Underwater Inspection Report for

CUY-006-1456

SFN 1800930

U.S. Route 6 over the Cuyahoga River in Cuyahoga County, OH

July 8, 2020

Prepared for:

Ohio Department of Transportation

District 12

5500 Transportation Blvd.

Garfield Heights, OH 44125

Prepared By:

Palmer ENGINEERING

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STATE OF OHIO
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REGISTERED PROFESSIONAL ENGINEER
11/25/20

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STRUCTURE DATA

GENERAL

Structure File No.: 1800930
Construction Date: 1917. Major Rehab 1997.
Facility: U.S. Route 6
Featured Intersection: Cuyahoga River
County: Cuyahoga
Structure Type: Steel Thru-Arch, Concrete Deck Arch
Number of Spans: Thirteen
Total Length: 2656 feet
Abutments: Reinforced Concrete Wall on Spread Footings
Piers: Reinforced Concrete Towers on Spread Footings
Slope/Channel Protection: Dumped rock and vegetation on west bank. Sheet piling on east bank.

CHANNEL

Flow Direction: South to North
Thalweg: Midspan between Piers 3 & 4.
Streambed Material: Construction debris and soft mud.

INSPECTION DATA

NBIS Team Leader & P.E. Reviewer: Justin Rufener, P.E. (Palmer)
NBIS Underwater Bridge Inspectors: Tim Kivi (Stantec)
Ian Kidney (Stantec)
Dive Team Member: Jane DeClerck (Stantec)

Inspection Equipment: Surface Supplied Air
Date: July 8, 2020
Current: < 1 fps
Visibility: < 1 foot
Max. Water Depth: 35.5 feet
Substructures Inspected: Piers 3 & 4
Hydraulic Reference: The top surface of the concrete wall cap on the west side of Pier 4. The waterline was approximately 1.6 feet below this reference.

INSPECTION OPERATIONS

The underwater inspection was performed by a team composed of personnel from Palmer Engineering and Stantec on July 8, 2020. The Underwater Dive Inspection included a 100% Level I inspection and a 10% Level II inspection, in accordance with the ODOT Manual of Bridge Inspection. Surface supplied air, probing and tactile methods were used to complete inspection. Soundings were taken along all substructure units, mid span and up to 30 feet upstream and downstream of the bridge using a survey rod, digital fathometer and pneumofathometer. As with previous underwater inspections, only Piers 3 and 4 were inspected. The abutments and remaining piers are not located underwater. The numbering convention will follow ODOT conventions and that previously established by the previous underwater inspection report, with numbering going from west to east. A rehabilitation of the bridge, which includes pier concrete patching and repairs to the sheet piling wall at Pier 4, was ongoing at the time of the underwater inspection.

INSPECTION FINDINGS

CHANNEL

- The channel has stayed relatively the same since the last inspection with some minor changes in streambed elevation.
- The bottom material around Pier 3 consists of rebar, concrete chunks and other construction debris. The bottom material around Pier 4 consists of soft silt.

PIER 3

- Zebra mussels are present on the underwater faces of the pier.
- Scaling from 4 to 8 inches deep is present on all faces of the pier was confirmed as documented in underwater inspection done in 2015 and has not advanced in severity.
- At scattered locations there is minor scaling with exposed aggregate.
- A corner spall 12 feet high x 10 feet wide x 2 feet deep located at the southeast corner of the pier has advanced in severity since the 2015 underwater inspection (*see Photo 6*).
- A corner spall 3 feet high x 3 feet wide x 3 inches deep located 6 feet above mudline at the southeast corner of the pier was confirmed as documented in underwater inspection done in 2015 and has not advanced in severity.
- A corner spall on southeast corner of the pier 6 feet high x 2 feet wide x 4 inches deep, located between the two spalls mentioned above, was confirmed as documented in underwater inspection done in 2015 and has not advanced in severity.
- A corner spall 4 feet high x 2 feet wide x 1.5 feet deep located at a corner on the east face of the pier in splash zone was confirmed as documented in underwater inspection done in 2015 and has not advanced in severity.

- A corner spall 1.5 feet high x 2 feet wide x 6 inches deep located 6 feet above mudline at a corner on the east face of the pier was confirmed as documented in underwater inspection done in 2015 and has not advanced in severity.
- A spall 2 feet high x 9 inches wide x 3 inches deep located at the waterline on the south face of the pier was noted.
- A scupper drain is disconnected allowing water to leak onto south corner contributing to large spall. This condition was noted in the underwater inspection done in 2015 and has not advanced in severity (*see Photo 7*).
- Voids in the southwest embankment near the pier with 2.5 feet of penetration confirmed as documented in underwater inspection done in 2015 and have not advanced in severity.
- For sketches of Pier 3 and the above mentioned defects see the INSPECTION SKETCHES report section.

PIER 4

- Repairs of the sheet pile wall on the north side of the pier have been completed since the last underwater inspection. These include concrete patching, redirecting a scupper downspout, filling sinkholes with rock, and addressing voids at wall interfaces (see *Photo 8*).
- Scaling from 1/8 inch to ¼ inch deep is typical on all concrete faces of Pier 4.
- Heavy zebra mussel growth on sheet piles was present.
- Sheet pile has 100% coverage of rust nodules with up to ¼ inch pitting.
- On the bottom edge of the concrete cap near the east end of Pier 4, there is a 5 inch high x 6 inch wide spall with 4 inches of penetration.
- A vertical void at west interface of sheet pile and the Pier 4 underwater face was noted. The void is 2 inches wide with 44 inches of penetration to refusal.
- A vertical void in the sheet piling near the west end of the concrete cap was noted. The void is 8 feet high and 20 inches wide with 40 inches of penetration to refusal.
- At the exposed face of Pier 4 underwater, there is a concrete pour that has voids up to 2 feet wide with 25 inches of penetration. Some reinforcing in this area is exposed due to poor cover.
- For sketches of Pier 4 and the above mentioned defects see the INSPECTION SKETCHES report section.

EMBANKMENTS

- Minor erosion and sloughing observed on northwest and southwest embankments adjacent to Pier 3.

COMPARISON TO PREVIOUS REPORT AND SUMMARY

Overall, the majority of deficiencies noted in this report for Pier 3 match those from the 2015 inspection with some minor changes. The spalling of the concrete surfaces on Pier 3 has advanced in severity, with one location of new spalling noted. Numerous changes were noted at Pier 4 compared to the 2015 inspection, due to rehabilitation measures which were completed at this location. New voids were observed at several locations on the sheet pile wall, and a new spall was observed on the concrete wall cap. No undermining of footers at either pier was observed.

RECOMMENDATIONS

Underwater bridge inspection of the substructure elements should continue to be performed at a maximum interval of 60 months. Underwater inspections should also take place following any significant or potentially damaging event. We recommend a fendering system be installed to protect Pier 3 from boat and barge impacts. Repair the broken scupper drain at Pier 3. Resurface Pier 3 concrete faces. Grout voids in the sheet pile and concrete at Pier 4.

The following minimum ratings should be used in the bridge inspection report. Ratings may be lowered based on findings from the routine inspection.

- Item 59-Substructure: 5 – Fair
- Item 61-Channel: 6 – Satisfactory
- Item 61.01-Scour: 7 – Good

PHOTOS

Photo 1 – South Elevation of the Bridge. Looking North.

Photo 2 – North Elevation of the Bridge. Looking South.

Photo 3 – Pier 3 East Elevation. Looking West.

Photo 4 – Pier 3 South Elevation. Looking North.

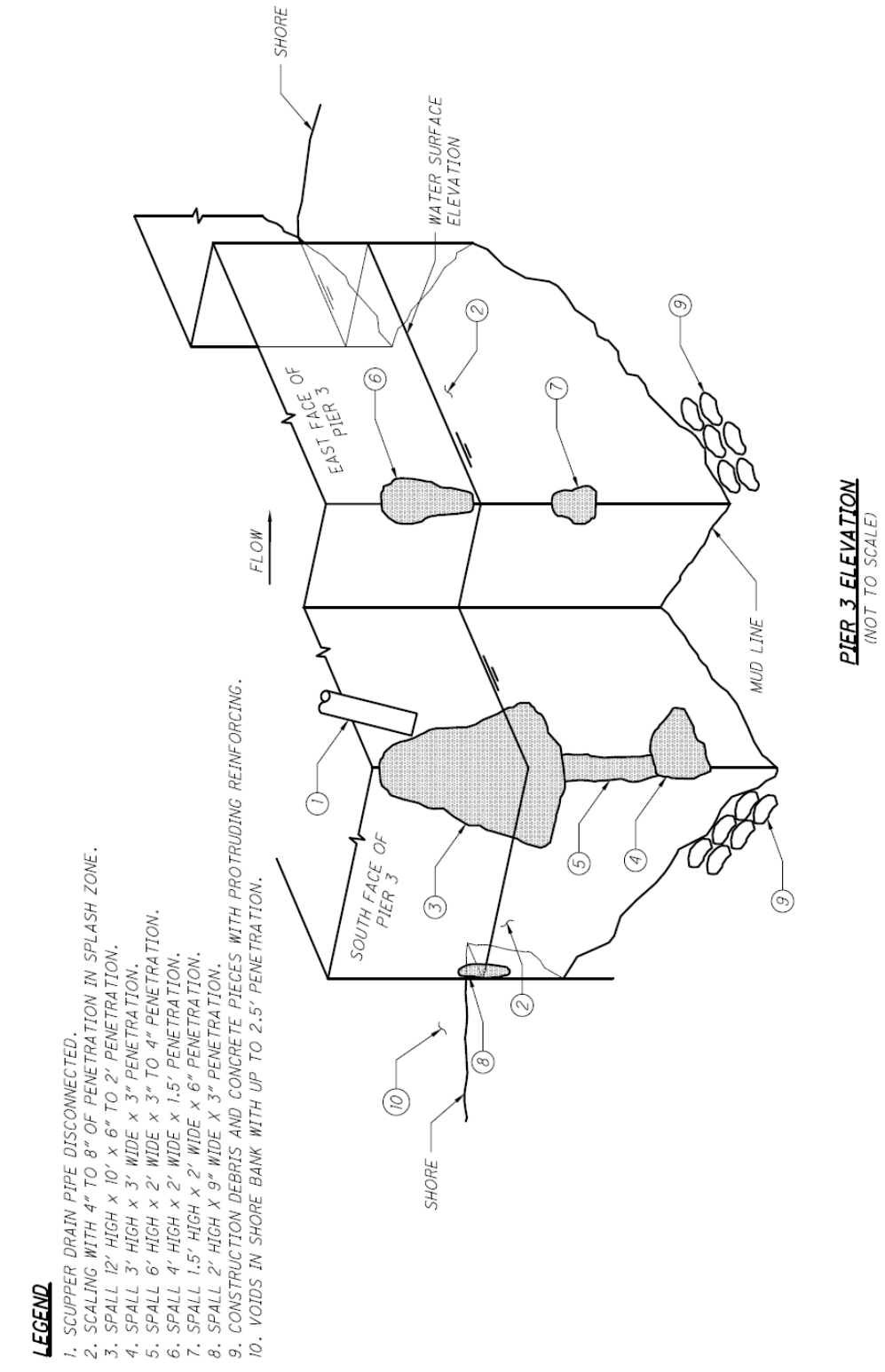
Photo 5 – Pier 4 North Face. Looking South.

Photo 6 – Pier 3 Spalling on Southeast Corner. Looking North.

Photo 7 – Pier 3 Spalling and Detached Downspout on Southeast Corner. Looking West.

Photo 8 – Pier 4 Repaired Top of Sheet Pile Wall at Northwest Corner. Looking South..

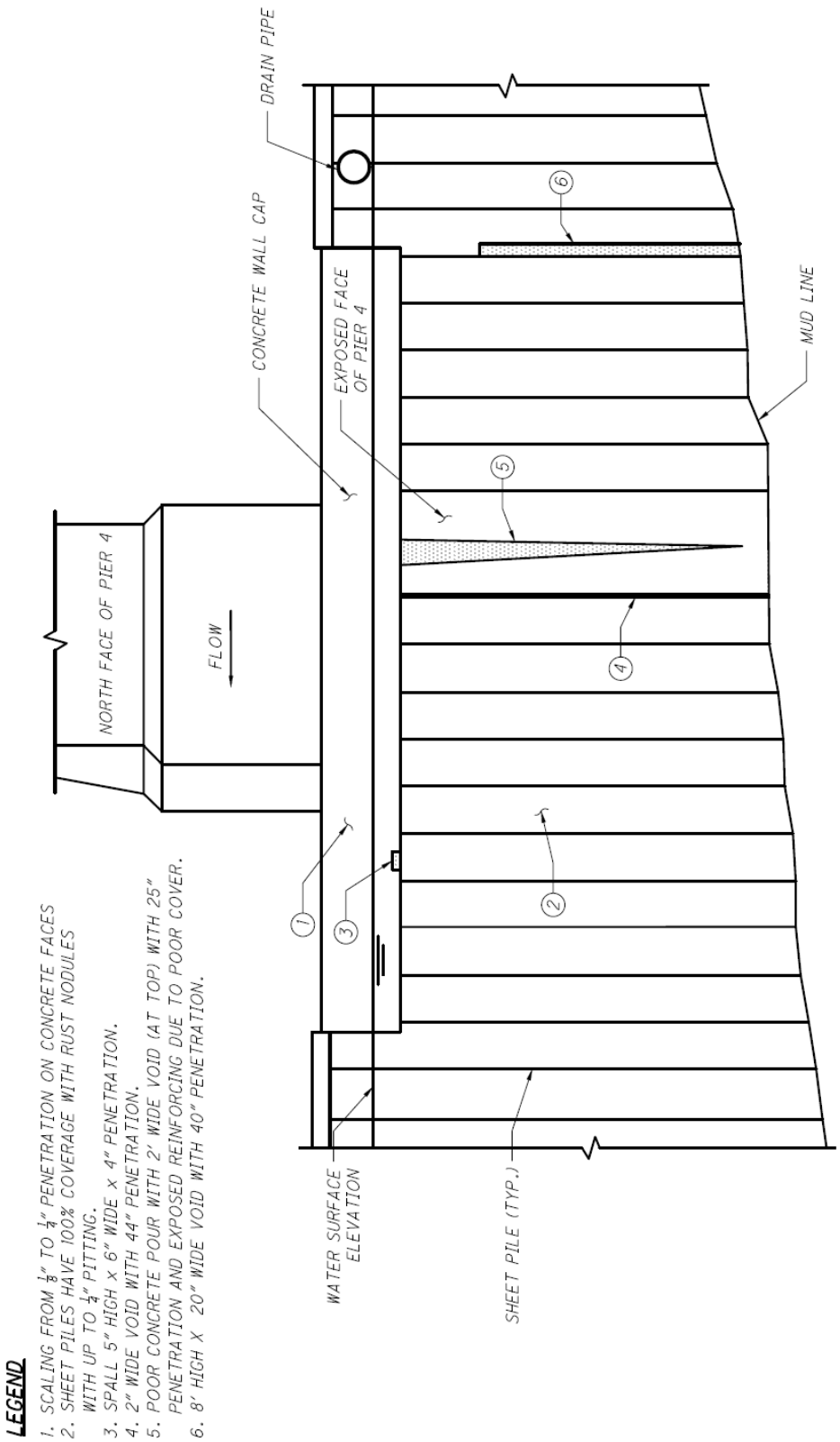
INSPECTION SKETCHES



PIER 3 ELEVATION
(NOT TO SCALE)

LEGEND

1. SCUPPER DRAIN PIPE DISCONNECTED.
2. SCALING WITH 4" TO 8" OF PENETRATION IN SPLASH ZONE.
3. SPALL 12' HIGH x 10' x 6" TO 2' PENETRATION.
4. SPALL 3' HIGH x 3' WIDE x 3" PENETRATION.
5. SPALL 6' HIGH x 2' WIDE x 3" TO 4" PENETRATION.
6. SPALL 4' HIGH x 2' WIDE x 1.5' PENETRATION.
7. SPALL 1.5' HIGH x 2' WIDE x 6" PENETRATION.
8. SPALL 2' HIGH X 9" WIDE X 3" PENETRATION.
9. CONSTRUCTION DEBRIS AND CONCRETE PIECES WITH PROTRUDING REINFORCING.
10. VOIDS IN SHORE BANK WITH UP TO 2.5' PENETRATION.

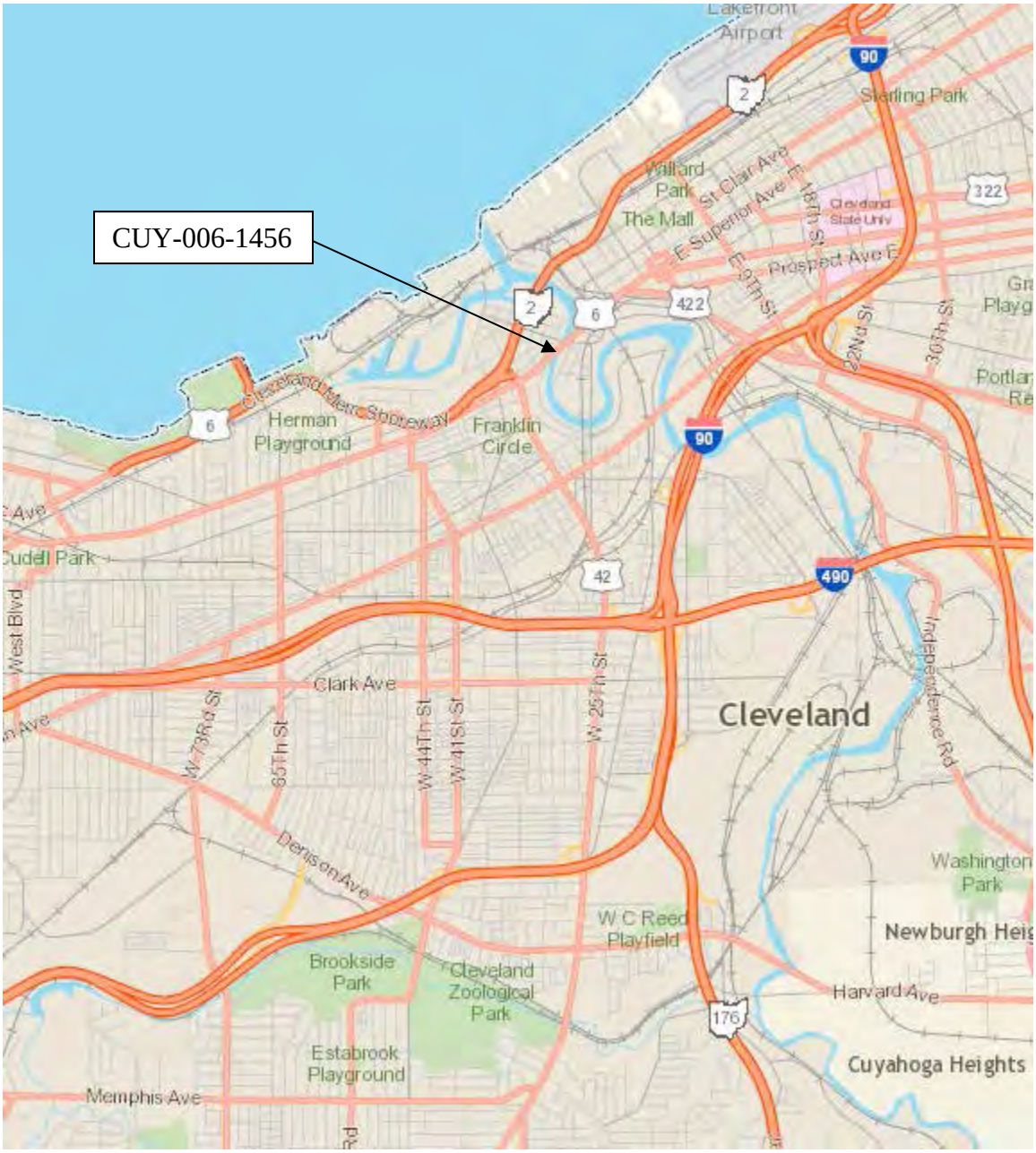


PIER 4 ELEVATION
(NOT TO SCALE)

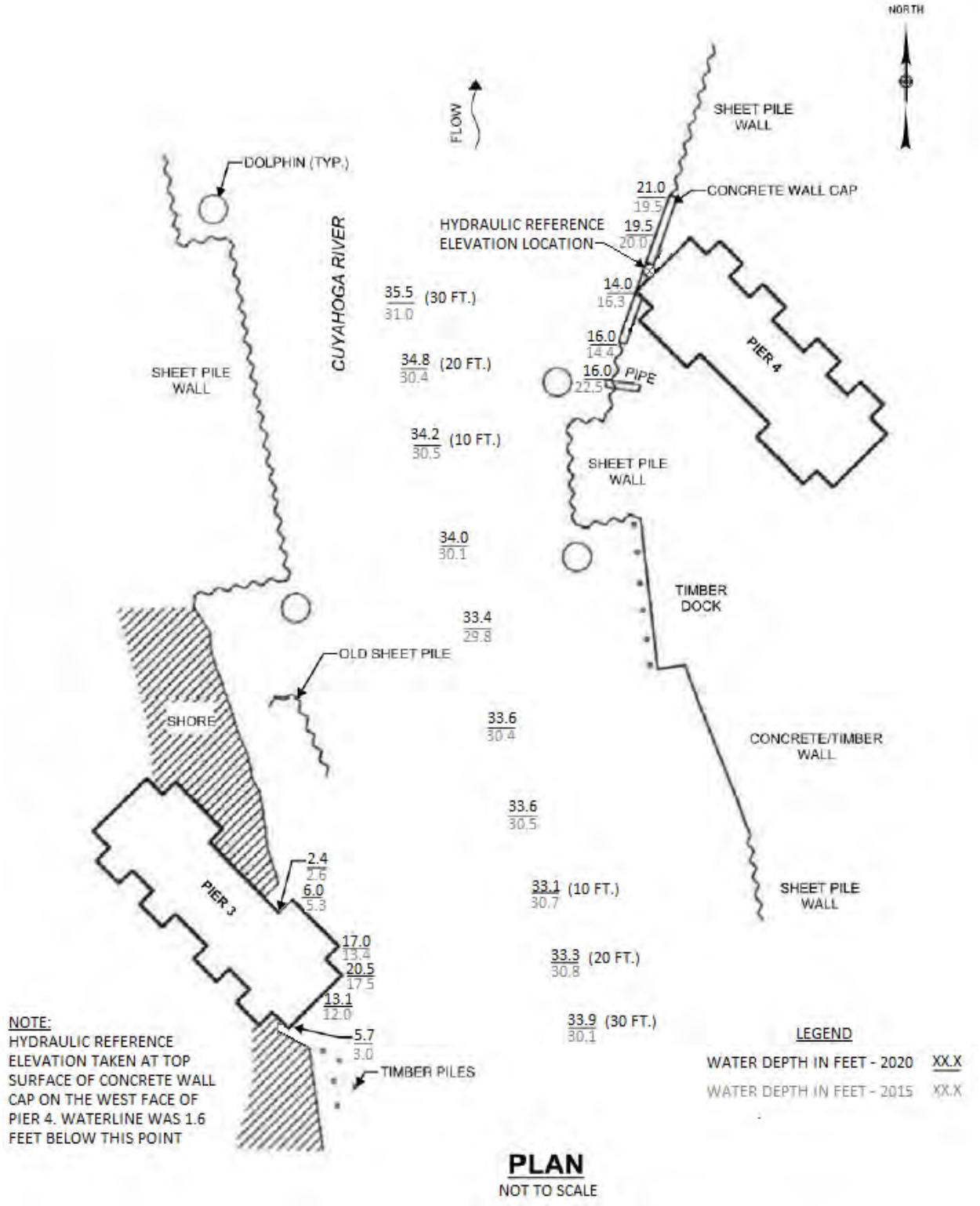
LEGEND

1. SCALING FROM $\frac{1}{8}$" TO $\frac{1}{4}$" PENETRATION ON CONCRETE FACES
2. SHEET PILES HAVE 100% COVERAGE WITH RUST NODULES WITH UP TO $\frac{1}{4}$" PITTING.
3. SPALL 5" HIGH x 6" WIDE x 4" PENETRATION.
4. 2" WIDE VOID WITH 44" PENETRATION.
5. POOR CONCRETE POUR WITH 2' WIDE VOID (AT TOP) WITH 25" PENETRATION AND EXPOSED REINFORCING DUE TO POOR COVER.
6. 8' HIGH X 20" WIDE VOID WITH 40" PENETRATION.

LOCATION MAP



SOUNDINGS



PLAN
NOT TO SCALE

APPENDIX A

UNDERWATER INSPECTION PROCEDURE

Underwater Inspection Procedure

Acceptable written procedures are those that communicate from the previous underwater inspection and/or the public entity with inspection responsibility to the next field inspection team leader what is necessary to ensure a safe and successful inspection. Each bridge with elements requiring underwater diving inspection must have written inspection procedures specific to each bridge which address items unique to that bridge. The prior inspection report condition ratings and inspection comments, by themselves, do not suffice for the required procedures. It is valuable to review these items but they do not serve the same purpose as the inspection procedures. The inspection report records what an inspector actually did, what was looked at, and what was found. Procedures lay out what should be done, looked at, etc. Often consultant underwater reports will include a paragraph or section in the written report that communicates the underwater inspection procedures. This will often suffice as adequate inspection procedures and fulfill the intent of the FHWA requirement. The checklist herein is a framework, and may be completed for all underwater diving inspections when inspection procedures do not exist.

Bridge Identification

Agency with Inspection Responsibility ODOT District 12

Dive Frequency if less than 60 months: _____months

SFN 1800930 Bridge Number CUY 06 1456

Superstructure:	Main Span Type	Steel Arch Truss
	Approach Span	Concrete Arch
Substructure:	Abutments	Concrete
	Piers	Concrete Walls
	Foundations	Spread Footings
Feature Intersected		Cuyahoga River

Office and Field Assessment

Prior to the inspection, obtain and review copies of the previous underwater inspection reports, routine inspection reports and design plans in preparation of the inspection. Divers should pay particular attention given to any observed areas of deterioration, the channel conditions and factors that may accelerate material deterioration. Changes shall be noted in the inspection procedure. Site conditions should be reviewed prior to diving.

Channel Conditions

X ____Waterway features

X ____Rapid stream flows,

____Significant debris accumulation

____Constricted waterway openings

____Soft or unstable streambeds

____Meandering channels

____Other which may promote scour and undermining of substructure elements

Water conditions which may affect the inspection

____Black water

____Rapid stream flows

____Near military facility

____Tribal fishing

____Water quality

____History of Log jams

Identify factors that may accelerate the deterioration of the bridge elements:

____Highly corrosive water

____Unprotected steel members

____Timber piling with of teredos or limnoria

____Other

Risk Factor Comments:

_____

_____

Contacts

Divers shall notify Ken Banaszak, ODOT District 12, (216) 584-2233

(*point of contact for immediate action such as closing the bridge due to findings*)

14 (*number*) days before the proposed underwater inspection date.

Special contracting and scheduling procedures prior to inspection, include recommended lead time

Entity	Contact Name and Title	Contact Phone	Lead Time
Coast Guard	Lee Soule Bridge Management Specialist	(216) 902-6085	1 month
Property Owner	NA	NA	NA
Access Equipment	NA	NA	NA
Lake or River draw-down	NA	NA	NA
Canal dry time	NA	NA	NA
Tree removal	NA	NA	NA
Other			
Other			

Team

The field inspection team, at a minimum, should include

Team Leaders	Number
NBIS requirements (required)	1
Professional Engineer	
Successful completion of underwater bridge inspection course	
OSHA qualified diver	
Team Members	**Number**
Engineer-diver	
Successful completion of comprehensive bridge inspection course	
Successful completion of underwater bridge inspection course	1
OSHA qualified diver	3
Other	**Number**
Surveyor	
Representative from the Entity with Inspection Responsibility	
Other:_____	

Site Information

Navigable waterway: (Y) / N

If Yes, waterway river point _____

Anticipated water visibility depth 2' ft

Anticipated Dive depth 25' ft

Anticipated current 1kt ft

Scour Critical (item 113): 8

POA in place: Y/(N)

Scour Monitoring devices present: Y/N

The procedure for underwater elements that are not in water during an inspection:

_____

_____

_____

The underwater inspection consists of a visual and tactile examination of the accessible surfaces of the following items. Specify the elements to be inspected and the level of the underwater inspection (ex: Level 1, 100%, Level II at three elevations on 10% of piles and four locations at three elevations per substructure unit, Level III)

Item	Number of Units	Level of Inspection
Piers and Number of Columns	2 Piers, 1 Wall per Pier	Level I / Level II
Abutment	0	
Culvert	0	
Scour Countermeasures	NA	
Fenders or Dolphins	NA	

Photographs, at a minimum, should be taken for typical conditions and at a minimum of 1_____ per substructure unit. Video should be taken at a minimum n/a_____. The type of channel bottom material, the presence or extent of scour, the presence or extent of riprap, the presence or extent of drift and debris, and the location of any foundation exposure or undermining shall be quantified. Include depth, length, height and location of deficiencies.

Equipment and Field Logistics

The inspection should be conducted using:

____Chest waders

____Hip waders

X ____Diving equipment

____SCUBA

____SCUBA with communication

X ____Surface Supplied air with communication

The channel bottom should be sounded utilizing

X ____Digital fathometer

X ____Telescoping survey rod

____ acoustic imaging

During the inspection, the divers should work from

____Shore

X ____Boat

____Either

A note taker should work

____On shore / X ____ In the boat

Access to the waterway should be obtained from the shore (north bank, southwest quadrant, driveway 30 yards north etc.)

Via waterway

The maximum depth of the channel is typically measured 300 feet from Pier 4

Reference Datum_____

Soundings should be recorded

X ____along the centerline

X ____along fascia, circle: US/DS

X ____along the submerged substructure units

____culvert centerline and along both fascias

X ____ Grid pattern between substructure units

X ____Additional soundings recorded at:

Upstream: 30' at 10' spacing

Downstream: 30' at 10' spacing