

**NORTH DAKOTA
DEPARTMENT OF TRANSPORTATION**

**MATERIALS AND RESEARCH
DIVISION**

Experimental Study ND 2010-03

**Evaluation of ScourStop® Flow Transition Mats
For Scour Protection**

1st Evaluation Report

SU-2-987(029)033

April, 2014

Prepared by

**NORTH DAKOTA DEPARTMENT OF TRANSPORTATION
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T.J. Murphy

Disclaimer

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EXPERIMENTAL PROJECT REPORT

EXPERIMENTAL PROJECT	EXPERIMENTAL PROJECT NO.					CONSTRUCTION PROJ NO		LOCATION			
	1	STATE ND	Y EAR 2010	NUMBER -	SURF 03	SU-2-987(029)033		I-94 Jamestown business loop			
						8	28				
	EVALUATION FUNDING					NEEP NO.	PROPRIETARY FEATURE?				
	48	1	HP&R	3	X	DEMONSTRATION		X Yes			
	2	CONSTRUCTION	4		IMPLEMENTATION	49	51 No				
SHORT TITLE	TITLE 52 Evaluation of ScourStop® Flow Transition Mats for Scour Protection										
THIS FORM	DATE	MO.	YR.	REPORTING							
	140	April	--	2014	1	INITIAL	2	X	ANNUAL	3	FINAL
KEY WORDS	KEY WORD 1					KEY WORD 2					
	145 ScourStop					167 Flow Transition Mats					
	KEY WORD 3					KEY WORD 4					
	189 Scour					211					
	UNIQUE WORD					PROPRIETARY FEATURE NAME					
	233					255 ScourStop					
CHRONOLOGY	Date Work Plan Approved		Date Feature Constructed:		Evaluation Scheduled Until:		Evaluation Extended Until:		Date Evaluation Terminated:		
	277 August 2010		281 June 2012		285 September 2018		289		293		
QUANTITY AND COST	QUANTITY OF UNITS (ROUNDED TO WHOLE NUMBERS)				UNITS				UNIT COST (Dollars, Cents)		
	297				305				306		
AVAILABLE EVALUATION REPORTS	CONSTRUCTION			PERFORMANCE				FINAL			
	X			X							
EVALUATION	CONSTRUCTION PROBLEMS					PERFORMANCE					
	1	X	NONE	1	EXCELLENT	2	GOOD	3	X	SATISFACTORY	4
	2		SLIGHT	3		5		UNSATISFACTORY			
	3		MODERATE	4		5					
	4		SIGNIFICANT	5							
	5		SEVERE	6							
APPLICATION	1 ADOPTED AS PRIMARY STD.		4 X PENDING		(Explain in remarks if 3, 4, 5, or 6 is checked)						
	2 PERMITTED ALTERNATIVE		5 REJECTED								
	3 ADOPTED CONDITIONALLY		6 NOT CONSTRUCTED								
REMARKS	321 The four installations of ScourStop® were successfully installed according to the plans and manufacturer's recommendation. The top soil adjacent to the installations was eroded away during the flood of 2011 prior to installation. This resulted in a low success rate of the permanent seeding around the ScourStop® installations. The picture in photo 6 captures the state of the permanent seeding in August of 2012. The sod appears to be growing and is covered with a minor amount of top soil and water and is documented in the 1 st evaluation as of October 2013.										

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Evaluation of ScourStop® Flow Transition Mats For Scour Protection

Purpose and Need

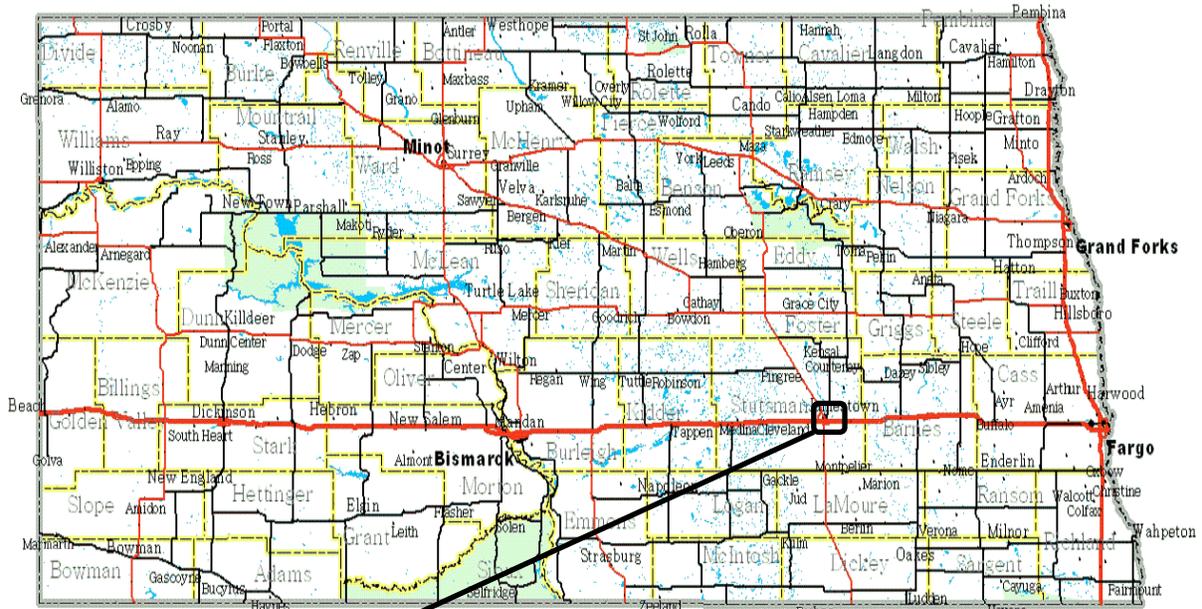
Storm water flow from culverts and pavement in urban and rural settings can accelerate soil scour and erosion in turn impeding proper drainage which then may require maintenance to restore. Rip-rap and TRM “turf reinforcement mat” is currently used as a permanent scour and erosion protection, but rip-rap revetment may erode away and disintegrate over time requiring periodic maintenance. Rip-rap also may pose a safety hazard to children in residential settings and can collect debris and weeds producing an aesthetically unappealing structure. Flow Transition Mats are designed to replace rip-rap revetment as a permanent maintenance free scour and erosion protection system at culverts, pipes, and pavement drainage areas. Mats allow vegetation to become established and protect flow paths from erosion.

Objective

The objective of this experimental project is to evaluate the performance of ScourStop® Flow Transition Mats as a permanent method for energy dissipation to prevent scour downstream from culverts, pipes, or pavement.

Location

NDDOT plans to incorporate ScourStop® Flow Transition Mats as part of project SU-2-987(029)033. This project is located near Jamestown Business Loop East respectively.



SU-2-987(029)033
Begin Project

SU-2-987(029)033
End Project

Proposed ScourStop®
Location (south ditch)

Design

NDDOT plans to incorporate ScourStop® Flow Transition Mats on I-94 near Jamestown as part of project SU-2-987(029)033 designed by Ulteig Engineers, Inc. ScourStop® Flow Transition Mats shall be installed according to plan and abiding all manufacturers' recommendations. The plan note used to incorporate ScourStop® is included below.

709-P01 EROSION CONTROL TRANSITION MAT: The contractor shall install Erosion Control Transition Mat at the storm drain outlets indicated in the plan. The Erosion Control Transition Mat shall be ScourStop®.

Installation shall be in accordance with the following:

1. The Erosion Control Transition Mat shall butt directly against the flared end section.
2. The Erosion Control Transition Mat shall not be installed on bare soil. The Erosion Control Transition Mat shall be placed on sod. The cost of sod shall be included in the price bid for "Erosion Control Transition Mat."
3. Use flexible strapping with deadman anchor, flat washers (>2.5 inches) and one way stops to attach the Erosion Control Transition Mats to the soil a minimum of 24 inches. Firmly pull straps to snug the Erosion Control Transition Mat down against the soil with the washer and one-way stop.
4. Discharge area width shall be as level as possible to avoid water concentration and riling. Mats may be installed in partial lengths; downstream mats may be shingled to minimize anchors.

SU-2-987(029)033

This project consists of the reconstruction of the Jamestown Business Loop East from 12th Street SE to Country Club Drive. The roadway will have four installation of ScourStop®. For exact installations locations see Appendix A. The project will also have a control site with conventional rip rap; for exact installations locations see Appendix A.

Evaluation

The project will be evaluated during construction and completion and then followed up with an annual evaluation for the next six years. The project will be evaluated on the following criteria:

- Visual Inspection
- Durability Issues
- Photos
- District comments on their visual observations
- Maintenance cost

Materials and Research will publish a biennial report documenting the observations of this project.

Construction

Project SU-2-987(029)033 was a reconstruction administered by Ulteig Engineering. ScourStop® was installed June 12 and June 13 of 2012 by Pro Landscapers LLC. A small crew of landscapers was able to perform the four ScourStop® installations over two days. Installation sites required minimal grade preparation as pictured below.



Photo 1: Crew performing grade prep prior to install.

Once the grade was ready for installations the area was covered with sod.



Photo 2: Site with sod placed.

Once the sod had been placed the matrix of 4'x4' ScourStop® Panels was laid out; some panels were cut to achieve the desired dimension in the plans. No panels were overlapped as the contractor advised against overlapping panels.



Photo 3: Crew placing the ScourStop® panels.

ScourStop® Bullet anchors were then inserted 18" deep into the soil with rebar and secured with locking washers pictured below in photo 4. The depth of anchoring was inspected with a tape measure to insure proper embedment. The crew pounded the first few anchors in with a sledge hammer; this process was time consuming and an air hammer was brought over to speed up the process. It should also be noted that once the rebar was used to pound the anchors it often became stuck due to the confining pressure of the in place embankment. The process was slowed by the time required to remove the stuck rebar. A post puller would have been useful in speeding up anchor installation. The crew at the time did not have a post puller and used a skid steer bucket to remove stuck rebar.



Photo 4: ScourStop® bullet anchor.

The anchoring pattern was recommended by the manufacturer. Each 4'x4' panel was secured with eight anchors. It should be noted that to reduce anchors the panels can be overlapped in the direction of flow. The contractor opted to not overlap panels due to their past experience. The contractor felt the ScourStop® panels perform better when placed flush. Pictured in photo 5 is a completed installation of ScourStop®.



Photo 5: Completed ScourStop® installation.

1st Evaluation-2013

The four Scourstop® installations installed 6/12/2012 on the I-94 Jamestown Business loop in the Valley City District were last visually inspected on October 15, 2013. All four installations have successfully provided scour protection and remain in service. Installations at STA 47+90 and STA 53+00 have exhibited signs of severe sod distress. This distress is likely a result of excess pooled runoff unable to drain due to ditch grades. This pooling from excessive moisture is captured in the photos from M&R last visual inspection. Photos of the four installations initial and current condition can be found on pages eight thru eleven of this report.

The control section experienced an increase in scour ranging from 2" - 4" of depth throughout the immediate outfall of the culvert. This increase in scour is likely a result from excess precipitation in 2013 scouring the unprotected outfall; which had been exposed by the flooding of 2011. Photos of the initial control installation and from M&R last visual inspection can be found on pages twelve thru thirteen.



Photo 6: Installation at - Sta. 47+90 Rt. (09/25/2012)



Photo 7: Installation at - Sta. 47+90 Rt. 1st Evaluation (10/15/2013)



Photo 8: Installation at - Sta. 48+25 Rt. (9/25/2012)



Photo 9: Installation at - Sta. 48+25 Rt. 1st Evaluation (10/15/2013)



Photo 10: Installation at – Sta. 50+36 Rt. (9/25/2012)



Photo 11: Installation at – Sta. 50+36 Rt. 1st Evaluation (10/15/2013)



Photo 12: Installation at - Sta. 53+00 Rt. (9/25/2012)



Photo 13: Installation at – Sta. 53+00 Rt. 1st Evaluation (10/15/2013)



Photo 14-15: Control Installation Sta. 24+36 Rt. to Sta. 24+57 Rt. (2012/06/12)





Photo 16-17: 1st Evaluation Control Installation Sta. 24+36 Rt. to Sta. 24+57 Rt. (2013/10/15)



Summary

The four installations of ScourStop® were successfully installed according to the plans and manufacturer's recommendation and are performing as designed with some sod distress. The top soil adjacent to the installations was eroded away during the flood of 2011 prior to installation. This resulted in a low success rate of the permanent seeding around the ScourStop® installations. The picture in photo 18 captures the state of the permanent seeding in August of 2012. The sod appears to be growing with the exception of the two installations at STA 47+90 and STA 53+00. The sod at these two locations is showing signs of distress; due to high amounts of precipitation pooling over the installation. The sod condition has not impacted the performance of these two installations ability to protect against scour.

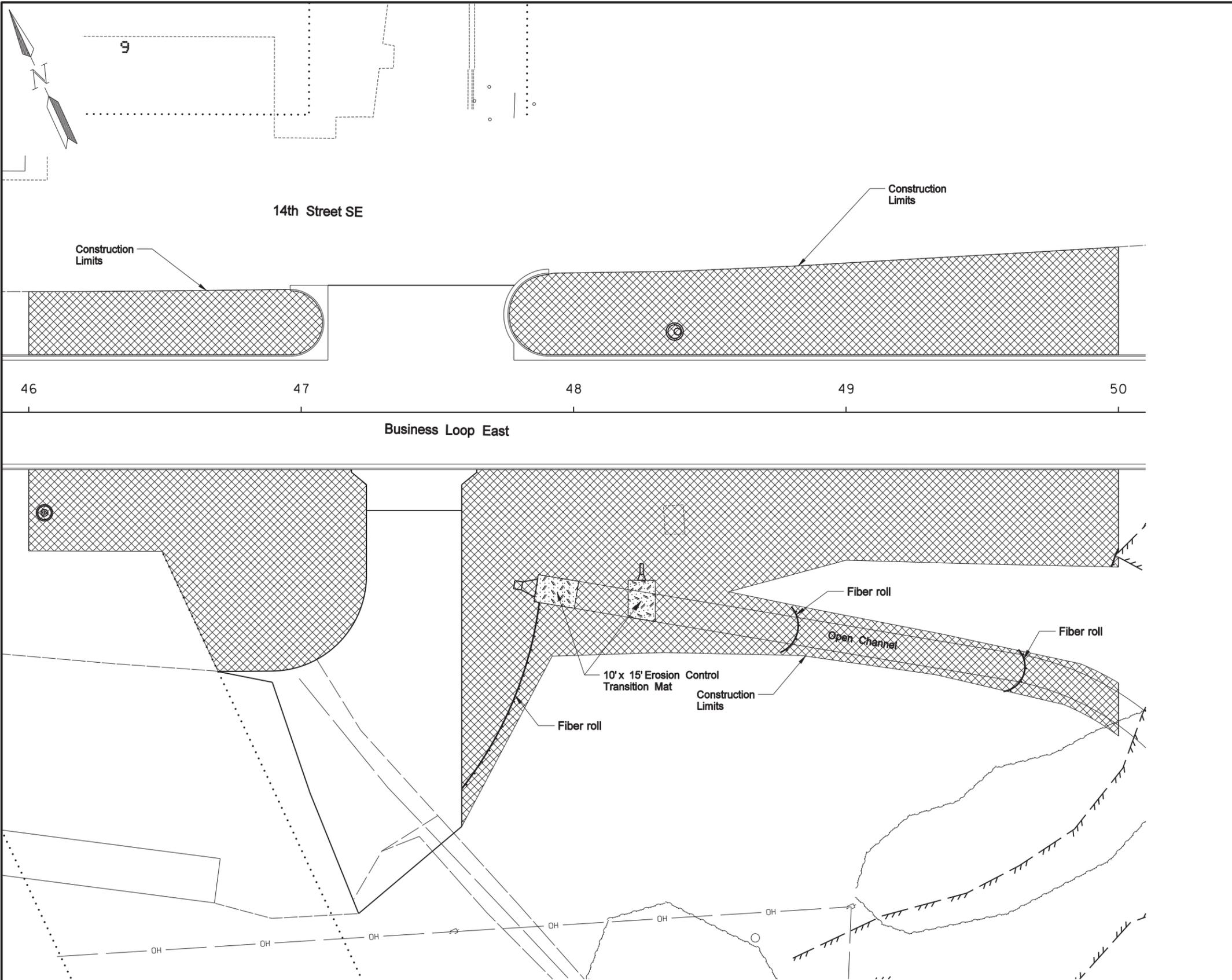


Photo 18: ScourStop® installation August 2012.

The ScourStop® installations will be monitored for durability and performance over the next five years.

Appendix A

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	SU-2-987(029)033	075	10



Fiber Rolls 12IN

Sta. 47+60 Rt. to Sta. 47+87 Rt.	75 LF
Sta. 48+80 Rt.	20 LF
Sta. 49+65 Rt.	20 LF

Seeding-Hydromulch

Sta 46+00 Lt. to Sta. 47+08 Lt.	0.057 Acre
Sta 46+00 Rt. to Sta. 47+24 Rt.	0.144 Acre
Sta 47+76 Lt. to Sta. 50+00 Lt.	0.170 Acre
Sta. 47+59 Rt. to Sta. 50+00 Rt.	0.348 Acre

Erosion Control Transition Mat

Sta. 47+90 Rt.	17 SY
Sta. 48+25 Rt.	17 SY

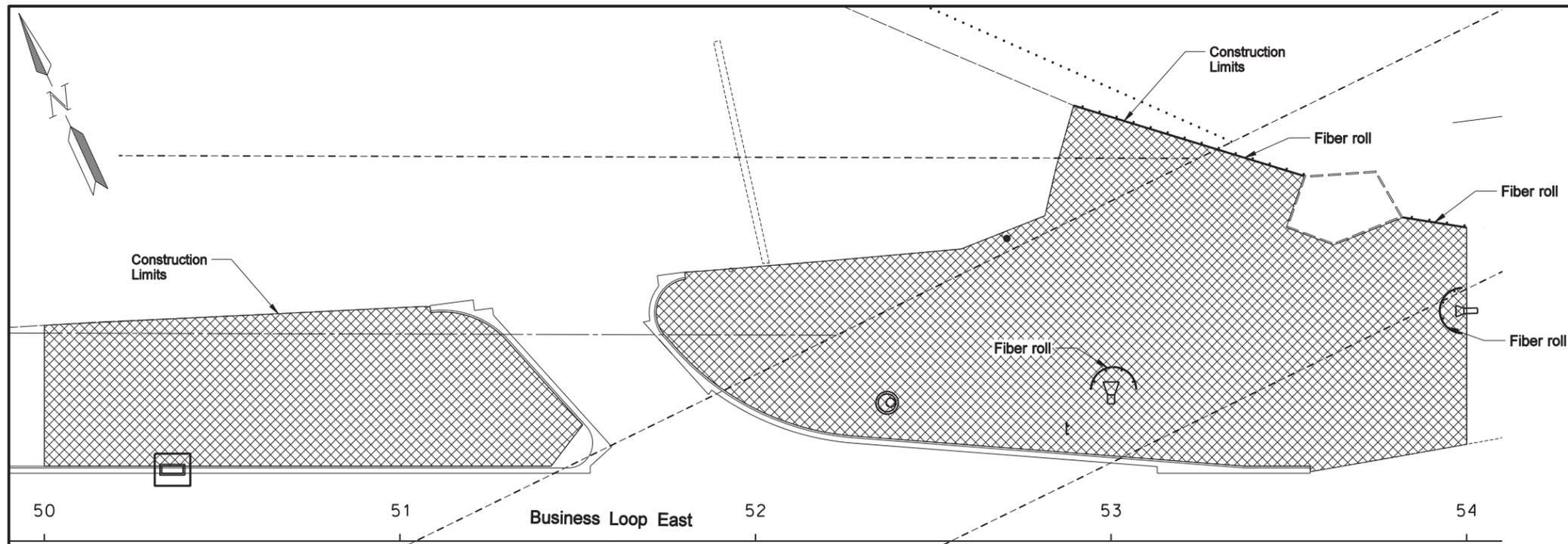
Legend

-  Seeding-Hydromulch
-  Inlet Protection-Sandbag
-  Fiber Rolls 12 IN
-  Existing Delineated Wetland
-  Permanent Wetland Impacts
-  Temporary Wetland Impacts

This document was originally issued and sealed by Clinton Knutson Registration Number PE-4523, on 10/05/2010 and the original document is stored at the City of Jamestown

Business Loop East
Wetlands, Erosion Control & Seeding
Sta. 46+00 to Sta. 50+00

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	SU-2-987(029)033	075	11



Inlet Protection-Sandbag

Sta. 50+36 Lt.	1 EA
Sta. 50+36 Rt.	1 EA

Fiber Rolls 12 IN

Sta. 50+00 Rt. to Sta. 53+56 Rt.	430 LF
Sta. 52+90 Lt. to Sta. 53+54 Lt.	68 LF
Sta. 53+00 Lt.	20 LF
Sta. 53+82 Lt. to Sta. 54+00 Lt.	18 LF
Sta. 53+90 Lt.	20 LF

Seeding-Hydromulch

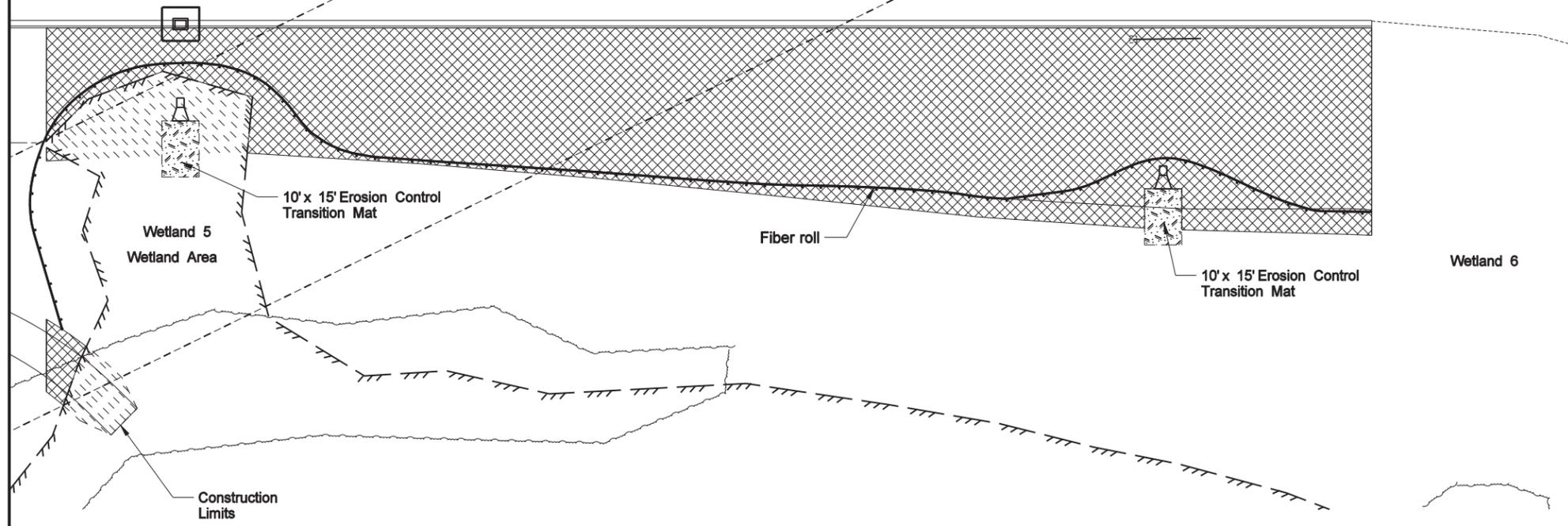
Sta. 50+00 Lt. to Sta. 51+51 Lt.	0.136 Acre
Sta. 51+72 Lt. to Sta. 54+00 Lt.	0.331 Acre
Sta. 50+00 Rt. to Sta. 53+56 Rt.	0.338 Acre

Erosion Control Transition Mat

Sta. 50+36 Rt.	17 SY
Sta. 53+00 Rt.	17 SY

Legend

	Seeding-Hydromulch
	Inlet Protection-Sandbag
	Fiber Rolls 12 IN
	Existing Delineated Wetland
	Permanent Wetland Impacts
	Temporary Wetland Impacts



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Business Loop East
Wetlands, Erosion Control & Seeding
Sta. 50+00 to Sta. 54+00