Final Total Maximum Daily Load (TMDL)
for Fecal Coliform

October 2001

Fourth Creek (Subbasin 03-07-06)
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
Fourth Creek	SR2308 in Iredell County to 1.5 miles upstream of Rowan County SR1985	C	15-4b	03040102	9.5

8 Digit Cataloging Unit(s) 03040102

Area of Impairment 9.5 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 Fourth Creek Fecal Coliform TMDL was publically noticed through various means, including mailings to interested parties in the Yadkin-Pee Dee River Basin. A public comment period was held for the 45 days prior to May 23, 2001. A public meeting was held in Statesville on April 30, 2001.

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 V of the TMDL document

TMDL Information

Critical condition	wet weather, late spring-early summer
Seasonality	Modeled from 1995-1999 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, Fourth Creek (Sub-basin 03-07-06)"

TMDL(s)

Loading allowed at critical condition:

Wasteload Allocation (WLA): 9.09×10^{11} cfu per 30 days
Load Allocation (LA): 4.59×10^{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		0%	0%
	High Density Development	WS04-WS05	97%	60%
	Low Density Development	WS04-WS05	97%	60%
	Livestock Grazing/Manure Application (Pastureland)	WS02	95%	40%
		WS03	98%	40%
		WS04	98%	40%
		WS05	97%	50%
	Manure Application (Cultivated)	WS02	88%	40%
		WS03	96%	40%
		WS04-WS05	94%	40%
	Wildlife	WS01-WS05	0%	0%

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

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1.0 INTRODUCTION

The North Carolina Division of Water Quality (DWQ) has identified a 9.5 mile segment (12-108-20-(1)b) of Fourth Creek 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 State Road 2308 in Iredell County and 1.5 miles upstream of Rowan County State Road 1985. This section of the stream, located in subbasin 03-07-06, 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 Fourth Creek. Although an implemetation 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

Fourth Creek, located in the central piedmont region of North Carolina, drains to the Yadkin-Pee Dee River Basin. Figure 1 depicts the location of Fourth Creek in North Carolina. The Fourth Creek watershed in the TMDL includes the drainage area above the confluence of Fourth and

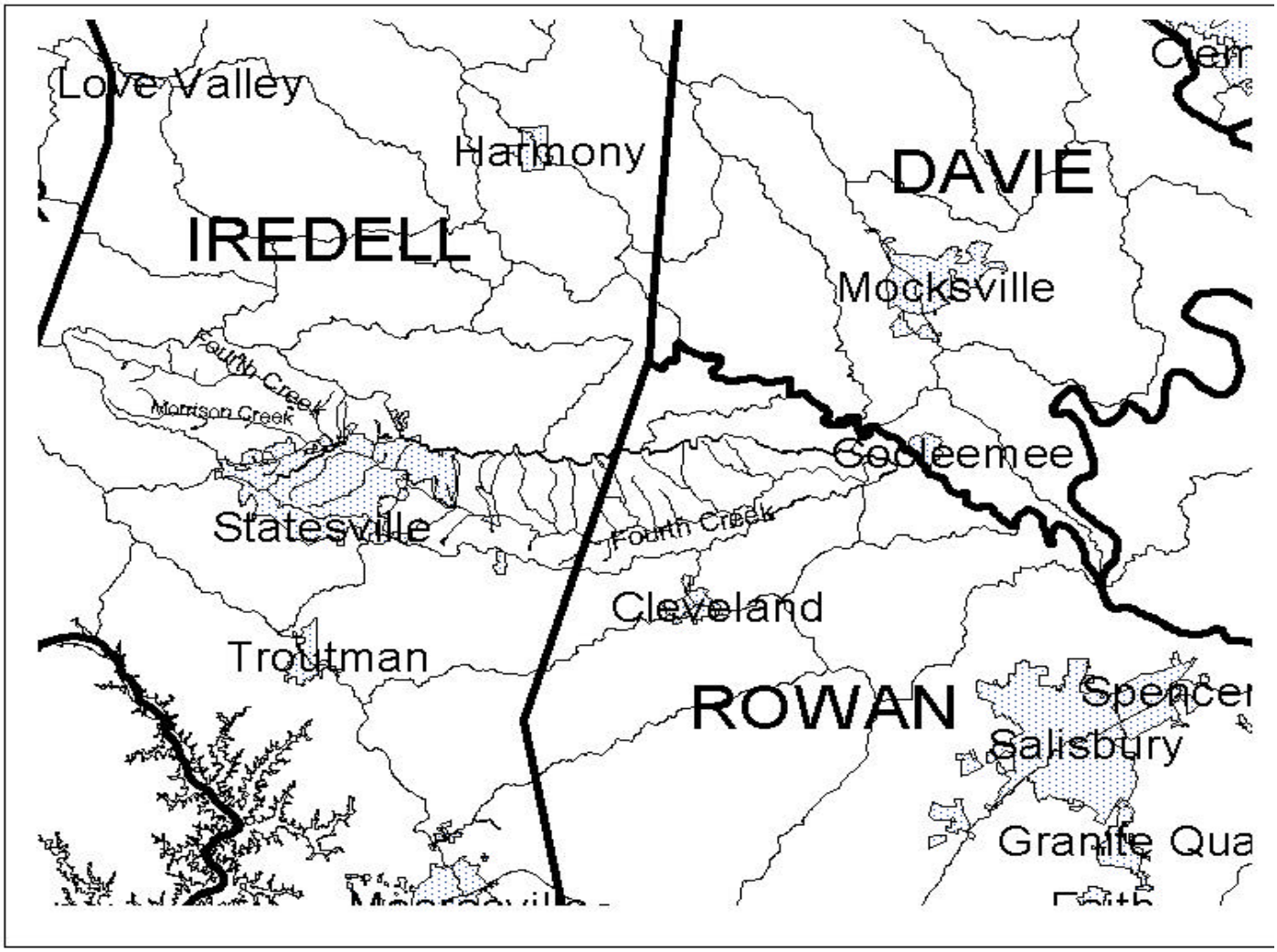
Third Creeks. The Fourth Creek watershed is divided between Rowan and Iredell counties. The majority of the impaired stream segment is located in Rowan County. The portion of the watershed that lies in Iredell County has an area of 58.9 mi^2. The remaining portion of the watershed (24.1 mi^2) falls in Rowan County. The Fourth Creek watershed includes two 14 digit hydrologic units and is approximately 83 square miles (53,071 acres) in area. The city of Statesville (1993 population of 20,876), is located upstream of the ambient monitoring station within the Fourth Creek watershed.

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 Fourth and Third Creeks is shown in Table 1.

Land Cover/Land Use	Fourth Creek Watershed Acres (%)
Cultivated	3,420 (6.4%)
High Intensity Developed	1,708 (3.2%)
Low Intensity Developed	1,527 (2.9%)
Shrubland	366 (0.7%)
Forest	25,376 (47.8%)
Herbaceous Cover	20,522 (38.7%)
Open Water	122 (0.2%)
Total	53,071

Table 1. The land cover/land use coverage of the Fourth Creek watershed.

Figure 1. Fourth Creek Watershed, NC



1.2 Water Quality Monitoring Program

The segment of Fourth Creek was listed as impaired based on data from an ambient monitoring station located at SR 2308 near the town of Elmwood (Station Q3735000). Figure 2 shows the locations of the monitoring stations in the Fourth Creek watershed. The fecal coliform samples were collected on a monthly interval beginning in June 1995 to the present. A Yadkin-Pee Dee River Basin Association discharger coalition monitoring station is also sited at this location (Station Q3735000). An additional discharger coalition monitoring station is located in the headwaters of an unnamed tributary of Fourth Creek at SR 2316 (Q3720000). The discharger coalition has been monitoring fecal coliform concentrations at these locations since 1998. The data from these monitoring stations are shown in Appendix I. The Fourth Creek WWTP monitored instream fecal coliform concentrations at upstream and downstream locations in years prior to the discharger coalition monitoring. The upstream/downstream fecal coliform concentration data are shown in Appendix I.

The fecal coliform concentrations of the samples collected at the DWQ ambient monitoring station ranged from 27cfu/100ml to 11,000cfu/100ml. The fecal coliform concentrations for the samples collected by the discharger coalition at station Q3735000 ranged between 10 and 4,500 cfu/100ml between July 1998 and June 2000. Samples are collected at the DWQ ambient monitoring station and at the discharger coalition station on a monthly basis. As a result, the 30-day geometric mean of the samples could not be calculated using the minimum required 5 samples in 30 days.

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 Fourth Creek 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 and does not address the portion of the standard that limits the percentage of instantaneous excursions over 400cfu/100ml to twenty percent.

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 Fourth Creek watershed. The evaluation location of this watershed is located in Fourth Creek at SR2308, the location of the ambient monitoring and discharger coalition stations.

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 Fourth Creek 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 are two NPDES individually permitted dischargers in the Fourth Creek watershed. The Statesville WWTP (NC0031836) 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 monthly geometric means of the discharge are listed in Appendix II. The Fourth Creek WWTP land applies a percentage of the residuals generated during the wastewater treatment process. The residuals are land applied outside the Fourth Creek watershed in Alexander County (Smith Communication, 2001). The treatment plant processes the remainder of the residuals into an alkaline product for distribution to local farmers (Statesville, 2000). Southern States Cooperative treatment plant (NC0082821) does not discharge fecal coliform bacteria.

NDPES #	Facility Name	Facility Class	Permitted Flow	Receiving Water
NC0031836	Statesville WWTP	IV	4 MGD	Fourth Creek
NC0082821	Southern States Cooperative		0.114 MGD	Fourth Creek

Table 2. Individually permitted NPDES wastewater treatment facilities.

2.1.2 General Permitted NPDES Dischargers

There are five general permitted facilities located in the Fourth Creek watershed. Four of the facilities are 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. One single-family residence is permitted to discharge wastewater in the Fourth Creek watershed. The permitted limits of the facility include a maximum daily flow of 1000 gallons per day, a monthly geometric mean of 200cfu/100ml and a daily maximum of 400cfu/100ml.

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 Fourth Creek include wildlife, livestock (land application of agricultural manure and grazing), concentrated animal feed-lots, urban development (stormwater), failing septic systems, and sewer line systems (illicit connections, leaky sewer lines and sewer system overflows).

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).

2.2.1 Livestock

Iredell County is the leading dairying county and producer of chickens in North Carolina. With a total area of approximately 367,600 acres, Iredell County has an estimated 1,200 farms (Agriculture Census, 2001). In the 1997 Agricultural Census of Iredell County there were 180 poultry farms, 705 beef cow farms and 227 horse and pony farms. Compared to the rest of Iredell County, there are fewer total animals in the Fourth Creek watershed (Stevenson communication, 2001). Rowan County, with a total area of 327,296 acres is a producer of cattle, beef and milk cows, chickens, hogs and pigs. According to the 1997 Agricultural Census, there were 48 poultry farms, 473 beef farms and 36 dairy farms in Rowan County. There are no registered animal operations in the Rowan County portion of Fourth Creek. In 1997 there were 154 horse and pony farms throughout Rowan County (Agriculture Census, 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 or horses have direct access to streams, feces may be deposited directly into a stream. There are small, scattered beef operations (+/- 500 total animals) which may have access to streams in the Fourth Creek

watershed. There are a few beef farms that have fenced the streams out to not allow cattle access to the streams (Stevenson communication, 2001).

2.2.1.2 Agricultural Manure Application/Concentrated Animal Feedlot Operations

The three registered dairy cattle operations, located in Iredell County, have one onsite lagoon per operation. The average cattle population of the three operations range from 180-275 heads of cattle. There is an estimated total of 693 total dairy cattle on the 3 dairies. The dairy cattle may have limited access to streams. Dairy manure is mostly applied to cropland with some to pasutre/hayland. Manure is generally applied to cropland from March to June and from September to November. Manure is typically applied to pastureland during the same periods although application extends through December. Poultry litter produced by the chickens is routinely collected and applied as an alternative to fertilizer and applied predominately to pasture/hayland (Stevenson communication, 2001).

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 Iredell County Health Department has estimated that approximately 65-70% of the county population (1999 population of 117,800) is served by on-site septic tank systems (Sheeks communication, 2001). The Department of Environmental Health has estimated that Iredell and Rowan Counties have approximately 11,400 and 20,000 housing units on septic systems, respectively (DEH, 1999). In the Fourth Creek watershed, the number of septic systems per square mile is greatest in the area surrounding Statesville. Septic system failure rate data in North Carolina are very limited. 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. The city of Statesville owns and operates the Fourth Creek WWTP and the sewage collection system. In 1999, Statesville reported three sanitary sewer overflows (SSOs) of greater than 1000 gallons (Statesville, 2000).

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 Rowan and Iredell 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 Fourth Creek 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 Fourth Creek watershed was delineated into five subwatersheds. The land areas of each of the subwatersheds are shown in Table 4. The subwatersheds range in size from 3.5 mi^2 to 26.5 mi^2 and encompass pasture, cultivated lands, forest, and low and high density development lands.

Subwatershed	Area (square miles)
WS01	3.5
WS02	24.6
WS03	9.6
WS04	18.7
WS05	26.5

Table 4. The areas of the subwatersheds of the Fourth Creek watershed.

Figure 2 illustrates the subwatershed delineations for the Fourth Creek watershed. The subwatershed delineations were based, in part, on the 14 digit hydrologic unit watershed boundaries, the location of the ambient and discharger coalition monitoring sites, the location of Statesville's WWTP, and the geographic extent of the impaired segment of Fourth Creek. Subwatershed WS05, located above Statesville, contains the upstream 14 digit hydrologic unit watershed. The downstream point of subwatershed WS04 is located at SR2316, the site of the Fourth Creek WWTP downstream monitoring prior to 1998. The outlet of subwatershed WS03 is the located at SR2308, the site of the ambient monitoring and discharger coalition stations. Subwatershed WS02 contains all of the impaired segment of Fourth Creek. Subwatershed WS01 is located downstream of the impaired segment and above the confluence of Fourth and Third Creeks. The land cover coverage for the subwatersheds is shown in Table 5.

Land Cover	Watershed 01 acres (%)	Watershed 02 acres (%)	Watershed 03 acres (%)	Watershed 04 acres (%)	Watershed 05 acres (%)
Cultivated	124 (5.6%)	1044 (6.6%)	542 (9%)	302 (2.5%)	1408 (8.3%)
High Intensity Development	1 (<1%)	95 (<1%)	23 (<1%)	1058 (8.8%)	531 (3.1%)
Low Intensity Development	0 (0%)	3 (<1%)	5 (<1%)	1166 (9.7%)	353 (2.1%)
Shrubland	11 (<1%)	211 (1.3%)	35 (<1%)	18 (<1%)	91 (<1%)
Forest	1472 (66.4%)	8017 (50.9%)	3159 (51%)	5575(46.5%)	7153 (42.2%)
Herbaceous Cover	605 (27.3%)	6360 (40.4%)	2382 (39%)	3819 (31.9%)	7386 (43.6%)
Open Water	4 (<1%)	25 (<1%)	14 (<1 %)	43 (<1%)	36 (<1%)
Total	2,217	15,755	6,160	11,981	16,958

Table 5. The land cover/land use coverage of the subwatersheds in the Fourth Creek watershed.

3.2.1 Hydrology

Since Fourth Creek is not gaged, flow information for Fourth Creek was estimated using flow data from the Second Creek USGS gage station near Barber, North Carolina (Station Number 02120780). This method of calculating flows for Fourth Creek is based on the assumption of equal flow and runoff per square mile for Fourth and Second Creeks. Given the close proximity and similarities in land cover between the two watersheds, this is a reasonable assumption. Prior

to calculating the flow of Fourth Creek using areal weighting, the flows from the NPDES dischargers upstream of the gage on Second Creek were subtracted from the recorded flow at the USGS gage. The upstream permitted facilities include Rowan County/Second Creek WWTP (NC0078361), Arteva Specialties-KOSA (NC0004944) and Rowan-Salisbury Schools/West Rowan (NC0034959). The adjusted flows for Second Creek are shown in Appendix III. To estimate the daily flow of Fourth Creek, an adjustment coefficient was established by dividing the drainage area of Fourth Creek (82.95 square miles) by the drainage area of the Second Creek gage (118.00 square miles). This coefficient (0.703) was multiplied by the adjusted daily flow of Second Creek to arrive at the estimates for Fourth Creek. The flows from the effluent of the Fourth Creek WWTP (NC0031836) and the Southern States Cooperative (NC0082821) were added to the subwatersheds that are downstream of these facilities.

3.2.2 Hydraulics

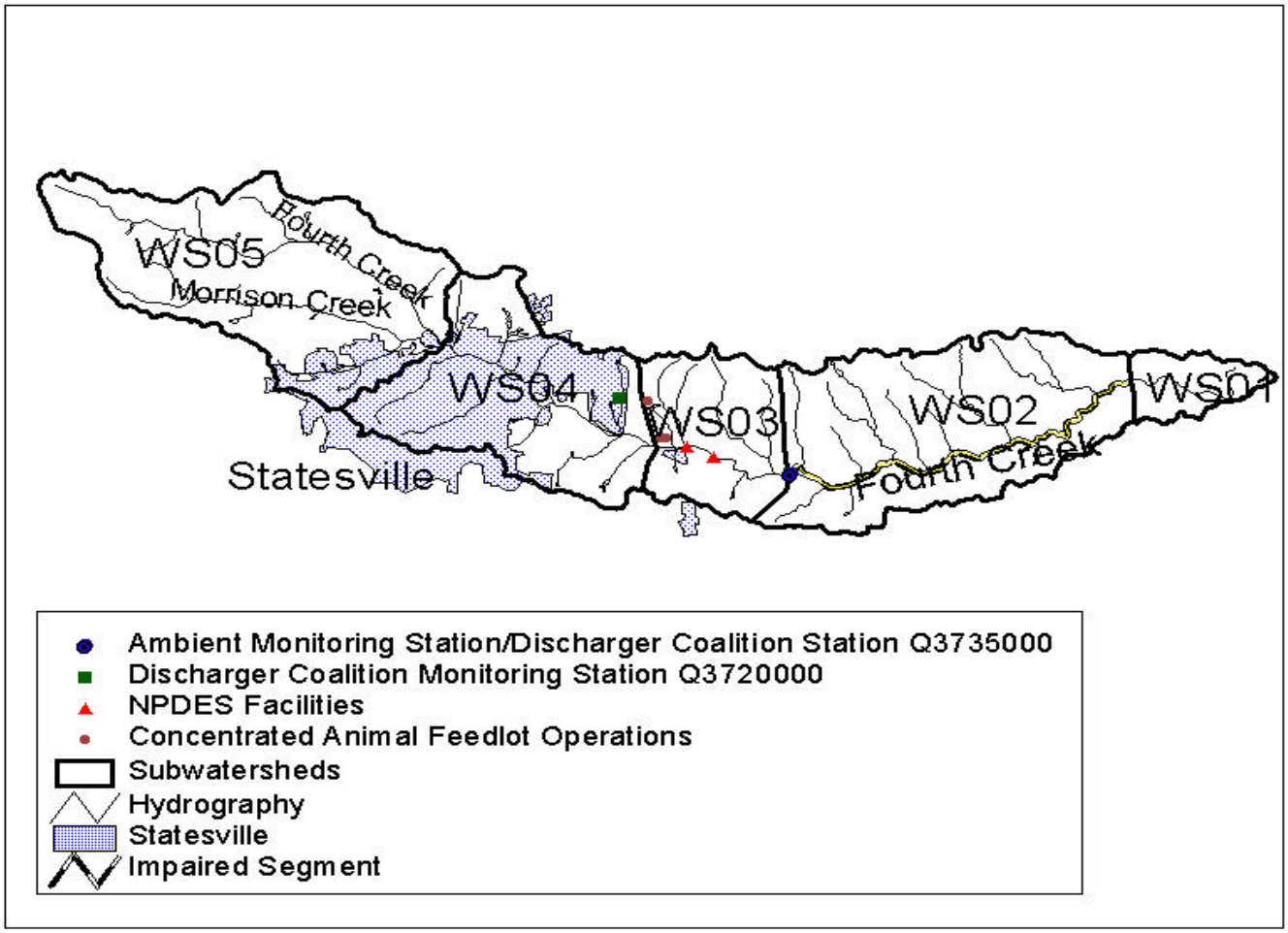
There are several methods to estimate stream velocity based on stream flow data. The water quality model utilized the power function to calculate the hydraulics of Fourth Creek.

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)

Since a time of travel (TOT) study was not available for Fourth Creek, a TOT study for North Second Creek (1978) was used to estimate the values of the coefficient and exponent for the Fourth Creek hydraulics. North Second Creek is located in the same subbasin (03-07-06) as Fourth Creek. The following values were used in the Fourth Creek model to calculate stream velocity: a = 0.157 and b = 0.478.

Figure 2. Fourth Creek Subwatershed Delineations



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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 3 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

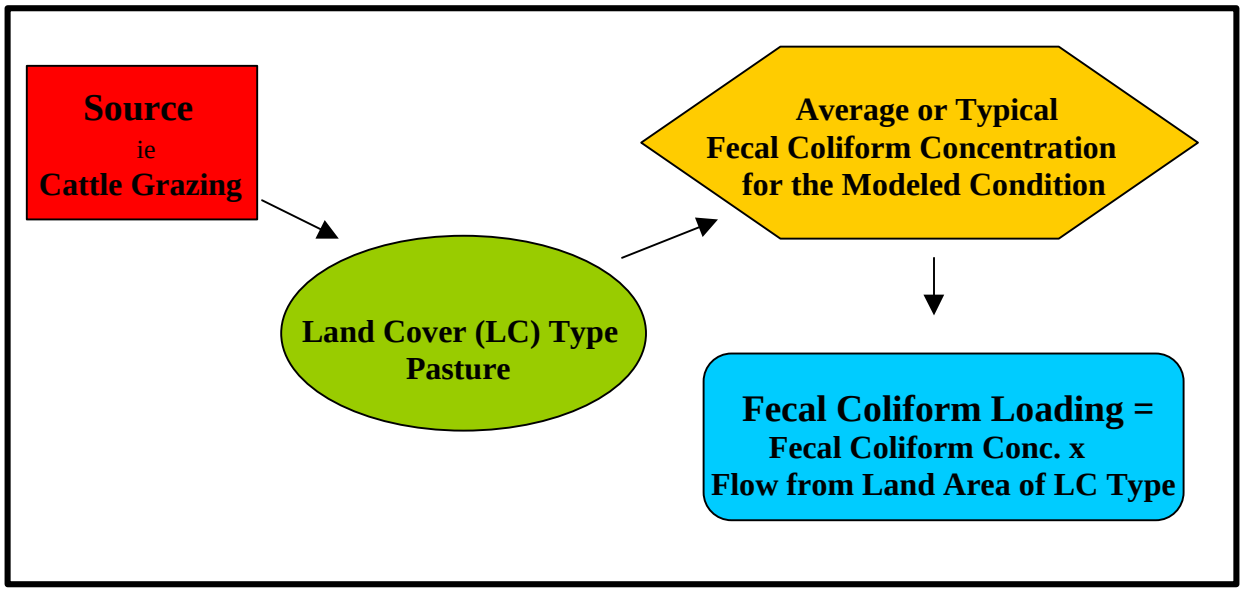


Figure 3. A schematic diagram of the non-point source fecal coliform loading calculations.

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 Fourth Creek 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 6 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	WS03		23 (average concentration of effluent)	23 (average concentration of effluent)
Non-Point Source	Wildlife	WS01 – WS05	Forest	100	30
	Livestock Grazing	WS03	Herbaceous/ Pasture	15,000	500
	Livestock Grazing	WS02 ,WS04 WS05	Herbaceous/ Pasture	10,000	500
	Manure Application (Mar. – June; Sept. – Dec.)	WS03	Herbaceous/ Pasture	10,000	500
	Manure Application (Mar. – June; Sept. – Dec.)	WS02, WS04, WS05	Herbaceous/ Pasture	5,000	500
	Manure Application (Mar. – June; Sept. – Nov.)	WS03	Cultivated	10,000	500
	Manure Application (Mar. – June; Sept. – Nov.)	WS02, WS04, WS05	Cultivated	5,000	500
	High Intensity Development (SSOs, stormwater, sewer infiltration)	WS04 – WS05	High Intensity Developed	8,700	1,500
	Low Intensity Development (include septic system failure, stormwater)	WS04 – WS05	Low Intensity Developed	8,700	1,500

Table 6. 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 Fourth Creek TMDL application of the CRAP model, dry weather conditions were defined as three consecutive days without recorded rainfall in Statesville, 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.

3.3.2 NPDES Discharge

Fourth Creek WWTP, a 4 MGD NPDES individually permitted facility, is located in subwatershed WS03. To calculate the fecal coliform loading from the Fourth Creek WWTP, the average monthly flow calculated from the 1998-2000 discharge monitoring reports was multiplied by the concentration of 23cfu/100ml, the average of the monthly geometric means of the fecal coliform concentrations reported in the discharge monitoring reports. The monthly average flow and monthly geometric means of the fecal coliform concentrations did not substantially vary over the observed period (see Appendix II). Therefore it was reasonable to use the average flow and concentration values over the modeled period.

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 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 x 10^6 cfu/100ml (Doran et al, 1981). A fecal coliform concentration of 10,000 cfu/100ml for wet weather days was input into the model to calculate the fecal coliform load from grazing livestock in subwatersheds WS02, WS04 and WS05. Due to the increased number of dairy cattle in subwatershed WS03, a fecal coliform concentration of 15,000cfu/100ml was used to calculate the loads for wet weather in WS03. The fecal coliform concentration used to calculate the load from grazing on dry weather days was 500cfu/100ml for all subwatersheds. The fecal coliform concentrations used in the CRAP model fall within the range of fecal coliform concentrations found in the literature.

3.3.3.2 Land Application of Agricultural Manure/Concentrated Animal Feedlot Operations

Fecal coliform loading values from the land application of manure, poultry litter and concentrated animal feedlot operations were calculated in the model using an instream fecal coliform concentration for the portion of the stream flow that originates from cultivated lands and pasturelands (herbaceous land cover). 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. Due to a lack of site specific data on these sources, cattle and poultry manure application were grouped together as one source, the land application of agricultural manure. 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 for the portion of the stream flow that originates from cultivated land. 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. The fecal coliform loading from manure application on pastureland in dry weather was calculated using an in-stream fecal coliform concentration of 500cfu/100ml for the portion of stream flow that originates on pastureland.

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 WS04 and WS05. 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. 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. Loading from low intensity developed land was not included from subwatersheds WS01-WS03 because the percentages of developed land in these subwatersheds are less than 1% of the total subwatershed areas.

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 WS04 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 Fourth Creek 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 photo-oxidation, 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 k value between 0.7/day and 1.5/day (Center for Watershed Protection, 1999). In the Fourth Creek model, a k value of 0.8/day was used for the existing condition and allocation runs.

3.5 Critical Conditions

Fecal coliform pollution in the Fourth Creek 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

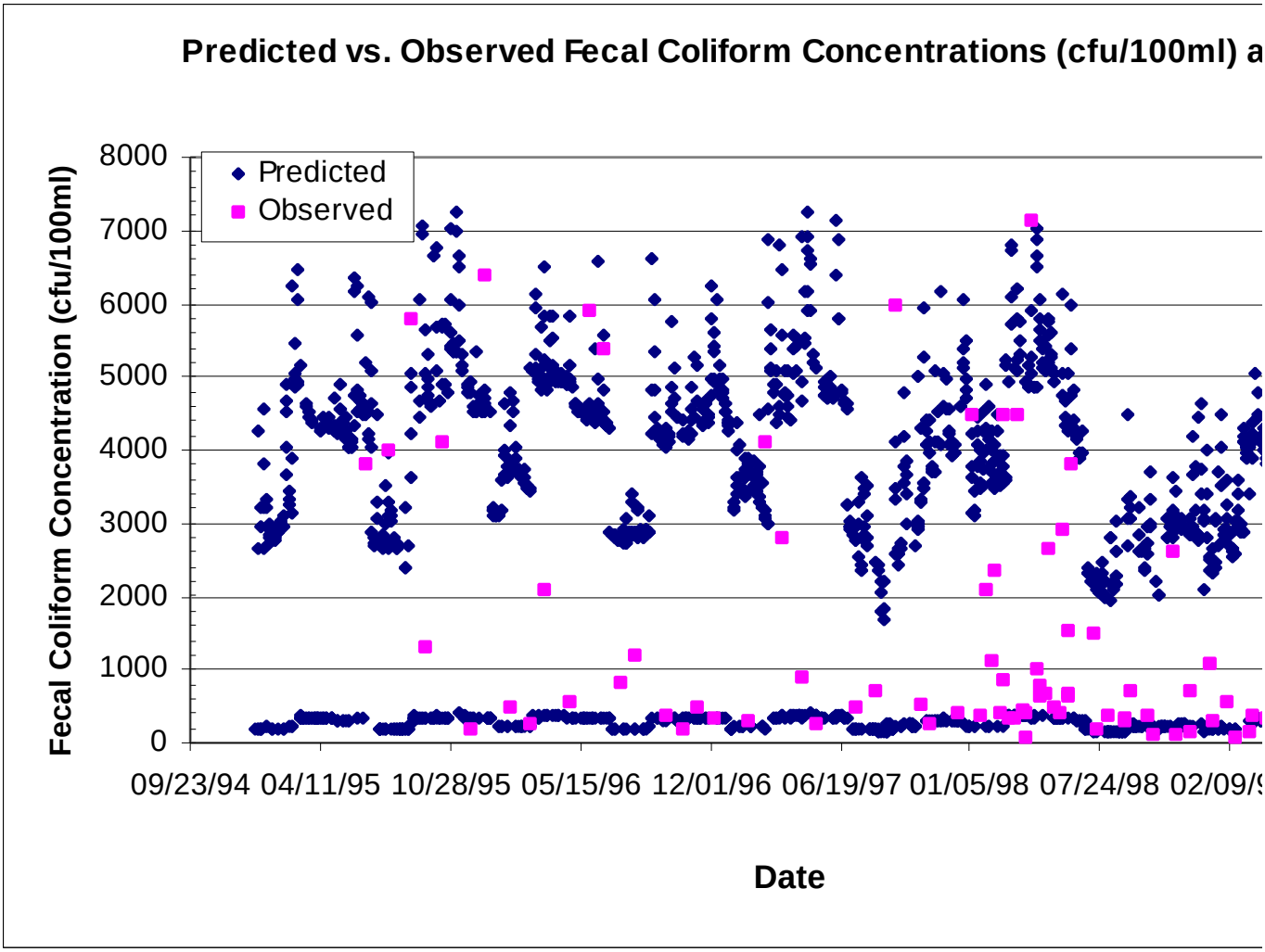
wet weather. The Fourth Creek fecal coliform monitoring data indicate that elevated fecal coliform levels occur throughout the year, during both dry and wet weather conditions. The model was run for a five year simulation period using estimated daily stream flows. The highest 30-day geometric mean of the predicted daily fecal coliform concentrations occurred between April 13, 1998 and May 13, 1998. Rain was recorded in Statesville on 22 days during that 30 day period.

3.6 Model Results

The predicted daily fecal coliform concentrations over the five year simulation period at the model evaluation location are shown in Figure 4. The model evaluation location is located at the DWQ ambient monitoring station at SR2308. The modeling results indicate that non-point source fecal coliform loading has a significant impact on instream fecal coliform concentrations in the Fourth Creek watershed. The Fourth Creek WWTP is permitted to discharge a monthly geometric mean fecal coliform concentration of 200 cfu/100ml with a maximum permitted discharge of 4 MGD. While the WWTP is permitted at the 200cfu/100ml level, the plant has discharged on average monthly geometric mean of 23cfu/100ml from Of the total fecal coliform loading, the portion of the loading from the Fourth Creek WWTP was less than one percent.

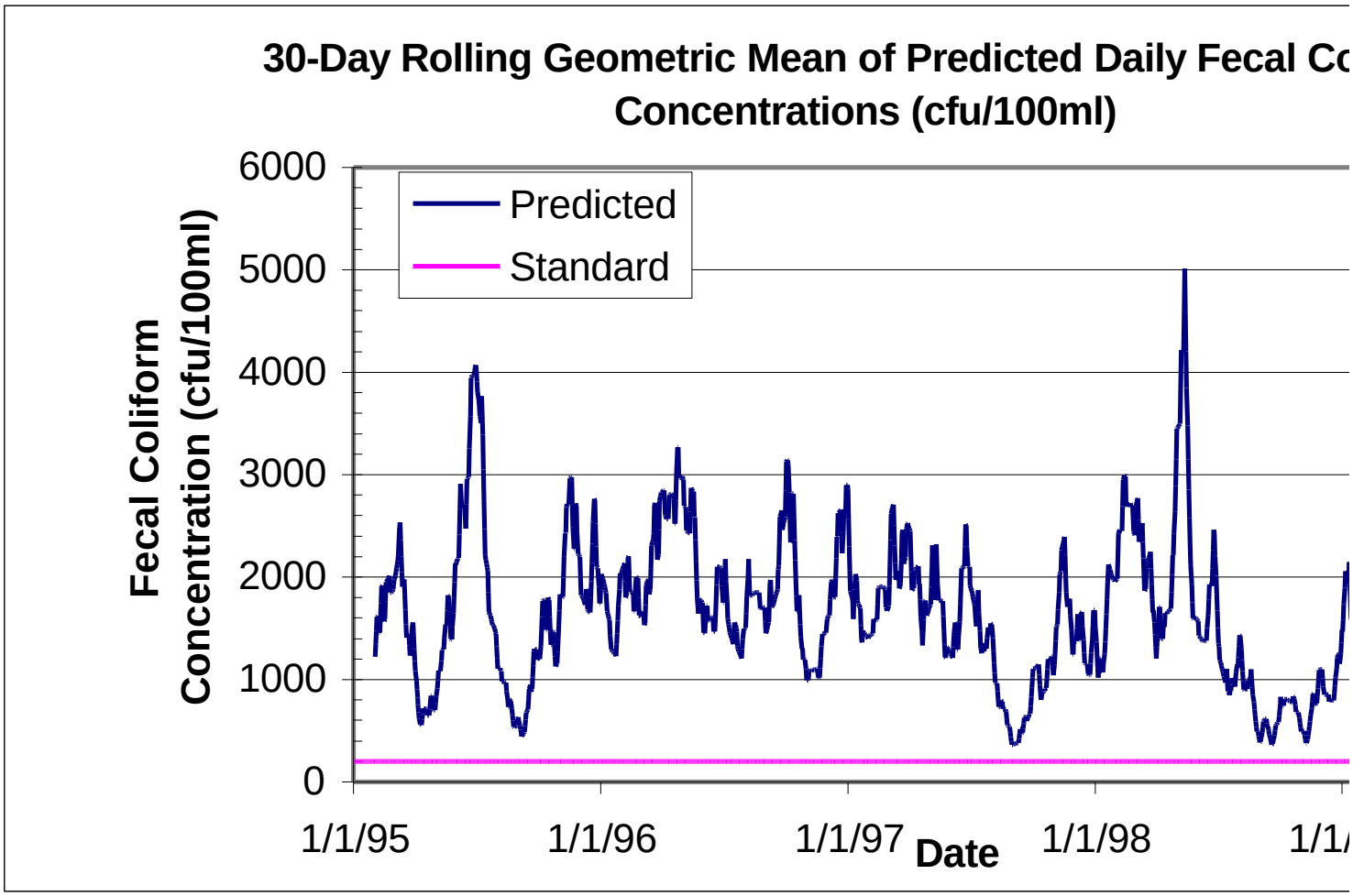
The predicted 30-day rolling geometric mean fecal coliform concentrations are shown in Figure 5. Throughout the five-year modeled period, the rolling 30-day geometric means of the predicted values are greater than 200cfu/100ml throughout the entire modeled period. The 30-day geometric means range in value from 359 cfu/100ml to 5009 cfu/100ml. Since the DWQ ambient monitoring station and the discharger coalition station only collect fecal coliform samples on a monthly basis, an observed 30-day geometric mean, with a minimum of 5 samples a month, can not be calculated for much of the 5 year modeled period. However, from the period of January 8, 1998 to June 5, 1998, enough samples were collected at SR2308 by the Fourth Creek WWTP to calculate rolling 30 day geometric means of the observed fecal coliform concentrations. The predicted versus the observed geometric means of the fecal coliform concentrations are shown in Figure 6.

Figure 4. Modeling Results of the Simulated Daily Fecal Coliform Concentrations (cfu/100ml) at SR2308 compared
concentrations.



Measured fecal coliform concentrations of 16,900 cfu/100ml on January 15, 1998 and 11,000 cfu/100ml on August 8, 1
ecause of the scale formatting.)

igure 5. Rolling 30-Day Geometric Mean of Predicted Fecal Coliform Concentrations at SR2308.



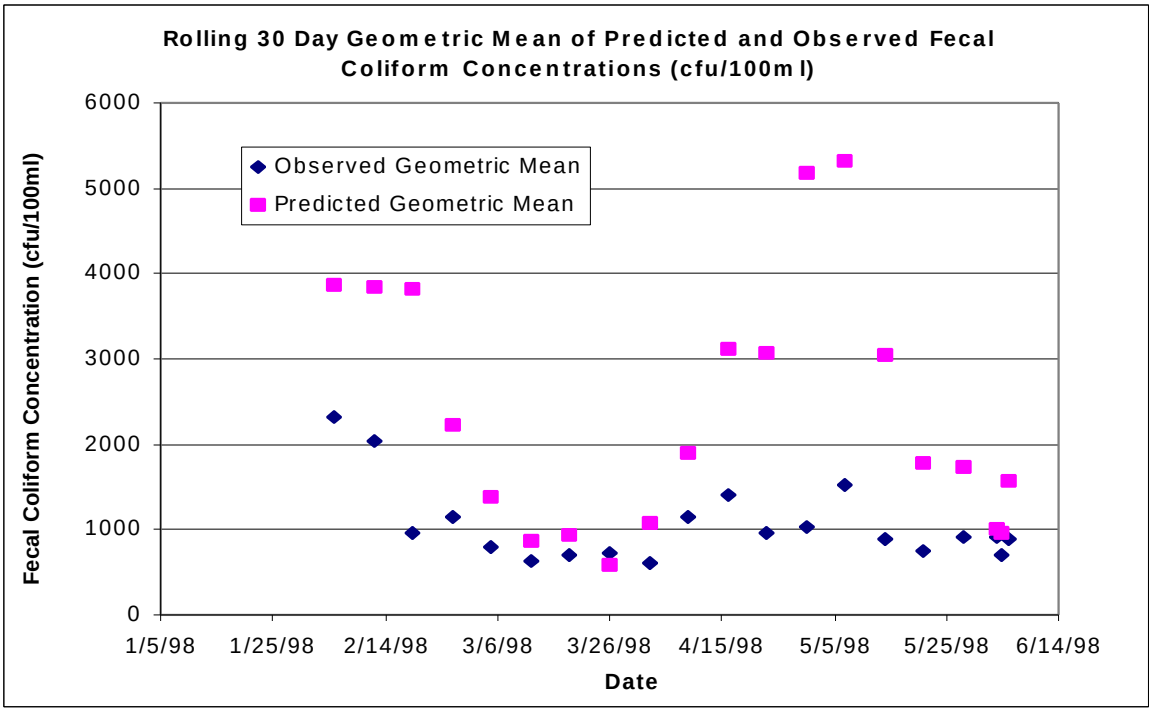


Figure 6. Predicted and Observed 30 Day Rolling Geometric Mean of Fecal Coliform Concentrations at the evaluation location (SR2308).

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:

$$TMDL = \sum WLAs + \sum LAs + MOS$$

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 Fourth Creek fecal coliform TMDL, loads are calculated based on

stream flow and instream fecal coliform concentrations that originate from a specific source/land cover.

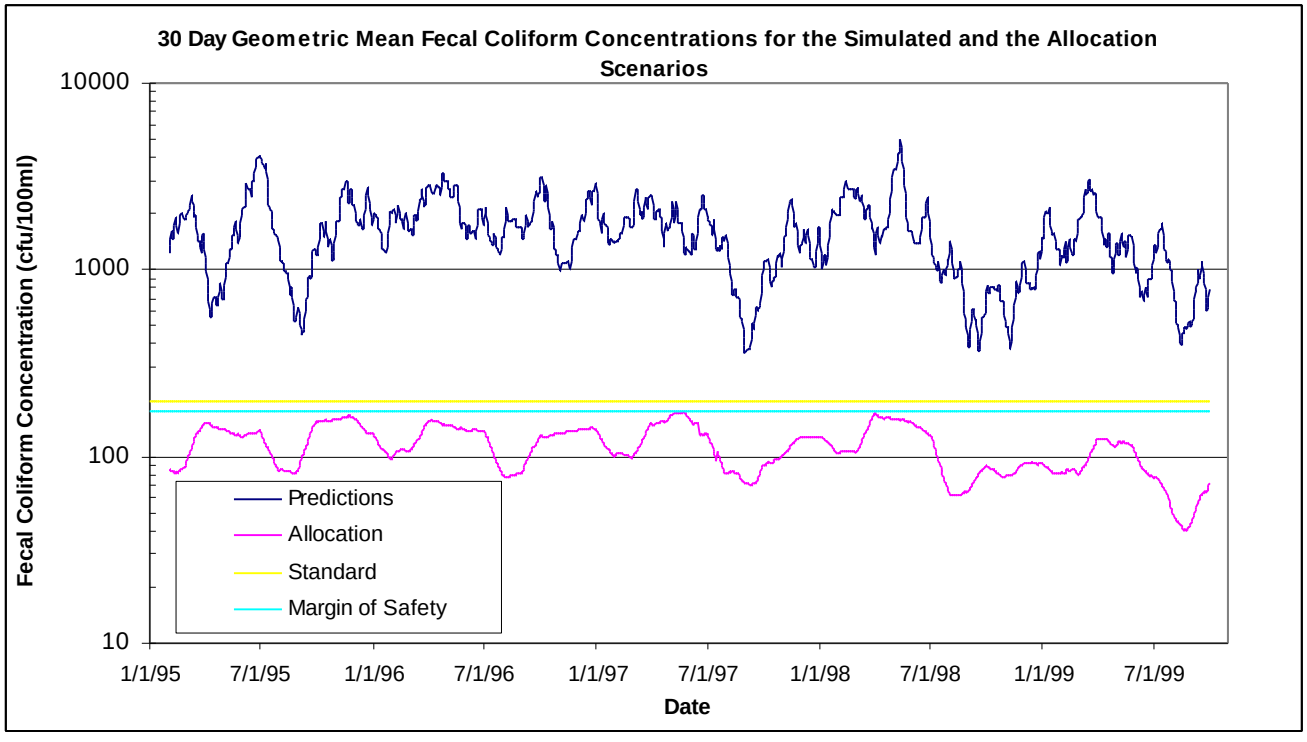
4.2 Seasonal Variation

The model was run over a five-year 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 Fourth Creek watershed, 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 7. 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)	WS04-WS05	8,700	250	97%
	Low Density Development (septic systems)	WS04-WS05	8,700	250	97%
	Livestock Grazing/Manure Application (Pastureland)	WS02	10,000 grazing 5,000 manure application	800 (600 grazing/ 200 man. app.)	95%
	Livestock Grazing/Manure Application (Pastureland)	WS03	15,000 grazing 10,000 manure application	450 (200 grazing/ 250 man. app.)	98%
	Livestock Grazing/ Manure Application (Pastureland)	WS04	10,000 grazing 5,000 manure application	450 (200 grazing/ 250 man. app.)	97%
	Livestock Grazing/Manure Application (Pastureland)	WS05	10,000 grazing 5,000 manure application	300 (200 grazing/ man. app. 100)	98%
	Manure Application (Cultivated)	WS02	5,000	600	88%
	Manure Application (Cultivated)	WS03	10,000	400	96%
	Manure Application (Cultivated)	WS04-WS05	5,000	300	94%

Table 9. Wet Weather In-Stream Fecal Coliform Load Reductions for Subwatersheds in the Fourth Creek Watershed.

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	30	30	0%
	High Density Development (stormwater, SSOs, sewer exfiltration)	WS04-WS05	1500	600	60%
	Low Density Development (septic systems)	WS04-WS05	1500	600	60%
	Livestock Grazing/ Manure Application (Pastureland)	WS02	1000 500 grazing/ 500 manure application	600 (300 grazing/ 300 man. app.)	40%
	Livestock Grazing/ Manure Application (Pastureland)	WS03-WS04	1000 500 grazing/ 500 manure application	600 (300 grazing/ 300 man. app.)	40%
	Livestock Grazing/ Manure Application (Pastureland)	WS05	1000 500 grazing/ 500 manure application	500 (400 grazing/ man. app. 100)	50%
	Manure Application (Cultivated)	WS02	500	300	40%
	Manure Application (Cultivated)	WS03-WS05	500	300	40%

Table 10. Dry Weather In-Stream Fecal Coliform Load Reductions for Subwatersheds in the Fourth Creek Watershed.

The final allocation of fecal coliform loads are shown in Table 9 (wet weather) and Table 10 (dry weather). The 30-day running geometric mean of the predicted fecal coliform concentrations at SR2308 with the final fecal coliform allocations are shown in Figure 7.

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 40%-60% for the various sources in dry weather conditions and 84%-98% reductions in wet weather conditions. During the critical conditions, the total wasteload alloction (WLA) is 9.09×10^{11} cfu/100ml per 30 days. The wasteload allocation was calculated by multiplying the permitted 30 day geometric mean of 200cfu/100ml by the permitted flow of 4MGD. The total load allocation (LA) equals 4.59×10^{13} cfu per 30 days. The NPDES individually permitted Fourth Creek WWTP discharges less than 1% of the modeled fecal coliform loading into the Fourth Creek watershed and has consistently met their monthly discharge limit (Appendix III). Therefore, the TMDL allocation focuses the fecal coliform loading reductions on the non-point sources.

5.0 SUMMARY AND FUTURE CONSIDERATIONS

The sources of fecal coliform in the Fourth Creek watershed include urban sources in the Statesville area, livestock grazing and manure application on agricultural lands, the Fourth Creek WWTP, and wildlife in the forested areas of the watershed. 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 40%-60% under dry weather conditions and 84%-98% under wet weather conditions for the various non-point sources of fecal coliform. The model estimated that the Fourth Creek WWTP contributes less than one percent 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 (SR2308) and at the two discharger coalition monitoring sites (SR2308 and unnamed tributary at SR2316). 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. A bacteria source tracking study of the Fourth Creek watershed, to help determine the portion of fecal coliform loads derived from humans versus animals throughout the watershed, may be considered as a part of the future monitoring of Fourth Creek.

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, 2000b), 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 begin developing the implementation plan during public review of the TMDL.

6.0 PUBLIC PARTICIPATION

The City of Statesville, Rowan and Iredell Counties have been notified throughout the TMDL process of the progress of the Fourth Creek Fecal Coliform TMDL. The counties, extension service and soil and water conservation district have supplied septic data and agricultural information to aid in the source assessment portion of the TMDL. The Fourth Creek TMDL was public noticed (Appendix IV) in the Statesville Record & Landmark on April 13, 2001. A public comment period was held after the TMDL has been publicly noticed through May 23, 2001. A public meeting was held in Statesville on April 30, 2001 as a part of the public

comment period. Written comments on the TMDL were received from the City of Statesville (Appendix V).

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Appendix I. Ambient Monitoring Station Q3735000 Fecal Coliform Concentration Monitoring Data

Date	Instream Fecal Coliform Concentration (cfu/100ml)	Date	Instream Fecal Coliform Concentration (cfu/100ml)
6/20/1995	3800	5/28/1998	2900
7/25/1995	4000	6/11/1998	3800
8/29/1995	5800	7/20/1998	200
9/19/1995	1300	8/31/1998	310
10/16/1995	4100	9/10/1998	710
11/28/1995	180	10/6/1998	390
12/19/1995	6400	11/17/1998	100
1/29/1996	500	12/10/1998	150
2/26/1996	280	1/13/1999	290
3/20/1996	2100	2/17/1999	91
4/29/1996	550	3/16/1999	370
5/28/1996	5900	4/26/1999	570
6/20/1996	5400	5/18/1999	280
7/17/1996	820	6/14/1999	340
8/5/1996	1200	7/12/1999	5600
9/25/1996	380	8/9/1999	11000L*
10/21/1996	200	9/9/1999	840L
11/13/1996	480	10/12/1999	600L
12/9/1996	350	11/8/1999	150J*
1/29/1997	290	12/15/1999	660L
2/24/1997	4100	1/4/2000	2000
3/20/1997	2800	2/14/2000	6900L
4/22/1997	890	3/14/2000	360
5/12/1997	260	4/19/2000	890
7/15/1997	490	5/16/2000	370
8/12/1997	700	6/15/2000	1100
9/10/1997	6000L	7/17/2000	1600
10/20/1997	520A*	8/9/2000	550
11/5/1997	280	9/7/2000	530
12/19/1997	420	10/16/2000	170
1/15/1998	5100	11/16/2000	27
2/23/1998	4500	12/6/2000	54
3/30/1998	81	1/8/2001	340
4/21/1998	770		

*L= Actual value is known to be greater than value given.
J= Estimated value.
A= Value reported is the mean of two or more determination.

Appendix I. Yadkin Pee-Dee River Basin Association Discharge Coalition Monitoring Fecal Coliform Concentration Monitoring Data

Date	Instream Fecal Coliform Concentration (cfu/100ml)
7/14/98	1500
8/3/98	370
9/2/98	345
10/15/98	100
11/11/98	2600
12/11/98	710
1/8/99	1100
2/5/99	560
3/10/99	140
4/6/99	320
5/11/99	530
6/2/99	480
7/6/99	450
9/7/99	4500
10/13/99	1200
11/8/99	220
12/10/99	420
1/12/00	1000
2/03/00	10
3/23/00	240
4/21/00	590
5/9/00	320
6/13/00	600

Yadkin Pee-Dee River Basin Association Discharge Coalition Monitoring Station Q3735000 Fourth Creek (SR2308) Fecal Coliform Concentration Monitoring Data

Appendix I. Yadkin Pee-Dee River Basin Association Discharge Coalition Monitoring Fecal Coliform Concentration Monitoring Data

Date	Instream Fecal Coliform Concentration (cfu/100ml)
07/14/98	1000
08/03/98	690
09/02/98	302
10/15/98	872
11/11/98	3000
12/11/98	660
01/08/99	1300
02/05/99	300
03/10/99	120
04/06/99	390
05/11/99	650
06/02/99	3400
07/06/99	1900
09/07/99	940
10/13/99	670
11/08/99	210
12/10/99	2000
1/12/00	1800
2/03/00	61
3/23/00	350
4/21/00	770
5/9/00	2700
6/13/00	370

Appendix I: Yadkin Pee-Dee River Basin Association Discharge Coalition Monitoring Station Q3720000 (Headwaters of Untitled Tributary to Fourth Creek) Fecal Coliform Concentration Monitoring Data

Date	Fourth Creek Instream Fecal Coliform Concentration at SR2316	Fourth Creek Instream Fecal Coliform Concentration at SR2308
1/8/1998	39000	4500
1/15/1998	6400	16900
1/22/1998	288	363
1/29/1998	1500	2100
2/5/1998	1000	1138
2/12/1998	1950	2350
2/19/1998	300	400
2/26/1998	288	857
3/5/1998	340	330
3/12/1998	550	350
3/19/1998	4500	4500
3/26/1998	350	433
4/2/1998	357	400
4/9/1998	5380	7130
4/16/1998	513	1019
4/23/1998	1206	640
4/30/1998	729	662
5/7/1998	3404	2648
5/14/1998	900	475
5/21/1998	560	420
5/28/1998	1900	1887
6/3/1998	1600	675
6/4/1998	1450	650
6/5/1998	1750	1550

Appendix II. Statesville Wastewater Treatment Plant Monthly Effluent Data

Month/Year	Monthly Average Flow (MGD)	Geometric Mean of Daily Fecal Coliform Effluent Concentrations for the Month (cfu/100ml)
1/1998	3.7	62
2/1998	3.3	50
3/1998	3.1	16
4/1998	3.0	41
5/1998	2.7	36
6/1998	2.7	28
7/1998	2.6	48
8/1998	2.6	48
9/1998	2.6	46
10/1998	2.1	20
11/1998	2.5	27
12/1998	2.9	12
1/1999	3.2	4
2/1999	3.2	8
3/1999	3.1	8
4/1999	3.2	21
5/1999	3.0	13
6/1999	2.9	13
7/1999	3.0	10
8/1999	2.9	10
9/1999	2.8	18
10/1999	2.8	29
11/1999	2.8	53
12/1999		
1/2000	2.9	27
2/2000	3.0	6
3/2000	3.1	4
4/2000	3.1	20
5/2000	2.7	10
6/2000	2.5	75
7/2000	2.5	12
8/2000		
9/2000		
10/2000	2.5	6
11/2000	2.5	6
12/2000	2.5	7
1/2001	2.4	9

Appendix III. Adjusted Flow Data for Second Creek and Fourth Creek.

Date	Second Creek Flow after removal of Permitted Flows (cfs)	Fourth Creek without addition of Permitted Flows (cfs)
01_01_1995	53	37.55
01_02_1995	49	34.74
01_03_1995	48	34.03
01_04_1995	48	34.03
01_05_1995	49	34.74
01_06_1995	57	40.36
01_07_1995	460	323.67
01_08_1995	103	72.70
01_09_1995	78	55.12
01_10_1995	70	49.50
01_11_1995	64	45.28
01_12_1995	61	43.17
01_13_1995	58	41.06
01_14_1995	105	74.10
01_15_1995	873	614.01
01_16_1995	220	154.95
01_17_1995	104	73.40
01_18_1995	85	60.04
01_19_1995	78	55.12
01_20_1995	115	81.13
01_21_1995	82	57.94
01_22_1995	74	52.31
01_23_1995	69	48.80
01_24_1995	66	46.69
01_25_1995	63	44.58
01_26_1995	62	43.88
01_27_1995	60	42.47
01_28_1995	70	49.50
01_29_1995	72	50.91
01_30_1995	67	47.39
01_31_1995	65	45.98
02_01_1995	63	44.49
02_02_1995	64	45.19
02_03_1995	64	45.19
02_04_1995	66	46.60
02_05_1995	65	45.90
02_06_1995	63	44.49
02_07_1995	69	48.71
02_08_1995	70	49.41
02_09_1995	73	51.52
02_10_1995	72	50.82
02_11_1995	74	52.22
02_12_1995	71	50.12
02_13_1995	69	48.71
02_14_1995	70	49.41
02_15_1995	83	58.55
02_16_1995	1188	835.37
02_17_1995	2938	2065.62

02_18_1995	806	566.82
02_19_1995	287	201.96
02_20_1995	164	115.49
02_21_1995	123	86.67
02_22_1995	105	74.02
02_23_1995	98	69.10
02_24_1995	93	65.58
02_25_1995	88	62.07
02_26_1995	85	59.96
02_27_1995	85	59.96
02_28_1995	228	160.49
03_01_1995	357	250.68
03_02_1995	157	110.08
03_03_1995	112	78.45
03_04_1995	106	74.23
03_05_1995	97	67.90
03_06_1995	103	72.12
03_07_1995	98	68.60
03_08_1995	482	338.56
03_09_1995	285	200.07
03_10_1995	122	85.48
03_11_1995	104	72.82
03_12_1995	96	67.20
03_13_1995	91	63.68
03_14_1995	88	61.57
03_15_1995	86	60.17
03_16_1995	84	58.76
03_17_1995	82	57.36
03_18_1995	81	56.65
03_19_1995	80	55.95
03_20_1995	79	55.25
03_21_1995	83	58.06
03_22_1995	79	55.25
03_23_1995	76	53.14
03_24_1995	74	51.73
03_25_1995	72	50.33
03_26_1995	70	48.92
03_27_1995	72	50.33
03_28_1995	70	48.92
03_29_1995	68	47.51
03_30_1995	70	48.92
03_31_1995	68	47.51
04_01_1995	66	46.21
04_02_1995	63	44.10
04_03_1995	68	47.62
04_04_1995	64	44.80
04_05_1995	62	43.40
04_06_1995	60	41.99
04_07_1995	64	44.80
04_08_1995	62	43.40
04_09_1995	60	41.99
04_10_1995	58	40.59
04_11_1995	58	40.59

04_12_1995	58	40.59
04_13_1995	60	41.99
04_14_1995	67	46.91
04_15_1995	66	46.21
04_16_1995	65	45.51
04_17_1995	65	45.51
04_18_1995	64	44.80
04_19_1995	63	44.10
04_20_1995	62	43.40
04_21_1995	61	42.70
04_22_1995	61	42.70
04_23_1995	61	42.70
04_24_1995	67	46.91
04_25_1995	62	43.40
04_26_1995	60	41.99
04_27_1995	60	41.99
04_28_1995	59	41.29
04_29_1995	59	41.29
04_30_1995	58	40.59
05_01_1995	58	40.58
05_02_1995	80	56.05
05_03_1995	62	43.40
05_04_1995	60	41.99
05_05_1995	59	41.29
05_06_1995	57	39.88
05_07_1995	56	39.18
05_08_1995	56	39.18
05_09_1995	56	39.18
05_10_1995	72	50.43
05_11_1995	61	42.69
05_12_1995	63	44.10
05_13_1995	62	43.40
05_14_1995	95	66.59
05_15_1995	64	44.80
05_16_1995	59	41.29
05_17_1995	57	39.88
05_18_1995	56	39.18
05_19_1995	66	46.21
05_20_1995	58	40.58
05_21_1995	54	37.77
05_22_1995	53	37.07
05_23_1995	52	36.37
05_24_1995	51	35.66
05_25_1995	50	34.96
05_26_1995	50	34.96
05_27_1995	49	34.26
05_28_1995	54	37.77
05_29_1995	52	36.37
05_30_1995	50	34.96
05_31_1995	49	34.26
06_01_1995	64	44.98
06_02_1995	417	293.14
06_03_1995	333	234.09

06_04_1995	87	61.15
06_05_1995	73	51.31
06_06_1995	357	250.96
06_07_1995	175	123.02
06_08_1995	94	66.07
06_09_1995	85	59.75
06_10_1995	83	58.34
06_11_1995	82	57.64
06_12_1995	86	60.45
06_13_1995	77	54.12
06_14_1995	72	50.61
06_15_1995	70	49.20
06_16_1995	81	56.94
06_17_1995	80	56.23
06_18_1995	75	52.72
06_19_1995	76	53.42
06_20_1995	75	52.72
06_21_1995	71	49.91
06_22_1995	123	86.46
06_23_1995	296	208.08
06_24_1995	60	42.17
06_25_1995	74	52.01
06_26_1995	56	39.36
06_27_1995	52	36.55
06_28_1995	113	79.43
06_29_1995	276	194.02
06_30_1995	81	56.94
07_01_1995	61	42.63
07_02_1995	57	39.82
07_03_1995	56	39.12
07_04_1995	53	37.01
07_05_1995	51	35.60
07_06_1995	53	37.01
07_07_1995	674	473.57
07_08_1995	97	67.94
07_09_1995	75	52.47
07_10_1995	68	47.55
07_11_1995	63	44.04
07_12_1995	58	40.52
07_13_1995	53	37.01
07_14_1995	48	33.49
07_15_1995	48	33.49
07_16_1995	48	33.49
07_17_1995	58	40.52
07_18_1995	53	37.01
07_19_1995	48	33.49
07_20_1995	43	29.98
07_21_1995	68	47.55
07_22_1995	128	89.73
07_23_1995	78	54.58
07_24_1995	53	37.01
07_25_1995	48	33.49
07_26_1995	250	175.50

07_27_1995	96	67.24
07_28_1995	83	58.10
07_29_1995	78	54.58
07_30_1995	73	51.07
07_31_1995	63	44.04
08_01_1995	63	44.03
08_02_1995	63	44.03
08_03_1995	58	40.51
08_04_1995	53	37.00
08_05_1995	53	37.00
08_06_1995	48	33.48
08_07_1995	48	33.48
08_08_1995	48	33.48
08_09_1995	43	29.97
08_10_1995	43	29.97
08_11_1995	43	29.97
08_12_1995	38	26.45
08_13_1995	38	26.45
08_14_1995	38	26.45
08_15_1995	38	26.45
08_16_1995	38	26.45
08_17_1995	33	22.94
08_18_1995	33	22.94
08_19_1995	89	62.30
08_20_1995	38	26.45
08_21_1995	38	26.45
08_22_1995	38	26.45
08_23_1995	33	22.94
08_24_1995	33	22.94
08_25_1995	38	26.45
08_26_1995	51	35.59
08_27_1995	2258	1587.11
08_28_1995	5278	3710.17
08_29_1995	390	273.91
08_30_1995	146	102.37
08_31_1995	113	79.18
09_01_1995	98	68.57
09_02_1995	93	65.05
09_03_1995	88	61.54
09_04_1995	83	58.02
09_05_1995	78	54.51
09_06_1995	73	50.99
09_07_1995	73	50.99
09_08_1995	68	47.48
09_09_1995	68	47.48
09_10_1995	63	43.96
09_11_1995	277	194.41
09_12_1995	78	54.51
09_13_1995	66	46.07
09_14_1995	63	43.96
09_15_1995	59	41.15
09_16_1995	1108	778.60
09_17_1995	1348	947.32

09_18_1995	181	126.92
09_19_1995	105	73.49
09_20_1995	88	61.54
09_21_1995	82	57.32
09_22_1995	100	69.97
09_23_1995	132	92.47
09_24_1995	91	63.65
09_25_1995	83	58.02
09_26_1995	79	55.21
09_27_1995	77	53.81
09_28_1995	75	52.40
09_29_1995	74	51.70
09_30_1995	72	50.29
10_01_1995	80	55.93
10_02_1995	79	55.23
10_03_1995	79	55.23
10_04_1995	636	446.80
10_05_1995	770	541.00
10_06_1995	194	136.08
10_07_1995	114	79.84
10_08_1995	101	70.70
10_09_1995	93	65.07
10_10_1995	88	61.56
10_11_1995	87	60.85
10_12_1995	85	59.45
10_13_1995	83	58.04
10_14_1995	193	135.37
10_15_1995	201	141.00
10_16_1995	97	67.88
10_17_1995	88	61.56
10_18_1995	84	58.75
10_19_1995	82	57.34
10_20_1995	81	56.64
10_21_1995	200	140.29
10_22_1995	97	67.88
10_23_1995	89	62.26
10_24_1995	85	59.45
10_25_1995	82	57.34
10_26_1995	80	55.93
10_27_1995	280	196.53
10_28_1995	1248	877.04
10_29_1995	180	126.23
10_30_1995	149	104.44
10_31_1995	146	102.33
11_01_1995	145	101.62
11_02_1995	159	111.46
11_03_1995	144	100.92
11_04_1995	147	103.03
11_05_1995	142	99.51
11_06_1995	142	99.51
11_07_1995	1178	827.82
11_08_1995	2268	1594.09
11_09_1995	269	188.79

11_10_1995	199	139.58
11_11_1995	510	358.22
11_12_1995	638	448.20
11_13_1995	161	112.87
11_14_1995	136	95.29
11_15_1995	121	84.75
11_16_1995	113	79.12
11_17_1995	106	74.20
11_18_1995	100	69.99
11_19_1995	97	67.88
11_20_1995	95	66.47
11_21_1995	95	66.47
11_22_1995	89	62.25
11_23_1995	86	60.14
11_24_1995	95	66.47
11_25_1995	98	68.58
11_26_1995	89	62.25
11_27_1995	86	60.14
11_28_1995	85	59.44
11_29_1995	101	70.69
11_30_1995	91	63.66
12_01_1995	87	60.93
12_02_1995	85	59.52
12_03_1995	84	58.82
12_04_1995	83	58.11
12_05_1995	82	57.41
12_06_1995	82	57.41
12_07_1995	88	61.63
12_08_1995	86	60.22
12_09_1995	172	120.68
12_10_1995	98	68.66
12_11_1995	90	63.03
12_12_1995	88	61.63
12_13_1995	87	60.93
12_14_1995	86	60.22
12_15_1995	85	59.52
12_16_1995	84	58.82
12_17_1995	84	58.82
12_18_1995	96	67.25
12_19_1995	106	74.28
12_20_1995	90	63.03
12_21_1995	86	60.22
12_22_1995	84	58.82
12_23_1995	83	58.11
12_24_1995	83	58.11
12_25_1995	83	58.11
12_26_1995	82	57.41
12_27_1995	83	58.11
12_28_1995	82	57.41
12_29_1995	83	58.11
12_30_1995	83	58.11
12_31_1995	84	58.82
01_01_1996	85	59.49

01_02_1996	86	60.19
01_03_1996	89	62.31
01_04_1996	82	57.42
01_05_1996	80	56.03
01_06_1996	82	57.47
01_07_1996	83	58.06
01_08_1996	85	59.42
01_09_1996	83	58.70
01_10_1996	80	56.56
01_11_1996	79	55.88
01_12_1996	83	58.04
01_13_1996	81	56.63
01_14_1996	85	59.49
01_15_1996	102	71.41
01_16_1996	131	91.79
01_17_1996	146	102.36
01_18_1996	231	162.10
01_19_1996	1058	743.45
01_20_1996	264	185.27
01_21_1996	160	112.24
01_22_1996	153	107.41
01_23_1996	150	105.34
01_24_1996	189	132.76
01_25_1996	156	109.52
01_26_1996	152	106.60
01_27_1996	1637	1151.05
01_28_1996	513	360.84
01_29_1996	212	149.32
01_30_1996	188	131.82
01_31_1996	173	121.38
02_01_1996	208	146.10
02_02_1996	799	561.49
02_03_1996	1247	876.86
02_04_1996	288	202.54
02_05_1996	217	152.57
02_06_1996	197	138.60
02_07_1996	187	131.66
02_08_1996	177	124.68
02_09_1996	173	121.37
02_10_1996	168	117.95
02_11_1996	163	114.48
02_12_1996	158	111.14
02_13_1996	158	111.04
02_14_1996	153	107.53
02_15_1996	153	107.55
02_16_1996	148	103.94
02_17_1996	148	103.92
02_18_1996	143	100.40
02_19_1996	143	100.36
02_20_1996	173	121.35
02_21_1996	137	96.01
02_22_1996	131	91.78
02_23_1996	129	90.37

02_24_1996	128	89.70
02_25_1996	124	86.91
02_26_1996	124	86.94
02_27_1996	123	86.25
02_28_1996	124	87.02
02_29_1996	120	84.28
03_01_1996	119	83.55
03_02_1996	119	83.50
03_03_1996	118	82.78
03_04_1996	116	81.34
03_05_1996	117	82.03
03_06_1996	142	99.53
03_07_1996	319	224.57
03_08_1996	257	180.33
03_09_1996	121	84.82
03_10_1996	108	75.66
03_11_1996	103	72.25
03_12_1996	100	70.25
03_13_1996	97	68.08
03_14_1996	95	66.53
03_15_1996	94	66.29
03_16_1996	110	77.48
03_17_1996	202	142.18
03_18_1996	119	83.96
03_19_1996	523	367.37
03_20_1996	230	161.57
03_21_1996	133	93.35
03_22_1996	116	81.35
03_23_1996	107	74.98
03_24_1996	103	72.13
03_25_1996	102	71.43
03_26_1996	101	70.69
03_27_1996	97	67.94
03_28_1996	231	162.09
03_29_1996	165	116.28
03_30_1996	123	86.43
03_31_1996	111	78.32
04_01_1996	220	154.55
04_02_1996	164	115.13
04_03_1996	120	84.18
04_04_1996	113	79.23
04_05_1996	107	75.00
04_06_1996	104	72.81
04_07_1996	101	71.31
04_08_1996	100	69.95
04_09_1996	112	78.49
04_10_1996	102	71.44
04_11_1996	100	70.14
04_12_1996	100	70.25
04_13_1996	99	69.49
04_14_1996	100	70.04
04_15_1996	101	71.21
04_16_1996	106	74.67

04_17_1996	98	69.07
04_18_1996	97	68.49
04_19_1996	98	68.59
04_20_1996	100	70.18
04_21_1996	104	72.96
04_22_1996	99	69.40
04_23_1996	97	67.95
04_24_1996	96	67.21
04_25_1996	94	65.80
04_26_1996	105	73.50
04_27_1996	102	71.46
04_28_1996	96	67.18
04_29_1996	97	68.48
04_30_1996	222	156.02
05_01_1996	114	80.47
05_02_1996	89	62.89
05_03_1996	83	58.03
05_04_1996	80	55.98
05_05_1996	78	54.71
05_06_1996	76	53.39
05_07_1996	75	52.81
05_08_1996	76	53.42
05_09_1996	74	51.89
05_10_1996	72	50.48
05_11_1996	72	50.61
05_12_1996	73	51.22
05_13_1996	69	48.71
05_14_1996	70	49.24
05_15_1996	71	49.84
05_16_1996	71	49.86
05_17_1996	69	48.60
05_18_1996	67	47.33
05_19_1996	66	46.62
05_20_1996	64	45.22
05_21_1996	63	44.52
05_22_1996	62	43.93
05_23_1996	62	43.29
05_24_1996	68	47.50
05_25_1996	67	47.39
05_26_1996	63	44.57
05_27_1996	65	46.01
05_28_1996	76	53.77
05_29_1996	68	48.05
05_30_1996	73	51.42
05_31_1996	63	44.56
06_01_1996	62	43.90
06_02_1996	61	43.23
06_03_1996	62	43.38
06_04_1996	64	44.66
06_05_1996	63	44.00
06_06_1996	61	42.78
06_07_1996	60	42.03
06_08_1996	68	47.54

06_09_1996	141	98.82
06_10_1996	544	382.71
06_11_1996	99	69.67
06_12_1996	76	53.49
06_13_1996	72	50.76
06_14_1996	67	47.35
06_15_1996	65	45.37
06_16_1996	64	44.71
06_17_1996	63	44.02
06_18_1996	61	42.64
06_19_1996	88	61.66
06_20_1996	168	117.80
06_21_1996	69	48.86
06_22_1996	64	45.32
06_23_1996	62	43.94
06_24_1996	61	43.21
06_25_1996	60	42.51
06_26_1996	60	41.86
06_27_1996	59	41.35
06_28_1996	58	40.85
06_29_1996	58	40.83
06_30_1996	58	40.83
07_01_1996	58	40.69
07_02_1996	58	40.55
07_03_1996	58	40.56
07_04_1996	57	39.92
07_05_1996	56	39.16
07_06_1996	57	39.82
07_07_1996	57	39.87
07_08_1996	56	39.20
07_09_1996	55	38.50
07_10_1996	54	37.87
07_11_1996	53	37.06
07_12_1996	55	38.35
07_13_1996	55	38.35
07_14_1996	54	37.73
07_15_1996	54	37.78
07_16_1996	56	39.15
07_17_1996	53	37.03
07_18_1996	52	36.32
07_19_1996	61	42.68
07_20_1996	52	36.26
07_21_1996	51	35.58
07_22_1996	51	35.58
07_23_1996	51	35.57
07_24_1996	52	36.22
07_25_1996	51	35.51
07_26_1996	72	50.64
07_27_1996	54	38.21
07_28_1996	56	39.69
07_29_1996	59	41.83
07_30_1996	54	38.31
07_31_1996	54	38.27

08_01_1996	59	41.73
08_02_1996	98	69.07
08_03_1996	61	42.93
08_04_1996	114	80.20
08_05_1996	62	43.69
08_06_1996	59	41.76
08_07_1996	58	40.42
08_08_1996	64	44.69
08_09_1996	60	41.93
08_10_1996	62	43.51
08_11_1996	58	40.68
08_12_1996	90	63.17
08_13_1996	87	60.93
08_14_1996	65	46.04
08_15_1996	62	43.26
08_16_1996	60	41.84
08_17_1996	59	41.18
08_18_1996	60	41.91
08_19_1996	58	40.49
08_20_1996	56	39.69
08_21_1996	56	39.63
08_22_1996	56	39.66
08_23_1996	55	39.00
08_24_1996	59	41.17
08_25_1996	64	44.73
08_26_1996	64	44.73
08_27_1996	62	43.29
08_28_1996	62	43.29
08_29_1996	78	54.58
08_30_1996	61	42.63
08_31_1996	60	41.92
09_01_1996	58	40.53
09_02_1996	58	40.53
09_03_1996	90	63.55
09_04_1996	605	425.46
09_05_1996	139	97.73
09_06_1996	286	201.17
09_07_1996	89	62.64
09_08_1996	68	47.49
09_09_1996	62	43.63
09_10_1996	59	41.80
09_11_1996	61	43.18
09_12_1996	60	42.45
09_13_1996	57	40.36
09_14_1996	56	39.69
09_15_1996	56	39.04
09_16_1996	56	39.04
09_17_1996	57	40.42
09_18_1996	55	38.32
09_19_1996	54	37.65
09_20_1996	53	36.99
09_21_1996	53	37.03
09_22_1996	53	37.02

09_23_1996	52	36.37
09_24_1996	51	35.66
09_25_1996	51	35.68
09_26_1996	61	42.67
09_27_1996	57	39.75
09_28_1996	55	38.37
09_29_1996	58	41.06
09_30_1996	53	37.59
10_01_1996	210	147.88
10_02_1996	93	65.55
10_03_1996	79	55.67
10_04_1996	74	52.19
10_05_1996	67	47.29
10_06_1996	62	43.82
10_07_1996	58	40.43
10_08_1996	117	82.59
10_09_1996	84	59.34
10_10_1996	68	48.09
10_11_1996	64	44.99
10_12_1996	54	37.62
10_13_1996	53	36.93
10_14_1996	52	36.25
10_15_1996	53	36.96
10_16_1996	50	34.88
10_17_1996	55	38.60
10_18_1996	58	40.52
10_19_1996	68	47.62
10_20_1996	60	41.98
10_21_1996	59	41.32
10_22_1996	59	41.32
10_23_1996	59	41.34
10_24_1996	59	41.22
10_25_1996	59	41.79
10_26_1996	61	43.23
10_27_1996	61	43.14
10_28_1996	59	41.80
10_29_1996	56	39.68
10_30_1996	58	41.10
10_31_1996	58	40.42
11_01_1996	59	41.14
11_02_1996	93	65.71
11_03_1996	73	51.63
11_04_1996	66	46.73
11_05_1996	65	45.97
11_06_1996	66	46.64
11_07_1996	68	48.08
11_08_1996	130	91.63
11_09_1996	118	83.20
11_10_1996	80	56.51
11_11_1996	75	53.02
11_12_1996	68	48.13
11_13_1996	69	48.85
11_14_1996	63	44.59

11_15_1996	60	41.86
11_16_1996	60	41.88
11_17_1996	61	42.57
11_18_1996	63	44.01
11_19_1996	73	51.61
11_20_1996	64	45.29
11_21_1996	65	45.35
11_22_1996	79	55.84
11_23_1996	66	46.75
11_24_1996	63	44.64
11_25_1996	65	46.03
11_26_1996	78	54.53
11_27_1996	69	48.20
11_28_1996	64	44.67
11_29_1996	64	44.72
11_30_1996	69	48.28
12_01_1996	547	384.31
12_02_1996	301	211.83
12_03_1996	129	90.91
12_04_1996	106	74.79
12_05_1996	127	89.59
12_06_1996	244	171.49
12_07_1996	186	131.03
12_08_1996	195	137.35
12_09_1996	122	86.03
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12_16_1996	118	82.68
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12_18_1996	108	75.66
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12_20_1996	113	79.18
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12_22_1996	98	68.58
12_23_1996	92	65.02
12_24_1996	89	62.90
12_25_1996	88	61.52
12_26_1996	96	67.18
12_27_1996	82	57.32
12_28_1996	80	55.93
12_29_1996	78	54.52
12_30_1996	76	53.12
12_31_1996	74	51.70
01_01_1997	74	51.76
01_02_1997	74	51.73
01_03_1997	72	50.35
01_04_1997	72	50.33
01_05_1997	98	68.56
01_06_1997	93	65.03

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01_08_1997	83	58.13
01_09_1997	547	384.74
01_10_1997	262	184.36
01_11_1997	147	103.53
01_12_1997	127	89.47
01_13_1997	112	79.04
01_14_1997	107	75.41
01_15_1997	122	86.03
01_16_1997	297	209.06
01_17_1997	147	103.65
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01_24_1997	152	106.55
01_25_1997	216	151.55
01_26_1997	177	124.13
01_27_1997	166	116.41
01_28_1997	226	158.58
01_29_1997	197	138.19
01_30_1997	176	123.44
01_31_1997	169	118.53
02_01_1997	164	115.00
02_02_1997	157	110.11
02_03_1997	148	103.79
02_04_1997	160	112.27
02_05_1997	137	96.60
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02_07_1997	127	89.57
02_08_1997	217	152.88
02_09_1997	177	124.70
02_10_1997	167	117.73
02_11_1997	147	103.68
02_12_1997	128	89.67
02_13_1997	118	82.71
02_14_1997	107	75.55
02_15_1997	697	490.04
02_16_1997	197	138.52
02_17_1997	147	103.28
02_18_1997	117	82.22
02_19_1997	107	75.26
02_20_1997	102	71.84
02_21_1997	97	68.40
02_22_1997	92	64.87
02_23_1997	87	61.41
02_24_1997	82	57.95
02_25_1997	78	54.50
02_26_1997	76	53.11
02_27_1997	75	53.07
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03_02_1997	281	197.39
03_03_1997	190	133.39
03_04_1997	150	105.36
03_05_1997	117	82.22
03_06_1997	120	84.42
03_07_1997	98	69.09
03_08_1997	90	63.58
03_09_1997	84	58.70
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03_17_1997	75	52.45
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03_27_1997	92	64.87
03_28_1997	90	63.50
03_29_1997	117	82.43
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03_31_1997	79	55.84
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04_02_1997	71	50.21
04_03_1997	102	71.52
04_04_1997	100	70.01
04_05_1997	95	66.52
04_06_1997	151	105.91
04_07_1997	179	126.15
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04_11_1997	102	71.44
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04_19_1997	98	68.62
04_20_1997	94	65.78
04_21_1997	88	61.57
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04_26_1997	137	96.39
04_27_1997	161	113.35
04_28_1997	724	509.04
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04_30_1997	979	688.12
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05_02_1997	240	168.85
05_03_1997	536	377.08
05_04_1997	594	417.85
05_05_1997	236	166.22
05_06_1997	185	130.33
05_07_1997	157	110.05
05_08_1997	140	98.18
05_09_1997	133	93.83
05_10_1997	121	84.83
05_11_1997	114	79.85
05_12_1997	110	77.12
05_13_1997	106	74.31
05_14_1997	101	70.83
05_15_1997	99	69.39
05_16_1997	94	65.94
05_17_1997	93	65.18
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05_24_1997	81	56.70
05_25_1997	86	60.19
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05_27_1997	93	65.11
05_28_1997	86	60.14
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06_02_1997	89	62.29
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06_04_1997	92	64.33
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06_06_1997	82	57.31
06_07_1997	85	59.46
06_08_1997	81	56.67
06_09_1997	79	55.26
06_10_1997	78	54.55
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06_12_1997	108	75.67
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06_14_1997	433	304.56

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06_20_1997	98	68.57
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06_23_1997	88	61.57
06_24_1997	80	55.94
06_25_1997	77	53.79
06_26_1997	74	51.88
06_27_1997	77	54.41
06_28_1997	76	53.75
06_29_1997	73	51.64
06_30_1997	70	48.90
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07_02_1997	93	65.70
07_03_1997	73	51.60
07_04_1997	65	45.44
07_05_1997	68	47.55
07_06_1997	66	46.72
07_07_1997	63	44.64
07_08_1997	60	41.86
07_09_1997	58	40.49
07_10_1997	60	41.92
07_11_1997	56	39.16
07_12_1997	54	37.77
07_13_1997	52	36.40
07_14_1997	51	35.72
07_15_1997	54	37.70
07_16_1997	97	67.85
07_17_1997	68	48.15
07_18_1997	43	30.54
07_19_1997	38	27.03
07_20_1997	36	25.64
07_21_1997	38	27.03
07_22_1997	37	25.67
07_23_1997	146	102.93
07_24_1997	125	87.96
07_25_1997	113	79.49
07_26_1997	66	46.36
07_27_1997	59	41.42
07_28_1997	54	38.10
07_29_1997	50	35.30
07_30_1997	129	90.89
07_31_1997	79	55.74
08_01_1997	57	40.33
08_02_1997	52	36.75
08_03_1997	49	34.76
08_04_1997	47	33.39
08_05_1997	50	35.50
08_06_1997	46	32.02

08_07_1997	45	31.36
08_08_1997	43	29.95
08_09_1997	43	29.97
08_10_1997	43	30.04
08_11_1997	45	31.44
08_12_1997	41	28.63
08_13_1997	40	27.92
08_14_1997	40	27.90
08_15_1997	39	27.20
08_16_1997	37	25.80
08_17_1997	35	24.39
08_18_1997	32	22.32
08_19_1997	32	22.37
08_20_1997	31	21.75
08_21_1997	27	18.78
08_22_1997	21	14.63
08_23_1997	18	12.59
08_24_1997	19	13.21
08_25_1997	19	13.28
08_26_1997	31	21.54
08_27_1997	22	15.33
08_28_1997	20	14.02
08_29_1997	18	12.57
08_30_1997	19	13.22
08_31_1997	26	18.19
09_01_1997	26	18.18
09_02_1997	26	18.15
09_03_1997	23	15.99
09_04_1997	21	14.61
09_05_1997	19	13.24
09_06_1997	13	9.02
09_07_1997	12	8.33
09_08_1997	11	7.62
09_09_1997	11	7.62
09_10_1997	34	23.82
09_11_1997	53	37.10
09_12_1997	31	21.61
09_13_1997	19	13.12
09_14_1997	20	13.83
09_15_1997	19	13.14
09_16_1997	19	13.16
09_17_1997	17	11.78
09_18_1997	20	13.82
09_19_1997	21	14.56
09_20_1997	20	13.78
09_21_1997	16	11.17
09_22_1997	21	14.63
09_23_1997	25	17.45
09_24_1997	55	38.51
09_25_1997	86	60.77
09_26_1997	41	29.10
09_27_1997	35	24.85
09_28_1997	38	27.04

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09_30_1997	32	22.79
10_01_1997	25	17.92
10_02_1997	26	18.00
10_03_1997	27	18.74
10_04_1997	27	18.63
10_05_1997	26	18.09
10_06_1997	24	16.68
10_07_1997	19	13.13
10_08_1997	19	13.11
10_09_1997	19	13.10
10_10_1997	20	13.78
10_11_1997	20	13.80
10_12_1997	20	13.81
10_13_1997	20	13.74
10_14_1997	21	14.58
10_15_1997	26	18.07
10_16_1997	25	17.33
10_17_1997	24	17.12
10_18_1997	26	18.37
10_19_1997	104	73.16
10_20_1997	62	43.75
10_21_1997	31	22.10
10_22_1997	31	22.11
10_23_1997	31	22.14
10_24_1997	35	24.81
10_25_1997	37	26.01
10_26_1997	131	92.05
10_27_1997	256	180.01
10_28_1997	66	46.36
10_29_1997	52	36.60
10_30_1997	46	32.50
10_31_1997	39	27.71
11_01_1997	58	41.03
11_02_1997	65	45.90
11_03_1997	53	37.49
11_04_1997	48	34.04
11_05_1997	45	31.35
11_06_1997	41	28.58
11_07_1997	43	30.00
11_08_1997	41	28.61
11_09_1997	40	27.91
11_10_1997	40	27.91
11_11_1997	39	27.19
11_12_1997	40	27.97
11_13_1997	53	36.98
11_14_1997	111	78.38
11_15_1997	72	50.27
11_16_1997	52	36.85
11_17_1997	47	33.33
11_18_1997	47	32.77
11_19_1997	46	32.15
11_20_1997	45	31.53

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11_22_1997	314	220.40
11_23_1997	108	76.23
11_24_1997	76	53.10
11_25_1997	62	43.35
11_26_1997	60	41.97
11_27_1997	55	38.50
11_28_1997	53	37.12
11_29_1997	52	36.38
11_30_1997	74	51.78
12_01_1997	131	92.40
12_02_1997	94	66.43
12_03_1997	72	50.31
12_04_1997	74	51.73
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12_06_1997	58	40.63
12_07_1997	59	41.40
12_08_1997	58	40.71
12_09_1997	58	40.67
12_10_1997	66	46.30
12_11_1997	65	45.44
12_12_1997	59	41.27
12_13_1997	57	39.92
12_14_1997	56	39.13
12_15_1997	54	37.74
12_16_1997	54	37.72
12_17_1997	54	37.76
12_18_1997	53	37.07
12_19_1997	53	37.02
12_20_1997	53	37.03
12_21_1997	52	36.39
12_22_1997	96	67.25
12_23_1997	95	67.11
12_24_1997	163	114.74
12_25_1997	432	303.66
12_26_1997	151	106.22
12_27_1997	196	137.93
12_28_1997	221	155.48
12_29_1997	133	93.65
12_30_1997	115	81.03
12_31_1997	104	73.35
01_01_1998	91	64.30
01_02_1998	88	62.19
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01_05_1998	90	63.60
01_06_1998	89	62.89
01_07_1998	166	117.02
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01_09_1998	204	143.74
01_10_1998	126	88.90
01_11_1998	110	77.66
01_12_1998	99	69.92

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01_14_1998	88	62.19
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01_16_1998	643	452.35
01_17_1998	433	304.72
01_18_1998	204	143.74
01_19_1998	276	194.35
01_20_1998	220	154.99
01_21_1998	150	105.78
01_22_1998	131	92.42
01_23_1998	452	318.08
01_24_1998	268	188.73
01_25_1998	182	128.27
01_26_1998	142	100.15
01_27_1998	842	592.25
01_28_1998	2647	1861.17
01_29_1998	484	340.58
01_30_1998	274	192.95
01_31_1998	208	146.55
02_01_1998	177	124.14
02_02_1998	155	108.67
02_03_1998	346	242.94
02_04_1998	998	701.30
02_05_1998	441	309.73
02_06_1998	277	194.44
02_07_1998	205	143.82
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02_10_1998	138	96.72
02_11_1998	134	93.91
02_12_1998	308	216.23
02_13_1998	218	152.96
02_14_1998	158	110.78
02_15_1998	138	96.72
02_16_1998	158	110.78
02_17_1998	698	490.40
02_18_1998	448	314.65
02_19_1998	238	167.02
02_20_1998	178	124.84
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02_22_1998	135	94.61
02_23_1998	251	176.16
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02_25_1998	149	104.45
02_26_1998	134	93.91
02_27_1998	162	113.59
02_28_1998	154	107.97
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03_02_1998	122	85.54
03_03_1998	114	79.91
03_04_1998	108	75.70
03_05_1998	105	73.59
03_06_1998	103	72.18

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03_08_1998	723	508.04
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03_12_1998	168	117.88
03_13_1998	145	101.71
03_14_1998	137	96.08
03_15_1998	126	88.35
03_16_1998	121	84.83
03_17_1998	117	82.02
03_18_1998	130	91.16
03_19_1998	347	243.71
03_20_1998	221	155.13
03_21_1998	213	149.51
03_22_1998	165	115.77
03_23_1998	139	97.49
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03_28_1998	111	77.80
03_29_1998	108	75.70
03_30_1998	105	73.59
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04_07_1998	93	65.09
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04_11_1998	109	76.34
04_12_1998	100	70.01
04_13_1998	95	66.50
04_14_1998	96	67.20
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04_16_1998	95	66.50
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04_18_1998	496	348.40
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04_22_1998	220	154.37
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04_25_1998	144	100.94
04_26_1998	130	91.10
04_27_1998	117	81.96
04_28_1998	123	86.18

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05_02_1998	120	84.21
05_03_1998	111	77.88
05_04_1998	168	117.95
05_05_1998	202	141.86
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05_08_1998	175	122.88
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05_16_1998	84	58.90
05_17_1998	81	56.79
05_18_1998	77	53.98
05_19_1998	72	50.47
05_20_1998	70	49.06
05_21_1998	69	48.36
05_22_1998	66	46.25
05_23_1998	64	44.84
05_24_1998	64	44.84
05_25_1998	64	44.84
05_26_1998	66	46.25
05_27_1998	307	215.67
05_28_1998	104	72.96
05_29_1998	83	58.20
05_30_1998	79	55.39
05_31_1998	81	56.79
06_01_1998	68	47.56
06_02_1998	63	44.05
06_03_1998	61	42.64
06_04_1998	60	41.94
06_05_1998	66	46.16
06_06_1998	109	76.39
06_07_1998	85	59.51
06_08_1998	64	44.75
06_09_1998	62	43.34
06_10_1998	261	183.24
06_11_1998	141	98.88
06_12_1998	91	63.73
06_13_1998	84	58.81
06_14_1998	69	48.27
06_15_1998	66	46.16
06_16_1998	60	41.94
06_17_1998	57	39.83
06_18_1998	54	37.72
06_19_1998	53	37.02
06_20_1998	52	36.31

06_21_1998	50	34.91
06_22_1998	49	34.21
06_23_1998	48	33.50
06_24_1998	46	32.10
06_25_1998	59	41.24
06_26_1998	48	33.50
06_27_1998	44	30.69
06_28_1998	43	29.99
06_29_1998	41	28.58
06_30_1998	45	31.39
07_01_1998	45	31.65
07_02_1998	40	28.13
07_03_1998	38	26.73
07_04_1998	36	25.32
07_05_1998	36	25.32
07_06_1998	34	23.91
07_07_1998	34	23.91
07_08_1998	33	23.21
07_09_1998	34	23.91
07_10_1998	33	23.21
07_11_1998	31	21.81
07_12_1998	31	21.81
07_13_1998	31	21.81
07_14_1998	30	21.10
07_15_1998	29	20.40
07_16_1998	30	21.10
07_17_1998	34	23.91
07_18_1998	30	21.10
07_19_1998	27	18.99
07_20_1998	27	18.99
07_21_1998	31	21.81
07_22_1998	26	18.29
07_23_1998	26	18.29
07_24_1998	26	18.29
07_25_1998	32	22.51
07_26_1998	39	27.43
07_27_1998	30	21.10
07_28_1998	33	23.21
07_29_1998	29	20.40
07_30_1998	26	18.29
07_31_1998	25	17.59
08_01_1998	31	21.85
08_02_1998	25	17.63
08_03_1998	24	16.93
08_04_1998	22	15.52
08_05_1998	21	14.82
08_06_1998	21	14.82
08_07_1998	20	14.11
08_08_1998	23	16.22
08_09_1998	23	16.22
08_10_1998	56	39.42
08_11_1998	56	39.42
08_12_1998	28	19.74

08_13_1998	27	19.03
08_14_1998	28	19.74
08_15_1998	30	21.14
08_16_1998	71	49.97
08_17_1998	46	32.39
08_18_1998	33	23.25
08_19_1998	29	20.44
08_20_1998	27	19.03
08_21_1998	26	18.33
08_22_1998	25	17.63
08_23_1998	24	16.93
08_24_1998	23	16.22
08_25_1998	22	15.52
08_26_1998	20	14.11
08_27_1998	19	13.41
08_28_1998	18	12.71
08_29_1998	19	13.41
08_30_1998	22	15.52
08_31_1998	20	14.11
09_01_1998	18	12.62
09_02_1998	17	11.91
09_03_1998	20	14.02
09_04_1998	68	47.77
09_05_1998	30	21.05
09_06_1998	26	18.24
09_07_1998	25	17.54
09_08_1998	28	19.65
09_09_1998	31	21.76
09_10_1998	26	18.24
09_11_1998	25	17.54
09_12_1998	22	15.43
09_13_1998	21	14.73
09_14_1998	20	14.02
09_15_1998	19	13.32
09_16_1998	19	13.32
09_17_1998	19	13.32
09_18_1998	19	13.32
09_19_1998	18	12.62
09_20_1998	18	12.62
09_21_1998	19	13.32
09_22_1998	28	19.65
09_23_1998	22	15.43
09_24_1998	19	13.32
09_25_1998	19	13.32
09_26_1998	18	12.62
09_27_1998	17	11.91
09_28_1998	16	11.21
09_29_1998	16	11.21
09_30_1998	20	14.02
10_01_1998	19	13.46
10_02_1998	16	11.35
10_03_1998	16	11.35
10_04_1998	18	12.75

10_05_1998	20	14.16
10_06_1998	23	16.27
10_07_1998	23	16.27
10_08_1998	30	21.19
10_09_1998	38	26.81
10_10_1998	24	16.97
10_11_1998	19	13.46
10_12_1998	14	9.94
10_13_1998	13	9.24
10_14_1998	13	9.24
10_15_1998	12	8.53
10_16_1998	12	8.53
10_17_1998	13	9.24
10_18_1998	12	8.53
10_19_1998	12	8.53
10_20_1998	14	9.94
10_21_1998	12	8.53
10_22_1998	12	8.53
10_23_1998	12	8.53
10_24_1998	15	10.64
10_25_1998	15	10.64
10_26_1998	14	9.94
10_27_1998	14	9.94
10_28_1998	14	9.94
10_29_1998	14	9.94
10_30_1998	14	9.94
10_31_1998	16	11.35
11_01_1998	19	13.44
11_02_1998	19	13.44
11_03_1998	25	17.65
11_04_1998	25	17.65
11_05_1998	21	14.84
11_06_1998	21	14.84
11_07_1998	20	14.14
11_08_1998	22	15.55
11_09_1998	23	16.25
11_10_1998	23	16.25
11_11_1998	27	19.06
11_12_1998	22	15.55
11_13_1998	21	14.84
11_14_1998	23	16.25
11_15_1998	36	25.39
11_16_1998	26	18.36
11_17_1998	32	22.58
11_18_1998	24	16.95
11_19_1998	22	15.55
11_20_1998	23	16.25
11_21_1998	21	14.84
11_22_1998	21	14.84
11_23_1998	22	15.55
11_24_1998	23	16.25
11_25_1998	22	15.55
11_26_1998	25	17.65

11_27_1998	24	16.95
11_28_1998	23	16.25
11_29_1998	23	16.25
11_30_1998	23	16.25
12_01_1998	24	16.92
12_02_1998	23	16.22
12_03_1998	24	16.92
12_04_1998	25	17.62
12_05_1998	25	17.62
12_06_1998	25	17.62
12_07_1998	25	17.62
12_08_1998	25	17.62
12_09_1998	30	21.14
12_10_1998	26	18.33
12_11_1998	26	18.33
12_12_1998	26	18.33
12_13_1998	67	47.15
12_14_1998	46	32.39
12_15_1998	28	19.73
12_16_1998	49	34.50
12_17_1998	33	23.25
12_18_1998	27	19.03
12_19_1998	26	18.33
12_20_1998	27	19.03
12_21_1998	26	18.33
12_22_1998	26	18.33
12_23_1998	25	17.62
12_24_1998	82	57.69
12_25_1998	97	68.24
12_26_1998	48	33.79
12_27_1998	38	26.76
12_28_1998	34	23.95
12_29_1998	33	23.25
12_30_1998	30	21.14
12_31_1998	29	20.44
01_01_1999	29	20.55
01_02_1999	30	21.28
01_03_1999	278	195.39
01_04_1999	120	84.25
01_05_1999	60	42.12
01_06_1999	50	35.17
01_07_1999	50	35.10
01_08_1999	46	32.39
01_09_1999	44	31.05
01_10_1999	38	26.84
01_11_1999	37	26.23
01_12_1999	37	26.17
01_13_1999	41	29.02
01_14_1999	41	28.99
01_15_1999	52	36.68
01_16_1999	43	30.36
01_17_1999	40	28.25
01_18_1999	78	54.91

01_19_1999	75	52.79
01_20_1999	55	38.70
01_21_1999	50	35.25
01_22_1999	47	33.12
01_23_1999	175	123.05
01_24_1999	729	512.28
01_25_1999	281	197.23
01_26_1999	133	93.22
01_27_1999	94	65.91
01_28_1999	80	56.17
01_29_1999	69	48.56
01_30_1999	63	44.43
01_31_1999	57	40.32
02_01_1999	67	47.36
02_02_1999	149	104.90
02_03_1999	97	68.24
02_04_1999	78	54.84
02_05_1999	67	47.22
02_06_1999	62	43.76
02_07_1999	60	42.33
02_08_1999	57	40.29
02_09_1999	54	38.19
02_10_1999	54	38.22
02_11_1999	51	36.14
02_12_1999	51	36.00
02_13_1999	50	35.46
02_14_1999	46	32.62
02_15_1999	46	32.63
02_16_1999	46	32.63
02_17_1999	47	33.32
02_18_1999	68	48.00
02_19_1999	77	54.29
02_20_1999	151	106.10
02_21_1999	115	80.77
02_22_1999	88	61.88
02_23_1999	76	53.52
02_24_1999	72	50.79
02_25_1999	68	48.00
02_26_1999	65	45.91
02_27_1999	63	44.49
02_28_1999	63	44.48
03_01_1999	59	41.71
03_02_1999	55	38.90
03_03_1999	55	38.91
03_04_1999	63	44.48
03_05_1999	52	36.74
03_06_1999	52	36.70
03_07_1999	50	35.36
03_08_1999	48	33.99
03_09_1999	52	36.78
03_10_1999	55	38.85
03_11_1999	35	24.59
03_12_1999	48	33.94

03_13_1999	47	33.25
03_14_1999	55	38.88
03_15_1999	66	46.54
03_16_1999	60	42.30
03_17_1999	57	40.20
03_18_1999	53	37.38
03_19_1999	50	35.29
03_20_1999	50	35.31
03_21_1999	110	77.40
03_22_1999	90	63.18
03_23_1999	71	49.78
03_24_1999	66	46.27
03_25_1999	73	51.29
03_26_1999	59	41.55
03_27_1999	55	38.77
03_28_1999	53	37.40
03_29_1999	52	36.71
03_30_1999	50	35.32
03_31_1999	50	35.35
04_01_1999	64	45.11
04_02_1999	59	41.57
04_03_1999	52	36.64
04_04_1999	50	35.25
04_05_1999	48	33.79
04_06_1999	46	32.36
04_07_1999	46	32.33
04_08_1999	45	31.66
04_09_1999	45	31.64
04_10_1999	42	29.51
04_11_1999	41	28.73
04_12_1999	41	29.03
04_13_1999	38	26.86
04_14_1999	38	26.88
04_15_1999	48	33.91
04_16_1999	50	35.22
04_17_1999	39	27.52
04_18_1999	36	25.48
04_19_1999	36	25.46
04_20_1999	35	24.72
04_21_1999	32	22.67
04_22_1999	31	21.93
04_23_1999	29	20.51
04_24_1999	30	21.28
04_25_1999	31	21.99
04_26_1999	29	20.59
04_27_1999	30	21.24
04_28_1999	79	55.61
04_29_1999	67	47.00
04_30_1999	761	535.22
05_01_1999	232	163.17
05_02_1999	126	88.78
05_03_1999	94	65.75
05_04_1999	77	53.87

05_05_1999	67	46.93
05_06_1999	65	45.59
05_07_1999	60	42.08
05_08_1999	56	39.28
05_09_1999	51	35.81
05_10_1999	44	31.00
05_11_1999	37	26.16
05_12_1999	35	24.77
05_13_1999	35	24.76
05_14_1999	33	23.47
05_15_1999	33	23.46
05_16_1999	31	21.98
05_17_1999	29	20.53
05_18_1999	28	19.77
05_19_1999	51	35.88
05_20_1999	32	22.49
05_21_1999	28	19.69
05_22_1999	27	19.01
05_23_1999	26	18.29
05_24_1999	25	17.65
05_25_1999	23	16.30
05_26_1999	24	17.02
05_27_1999	26	18.41
05_28_1999	23	16.34
05_29_1999	22	15.60
05_30_1999	21	14.87
05_31_1999	20	14.17
06_01_1999	18	12.89
06_02_1999	18	12.93
06_03_1999	18	12.89
06_04_1999	17	12.23
06_05_1999	16	10.96
06_06_1999	16	11.08
06_07_1999	15	10.22
06_08_1999	14	9.85
06_09_1999	12	8.54
06_10_1999	15	10.78
06_11_1999	19	13.42
06_12_1999	16	11.35
06_13_1999	14	9.98
06_14_1999	13	9.24
06_15_1999	14	9.93
06_16_1999	26	18.41
06_17_1999	42	29.49
06_18_1999	19	13.33
06_19_1999	15	10.56
06_20_1999	16	11.29
06_21_1999	23	16.17
06_22_1999	20	14.09
06_23_1999	17	11.95
06_24_1999	16	11.24
06_25_1999	20	14.05
06_26_1999	42	29.51

06_27_1999	19	13.37
06_28_1999	17	11.96
06_29_1999	49	34.44
06_30_1999	19	13.27
07_01_1999	19	13.24
07_02_1999	646	453.84
07_03_1999	116	81.27
07_04_1999	48	33.51
07_05_1999	33	22.99
07_06_1999	28	19.51
07_07_1999	25	17.47
07_08_1999	28	19.63
07_09_1999	22	15.42
07_10_1999	19	13.38
07_11_1999	19	13.51
07_12_1999	27	19.16
07_13_1999	32	22.58
07_14_1999	26	18.34
07_15_1999	25	17.63
07_16_1999	21	14.85
07_17_1999	18	12.78
07_18_1999	17	12.05
07_19_1999	15	10.66
07_20_1999	13	9.24
07_21_1999	13	9.23
07_22_1999	13	9.24
07_23_1999	12	8.54
07_24_1999	13	9.24
07_25_1999	48	33.76
07_26_1999	14	9.85
07_27_1999	11	7.77
07_28_1999	11	7.78
07_29_1999	10	7.11
07_30_1999	9	6.39
07_31_1999	10	7.03
08_01_1999	9	6.34
08_02_1999	8	5.43
08_03_1999	10	7.18
08_04_1999	12	8.57
08_05_1999	11	7.90
08_06_1999	11	7.91
08_07_1999	9	6.52
08_08_1999	9	6.48
08_09_1999	12	8.55
08_10_1999	11	7.82
08_11_1999	12	8.53
08_12_1999	11	7.81
08_13_1999	9	6.41
08_14_1999	12	8.51
08_15_1999	14	9.74
08_16_1999	11	7.60
08_17_1999	10	6.93
08_18_1999	8	5.58

08_19_1999	8	5.33
08_20_1999	10	7.02
08_21_1999	28	19.60
08_22_1999	12	8.38
08_23_1999	11	7.70
08_24_1999	13	9.11
08_25_1999	137	96.02
08_26_1999	32	22.77
08_27_1999	39	27.69
08_28_1999	17	12.21
08_29_1999	19	13.06
08_30_1999	16	11.10
08_31_1999	14	9.81
09_01_1999	14	9.89
09_02_1999	14	9.96
09_03_1999	12	8.57
09_04_1999	11	7.86
09_05_1999	35	24.63
09_06_1999	82	57.40
09_07_1999	21	14.45
09_08_1999	13	8.94
09_09_1999	64	44.85
09_10_1999	48	33.41
09_11_1999	13	9.47
09_12_1999	10	6.75
09_13_1999	8	5.51
09_14_1999	8	5.67
09_15_1999	14	9.99
09_16_1999	28	19.69
09_17_1999	10	6.97
09_18_1999	8	5.61
09_19_1999	8	5.54
09_20_1999	7	5.25
09_21_1999	8	5.29
09_22_1999	8	5.34
09_23_1999	6	4.50
09_24_1999	8	5.85
09_25_1999	12	8.66
09_26_1999	12	8.63
09_27_1999	14	10.07
09_28_1999	51	36.10
09_29_1999	58	41.12
09_30_1999	55	38.79

Appendix IV. Public Notice of Draft Fourth Creek Fecal Coliform TMDL

NORTH CAROLINA
IREDELL COUNTY

AFFIDAVIT OF PUBLICATION

LEGAL NOTICE

PUBLIC NOTICE
State of North Carolina
Division of Water Quality

Availability of the Fourth Creek Fecal Coliform Total Maximum Daily Load (TMDL).

Copies of the TMDL may be obtained by calling Jamie Smith at (919) 733-5083, ext. 558, or on the internet at http://h2o.enr.state.nc.us/tmdl/. A public meeting will be held at 2:00 pm, April 30, 2001 at the Old City Hall Building on South Center Street in Statesville, NC. Written comments regarding the TMDL will be accepted until May 23, 2001. Please mail comments to 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.
April 13

Before the undersigned, a Notary Public of said County and State, duly commissioned, qualified, and authorized by law to administer oaths, personally appeared **W. Allison Bumgarner** who being first duly sworn, deposes and says: that she is an employee authorized to make this statement by **Media General Newspapers, Inc.** engaged in the publication of a newspaper known as the **Statesville Record & Landmark** published, issued, and entered as second class mail in the city of Statesville in said County and State, that 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 **Statesville Record & Landmark** on the following dates:

APRIL 13, 2001

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 1st day AUG, 20 01

W. Allison Bumgarner
(Signature of person making affidavit)

Sworn to and subscribed before me, this 1st

day of AUG 20 01

Notary Public

Commission expires: 5-12-2004

Michael F. Easley
Governor

Sherri Evans-Stanton, Acting Secretary
North Carolina Department of Environment and Natural Resources

Kerr T. Stevens, Director
Division of Water Quality

Fourth Creek, Yadkin-Pee Dee River Basin

Now Available Upon Request

Copies of the draft TMDL study:

Fourth Creek (in Subbasin 03-07-06)
Fecal Coliform Total Maximum Daily Load

Are now available upon request from the North Carolina Division of Water Quality. This TMDL study was prepared as a requirement of the Federal Water Pollution Control Act, Section 303(d). The study identifies the sources of pollution, determines allowable loads to the surface waters, and suggests allocations for pollutants of concern.

TO OBTAIN A FREE COPY OF THE TMDL REPORT:

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

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

Interested parties are invited to comment on the draft TMDL study by May 23, 2001. Comments and questions concerning the report should be directed to Ms. Betsy Albright at the above number (extension 514) and address. The draft TMDL is also located on the following website: http://h2o.enr.state.nc.us/tmdl

Public Hearing Notice

A public hearing to discuss the Fourth Creek Fecal Coliform TMDL will be held on Monday, April 30th at 2:00pm at the following address:

The Old City Hall Building
Council Chambers (2nd Floor)
301 South Center Street
Statesville, North Carolina

Appendix V. Public Comments on the Draft Fourth Creek Fecal Coliform TMDL and DWQ Response to Comments

COMMENTS OF
THE CITY OF STATESVILLE
ON THE DRAFT TOTAL MAXIMUM DAILY LOAD
FOR FECAL COLIFORM FOR FOURTH CREEK,
YADKIN-PEE DEE RIVER BASIN, NORTH CAROLINA
(April 30, 2001)

Good afternoon. My name is Joe Hudson. I am the Director of Water Resources for the City of Statesville. The City of Statesville operates its own wastewater treatment plants, one of which discharges into the Fourth Creek, under a National Pollutant Discharge Elimination System Permit.

On behalf of the City of Statesville, I would like to offer the following comments on the Division of Water Quality's Draft Total Maximum Daily Load for Fecal Coliform for Fourth Creek. First, I want to say that the City of Statesville fully supports the effort to address the fecal coliform impairment of Fourth Creek. Only by taking a comprehensive, scientifically based approach can we hope to protect and improve water quality in Fourth Creek and do so in a way that is cost-effective.

Second, I commend the Division of Water Quality not only for taking the initiative here to study the fecal coliform loading issue in Fourth Creek but also for the tremendous effort that has gone into development of the fecal coliform draft TMDL. DWQ has done an outstanding job of studying Fourth Creek, measuring and documenting fecal coliform levels, and beginning to identify the kinds of strategies that are necessary to accomplish reductions in the levels of fecal coliform present in Fourth Creek.

In addition, I commend DWQ for focusing on the challenges presented by the non-point sources of fecal coliform. Non-point discharges of fecal coliform bacteria present special difficulties

Appendix V. Public Comments on the Draft Fourth Creek Fecal Coliform TMDL and DWQ Response to Comments.

to the promulgation of a TMDL, especially when we consider that Iredell and Rowan Counties contain major producers of livestock and dairy products. While the task of reducing pollution from these sources is a daunting one, requiring tremendous resources, cooperation, patience, and time, those impediments cannot be made excuses for delay or inaction. The City of Statesville is prepared to participate—and I strongly encourage all affected local governments and agencies to cooperate—in the development of implementation plans for the TMDL. We face a mammoth task: namely the reduction of the non-point source fecal coliform load by 60 to almost 80 percent. Working together toward this common goal, I am confident that we can accomplish it.

Finally, I would like to mention my concern that the proposed TMDL for fecal coliform in Fourth Creek has the potential to constrain the growth of the City of Statesville. As the City of Statesville grows, the City's wastewater treatment plant will increase its operations. As DWQ acknowledged in the draft TMDL, the City's wastewater treatment plant is responsible for *less than one percent* of the fecal coliform load in the Creek and has consistently fallen well within its Permit limits for fecal coliform levels. At this stage, however, the TMDL does not appear to take into account an increased discharge that would naturally result from the growth of Statesville. The TMDL can be modified to accommodate anticipate population growth in Statesville and the surrounding area without significantly increasing the reduction obligations of nonpoint sources.

In closing, let me say that the City of Statesville recognizes how important Fourth Creek is to the economy and quality of life in both Iredell and Rowan Counties. We look forward to helping DWQ and other interested parties reduce the levels of fecal coliform present in the Creek, through creative and pragmatic strategies to address the non-point sources of the bacteria. And, at the same time, we are confident that DWQ will rise to the challenge of adjusting the TMDL to take into account the growth of Statesville.

Appendix V. Public Comments on the Draft Fourth Creek Fecal Coliform TMDL and DWQ Response to Comments

DWQ Response to Comments from the City of Statesville:

DWQ greatly appreciates the comments on the Draft Total Maximum Daily Load for Fecal Coliform Bacteria for Fourth Creek. We look forward to working with Statesville and other interested parties to develop an implementation plan to reduce the fecal coliform concentrations in Fourth Creek, with the overall goal of obtaining the designated uses of Fourth Creek. If future expansion of the Fourth Creek WWTP is requested, we will review the fecal coliform loading allocation to the Fourth Creek Wastewater Treatment Plant.