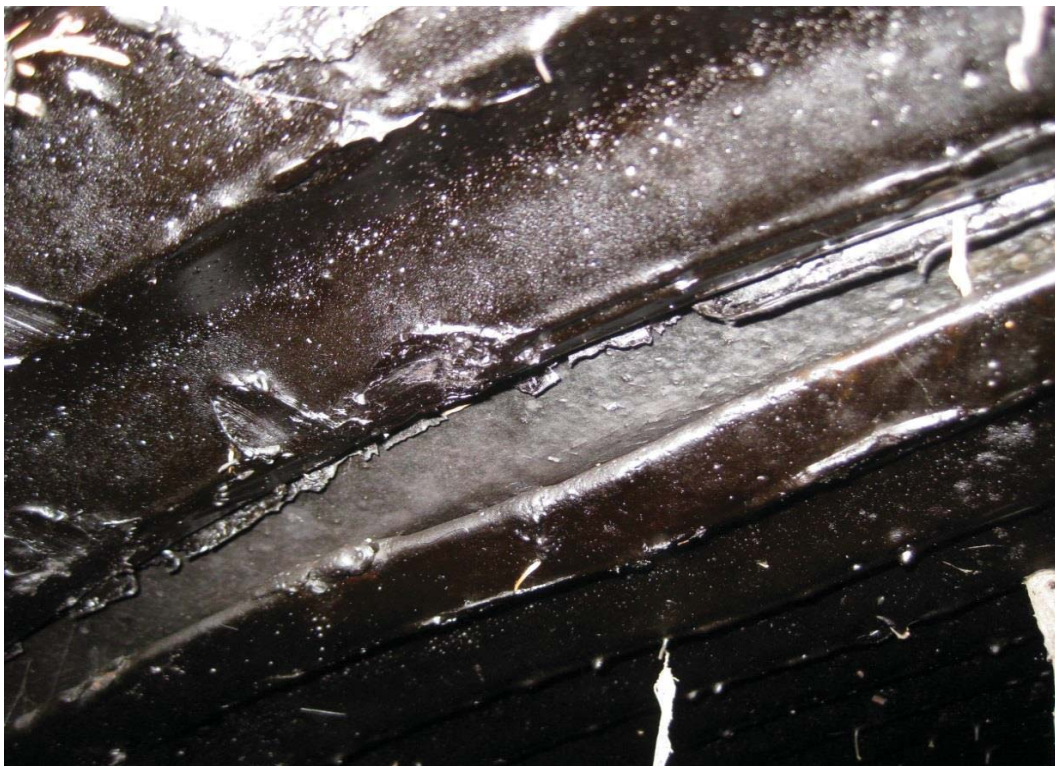


Photo 10

Drain A - 160'  
 Seam at 11 o'clock with gap to 1" and offset up to 1". Minor surface rust on edge.



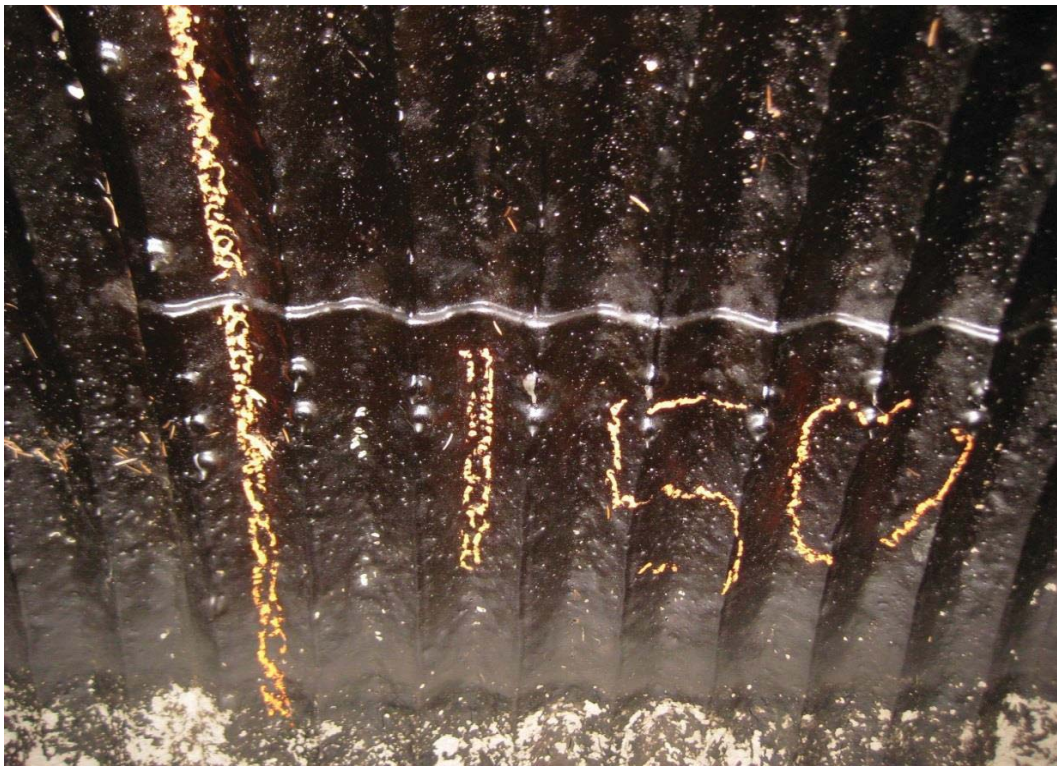


Photo 11

Ultrasonic testing location for Drain A at 150'. Coating over seam intact.

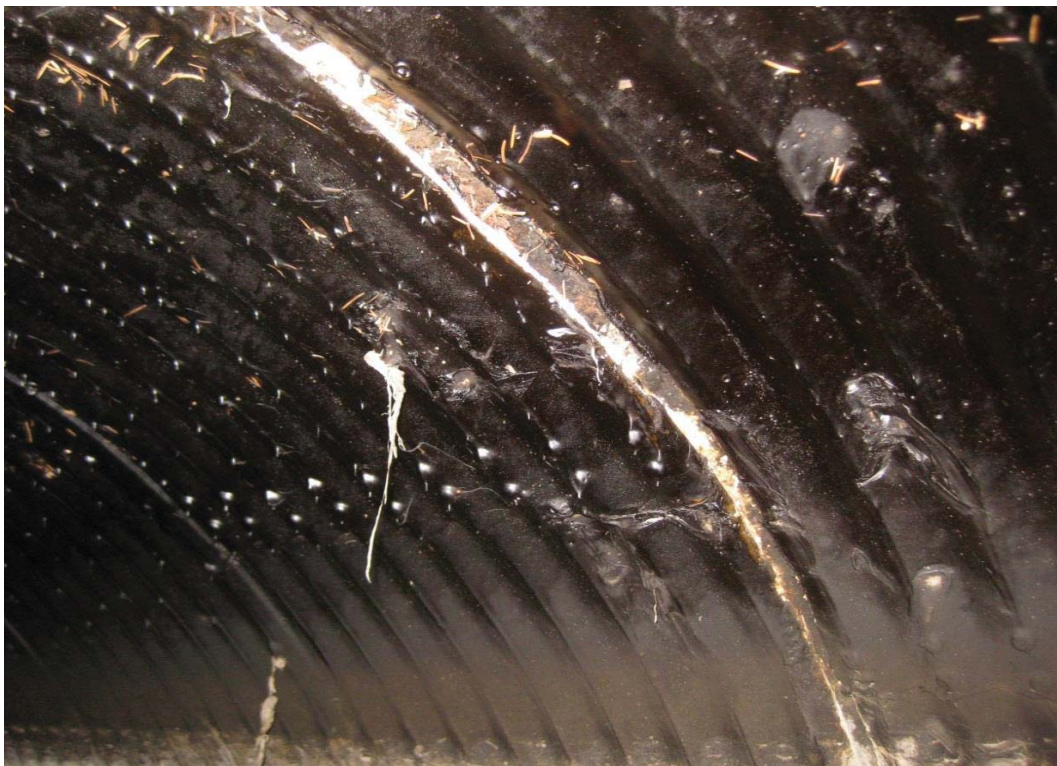


Photo 12

Drain A - 184'  
Seam at 11 o'clock looking upstream with gap to 1" and offset up to 1/2".



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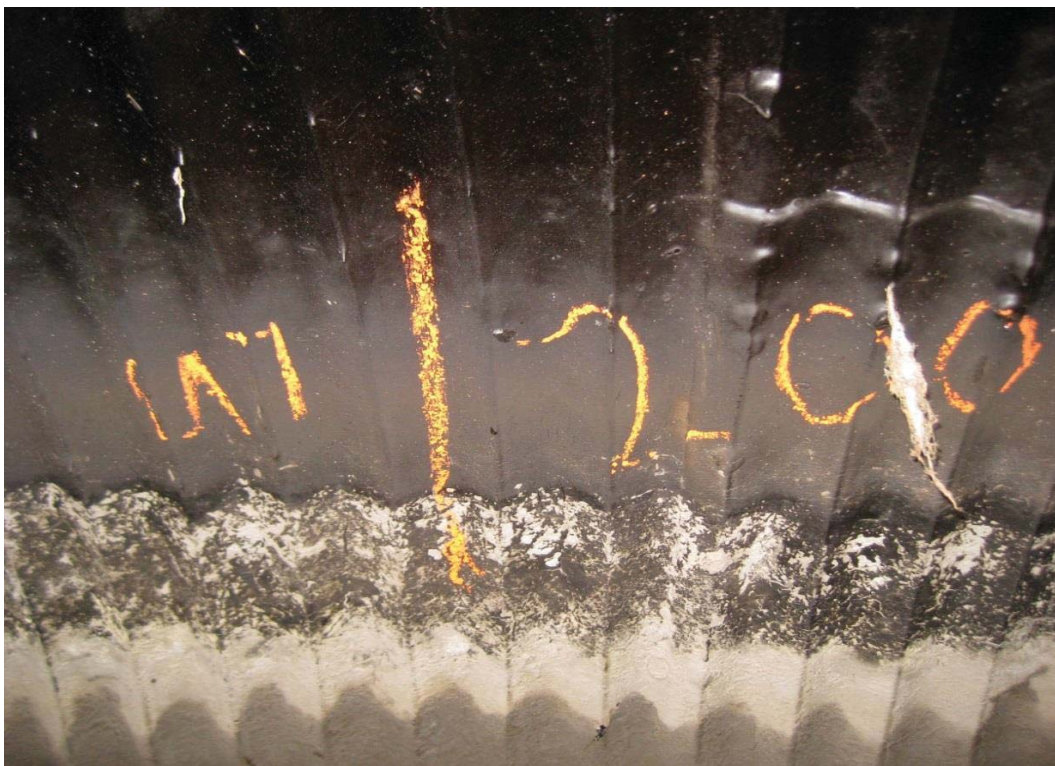


Photo 13

Ultrasonic testing location for Drain A at 200'.



Photo 14

Drain A - 218'

Seam at 3 o'clock. Coating is peeling from 2:30 to 3 o'clock between 215' and 218'.





Photo 15

Drain A - 225'  
Seam at 12 o'clock with gap to 1" and offset up to 1/2".



Photo 16

Drain A - 247'  
Seam at 3 o'clock with gap to 1-1/2". No offset or corrosion.





Photo 17

Ultrasonic testing location for Drain A at 250'.

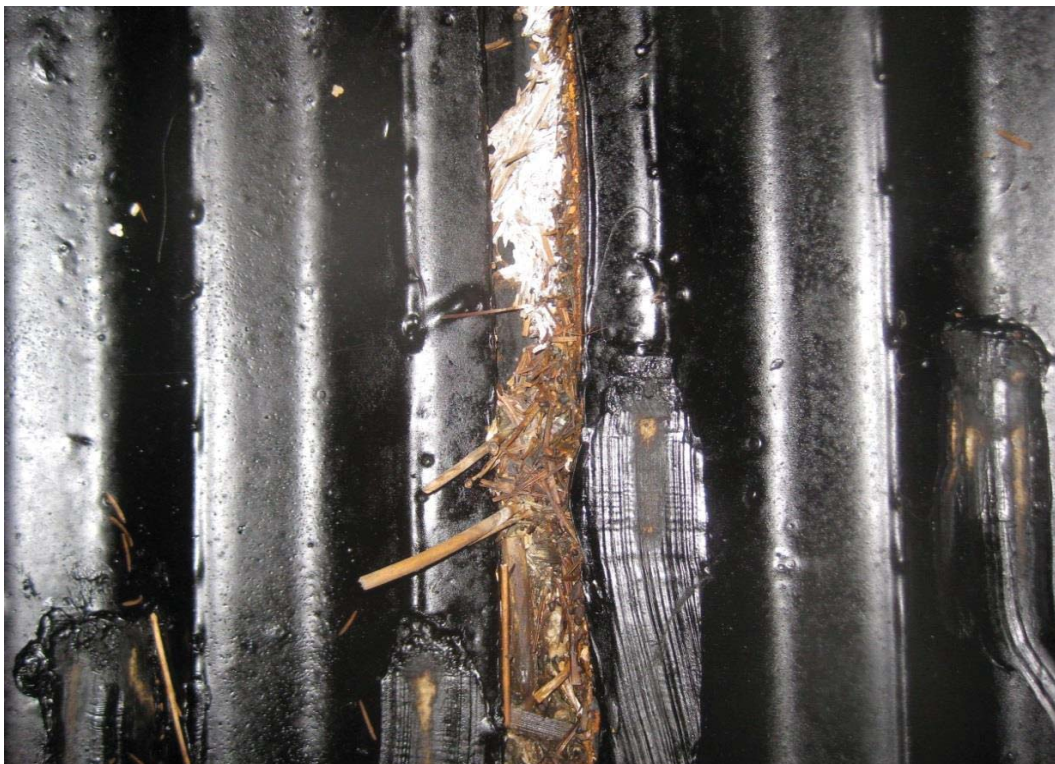


Photo 18

Drain A - 266'  
Seam at 12 o'clock with gap to 1". Minor corrosion.





Photo 19

Drain A - 282'  
There is a 2' x 4' area that is caved in 3-1/2".



Photo 20

Drain A - 288'  
Seam at 12 o'clock with gap to 1" and an offset of 2". There is a 2' square area that is caved or pressed in 2".





Photo 21

Ultrasonic testing location for Drain A at 300'.



Photo 22

Drain A - 312'

Seam at 12 o'clock with gap to 1-1/4" and an offset of 1/2". Moderate corrosion on edge.





Photo 23

Drain A - 333'

Seam at 9 o'clock with gap to 1-1/4" and an offset of 1/4" and an offset up to 1/2". Moderate corrosion.



Photo 24

Ultrasonic testing location for Drain A at 300'.





Photo 25

Soil deposits between 350' and 358'. Sediment deposits are up to 3-1/2' x 10" x 2'.

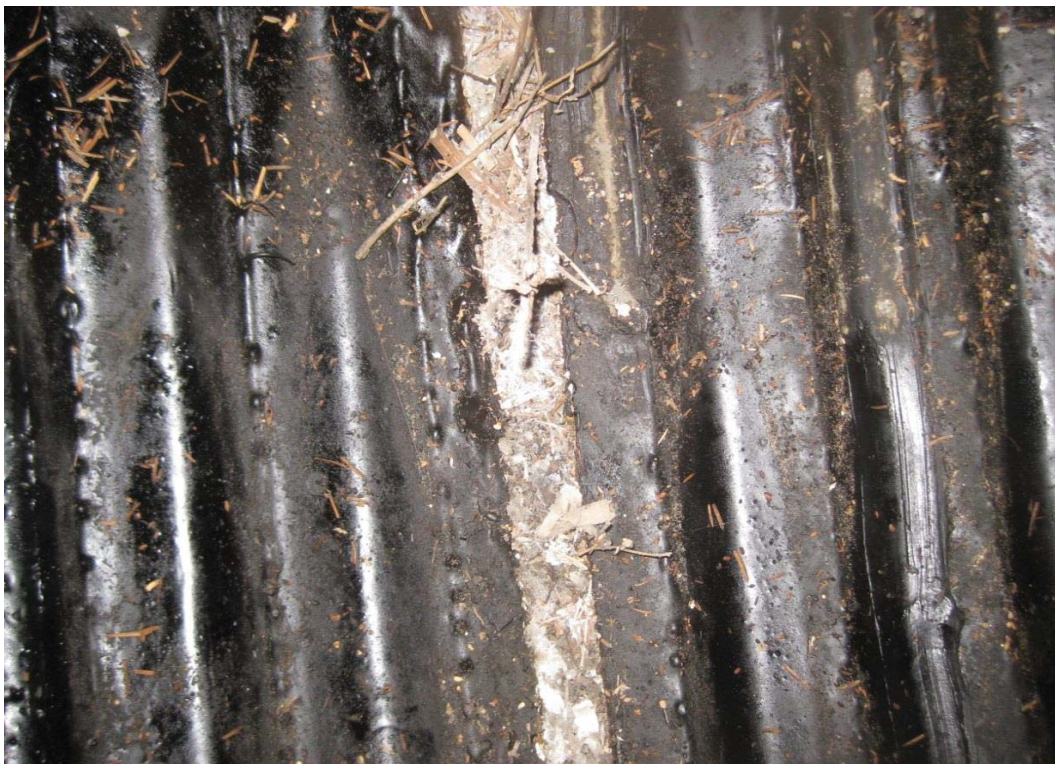


Photo 26

Drain A - 358'

Seam at 12 o'clock with gap to 1-1/2" and an offset of 1". Moderate corrosion.





Photo 27

Drain A - 380'  
Seam at 12 o'clock with gap to 2" and an offset up to 1/2".



Photo 28

Ultrasonic testing location for Drain A at 400'.



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Photo 29

Drain A - 402'  
 Seam at 9 o'clock with gap to 1-1/2" and an offset of 1". Moderate edge corrosion.



Photo 30

Drain A - 425'  
 Seam at 12 o'clock with gap to 1-1/2" and an offset of 1/2". Minor corrosion along edges.



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Photo 31

Ultrasonic testing location for Drain A at 450'.



Photo 32

Drain A - 466'  
Seam at 9 o'clock with gap to 1-1/2" and an offset of 1". Moderate corrosion.





Photo 33

Drain A - 487'  
Seam at 12 o'clock with gap to 1" and an offset of 1-1/2".



Photo 34

Drain A - 497'  
View of 3' x 2' x 2" caved in area at 6 o'clock for 2".





Photo 35

Ultrasonic testing location for Drain A at 500'.



Photo 36

Drain A - 508'

Seam at 12 o'clock looking upstream with gap to 1" and an offset of 1-1/2". Moderate corrosion.





Photo 37

Drain A - 510'

Seam at 12 o'clock looking upstream with gap to 1" and an offset of 1-1/2". Moderate corrosion.



Photo 38

Drain A - 516'  
Drain exit at Marine Drive.





Photo 39

Drain A - 519'

Storm drain entering at 3 o'clock. Water from Drains A and B flow through this drain that runs along Marine Drive. Rock in drain pipe to 14" deep.



Photo 40

Drain A - 521'

In Marine Drive chamber looking downstream at Drain A.



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Photo 41

Drain A - 541'  
Seam at 9 o'clock looking upstream with gap to 1-1/2" and an offset of 2".



Photo 42

Drain A - 521'  
2' x 2' area of failed coating at 6 o'clock with moderate surface rust.



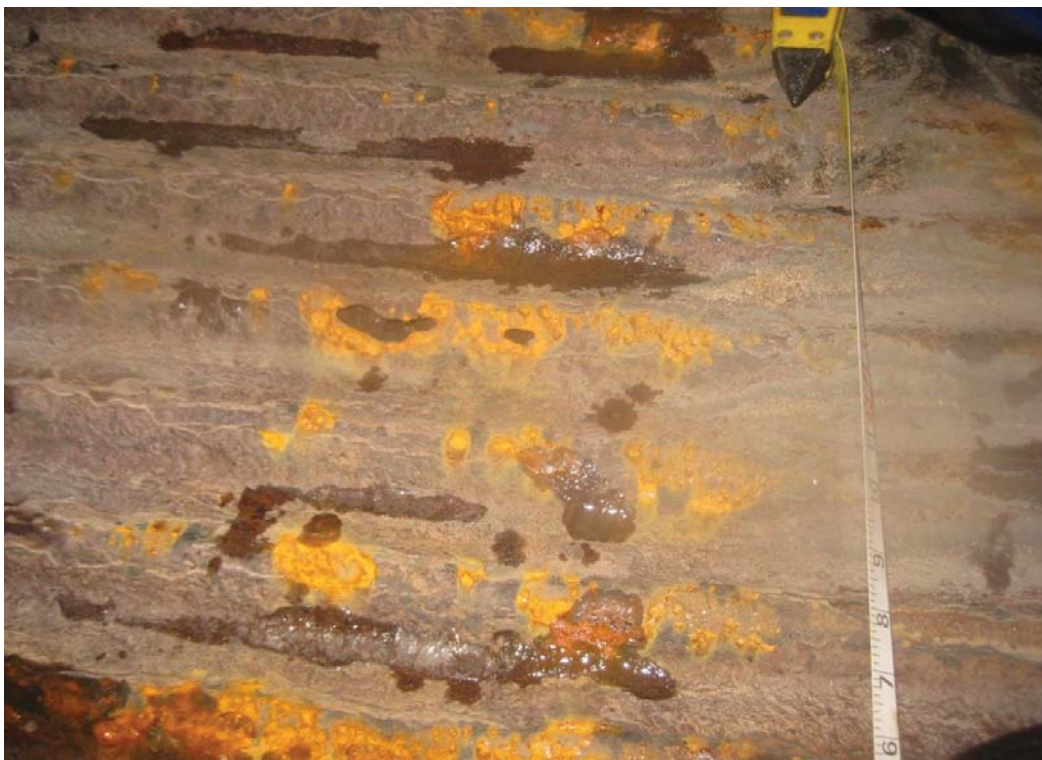


Photo 43

Drain A - 542'  
Hole in drain 1/2" x 2" at 6 o'clock with heavy corrosion.



Photo 43

Drain A - 560'  
2' coating failure with heavy corrosion to end of drain at 9 o'clock and 3 o'clock.



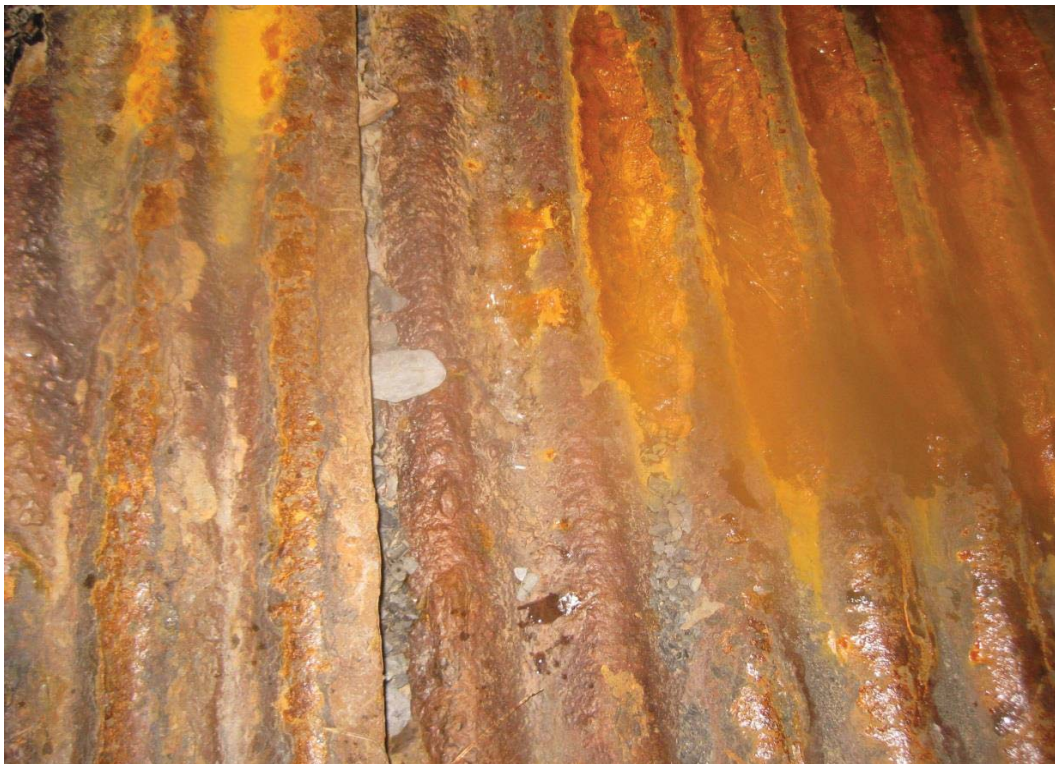


Photo 44

Drain A - 561'  
Seam at 6 o'clock with gap to 1" and an offset of 2". Heavy corrosion.



Photo 45

Drain B - 0'  
Ultrasonic testing location at entrance to Drain B. Some damage to coating on torch cut edge.  
Sandy soil in bottom.





Photo 46

Drain B - 6'  
Seam at 9 o'clock.

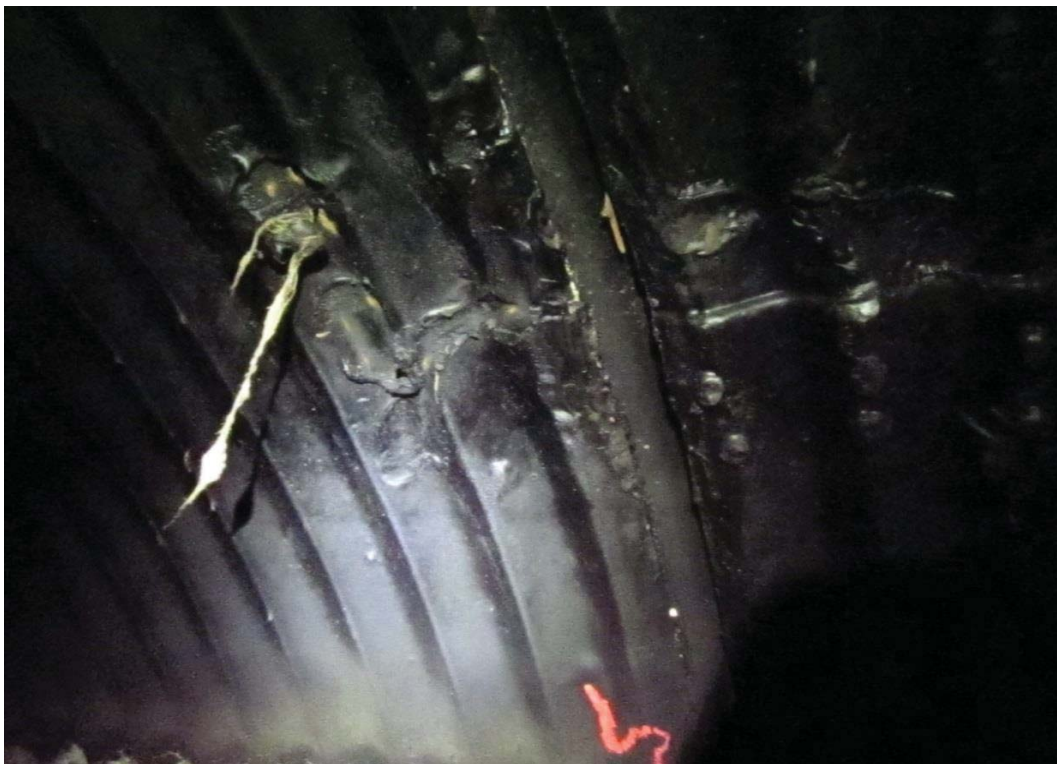


Photo 47

Drain B - 7'  
Seam at 3 o'clock with gap to 1-1/2".





Photo 48

Drain B - 19'

4" drain pipe at 11 o'clock. Coating is broken with moderate corrosion around the torch cut hole.



Photo 49

Drain B - 25'

View of ultrasonic testing location. Seam with gap to 1-1/2". In some spots, the coating below the water line is cracked and easy to remove, above the water line coating is in good condition.



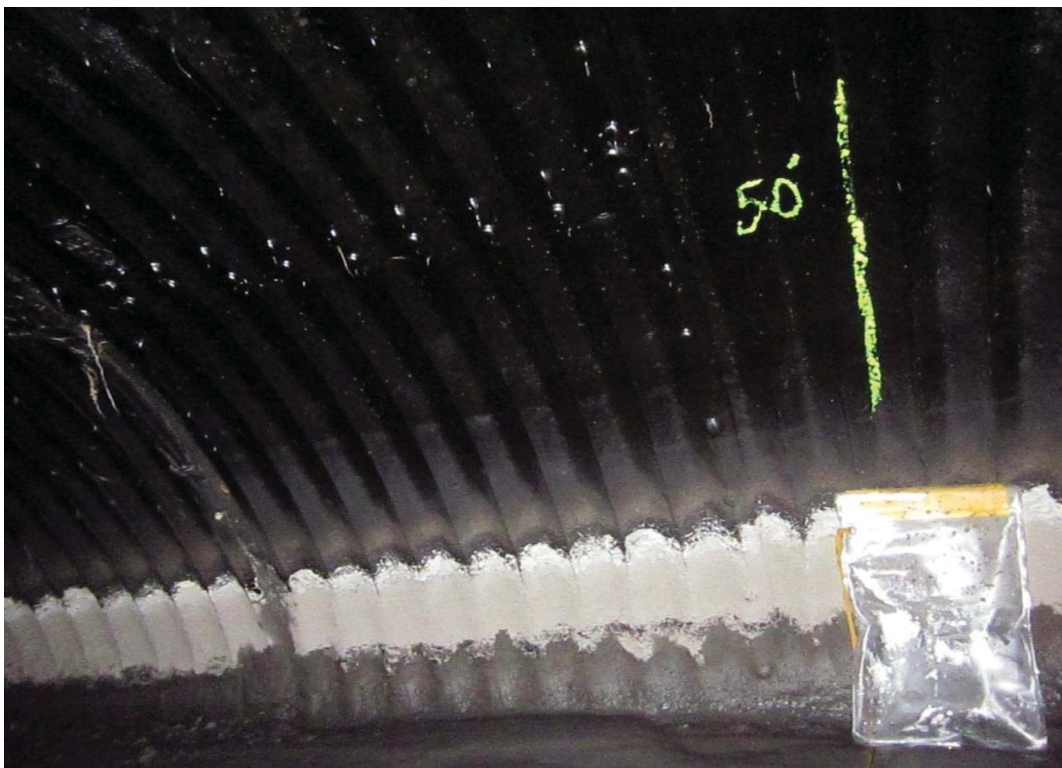


Photo 50

Drain B - 50'  
View of ultrasonic testing location. Seam with gap to 1".



Photo 51

Drain B - 50'  
View downstream from culvert. Up to 1' of sand and rock deposits.





Photo 52

Drain B - 70'  
Seam with gap to 1" and opening of 7".



Photo 53

Drain B - 90'  
Seam open to 1-1/2".





Photo 54

Drain B - 135'

Broken seam looking upstream. Moderate corrosion with coating damage on edge.



Photo 55

Drain B - 140'

Seam beneath manhole at 1 o'clock. No significant deficiency.





Photo 56

Drain B - 140'  
Seam beneath manhole at 9 o'clock. No significant deficiency.



Photo 57

Drain B - 140'  
Looking up at manhole.



Photo 58

Drain B - 142'  
Seam open to 3/4" with minor surface rust and coating damage.



Photo 59

Ultrasonic testing location for Drain B at 150'.





Photo 60

Drain B - 160'

24" cast iron grate. 17" torch cut hole with coating damage and heavy rust. 2" fill on grate. Drain does not show deformation.



Photo 61

Drain B - 180'

Seam open to 1-1/2" with offset of 1-1/2". Minor surface rust and coating damage.





Photo 62

Drain B - 185'

8" corrugated pipe enters at 10 o'clock. Torch cut hole with coating damage and moderate surface rust. Pipe is 1/3 full of debris and not draining.



Photo 63

Drain B - 210'

Seam open to 1" with minor coating damage. 2" downstream from seam a 12" corrugated pipe is located at 1 o'clock. The pipe is in a torch cut hole with coating damage and moderate rust.

There is a clear manhole cover above,



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Photo 64

Drain B - 228'  
 Seam at 12 o'clock open to 1-1/2" with offset of 1-1/4". Minor coating damage on edge with surface rust.



Photo 65

Ultrasonic testing location for Drain B at 250'.



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Photo 66

Drain B - 268'  
Seam with gap open to 2" with offset of 1" at crown.



Photo 67

Drain B - 290'  
Seam with gap open to 1-1/2" with water flowing out at the 7 o'clock position. Flow rate is approximately 2 gallons/minute.





Photo 68

Ultrasonic testing location for Drain B at 300'.



Photo 69

Drain B - 312'

Seam with apparent leakage. Floor sounds unsupported from 300' to 475'. No gap for probe. There is fine silt to 3" deep. Photo is of 9 o'clock position.





Photo 70

Drain B - 336'

Seam with apparent leakage. Floor sounds unsupported from 300' to 475'. No gap for probe. There is fine silt to 3" deep. Photo is of 7 o'clock position.



Photo 71

Drain B - 400'

Seam at 8 o'clock with vertical gap to 1-1/2" and horizontal gap to 1/2". Solid behind gap, no void.



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Photo 72

Drain B - 400'  
View downstream. Coating is intact.



Photo 73

Drain B - 424'  
Seam at 1:30 with vertical gap to 1/2" and horizontal gap to 1".





Photo 74

Drain B - 475'

View upstream. Coating is intact. Coating is much thinner and less adhered on bottom and sides going downstream.



Photo 75

Drain B - 484'

Seam at 5 o'clock with lip lifted 2-3/4". Horizontal void to 12" deep, no vertical void found. The coating is thin and poorly bonded on bottom and sides.





Photo 76

Drain B - 495'  
View downstream. Drain is half full of tidewater. Coating is thin.



Photo 77

Drain B - 495' looking back at 484'.  
View upstream. Ultrasonic testing and coating removal.





Photo 78

Drain B - 539'

Seam at 6 o'clock with gap to 1" and offset up to 2". Heavy corrosion.



Photo 79

Drain B - 550'

Coating failure with heavy corrosion in a 2' strip to drain exit. No ultrasonic testing at this location due to heavy corrosion and crew fatigue.





Photo 80

Drain B - 557'  
Seam at 6 o'clock with gap to 1" and offset up to 2". Heavy corrosion.