Final Total Maximum Daily Load (TMDL)
for Fecal Coliform

August 2002
(Approved September, 2002)

Rocky River (Subbasin 03-07-11)
Yadkin-Pee Dee River Basin
North Carolina

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INDEX OF TMDL SUBMITTAL

303(d) List Information

State North Carolina

Basin Yadkin-Pee Dee River Basin

303(d) Listed Waters

Name of Stream	Description	Class	Index #	8 Digit CU	Miles
Rocky River	From source to SR2420 in Mecklenburg County	C	13-17a	03040105	9.2

8 Digit Cataloging Unit(s) 03040105

Area of Impairment 9.2 miles

WQS Violated Fecal Coliform

Pollutant of Concern Fecal Coliform

Sources of Impairment Point and nonpoint sources from entire watershed

Public Notice Information

Form of Public Notification: A draft of the Rocky River Fecal Coliform TMDL was publically noticed through various means, including notification in a local newspaper. A public comment period was held for the 30 days prior to May 24, 2002. A public meeting was held in Mooresville on May 8, 2002.

Did notification contain specific mention of TMDL proposal? Yes

Were comments received from the public? Yes

Was a responsiveness summary prepared? A summary of the comments and DWQ's responses are included in Appendix VII of the TMDL document

Final Fecal Coliform TMDL for Rocky River

TMDL Information

Critical condition: wet weather, late winter-early spring

Seasonality: Modeled from 1996- May 2001 to include fluctuations in seasonal fecal coliform loading.

Development tools: Coliform Routing and Allocation Program (CRAP)

Supporting documents: "Final Total Maximum Daily Load for Fecal Coliform, Rocky River"

TMDL(s)

Loading allowed at critical condition:

Wasteload Allocation (WLA): 1.18×10^{12} cfu per 30 days
Load Allocation (LA): 1.09×10^{13} cfu per 30 days

Total Maximum Daily Load (TMDL)	Sources	Sub-Watershed	Wet Weather Fecal Coliform Loading Reductions	Dry Weather Fecal Coliform Loading Reductions
Wasteload Allocation (WLA)	WWTP	WS03	0%	0%
	High Density Development	WS01-WS03; WS05	91%	33%
	Low Density Development	WS01-WS03	91%	33%
	Livestock Grazing/Manure Application (Pastureland)	WS04-WS07	86%	20%
	Manure Application (Cultivated)	WS04-WS07	86%	20%
	Wildlife	WS01-WS07	0%	0%

Margin of Safety: Explicit margin of safety of 25 cfu/100ml.

Final Fecal Coliform TMDL for Rocky River

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1.0 INTRODUCTION

The North Carolina Division of Water Quality (DWQ) has identified a 9.2 mile segment (13-17a) of Rocky River in the Yadkin River Basin as impaired by fecal coliform bacteria as reported in the 2000 North Carolina 303(d) list. The impaired segment is located between its source and SR2420 in Mecklenburg County (Davidson Road). This section of the stream, located in subbasin 03-07-11, is designated as a class C water.[1]

Section 303(d) of the Clean Water Act (CWA) requires states to develop a list of waters not meeting water quality standards or which have impaired uses. This list, referred to as the 303(d) list, is submitted biennially to the U.S. Environmental Protection Agency (EPA) for review. The 303(d) process requires that a Total Maximum Daily Load (TMDL) be developed for each of the waters appearing on Part I of the 303(d) list. The objective of a TMDL is to estimate allowable pollutant loads and allocate to known sources so that actions may be taken to restore the water to its intended uses (USEPA, 1991). Generally, the primary components of a TMDL as identified by EPA (1991, 2000a) and the Federal Advisory Committee (FACA, 1998) are as follows:

Target identification or selection of pollutant(s) and end-point(s) for consideration. The pollutant and end-point are generally associated with measurable water quality related characteristics that indicate compliance with water quality standards. North Carolina indicates known pollutants on the 303(d) list.

Source assessment. All sources that contribute to the impairment should be identified and loads quantified, where sufficient data exist.

Assimilative capacity estimation or level of pollutant reduction needed to achieve water quality goal. The level of pollution should be characterized for the waterbody, highlighting how current conditions deviate from the target end-point. Generally, this component is identified through water quality modeling.

[1] Class C waters are freshwaters that are protected for secondary recreation, fishing, aquatic life including propagation and survival of wildlife.

Allocation of pollutant loads. Allocating pollutant control responsibility to the sources of impairment. The wasteload allocation portion of the TMDL accounts for the loads associated with existing and future point sources. Similarly, the load allocation portion of the TMDL accounts for the loads associated with existing and future non-point sources, stormwater, and natural background.

Margin of Safety. The margin of safety addresses uncertainties associated with pollutant loads, modeling techniques, and data collection. Per EPA (2000a), the margin of safety may be expressed explicitly as unallocated assimilative capacity or implicitly due to conservative assumptions.

Seasonal variation. The TMDL should consider seasonal variation in the pollutant loads and end-point. Variability can arise due to stream flows, temperatures, and exceptional events (e.g., droughts, hurricanes).

Section 303(d) of the CWA and the Water Quality Planning and Management regulation (USEPA, 2000a) require EPA to review all TMDLs for approval or disapproval. Once EPA approves a TMDL, then the waterbody may be moved to Part III of the 303(d) list. Waterbodies remain on Part III of the list until compliance with water quality standards is achieved. Where conditions are not appropriate for the development of a TMDL, management strategies may still result in the restoration of water quality.

The goal of the TMDL program is to restore uses to water bodies. Thus, the implementation of bacteria controls will be necessary to restore uses in Rocky River. Although an implementation plan is not included as part of this TMDL, reduction strategies are needed. The involvement of local governments and agencies will be critical in order to develop implementation plans and reduction strategies. The DWQ will begin developing the implementation plan during public review of the TMDL.

1.1 Watershed Description

Rocky River, located in the central piedmont region of North Carolina, drains to the Yadkin-Pee Dee River Basin. Figure 1 depicts the location of the fecal coliform impaired segment of the Rocky River in North Carolina. Rocky River flows generally eastward from its source, just east of Mooresville, to the Pee Dee River for a distance of 86 miles. The Rocky River watershed in the TMDL includes the drainage area above the confluence of the West Branch Rocky River and Rocky River. The major tributary of Rocky River in the watershed is Dye Creek. The Rocky River watershed is divided between Iredell, Mecklenburg and Cabarrus counties. The fecal coliform impaired portion of the Rocky River spans from the source of the River to SR2420 in Mecklenburg County (Davidson Road). The majority of the impaired stream segment is located in Iredell County. The Rocky River watershed is located within one 14 digit hydrologic unit (HUC 03040105010010) and is approximately 14 square miles in area. The portion of the watershed that lies in Iredell County has an area of 10.6 mi^2. The remaining portion of the watershed falls in Cabarrus County (2.3 mi^2) and Mecklenburg County (1.3 mi^2). A portion of the town of Mooresville (2000 population of 18,823) is located in the upper portion of the Rocky River watershed. The town of Mooresville has witnessed a population growth of approximately 100% over the past decade (CCOG, 2001).

The land use/ land cover characteristics of the watershed were determined using 1996 land cover data. The North Carolina Center for Geographic Information and Analysis, in cooperation with the NC Department of Transportation and United States Environmental Protection Agency Region IV Wetlands Division, contracted Earth Satellite Corporation (EarthSat) of Rockville, Maryland to generate comprehensive land cover data for the entire state of North Carolina. Land cover/land use coverage for the watershed above the confluence of Rocky River and West Branch Rocky River is shown in Table 1.

Land Cover/Land Use	Rocky River Watershed Acres (%)
Cultivated	210 (2.3%)
High Intensity Developed	197 (2.2%)
Low Intensity Developed	357 (4.0%)
Forest/Shrubland	5,602 (62.1%)
Herbaceous Cover	2,638 (29.2%)
Open Water	15 (0.17%)
Total	9,018

Table 1. The land cover/land use coverage of the Rocky River watershed.

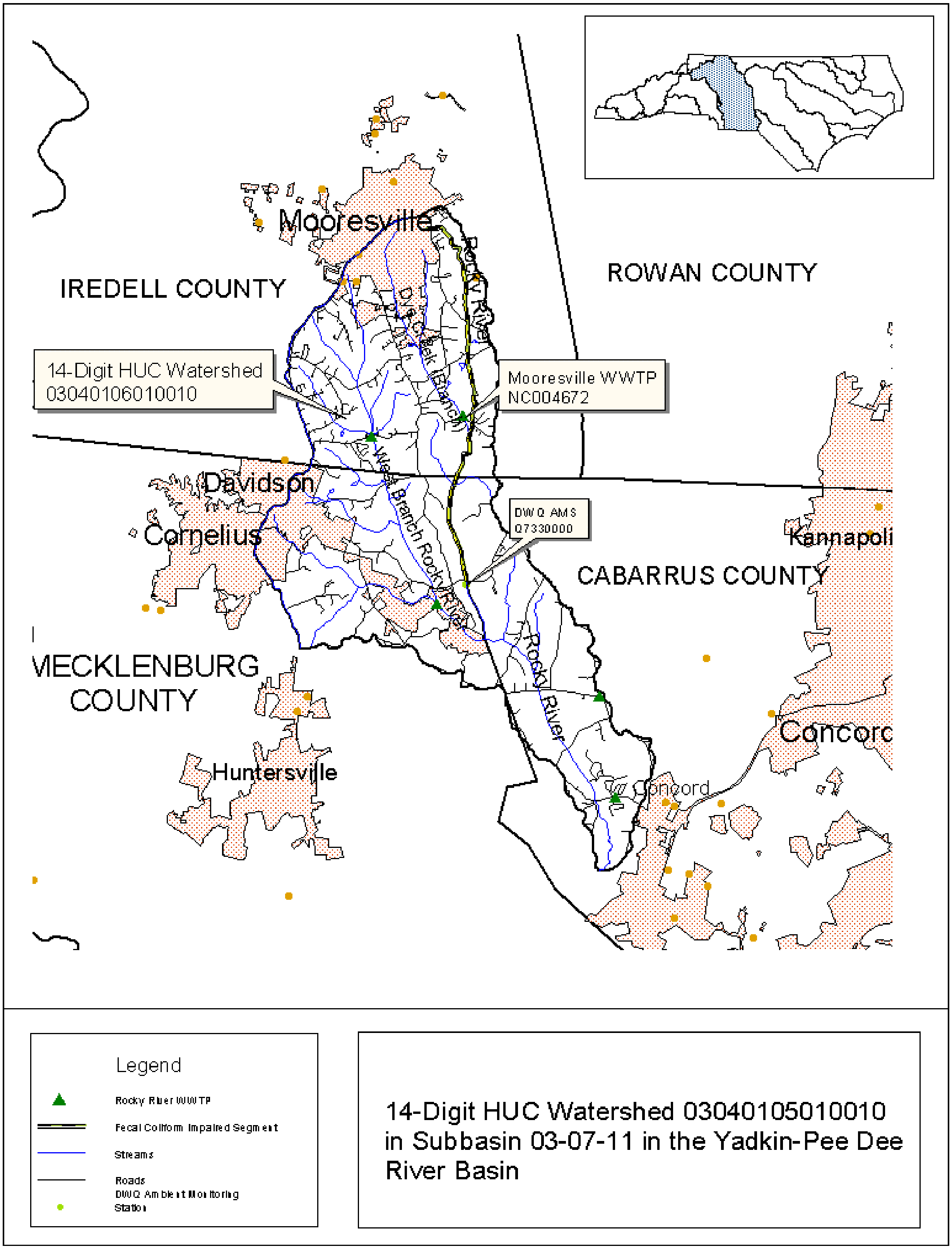


Figure 1. The Fecal Coliform Impaired Segment of the Rocky River.

1.2 Water Quality Monitoring Program

The segment of Rocky River was listed as impaired based on data from an ambient monitoring station located at SR 2420 in Mecklenburg County (Davidson Road) (Station Q733000). Figure 2 shows the locations of the monitoring stations in the Rocky River watershed. The fecal coliform samples were collected on a monthly interval. A Yadkin-Pee Dee River Basin Association discharger coalition monitoring station is also sited at this location (Station Q733000). The discharger coalition has been monitoring fecal coliform concentrations at this location since July of 1998. The data from these monitoring stations are shown in Appendix I. The Mooresville WWTP monitored instream fecal coliform concentrations at one upstream and two downstream locations in years prior to the discharger coalition monitoring. The upstream station was sited above the outfall of the WWTP on Dye Creek and the two downstream stations were located at SR2420 and SR1394. The upstream/downstream fecal coliform concentration data are shown in Appendix II.

The fecal coliform concentrations of the samples collected at the DWQ ambient monitoring station ranged from 10cfu/100ml to 13,000cfu/100ml (cfu=colony forming units). The fecal coliform concentrations for the samples collected by the discharger coalition at station Q733000 ranged between 42 and 6,000 cfu/100ml between July 1998 and April 2001. Samples are collected at the DWQ ambient monitoring station and at the discharger coalition station on a monthly basis. The DWQ ambient data are shown in Figure 6. As a result, since June of 1998, the 30-day geometric mean of the samples could not be calculated using the minimum required 5 samples in 30 days. Prior to 1998, 30-day geometric means can be calculated using the instream monitoring by the Mooresville WWTP. The rolling 30-day geometric means for 1996, 1997 and 1998 are shown in Figures 2 through 5. The discharger coalition data at station Q7330000 are shown in Figure 7.

An intensive study of fecal coliform levels in Rocky River and Dye branch was conducted by DWQ for eight weeks from April-May in 2001 at four locations in the watershed. The samples were collected at the ambient station (Q7330000), Dye Branch at SR1142, Rocky River at SR 1142 in Iredell County, and Rocky River at NC136. The data from the study is shown in Figure 8.

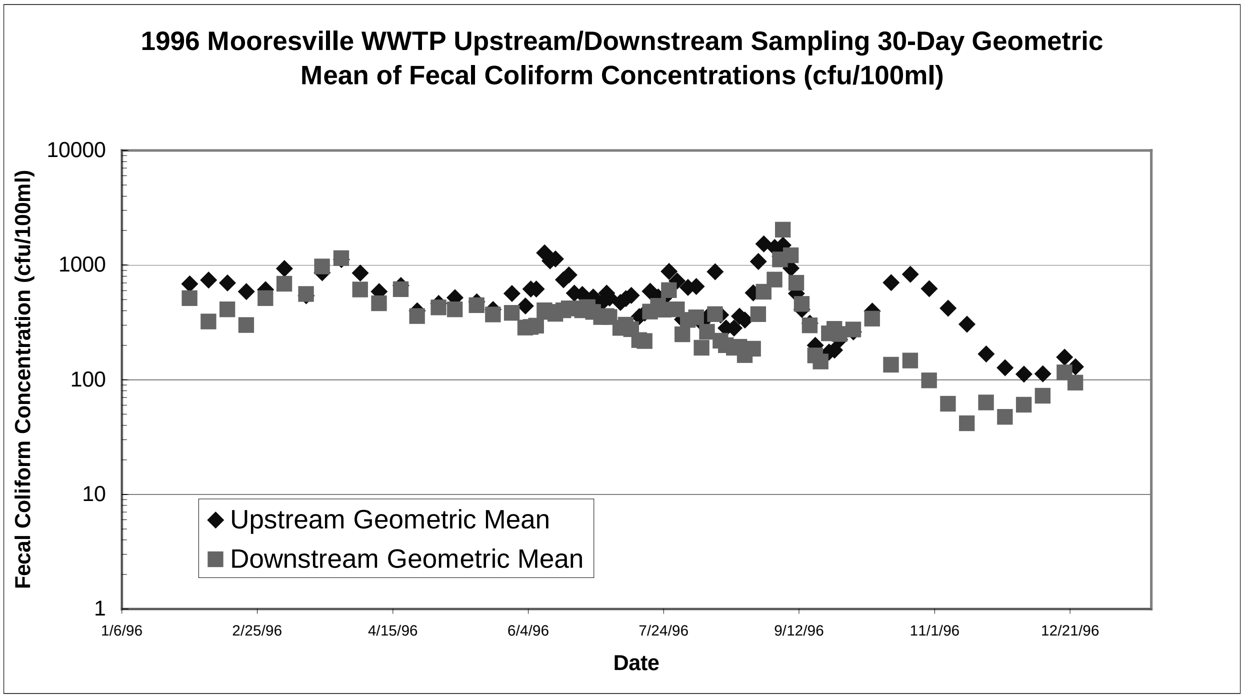


Figure 2. 1996 Mooresville WWTP Upstream/Downstream Sampling (SR2420) 30-Day Rolling Geometric Mean of Fecal Coliform Concentrations.

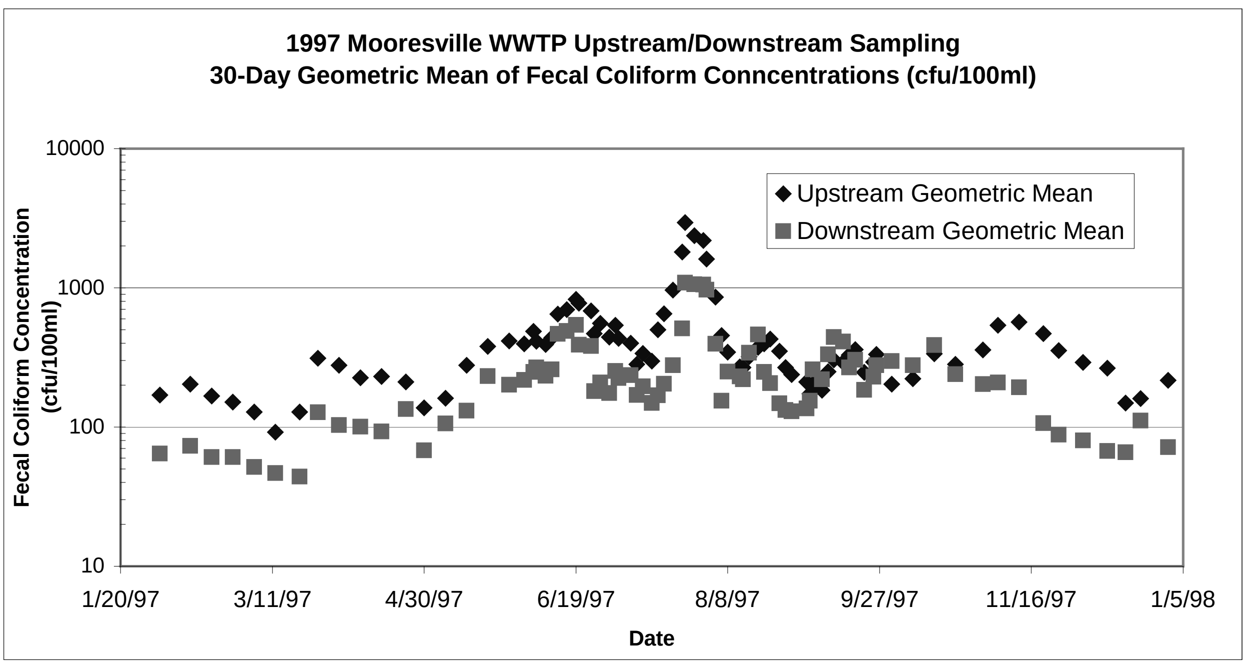


Figure 3. 1997 Mooresville WWTP Upstream/Downstream Sampling (SR2420) 30-Day Rolling Geometric Mean of Fecal Coliform Concentrations.

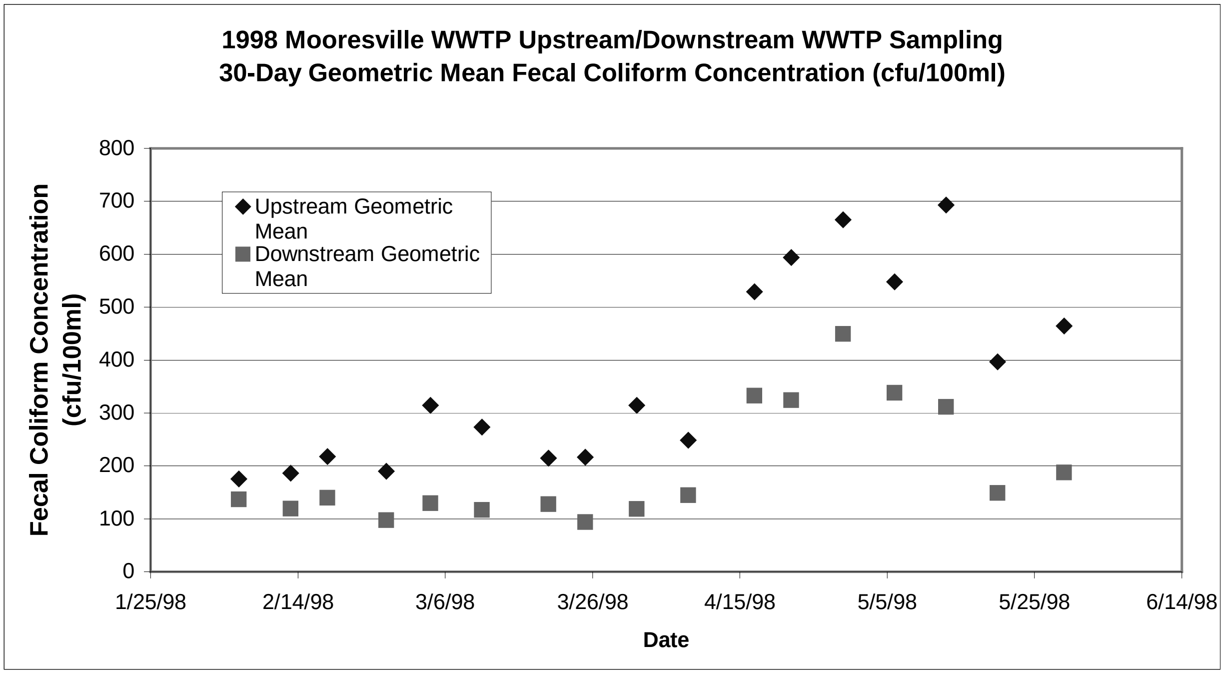


Figure 4. 1998 Mooresville WWTP Upstream/Downstream Sampling (SR2420) 30-Day Rolling Geometric Mean of Fecal Coliform Concentrations.

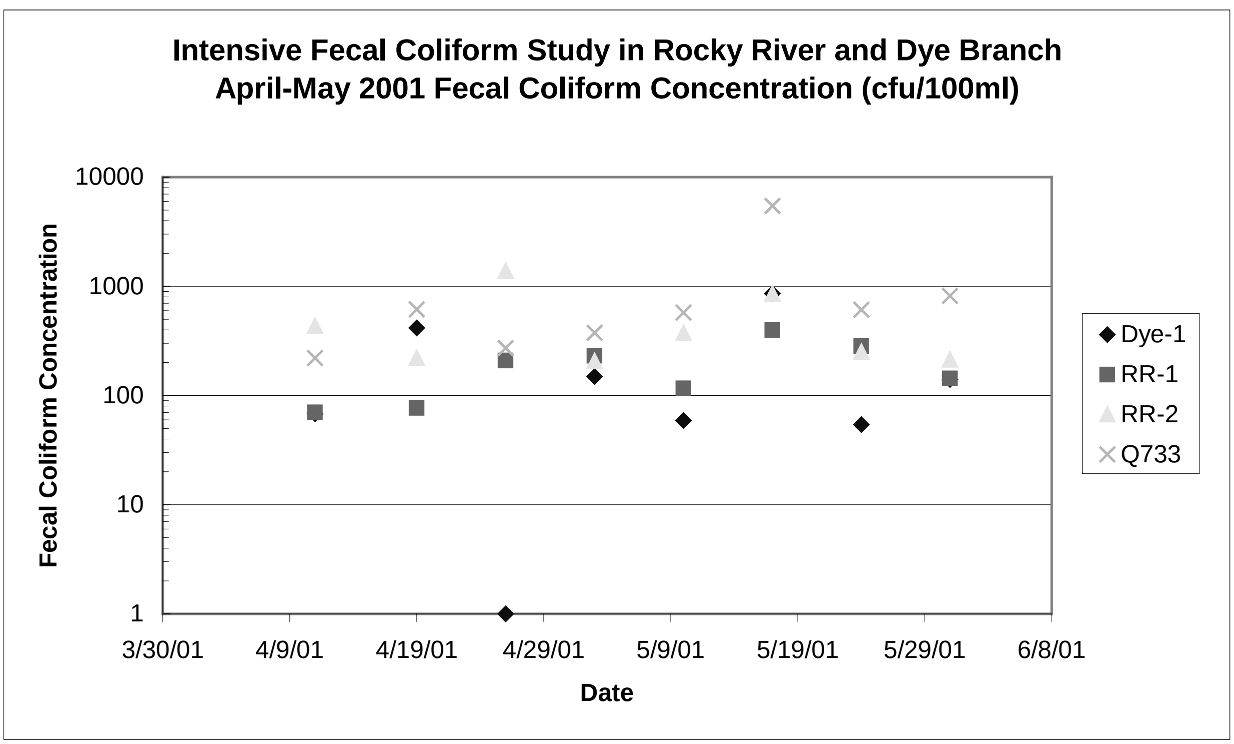


Figure 5. 2001 DWQ Intensive Fecal Coliform Study: Measured Fecal Coliform Concentrations on Dye Creek (SR1142), Rocky River at NC136 (RR-1), Rocky River at SR1142 (RR-2) and Rocky River at SR2420 (Q733

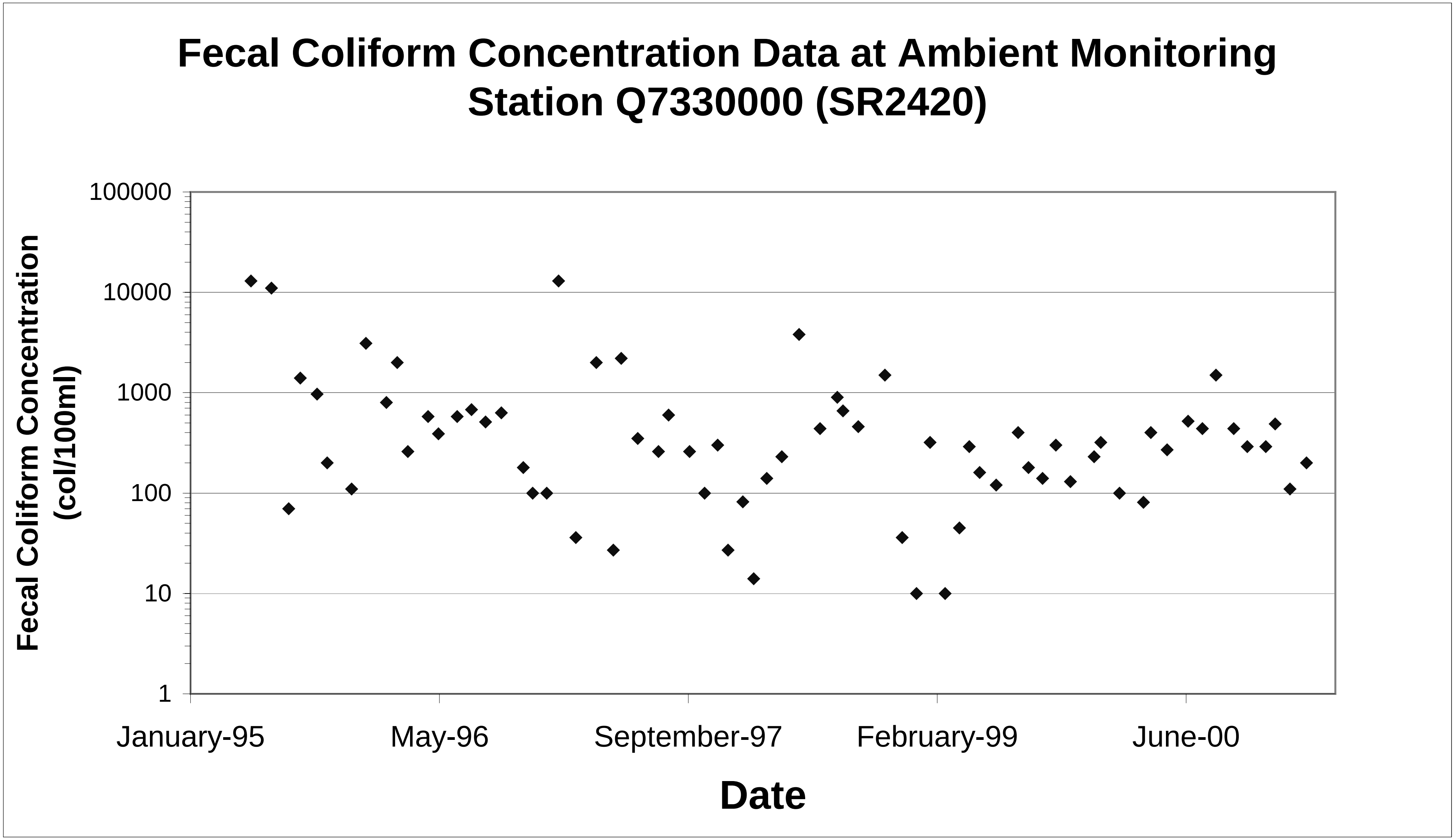


Figure 6. North Carolina Division of Water Quality Ambient Monitoring Station Fecal Coliform Concentration Data at Station Q7330000 (SR2420).

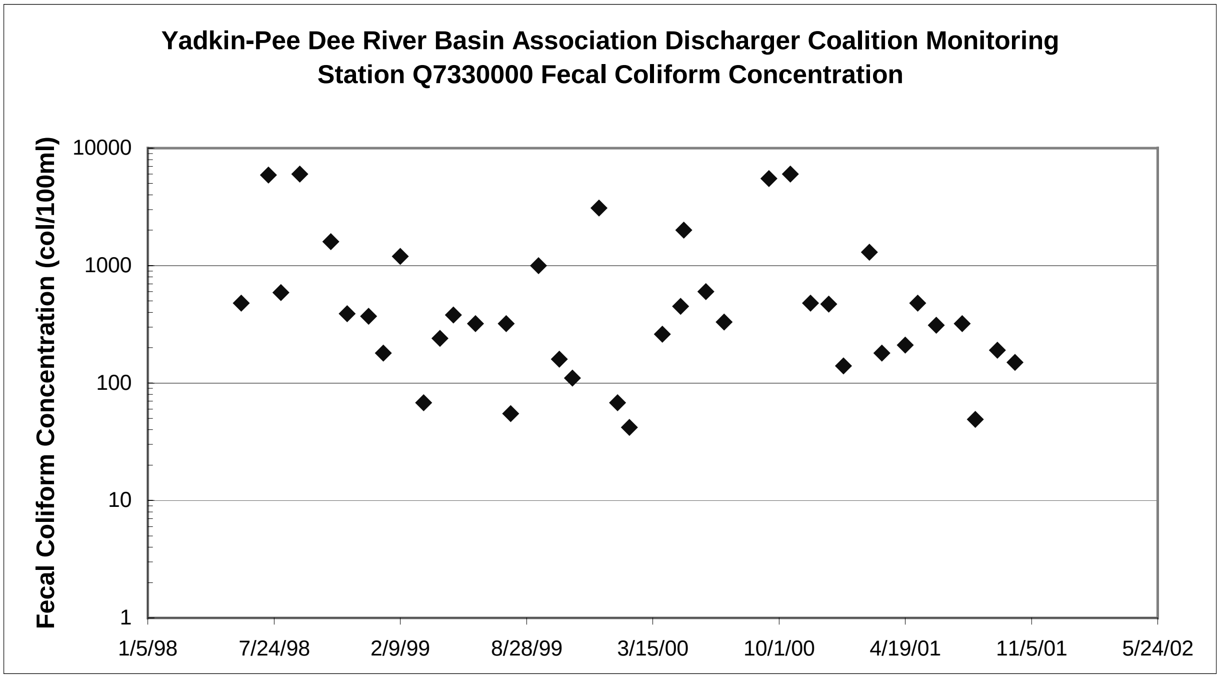


Figure 7. Yadkin-Pee Dee River Basin Association Discharger Coalition Monitoring Station Q7330000 Fecal Coliform Concentrations.

1.3 Water Quality Target

The North Carolina fresh water quality standard for Class C waters for fecal coliform (T15A: 02B.0211) states:

> Organisms of the coliform group: fecal coliforms shall not exceed a geometric mean of 200/100ml (MF count) based upon at least five consecutive samples examined during any 30 day period, nor exceed 400/100 ml in more than 20 percent of the samples examined during such period; violations of the fecal coliform standard are expected during rainfall events and, in some cases, this violation is expected to be caused by uncontrollable non-point source pollution; all coliform concentrations are to be analyzed using the membrane filter technique unless high turbidity or other adverse conditions necessitate the tube dilution method; in case of controversy over results, the MPN 5-tube dilution technique will be used as the reference method.

The instream numeric target, or endpoint, is the restoration objective expected to be reached by implementing the specified load reductions in the TMDL. The target allows for the evaluation of progress towards the goal of reaching water quality standards for the impaired stream by comparing the instream data to the target. In the Rocky River watershed, the water quality target is the geometric mean concentration of 200cfu/100ml over a 30-day period. The water quality target is based on the 30 day geometric mean standard of 200cfu/100ml. The water quality target also evaluates for no greater than 20% of the instantaneous samples to exceed 400cfu/100ml.

In order to evaluate the fecal coliform model, monitor water quality conditions and assess progress of the TMDL, an evaluation location was established for the Rocky River watershed. The evaluation location of this watershed is located in Rocky River at SR2420, the location of the ambient monitoring and discharger coalition stations, and the bottom point of the fecal coliform impaired segment.

2.0 SOURCE ASSESSMENT

A source assessment is used to identify and characterize the known and suspected sources of fecal coliform bacteria in the watershed. The source assessment of Rocky River will be used in the water quality model and in the development of the TMDL.

2.1 Point Source Assessment

General sources of fecal coliform bacteria are divided between point and non-point sources. Facilities that treat domestic waste which are permitted through the National Pollutant Discharge Elimination System (NPDES) are the primary point sources of fecal coliform bacteria.

2.1.1 Individually Permitted NPDES Dischargers

There is one NPDES individually permitted discharger in the Rocky River watershed. The Mooresville WWTP (NC0046728) has a maximum permitted effluent fecal coliform concentration of a 30 day geometric mean of 200 cfu/100ml, and a weekly geometric mean of 400 cfu/100ml. The fecal coliform concentrations of the discharge are listed in Appendix II. The Mooresville WWTP land applies a percentage of the residuals generated during the wastewater treatment process. The source assessment for the land application of residuals is outlined below in the land application section.

NDPES #	Facility Name	Facility Class	Permitted Flow	Receiving Water
NC0046728	Mooresville WWTP	IV	5.2 MGD	Dye Creek

Table 2. Individually permitted NPDES wastewater treatment facility in the Rocky River Watershed.

2.1.2 General Permitted NPDES Dischargers

There is one general permitted facility located in the Rocky River watershed. The facility is permitted to discharge non-contact cooling water, boiler blowdown, cooling tower blowdown, and other similar wastewaters. The effluents of these facilities are not limited or monitored for fecal coliform.

2.2 Non-point Source Assessment

Non-point sources of fecal coliform bacteria include those sources that can not be identified as entering the waterbody at a specific location (e.g., a pipe). Non-point source pollution can include both urban and agricultural sources, and human and non-human sources. Table 3 lists the potential human and animal non-point sources of fecal coliform bacteria (Center for Watershed Protection, 1999). The non-point sources of fecal coliform bacteria in the Rocky River

Source Type		**Source**
Human Sources	Sewered watershed	Combined sewer overflows
		Sanitary sewer overflows
		Illegal sanitary connections to storm drains
		Illegal disposal to storm drains
	Non-sewered watershed	Failing septic systems
		Poorly operated package plant
		Landfills
		Marinas
Non-human Sources	Domestic animals and urban wildlife	Dogs, cats
		Rats, raccoons
		Pigeons, gulls, ducks, geese
	Livestock and rural wildlife	Cattle, horse, poultry
		Beaver, muskrats, deer, waterfowl
		Hobby farms

Table 3. Potential sources of fecal coliform bacteria in urban and rural watersheds (Center for Watershed Protection, 1999).

watershed include wildlife, livestock (land application of agricultural manure and grazing), land application of residuals from WWTP, urban development (stormwater), failing septic systems, and sewer line systems (illicit connections, leaky sewer lines and sewer system overflows).

2.2.1 Livestock

The Rocky River watershed is divided between three counties: Mecklenburg, Cabarrus and Iredell. There are no permitted concentrated animal feedlot operations (CAFOs) in the watershed. There are, however, several small livestock and horse farms in the lower portion of the Rocky River Watershed. The small operations are generally located in the lower portion of the watershed, south of the city limits of Mooresville. The small animal farms include horses, beef cattle, brood cattle and sheep (Testerman communications, 2001).

2.2.1.1 Livestock Grazing/Horse and Pony Grazing

Cattle, including both dairy and beef cows, and horses graze on pasture land and deposit feces onto the land. During a rainfall runoff event, a portion of the fecal material that contains coliform bacteria is transported to the streams. In addition, when cattle have direct access to streams, feces may be deposited directly into a stream. There are small, scattered cattle operations and horse stables which may have access to streams in the Rocky River Watershed.

2.2.1.2 Agricultural Manure Application/Residual Application from the Mooresville WWTP.

The town of Mooresville is permitted to land apply residuals from its wastewater treatment process (Permit Number WQ0014136). There are 51 total application fields in the permit. Some of these fields are located within the Rocky River watershed. In 1998, ten of these fields were utilized for land application with a total acreage of 167.6 acres. The total amount of dry tons applied during the year for all application sites was 155.7. Permit Number WQ0014136 was reissued on January 8, 2001 for the land application of sludge generated by the Town of Mooresville WWTP.

2.2.2 Failed Septic Systems

Failing septic systems have been cited as a potential source of fecal coliform bacteria to water bodies (USEPA, 2000). The developed areas outside of the city of Mooresville are typically on on-site waste-water systems. Specific data on the malfunction rate of septic systems in the watershed were unavailable. A study conducted in 1981 by the North Carolina Office of State Budget and Management suggested that approximately 11% of systems that were surveyed experienced malfunctions or failures over a year (DEH, 2000).

2.2.3 Urban Development/Sanitary Sewer Overflows

Fecal coliform bacteria can originate from various urban sources. These sources include pet waste, runoff through stormwater sewers, illicit discharges/connections of sanitary waste, leaky sewer systems and sewer systems overflows. Several sanitary sewer overflows in city of Mooresville have been reported from 1998-2000. In 1998, the town of Mooresville reported six sanitary sewer overflows. The estimated volume of these spills ranged from 50 to 2,000 gallons. All of these spills were treated with chlorination. In 1999, the town of Mooresville reported six sanitary sewer overflows and thirteen pump station overflows. The sanitary sewer overflows in 1999 ranged in volume between 1,000 and 25,000 gallons. Four of the sanitary sewer overflows were treated with chlorination in 1999. In 1999, the pump station overflows varied in volume from 100 to 23,000 gallons. Nine of the thirteen pump station overflows in 1999 were treated with chlorination. In 2000, six sanitary sewer overflows were reported by the town of Mooresville. These spills ranged in volume from 200 to 900 gallons. Mooresville also reported four pump station spills in 2000 with volumes between 200 and 84,000 gallons. All of the pump station and sanitary sewer overflows that reached surface waters were treated with chlorination. All of these spills listed above were reported to DWQ by the town of Mooresville. However, all of the spills may not have occurred in the Rocky River watershed, as the Rocky River watershed includes only a portion of the town of Mooresville.

2.4 Wildlife

Wildlife can be a source of fecal coliform bacteria in forested, wetland, pasture and cropland areas. Wildlife deposit fecal material in these areas which can be transported to a stream in a rain event. Wildlife in the Iredell, Cabarrus and Mecklenburg county area include deer, raccoons, squirrels, and birds (including waterfowl).

3.0 MODELING APPROACH

3.1 Model Framework

The Coliform Routing and Allocation Program (CRAP), a geographic information system (GIS) based tool (ArcView), was selected for the Rocky River fecal coliform bacteria TMDL evaluation in order to satisfy a variety of modeling objectives. CRAP is designed to be an easy to use GIS based model for fecal coliform TMDL development. In 1998 the Modeling Unit staff reviewed the available tools potentially suitable for use in fecal coliform TMDLs and determined that most of the models examined tended to be either overly complex for the modeling objectives or too simple and inflexible. With the notable exception of a few major urban areas, most fecal impaired streams are located in watersheds where relatively little information is available on sources and stream/watershed morphology. Monthly instream fecal concentration data, collected at DWQ ambient stations, tends to comprise the bulk of the available data on fecal coliform bacteria in these watersheds.

Hence, in 1999 Modeling Unit staff began development of a simple, flexible, steady state modeling tool which could be applied in a variety of watersheds for which there is limited available data. CRAP is a customized ArcView project, written in Avenue, ArcView's scripting language. Output from the model is intended to represent 'typical' instream fecal coliform concentrations within a given time step, for predefined design (critical) conditions.

3.2 Model Setup

The Rocky River watershed was delineated into seven subwatersheds. The land areas of each of the subwatersheds are shown in Table 4. The subwatersheds range in size from 0.65 mi^2 to 4.82 mi^2 and encompass pasture, cultivated lands, forest, and low and high density development lands.

Subwatershed	Area (square miles)
WS01	1.82
WS02	1.46
WS03	1.75
WS04	1.40
WS05	2.21
WS06	4.82
WS07	0.65

Table 4. The areas of the subwatersheds of the Rocky River watershed.

Figure 9 illustrates the subwatershed delineations for the Rocky River watershed. The subwatershed delineations were based, in part, on the location of the ambient and discharger coalition monitoring sites, the location of the Mooresville WWTP, the topography of the area and the geographic extent of the impaired segment of Rocky River. Subwatershed WS01 is located below the ambient monitoring station at SR2420. The subwatershed WS02 includes the area which drains the segment of the river from below the confluence of Rocky River and Dye Branch to SR2420.

Land Cover	WS01 acres (%)	WS02 acres (%)	WS 03 acres (%)	WS 04 acres (%)	WS05 acres (%)	WS06 acres (%)	WS07 acres (%)
Cultivated	25.6 (2.2%)	5.0 (0.5%)	48.9 (4.4%)	14.1 (1.6%)	40.1 (2.8%)	57.2 (1.9%)	19.2 (4.6%)
High Intensity Development	130.4 (11.2%)	27.3 (2.9%)	18.1 (1.6%)	0	4.2 (0.3%)	14.3 (0.5%)	2.6 (0.6%)
Low Intensity Development	108.9 (9.4%)	218.4 (23.4%)	29.3 (2.6%)	0	0	0	0
Forest	633.3 (54.6%)	518.3 (55.6%)	523.4 (46.6%)	471.5 (52.8%)	762.0 (53.9%)	2397.9 (72.8%)	295.8 (71.1%)
Herbaceous Cover	260.0 (22.4%)	163.6 (17.5%)	500.0 (44.5%)	404.8 (45.3%)	599.2 (42.4%)	611.6 (19.8%)	98.3 (23.6%)
Open Water	1.0 (0.1%)	0	2.2 (0.2%)	2.8 (0.3%)	7.2 (0.5%)	1.8 (0.06%)	0
Total	1159.2	932.6	1121.9	893.2	1412.7	3082.8	415.9

Table 5. The land cover/land use coverage of the subwatersheds in the Upper Rocky River watershed.

3.2.1 Hydrology

Since the upper portion of the Rocky River is not gaged, flow information for Rocky River was estimated using flow data from the Mallard Creek USGS gage station near Harrisburg, North Carolina (Station Number 0212414900). This method of calculating flows for Rocky River is based on the assumption of equal flow and runoff per square mile for Mallard Creek and Rocky River. Given the close proximity and similarities in land cover between the two watersheds, this is a reasonable assumption.

To estimate the daily flow of Rocky River, an adjustment coefficient was established by dividing the drainage area of Rocky River (14.09 square miles) by the drainage area of the Mallard Creek gage (34.6 square miles). This coefficient (0.407) was multiplied by the daily flow of Mallard Creek to arrive at the daily flow estimates for Rocky River. The daily effluent of the Mooresville WWTP was added to the stream flow of subwatersheds downstream of the WWTP (WS04, WS06, and WS07).

3.2.2 Hydraulics

There are several methods to estimate stream velocity based on stream flow data. The water quality model utilized the power function to calculate the hydraulics of Rocky River.

The power function: $V = aQ^b$

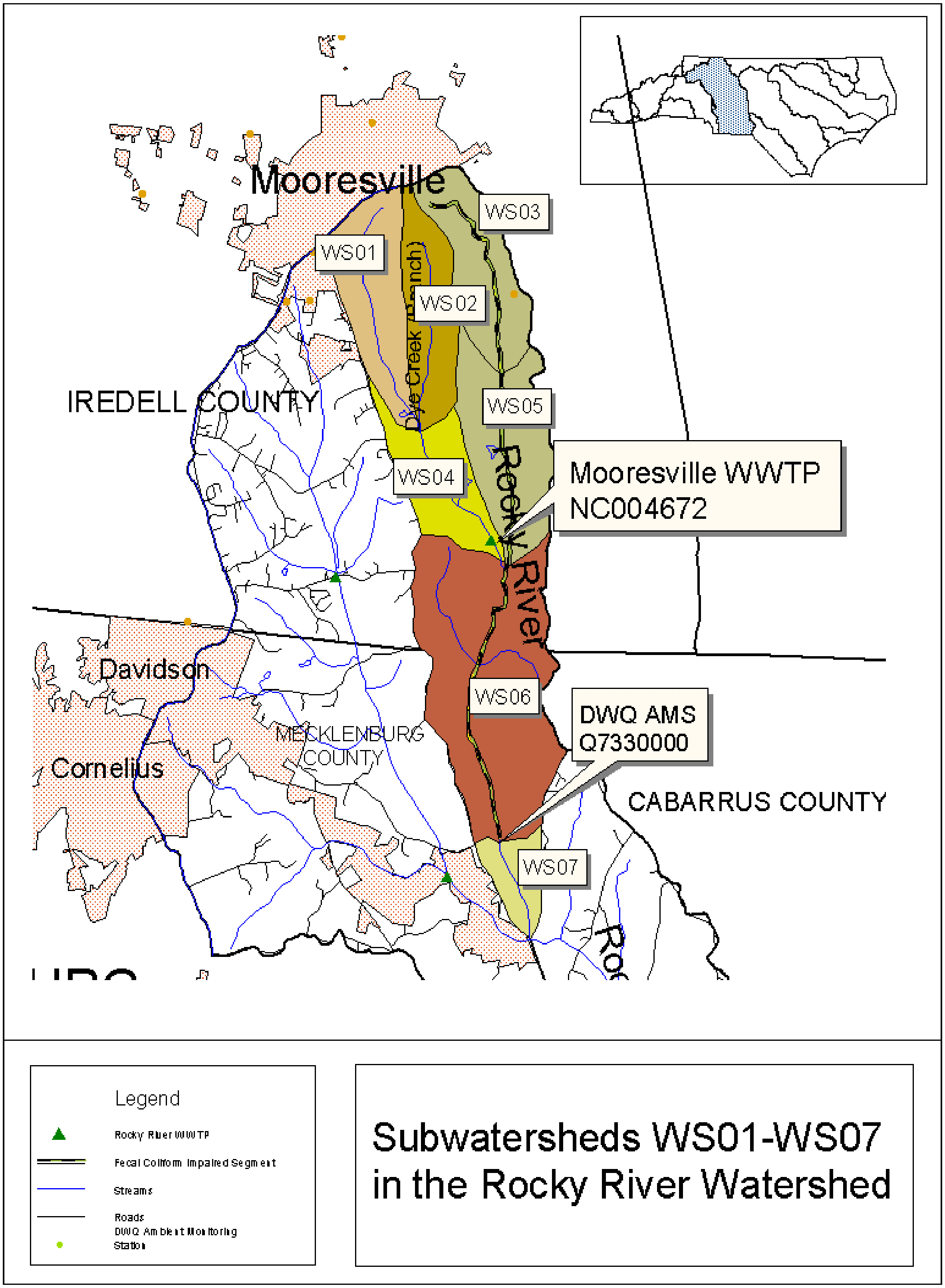
V = velocity (feet per second)
Q = stream flow (cubic feet per second)
a = flow coefficient (unitless)
b = exponent for flow (unitless)

Time of travel (TOT) studies have been completed for the upper portion of Rocky River and Dye Creek (DEHNR, 1993). The following values were used in the Rocky River model to calculate stream velocity for the stream reaches in the subwatersheds.

Subwatershed	Flow Coefficient a	Exponent for flow b
WS01	0.25	0.64
WS02	0.25	0.64
WS03	0.377	0.428
WS04	0.25	0.64
WS05	0.377	0.428
WS06	0.377	0.428
WS07	0.377	0.428

Table 6. The power function variables used to calculate stream velocities in the Rocky River watershed

Figure 8. The subwatersheds of the Rocky River watershed.



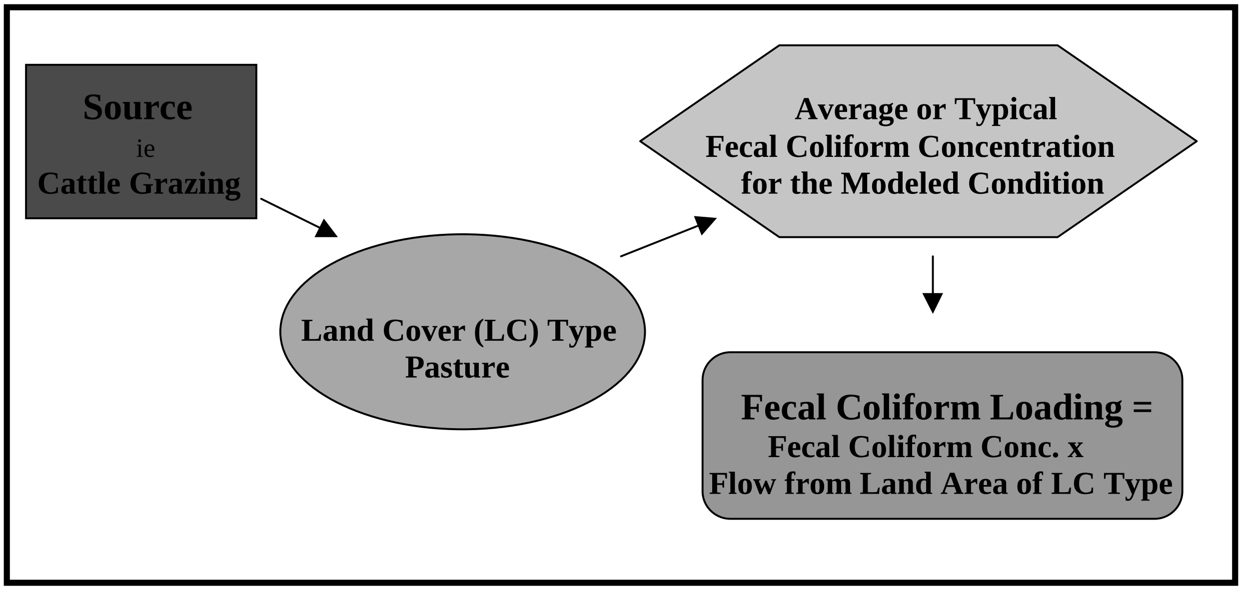


Figure 9. A schematic diagram of the non-point source fecal coliform loading calculations.

3.3 Fecal Coliform Source Representation

Both point sources and non-point sources of fecal coliform are represented in the Coliform Routing and Allocation Program (CRAP) model. Figure 9 depicts the process the CRAP model utilizes to calculate the fecal coliform loading from the non-point sources Each of the non-point.sources of fecal coliform is linked to one or more land cover types (i.e., cattle grazing is linked to herbaceous cover). Based on the assumption that flow yields from each of the land covers in the watershed are equal per square mile, CRAP calculates the portion of the Rocky River stream flow that originates from each land cover type. To calculate the fecal coliform load (in cfu) from a specific source, the calculated flow from the land cover type was multiplied by the assumed monthly average or typical fecal coliform concentration under the modeled condition (either dry or wet weather). The fecal coliform loading was calculated on a daily basis in the model runs. Table 7 outlines the assumed average fecal coliform concentrations for both dry weather and wet weather conditions.

Source Category	Source Sub-Category	Subwatershed	Land Cover/ Land Use	Wet Weather Assumed FC Instream Concentration (cfu/100ml)	Dry Weather Assumed FC Instream Concentration (cfu/100ml)
Point Source	WWTP	WS04		Daily Concentration (varied on daily basis)	Daily Concentration (varied on daily basis)
Non-Point Source	Wildlife	WS01 – WS07	Forest	100	30
	Livestock Grazing/ Manure App./ Residual App.	WS04-WS07	Herbaceous/ Pasture	5,000	500
	Manure Application/ Residual App. (Mar. – June; Sept. – Nov.)	WS04-WS07	Cultivated	5,000	500
	High Intensity Development (SSOs, stormwater, sewer infiltration)	WS01 – WS03, WS05	High Intensity Developed	8,700	1,500
	Low Intensity Development (include septic system failure, stormwater)	WS01 – WS03	Low Intensity Developed	8,700	1,500

Table 7. The Assumed Instream Fecal Coliform Concentrations by Source Category and Land Cover for the Mean Flow Condition in the Subwatersheds.

3.3.1 Wet Weather Versus Dry Weather Fecal Coliform Loading

The CRAP model can calculate fecal coliform loading on a daily time step during both dry and wet weather conditions. For the Rocky River TMDL application of the CRAP model, dry weather conditions were defined as three consecutive days without recorded rainfall in Salisbury, North Carolina. Wet weather days account for all of the remaining days. To calculate the daily fecal coliform loadings, different in-stream concentrations for dry and wet weather conditions were used. For the non-point sources of fecal coliform, it was assumed that wet weather fecal coliform loads would be greater than dry weather loads.

3.3.2 NPDES Discharge

Mooresville WWTP, a 5.2 MGD NPDES individually permitted facility, is located in subwatershed WS04. The daily fecal coliform load from the Mooresville WWTP was calculated by using the daily fecal coliform effluent concentration and the daily discharge as reported in the discharge monitoring reports. The daily fecal coliform loads from 1996- May 2001 were entered into the model as a point source.

3.3.3 Livestock

3.3.3.1 Livestock Grazing

Fecal coliform loading from grazed areas was calculated using an instream fecal coliform concentration for the portion of the stream flow that originates from pasturelands (managed herbaceous and upland herbaceous land cover). Different fecal coliform concentrations were used to calculate the fecal coliform bacteria loading during wet weather and dry weather events. As previously described, dry weather days were defined as at least three consecutive days without rain. The increased fecal coliform loading on wet weather takes into account the increased fecal coliform concentrations in stormwater runoff.

Site specific information on annual grazing patterns was not available, therefore it was assumed that there is no monthly variation in animal grazing on pasture land throughout the year. Several studies have indicated that grazing cattle increases instream fecal coliform concentrations. Stephenson and Street (1978) observed that the presence of cattle on rangelands increased fecal coliform concentrations in stream from 0 to 2500/100ml (Khaleel et al., 1980). Fecal coliform concentrations from grazed pasture runoff have been measured in the range of 120 – 1.3×10^6 cfu/100ml (Doran et al, 1981). A fecal coliform concentration of 5,000 cfu/100ml for wet weather days was input into the model to calculate the fecal coliform load from grazing livestock and manure application on pasture land (see Section 3.3.3.2 below) in subwatersheds WS04, WS05, WS06 and WS07. A fecal coliform concentration of 500 cfu/100 ml was input into the model for dry weather days to calculate the fecal coliform load from grazing livestock and manure application on pasture land.

3.3.3.2 Land Application of Agricultural Manure/Land Application of Residuals from Mooresville WWTP

Fecal coliform loading values from the land application of manure and residual application were calculated in the model using an instream fecal coliform concentration for the portion of the stream flow that originates from cultivated lands and pasture lands (herbaceous land cover) in WS04-WS07. Based on the information from Iredell Soil & Water Conservation District, manure application is applied to cropland from March-June and September-November (Stevenson communications, 2001). Manure is applied to pastureland during the same period but extending through December. Under wet weather conditions, the manure application contribution to the instream fecal coliform concentration was represented by a concentration of 5,000 cfu/100ml for the portion of the stream flow that originates from pasturelands (managed herbaceous and upland herbaceous land cover).

The application of manure on cultivated lands was represented in the model by an input of 5,000cfu/100ml fecal coliform concentration during wet weather for the portion of the stream flow that originates from cultivated land. The application of manure on cultivated lands has been shown to increase fecal coliform to as high as 7200 counts/100ml (Khaleel et al, 1980). Under dry weather conditions, the application of manure on cultivated lands was represented in the model by an input of 500 cfu/100ml fecal coliform concentration for the portion of the stream flow that originates on cultivated land.

3.3.4 Low Density Development/Septic Systems

Fecal coliform loading from developed land includes septic systems failure, leaking sanitary sewers, illicit sanitary sewer connections and stormwater runoff (which can include waste from domesticated animals and urban wildlife). Due to a lack of site specific data on these sources, the fecal coliform loading from these sources were lumped together into one source category, low density development. Several studies have been conducted to evaluate the effects of development on stormwater runoff and instream fecal coliform concentrations. Farrell-Poe et al. (1997) evaluated the effects of small rural municipalities on instream fecal coliform concentrations in agricultural watersheds. Samples collected from perennial streams downstream of four small municipalities (populations ranged from 561 to 4,829) were statistically significantly higher than the upstream samples. Two of the four towns were serviced by sanitary sewers, but none of the towns had stormwater drains. The mean differences of the fecal coliform concentrations of upstream and downstream samples ranged from 21 to 294 cfu/100ml.

Geldreich et al. studied fecal coliform concentration levels in urban runoff from a suburban area of Cincinnati, Ohio. The average fecal coliform concentrations of runoff water, collected throughout the year, from a wooded hillside, street gutters and a business district were 635cfu/100ml, 13,420cfu/100ml and 14,950cfu/100ml respectively (Khaleel et al., 1980). Fecal coliform concentration levels have been studied in Onondaga Lake and seven of its tributaries in metropolitan Syracuse, New York (Canale et al., 1993). The dry weather fecal coliform concentrations of the tributaries, which were monitored daily throughout the summer of 1987, ranged from 108cfu/100ml to 25,525cfu/100ml. Intensive sampling during two storm events was conducted from the onset of the storms until the hydrographs returned to base flow conditions. The mean wet weather fecal coliform concentrations of the tributaries ranged from >8,720 to 240,046cfu/100ml. In the supporting documentation of P-Load, a component of the USEPA BASINS model, the geometric mean of fecal coliform concentrations in stormwater runoff from residential land in the Atlanta area was cited as 8,700 cfu/100ml. This fecal coliform concentration value was based on the Atlanta Regional Storm Water Characterization Study (ARSWCS) (BASINS, 2001).

Fecal coliform loading values from septic system failure, leaking sanitary sewers and stormwater runoff from low intensity development were calculated in the model using an instream fecal coliform concentration for the portion of the stream flow that originates from the low intensity developed lands in subwatersheds WS01, WS02 and WS03. The wet weather fecal coliform loading from low intensity developed land was calculated in the model by multiplying a fecal coliform concentration of 8700cfu/100ml by the portion of the stream flow that originates from low intensity developed land. This is the same value cited in the P-Load component of the USEPA Basins model. The dry weather fecal coliform loading was calculated by multiplying

1500cfu/100ml by the portion of the stream flow that originates from low intensity developed land.

3.3.5 High Density Development/ Sanitary Sewer Overflows

Fecal coliform bacteria from high intensity developed areas can originate from various sources including runoff through storm sewers, illicit discharges of sanitary waste, overflowing sanitary sewer systems, and leaking collection lines. Due to a lack of data on site specific fecal coliform loadings from these sources, they were grouped together into one source class. The wet weather, high density urban development loading was represented in the model by multiplying the instream fecal coliform concentration of 8700 cfu/100ml to the portion of the stream flow that originates from the high intensity developed lands in subwatersheds WS01, WS02, WS03 and WS05. The dry weather loading was calculated by multiplying the instream fecal coliform concentration of 1500cfu/100ml by the portion of the stream flow that originates from high intensity developed lands. This value falls within the range of the urban dry weather instream fecal coliform concentrations which have been measured in Mecklenburg County, North Carolina for the Fecal Coliform Total Maximum Daily Load for Irwin, McAlpine, Little Sugar and Sugar Creek Watersheds (Mecklenburg County, 2001)

3.3.6 Wildlife

To represent the wildlife fecal coliform loading in dry weather conditions, a concentration of 30 col/100ml was multiplied by the portion of the Rocky River stream flow that originates in forested or shrubland areas. Under wet weather conditions, a concentration of 100 cfu/100ml was used to calculate the wildlife loading. The State of South Carolina has estimated that the geometric mean of fecal coliform concentrations in waterbodies that flow through forested areas in South Carolina during all flow conditions is 30 col/100ml (SCDHEC, 1999). The Center for Watershed Protection (1999) has cited a fecal coliform concentration range of 10-100 cfu/100ml for forest runoff. The South Carolina estimate falls in this range.

3.4 Instream Decay Rate

Once fecal coliform bacteria reach a waterbody, environmental factors influence the extent of their growth and decay. Physical factors that influence the bacteria populations include photooxidation, adsorption, flocculation, coagulation, sedimentation and temperature (USEPA, 1985). Chemical toxicity, pH, nutrient levels, algae and the presence of fecal matter may also influence the fecal coliform populations. The water quality model utilizes a first order decay rate to calculate instream decay of fecal coliform bacteria.

$$C_t = C_o e^{-kt}$$

C= coliform concentration (cfu/100ml)
C_o= initial coliform concentration (cfu/100ml)
C_t= coliform concentration at time t (cfu/100ml)
k= decay rate constant (day^{-1})
t = exposure time (days)

Bacterial die-off has been modeled as a first-order decay equation, using a decay rate between 0.7/day and 1.5/day (Center for Watershed Protection, 1999). In the Rocky River model, a decay rate of 0.8/day was used for the existing condition and allocation runs.

3.5 Uncertainty

The lack of agreement between modeled and observed fecal coliform concentrations is due in part to the high degree of uncertainty associated with predicting any water quality variable, especially fecal coliform. The inability to accurately predict specific observed fecal coliform concentrations can be attributed to model error, lack of sufficient information in source assessment, gaps in our scientific knowledge, natural variability in instream fecal coliform concentrations, field and laboratory measurement error, and lack of current site specific model input parameters including decay rate, flow, rainfall data and landuse information. The available models used to predict fecal coliform concentrations are not adept at characterizing prediction uncertainty. The Coliform Routing and Allocation Program (CRAP) was intended to predict daily average fecal coliform concentrations based on land use information. Due to the lack of site specific information, literature values were used to calculate the fecal coliform loadings from the various landuses. Because uncertainty associated with CRAP is expected to be large, the model results should be interpreted in light of the model limitations and prediction uncertainty. Simple models like CRAP can be used to guide initial decision making but continued observation of the watershed and stream, as fecal coliform controls are implemented (e.g., exclusion fencing, leaky sanitary sewer repairs), is expected to be our best approach for determining the appropriate level of management.

3.6 Critical Conditions

Fecal coliform pollution in the Rocky River watershed originates from both point and non-point sources. The critical conditions for waterbodies impaired by point sources typically occur during periods of dry weather, while those impaired by non-point sources generally occur in periods of wet weather. The Rocky River fecal coliform monitoring data indicate that elevated fecal coliform levels occur throughout the year, during both dry and wet weather conditions. The model was run for the period between January 1, 1996 and May 31, 2001 using estimated daily stream flows. The model predicted the highest 30-day geometric mean to occur on February 13, 1998. As a result, the critical period was determined to be the thirty days between January 15, 1998 and February 13, 1998. Throughout this period, wet weather days (those day in which it had rained in the last 72 hours) accounted for 27 of the 30 day period.

3.7 Model Results

The predicted daily fecal coliform concentrations over the simulation period (1996-June 2001) at the model evaluation location are shown in Figure 10. The predicted and observed 30-day geometric mean fecal coliform concentrations at SR2420 from 1996 to June 1998 are shown in Figure 11. The model evaluation location is located at the DWQ ambient monitoring station at SR2420 in Mecklenburg County. The modeling results indicate that non-point source fecal coliform loading has a significant impact on instream fecal coliform concentrations in the Rocky River watershed. The Mooresville WWTP is permitted to discharge a monthly geometric mean fecal coliform concentration of 200 cfu/100ml with a maximum permitted discharge of 5.2 MGD.

The predicted 30-day rolling geometric mean fecal coliform concentrations are shown in Figure 12. Throughout the modeled period, the rolling 30-day geometric means of the predicted values are greater than 200cfu/100ml throughout much of the modeled period. The 30-day geometric means range in value from 23 cfu/100ml to 899 cfu/100ml.

Figure 10. Modeling Results of the Simulated Daily Fecal Coliform Concentrations (cfu/100ml) at SR2420 compared to the observed fecal coliform concentrations.

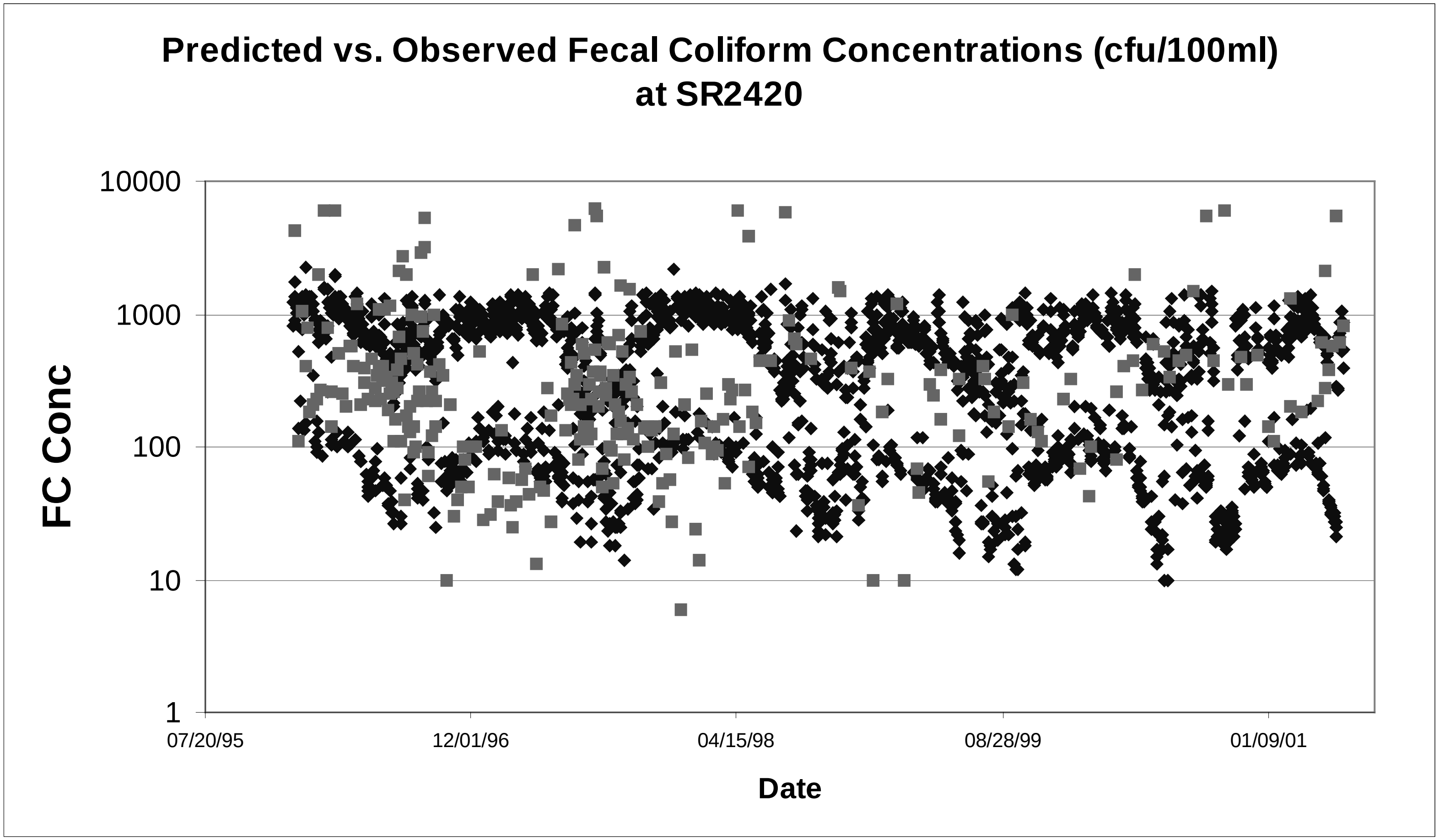
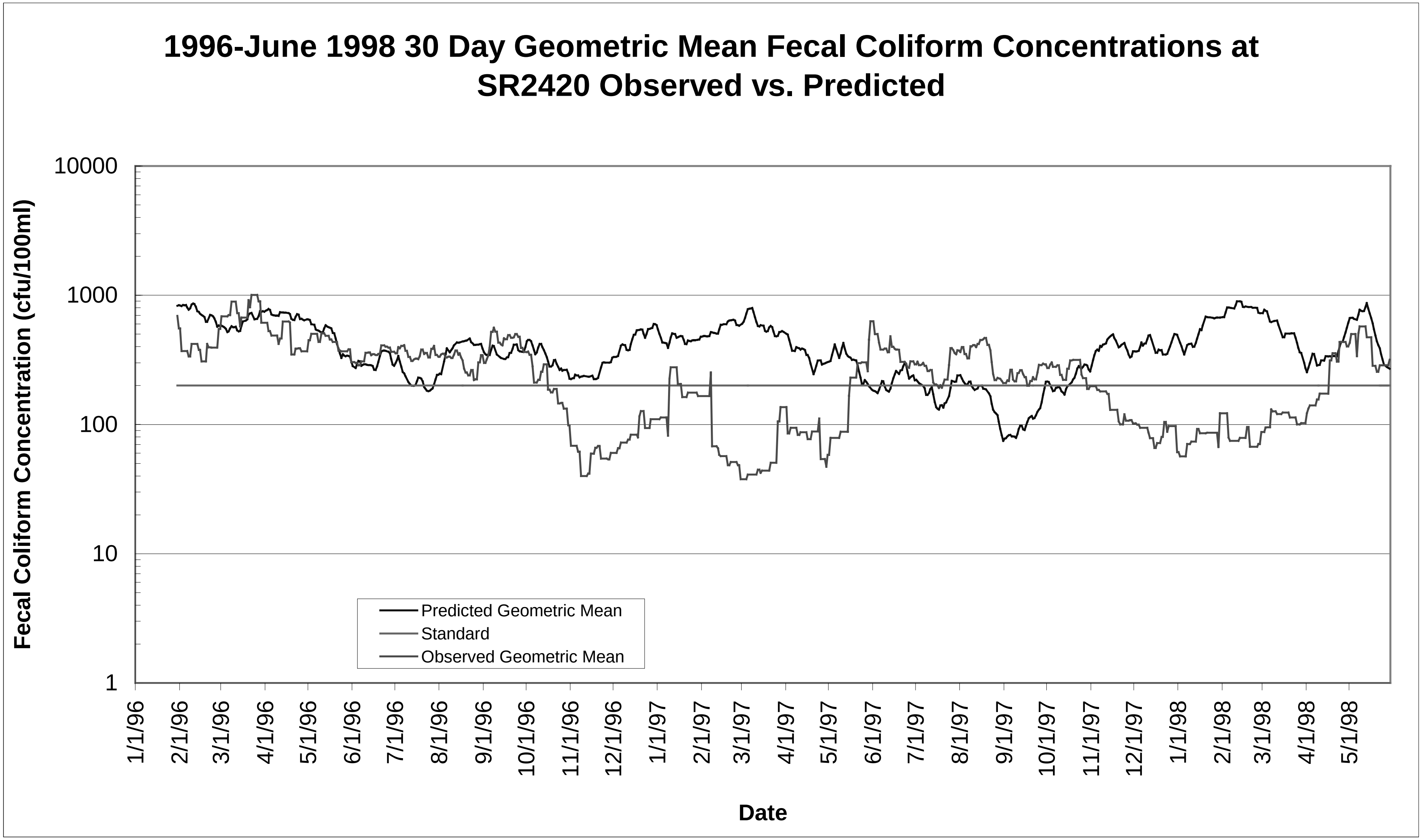
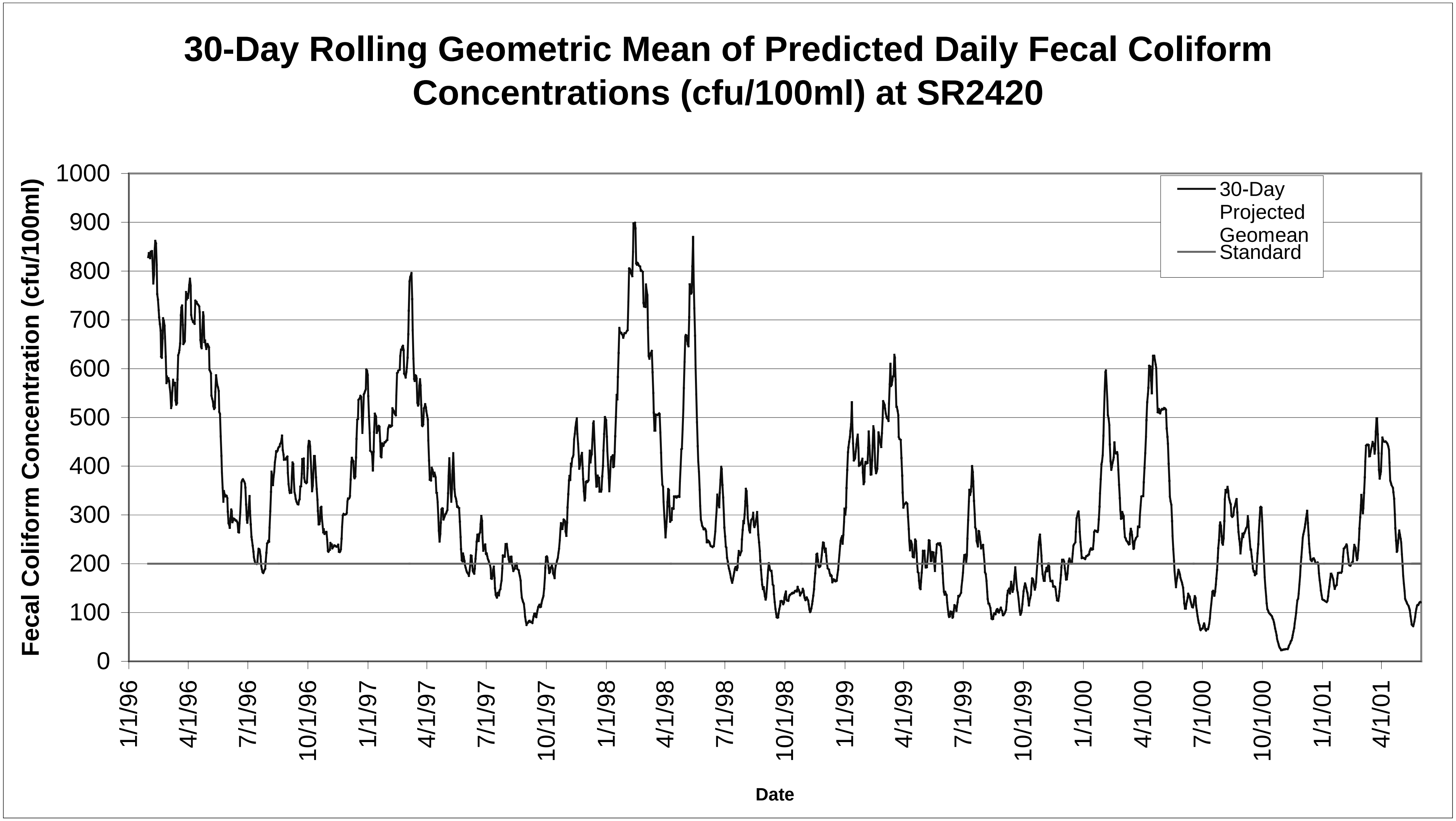


Figure 11. 1996 –1998 Predicted vs. Observed 30-Day Geometric Mean of Fecal Coliform Concentrations at SR2420.



Final Fecal Coliform TMDL for Rocky River

Figure12. Rolling 30-Day Geometric Mean of Predicted Fecal Coliform Concentrations at SR2420.



4.0 ALLOCATION

4.1 Total Maximum Daily Load

A total maximum daily load is the total amount of pollutant that can be assimilated by the receiving water body while achieving water quality standards. A TMDL is comprised of the sum of wasteload allocations (WLA) for point sources, load allocations (LA) for non-point sources and a margin of safety (MOS). This definition is expressed by the equation:

$$\text{TMDL} = \Sigma\ \text{WLAs} + \Sigma\ \text{LAs} + \text{MOS}$$

The objective of the TMDL is to estimate allowable pollutant loads and to allocate to the known pollutant sources in the watershed so the appropriate control measures can be implemented and the water quality standard can be achieved. The Code of Federal Regulations (40 CFR §130.2(1)) states that TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measures. In the Rocky River fecal coliform TMDL, loads are calculated based on stream flow and instream fecal coliform concentrations that originate from a specific source/land cover.

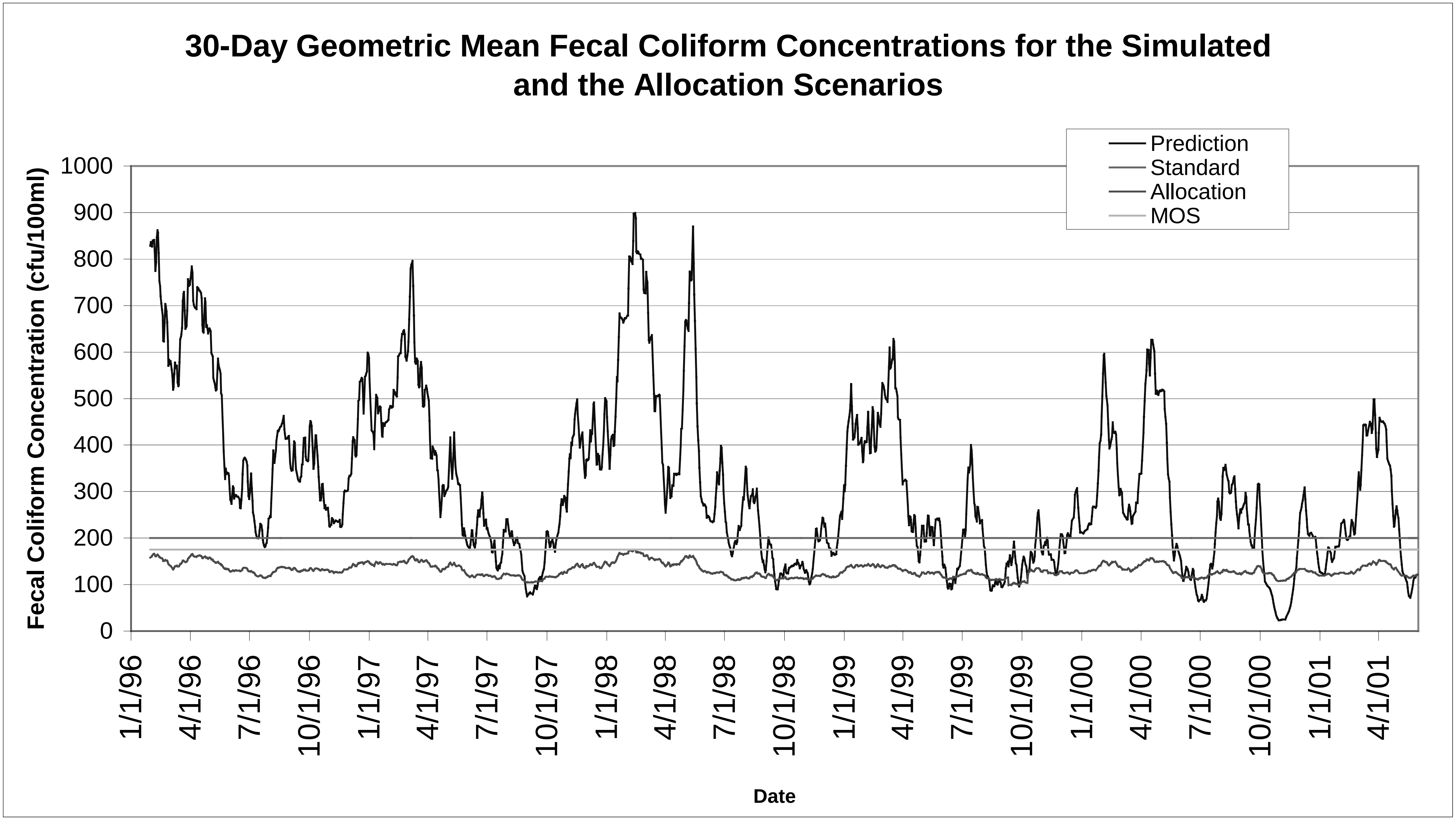
4.2 Seasonal Variation

The model was run over the time period of 1996- June 2001 simulation period under varying daily flow conditions in order to capture seasonal flow fluctuations. The contribution of fecal coliform bacteria from the various sources also varied throughout the year to reflect changes in fecal coliform loading due to monthly changes in agricultural management practices.

4.3 Margin of Safety

The margin of safety (MOS) may be incorporated into a TMDL either implicitly, through the use of conservative assumptions to develop the allocations, or explicitly through a reduction in the TMDL target. For the Rocky River TMDL, an explicit margin of safety was incorporated in the modeling analysis by setting the TMDL target at 175cfu/100ml, which is 25cfu/100ml lower than the water quality target of 200cfu/100ml.

Figure 14. Fecal Coliform Concentrations for the Simulated and the Reduction Scenarios.



Source Category	Source Sub-Category	Subwatershed	Simulation FC Concentration (cfu/100ml)	Allocation FC Concentration (cfu/100ml)	% Reduction
Point-Source (WLA)	WWTP	WS03	23	200	0%
Non-Point Source (LA)	Wildlife	WS01-WS05	100	100	0%
	High Density Development (stormwater, SSOs, sewer exfiltration)	WS01-WS03, WS05	8,700	800	91%
	Low Density Development (septic systems, domestic animals, urban wildlife)	WS01-WS03	8,700	800	91%
	Livestock Grazing/ Manure Application (Pastureland)	WS04-WS07	5,000	700	86%
	Manure Application/ Residual Application (Mar.-Jun; Sept.-Nov.) (Cultivated)	WS04-WS07	5,000	1000	80%

Table 8. Wet Weather in Stream Fecal Coliform Load Reductions for Subwatersheds in the Rocky River Watershed.

Final Fecal Coliform TMDL for Rocky River

Source Category	Source Sub-Category	Subwatershed	Simulation FC Concentration (cfu/100ml)	Allocation FC Concentration (cfu/100ml)	% Reduction
Point-Source (WLA)	WWTP	WS04	varied	200	0%
Non-Point Source (LA)	Wildlife	WS01-WS05	30	30	0%
	High Density Development (stormwater, SSOs, sewer exfiltration)	WS01-WS03; WS05	1500	1000	33%
	Low Density Development (septic systems, domestic animals)	WS01-WS03	1500	1000	33%
	Livestock Grazing/ Manure Application/ Residual Application (Pastureland)	WS04-WS07	500	400	20%
	Manure Application/ Residual Application (Cultivated Land) (March-June; Sept.-Nov.)	WS04-WS07	500	400	20%

Table 9. Dry Weather in Stream Fecal Coliform Load Reductions for Subwatersheds in the Rocky River Watershed.

4.4 Load Reductions

The final allocation of fecal coliform loads are shown in Table 8 (wet weather) and Table 9 (dry weather). The 30-day running geometric mean of the predicted fecal coliform concentrations at SR2420 with the final fecal coliform allocations are shown in Figure 13.

In order to reach the water quality target of 200 cfu/100ml, with a 25 cfu/100ml explicit margin of safety, the non-point source fecal coliform loading needs to be reduced by 20%-33% for the various sources in dry weather conditions and 80%-91% reductions in wet weather conditions. The NPDES individually permitted Mooresville WWTP typically discharges a small portion of the modeled fecal coliform loading into the Rocky River watershed and has consistently met their monthly discharge limit (Appendix I). Therefore, the TMDL allocation focuses the fecal coliform loading reductions on the non-point sources. The Total Maximum Daily Load of fecal coliform bacteria is shown in Table 10.

When the sources of fecal coliform are reduced in the model to satisfy the water quality target of 200 cfu/100ml, the predicted instantaneous fecal coliform concentrations in the allocation scenario never exceed 400 cfu/100ml. As a result, the reduction scenario summarized in Tables 8 and 9 satisfy the portion of the standard which states that instantaneous fecal coliform concentrations should not exceed 400 cfu/100ml over 20% of the time.

Wasteload Allocation (WLA)	Load Allocation (LA)	Margin of Safety (MOS)	Total Maximum Daily Load (TMDL)
1.18 E12 cfu/30 days	1.09 E13 cfu/30 days	1.74 E12 cfu/30 days	1.38 E13 cfu/30days

Table 10. Total Maximum Daily Load of fecal coliform bacteria during the critical period (1/15/1998-2/13/1998).

5.0 SUMMARY AND FUTURE CONSIDERATIONS

The sources of fecal coliform in the Rocky River watershed include urban sources in the Mooresville area, livestock grazing and manure application on agricultural lands, residual application from the Mooresville WWTP, the Mooresville WWTP, and wildlife. There is a significant contribution of fecal coliform load from the Mooresville area. The Coliform Routing and Allocation Program was utilized to simulate instream fecal concentrations and to allocate the fecal coliform loads to the various sources. In order for the water quality target to be met, the final allocation of the fecal coliform loads requires a non-point source load reduction between 20%-33% under dry weather conditions and 80%-91% under wet weather conditions for the various non-point sources of fecal coliform. The model estimated that the Mooresville WWTP typically contributes a small portion of the total fecal coliform loading in the watershed. Therefore, the reduction allocation focuses on the fecal coliform loading from non-point sources.

5.1 Monitoring

Fecal coliform monitoring will continue on a monthly interval at the ambient monitoring site and at the discharger coalition site (SR2420). The continued monitoring of fecal coliform concentrations will allow for the evaluation of progress towards the goal of reaching water quality standards by comparing the instream data to the TMDL target. In addition to this data collection, further fecal coliform monitoring may be considered. Additional monitoring beyond the ambient and discharger stations' monitoring could aid in a fecal coliform source assessment in the watershed and further aid in the evaluation of the progress towards meeting the water quality target and the water quality standard.

To comply with EPA guidance, North Carolina may adopt new bacteria standards utilizing Escherichia coli (E. coli) and enterococci in the near future. Thus, future monitoring efforts to measure compliance with this TMDL should include using the E. coli and enterococci. Per EPA recommendations (EPA, 2000c), if future monitoring for E. coli/enterococci indicates the standard has not been exceeded, these monitoring data may be used to support delisting the water body from the 303(d) list. If a continuing problem is identified using E. coli/enterococci, the TMDL may be revised.

5.2 Implementation

Implementation plans are not included in this TMDL. The involvement of local governments and agencies will be needed in order to develop implementation plans. The DWQ will assist the local governments and agencies in developing the implementation plan for the Rocky River TMDL.

6.0 PUBLIC PARTICIPATION

The City of Mooresville, Mecklenburg, Iredell and Cabarrus Counties have been notified throughout the TMDL process of the progress of the Rocky River Fecal Coliform TMDL. The counties, extension service and soil and water conservation districts have supplied septic data to aid in the source assessment portion of the TMDL. A public meeting was held in the watershed to discuss the TMDL. The TMDL was publicly noticed and comments on the TMDL were accepted over a period of at least thirty days.

8.0 REFERENCES

BASINS 3.0 Beta 2001. U.S. Environmental Protection Agency. P-Load Reference Guide

Canale, R.P., Auer, M.T., Owens, E.M., Heidtke, T.M., and S.W. Effler. 1993. Modeling Fecal Coliform Bacteria-II. Model Development and Application. Wat. Res. 27(4):703-714.

Center for Watershed Protection. 1999. Microbes and Urban Watersheds: Concentrations, Sources and Pathways. Watershed Protection Techniques 3(1): 554:565.

Division of Environmental Health (DEH). NCDENR. 1999. North Carolina On-Site Wastewater Non-Point Source (NPS) Pollution Program. June 24, 1999.

Division of Environmental Health (DEH). NCDENR. 2000. Report on the Proper Maintenance of Septic Tank Systems in Accordance with Section 13.5 of HB 1160 (Clean Water Act of 1999). March 15, 2000.

Doran, J.W., J.S. Schepers, and N.P. Swanson. 1981. Chemical and bacteriological quality of pasture runoff. Journal of Soil and Water Conservation May-June: 166-171.

Farrell-Poe, K.L., Ranjha, A.Y. and S. Ramalingam. 1997. Bacterial Contributions by Rural Municipalities in Agricultural Watersheds. Trans of the ASAE, 40(1) 97-101.

Khaleel, R. Reddy, K.R. and M.R. Overcash. 1980. Transport of Potential Pollutants in Runoff Water from Land Areas Receiving Animal Wastes: A Review. *Water Research* 14: 421-436.

Mecklenburg County Department of Environmental Protection. 2001. Public Review Draft Fecal Coliform Total Maximum Daily Load for Irwin, McAlpine, Little Sugar and Sugar Creek Watersheds.

North Carolina Department of Agriculture. 2001. Agricultural Statistics Division-County Statistics. www.ncagr.com/stats/cntysumm/ and http://govinfo.library.orst.edu/cgi-bin/ag-state?North+Carolina.

North Carolina Department of Environment, Health and Natural Resources (DEHNR, 1993). A QUAL2E-UNCAS Application to the Rocky River and Mallard Creek. Cabbarrus, Iredell, and Mecklenburg Counties, North Carolina. March 31, 1993.

South Carolina Department of Health and Environmental Control. Total Maximum Daily Load Development for Camp Creek CW-235 Fecal Coliform. August 17, 1999.

Stevenson, J. 2001. Iredell Soil & Water Conservation District. Personal communication with John Stevenson. August 2001.

Stephenson, G.R. and L.U. Street. 1978. Bacterial Variations in streams from a southwest Idaho rangeland watershed. J. Environ. Qual. 7:150-57

Testerman, D. 2002. Cabarrus Soil & Water Conservation District Personal Communication with John Stevenson. February 2002.

U.S. Environmental Protection Agency (USEPA). 1991. Guidance for Water Quality-Based Decisions: The TMDL Process. Assessment and Watershed Protection Division, Washington, DC.

U.S. Environmental Protection Agency, Federal Advisory Committee (FACA). Draft final TMDL Federal Advisory Committee Report. 4/28/98.

U.S. Environmental Protection Agency (USEPA) 2000a. Revisions to the Water Quality Planning and Management Regulation and Revisions to the National Pollutant Discharge Elimination System Program in Support of Revisions to the Water Quality Planning and management Regulation; Final Rule. Fed. Reg. 65:43586-43670 (July 13, 2000).

U.S.Environmental Protection Agency (USEPA) 2000c. Implementation Guidance for Ambient Water Quality Criteria for Bacteria – 1986. DRAFT. Office of Water. EPA-823-D-00-001.

U.S. Environmental Protection Agency (USEPA) 1985. Rates, constants, and kinetics formulations in surface water quality modeling (II ed.). Athens, GA: EPA-600-3-85-040.

Centralina Council of Governments, 2001. 2000 Population of Centralina's Member Governments. http://www.centralina.org/pdf/2000%20Population.pdf

Appendix 1. Moorsesville WWTP (NC0046728) Discharge Data Used in the Rocky River Fecal Coliform Model.[2]

Mooresville WWTP NC0046728 Discharge

Date	MGD	CFS	Effluent FC Conc	Date	MGD	CFS	Effluent FC Conc
1/1/96	1.685	2.608	1	2/7/96	3.542	5.483	1000
1/2/96	2.531	3.918	1690	2/8/96	3.202	4.957	6000
1/3/96	2.425	3.754	3435	2/9/96	2.925	4.528	67
1/4/96	1.819	2.816	82	2/10/96	2.973	4.602	67
1/5/96	2.343	3.627	2150	2/11/96	2.531	3.918	67
1/6/96	1.708	2.644	146	2/12/96	3.208	4.966	440
1/7/96	1.103	1.707	146	2/13/96	2.354	3.644	6
1/8/96	1.176	1.820	6	2/14/96	3.226	4.994	2
1/9/96	1.809	2.800	230	2/15/96	3.585	5.550	2
1/10/96	1.87	2.895	114	2/16/96	3.1	4.799	200
1/11/96	2.203	3.410	2600	2/17/96	3.215	4.977	67
1/12/96	1.754	2.715	4	2/18/96	4.069	6.299	67
1/13/96	1.881	2.912	146	2/19/96	4.43	6.858	54
1/14/96	2.675	4.141	146	2/20/96	3.028	4.687	2
1/15/96	2.532	3.920	146	2/21/96	3.05	4.721	74
1/16/96	2.831	4.382	510	2/22/96	3.364	5.207	24
1/17/96	2.491	3.856	3600	2/23/96	3.497	5.413	310
1/18/96	3.554	5.502	2000	2/24/96	2.601	4.026	67
1/19/96	3.302	5.111	2	2/25/96	2.993	4.633	67
1/20/96	1.676	2.594	146	2/26/96	3.831	5.930	350
1/21/96	1.743	2.698	146	2/27/96	3.459	5.354	2
1/22/96	2.668	4.130	104	2/28/96	3.319	5.138	4300
1/23/96	2.249	3.481	42	2/29/96	3.094	4.789	120
1/24/96	3.433	5.314	88	3/1/96	2.912	4.508	2500
1/25/96	2.642	4.090	2100	3/2/96	2.139	3.311	121
1/26/96	3.37	5.217	6000	3/3/96	2.513	3.890	121
1/27/96	5.219	8.079	146	3/4/96	2.954	4.573	2
1/28/96	2.545	3.940	146	3/5/96	2.82	4.365	390
1/29/96	2.621	4.057	2	3/6/96	3.015	4.667	2200
1/30/96	3.002	4.647	42	3/7/96	3.844	5.950	3800
1/31/96	3.286	5.087	86	3/8/96	2.727	4.221	4
2/1/96	2.814	4.356	12	3/9/96	2.342	3.625	121
2/2/96	4.2	6.502	300	3/10/96	1.963	3.039	121
2/3/96	2.19	3.390	67	3/11/96	1.668	2.582	42
2/4/96	1.476	2.285	67	3/12/96	2.672	4.136	2
2/5/96	2.172	3.362	100	3/13/96	3.029	4.689	76
2/6/96	2.658	4.115	1040	3/14/96	2.853	4.416	32

[2] Weekly fecal coliform averages were used in the model if the effluent was not monitored for fecal coliform on a given day.

Date	MGD	CFS	Effluent FC Conc	Date	MGD	CFS	Effluent FC Conc
3/15/96	3.247	5.026	2000	4/30/96	3.426	5.303	2
3/16/96	2.821	4.367	121	5/1/96	3.047	4.717	2
3/17/96	2.787	4.314	121	5/2/96	2.914	4.511	4
3/18/96	2.3	3.560	105	5/3/96	3.066	4.746	14
3/19/96	3.87	5.991	46	5/4/96	3.167	4.902	7
3/20/96	2.569	3.977	310	5/5/96	2.46	3.808	7
3/21/96	2.74	4.241	5300	5/6/96	2.822	4.368	10
3/22/96	2.338	3.619	6000	5/7/96	2.571	3.980	6
3/23/96	2.597	4.020	121	5/8/96	2.822	4.368	12
3/24/96	2.333	3.611	121	5/9/96	4.078	6.313	4
3/25/96	2.823	4.370	4	5/10/96	2.435	3.769	2
3/26/96	3.273	5.067	96	5/11/96	2.876	4.452	7
3/27/96	3.03	4.690	2	5/12/96	2.858	4.424	7
3/28/96	3.377	5.228	1067	5/13/96	2.955	4.574	2
3/29/96	2.501	3.872	538	5/14/96	3.415	5.286	10
3/30/96	2.733	4.231	121	5/15/96	3.09	4.783	30
3/31/96	2.572	3.981	121	5/16/96	3.295	5.101	320
4/1/96	3.362	5.204	2	5/17/96	3.25	5.031	4
4/2/96	3.22	4.985	2	5/18/96	3.041	4.707	7
4/3/96	2.651	4.104	2	5/19/96	2.349	3.636	7
4/4/96	2.971	4.599	2	5/20/96	3.417	5.289	2
4/5/96	2.822	4.368	3	5/21/96	2.831	4.382	6
4/6/96	1.845	2.856	3	5/22/96	2.631	4.073	18
4/7/96	1.526	2.362	3	5/23/96	3.904	6.043	14
4/8/96	2.387	3.695	2	5/24/96	2.62	4.056	14
4/9/96	2.368	3.666	2	5/25/96	1.85	2.864	7
4/10/96	2.796	4.328	2	5/26/96	2.437	3.772	7
4/11/96	3.31	5.124	42	5/27/96	1.948	3.015	7
4/12/96	2.452	3.796	34	5/28/96	1.969	3.048	2
4/13/96	2.864	4.433	3	5/29/96	2.517	3.896	2
4/14/96	2.156	3.337	3	5/30/96	2.572	3.981	4
4/15/96	3.327	5.150	8	5/31/96	1.915	2.964	10
4/16/96	3.3	5.108	16	6/1/96	1.554	2.406	4
4/17/96	3.313	5.128	98	6/2/96	1.687	2.611	4
4/18/96	2.941	4.553	4	6/3/96	2.443	3.782	2
4/19/96	3.294	5.099	2	6/4/96	2.461	3.810	6
4/20/96	2.352	3.641	3	6/5/96	2.52	3.901	2
4/21/96	3.063	4.741	3	6/6/96	2.517	3.896	24
4/22/96	2.996	4.638	2	6/7/96	2.042	3.161	4
4/23/96	3.997	6.187	12	6/8/96	2.53	3.916	4
4/24/96	3.951	6.116	6	6/9/96	2.686	4.158	4
4/25/96	3.353	5.190	2	6/10/96	2.214	3.427	4
4/26/96	3.078	4.765	2	6/11/96	2.283	3.534	2
4/27/96	2.497	3.865	3	6/12/96	2.857	4.423	12
4/28/96	2.752	4.260	3	6/13/96	2.298	3.557	10
4/29/96	3.515	5.441	2	6/14/96	2.977	4.608	6

Final Fecal Coliform TMDL for Rocky River

Date	MGD	CFS	Effluent FC Conc	Date	MGD	CFS	Effluent FC Conc
6/15/96	2.854	4.418	4	7/31/96	3.837	5.940	30
6/16/96	2.263	3.503	4	8/1/96	4.19	6.486	2
6/17/96	2.977	4.608	2	8/2/96	3.522	5.452	2
6/18/96	2.474	3.830	2	8/3/96	3.305	5.116	2
6/19/96	3.424	5.300	24	8/4/96	3.377	5.228	2
6/20/96	2.996	4.638	2	8/5/96	3.099	4.797	2
6/21/96	2.091	3.237	2	8/6/96	2.863	4.432	2
6/22/96	2.498	3.867	4	8/7/96	2.624	4.062	2
6/23/96	2.354	3.644	4	8/8/96	2.503	3.875	2
6/24/96	2.318	3.588	2	8/9/96	2.231	3.454	2
6/25/96	3.305	5.116	2	8/10/96	3.322	5.142	2
6/26/96	3.176	4.916	8	8/11/96	3.432	5.313	2
6/27/96	2.926	4.529	10	8/12/96	2.771	4.289	2
6/28/96	2.604	4.031	2	8/13/96	2.796	4.328	2
6/29/96	2.955	4.574	4	8/14/96	2.618	4.053	2
6/30/96	2.403	3.720	4	8/15/96	2.322	3.594	2
7/1/96	3.863	5.980	2	8/16/96	2.27	3.514	2
7/2/96	3.299	5.107	2	8/17/96	2.093	3.240	2
7/3/96	1.683	2.605	2	8/18/96	2.643	4.091	2
7/4/96	2.437	3.772	2	8/19/96	2.788	4.316	2
7/5/96	2.446	3.786	2	8/20/96	3.276	5.071	2
7/6/96	2.858	4.424	2	8/21/96	3.297	5.104	12
7/7/96	2.555	3.955	2	8/22/96	3.228	4.997	6
7/8/96	3.115	4.822	2	8/23/96	2.536	3.926	20
7/9/96	3.37	5.217	2	8/24/96	2.589	4.008	2
7/10/96	3.848	5.957	4	8/25/96	3.188	4.935	2
7/11/96	3.553	5.500	10	8/26/96	3.309	5.122	4
7/12/96	3.847	5.955	4	8/27/96	2.995	4.636	43
7/13/96	3.577	5.537	2	8/28/96	2.995	4.636	2
7/14/96	3.839	5.943	2	8/29/96	3.326	5.149	2
7/15/96	3.369	5.215	2	8/30/96	2.557	3.958	2
7/16/96	3.642	5.638	2	8/31/96	1.967	3.045	2
7/17/96	3.604	5.579	8	9/1/96	1.942	3.006	3
7/18/96	3.841	5.946	2	9/2/96	2.314	3.582	3
7/19/96	2.845	4.404	2	9/3/96	3.263	5.051	2
7/20/96	2.702	4.183	2	9/4/96	4.24	6.563	2
7/21/96	2.153	3.333	2	9/5/96	2.788	4.316	18
7/22/96	2.781	4.305	2	9/6/96	3.487	5.398	2
7/23/96	3.121	4.831	4	9/7/96	3.281	5.079	3
7/24/96	2.847	4.407	30	9/8/96	2.729	4.224	3
7/25/96	3.807	5.893	2	9/9/96	2.729	4.224	2
7/26/96	2.614	4.046	2	9/10/96	2.839	4.395	2
7/27/96	2.23	3.452	2	9/11/96	3.84	5.944	2
7/28/96	2.396	3.709	2	9/12/96	3.176	4.916	8
7/29/96	2.799	4.333	4	9/13/96	3.054	4.728	22
7/30/96	3.178	4.920	2	9/14/96	2.349	3.636	3

Final Fecal Coliform TMDL for Rocky River

Date	MGD	CFS	Effluent FC Conc	Date	MGD	CFS	Effluent FC Conc
9/15/96	2.045	3.166	3	10/31/96	3.141	4.862	2
9/16/96	3.119	4.828	2	11/1/96	2.974	4.604	16
9/17/96	2.856	4.421	2	11/2/96	1.932	2.991	11
9/18/96	3.082	4.771	52	11/3/96	1.593	2.466	11
9/19/96	3.254	5.037	2	11/4/96	2.654	4.108	2
9/20/96	2.529	3.915	2	11/5/96	2.834	4.387	12
9/21/96	2.623	4.060	3	11/6/96	3.222	4.988	20
9/22/96	1.594	2.467	3	11/7/96	3.63	5.619	40
9/23/96	3.232	5.003	2	11/8/96	2.786	4.313	56
9/24/96	2.936	4.545	2	11/9/96	2.169	3.358	11
9/25/96	3.204	4.960	2	11/10/96	1.177	1.822	11
9/26/96	3.245	5.023	4	11/11/96	2.322	3.594	11
9/27/96	2.527	3.912	2	11/12/96	2.58	3.994	3
9/28/96	2.608	4.037	3	11/13/96	3.94	6.099	6
9/29/96	1.525	2.361	3	11/14/96	2.728	4.223	2
9/30/96	3.071	4.754	2	11/15/96	2.286	3.539	18
10/1/96	3.624	5.610	8	11/16/96	1.787	2.766	11
10/2/96	3.049	4.720	20	11/17/96	1.625	2.515	11
10/3/96	3.155	4.884	6	11/18/96	3.115	4.822	8
10/4/96	2.555	3.955	10	11/19/96	3.213	4.974	24
10/5/96	1.853	2.868	6	11/20/96	2.888	4.471	42
10/6/96	1.345	2.082	6	11/21/96	3.047	4.717	2
10/7/96	2.612	4.043	2	11/22/96	1.876	2.904	20
10/8/96	3.7	5.728	2	11/23/96	1.473	2.280	11
10/9/96	2.958	4.579	2	11/24/96	1.704	2.638	11
10/10/96	2.448	3.789	2	11/25/96	3.101	4.800	6
10/11/96	2.612	4.043	2	11/26/96	2.972	4.601	94
10/12/96	1.507	2.333	6	11/27/96	2.428	3.759	2
10/13/96	1.476	2.285	6	11/28/96	2.282	3.533	11
10/14/96	2.567	3.974	2	11/29/96	1.468	2.272	11
10/15/96	2.612	4.043	8	11/30/96	1.488	2.303	11
10/16/96	2.662	4.121	10	12/1/96	3.513	5.438	4
10/17/96	2.752	4.260	5	12/2/96	2.806	4.344	2
10/18/96	2.751	4.259	14	12/3/96	1.533	2.373	4
10/19/96	1.587	2.457	6	12/4/96	2.928	4.533	2
10/20/96	1.268	1.963	6	12/5/96	3.134	4.851	2
10/21/96	2.757	4.268	776	12/6/96	2.569	3.977	8
10/22/96	2.767	4.283	3	12/7/96	2.775	4.296	4
10/23/96	2.866	4.437	2	12/8/96	1.802	2.789	4
10/24/96	2.664	4.124	24	12/9/96	1.713	2.652	2
10/25/96	2.245	3.475	2	12/10/96	3.311	5.125	2
10/26/96	2.174	3.365	6	12/11/96	3.466	5.365	2
10/27/96	1.485	2.299	6	12/12/96	3.239	5.014	2
10/28/96	3.075	4.760	6	12/13/96	3.714	5.749	2
10/29/96	3.176	4.916	28	12/14/96	2.419	3.745	4
10/30/96	3.213	4.974	2	12/15/96	1.882	2.913	4

Final Fecal Coliform TMDL for Rocky River

Date	MGD	CFS	Effluent FC Conc	Date	MGD	CFS	Effluent FC Conc
12/16/96	3.325	5.147	4	1/31/97	3.051	4.723	1245
12/17/96	3.219	4.983	137	2/1/97	1.916	2.966	22
12/18/96	3.05	4.721	182	2/2/97	1.483	2.296	22
12/19/96	3.103	4.803	7	2/3/97	2.668	4.130	2
12/20/96	2.051	3.175	4	2/4/97	3.529	5.463	39
12/21/96	1.705	2.639	4	2/5/97	3.316	5.133	23
12/22/96	1.562	2.418	4	2/6/97	3.132	4.848	43
12/23/96	1.3434	2.080	2	2/7/97	2.872	4.446	64
12/24/96	1.323	2.048	4	2/8/97	1.828	2.830	5
12/25/96	1.095	1.695	4	2/9/97	1.546	2.393	5
12/26/96	1.158	1.793	4	2/10/97	2.687	4.159	2
12/27/96	1.131	1.751	2	2/11/97	3.044	4.712	4
12/28/96	1.259	1.949	4	2/12/97	3.031	4.692	2
12/29/96	1.404	2.173	4	2/13/97	3.033	4.695	58
12/30/96	2.047	3.169	2	2/14/97	4.234	6.554	4
12/31/96	1.465	2.268	2	2/15/97	3.718	5.755	67
1/1/97	1.177	1.822	2	2/16/97	2.106	3.260	67
1/2/97	1.739	2.692	2	2/17/97	2.998	4.641	22
1/3/97	1.58	2.446	2	2/18/97	3.21	4.969	58
1/4/97	1.337	2.070	2	2/19/97	3.076	4.762	1390
1/5/97	1.843	2.853	2	2/20/97	3.489	5.401	260
1/6/97	2.425	3.754	2	2/21/97	3.591	5.559	3
1/7/97	3.035	4.698	2	2/22/97	2.609	4.039	4
1/8/97	3.011	4.661	2	2/23/97	1.495	2.314	4
1/9/97	3.886	6.015	6	2/24/97	2.857	4.423	2
1/10/97	3.224	4.991	54	2/25/97	2.974	4.604	31
1/11/97	1.782	2.759	51	2/26/97	3.024	4.681	2
1/12/97	1.812	2.805	51	2/27/97	3.544	5.486	2
1/13/97	2.684	4.155	27	2/28/97	5.76	8.916	4
1/14/97	2.709	4.193	67	3/1/97	3.157	4.887	4
1/15/97	3.328	5.152	106	3/2/97	2.545	3.940	4
1/16/97	3.401	5.265	56	3/3/97	3.423	5.299	10
1/17/97	2.791	4.320	32	3/4/97	3.299	5.107	10
1/18/97	2.083	3.224	34	3/5/97	3.386	5.241	2
1/19/97	1.352	2.093	34	3/6/97	2.914	4.511	2
1/20/97	2.761	4.274	34	3/7/97	3.044	4.712	2
1/21/97	3.511	5.435	2	3/8/97	2.633	4.076	7
1/22/97	3.427	5.305	330	3/9/97	1.917	2.967	7
1/23/97	3.227	4.995	82	3/10/97	2.927	4.531	2
1/24/97	3.09	4.783	24	3/11/97	3.776	5.845	2
1/25/97	2.4	3.715	46	3/12/97	3.903	6.042	116
1/26/97	1.388	2.149	46	3/13/97	3.975	6.153	2
1/27/97	2.847	4.407	74	3/14/97	3.485	5.395	13
1/28/97	3.252	5.034	64	3/15/97	2.487	3.850	65
1/29/97	3.223	4.989	6	3/16/97	1.54	2.384	65
1/30/97	3.107	4.810	6	3/17/97	2.907	4.500	35

Final Fecal Coliform TMDL for Rocky River

Date	MGD	CFS	Effluent FC Conc	Date	MGD	CFS	Effluent FC Conc
3/18/97	3.774	5.842	180	5/3/97	2.039	3.156	2
3/19/97	5.633	8.720	450	5/4/97	2.162	3.347	2
3/20/97	3.952	6.118	66	5/5/97	3.607	5.584	2
3/21/97	3.678	5.693	6	5/6/97	3.86	5.975	23
3/22/97	2.504	3.876	30	5/7/97	3.87	5.991	46
3/23/97	1.812	2.805	30	5/8/97	4.074	6.307	2
3/24/97	3.183	4.927	46	5/9/97	3.572	5.529	2
3/25/97	3.505	5.426	280	5/10/97	2.597	4.020	6
3/26/97	3.581	5.543	7	5/11/97	1.897	2.937	6
3/27/97	3.614	5.594	8	5/12/97	3.096	4.793	2
3/28/97	3.146	4.870	29	5/13/97	3.729	5.772	58
3/29/97	1.852	2.867	29	5/14/97	3.348	5.183	370
3/30/97	1.664	2.576	29	5/15/97	3.108	4.811	4
3/31/97	1.981	3.067	2	5/16/97	2.908	4.502	14
4/1/97	3.058	4.734	2	5/17/97	2.516	3.895	19
4/2/97	3.423	5.299	2	5/18/97	2.104	3.257	19
4/3/97	3.345	5.178	16	5/19/97	2.982	4.616	16
4/4/97	3.33	5.155	10	5/20/97	3.923	6.073	42
4/5/97	2.701	4.181	8	5/21/97	3.595	5.565	8
4/6/97	2.646	4.096	8	5/22/97	3.234	5.006	2
4/7/97	3.529	5.463	8	5/23/97	2.78	4.303	52
4/8/97	3.387	5.243	31	5/24/97	1.831	2.834	14
4/9/97	3.011	4.661	2	5/25/97	2.638	4.084	14
4/10/97	3.674	5.687	6	5/26/97	2.867	4.438	14
4/11/97	3.294	5.099	10	5/27/97	3.536	5.474	8
4/12/97	3.424	5.300	29	5/28/97	3.463	5.361	2
4/13/97	2.386	3.693	29	5/29/97	3.511	5.435	64
4/14/97	3.62	5.604	6	5/30/97	3.511	5.435	138
4/15/97	3.93	6.084	68	5/31/97	3.102	4.802	19
4/16/97	3.75	5.805	86	6/1/97	1.908	2.954	80
4/17/97	3.539	5.478	300	6/2/97	3.226	4.994	50
4/18/97	3.092	4.786	2	6/3/97	3.198	4.950	111
4/19/97	2.371	3.670	9	6/4/97	3.387	5.243	106
4/20/97	1.924	2.978	9	6/5/97	3.273	5.067	52
4/21/97	3.336	5.164	6	6/6/97	3.247	5.026	108
4/22/97	4.236	6.557	2	6/7/97	2.702	4.183	80
4/23/97	5.21	8.065	6	6/8/97	1.936	2.997	80
4/24/97	3.693	5.717	18	6/9/97	3.319	5.138	20
4/25/97	3.167	4.902	52	6/10/97	3.306	5.118	200
4/26/97	2.36	3.653	9	6/11/97	3.318	5.136	14
4/27/97	3.489	5.401	9	6/12/97	5.185	8.026	12
4/28/97	5.982	9.260	2	6/13/97	3.894	6.028	2
4/29/97	5.031	7.788	2	6/14/97	2.838	4.393	17
4/30/97	4.216	6.526	2	6/15/97	2.096	3.245	17
5/1/97	4.05	6.269	2	6/16/97	3.389	5.246	4
5/2/97	2.888	4.471	2	6/17/97	3.955	6.122	2

Date	MGD	CFS	Effluent FC Conc	Date	MGD	CFS	Effluent FC Conc
6/18/97	3.672	5.684	2	8/3/97	3.512	5.437	2
6/19/97	3.777	5.847	8	8/4/97	3.815	5.906	290
6/20/97	4.024	6.229	310	8/5/97	3.738	5.786	450
6/21/97	3.063	4.741	8	8/6/97	3.537	5.475	67
6/22/97	2.255	3.491	8	8/7/97	3.044	4.712	12
6/23/97	3.335	5.163	3	8/8/97	2.374	3.675	8
6/24/97	3.692	5.715	26	8/9/97	2.12	3.282	8
6/25/97	3.688	5.709	6	8/10/97	3.644	5.641	6
6/26/97	3.653	5.655	5	8/11/97	3.832	5.932	2
6/27/97	3.028	4.687	2	8/12/97	3.793	5.872	5
6/28/97	2.928	4.533	5	8/13/97	4.095	6.339	6
6/29/97	2.053	3.178	5	8/14/97	3.047	4.717	2
6/30/97	2.328	3.604	2	8/15/97	2.866	4.437	8
7/1/97	2.111	3.268	135	8/16/97	2.361	3.655	8
7/2/97	2.494	3.861	2	8/17/97	3.409	5.277	6
7/3/97	2.396	3.709	2	8/18/97	3.698	5.724	23
7/4/97	2.101	3.252	8	8/19/97	3.893	6.026	2
7/5/97	2.011	3.113	8	8/20/97	3.61	5.588	4
7/6/97	1.872	2.898	8	8/21/97	2.31	3.576	10
7/7/97	2.885	4.466	2	8/22/97	3.205	4.961	8
7/8/97	3.489	5.401	2	8/23/97	2.068	3.201	8
7/9/97	3.711	5.745	2	8/24/97	3.271	5.063	2
7/10/97	3.93	6.084	8	8/25/97	3.338	5.167	56
7/11/97	3.184	4.929	10	8/26/97	3.207	4.964	2
7/12/97	2.98	4.613	4	8/27/97	3.905	6.045	2
7/13/97	2.365	3.661	4	8/28/97	2.618	4.053	2
7/14/97	3.119	4.828	8	8/29/97	1.958	3.031	8
7/15/97	3.969	6.144	24	8/30/97	2.091	3.237	8
7/16/97	3.627	5.615	2	8/31/97	2.232	3.455	303
7/17/97	3.339	5.169	6	9/1/97	3.355	5.193	94
7/18/97	3.587	5.553	18	9/2/97	3.486	5.396	370
7/19/97	2.836	4.390	8	9/3/97	3.287	5.088	510
7/20/97	2.419	3.745	8	9/4/97	3.133	4.850	480
7/21/97	3.78	5.851	8	9/5/97	2.124	3.288	11
7/22/97	4.316	6.681	3	9/6/97	2.158	3.341	11
7/23/97	5.776	8.941	52	9/7/97	3.156	4.885	16
7/24/97	4.308	6.669	2	9/8/97	3.478	5.384	2
7/25/97	3.579	5.540	10	9/9/97	1.979	3.063	34
7/26/97	3.138	4.858	8	9/10/97	3.548	5.492	40
7/27/97	2.453	3.797	8	9/11/97	3.58	5.542	13
7/28/97	3.247	5.026	7	9/12/97	3.291	5.094	10
7/29/97	3.922	6.071	220	9/13/97	2.034	3.149	11
7/30/97	4.02	6.223	26	9/14/97	1.977	3.060	11
7/31/97	3.6	5.573	21	9/15/97	3.142	4.864	4
8/1/97	2.928	4.533	8	9/16/97	3.794	5.873	76
8/2/97	2.348	3.635	8	9/17/97	3.65	5.650	64

Date	MGD	CFS	Effluent FC Conc	Date	MGD	CFS	Effluent FC Conc
9/18/97	3.643	5.639	255	11/3/97	3.083	4.772	108
9/19/97	3.09	4.783	90	11/4/97	2.852	4.415	50
9/20/97	2.301	3.562	54	11/5/97	3.111	4.816	24
9/21/97	1.765	2.732	54	11/6/97	2.866	4.437	118
9/22/97	3.325	5.147	2	11/7/97			
9/23/97	3.48	5.387	220	11/8/97	1.964	3.040	34
9/24/97	3.791	5.868	4	11/9/97	2.579	3.992	112
9/25/97	3.487	5.398	12	11/10/97	2.951	4.568	118
9/26/97	3.09	4.783	31	11/11/97	3.303	5.113	120
9/27/97	2.353	3.642	15	11/12/97	4.171	6.457	145
9/28/97	1.953	3.023	15	11/13/97	2.567	3.974	98
9/29/97	3.239	5.014	9	11/14/97	2.098	3.248	118
9/30/97	3.576	5.536	590	11/15/97	1.67	2.585	118
10/1/97	3.483	5.392	13	11/16/97	2.428	3.759	5
10/2/97	3.2	4.954	41	11/17/97	2.72	4.211	850
10/3/97	2.78	4.303	14	11/18/97	2.442	3.780	220
10/4/97	2.158	3.341	20	11/19/97	2.922	4.523	48
10/5/97	1.979	3.063	20	11/20/97	3.484	5.393	98
10/6/97	3.558	5.508	10	11/21/97	2.419	3.745	85
10/7/97	3.702	5.731	230	11/22/97	1.647	2.550	85
10/8/97	3.596	5.567	16	11/23/97	2.608	4.037	16
10/9/97	3.254	5.037	29	11/24/97	2.737	4.237	143
10/10/97	2.572	3.981	350	11/25/97	3.347	5.181	380
10/11/97	2.109	3.265	52	11/26/97	2.161	3.345	95
10/12/97	1.983	3.070	52	11/27/97	2.366	3.663	95
10/13/97	2.925	4.528	18	11/28/97	1.566	2.424	95
10/14/97	3.739	5.788	113	11/29/97	1.977	3.060	95
10/15/97	3.256	5.040	94	11/30/97	2.816	4.359	13
10/16/97	3.33	5.155	40	12/1/97	2.733	4.231	56
10/17/97	2.751	4.259	94	12/2/97	2.898	4.486	31
10/18/97	2.39	3.700	59	12/3/97	2.791	4.320	31
10/19/97	2.712	4.198	59	12/4/97	2.485	3.847	118
10/20/97	2.747	4.252	2	12/5/97	1.947	3.014	38
10/21/97	3.162	4.895	2	12/6/97	1.441	2.231	38
10/22/97	3.21	4.969	2	12/7/97	2.465	3.816	6
10/23/97	3.13	4.845	2	12/8/97	2.881	4.460	21
10/24/97	2.391	3.701	16	12/9/97	3.031	4.692	17
10/25/97	3.241	5.017	3	12/10/97	2.803	4.339	2
10/26/97	2.071	3.206	3	12/11/97	3.105	4.807	12
10/27/97	2.81	4.350	44	12/12/97	2.275	3.522	9
10/28/97	3.414	5.285	525	12/13/97	1.66	2.570	9
10/29/97	3.453	5.345	7	12/14/97	2.658	4.115	2
10/30/97	3.396	5.257	6	12/15/97	2.757	4.268	72
10/31/97	2.836	4.390	26	12/16/97	2.981	4.615	50
11/1/97	1.803	2.791	34	12/17/97	2.929	4.534	6300
11/2/97	3.094	4.789	3	12/18/97	2.754	4.263	44

Date	MGD	CFS	Effluent FC Conc	Date	MGD	CFS	Effluent FC Conc
12/19/97	2.152	3.331	72	2/3/98	4.414	6.833	4
12/20/97	2.039	3.156	72	2/4/98	4.199	6.500	28
12/21/97	2.767	4.283	14	2/5/98	3.277	5.073	5
12/22/97	2.521	3.902	13	2/6/98	3.846	5.954	134
12/23/97	2.074	3.211	23	2/7/98	2.053	3.178	6
12/24/97	2.649	4.101	18	2/8/98	2.032	3.146	6
12/25/97	1.677	2.596	18	2/9/98	2.566	3.972	2
12/26/97	1.671	2.587	18	2/10/98	3.221	4.986	3
12/27/97	2.357	3.649	18	2/11/98	3.291	5.094	36
12/28/97	1.791	2.772	18	2/12/98	3.533	5.469	3
12/29/97	2.081	3.221	8	2/13/98	2.3	3.560	6
12/30/97	1.929	2.986	2	2/14/98	1.907	2.952	6
12/31/97	2.157	3.339	12	2/15/98	4.21	6.517	3
1/1/98	2.458	3.805	48	2/16/98	4.859	7.522	15
1/2/98	2.328	3.604	22	2/17/98	3.258	5.043	2
1/3/98	2.236	3.461	22	2/18/98	3.089	4.782	8
1/4/98	1.782	2.759	2	2/19/98	2.781	4.305	12
1/5/98	2.888	4.471	4	2/20/98	1.88	2.910	40
1/6/98	3.167	4.902	2	2/21/98	2.036	3.152	40
1/7/98	5.852	9.059	24	2/22/98	3.109	4.813	13
1/8/98	6.571	10.172	13	2/23/98	3.356	5.195	100
1/9/98	2.865	4.435	22	2/24/98	3.427	5.305	110
1/10/98	2.004	3.102	22	2/25/98	3.134	4.851	18
1/11/98	1.86	2.879	45	2/26/98	3.167	4.902	40
1/12/98	2.618	4.053	2	2/27/98	2.103	3.255	40
1/13/98	2.708	4.192	12	2/28/98	1.747	2.704	23
1/14/98	2.803	4.339	24	3/1/98	3.064	4.743	8
1/15/98	3.497	5.413	2	3/2/98	3.112	4.817	7
1/16/98	3.431	5.311	22	3/3/98	3.3	5.108	34
1/17/98	2.016	3.121	22	3/4/98	2.833	4.385	40
1/18/98	1.745	2.701	88	3/5/98	2.892	4.477	78
1/19/98	4.732	7.325	28	3/6/98	2.24	3.467	34
1/20/98	3.365	5.209	2	3/7/98	4.058	6.282	34
1/21/98	3.004	4.650	18	3/8/98	4.442	6.876	8
1/22/98	2.712	4.198	22	3/9/98	3.309	5.122	66
1/23/98	3.362	5.204	22	3/10/98	3.055	4.729	104
1/24/98	2.279	3.528	2	3/11/98	2.935	4.543	42
1/25/98	2.069	3.203	2	3/12/98	2.641	4.088	21
1/26/98	2.757	4.268	2	3/13/98	2.541	3.933	22
1/27/98	4.668	7.226	40	3/14/98	2.201	3.407	22
1/28/98	3.702	5.731	750	3/15/98	2.634	4.077	10
1/29/98	3.415	5.286	22	3/16/98	3.001	4.646	31
1/30/98	2.832	4.384	22	3/17/98	3.39	5.248	42
1/31/98	1.9	2.941		3/18/98	3.614	5.594	68
2/1/98	1.764	2.731	11	3/19/98	3.231	5.002	6
2/2/98	2.794	4.325	2	3/20/98	2.082	3.223	14

3/21/98	1.945	3.011	14				
3/22/98	2.824	4.372	4	5/7/98	3.974	6.152	22
3/23/98	3.263	5.051	42	5/8/98	3.021	4.676	10
3/24/98	3.109	4.813	5	5/9/98	2.346	3.632	9
3/25/98	3.347	5.181	26	5/10/98	1.974	3.056	9
3/26/98	3.216	4.978	27	5/11/98	3.135	4.853	16
3/27/98	2.329	3.605	6	5/12/98	3.738	5.786	2
3/28/98	2.194	3.396	6	5/13/98	3.295	5.101	82
3/29/98	2.949	4.565	4	5/14/98	3.473	5.376	6
3/30/98	3.428	5.307	8	5/15/98	3.277	5.073	4
3/31/98	3.407	5.274	26	5/16/98	2.372	3.672	28
4/1/98	3.243	5.020	27	5/17/98	2.064	3.195	28
4/2/98	3.001	4.646	53	5/18/98	3.374	5.223	2
4/3/98	2.062	3.192	33.3	5/19/98	3.479	5.385	10
4/4/98	1.66	2.570	33.3	5/20/98	3.748	5.802	18
4/5/98	3.759	5.819	150	5/21/98	3.5	5.418	164
4/6/98	2.798	4.331	10	5/22/98	2.851	4.413	280
4/7/98	3.131	4.847	10	5/23/98	2.124	3.288	15
4/8/98	3.733	5.779	2	5/24/98	2.2	3.406	15
4/9/98	3.671	5.683	11	5/25/98	3.122	4.833	12
4/10/98	2.547	3.943	8	5/26/98	4.376	6.774	16
4/11/98	2.178	3.372	8	5/27/98			
4/12/98	1.901	2.943	8	5/28/98	3.916	6.062	16
4/13/98	2.831	4.382	10	5/29/98	3.006	4.653	16
4/14/98	2.951	4.568	10	5/30/98	2.5	3.870	16
4/15/98	3.6	5.573	74	5/31/98	3.604	5.579	2
4/16/98	3.457	5.351	13	6/1/98	3.771	5.837	70
4/17/98	4.029	6.237	26	6/2/98	3.708	5.740	26
4/18/98	2.667	4.128	19	6/3/98	3.469	5.370	14
4/19/98	3.502	5.421	19	6/4/98	3.209	4.967	34
4/20/98	3.51	5.433	6	6/5/98	2.425	3.754	18
4/21/98	3.596	5.567	25	6/6/98	2.177	3.370	18
4/22/98	3.456	5.350	60	6/7/98	3.013	4.664	2
4/23/98	2.798	4.331	11	6/8/98	3.379	5.231	64
4/24/98	2.959	4.580	12	6/9/98	4.843	7.497	60
4/25/98	2.093	3.240	16	6/10/98	3.927	6.079	22
4/26/98	2.072	3.207	16	6/11/98	3.222	4.988	10
4/27/98	3.059	4.735	2	6/12/98	2.729	4.224	18
4/28/98	3.384	5.238	12	6/13/98	2.196	3.399	18
4/29/98	3.241	5.017	22	6/14/98	3.392	5.251	12
4/30/98	3.193	4.943	28	6/15/98	3.661	5.667	16
5/1/98	2.939	4.550	104	6/16/98	3.978	6.158	16
5/2/98	2.227	3.447	24	6/17/98	3.69	5.712	59
5/3/98	2.182	3.378	24	6/18/98	3.319	5.138	2200
5/4/98	2.943	4.556	40	6/19/98	2.786	4.313	32
5/5/98	3.44	5.325	44	6/20/98	2.136	3.307	32
5/6/98	3.322	5.142	20	6/21/98	3.643	5.639	10

Final Fecal Coliform TMDL for Rocky River

Date	MGD	CFS	Effluent FC Conc	Date	MGD	CFS	Effluent FC Conc
6/22/98	3.876	6.000	53	8/7/98	3.635	5.627	4
6/23/98	4.296	6.650	160	8/8/98	2.813	4.354	2
6/24/98	3.865	5.983	52	8/9/98	2.488	3.851	2
6/25/98	3.82	5.913	54	8/10/98	3.381	5.234	2
6/26/98	2.421	3.748	47	8/11/98	3.885	6.014	2
6/27/98	2.57	3.978	47	8/12/98	3.983	6.166	2
6/28/98	2.607	4.036	40	8/13/98	3.54	5.480	2
6/29/98	2.845	4.404	2	8/14/98	3.063	4.741	2
6/30/98	2.277	3.525	8	8/15/98	2.951	4.568	2
7/1/98	2.44	3.777	2	8/16/98	2.26	3.498	2
7/2/98	2.387	3.695	2	8/17/98	3.651	5.652	2
7/3/98	2.323	3.596	3	8/18/98	3.589	5.556	2
7/4/98	2.25	3.483	3	8/19/98	3.906	6.046	2
7/5/98	3.03	4.690	3	8/20/98	3.419	5.293	2
7/6/98	3.847	5.955	22	8/21/98	3.139	4.859	2
7/7/98	3.601	5.574	12	8/22/98	2.687	4.159	2
7/8/98	3.8	5.882	62	8/23/98	2.275	3.522	2
7/9/98	3.501	5.420	16	8/24/98	3.725	5.766	28
7/10/98	3.119	4.828	22	8/25/98	3.88	6.006	4
7/11/98	2.525	3.909	22	8/26/98	4.188	6.483	6
7/12/98	3.4	5.263	6	8/27/98	4.15	6.424	2
7/13/98	3.544	5.486	120	8/28/98	3.626	5.613	2
7/14/98	4.172	6.458	1700	8/29/98	3.273	5.067	5
7/15/98	3.578	5.539	3400	8/30/98	2.503	3.875	5
7/16/98	3.983	6.166	600	8/31/98	3.684	5.703	2
7/17/98	2.97	4.598	300	9/1/98	3.811	5.899	2
7/18/98	3.286	5.087	2	9/2/98	3.958	6.127	2
7/19/98	2.822	4.368	300	9/3/98	3.922	6.071	4
7/20/98	3.367	5.212	20	9/4/98	3.601	5.574	4
7/21/98	3.669	5.680	12	9/5/98	2.445	3.785	3
7/22/98	4.319	6.686	22	9/6/98	2.181	3.376	3
7/23/98	3.82	5.913	62	9/7/98	3.073	4.757	3
7/24/98	3.635	5.627	2	9/8/98	3.492	5.406	6
7/25/98	3.328	5.152	15	9/9/98	3.308	5.121	20
7/26/98	2.456	3.802	15	9/10/98	3.321	5.141	2
7/27/98	3.375	5.224	2	9/11/98	3.056	4.731	5
7/28/98	4.208	6.514	6	9/12/98	2.643	4.091	5
7/29/98	3.978	6.158	2	9/13/98	3.744	5.796	2
7/30/98	3.547	5.491	2	9/14/98	3.933	6.088	2
7/31/98	3.181	4.924	2	9/15/98	3.822	5.916	2
8/1/98	2.609	4.039	5	9/16/98	4	6.192	2
8/2/98	2.204	3.412	5	9/17/98	3.509	5.432	10
8/3/98	3.202	4.957	2	9/18/98	2.951	4.568	3
8/4/98	3.869	5.989	2	9/19/98	2.467	3.819	3
8/5/98	3.695	5.720	2	9/20/98	3.159	4.890	2
8/6/98	3.405	5.271	66	9/21/98	3.319	5.138	10

Final Fecal Coliform TMDL for Rocky River

Date	MGD	CFS	Effluent FC Conc	Date	MGD	CFS	Effluent FC Conc
9/22/98	3.268	5.059	2	11/7/98	2.04	3.158	29
9/23/98	3.315	5.132	2	11/8/98	0.601	0.930	229
9/24/98	3.223	4.989	24	11/9/98	0	0.000	29
9/25/98	2.747	4.252	5	11/10/98	3.224	4.991	30
9/26/98	2.49	3.854	5	11/11/98	3.171	4.909	57
9/27/98	3.564	5.517	2	11/12/98	3.146	4.870	69
9/28/98	3.979	6.159	18	11/13/98	2.628	4.068	90
9/29/98	3.662	5.669	50	11/14/98	2.356	3.647	75
9/30/98	4.03	6.238	2	11/15/98	1.926	2.981	75
10/1/98	3.399	5.262	2	11/16/98	3.318	5.136	18
10/2/98	2.8	4.334	2	11/17/98	3.159	4.890	360
10/3/98	2.277	3.525	2	11/18/98	2.922	4.523	98
10/4/98	3.451	5.342	2	11/19/98	2.786	4.313	102
10/5/98	3.674	5.687	10	11/20/98	2.775	4.296	38
10/6/98	3.896	6.031	2	11/21/98	1.994	3.087	76
10/7/98	3.596	5.567	12	11/22/98	1.868	2.892	76
10/8/98	2.97	4.598	86	11/23/98	2.257	3.494	116
10/9/98	2.296	3.554	8	11/24/98	2.433	3.766	163
10/10/98	2.343	3.627	8	11/25/98	2.218	3.433	90
10/11/98	3.398	5.260	2	11/26/98	1.624	2.514	119
10/12/98	3.71	5.743	54	11/27/98	1.74	2.693	119
10/13/98	3.728	5.771	2	11/28/98	1.578	2.443	119
10/14/98	3.283	5.082	2	11/29/98	1.865	2.887	119
10/15/98	2.861	4.429	32	11/30/98	2.73	4.226	2
10/16/98	2.206	3.415	7	12/1/98	3.274	5.068	2
10/17/98	1.984	3.071	7	12/2/98	3.259	5.045	310
10/18/98	3.613	5.593	2	12/3/98	3.117	4.825	230
10/19/98	3.24	5.015	12	12/4/98	2.621	4.057	2
10/20/98	3.388	5.245	28	12/5/98	2.171	3.361	23
10/21/98	3.261	5.048	8	12/6/98	2.047	3.169	23
10/22/98	2.744	4.248	140	12/7/98	3.26	5.046	16
10/23/98	2.359	3.652	15	12/8/98	3.035	4.698	12
10/24/98	1.929	2.986	15	12/9/98	2.635	4.079	2
10/25/98	3.021	4.676	25	12/10/98	2.827	4.376	2
10/26/98	3.218	4.981	22	12/11/98	2.864	4.433	4
10/27/98	3.617	5.599	66	12/12/98	2.364	3.659	5
10/28/98	3.749	5.803	74	12/13/98	2.306	3.570	5
10/29/98	3.12	4.830	90	12/14/98	2.407	3.726	8
10/30/98	2.188	3.387	2	12/15/98	3.387	5.243	20
10/31/98	2.178	3.372	48	12/16/98	4.325	6.695	47
11/1/98	2.119	3.280	29	12/17/98	2.897	4.485	4
11/2/98	3.299	5.107	2	12/18/98	2.8	4.334	12
11/3/98	3.217	4.980	74	12/19/98	2.205	3.413	13
11/4/98	2.851	4.413	54	12/20/98	1.802	2.789	13
11/5/98	2.833	4.385	30	12/21/98	2.17	3.359	2
11/6/98	2.567	3.974	78	12/22/98	1.809	2.800	2

Final Fecal Coliform TMDL for Rocky River

Date	MGD	CFS	Effluent FC Conc	Date	MGD	CFS	Effluent FC Conc
12/23/98	2.98	4.613	2	2/7/99	2.947	4.562	2
12/24/98	1.463	2.265	2	2/8/99	3.122	4.833	8
12/25/98	1.495	2.314	2	2/9/99	2.836	4.390	2
12/26/98	1.499	2.320	2	2/10/99	3.056	4.731	6
12/27/98	1.907	2.952	2	2/11/99	2.984	4.619	2
12/28/98	1.814	2.808	2	2/12/99			
12/29/98	1.691	2.618	2	2/13/99			
12/30/98	1.708	2.644	2	2/14/99	1.679	2.599	4
12/31/98	1.705	2.639	2	2/15/99	2.821	4.367	2
1/1/99	2.254	3.489	2	2/16/99	2.938	4.548	8
1/2/99	2.24	3.467	2	2/17/99	3.095	4.791	6
1/3/99	2.443	3.782	2	2/18/99	2.869	4.441	8
1/4/99	2.844	4.402	2	2/19/99	3.694	5.718	4
1/5/99	3.111	4.816	2	2/20/99	2.51	3.885	5
1/6/99	3.138	4.858	24	2/21/99	1.803	2.791	5
1/7/99	2.453	3.797	6	2/22/99	2.769	4.286	10
1/8/99	1.983	3.070	7	2/23/99	3.194	4.944	2
1/9/99	1.808	2.799	7	2/24/99	3.207	4.964	4
1/10/99	2.534	3.923	2	2/25/99	3.097	4.794	16
1/11/99	2.569	3.977	2	2/26/99	2.602	4.028	8
1/12/99	3.012	4.663	2	2/27/99	2.315	3.584	6
1/13/99	3.349	5.184	2	2/28/99	2.047	3.169	6
1/14/99	3.014	4.666	1600	3/1/99	2.89	4.474	2
1/15/99	2.117	3.277	7	3/2/99	3.069	4.751	2
1/16/99	1.945	3.011	7	3/3/99	3.034	4.697	2
1/17/99	3.404	5.269	7	3/4/99	3.301	5.110	6
1/18/99	3.472	5.375	33	3/5/99	2.641	4.088	2
1/19/99	3.153	4.881	4	3/6/99	2.185	3.382	3
1/20/99	2.676	4.142	8	3/7/99	2.025	3.135	3
1/21/99	2.906	4.498	2	3/8/99	2.66	4.118	10
1/22/99	3.333	5.159	7	3/9/99	2.988	4.625	6
1/23/99	3.237	5.011	7	3/10/99	2.937	4.546	12
1/24/99	3.426	5.303	2	3/11/99	2.774	4.294	12
1/25/99	2.79	4.319	8	3/12/99	2.403	3.720	4
1/26/99	3.341	5.172	14	3/13/99	2.248	3.480	8
1/27/99	3.238	5.012	16	3/14/99	3.787	5.862	8
1/28/99	2.806	4.344	10	3/15/99	3.089	4.782	2
1/29/99	1.967	3.045	8	3/16/99	3.037	4.701	10
1/30/99	1.783	2.760	8	3/17/99	3.268	5.059	2
1/31/99	3.177	4.918	2	3/18/99	3.152	4.879	4
2/1/99				3/19/99	2.742	4.245	8
2/2/99				3/20/99	2.41	3.731	4
2/3/99	3.391	5.249	2	3/21/99	2.269	3.512	4
2/4/99	2.99	4.628	8	3/22/99	2.811	4.351	2
2/5/99	2.448	3.789	2	3/23/99	3.381	5.234	2
2/6/99	2.271	3.515	2	3/24/99	3.562	5.514	2

Date	MGD	CFS	Effluent FC Conc	Date	MGD	CFS	Effluent FC Conc
3/25/99	3.38	5.232	4	5/10/99	3.027	4.686	2
3/26/99	2.845	4.404	4	5/11/99	3.371	5.218	2
3/27/99	2.238	3.464	3	5/12/99	3.299	5.107	2
3/28/99	2.17	3.359	2	5/13/99	2.99	4.628	2
3/29/99	2.795	4.327	2	5/14/99	2.36	3.653	2
3/30/99	3.342	5.173	2	5/15/99	2.285	3.537	2
3/31/99	2.903	4.494	2	5/16/99	3.088	4.780	2
4/1/99	3.237	5.011	2	5/17/99	3.728	5.771	4
4/2/99	2.626	4.065	2	5/18/99	3.078	4.765	2
4/3/99	2.355	3.646	2	5/19/99	3.024	4.681	6
4/4/99	2.197	3.401	2	5/20/99	3.265	5.054	4
4/5/99	2.912	4.508	2	5/21/99	2.791	4.320	3
4/6/99	3.435	5.317	8	5/22/99	2.299	3.559	3
4/7/99	3.104	4.805	22	5/23/99	2.887	4.469	2
4/8/99	3.071	4.754	18	5/24/99	3.137	4.856	2
4/9/99	2.519	3.899	7	5/25/99	3.003	4.649	12
4/10/99	2.382	3.687	7	5/26/99	2.333	3.611	5
4/11/99	3.144	4.867	2	5/27/99	3.315	5.132	22
4/12/99	3.403	5.268	10	5/28/99	2.813	4.354	46
4/13/99	3.525	5.457	4	5/29/99	2.321	3.593	9
4/14/99	3.11	4.814	32	5/30/99	2.304	3.567	9
4/15/99	2.843	4.401	68	5/31/99	2.269	3.512	9
4/16/99	2.227	3.447	11	6/1/99	2.884	4.464	2
4/17/99	2.076	3.214	11	6/2/99	3.099	4.797	2
4/18/99	3.136	4.854	4	6/3/99	3.214	4.975	4
4/19/99	2.983	4.618	31	6/4/99	3.428	5.307	2
4/20/99	3.176	4.916	22	6/5/99	2.656	4.111	2
4/21/99	3.314	5.130	10	6/6/99	2.471	3.825	2
4/22/99	3.48	5.387	12	6/7/99	2.832	4.384	2
4/23/99	2.779	4.302	13	6/8/99	2.862	4.430	2
4/24/99	2.322	3.594	13	6/9/99	2.849	4.410	2
4/25/99	3.042	4.709	10	6/10/99	3.521	5.450	2
4/26/99	4.122	6.381	14	6/11/99	3.211	4.971	2
4/27/99	3.495	5.410	10	6/12/99	2.591	4.011	2
4/28/99	4.19	6.486	6	6/13/99	2.363	3.658	2
4/29/99	4.681	7.246	52	6/14/99	3.004	4.650	2
4/30/99	2.8	4.334	10	6/15/99	3.024	4.681	2
5/1/99	2.586	4.003	10	6/16/99	3.246	5.025	2
5/2/99	3.138	4.858	20	6/17/99	3.043	4.711	6
5/3/99	3.142	4.864	22	6/18/99	2.874	4.449	2
5/4/99	3.028	4.687	6	6/19/99	2.611	4.042	3
5/5/99	3.313	5.128	4	6/20/99	2.102	3.254	3
5/6/99	3.125	4.837	10	6/21/99	2.509	3.884	12
5/7/99	2.471	3.825	10	6/22/99	3.104	4.805	2
5/8/99	2.599	4.023	10	6/23/99	2.914	4.511	600
5/9/99	2.992	4.632	2	6/24/99	3.261	5.048	2

Final Fecal Coliform TMDL for Rocky River

Date	MGD	CFS	Effluent FC Conc	Date	MGD	CFS	Effluent FC Conc
6/25/99	3.13	4.845	2	8/10/99	3.031	4.692	2
6/26/99	2.687	4.159	9	8/11/99	3.035	4.698	4
6/27/99	2.497	3.865	9	8/12/99	2.693	4.169	2
6/28/99	3.082	4.771	2	8/13/99	2.639	4.085	2
6/29/99	3.09	4.783	2	8/14/99	2.453	3.797	2
6/30/99	2.909	4.503	2	8/15/99	3.247	5.026	2
7/1/99	3.303	5.113	2	8/16/99	3.204	4.960	2
7/2/99	2.853	4.416	2	8/17/99	2.971	4.599	2
7/3/99	2.568	3.975	2	8/18/99	3.061	4.738	2
7/4/99	2.178	3.372	2	8/19/99	2.662	4.121	2
7/5/99	2.447	3.788	2	8/20/99	2.463	3.813	2
7/6/99	2.858	4.424	2	8/21/99	2.247	3.478	2
7/7/99	2.918	4.517	2	8/22/99	2.874	4.449	2
7/8/99	2.722	4.214	2	8/23/99	3.4	5.263	2
7/9/99	3.127	4.841	2	8/24/99	3.2	4.954	4
7/10/99	2.437	3.772	2	8/25/99	2.88	4.458	2
7/11/99	2.269	3.512	2	8/26/99	2.528	3.913	2
7/12/99	2.852	4.415	2	8/27/99	2.536	3.926	2
7/13/99	2.653	4.107	62	8/28/99	2.478	3.836	2
7/14/99	2.838	4.393	2	8/29/99	2.738	4.238	2
7/15/99	2.962	4.585	2	8/30/99	2.65	4.102	2
7/16/99	2.841	4.398	4	8/31/99	2.681	4.150	2
7/17/99	2.81	4.350	2	9/1/99	2.919	4.519	10
7/18/99	3.306	5.118	5	9/2/99	2.634	4.077	4
7/19/99	3.377	5.228	2	9/3/99	2.586	4.003	4
7/20/99	3.124	4.836	2	9/4/99	2.301	3.562	4
7/21/99	3.154	4.882	2	9/5/99	2.427	3.757	4
7/22/99	3.148	4.873	2	9/6/99	2.592	4.012	2
7/23/99	2.998	4.641	2	9/7/99	2.068	3.201	2
7/24/99	2.323	3.596	2	9/8/99			
7/25/99	3.239	5.014	1	9/9/99	2.968	4.594	4
7/26/99	3.138	4.858	1	9/10/99	2499	3868.421	22
7/27/99	3.152	4.879	2	9/11/99	2.411	3.732	4
7/28/99	2.877	4.454	2	9/12/99	2.192	3.393	4
7/29/99	3.021	4.676	2	9/13/99	2.536	3.926	20
7/30/99	2.714	4.201	2	9/14/99	2.825	4.373	10
7/31/99	2.678	4.146	2	9/15/99	2.729	4.224	25
8/1/99	3.219	4.983	2	9/16/99	2.682	4.152	12
8/2/99	3.228	4.997	2	9/17/99	2.367	3.664	8
8/3/99	2.873	4.447	2	9/18/99	2.233	3.457	3
8/4/99	2.824	4.372	2	9/19/99	2.024	3.133	13
8/5/99	2.752	4.260	2	9/20/99	2.875	4.450	2
8/6/99	2.825	4.373	2	9/21/99	2.717	4.206	2
8/7/99	2.426	3.755	2	9/22/99	2.733	4.231	2
8/8/99	3.061	4.738	2	9/23/99	2.534	3.923	4
8/9/99	3.299	5.107	2	9/24/99	2.345	3.630	2

Final Fecal Coliform TMDL for Rocky River

Date	MGD	CFS	Effluent FC Conc	Date	MGD	CFS	Effluent FC Conc
9/25/99	2.132	3.300	2	11/10/99	2.712	4.198	2
9/26/99	2.331	3.608	2	11/11/99	2.072	3.207	2
9/27/99	2.949	4.565	2	11/12/99	2.008	3.108	3
9/28/99	2.767	4.283	2	11/13/99	2.208	3.418	3
9/29/99	3.09	4.783	2	11/14/99	2.04	3.158	2
9/30/99	2.495	3.862	2	11/15/99	2.34	3.622	2
10/1/99	2.562	3.966	2	11/16/99	2.488	3.851	2
10/2/99	2.256	3.492	2	11/17/99	2.531	3.918	2
10/3/99	2.291	3.546	2	11/18/99	2.199	3.404	2
10/4/99	2.697	4.175	2	11/19/99	2.024	3.133	2
10/5/99	2.6	4.025	2	11/20/99	2.391	3.701	2
10/6/99	2.615	4.048	2	11/21/99	2.574	3.985	2
10/7/99	2.484	3.845	4	11/22/99	2.663	4.122	2
10/8/99	2.32	3.591	2	11/23/99	2.522	3.904	4
10/9/99	2.535	3.924	2	11/24/99	2.125	3.289	2
10/10/99	2.545	3.940	2	11/25/99	2.291	3.546	2
10/11/99	4.374	6.771	2	11/26/99	1.866	2.889	2
10/12/99	2.607	4.036	2	11/27/99	2.407	3.726	2
10/13/99	2.615	4.048	2	11/28/99	2.375	3.676	2
10/14/99	2.645	4.094	28	11/29/99	2.301	3.562	2
10/15/99	2.538	3.929	3	11/30/99	2.433	3.766	2
10/16/99	2.344	3.628	3	12/1/99	2.461	3.810	2
10/17/99	2.249	3.481	2	12/2/99	2.199	3.404	2
10/18/99	2.523	3.906	2	12/3/99	2.305	3.568	2
10/19/99	2.41	3.731	12	12/4/99	2.229	3.450	2
10/20/99	3.057	4.732	8	12/5/99	2.639	4.085	2
10/21/99	4.093	6.336	2	12/6/99	2.43	3.762	2
10/22/99	2.353	3.642	4	12/7/99	2.454	3.799	4
10/23/99	2.005	3.104	4	12/8/99	2.815	4.358	2
10/24/99	2.003	3.101	2	12/9/99	2.416	3.740	2
10/25/99	2.184	3.381	10	12/10/99	2.081	3.221	2
10/26/99	2.37	3.669	2	12/11/99	1.923	2.977	2
10/27/99	2.672	4.136	4	12/12/99	2.6	4.025	8
10/28/99	2.389	3.698	2	12/13/99	3.045	4.714	14
10/29/99	2.422	3.749	2	12/14/99	2.999	4.642	2
10/30/99	2.472	3.827	2	12/15/99	2.546	3.941	6
10/31/99	2.379	3.683	4	12/16/99	2.149	3.327	2
11/1/99	2.769	4.286	2	12/17/99	2.19	3.390	5
11/2/99	2.291	3.546	2	12/18/99	1.961	3.036	5
11/3/99	2.202	3.409	2	12/19/99	2.327	3.602	2
11/4/99	2.213	3.426	2	12/20/99	2.32	3.591	2
11/5/99	1.943	3.008	2	12/21/99	2.684	4.155	2
11/6/99	1.905	2.949	2	12/22/99	2.168	3.356	2
11/7/99	2.491	3.856	2	12/23/99	1.929	2.986	2
11/8/99	2.53	3.916	2	12/24/99	1.838	2.845	2
11/9/99	2.444	3.783	6	12/25/99	1.747	2.704	2

Final Fecal Coliform TMDL for Rocky River

Date	MGD	CFS	Effluent FC Conc	Date	MGD	CFS	Effluent FC Conc
12/26/99	1.752	2.712	2	2/10/00	2.506	3.879	2
12/27/99	1.855	2.872	2	2/11/00	2.61	4.040	2
12/28/99	1.948	3.015	2	2/12/00	2.51	3.885	2
12/29/99	1.891	2.927	4	2/13/00	2.883	4.463	2
12/30/99	1.773	2.745	2	2/14/00	2.52	3.901	2
12/31/99	2.056	3.183	2	2/15/00	2.549	3.946	2
1/1/00	1.886	2.920	2	2/16/00	2.282	3.533	2
1/2/00	1.913	2.961	2	2/17/00	2.162	3.347	2
1/3/00	2.572	3.981	2	2/18/00	2.242	3.471	2
1/4/00	2.635	4.079	2	2/19/00	1.831	2.834	2
1/5/00	2.127	3.293	2	2/20/00	2.433	3.766	2
1/6/00	2.053	3.178	2	2/21/00	2.352	3.641	2
1/7/00	1.985	3.073	2	2/22/00	2.233	3.457	2
1/8/00	2.084	3.226	2	2/23/00	2.424	3.752	2
1/9/00	2.056	3.183	2	2/24/00	2.349	3.636	2
1/10/00	3.447	5.336	2	2/25/00	2.347	3.633	2
1/11/00	2.319	3.590	2	2/26/00	2.069	3.203	2
1/12/00	2.58	3.994	2	2/27/00	2.342	3.625	2
1/13/00	2.431	3.763	8	2/28/00	2.316	3.585	2
1/14/00	1.985	3.073	33	2/29/00	2.206	3.415	2
1/15/00	1.78	2.755	5	3/1/00	2.377	3.680	2
1/16/00	1.855	2.872	5	3/2/00	2.041	3.159	2
1/17/00	2.003	3.101	5	3/3/00	1.988	3.077	2
1/18/00	2.156	3.337	2	3/4/00	2.126	3.291	2
1/19/00	2.249	3.481	2	3/5/00	2.349	3.636	2
1/20/00	2.276	3.523	4	3/6/00	2.423	3.751	2
1/21/00	1.787	2.766	2	3/7/00	2.288	3.542	2
1/22/00	1.842	2.851	2	3/8/00	2.6	4.025	2
1/23/00	1.671	2.587	2	3/9/00	2.306	3.570	2
1/24/00	2.054	3.180	2	3/10/00	2.38	3.684	2
1/25/00	2.289	3.543	2	3/11/00	1.951	3.020	2
1/26/00	2.26	3.498	2	3/12/00	1.956	3.028	2
1/27/00	2.086	3.229	2	3/13/00	2.376	3.678	10
1/28/00	1.842	2.851	2	3/14/00	2.352	3.641	2
1/29/00	1.956	3.028	2	3/15/00	3.019	4.673	2
1/30/00	2.199	3.404	2	3/16/00	2.65	4.102	2
1/31/00	2.372	3.672	2	3/17/00	2.101	3.252	2
2/1/00	2.278	3.526	2	3/18/00	1.921	2.974	2
2/2/00	2.117	3.277	2	3/19/00	3.213	4.974	2
2/3/00	2.479	3.837	2	3/20/00	3.204	4.960	2
2/4/00	2.066	3.198	2	3/21/00	2.635	4.079	2
2/5/00	1.954	3.025	2	3/22/00	2.34	3.622	2
2/6/00	2.047	3.169	2	3/23/00	2.123	3.286	2
2/7/00	2.367	3.664	2	3/24/00	2.392	3.703	2
2/8/00	2.193	3.395	2	3/25/00	2.315	3.584	2
2/9/00	2.447	3.788	2	3/26/00	2.227	3.447	2

Date	MGD	CFS	Effluent FC Conc	Date	MGD	CFS	Effluent FC Conc
3/27/00	2.315	3.584	2	5/12/00	2.763	4.277	2
3/28/00	2.227	3.447	2	5/13/00	2.305	3.568	2
3/29/00	2.438	3.774	2	5/14/00	2.35	3.638	2
3/30/00	2.178	3.372	2	5/15/00	2.141	3.314	2
3/31/00	2.325	3.599	2	5/16/00	2.647	4.098	2
4/1/00	2.215	3.429	2	5/17/00	2.716	4.204	2
4/2/00	2.617	4.051	8	5/18/00	2.586	4.003	4
4/3/00	2.659	4.116	2	5/19/00	2.786	4.313	2
4/4/00	2.479	3.837	2	5/20/00	2.561	3.964	2
4/5/00	2.191	3.392	2	5/21/00	2.233	3.457	2
4/6/00	2.542	3.935	2	5/22/00	2.562	3.966	2
4/7/00	2.379	3.683	2	5/23/00	2.501	3.872	2
4/8/00	2.291	3.546	2	5/24/00	2.542	3.935	32
4/9/00	2.087	3.231	2	5/25/00	2.538	3.929	2
4/10/00	2.374	3.675	2	5/26/00	2.739	4.240	5
4/11/00	2.552	3.950	2	5/27/00	2.199	3.404	5
4/12/00	2.644	4.093	2	5/28/00	2.548	3.944	5
4/13/00	2.139	3.311	2	5/29/00	2.394	3.706	2
4/14/00	2.143	3.317	2	5/30/00	2.434	3.768	2
4/15/00	2.844	4.402	2	5/31/00	2.713	4.200	2
4/16/00	2.188	3.387	2	6/1/00	2.641	4.088	2
4/17/00	2.447	3.788	2	6/2/00	2.462	3.811	2
4/18/00	2.433	3.766	2	6/3/00	2.234	3.458	2
4/19/00	2.328	3.604	2	6/4/00	2.881	4.460	2
4/20/00	2.422	3.749	2	6/5/00	2.437	3.772	2
4/21/00	2.239	3.466	2	6/6/00	2.617	4.051	2
4/22/00	1.847	2.859	2	6/7/00	2.307	3.571	2
4/23/00	1.948	3.015	2	6/8/00	2.673	4.138	2
4/24/00	2.486	3.848	2	6/9/00	2.368	3.666	2
4/25/00	2.34	3.622	2	6/10/00	2.278	3.526	2
4/26/00	2.426	3.755	2	6/11/00	2.662	4.121	2
4/27/00	2.138	3.310	2	6/12/00	2.642	4.090	2
4/28/00	2.965	4.590	2	6/13/00	2.82	4.365	2
4/29/00	2.572	3.981	2	6/14/00	2.578	3.991	2
4/30/00	2.157	3.339	2	6/15/00	2.634	4.077	2
5/1/00	2.578	3.991	4	6/16/00	2.694	4.170	2
5/2/00	2.703	4.184	74	6/17/00	2.258	3.495	2
5/3/00	2.497	3.865	12	6/18/00	2.715	4.203	2
5/4/00	2.408	3.728	2	6/19/00	2.446	3.786	2
5/5/00	2.392	3.703	2	6/20/00	2.754	4.263	2
5/6/00	2.609	4.039	7	6/21/00	2.53	3.916	2
5/7/00	2.328	3.604	7	6/22/00	2.483	3.844	2
5/8/00	2.566	3.972	4	6/23/00	2.911	4.506	2
5/9/00	2.829	4.379	2	6/24/00	2.265	3.506	2
5/10/00	2.69	4.164	2	6/25/00	2.649	4.101	2
5/11/00	2.548	3.944	2	6/26/00	3.024	4.681	2

Final Fecal Coliform TMDL for Rocky River

Date	MGD	CFS	Effluent FC Conc	Date	MGD	CFS	Effluent FC Conc
6/27/00	2.506	3.879	2	8/12/00	2.557	3.958	8
6/28/00	2.615	4.048	2	8/13/00	2.648	4.099	8
6/29/00	2.512	3.889	2	8/14/00	2.7	4.180	2
6/30/00	2.207	3.416	2	8/15/00	3.087	4.779	2
7/1/00	2.424	3.752	2	8/16/00	2.921	4.522	2
7/2/00	2.431	3.763	2	8/17/00	3.074	4.759	2
7/3/00	2.457	3.803	2	8/18/00	3.102	4.802	4
7/4/00	2.54	3.932	2	8/19/00	2.687	4.159	2
7/5/00	3.089	4.782	2	8/20/00	2.549	3.946	2
7/6/00	2.581	3.995	2	8/21/00	2.864	4.433	2
7/7/00	2.631	4.073	2	8/22/00	2.686	4.158	18
7/8/00	2.324	3.598	2	8/23/00	2.678	4.146	18
7/9/00	2.807	4.345	2	8/24/00	2.638	4.084	4
7/10/00	2.756	4.266	2	8/25/00	2.484	3.845	8
7/11/00	2.813	4.354	2	8/26/00	2.793	4.324	8
7/12/00	2.712	4.198	2	8/27/00	2.389	3.698	8
7/13/00	2.583	3.998	2	8/28/00	3.129	4.844	4
7/14/00	2.739	4.240	2	8/29/00	2.71	4.195	2
7/15/00	2.496	3.864	6	8/30/00	2.666	4.127	4
7/16/00	2.2	3.406	2	8/31/00	3.152	4.879	2
7/17/00	2.516	3.895	2	9/1/00	2.919	4.519	2
7/18/00	2.87	4.443	2	9/2/00	2.723	4.215	2
7/19/00	2.463	3.813	2	9/3/00	2.555	3.955	2
7/20/00	2.565	3.971	2	9/4/00	2.527	3.912	2
7/21/00	2.478	3.836	2	9/5/00	2.56	3.963	2
7/22/00	2.657	4.113	2	9/6/00	2.496	3.864	6
7/23/00	2.285	3.537	2	9/7/00	2.823	4.370	12
7/24/00	2.442	3.780	2	9/8/00	2.579	3.992	20
7/25/00	2.634	4.077	2	9/9/00	2.458	3.805	4
7/26/00	2.398	3.712	2	9/10/00	2.819	4.364	4
7/27/00	2.487	3.850	2	9/11/00	2.558	3.960	50
7/28/00	2.577	3.989	2	9/12/00	2.658	4.115	4
7/29/00	2.517	3.896	2	9/13/00	2.58	3.994	14
7/30/00	2.393	3.704	2	9/14/00	2.738	4.238	18
7/31/00	2.849	4.410	2	9/15/00	2.028	3.139	20
8/1/00	2.813	4.354	2	9/16/00	2.147	3.324	20
8/2/00	2.813	4.354	2	9/17/00	2.892	4.477	68
8/3/00	2.933	4.540	2	9/18/00	2.718	4.207	14
8/4/00	2.91	4.505	2	9/19/00	2.763	4.277	6
8/5/00	2.633	4.076	2	9/20/00	2.652	4.105	20
8/6/00	2.844	4.402	2	9/21/00	2.477	3.834	2
8/7/00	2.704	4.186	8	9/22/00	2.685	4.156	12
8/8/00	3.018	4.672	2	9/23/00	2.46	3.808	12
8/9/00	2.835	4.389	2	9/24/00	3.073	4.757	2
8/10/00	2.961	4.584	2	9/25/00	2.689	4.163	4
8/11/00	2.874	4.449	460	9/26/00	2.373	3.673	16

Date	MGD	CFS	Effluent FC Conc	Date	MGD	CFS	Effluent FC Conc
9/27/00	2.511	3.887	10	11/12/00	2.013	3.116	7
9/28/00	2.455	3.800	46	11/13/00	2.501	3.872	7
9/29/00	2.461	3.810	9	11/14/00	2.489	3.853	10
9/30/00	2.168	3.356	2	11/15/00	2.082	3.223	2
10/1/00	2.569	3.977	2	11/16/00	2.171	3.361	10
10/2/00	2.499	3.868	2	11/17/00	2.109	3.265	2
10/3/00	2.303	3.565	12	11/18/00	1.912	2.960	5
10/4/00	2.569	3.977	6	11/19/00	2.197	3.401	5
10/5/00	2.602	4.028	8	11/20/00	1.947	3.014	2
10/6/00	2.083	3.224	5	11/21/00	0.06	0.093	4
10/7/00	2.038	3.155	5	11/22/00	2.019	3.125	2
10/8/00	2.115	3.274	20	11/23/00	1.914	2.963	2
10/9/00	2.196	3.399	6	11/24/00	1.967	3.045	2
10/10/00	2.261	3.500	12	11/25/00	2.134	3.303	2
10/11/00	2.095	3.243	12	11/26/00	2.095	3.243	2
10/12/00	2.27	3.514	6	11/27/00	2.295	3.553	2
10/13/00	2.08	3.220	10	11/28/00	2.264	3.505	2
10/14/00	1.996	3.090	10	11/29/00	2.417	3.741	2
10/15/00	2.668	4.130	2	11/30/00	2.131	3.299	2
10/16/00	2.447	3.788	2	12/1/00	2.235	3.460	2
10/17/00	2.494	3.861	2	12/2/00	2.007	3.107	2
10/18/00	2.52	3.901	2	12/3/00	1.6	2.477	2
10/19/00	2.375	3.676	2	12/4/00	1.963	3.039	2
10/20/00	2.355	3.646	2	12/5/00	2.186	3.384	16
10/21/00	2.403	3.720	2	12/6/00	2.058	3.186	24
10/22/00	2.567	3.974	2	12/7/00	2.145	3.320	6
10/23/00	2.508	3.882	2	12/8/00	2.229	3.450	2
10/24/00	2.598	4.022	2	12/9/00	2.03	3.142	6
10/25/00	2.428	3.759	2	12/10/00	2.02	3.127	6
10/26/00	2.838	4.393	2	12/11/00	2.231	3.454	2
10/27/00	2.109	3.265	7	12/12/00	2.467	3.819	8
10/28/00	2.403	3.720	2	12/13/00	2.192	3.393	2
10/29/00	2.296	3.554	2	12/14/00	2.252	3.486	2
10/30/00	2.116	3.276	2	12/15/00	2.331	3.608	4
10/31/00	2.486	3.848	2	12/16/00	2.422	3.749	3
11/1/00	2.234	3.458	2	12/17/00	2.27	3.514	3
11/2/00	2.306	3.570	4	12/18/00	2.116	3.276	2
11/3/00	2.299	3.559	8				
11/4/00	2.329	3.605	4	12/20/00	2.081	3.221	22
11/5/00	2.145	3.320	4	12/21/00	2.045	3.166	20
11/6/00	2.161	3.345	2	12/22/00	1.851	2.865	10
11/7/00	2.412	3.734	14	12/23/00	1.89	2.926	10
11/8/00	2.319	3.590	18	12/24/00	1.651	2.556	10
11/9/00	2.727	4.221	4	12/25/00	1.738	2.690	24
11/10/00	2.225	3.444	10	12/26/00	2.09	3.235	10
11/11/00	2.206	3.415	7	12/27/00	2.077	3.215	14

Date	MGD	CFS	Effluent FC Conc	Date	MGD	CFS	Effluent FC Conc
12/28/00	1.813	2.807	15	2/12/01	2.193	3.395	2
12/29/00	1.817	2.813	15	2/13/01	2.164	3.350	4
12/30/00	1.771	2.741	15	2/14/01	2.436	3.771	2
12/31/00	2.44	3.777	5	2/15/01	2.402	3.718	2
1/1/01	2.44	3.777	5	2/16/01	2.653	4.107	2
1/2/01	2.44	3.777	5	2/17/01	2.91	4.505	2
1/3/01	2.44	3.777	5	2/18/01	1.888	2.923	2
1/4/01	2.44	3.777	5	2/19/01	2.171	3.361	2
1/5/01	2.44	3.777	5	2/20/01	2.43	3.762	2
1/6/01	2.44	3.777	5	2/21/01	2.294	3.551	2
1/7/01	2.44	3.777	5	2/22/01	2.175	3.367	2
1/8/01	2.44	3.777	5	2/23/01	2.176	3.368	4
1/9/01	2.44	3.777	5	2/24/01	2.322	3.594	2
1/10/01	2.44	3.777	5	2/25/01	2.503	3.875	2
1/11/01	2.44	3.777	5	2/26/01	2.545	3.940	2
1/12/01	2.44	3.777	5	2/27/01	2.499	3.868	5
1/13/01	2.44	3.777	5	2/28/01	2.264	3.505	2
1/14/01	2.44	3.777	5	3/1/01	2.444	3.783	2
1/15/01	2.44	3.777	5	3/2/01	2.393	3.704	2
1/16/01	2.44	3.777	5	3/3/01	2.496	3.864	2
1/17/01	2.44	3.777	5	3/4/01	2.802	4.337	2
1/18/01	2.44	3.777	5	3/5/01	2.315	3.584	2
1/19/01	2.44	3.777	5	3/6/01	2.235	3.460	2
1/20/01	2.44	3.777	5	3/7/01	2.345	3.630	8
1/21/01	2.44	3.777	5	3/8/01	2.217	3.432	4
1/22/01	2.44	3.777	5	3/9/01	2.088	3.232	12
1/23/01	2.44	3.777	5	3/10/01	2.052	3.176	4
1/24/01	2.44	3.777	5	3/11/01	1.927	2.983	4
1/25/01	2.44	3.777	5	3/12/01	2.274	3.520	2
1/26/01	2.44	3.777	5	3/13/01	2.421	3.748	2
1/27/01	2.44	3.777	5	3/14/01	2.281	3.531	2
1/28/01	2.44	3.777	5	3/15/01	2.808	4.347	2
1/29/01	2.44	3.777	5	3/16/01	2.278	3.526	2
1/30/01	2.44	3.777	5	3/17/01	2.146	3.322	2
1/31/01	2.17	3.359	2	3/18/01	2.086	3.229	2
2/1/01	2.083	3.224	10	3/19/01	2.168	3.356	2
2/2/01	2.144	3.319	5	3/20/01	2.73	4.226	10
2/3/01	2.002	3.099	5	3/21/01	3.426	5.303	4
2/4/01	1.971	3.051	8	3/22/01	2.707	4.190	2
2/5/01	2.069	3.203	41	3/23/01	2.382	3.687	2
2/6/01	2.211	3.423	36	3/24/01	2.307	3.571	3
2/7/01	2.135	3.305	58	3/25/01	2.177	3.370	3
2/8/01	2.434	3.768	2	3/26/01	2.301	3.562	2
2/9/01	2.306	3.570	28	3/27/01	2.069	3.203	2
2/10/01	2.327	3.602	29	3/28/01	2.306	3.570	2
2/11/01	1.998	3.093	29	3/29/01	3.217	4.980	2

Final Fecal Coliform TMDL for Rocky River

Date	MGD	CFS	Effluent FC Conc	Date	MGD	CFS	Effluent FC Conc
3/30/01	3.078	4.765	2	5/15/01	2.582	3.997	2
3/31/01	2.546	3.941	2	5/16/01	2.627	4.067	6
4/1/01	2.398	3.712	2	5/17/01	2.761	4.274	2
4/3/01	2.44	3.777	2	5/18/01	2.514	3.892	3
4/4/01	2.563	3.967	2	5/19/01	2.677	4.144	3
4/5/01	2.558	3.960	2	5/20/01	2.673	4.138	2
4/6/01	2.728	4.223	2	5/21/01	2.674	4.139	2
4/7/01	2.375	3.676	2	5/22/01	2.501	3.872	2
4/8/01	2.828	4.378	2	5/23/01			
4/9/01	2.555	3.955	2	5/24/01	2.648	4.099	2
4/10/01	2.71	4.195	2	5/25/01	2.714	4.201	6
4/11/01	2.772	4.291	2	5/26/01	2.482	3.842	2
4/12/01	2.368	3.666	2	5/27/01	2.225	3.444	2
4/13/01	2.451	3.794	2	5/28/01	2.391	3.701	2
4/14/01	2.185	3.382	2	5/29/01	2.677	4.144	2
4/15/01	2.403	3.720	2	5/30/01	2.533	3.921	2
4/16/01	2.158	3.341	2	5/31/01	2.552	3.950	2
4/17/01	2.321	3.593	2				
4/18/01	2.138	3.310	2				
4/19/01	2.36	3.653	2				
4/20/01	2.563	3.967	2				
4/21/01	2.374	3.675	2				
4/22/01	2.444	3.783	2				
4/23/01	2.936	4.545	2				
4/24/01	2.756	4.266	4				
4/25/01	2.49	3.854	2				
4/26/01	2.435	3.769	2				
4/27/01	2.568	3.975	2				
4/28/01	2.093	3.240	2				
4/29/01	2.635	4.079	4				
4/30/01	2.44	3.777	4				
5/1/01	2.496	3.864	6				
5/2/01	2.763	4.277	10				
5/3/01	2.583	3.998	10				
5/4/01	2.613	4.045	7				
5/5/01	2.284	3.536	7				
5/6/01	2.521	3.902	2				
5/7/01	2.402	3.718	2				
5/8/01	2.596	4.019	4				
5/9/01	2.592	4.012	2				
5/10/01	2.629	4.070	2				
5/11/01	2.449	3.791	2				
5/12/01	2.264	3.505	2				
5/13/01	2.412	3.734	2				
5/14/01	2.799	4.333	2				

Appendix II. North Carolina Division of Water Quality Ambient Data Fecal Coliform Concentrations at Station Q7330000 (SR2420). The remark codes are listed below the data.

Date	Fecal Coliform Concentration	Remark
5/2/95 11:00	13000	
6/12/95 10:20	11000	
7/17/95 10:00	70	
8/9/95 10:35	1400	
9/12/95 11:15	970	
10/2/95 10:10	200	
11/20/95 10:50	110	
12/19/95 16:10	3100	
1/29/96 16:10	800	
2/20/96 10:00	2000	
3/12/96 10:55	260	
4/22/96 9:40	580	
5/13/96 9:40	390	
6/19/96 15:20	580	
7/18/96 16:20	680	
8/15/96 14:40	510	
9/16/96 10:50	630	
10/30/96 16:30	180	
11/18/96 10:10	100	
12/16/96 13:30	100	
1/9/97 13:45	13000	
2/13/97 9:20	36	
3/26/97 11:50	2000	
4/29/97 11:45	27	
5/15/97 13:35	2200	
6/17/97 15:55	350	
7/29/97 10:10	260	
8/18/97 16:05	600	
9/29/97 9:40	260	
10/29/97 15:50	100	
11/24/97 14:55	300	
12/15/97 13:15	27	
1/14/98 13:20	82	
2/5/98 9:40	14	
3/3/98 9:45	140	
4/2/98 15:55	230	
5/7/98 10:30	3800	
6/18/98 14:00	440	
7/23/98 10:30	900	
8/3/98 16:55	660	
9/3/98 11:30	460	A
10/26/98 15:30	1500	

11/30/98 15:40	36	
12/29/98 11:00	10	K
1/25/99 10:10	320	
2/24/99 15:20	10	K
3/25/99 10:40	45	
4/14/99 11:05	290	
5/5/99 9:25	160	
6/7/99 11:45	120	
7/21/99 15:50	400	
8/11/99 10:30	180	J
9/8/99 10:00	140	J
10/5/99 11:40	300	
11/3/99 9:35	130	J
12/21/99 10:13	230	
1/3/00 15:40	320	
2/10/00 10:40	100	
3/29/00 11:00	81	
2000-04-13	400	
2000-05-16	270	
2000-06-27	520	
2000-07-26	440	
2000-08-22	1500	
2000-09-27	440	
2000-10-24	290	
2000-11-30	290	
2000-12-19	490	
2001-01-18	110	
2001-02-20	200	
2001-04-25	2100	
2001-06-06	980	

STORET REMARK CODES

A	Value reported is the mean of two or more determinations.
B	Results based upon colony counts outside the acceptable range.
C	Value calculated. (Also see "$")
D	Indicates field measurement.
E	Indicates extra samples taken at composite stations.
F	In the case of species, F indicates female sex.
G	Value reported is the maximum of two or more determinations.
H	Value based on field kit determination; results may or may not be accurate.
J	Estimated value; value not accurate.
K	Actual value is known to be less than value given.
L	Actual value is known to be greater than value given.
M	Presence of material verified but not quantified. In the case of temperature or oxygen reduction potential, M indicates a negative value. In the case of species, M indicates male sex.
N	Presumptive evidence of presence of material.
O	Sampled, but analysis lost or not performed.
P	Too numerous to count.
Q	Sample held beyond normal holding time.
R	Significant rain in the past 48 hours.
S	Laboratory test.
T	Value reported is less than criteria of detection.
U	Indicates material was analyzed for, but not detected. In case of species, U indicates undetermined sex.
V	Indicates the analyte was detected in the sample and associated blank method.
W	Value observed is less than the lowest value reportable under "T" code.
X	Value is quasi vertically integrated sample.
Y	Laboratory analysis from unpreserved data may not be accurate.
Z	Too many colonies were present to count (TMTC), the numeric value represents the filtration volume.
$	Calculated value. (also see "C")

Appendix III. Yadkin Pee-Dee River Basin Association Discharger Coalition Monitoring Station Q7330000.

DATE	FC Conc (col/100ml)	REMARK
6/2/98	480	
7/15/98	5900	
8/4/98	590	
9/3/98	6000	L
10/22/98	1600	
11/17/98	390	
12/21/98	370	
1/13/99	180	
2/9/99	1200	P
3/18/99	68	B
4/13/99	240	
5/4/99	380	
6/8/99	320	
7/27/99	320	
8/3/99	55	B
9/16/99	1000	B
10/19/99	160	
11/9/99	110	
12/21/99	3100	
1/19/00	68	B
2/7/00	42	B
3/30/00	260	
4/28/00	450	
5/3/00	2000	
6/7/00	600	B
7/6/00	330	
9/15/00	5500	
10/19/00	6000	P
11/20/00	480	
12/19/00	470	
1/11/01	140	B
2/21/01	1300	B
3/13/01	180	B
4/19/01	210	
5/9/01	480	
6/7/01	310	
7/18/01	320	
8/8/01	49	
9/12/01	190	
10/10/01	150	

Date	FC Conc. Upstream	FC. Conc Downstream
1/3/96	370	4200
1/10/96	160	110
1/17/96	600	1060
1/24/96	2200	410
1/31/96	310	180
2/7/96	320	400
2/14/96	160	370
2/21/96	240	220
2/28/96	580	6000
3/6/96	1800	780
3/14/96	110	140
3/20/96	100	6000
3/27/96	220	510
4/3/96	220	250
4/10/96	250	200
4/18/96	450	580
4/24/96	250	400
5/2/96	340	1200
5/8/96	100	210
5/16/96	200	300
5/22/96	520	230
5/29/96	100	460
6/3/96	580	280
6/5/96	480	220
6/7/96	4400	340
6/10/96	7200	1080
6/12/96	700	400
6/14/96	560	230
6/17/96	470	310
6/19/96	660	410
6/21/96	920	1080
6/24/96	380	330
6/26/96	280	320
6/28/96	190	190
7/1/96	510	250
7/3/96	800	1160
7/4/96	594	300
7/8/96	200	110
7/10/96	520	260
7/12/96	180	160
7/15/96	760	380
7/17/96	390	280
7/19/96	1060	2100
7/22/96	290	460
7/24/96	220	110
7/26/96	2300	2700
7/29/96	70	40

Date	FC Conc. Upstream	FC. Conc Downstream
7/31/96	330	170
8/2/96	3000	2000
8/5/96	230	140
8/7/96	120	130
8/9/96	180	200
8/12/96	3700	980
8/14/96	230	140
8/16/96	10	90
8/19/96	340	100
8/21/96	220	220
8/23/96	488	420
8/26/96	960	263
8/28/96	500	2900
8/30/96	370	960
9/3/96	6000	740
9/5/96	1680	3200
9/6/96	5400	5300
9/9/96	425	220
9/11/96	40	60
9/13/96	120	90
9/16/96	110	370
9/18/96	400	260
9/20/96	90	120
9/23/96	320	1000
9/25/96	190	140
9/27/96	380	220
10/2/96	180	420
10/9/96	1080	350
10/16/96	620	10
10/23/96	3600	210
10/30/96	600	30
11/6/96	200	40
11/13/96	100	50
11/20/96	90	80
11/27/96	41	50
12/4/96	106	100
12/11/96	280	100
12/19/96	3400	520
12/23/96	231	28

Appendix IV. Mooresville WWTP Upstream/Downstream Data 1996 – June 1998.

	FC Conc.	FC Conc.
Date	Upstream	Downstream
01/08/97	50	31
01/15/97	150	63
01/22/97	181	38
01/29/97	188	131
02/02/97	550	113
02/12/97	125	59
02/19/97	56	25
02/26/97	110	38
03/05/97	81	57
03/12/97	106	69
03/20/97	660	44
03/26/97	4800	5200
04/02/97	60	13
04/09/97	29	50
04/16/97	119	47
04/24/97	420	280
04/30/97	563	169
05/07/97	131	119
05/14/97	450	144
05/21/97	560	840
05/28/97	660	135
06/02/97	450	250
06/05/97	365	230
06/06/97	200	210
06/09/97	430	425
06/11/97	1150	230
06/13/97	3200	4700
06/16/97	520	290
06/19/97	470	350
06/20/97	310	81
06/24/97	620	210
06/25/97	490	113
06/27/97	1188	595
06/30/97	150	144
07/02/97	830	500
07/03/97	210	119
07/07/97	330	144
07/09/97	210	113
07/11/97	360	297
07/14/97	440	125
07/16/97	2833	230
07/18/97	1260	370
07/21/97	1469	530
07/24/97	8500	6200

	FC Conc.	FC Conc.
Date	Upstream	Downstream
07/31/97	835	365
08/01/97	320	347
08/04/97	360	69
08/06/97	210	50
08/08/97	240	2250
08/12/97	250	240
08/13/97	300	280
08/15/97	900	610
08/18/97	450	230
08/20/97	320	100
08/22/97	375	95
08/25/97	110	53
08/27/97	230	350
08/29/97	250	210
09/03/97	175	125
09/04/97	143	181
09/05/97	240	700
09/08/97	138	156
09/10/97	1180	1630
09/12/97	470	527
09/15/97	113	125
09/17/97	443	81
09/19/97	219	295
09/22/97	181	138
09/25/97	1100	1533
09/26/97	210	330
10/01/97	38	113
10/08/97	340	210
10/15/97	1450	730
10/22/97	460	138
10/31/97	680	144
11/05/97	290	131
11/12/97	450	140
11/20/97	550	38
11/25/97	113	53
12/03/97	260	88
12/11/97	181	56
12/17/97	25	124
12/22/97	800	520
12/31/97	513	6

07/25/97	5000	5500
07/28/97	960	200

Date	FC Conc. Upstream	FC. Conc Downstream
01/07/98	320	210
01/14/98	100	113
01/21/98	210	540
01/29/98	88	24
02/06/98	280	156
02/13/98	430	106
02/18/98	220	250
02/26/98	106	88
03/04/98	1100	100
03/11/98	138	94
03/20/98	129	163
03/25/98	230	53
04/01/98	685	290
04/08/98	340	270
04/17/98	6000	6000
04/22/98	230	144
04/29/98	405	270
05/06/98	260	70
05/13/98	1100	180
05/20/98	370	150
05/29/98	505	450

Appendix V. Division of Water Quality Intensive Fecal Coliform Study in the Rocky River Watershed.

Station #		Description	Date	Fecal Coliform /100ml	Remark Code	Geometric Mean	Arithmetic Mean	Standard Deviation
DYE-1	1	Dye Creek in Iredell Co. at SR 1142	4/11/01	30		68	80	50
DYE-1	1A		4/11/01	81				
DYE-1	1B		4/11/01	130				
DYE-1	1		4/19/01	450		416	417	35
DYE-1	1A		4/19/01	420	A			
DYE-1	1B		4/19/01	380				
DYE-1	1		4/26/01	1	U	1	1	0
DYE-1	1A		4/26/01	1	U			
DYE-1	1B		4/26/01	1				
DYE-1	1		5/3/01	75		149	165	78
DYE-1	1A		5/3/01	210				
DYE-1	1B		5/3/01	210				
DYE-1	1		5/10/01	56		59	59	7
DYE-1	1A		5/10/01	55				
DYE-1	1B		5/10/01	67	B4			
DYE-1	1		5/17/01	520		1369	1707	1190
DYE-1	1A		5/17/01	1700	B1			
DYE-1	1B		5/17/01	2900				
DYE-1	1		5/24/01	57		54	54	4
DYE-1	1A		5/24/01	50				
DYE-1	1B		5/24/01	54				
DYE-1	1		5/31/01	76	B4	140	233	283
DYE-1	1A		5/31/01	64	B4			
DYE-1	1B		5/31/01	560				
RR-1	1	Rocky River in Iredell Co. at NC 136	4/11/01	69		70	70	1
RR-1	1A		4/11/01	70				
RR-1	1B		4/11/01	70				
RR-1	1		4/19/01	73		77	77	7
RR-1	1A		4/19/01	73				
RR-1	1B		4/19/01	85				
RR-1	1		4/26/01	180		209	217	72
RR-1	1A		4/26/01	170				
RR-1	1B		4/26/01	300				
RR-1	1		5/3/01	240		231	233	40
RR-1	1A		5/3/01	270				
RR-1	1B		5/3/01	190	B1			
RR-1	1		5/10/01	80	B4	116	120	35
RR-1	1A		5/10/01	140	B1			
RR-1	1B		5/10/01	140	B1			

RR-1	1		5/17/01	340		397	403	93
RR-1	1A		5/17/01	360				
RR-1	1B		5/17/01	510				
RR-1	1		5/24/01	240		283	297	116
RR-1	1A		5/24/01	430				
RR-1	1B		5/24/01	220				
RR-1	1		5/31/01	130	B1	143	143	12
RR-1	1A		5/31/01	150	B1			
RR-1	1B		5/31/01	150	B1			
RR-2	1	Rocky River in Iredell Co. at SR 1142	4/11/01	410		433	433	25
RR-2	1A		4/11/01	460				
RR-2	1B		4/11/01	430				
RR-2	1		4/19/01	210		220	220	17
RR-2	1A		4/19/01	210				
RR-2	1B		4/19/01	240				
RR-2	1		4/26/01	1700	B1	1384	1400	265
RR-2	1A		4/26/01	1300	B1			
RR-2	1B		4/26/01	1200	B1			
RR-2	1		5/3/01	150	B1	206	213	71
RR-2	1A		5/3/01	200	B1			
RR-2	1B		5/3/01	290				
RR-2	1		5/10/01	390		374	377	51
RR-2	1A		5/10/01	320				
RR-2	1B		5/10/01	420				
RR-2	1		5/17/01	910	B4	859	860	50
RR-2	1A		5/17/01	860	B4			
RR-2	1B		5/17/01	810	B4			
RR-2	1		5/24/01	240		250	250	10
RR-2	1A		5/24/01	260	J2			
RR-2	1B		5/24/01	250				
RR-2	1		5/31/01	220	J2	213	213	12
RR-2	1A		5/31/01	200				
RR-2	1B		5/31/01	220				
Q7330000	1	Rocky River in Mecklenburg Co. at SR 2420	4/11/01	260		220	223	47
Q7330000	1A		4/11/01	240				
Q7330000	1B		4/11/01	170				
Q7330000	1		4/19/01	630		614	617	71
Q7330000	1A		4/19/01	680				
Q7330000	1B		4/19/01	540				
Q7330000	1		4/26/01	200		271	277	67
Q7330000	1A		4/26/01	310				
Q7330000	1B		4/26/01	320				
Q7330000	1		5/3/01	330		375	377	40
Q7330000	1A		5/3/01	400				

Q7330000	1B		5/3/01	400				
Q7330000	1		5/10/01	560		575	577	57
Q7330000	1A		5/10/01	530				
Q7330000	1B		5/10/01	640	B4			
Q7330000	1		5/17/01	5800		5460	5500	794
Q7330000	1A		5/17/01	4600				
Q7330000	1B		5/17/01	6100	B3			
Q7330000	1		5/24/01	590		609	610	44
Q7330000	1A		5/24/01	660	B4			
Q7330000	1B		5/24/01	580				
Q7330000	1		5/31/01	850	B4	819	820	44
Q7330000	1A		5/31/01	840	B4			
Q7330000	1B		5/31/01	770	B4			

Appendix VI. Public Notification of Rocky River Fecal Coliform TMDL

Rocky River, Yadkin-Pee Dee River Basin
Grants Creek, Yadkin-Pee Dee River Basin

Now Available Upon Request

Rocky River (in Subbasin 03-07-11)
Fecal Coliform Total Maximum Daily Load

Grants Creek (in Subbasin 03-07-04)
Fecal Coliform Total Maximum Daily Load

Are now available upon request from the North Carolina Division of Water Quality. These TMDL studies were prepared as a requirement of the Federal Water Pollution Control Act, Section 303(d). The studies identify the sources of pollution, determine allowable loads to the surface waters, and suggest allocations for pollutants of concern.

TO OBTAIN A FREE COPY OF THE TMDL REPORTS:

Please contact Ms. Robin Markham (919) 733-5083, extension 558 or write to:

Ms. Betsy Albright
Water Quality Planning Branch
NC Division of Water Quality
1617 Mail Service Center
Raleigh, NC 27699-1617

Interested parties are invited to comment on the draft TMDL study by May 24, 2002. Comments and questions concerning the reports should be directed to Ms. Betsy Albright (ext. 514) at the above number and address. The draft TMDLs are also located on the following website: http://h2o.enr.state.nc.us/tmdl

Public Meetings Notice

Rocky River TMDL

A public meeting to discuss the Rocky River Fecal Coliform TMDL will be held On Wednesday, May 8th at 11:00am at the following address:

DENR Mooresville Regional Office
919 North Main Street
Mooresville, NC 28115

Grants Creek TMDL

A public meeting to discuss the Grants Creek Fecal Coliform TMDL will be held on Wednesday, May 8th at 3:30pm at the following address

Rowan County Center
2727-A Old Concord Road
Salisbury, NC 28146

THE MOORESVILLE **Tribune**

Saturating 95% of South Iredell and Iredell Lake Norman Shoreline

P.O. Box 300 - 147 E. Center Ave.
Mooresville, NC 28115
(704) 664-5554 • Fax (704) 664-3614

Public Notice
State of North Carolina
Division of Water Quality

Availability of the Rocky River Fecal Coliform Total Daily Load (TMDL). Copies of the TMDL may be obtained by calling Robin Markham (919)733-5083 ext. 558 or on the internet at http://h20.enr.state.nc.us/tmdl. A public meeting will be held at 11:00am, May 8th at the Mooresville DENR Regional Office at 919 North Main Street, Mooresville. Written comments regarding the TMDL will be accepted until May 24, 2002. Please mail comments to MS. Betsy Albright, TMDL Coordinator-Yakin Pee-Dee River Basin, Water Quality Planning Branch, NC Division of Water Quality, 1617 Mail Service Center, Raleigh, NC 27699-1617

NORTH CAROLINA
IREDELL COUNTY

AFFIDAVIT OF PUBLICATION

Before the undersigned, a Notary Public of said County and State, duly commissioned, qualified and authorized by law to administer oaths, personally appeared.

......Kay Allen...... who being first duly sworn, deposes and says: that he/she is the......

Legal Ad Clerk ...... of a Media General Newspaper of Mooresville, Inc., engaged in the publication of a newspaper known as the Mooresville Tribune, published, issued, and entered as second class mail in the Town of Mooresville, in said County and State; that he/she is authorized to make this affidavit and sworn statement; that the notice or other legal advertisement, a true copy of which is attached hereto, was published in the The Mooresville Tribune on the following dates:

......4/3, 4/10, 4/17, 4/24/02......

......

and that the said newspaper in which such notice, paper, document or legal advertisement was published was, at the time of each and every such publication, a newspaper meeting all of the requirements and qualifications of Section 1-597 of the General Statues of North Carolina and was a qualified newspaper within the meaning of Section 1-597 of the General Statues of North Carolina.

This ..24th.. day of ..April.., 20..02..

MEDIA GENERAL NEWSPAPERS OF MOORESVILLE, INC.

By ......Kay Allen......

Legal Ad Clerk
......
title

Sworn to and subscribed before me, this ..24th..

day of ..April.., 20..02..

......LeAnna B. Zalepka......
Notary Public

My Commission Expires April 6, 2004

My Commission expires: ......

LeANNA B. ZALEPKA
NOTARY
My Comm Exp April 6, 2004
PUBLIC
IREDELL COUNTY, NC

NORTH CAROLINA
FARM BUREAU FEDERATION

TELEPHONE (919) 782-1705 / P. O. BOX 27766 / RALEIGH, NORTH CAROLINA 27611

May 24, 2001

Ms. Betsy Albright
TMDL Coordinator-Yadkin-Pee Dee River Basin
Water Quality Planning Branch
NC Division of Water Quality
1617 Mail Service Center
Raleigh, NC 27699-1617

Dear Ms. Albright:

The North Carolina Farm Bureau Federation is the state's largest general farm organization, representing the interests of farmers and rural families all across our state. This letter is to comment on DWQ's Public Review Drafts of Total Maximum Daily Loads (TMDL) for fecal coliform in the Rocky River and Grants Creek, both in the Yadkin-Pee Dee River Basin. Farm Bureau is very concerned about the proposed TMDL's and opposes them in their current form.

In the draft TMDL for fecal coliform, you attribute most of the blame for excessive fecal coliform levels on non-point source pollution, especially livestock operations within these subbasins. We believe that this assertion is unfair and based on faulty assumptions, estimates, and other unknowns that are part of the Coliform Routing and Allocation Program (CRAP) model. The model (which determines the sources of fecal coliform pollution and allows the monthly input of stream flow and fecal coliform loading concentrations) contains entirely faulty assumptions regarding what happens on real-world farms.

The document indicates that there are no permitted CAFOs in the watersheds, but that there are several small livestock operations in the lower portion of the watersheds. In other parts of the document, the CRAP model assumes 100% of herbaceous cover is occupied by livestock and grazed daily, 100% of cultivated land is receiving animal waste, herbaceous lands are contributing fecal coliform at maximum levels of 5,000 cfu/100ml every wet day of the year, fecal coliform continues to be deposited instream at 500cfu/100ml on all dry weather days and that point sources aren't a problem at all. All of these assumptions misrepresent fecal coliform contributions from nonpoint sources, especially agriculture, and therefore unfairly allocate the majority of the proposed reductions to these nonpoint sources.

These issues are discussed in further detail in this letter. Because the same model is used in both subbasins, we will refer to the Rocky River document; however, the comments also apply to the Grants Creek document.

The model assumes that cattle populations were evenly distributed on herbaceous land throughout the counties (page 20). Since no information on site specific annual grazing patterns were available, it was assumed that there is no monthly variation in grazing on grazed pastureland throughout the year. On real cattle farms this cannot happen. The cattle eat grass in one pasture, and then are moved to another pasture, in order for the grass in the first pasture to grow. Therefore, some grazed pastureland is idle at all times.

Also, you assume (page 20) that all herbaceous land is grazed. This is certainly not correct. Based on our experience with the data on land cover, we know that the category "herbaceous and/or pasture land" can include grazed pasture. But it also includes hayland (used for hay production and not grazed), idle land, land in conservation easements (such as Conservation Reserve Program (CRP) land), and even golf courses and parks. However your model description says, "cattle grazing is linked to herbaceous cover" (page 18.) To claim that all pasture and herbaceous land is grazed and has animal manure on it is a ridiculous assumption.

Your report acknowledges that one study (Stephenson and Street, p. 20) observed that the presence of cattle on rangelands increased fecal coliform concentrations from 0 to 2500/100ml instream. First, rangelands are out in the western US and have little relevance in North Carolina. We feel that if you contact North Carolina State University you will find that they have more relevant work on this. The other study cited (Doran) is from 1981, which is really old, and it does not measure instream contributions. Get information from North Carolina. Contact NCSU and get more recent information.

Also, rather than choosing an amount some where in the middle of the range of 0 – 2500 (page 22), you choose instead to go with a level of 5000/100ml for wet days and 500/100ml for dry days. Using the highest instream measured number, the maximum it could be, based on your limited data cited here, is 2500. Further, if the same method were used for the development category, the highest measurement "in the tributary," meaning instream, is 240,046. Had the same tactic been used when calculating the fecal coliform load from development, levels would have been set at 240,046/100ml rather than the proposed level of 8,700 /100ml.

There is no justification given in the document for the 500/100ml (p. 20) for dry weather contributions at all from pasture and herbaceous cover. Where did this come from? Further, regarding the dry weather contributions, we assume that when there is no surface contribution that what is being transported is in the surficial groundwater. Based on residence time in groundwater a contribution of 500/100ml of fecal coliform for dry days just does not make sense when calculating the fecal coliform load from herbaceous cover, whether or not that land has livestock grazing on it. Keep in mind that herbaceous cover includes much more than just pastureland and certainly does not have animals on it. Also, herbaceous cover will have microbial activity in the surface layers to destroy the fecal coliform where impervious areas will not.

Most cultivated land in North Carolina is not fertilized with animal manures or waste (p. 21.) Most cultivated land is fertilized with mineral fertilizer. To assume that all cultivated lands in these subbasins are fertilized with animal manures or waste is just not credible. Again, this overestimates the contribution from agriculture, because mineral fertilizer is not a fecal coliform source.

More up to date land cover information is needed (page 3). In almost all instances where we have seen more up to date land cover information, the amount of cultivated land in the basins has decreased over time. Much of the data used to develop the draft TMDL is either old (obsolete/out-dated) or incomplete. For example, the information on land cover within the Rocky River watershed is from 1996. Land use patterns with the watershed have surely changed since then and therefore should be reflected in this document. Since many of the assumptions and estimates made in the draft TMDL are based on land cover within the basin, it is critical that these numbers be current. There is more recent information available to DWQ, such as more recent flights and satellite data, and that more recent data should be used.

The model assumes (page 18) "that flow yields from each of the land covers in the watershed are equal." This will wildly underestimate the flow from developed land and impervious surfaces. The fact that you do not have an even higher contribution (based on higher flow) from high intensity development is faulty. The amount of impervious surface in high intensity development will (obviously) increase flow over either low intensity development or from herbaceous, forest or cropland.

Because of infiltration in pastures and on cropland and herbaceous cover, the surface flow to streams will be less than from developed land. Yes, the amount of flow to surficial groundwater will be higher, but due to the increase in residence time underground, the fecal coliform bacteria will have more time to be killed before reaching surface waters. Failure to take these two situations into consideration again wildly overestimates the contributions of fecal coliform from farms.

On page 29 it is stated that the model was varied throughout the year to reflect changes in fecal coliform loading due to monthly changes in agricultural management practices. We do not see where this was done, and, if it was, the variation will be far overshadowed by the overestimates of agricultural contributions as described above. Further, because it was assumed that every acre was grazed everyday on herbaceous land, where would the seasonal variability be in the model? If the seasonal variability is for cropland, and you have assumed that all cropland receives animal waste, then you must also take into account that cattle waste would only be applied once or twice a year, and the time of year when those applications occur is relevant to the loading assigned to agricultural land.

It is important to note that the point source measurements were provided by the dischargers, who get to choose when they sample (p. 33 referencing Appendix 1). Their reduction allocation of zero implies that they either have no significant contribution, or that they cannot reduce the contribution that they have. We disagree, and think this should be reexamined, with DWQ doing random sampling rather than solely relying on data provided by the dischargers.

Also, the model shifts sanitary sewer overflows to development (p. 31.) SSOs should be the responsibility of the point sources, and they should be allocated a reduction in order to spur them to further seek and reduce faults in sewer lines. These contribute untreated sewerage, and the associated fecal coliform, into the waters and groundwater systems—groundwater without the benefit of infiltration through several inches or feet of surface soil, with its associated higher microbial activity, such as would happen in a pasture.

Lastly, the document describes the roles for local governments and agencies in developing implementation plans for the TMDL (page 34). It is critical that Farm Bureau and farmers be involved in development of any management strategy.

The CRAP model is a very simplistic model. Further, a model is only as good as the data that goes into it. It is clear that most of the data entered into the CRAP model, particularly regarding agriculture, is based on unknowns, assumptions, estimates, and a complete lack of understanding of farmland and farming. Because of these unknowns and overestimates of agriculture's contribution to fecal coliform loading, we believe that farmers are unfairly asked to shoulder a disproportionate share of the reductions that would be part of the TMDL strategies for these subbasins.

Therefore, we oppose these Draft TMDLs.

We strongly urge your department to allow more time to verify contributions to fecal coliform loading in these two subbasins before submitting the proposed TMDLs to the U.S. Environmental Protection Agency and to correct the faulty assumptions made about agriculture in the model. In addition, we request that when contributions have been identified, more time to be allowed to implement voluntary programs. We would oppose regulatory mandates in these TMDL strategies.

Thank you for the opportunity to comment on these Draft TMDL documents.

Sincerely,

Larry B. Wooten

Larry Wooten
President

LBW:afc:bms

Final Fecal Coliform TMDL for Rocky River

Appendix VII. DWQ Response to Public Comment on the Public Review Draft of the Rocky River Fecal Coliform TMDL

The North Carolina Division of Water Quality welcomes the comments from the North Carolina Farm Bureau Federation. As sited in the TMDL, the Coliform Routing and Allocation Program is a simple model and is used by DWQ when there is a dearth in site-specific fecal coliform concentration data. DWQ recognizes that there is uncertainty associated with the modeling and input data used in the modeling. Where there was not site specific or North Carolina based data available, an extensive literature review was conducted in order to determine the most appropriate input values for the CRAP model. DWQ recognizes that the land cover/land use is from 1996 and uncertainty in the modeling exists because of the age of this data. However, DWQ has recently conducted watershed reconnaissance and feels that the model appropriately approximates the presence and absence of livestock throughout the watershed.

The hydrology portion of the model is based on daily flow values which were calculated using an aerial weighting approach utilizing a gaged stream in a nearby watershed. These flows were adjusted to account for the discharge from the Mooresville WWTP (NC4672800).

The model assumes that livestock grazing and manure application occur only in watersheds 04-07. The area around Mooresville (including the herbaceous land in WS01-WS03) did not include livestock grazing or manure application in the model. The CRAP model is based on average conditions, while manure might not be deposited or applied every day throughout a specified period, fecal coliform polluted runoff does occur after manure has been deposited or applied. Stephenson and Street (1978), and Jawson et al. (1982) have determined that elevated levels of bacteria may persist in pasture runoff months after cattle have been removed from the pastureland.

Due to the level of uncertainty in the modeling assumptions and the input data, the DWQ supports an adaptive management approach to reducing the fecal coliform levels within Rocky River. We very much welcome the North Carolina Farm Bureau Federation's involvement in developing a fecal coliform management strategy for the Rocky River.

References:

Stephenson, G.R. and L.U. Street. 1978. Bacterial Variations in streams from a southwest Idaho rangeland watershed. J. Environ. Qual. 7:150-57

Jawson, M.D., L.F. Elliot, K.E. Saxton, and D.M. Fortier. 1982. The effect of cattle grazing on indicator bacteria in runoff from a Pacific Northwest watershed. J. Environ. Qual. 11:621-7