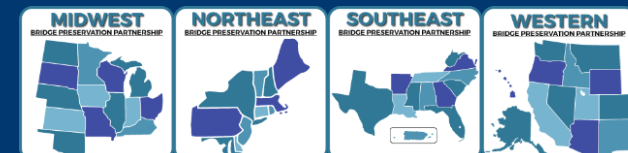


Scour Mitigation Program in Oklahoma DOT Local Government Division

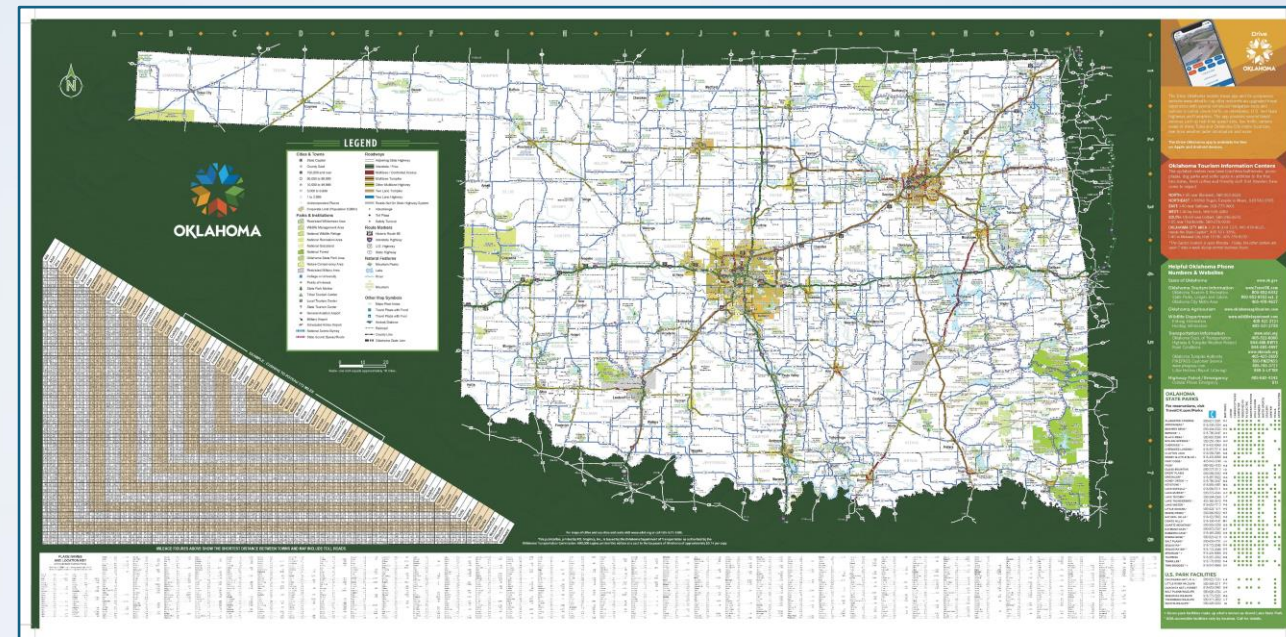
Melissa Davis, PMP – Oklahoma DOT Local Government Division

Michael Dukes, PE – Consor



Oklahoma Bridge Inventory

- ~6,800 on-system bridges
 - 2004 – 1,168 structurally deficient
 - 2022 – 47 structurally deficient
- ~16,000 off-system bridges
 - 1,706 structurally deficient
 - 603 – scour contributing factor



ODOT Local Government Division

- Scour Ratings - Span Bridges
 - Oklahoma Bridge Inspection Manual

NEW BRIDGES - All multi-span structures constructed since 1994 have included scour analysis and foundations have been designed for maximum scour. Code item 113 = 8. In all cases, item 113 must be compared to item 60. For a span bridge, Item 60 cannot be more than item 113. This will ensure the scour condition is factored into the bridge sufficiency rating which considers items 60 but not item 113. Also, in all cases, if item 113 is 5 or less, the Scour Smart Flag (961) must also exist.

APPENDIX C NBIS ITEMS WITH ODOT GUIDELINES

Item 113 Scour Critical Bridges
Prior to inspecting a bridge, the inspector must review the bridge file to see if bridge has been classified as scour critical. If so then the inspector should consult the plan of action to identify any special measures that should take place during inspection.

SPANS

Scour evaluations and assessments are to be done one time only for each span bridge by an engineer and coded accordingly. This code should not be changed by inspectors without consulting the engineer and documenting the reason for the change. At this time, all on system span and off system span structures have been evaluated.

NEW BRIDGES - All multi-span structures constructed since 1994 have included scour analysis and foundations have been designed for maximum scour. Code item 113 = 8. In all cases, item 113 must be compared to item 60. For a span bridge, item 60 cannot be more than item 113. This will ensure the scour condition is factored into the bridge sufficiency rating which considers items 60 but not item 113. Also, in all cases, if item 113 is 5 or less, the Scour Smart Flag (961) must also exist.

Always use engineering judgment when undecided. Think about painting the big picture and what information you are trying to convey to bridge owner.

Code Description

N Bridge not over waterway.

- U Bridge with "unknown" foundation that has not been evaluated for scour. At this time, all on system span and off system span structures have been evaluated. Please consult bridge maintenance file for scour computations, plan of action or off system scour assessments. Please do not code a U unless you have checked everywhere.
- 9 Bridge foundations (including piles) on dry land well above flood water elevations.
- 8 Bridge foundations determined to be stable for the calculated scour condition. Scour is determined to be above top of footing by assessment. When entering a new bridge in BrM, item 113 = 8.
- 7 Approved countermeasures have been installed to mitigate an existing problem with scour. Instructions contained in a plan of action have been implemented to reduce the risk to users from a bridge failure during or immediately after a flood event. Countermeasures have performed well for complete 2 year inspection cycle.
- 6 Do not code a 6.
- 5 Bridge foundations determined to be stable for calculated scour condition. Scour determined to be within the limits of footings or piles by assessment. Countermeasures for scour have been installed. Monitor for two years, if performing after two year change to 7. If countermeasures fail, change to appropriate rating. Countermeasure for spans structures must be approved to be changed.
- 4 Bridge foundations determined to be stable for calculated scour conditions. Field review indicates action is required to protect exposed foundations.
 - Scour within limits of footing or piles.
 - Scour below spread-footing base or pile tips.
 - Never code in field
- 3 Bridge is scour critical; bridge foundations determined to be unstable for calculated scour conditions:
 - Scour within limits of footing or piles.
 - Scour below spread-footing base or pile tips.
 - Never code in field
- 2 Bridge is scour critical; field review indicates that extensive scour has occurred at bridge foundations, which are determined to be unstable by: - a comparison of calculated scour and observed scour during the bridge inspection, or - an engineering evaluation of the observed scour condition reported by the bridge inspector in Item 60.
- 1 Bridge is scour critical; field review indicates that failure of piers/abutments is imminent. Bridge is closed to traffic. Failure is imminent based on field visit by PE. Contact Maintenance Engineer and Hydraulic Engineer.
- 0 Bridge is scour critical. Bridge has failed and is closed to traffic.

ODOT Local Government Division

- Scour Ratings - Culverts
 - Oklahoma Bridge Inspection Manual

In all cases, item 113 must be compared to item 62. This will ensure the scour condition is factored into the bridge sufficiency rating which considers items 62, but not item 113. For culverts where item 113 is rated 4 or more, item 62 should be coded according to the condition as described in 'Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges'. Also, in all cases, if item 113 is 5 or less, the Scour Smart Flag (961) must also exist.

APPENDIX C NBIS ITEMS WITH ODOT GUIDELINES

CULVERTS

Inspectors are to code all bridge length culverts for scour. This is to be done at every inspection. Start at the top of the list below and read down until the wording is applicable to your culvert. In all cases with multiple situations, the worse situation controls.

Always use engineering judgment when undecided. Think about painting the big picture and what information you are trying to convey to bridge owner.

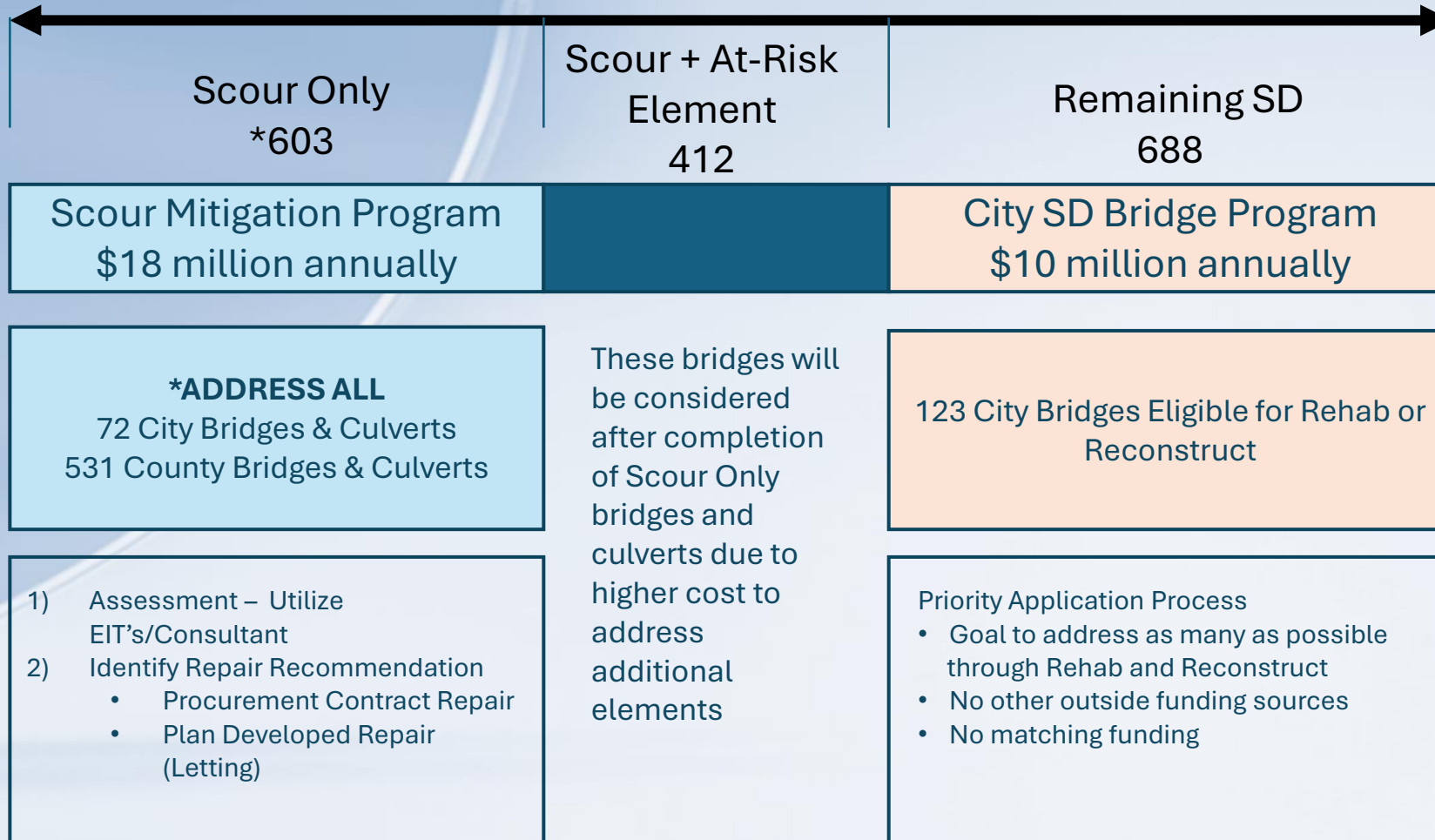
Code Description

- Scour is determined to be above top of floor by assessment. When entering a new bridge culvert in BrM, item 113 = 8.
- Approved countermeasures have been installed to mitigate an existing problem with scour. Instructions contained in a plan of action have been implemented to reduce the risk to users from a bridge failure during or immediately after a flood event. Countermeasures have performed well for complete 2 year inspection cycle.
- Countermeasures for scour have been installed. Monitor for two years, if performing after two year change to 7. If countermeasures fail, change to appropriate rating. Countermeasure for spans structures must be approved to be changed.

History of Scour Problems	Curtain wall present	Flowline	Inspection Frequency, once every...	Item 113 Code	Scour Smart Flag 961 Code	
No	No	Channel flowline is below wall or barrel with significant barrel or wing wall undermining present. Wing or barrel wall cracking with seepage has occurred. Standing water is present upstream of RCB and/or through barrel.	6 Months	2	CS 4	
		Culvert flowline = or > 2 feet above stream flowline with significant undermining of barrel or apron.	6 Months	2	CS 3	
		Culvert flowline = or > 2 feet above stream flowline. Minor or insignificant undermining of barrel or apron may be present.	Two years	3	CS 2	
		Culvert flowline < 2 feet above stream flowline	Two years	4	CS 1	
	Yes	Yes	Channel flowline is below toe of curtain wall or barrel with significant barrel, wingwall or apron undermining present. Wing or barrel wall cracking with seepage has occurred. Standing water is present upstream of RCB and/or through barrel.	6 Months	2	CS 4
			Toe of curtain wall above stream flowline with significant undermining of curtain wall.	6 Months	2	CS 3
			Toe of curtain wall above stream flowline. Minor or insignificant undermining of curtain wall may be present.	Two years	3	CS 2
			Toe of curtain wall below stream flowline.	Two years	4	CS 1
		Channel cutting behind wing walls (see Note 1). Stream is meandering and/or degrading, and attacking the fill behind the wing wall.	6 Months	2	Wing not undermined CS 2 Wing is undermined CS 3	

In all cases, item 113 must be compared to item 62. This will ensure the scour condition is factored into the bridge sufficiency rating which considers items 62, but not item 113. For culverts where item 113 is rated 4 or more, item 62 should be coded according to the condition as described in 'Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges'. Also, in all cases, if item 113 is 5 or less, the Scour Smart Flag (961) must also exist.

1,706 SD Bridges on Off-System



Scour Mitigation Program

- **ODOT and Consultant partnering to develop site assessments practices**
- ODOT Field District staff conducting site assessments
- Consultant Partners develop scour assessment reports
- ODOT Local Government – environmental permitting
- Installation of scour repairs

ODOT and Consultant Partnering

- Consultant team
 - Consor
 - Guy Engineering
 - Burgess & Niple
 - H.W. Lochner
- ODOT-Consultant joint kickoff meeting
- Collaboration to set standards
- Shared access to progress tracking site



ODOT and Consultant Partnering

- Site assessment practices
 - File review
 - Documentation
 - Photo standards
 - Standardized Field Books

Oklahoma Dept. of Transportation - Bridge Inspection Report

NBI No.: 06779	Structure No.: 02E0060N2510007	Local ID: 1030	Suff. Rating: 40.90	SD
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Inspection Date: 7/19/21
 Invoice No.: 802268 Inspected With: _____

BRIDGE NOTES:

INSPECTION NOTES: 7/19/21
 B/15/19 FX: needs all bridge end markers put up FX: needs grouted rip rap placed on both sides

Elem. I	Env	Description	Unit	Total Qty	% 1	Qty. 1	% 2	Qty. 2	% 3	Qty. 3	% 4	Qty. 4
241	I	Re Conc Culvert	ft	86.00	97%	84.00	0%	0.00	3%	2.00	0%	0.00
870	I	Concrete Wingwall	[EA]	4.00	100%	4.00	0%	0.00	0%	0.00	0%	0.00
961	I	Scour SF	[EA]	1.00	0%	0.00	100%	1.00	0%	0.00	0%	0.00

7/19/2021 - Not much change noted. FX:18m NORTH SIDE NO UNDERMINING AND 24m SOUTH SIDE WITH 4m UNDERMINING. Scour starting to silt in some. 10 inches of footing exposed on north side and 2ft below floor on south but no undermining visible. B/15/19 scour on S side 3' below floor with 6" of undermining 2' below floor on N side box has a 2' apron on both sides

Oklahoma Dept. of Transportation - Bridge Inspection Report

NBI No.: 06779	Structure No.: 02E0060N2510007	Local ID: 1030	Suff. Rating: 40.90	SD
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BRIDGE DESCRIPTION: IDENTIFICATION
 2-10R.X.3R.X.31R. R.C.BOX

INSPECTION
 Job: 1
 Insp. Res.: N
 Insp. Date: 7/19/2021
 Next Insp.: 07/19/2023

CLASSIFICATION
 12 Base Hwy Net: Not on Base Network
 20 Toll Facility: On free road
 21 Custodian: County
 22 Owner: County
 26 Function Class: 09 Rural Local
 27 Historical Sig: Not eligible for NHPH
 100 Def Hwy: Not a STRAHNET hwy

CONDITION
 59 Deck: N/A (NBI)
 62 Culvert: 3 Excessive D/I
 61 Chan.Achan. Proc.: 5 Bank Prot Eroded

LOAD RATING AND POSTING
 31 Design Load: MS 19 (HS 20)
 41 Post. Restr.: A Open, no restriction
 70 Posting: 5 A/Above Legal Loads
 83 Op / 65 Inv. Rating Meth.: 2 AS Allowable Stress / 2 AS Allowable Stress
 84 Operating Rating (tons): 23.00 36.00 0.00 0.00 0.00
 86 Inventory Rating (tons): 13.00 21.10

APPRaisal
 30a. Brdg. Rat.: 0 Substandard
 30b. Transition: 0 Substandard
 36c. Appr. Rat.: 0 Substandard
 36d. Appr. Rail Ends: 0 Substandard
 67. Str. Evaluation: 3 Intolerable - Com 113. Scour Critical: 3 SC - Unstable

PROPOSED IMPROVEMENTS
 84. Bridge Cost: \$100,000
 85. Roadway Cost: \$75,000
 86. Total Cost: \$225,000
 87. Yr of Cost Est.: 2015
 75. Type of Work: 33 Widens w/o Deck Re
 76. Length of Improvement: 89.4 ft
 114. Future ADT: 160
 115. Yr of Future ADT: 2040

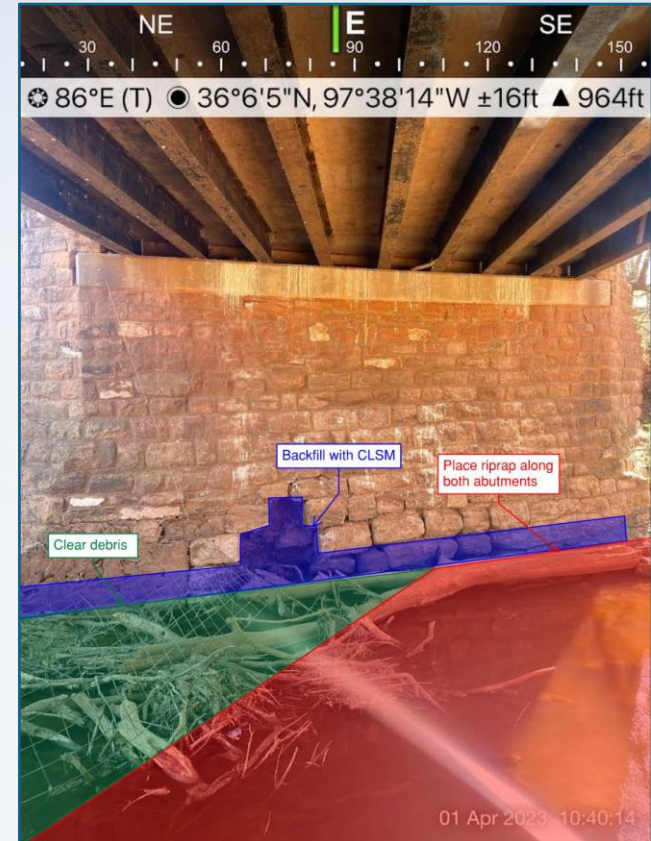
NAVIGATION DATA
 38 Nav. Control: Permit Not Required
 39 Vert. Clearance: 0.0 ft
 40. Horiz. Clearance: 0.0 ft
 111. Pier Protect.: 1 Not Required
 116. LR Bridge Vert. Cr.: 0.0 ft

OKLAHOMA ITEMS
 200. Temperature: 80
 204. Weather: Clear
 201. Struc. SR: ASTM Desig.: -1 / -1
 202. Waterp/Membrane: -1
 203. Type Exp. Device: -
 204. Type of Rating: N/A
 205. Material Quantity: -1.00
 208a. Type of Abutment: Other
 b. Type of Found.: -
 209. Type of Pier/Found.: -
 210. Foundation Elev.: -1.00 -1.00 -1.00
 211. Hwr. Suf. Prot. Sys.: -
 212. Date Installed: 01/01/1901
 211e. Silane Reapplied: -
 211d. Date: -
 211. Utilities Attached: -
 214a. Posted Weight Limit: NR
 b. Posted Speed Limit: NR
 c. Narrow I/Way Brdg Sign: No
 d. Vertical Cr. Sign: No
 e. Adv. Warning Sign: No
 f. Navigation Lights: No
 g. Working/Not Working: No
 215. Overpass: ACCO
 218. Functionally Obsolete: FO
 220. Bridge Redecked: -
 221. Subst. Cond./UW: -
 222. Fill Over RCB: FG
 223. Appr. Slab/Revy Cond.: 3
 225. Paint Type/Over: N/A
 226. Date Painted: -
 227. Fract. Coat: -1
 233. Deck Forming: Conventional Forming
 238. School Bus Rte.: Not Desired/Current rts.
 240. Appr. Rwy Type: Soil
 243. Ovr. Spacing/ht.: /

OK001_Bridge Inspection Report 9/9/2022

ODOT and Consultant Partnering

- Site assessment practices
 - File review
 - Documentation
 - Photo standards
 - Standardized Field Books



ODOT and Consultant Partnering

- Site assessment practices
 - File review
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ODOT SCOUR ASSESSMENTS
PHOTO MAP

Inspector: Matheus Dias, Inspection Date: 2023-05-10, BRIDGE #: 00466, Inspector Initials: MD, Inspection Day: 1

Select North or East for Arrow: East

CHANNEL DESCRIPTION/NOTES

Photo Map

ODOT SCOUR ASSESSMENTS
CHECKLIST

Inspector: Matheus Dias, Inspection Date: 2023-05-10, BRIDGE #: 00466, Inspector Initials: MD, Inspection Day: 1

DOCUMENT REVIEW

- Yes: Review previous IR and PH inspection files. Note any previous significant issues.
- Yes: Review all Scour Documents and Records (SD & SR)
- No: Are bridge plans with substructure and foundation details available?
- Yes: All previous scour-related issues have been identified?
- Yes: Assess channel characteristics upstream & downstream of bridge on Google Earth (historical). Click on the clock icon at the top and scroll back-and-forth on the timeline at the top of the window.
- No: Any other conditions causing bridge to be SD (Deck, Superstructure, or Substructure with NBR rating of 4 or less)? If so, see "SD Considerations" Tab

INSPECTION

- South: Note direction of streamflow
- Yes: For span bridges, all substructure units have been inspected and probed for scour?
- N/A: For culverts, upstream and downstream aprons have been probed full length?
- N/A: For culverts, note if curtain walls are present at upstream/downstream aprons? Measure depth/height if possible?
- Yes: Photos of substructure units have been taken and logged?
- Yes: Is water wadable?
- Sand(<1/4"): Channel Bed Material - Take photo with ruler to gauge size of material
- spread Footing: Foundation Type of units in water (see ODOT Items 208 and 209)
- Aggregation: Compare flowline measurements from past several inspections.
 - No: Evidence of overtopping, drift caught on bridge?
 - Yes: Debris accumulated at or near substructure
 - Yes: Channel movement laterally (substructure originally on bank now in/near water)
 - Yes: Stream directed at substructure during high water
 - 0: Estimate angle between flow and face of substructure
 - Yes: Scour developing at substructure (measurements and detailed descriptions)
 - No: Riprap or other scour mitigation already present?
 - No: Heavy bank cutting upstream/downstream? Include description and approximate dimensions on "Measurements" tab.
 - No: Other streams merging nearby? Note locations and describe and photograph.
 - Yes: Any islands, sandbars (aggradation) upstream or downstream?

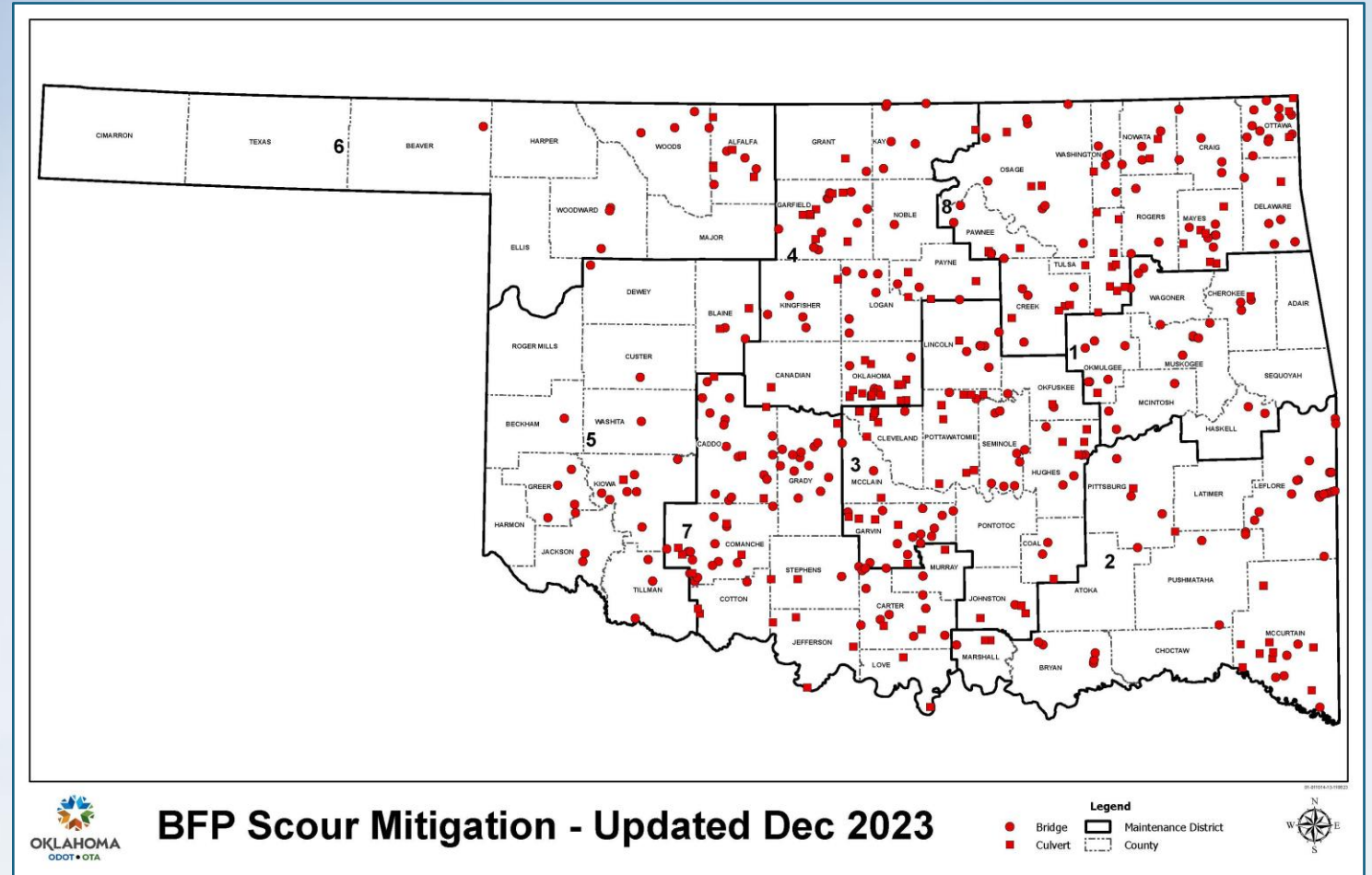
Checklist

Scour Mitigation Program

- ODOT and Consultant partnering to develop site assessments practices
- **ODOT Field District staff conducting site assessments**
- Consultant Partners develop scour assessment reports
- ODOT Local Government – environmental permitting
- Installation of scour repairs

Field District Site Assessments

- Two Districts per Consultant



Field District Site Assessments

- Discuss common findings
 - **Repairs already completed**
 - Update rating
 - Debris
 - Foundation Exposure
 - Poor Channel Alignment



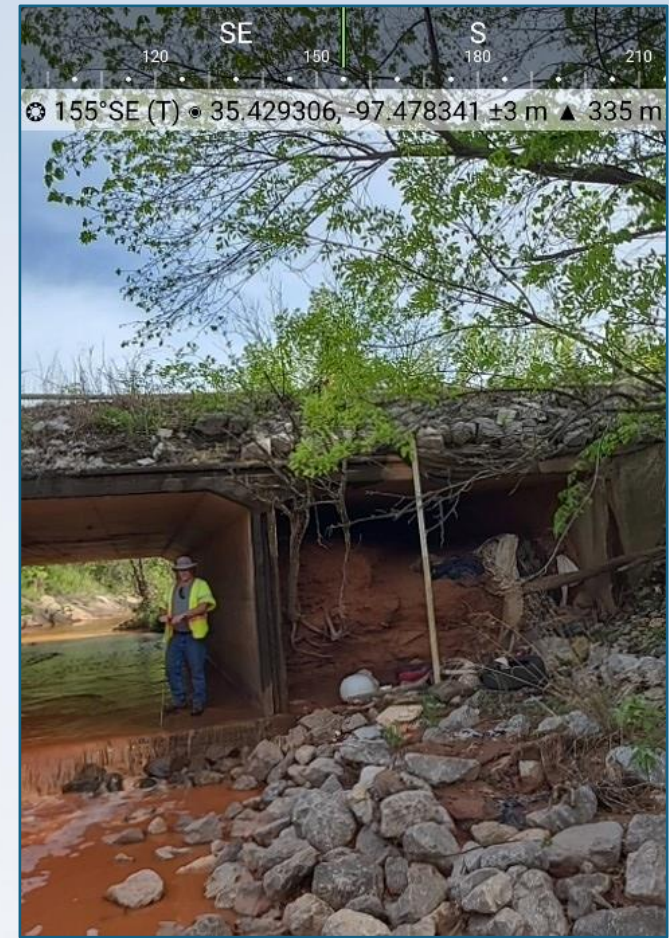
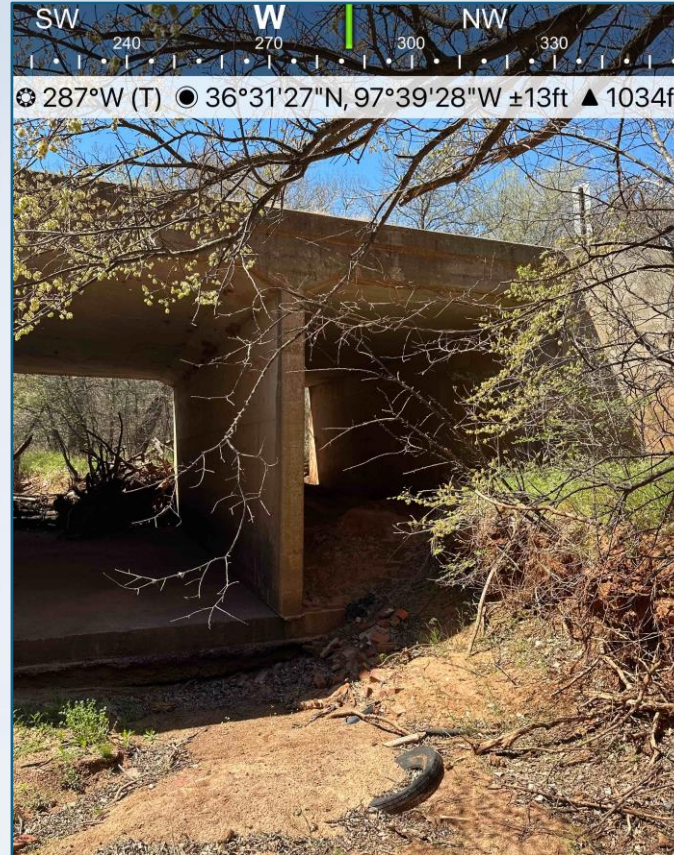
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- Discuss common findings
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Field District Site Assessments

- Discuss common findings
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Field District Site Assessments

- Discuss common findings
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Field District Site Assessments

- Discuss common findings
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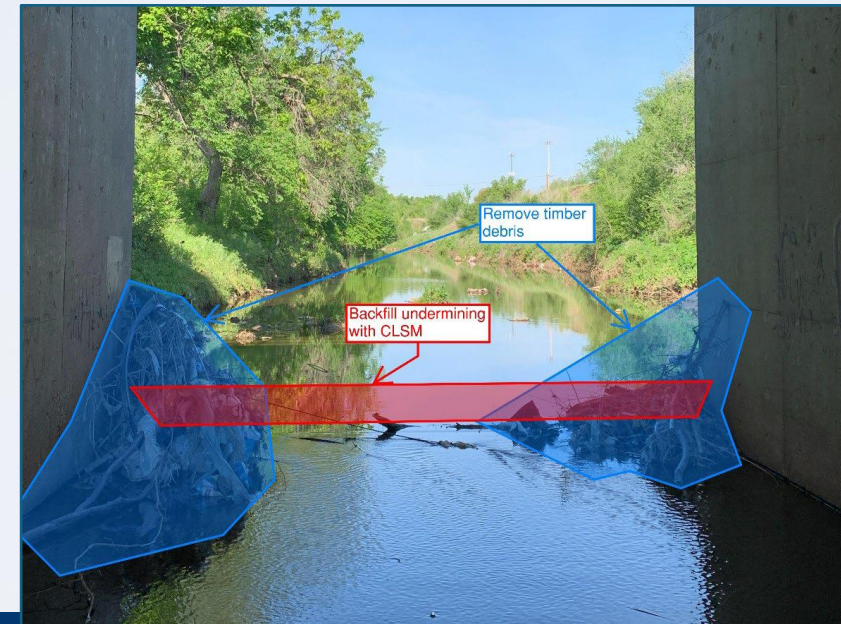


Scour Mitigation Program

- ODOT and Consultant partnering to develop site assessments practices
- ODOT Field District staff conducting site assessments
- **Consultant Partners develop scour assessment reports**
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- Installation of scour repairs

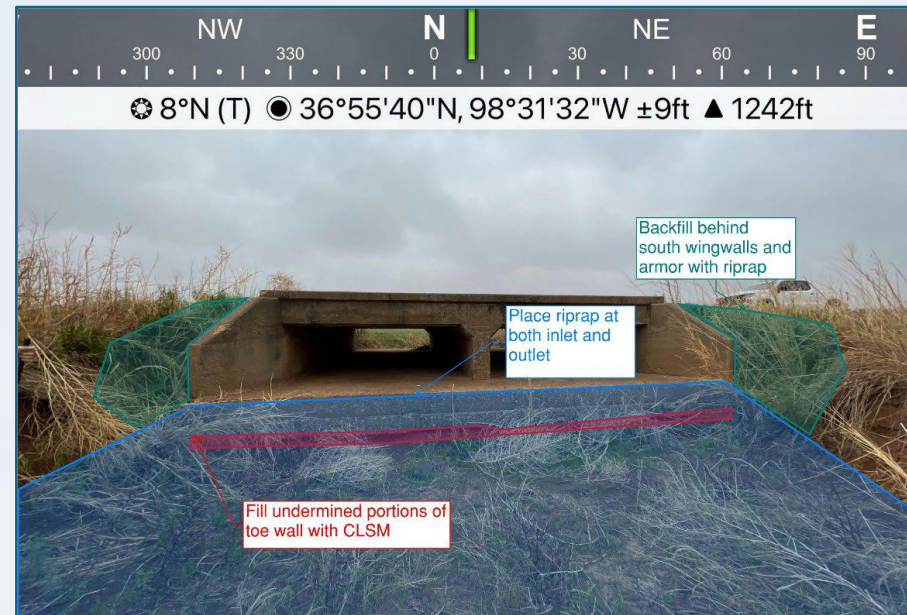
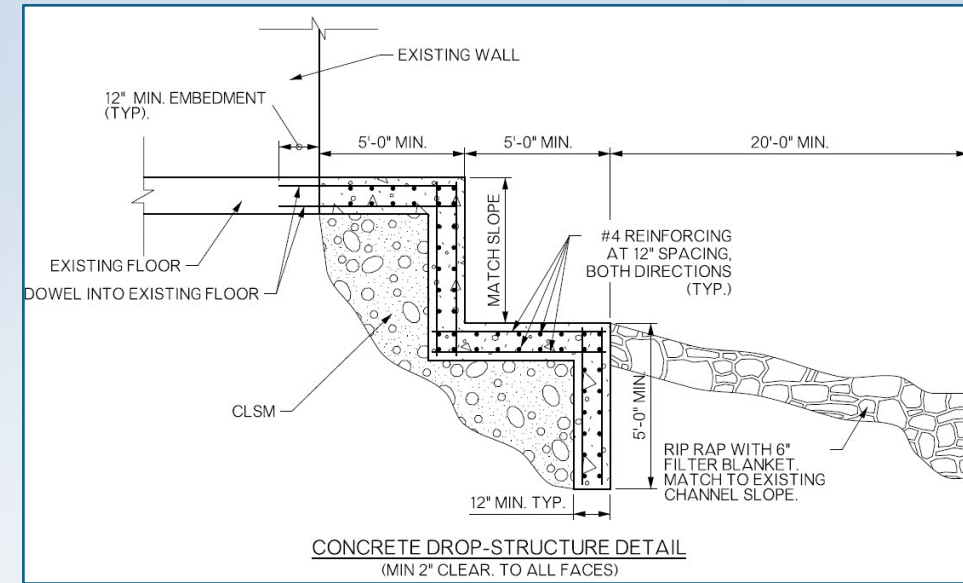
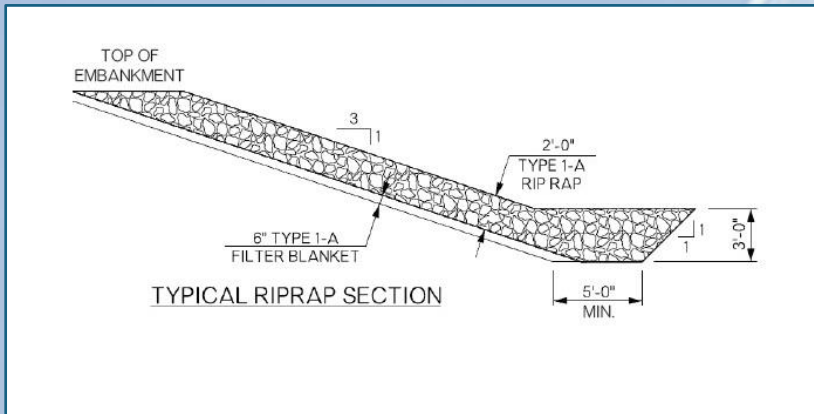
Develop Scour Assessments

- Review findings
- Refer to HEC guidance sheets
- Assessment Reports



Develop Scour Assessments

- Assessment Reports



Estimated Quantities and Costs

Mobilization and traffic control costs are not included.

Item No.	Item	Unit	Quantity	Unit Price	Total
201 1100	(PL) REMOVE DRIFT AND SILT	LSUM	1	\$2,500.00	\$2,500.00
202(A)2210	UNCLASSIFIED EXCAVATION	CY	80	\$60.00	\$4,800.00
501(G)1800	CLSM BACKFILL	CY	4	\$1,200.00	\$4,800.00
601(B)1230	TYPE I-A PLAIN RIPRAP	TON	200	\$120.00	\$24,000.00
601(C)1310	TYPE I-A FILTER BLANKET	TON	75	\$90.00	\$6,750.00
					\$42,850.00



Scour Mitigation Program

- ODOT and Consultant partnering to develop site assessments practices
- ODOT Field District staff conducting site assessments
- Consultant Partners develop scour assessment reports
- **ODOT Local Government – environmental permitting**
- Installation of scour repairs

Environmental Permitting

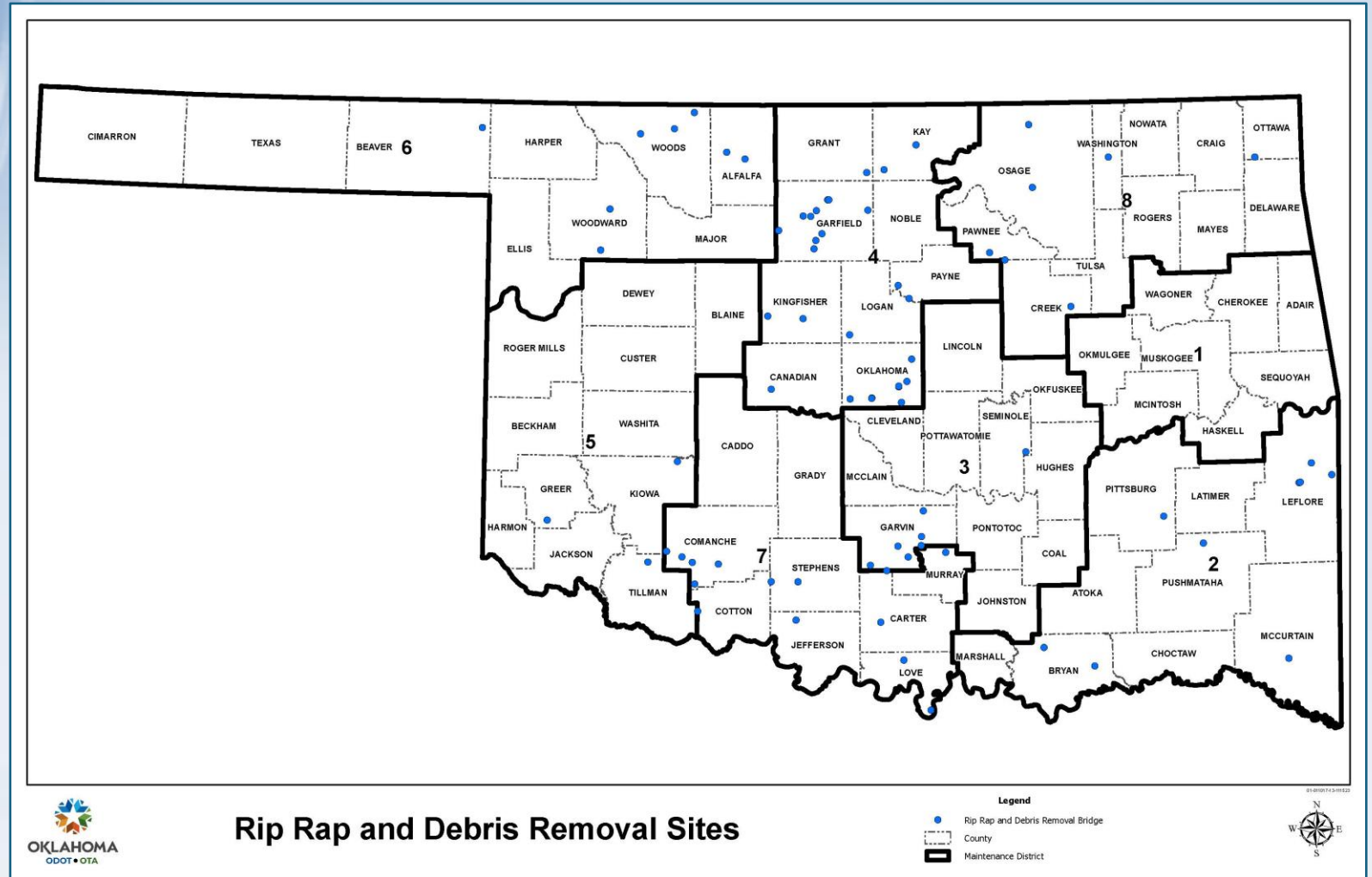
- Coordination with Natural Resources, Cultural Resources, Tribal Consultation, Clean Water, & 404 Permitting groups + 8 field district project managers
- Determined first round fell under ACE NEPA document and No-PCN 404 permit
- Environmental notes & 404 permit completed for each ODOT District

Scour Mitigation Program

- ODOT and Consultant partnering to develop site assessments practices
- ODOT Field District staff conducting site assessments
- Consultant Partners develop scour assessment reports
- ODOT Local Government – environmental permitting
- **Installation of scour repairs**

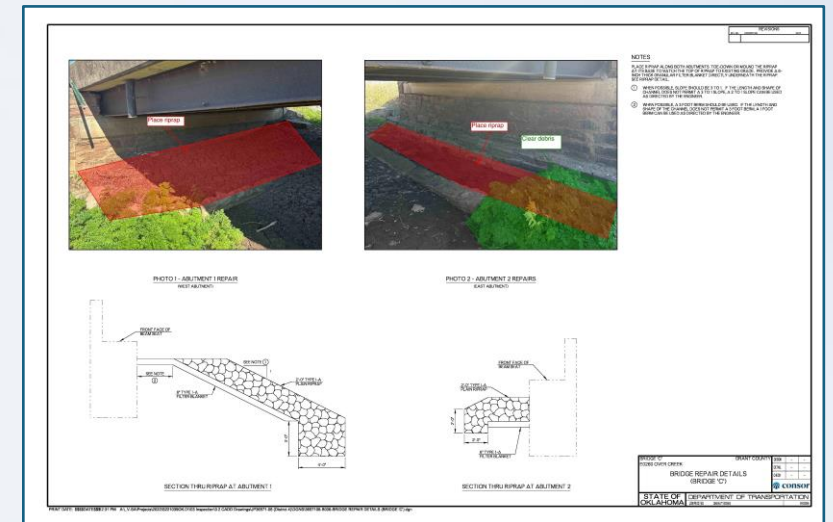
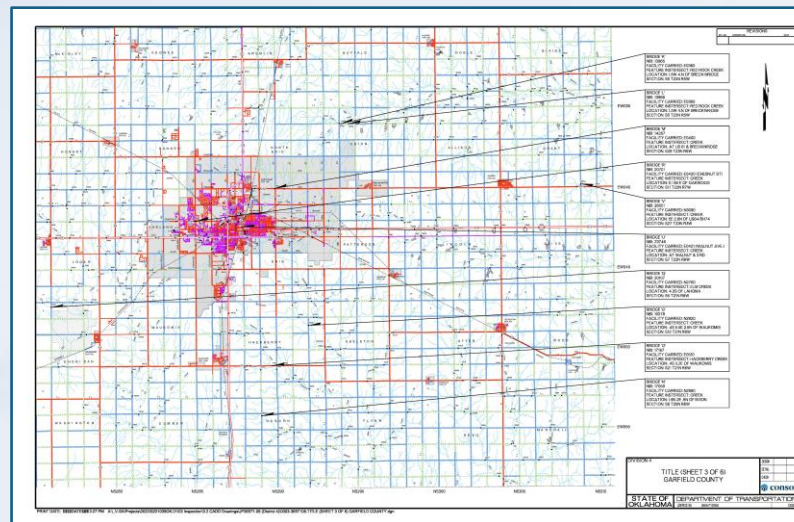
Scour Repairs

- Phase 1
 - Riprap
 - Debris removal



Scour Repairs

- Plan sets submitted August 8
- Project letting in November 2024
- Reduction of SD inventory in 2025
- Phase II plan



Scour Mitigation Program in Oklahoma DOT Local Government Division

Melissa Davis, PMP – Oklahoma DOT Local Government Division

Michael Dukes, PE – Consor

