MDOT ANCILLARY STRUCTURES – MANAGING AGING CULVERTS

NICHOLAS GREEN, HNTB

MDOT Michigan Department of Transportation

ANCILLARY STRUCTURES PROGRAM

BUREAU of BRIDGES and STRUCTURES

AGENDA

- Introduction to Ancillary Structures
- Ancillary Structures Innovations
  - Culvert Mix of Fixes
  - MDOT Ancillary Structure Forecasting System
- RFA Maintenance
  - I-94 North of M-59 – Crown Repair & Joint Seal Repairs
  - M-125 over Pike Swale – Partial Top Slab Replacement
  - M-79 over Fowler Drain - Jet Filter Pilot Project

INTRODUCTION TO ANCILLARY STRUCTURES

MDOT Asset Management Program maintains a statewide inventory of 16 assets

Program is aimed to improve public safety by minimizing risk from aging and deteriorating infrastructure

Over **35000** inspections have been performed with successful resolution of over **300** RFAs since 2021

DRAFT Ancillary Structures Program Viewer v3.0

Component Rating Summary (All Asset Types) - MDOT Ancillary Structures Program

Select an Asset Type
Culverts

Select a Sub Asset Type
Culvert less than 10 feet

Select a Region
No category selected

Select a TSC
No category selected

Select a Component Rating
1 - Imminent Failure, 2 - Critical, ... 10

Number of Open Work Recs
No category selected

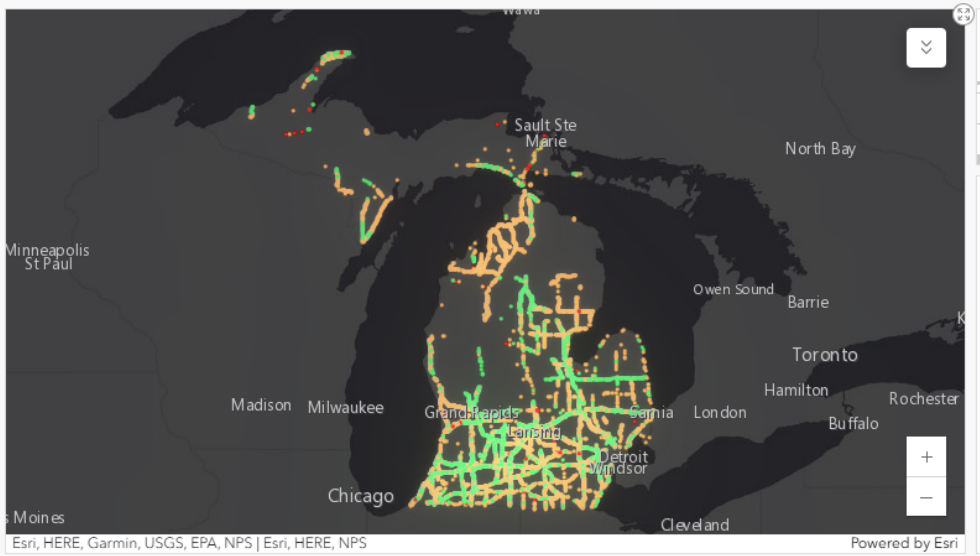
Number of Open RFAs
No category selected

Culvert Height (inches)
No number selected

Reset Clear

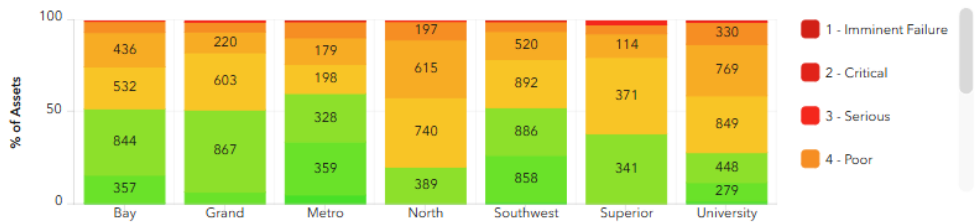
Culvert Width (inches)
No number selected

Note: Select "Light Poles" or "Sign Structures" under Asset Type and then choose either "Sign Cantilever", "Sign Truss", "Frangible Pole Structure" or "Non Frangible Pole Structure" under Sub Asset Type to filter by these asset types.



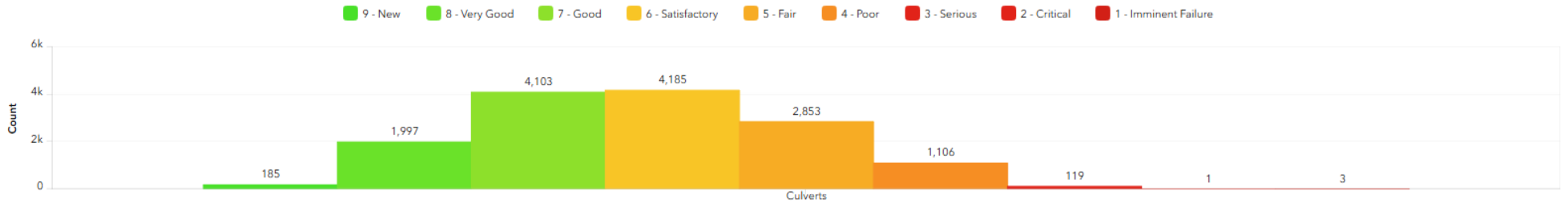
Structure Number	Sub Asset Type	MDOT Region	MDOT TSC	Main Route	Last Component Rating	Last Inspection Date	Number
CULV-000320	Culvert less than 10 feet	Southwest	Marshall	M-66	6 - Satisfactory	Jan 11, 2022	
CULV-000328	Culvert less than 10 feet	North	Gaylord	M-119	6 - Satisfactory	May 20, 2024	

Asset Condition Rating Distribution by Region



Note: Only rated counts are listed in this chart.

Statewide: Asset Condition Rating Distribution by Asset Type



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Rating by Asset Type (% of Assets) | Rating by Asset Type (Count) | Overall Component Rating

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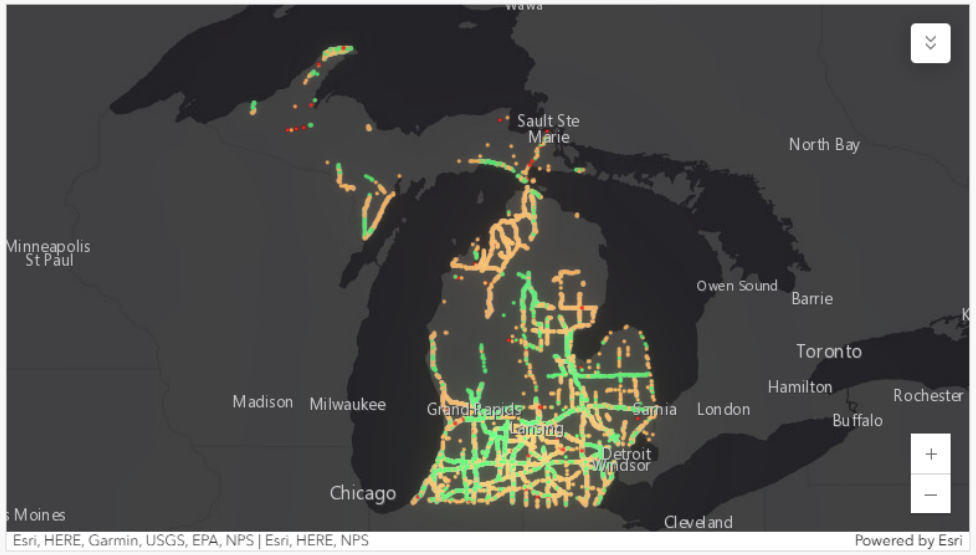

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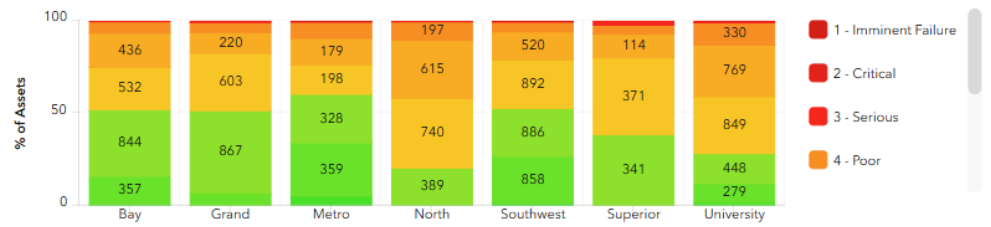
Asset Condition Rating Distribution by Region



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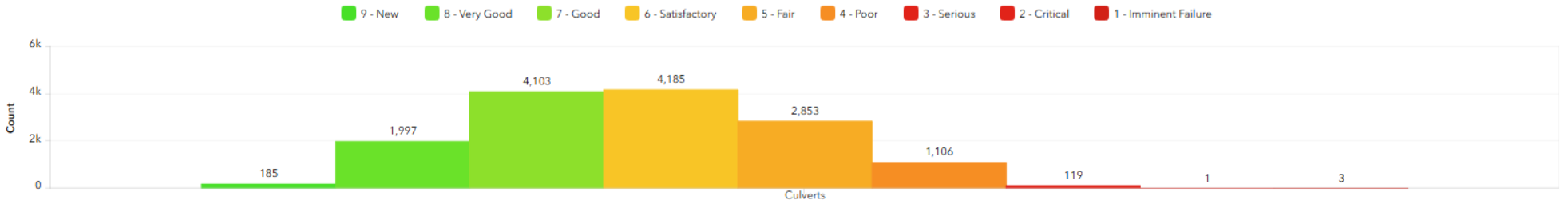

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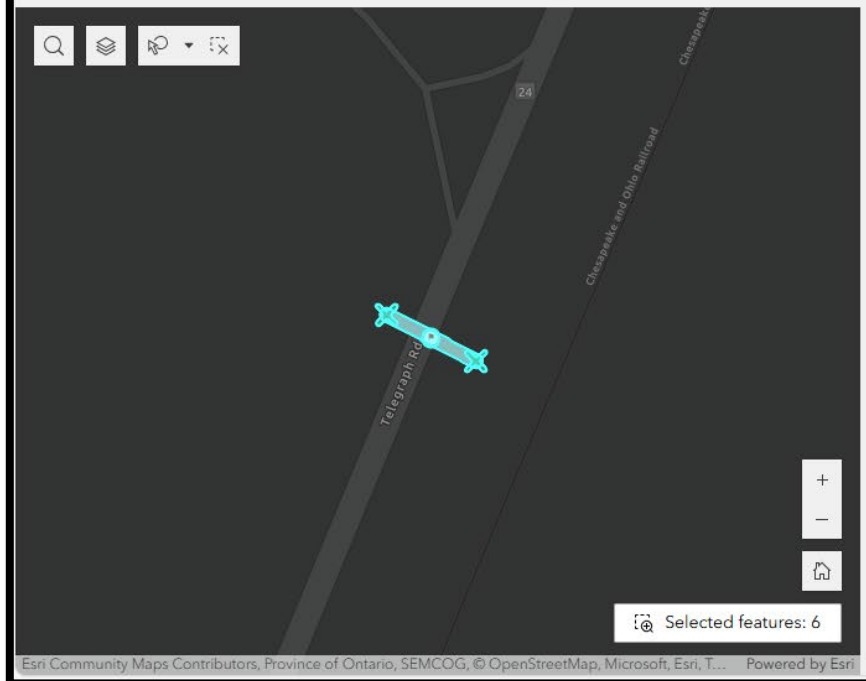
Culvert Less Than 10 Foot Span Inspection Viewer

CULV-012993

CULV-012993 - University



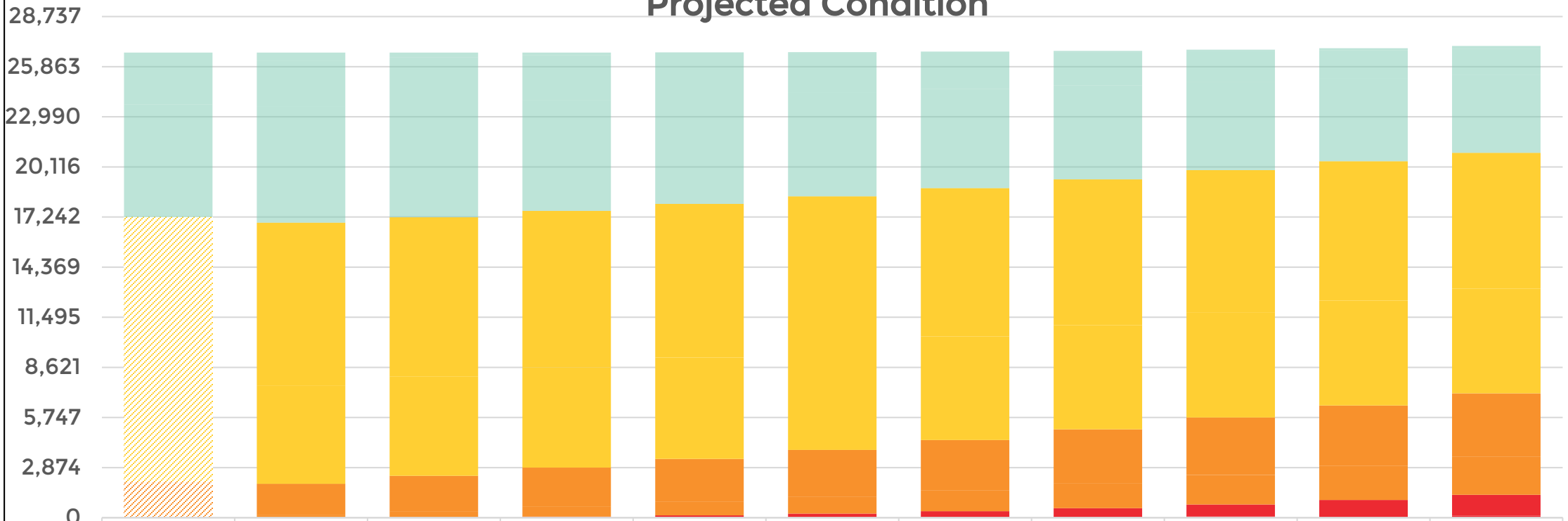
Inventory - CULV-012993 [Inventory Details]

Work Rec - 349102 [Work Rec Details]

Inspection - 7/26/2023, 12:49 PM [Inspection Details]

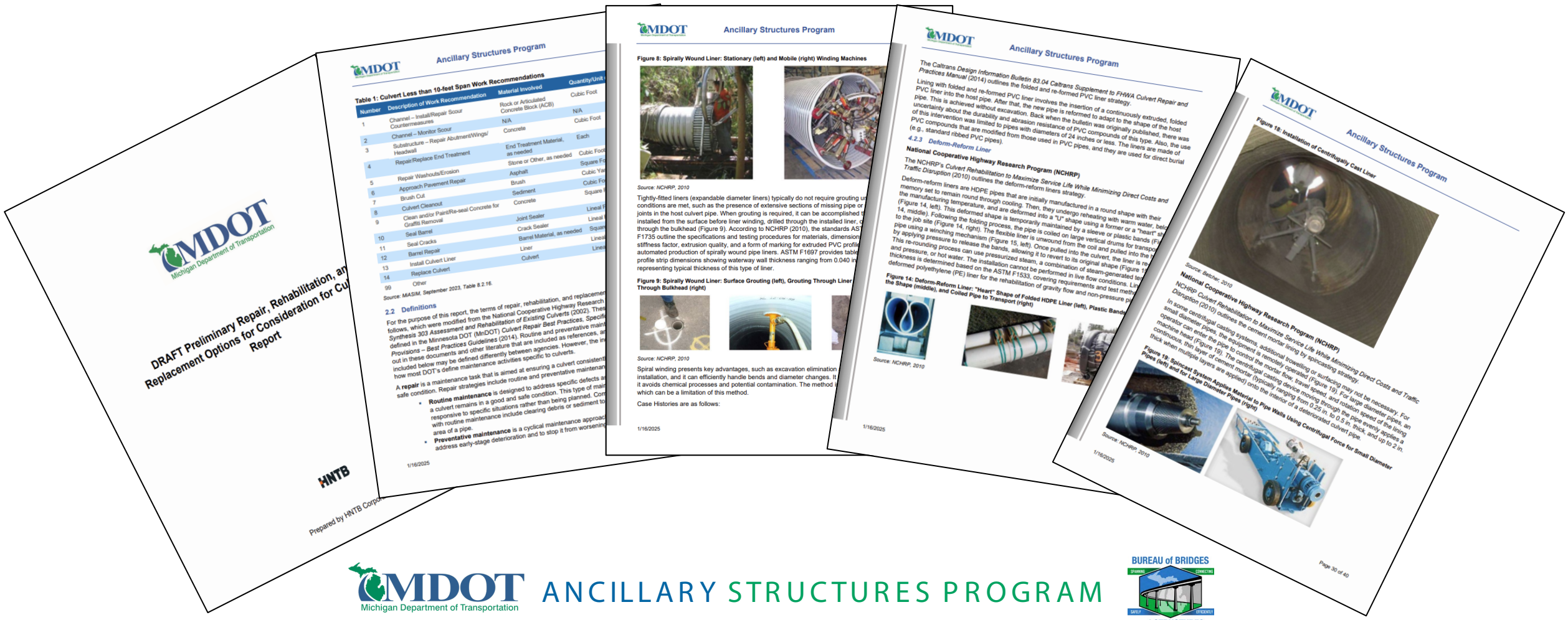
RFA - 96433 [RFA Details]

Projected Condition



	Current	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
9	452	456	262	155	98	71	64	71	87	117	160
8	2522	2619	2645	2561	2423	2259	2084	1909	1743	1599	1483
7	6463	6679	6536	6363	6165	5939	5680	5391	5078	4772	4481
6	9443	9354	9139	8962	8803	8654	8505	8348	8176	7986	7783
5	5687	5614	5682	5753	5821	5883	5937	5980	6007	6017	6010
4	1944	1807	2032	2253	2465	2672	2878	3082	3285	3465	3619
3	150	134	350	559	768	981	1205	1444	1698	1951	2196
2	6	6	22	63	129	221	343	499	694	924	1192
1	2	0	1	3	8	16	29	45	67	93	124
0	0	0	0	0	0	0	0	0	0	0	0

CULVERT MIX OF FIXES



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I-94 NORTH OF M-59 – EXISTING CONDITIONS

- 83” x 53” Concrete horizontal elliptical culvert
- Constructed in 1962 and extended in 1997
- Asset defects include:
  - Joint separation with active water & soil infiltration
  - Barrel Failure
- Culvert Crosses 8 lanes of traffic

I-94 NORTH OF M-59 – EXISTING CONDITIONS

Barrel Failure (Interior)

I-94 NORTH OF M-59 – EXISTING CONDITIONS

Barrel Failure (Exterior)

I-94 NORTH OF M-59 – EXISTING CONDITIONS

Joint Separation with Infiltration

I-94 NORTH OF M-59 – REPAIR OPTIONS

Repair Option #1

- Open Cut Excavation of I-94 Left Shoulder
- Remove & Replace of damaged 83”x53” Pipe
- 0.5 square mile drainage area to be maintain through bypass pumping
- Estimated Cost: $510,000

I-94 NORTH OF M-59 – REPAIR OPTIONS

Repair Option #2

Owner:	Michigan Department of Transportation				Contractor:	Corby Energy Services, Inc.		
Address:	425 W. Ottawa Street				Adress:	PO Box 970		
	Lansing, MI 48933					Belleville, MI 48112		
ATTN:	Michelle O'Neal, PE				ATTN:	Troy Freed		
Region:	Metro				Title:	Project Manager		
TSC:					Mobil:	989-213-4408		Proposal
Address:	6333 Lansing Road				Email:	tfreed@corbyenergy.com		
	Lansing, MI 48917							Date of service:
ATTN:	Michelle O'Neal, PE							Date: 07/08/2024
MDOT Contract #:	200000000843							Invoice Number:
MDOT DO#:								CES job #:8033-xxxx
Region	Section	Line Item	Description	U/M	Quantity	Unit Price	Price	Location
			Culvert Rehabilitation					I-94 / M-59
Metro	K	Misc.	Mobilization	LS	1	$ 11,500.00	$ 11,500.00	
			DCP Testing					Included
			83" x 53" Elliptical RCP					
	M	Mechanical seals	66" Joint Internal Joint Seals	EA	31	$ 6,700.00	$ 207,700.00	Install Joint Seals
	K	Misc.	Soil injection / fill voids	PD	3100	$ 8.00	$ 24,800.00	Estimated quantity
			Pipe repair					
	CO10	6	Pipe repair	LS	1	$ 5,000.00	$ 5,000.00	
	CO7	11	Hydro excavate	HR	8	$ 395.00	$ 3,160.00	8 hour minimum/Port to Port
	CO8	7	Concrete special	CY	1	$ 8,500.00	$ 8,500.00	
			Traffic					
	K	Misc.	Lane shoulder closure	Day	1	$ 1,500.00	$ 1,500.00	EB
	K	Misc.	Lane shoulder closure	Day	1	$ 1,500.00	$ 1,500.00	WB
	K	Misc.	Lane shoulder closure	Day	1	$ 1,500.00	$ 1,500.00	Ramp
	K	Misc.	TMA-1	Day	1	$ 1,460.00	$ 1,460.00	EB
	K	Misc.	TMA -2	Day	1	$ 1,460.00	$ 1,460.00	WB
	CO8	16	Misc. Traffic Devices	LS	1	$ 7,500.00	$ 7,500.00	
							$ 275,580.00	Sub-total
			Exclusions: Guardrail remove and replace					
			Pricing assumes all work to be completed					

- Crown Repair
  - Fabricated stainless steel crown to match unique culvert size and configuration
- Internal Joint Seals
- Soil Injection for site stabilization

I-94 NORTH OF M-59 – REPAIR

Crown Repair

I-94 NORTH OF M-59 – REPAIR

Crown Repair

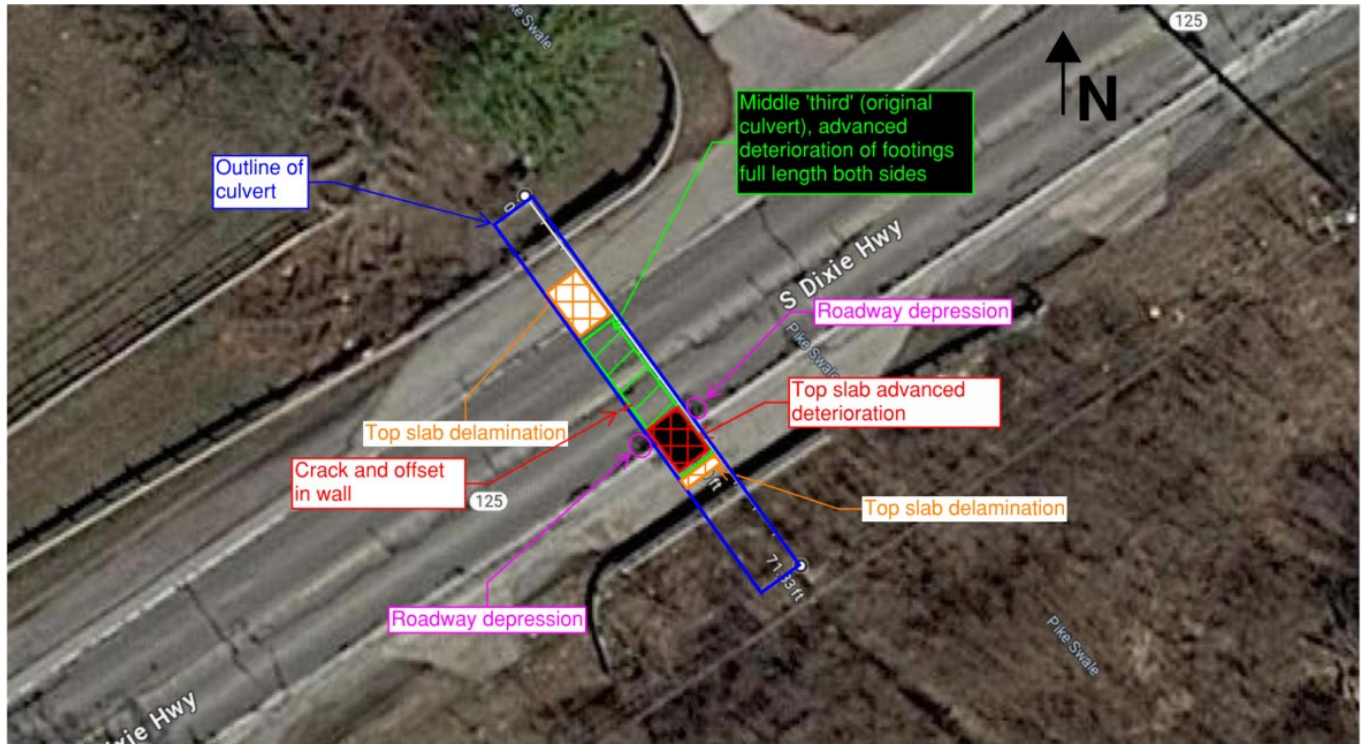
I-94 NORTH OF M-59 – REPAIR

- Joint Repair
  - Internal Joint Seals installed at 30 joints to mitigate separation & infiltration
  - DCP testing revealed soft areas of soil to be addressed through soil injection

I-94 NORTH OF M-59 – REPAIR

- Soil Injection
  - Injection ports spaced at 5’ increments in in left shoulders, left lanes, and median.
  - Over 2700 lbs of two-part foam injected into the voids

M-125 OVER PIKE SWALE – EXISTING CONDITIONS



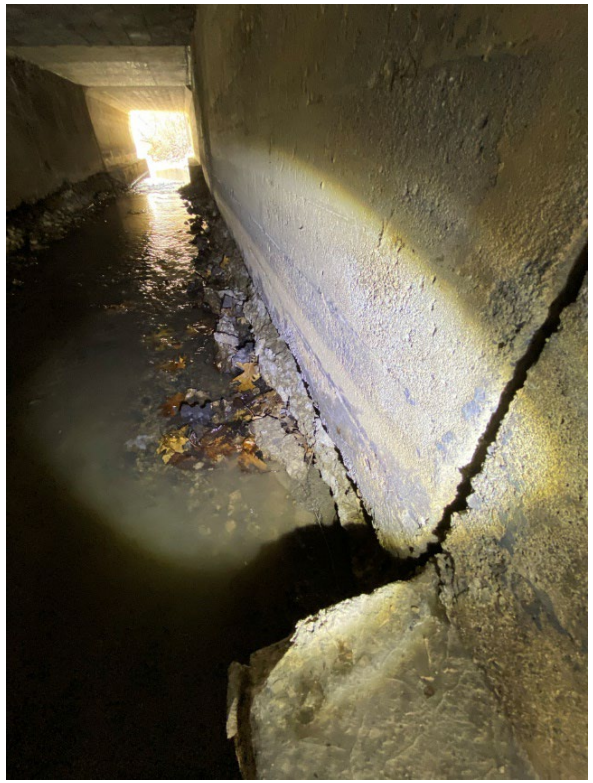
- 48” x 72” Three-Sided Concrete Culvert
- Constructed in 1930s
- Asset defects include:
  - Structural cracking
  - Deterioration of concrete footings
  - Spalling of culvert soffit exposing reinforcement
  - Depression in roadway above soffit deterioration
- Deemed RFA Priority Level 1 in February 2024

M-125 OVER PIKE SWALE – EXISTING CONDITIONS

Footing Deterioration

M-125 OVER PIKE SWALE – EXISTING CONDITIONS

Footing Deterioration



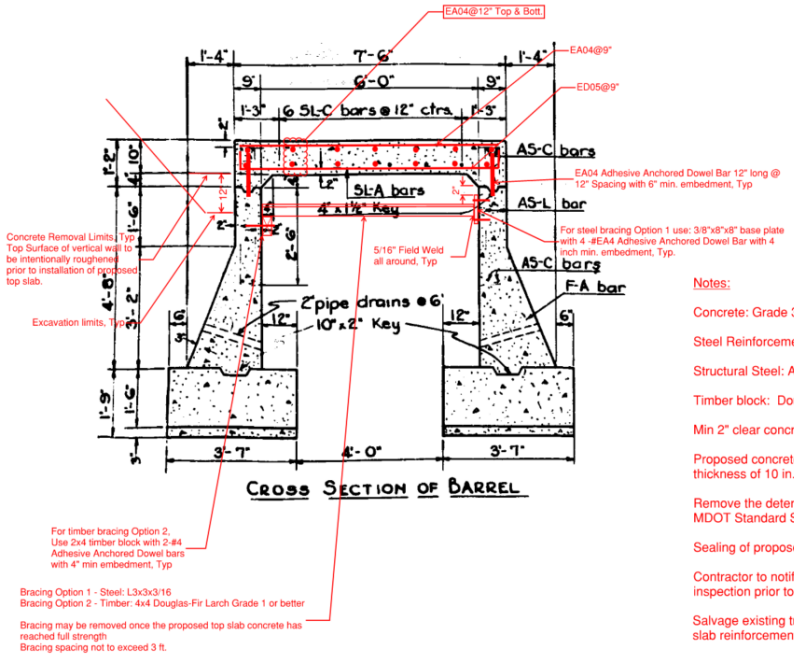
M-125 OVER PIKE SWALE – EXISTING CONDITIONS

Soffit Spalling

M-125 OVER PIKE SWALE – EXISTING CONDITIONS

Roadway Depression

M-125 OVER PIKE SWALE – SOFFIT REPAIR



Notes:

Concrete: Grade 3500, f'c = 3,000 psi.

Steel Reinforcement & Adhesive Anchor Bars: Fy = 60,000 psi.

Structural Steel: AASHTO M270 Grade 36, Fy = 36,000 psi. "E" denotes epoxy

Timber block: Douglas-Fir Larch Grade 1 or better

Min 2" clear concrete cover.

Proposed concrete top slab thickness to match the existing top slab thickness v thickness of 10 in. Notify MDOT Engineer if existing thickness is less than 10 in

Remove the deteriorated top slab down to the top of wall level according to the MDOT Standard Specification.

Sealing of proposed top slab to be done as per MDOT Standard Specifications.

Contractor to notify MDOT Engineer upon exposing the top slab of the existing inspection prior to removal.

Salvage existing transverse slab reinforcement to provide continuity or place ne slab reinforcement adhesively anchored with 6 inch min embedment into existir

Heat and house concrete placement in accordance with MDOT Standard Speci Construction 706.03.J.

Field Conditions will likely differ from what is shown in the existing cross sectior contractor shall field verify field conditions before submitting a cost estimate.

M-125 OVER PIKE SWALE – SOFFIT REPAIR

M-125 OVER PIKE SWALE – SOFFIT REPAIR

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M-125 OVER PIKE SWALE – SOFFIT REPAIR

M-79 OVER FOWLER DRAIN– EXISTING CONDITIONS

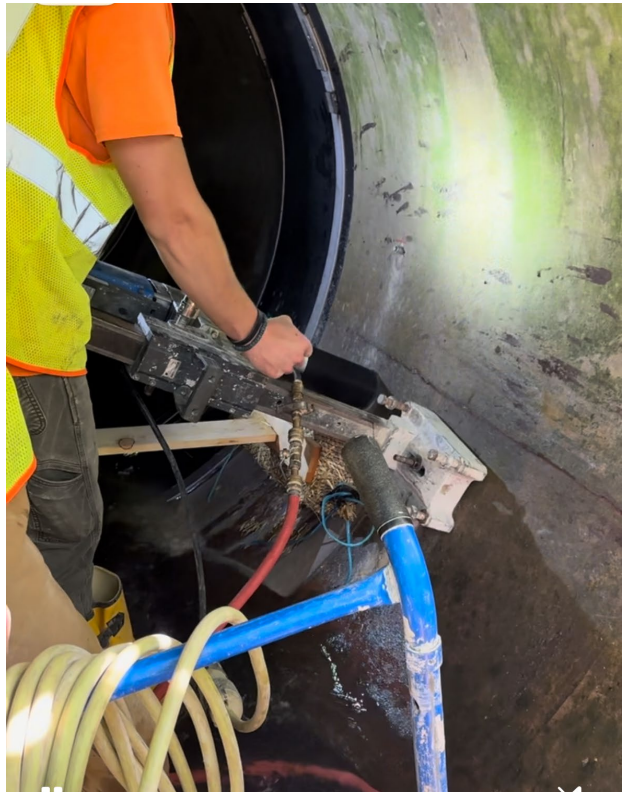
- 72” Circular Concrete Culvert
- Asset defects include:
  - Joint Separation with active water & soil infiltration

M-79 OVER FOWLER DRAIN– EXISTING CONDITIONS

Joint Separation & Infiltration

M-79 OVER FOWLER DRAIN – JOINT REPAIRS

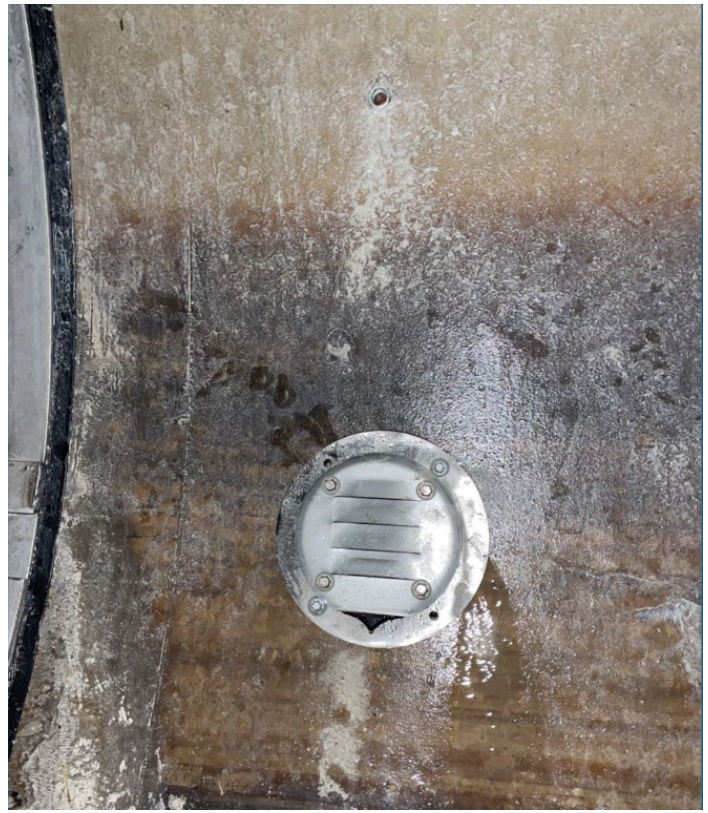
Concrete Coring



M-79 OVER FOWLER DRAIN – JOINT REPAIRS

Core

Jet Filter Install



M-79 OVER FOWLER DRAIN – JOINT REPAIRS

THANK YOU

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