Addendum to the 2011Muddy Creek TMDL for Impaired Segments in the Muddy Creek Watershed, North Carolina

Final Report
May 24, 2016

[Waterbody ID: (12-94-0.5)b2b]

Yadkin Pee Dee River Basin

Submitted by:
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Introduction

As reported in the 2010 303(d) list, the North Carolina Division of Water resources (DWR) first identified turbidity impairments in Muddy Creek within the Yadkin Pee Dee River Basin from State Road (SR) 2995 to a point 0.8 mile upstream of mouth in 2008. The associated assessment unit (AU) for the impaired section of the creek was 12-94-(0.05)c. This impaired section is shown in "green" below in Figure 1. As required by the Clean Water Act (CWA), the DWR developed a Total Daily Maximum Load (TMDL) for Turbidity for Muddy Creek. The TMDL was approved by the United States Environmental Protection Agency (EPA) Region 4 on November 17, 2011. The approved TMDL document is posted at http://portal.ncdenr.org/c/document_library/get_file?uuid=21f0fcc5-020f-4c37-9e34-f9da0e7dbd14&groupId=38364.

The Division identified an additional impairment for Turbidity on Muddy Creek from Silas Creek to SR 2995 on the 2014 303(d) list. The associated assessment unit for this impaired section is 12-94-(0.5)b2b. The newly identified impaired section is located directly above the original impairment and is shown in "red" in Figure 1. This document focuses on this impaired section in Muddy Creek and represents an addendum to the approved TMDL document.

Watershed Description

This TMDL addendum covers the Muddy Creek watershed in theYadkin Pee Dee River Basin. The watershed encompasses the North Carolina counties of Stokes, Forsyth and Davidson and covers 256 square miles (Figure 1). The 2011 National Land Cover Dataset (NLCD) indicates the watershed is predominantly covered by developed lands (52%) and forested lands (30%) (Figure 2 & Appendix Table A1). Pasture and grasslands covers only 15%. Of the developed lands, 32% is comprised of open spaces, which includes large lot single family housing units, parks, golf courses, and vegetation planting in developed settings. The developed open spaces is appeared to be expanded by 6% since 2006 (Appendix Table A1).

Point sources in the watershed are all stormwater. The Village of Clemmons (NCS000247), Winston Salem (NCS000410) and the NCDOT (NCS000250) are all Municipal Separate Storm Sewer System (MS4) stormwater permittees in the Muddy Creek Watershed. These permittees were all named in the original TMDL.

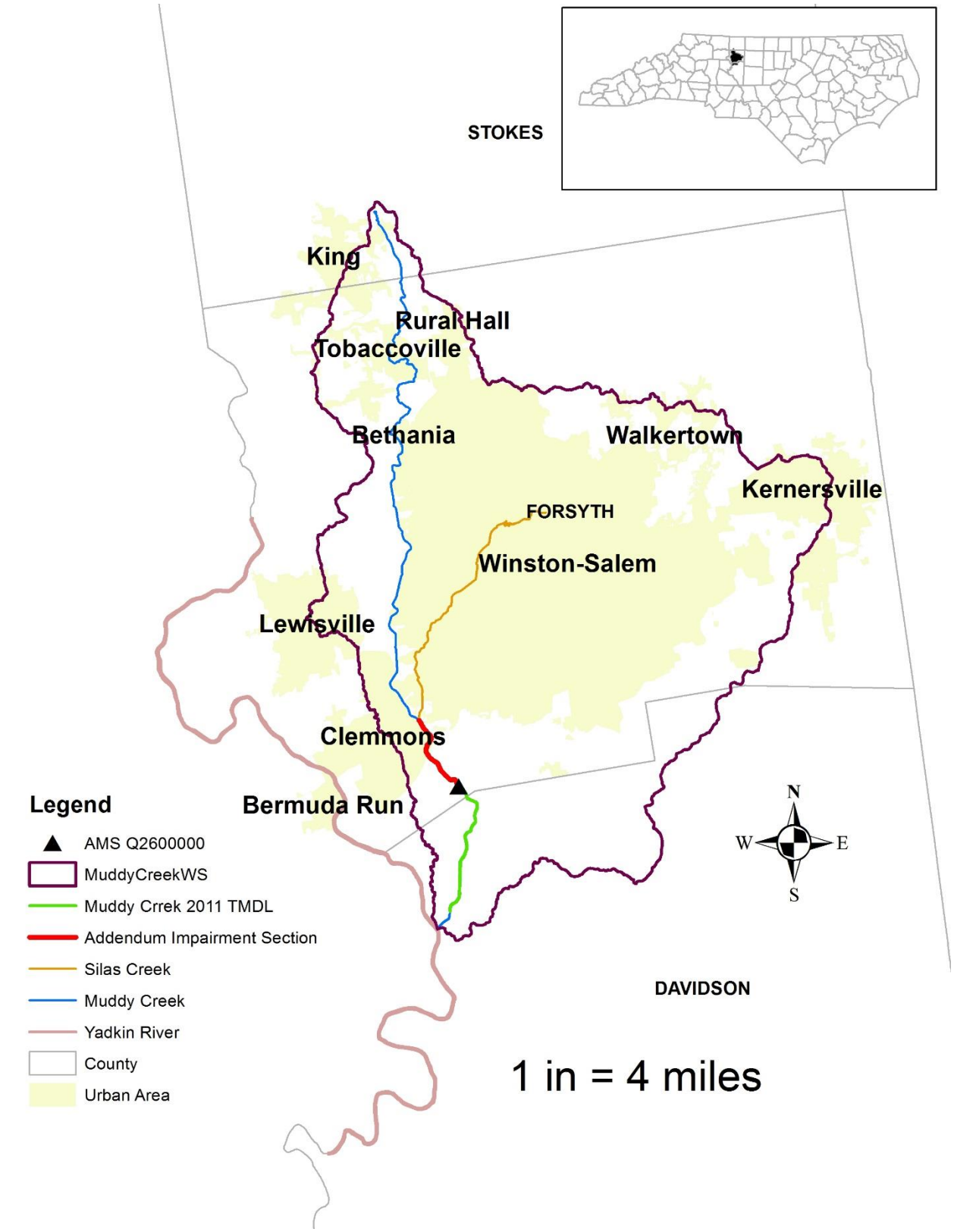

Figure 1. Muddy Creek Watershed showing addendum impairment section in Muddy Creek and urban areas across the watershed.

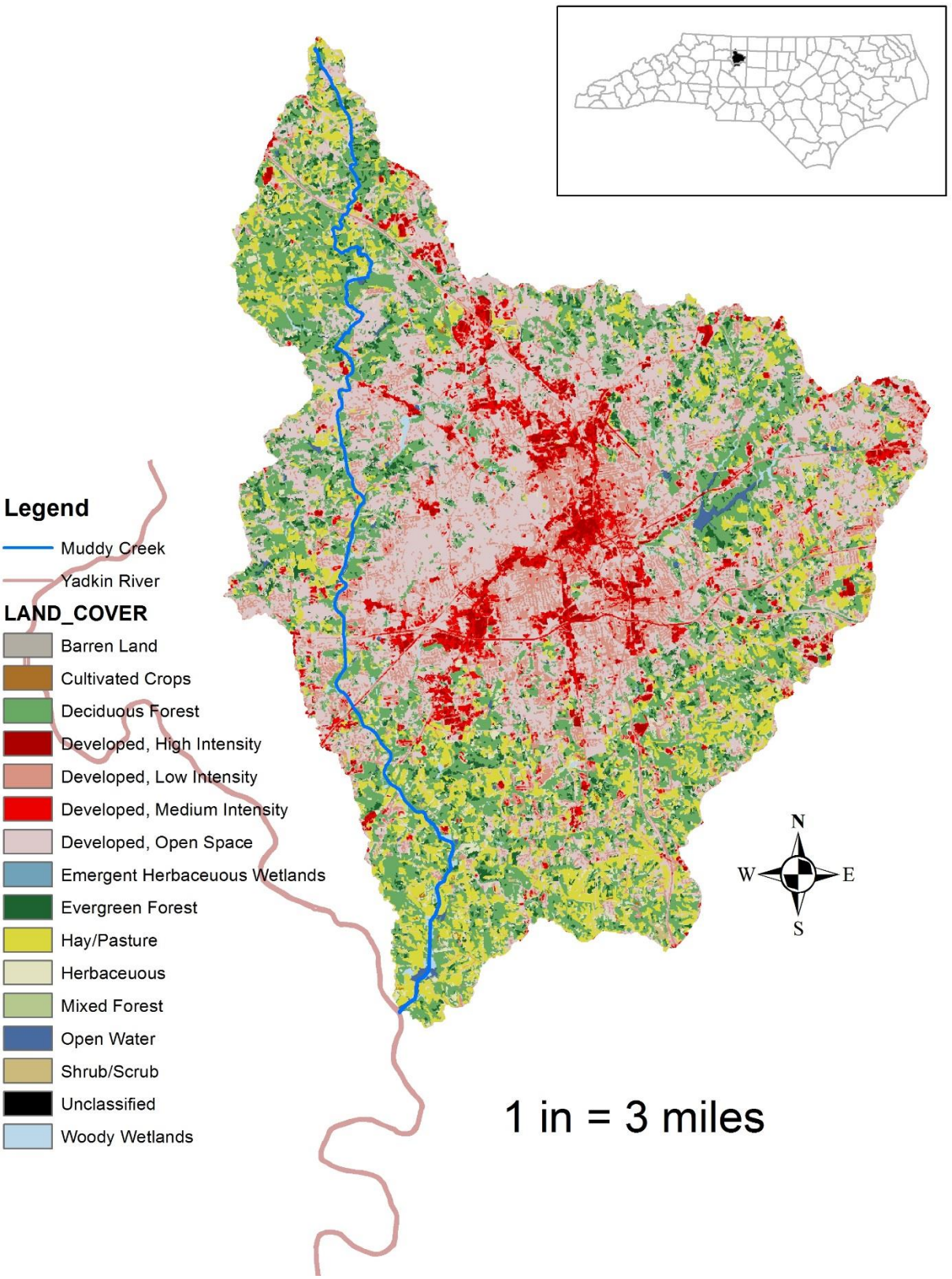

Figure 2. Land use distribution in the Muddy Creek Watershed, showing addendum impairment section.

Documentation of Impairment

The identified assessment unit is listed in Category 5 of the 2014 North Carolina Integrated Report for high turbidity. Waters within this classification, according to 15A NCAC 02B.0221 (Fresh Surface Water Quality Standards for Class C Waters), must meet the following water quality standard for turbidity in order to meet their designated use:

"The turbidity in the receiving water shall not exceed 50 Nephelometric Turbidity Units (NTU) in streams not designated as trout waters and 10 NTU in streams, lakes, or reservoirs designated as trout waters; for lakes and reservoirs not designated as trout waters, the turbidity shall not exceed 25 NTU; if turbidity exceeds these levels due to natural background conditions, the existing turbidity level shall not be increased. Compliance with this turbidity standard can be met when land management activities employ Best Management Practices (BMPs) [as defined by Rule .0202 of this Section] recommended by the Designated Nonpoint Source Agency [as defined by Rule .0202 of this Section]. BMPs shall be in full compliance with all specifications governing the proper design, installation, operation, and maintenance of such BMPs."

Data was collected through the NC Ambient Monitoring System station Q2600000 (Figure 1) for the 2014 303(d) assessment and are included in Appendix B and are summarized in Table 1. As per the assessment numeric criteria for NC streams, greater than 10% of the measured turbidity exceeded the evaluation level (50 NTU) with greater than or equal to 90% confidence. Consequently, Muddy Creek is identified as impaired for turbidity from Silas Creek to SR 2995 (red section in Figure 1).

Table 1. Turbidity measurement from 2008 through 2012 in Muddy Creek.

Station	Number of Samples (N)	N>Evaluation Level (EL=50 NTU)	%>EL	Significant Level (%)
Q2600000	57	11	19.3	97.56

Source Assessment

Turbidity is a measure of cloudiness of water, which can be increased due to silt and clay from the watershed stream erosion, organic detritus from stream bank vegetation, wastewater, and phytoplankton growth. Potential sources of turbidity from nonpoint sources are forests, agricultural lands, land disturbance, urban runoff, and stream channel erosion.

Surface runoff is the main carrier of sediments from forests and agricultural land. Normally, runoff flowing through undisturbed forest carries insignificant amounts of sediments. Runoff flowing through agricultural land can carry a substantial amount of sediments, depending on erodibility of soils, types of agricultural practices, crop type and density, rainfall intensity, and existence and type of agricultural BMPs. Urbanization also increases the amount of sediment transported to receiving waters. Impervious urban landscapes like roads, bridges, parking lots, and buildings prevent rainwater from percolating into the ground. In impervious areas, rainwater remains above the land surface, gathers sediments and solid materials, and runs off in large amounts.

TMDL Reductions

The required watershed reductions specified in the EPA approved TMDL for Turbidity for Muddy Creek and the Yadkin River on November 17, 2011 are expected to achieve water quality standards in the addendum-impaired section of the creek. Regular monitoring at the ambient station, Q2600000, will continue to provide a measure of progress towards meeting TMDL goals.

As a result of the original TMDL Winston-Salem has prepared and is implementing a water quality recovery program in accordance with its NPDES storm water permit. This recovery program includes the watershed in which the addendum assessment unit is located. The program is available from Storm Water Permitting Unit, Division of Energy, Mineral and Land Resources (DEMMLR).

DWR may reevaluate the need for a TMDL for the creek if the required reduction is determined to be insufficient.

Public Participation

The 2011 TMDL for Turbidity for Muddy Creek and the Yadkin River was publicly noticed for a 30-day period. Notice was published through the DWQ Modeling and TMDL unit (now known as the DWR Modeling and Assessment Branch) website, through the Modeling and TMDL unit listserv, through the DWQ events calendar, and through the Water Resources Research Institute (WRRI) listserv of North Carolina State University.

A draft of this addendum to the TMDL for Turbidity for Muddy Creek and the Yadkin River was publicly noticed for comments through the DWR TMDL listserv, Water Resources Research Institute listserv, and the DWR Public Events Calendar. A copy of the public notice is included in Appendix C. The addendum was made available on DWR's website at http://portal.ncdenr.org/web/wq/ps/mtu/tmdl/tmdls. The public comment period lasted for a minimum of 30 days, April 19 through May 23, 2016. NCDWR did not receive comments by the end of the comment period.

Appendix A: Land Cover Data

Appendix Table A1. Land use changes in the Muddy Creek Watershed, Yadkin Pee Dee River Basin, from 2006 to 2011.

Land use Types	2006 Land use Data[1]		2011 Land use Data[2]	
	Area (sq. mi)	%	Area (sq. mi)	%
Barren Land	0.3	0	0.13	0
Cultivated Crops	2.3	1	0.27	0
Deciduous Forest	28.2	11	60.77	24
Developed, High Intensity	6.7	3	5.41	2
Developed, Low Intensity	53.5	21	33.38	13
Developed, Medium Intensity	14.2	6	14.10	6
Developed, Open Space	65.2	26	80.67	32
Emergent Herbaceous Wetland	0	0	0.03	0
Evergreen Forest	26.8	10	10.19	4
Grassland/Herbaceous	1.2	0	10.37	4
Mixed Forest	13.8	5	1.16	0
Open Water	1.4	1	1.46	1
Pasture/Hay	37.3	15	33.41	13
Scrub/Shrub	2.7	1	2.38	1
Woody Wetlands	1.7	1	1.82	1

1. 2006 land use data was used to develop a TMDL for Turbidity for Muddy Creek, which was approved by the EPA Region 4 on November 17, 2011.
2. 2011 land use data is used to develop this addendum TMDL for Turbidity for Muddy Creek.

Appendix B: NC AMS

Appendix Table B1. Turbidity data used to assess impairment on Muddy Creek for the 2014 303(d) list.

Station	Date	Turbidity (NTU)
Q2600000	1/30/2008	7.9
Q2600000	2/27/2008	9.5
Q2600000	3/25/2008	5.9
Q2600000	4/16/2008	6.9
Q2600000	5/29/2008	7.2
Q2600000	6/23/2008	65
Q2600000	7/28/2008	9.3
Q2600000	8/27/2008	310
Q2600000	9/25/2008	5.3
Q2600000	10/23/2008	3.6
Q2600000	12/1/2008	40
Q2600000	12/18/2008	23
Q2600000	1/20/2009	8.8
Q2600000	2/19/2009	20
Q2600000	3/26/2009	8.4
Q2600000	5/5/2009	40
Q2600000	6/4/2009	25
Q2600000	6/29/2009	6.9
Q2600000	7/22/2009	20
Q2600000	8/25/2009	6.4
Q2600000	9/21/2009	5.4
Q2600000	10/21/2009	3.9
Q2600000	11/30/2009	5.4
Q2600000	12/10/2009	39
Q2600000	1/19/2010	20
Q2600000	2/3/2010	100
Q2600000	3/16/2010	13
Q2600000	4/29/2010	3.8
Q2600000	5/18/2010	23
Q2600000	6/16/2010	50
Q2600000	8/3/2010	6.8
Q2600000	9/1/2010	12
Q2600000	9/30/2010	110
Q2600000	10/27/2010	290
Continued on next page:		

Appendix Table B1 Continued:		
Station	Date	Turbidity (NTU)
Q2600000	11/16/2010	5.1
Q2600000	12/14/2010	5
Q2600000	1/12/2011	3.7
Q2600000	2/10/2011	7.6
Q2600000	3/17/2011	7.8
Q2600000	5/4/2011	140
Q2600000	5/17/2011	75
Q2600000	6/20/2011	6.5
Q2600000	7/20/2011	70
Q2600000	8/31/2011	2.9
Q2600000	9/6/2011	160
Q2600000	10/6/2011	3.1
Q2600000	11/21/2011	11
Q2600000	12/15/2011	5.1
Q2600000	2/28/2012	8.3
Q2600000	4/3/2012	5.6
Q2600000	4/23/2012	5.6
Q2600000	5/10/2012	230
Q2600000	6/27/2012	3.6
Q2600000	8/29/2012	220
Q2600000	9/27/2012	3.3
Q2600000	11/5/2012	1.9
Q2600000	12/4/2012	2.8
Maximum		**310**
Minimum		**1.9**
Average		**40.27**
% Result above standard		**19.30**
Binominal Probability of Exceeding the Standard		**0.97**

Appendix C: Public Notice

Public Comment Period for the Addendum to the 2011 Muddy Creek TMDL

Event Description

Now Available for Public Comment
2016 Addendum to the 2011 Muddy Creek TMDL for Impaired Segments in the Muddy Creek Watershed, North Carolina

April 19, 2016

This Draft Addendum TMDL report was prepared as a requirement of the Federal Water Pollution Control Act, Section 303(d). Interested parties are invited to comment on the Draft Addendum TMDL report by May 23, 2016. Comments and questions concerning the report should be directed to Narayan Rajbhandari at narayan.rajbhandari@ncdenr.gov.

The draft TMDL can be downloaded from the following website:
https://ncdenr.s3.amazonaws.com/s3fs-public/Water%20Quality/Planning/TMDL/Draft%20TMDLs/Muddy_Creek_AddendumTMDL_Draft_2016.pdf