Fecal Coliform Total Maximum Daily Load for the McKee and Clear Creek Watersheds, Mecklenburg and Cabarrus Counties, North Carolina

Final Report
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Yadkin River Basin

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SUMMARY SHEET
Total Maximum Daily Load (TMDL)
McKee Creek - At and Above the Confluence with Reedy Creek

1. 303(d) Listed Waterbody Information

State:	North Carolina
County:	Mecklenburg and Cabarrus
Major River Basin:	Yadkin Area Basin
Watershed:	McKee Creek (within HUC03040105) DWQ Subbasin 03-07-11
Waterbody Name:	McKee Creek / Clear Creek
Waterbody ID:	Use Support Index Numbers 13-17-8-4 / 13-17-8-4-1
Location:	Headwaters to confluence with Reedy Creek
Impacted Stream Length:	Partially Supporting: McKee Creek – 6.5 miles Clear Creek – 1.6 miles
Watershed Area:	8.6 square miles
Tributary to:	Reedy Creek

Constituent(s) of Concern: Fecal Coliform Bacteria

Designated Uses: Secondary Recreation

Applicable Water Quality Standard for Secondary Recreation (most stringent standard):

> 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.

2. Public Notice Information

Forms of Public Notification: A draft of the McKee and Clear Creek TMDL was publicly noticed through various means, including notification in two local newspapers, *The Charlotte Observer* and *The Independent Tribune*. The TMDL was also available from the Division of Water Quality's website at http://h2o.enr.state.nc.us/tmdl/draft_TMDLs.htm during the comment period. A public comment period was held for the 30 days prior to November 29, 2002. A public meeting was held in Concord on November 18, 2002. A second public comment period was held from May 19, 2003 to June 3, 2003 due to revisions to the TMDL.

Did notification contain specific mention of TMDL proposal? YES
Were comments received from the public? NO
Was a responsiveness summary prepared? Not applicable

3. TMDL Development

Analysis/Modeling:

A mass balance approach coupled with a series of Flow Duration and Load Duration curves was used to calculate the TMDLs for the impaired streams.

Critical Conditions:

An intensive survey at McKee Creek conducted by the NC DENR, Division of Water Quality, from April 10 to June 5, 2001, provided the basis for this TMDL. A comparison to a 7-year period of record in a nearby watershed indicated that flows during the intensive survey were only exceeded 16-26% of the time.

Seasonal Variation:

For the listed streams, upstream-downstream data collected at two point source discharges from 4/1/1998 through 7/6/2000 shows that high, instream fecal coliform levels were common throughout the year, with no particular season representing a worst case period.

3. Allocation Watershed/Stream Reach:

TMDL Components								
Watershed	Area	TMDL	WLA-Cont	LA +WLA wt wx	MOS	WLA Wet Wx	WLA Total	LA only
Units	Acres	cfu/day	cfu/day	cfu/day	cfu/day	cfu/day	cfu/day	cfu/day
Upper Mckee Creek at MCK-2	4166	1.82E+10	8.02E+09	8.36E+09	1.82E+09	7.92E+09	1.59E+10	4.37E+08
Clear Creek	**599**	**2.62E+09**	0	2.36E+09	**2.62E+08**	2.36E+08	**2.36E+08**	**2.12E+09**
Lower McKee	751	3.28E+09	0	2.95E+09	3.28E+08			2.95E+09
Total McKee	**5516**	**2.41E+10**	8.02E+09	1.37E+10	**2.41E+09**	8.16E+09	**1.62E+10**	**5.51E+09**

McKee WLA-Cont $_{\text{30-day load}}$ = 2.406e+11 cfu; McKee Wet Wx WLA $_{\text{30-day load}}$ = 2.448e+11 cfu
Wet Wx WLA = MS4 load

Wasteload Allocations (WLA): 1.62×10^{10} counts/day

Load Allocation (LA): 5.51×10^{9} counts/day

Margin of Safety (MOS): 40 counts/100 ml; conservative assumptions: 2.41×10^{9} counts/day

Total Maximum Daily Load (TMDL) including, by definition, the MOS =

2.41×10^{10} counts/day or 400 counts/100 ml

Reduction required: 85%

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1.0 INTRODUCTION

North Carolina's 2002 Integrated Report includes two stream segments totaling a linear distance of 8.1 miles in the McKee Creek watershed as impaired due to elevated fecal coliform concentrations. Clear Creek is a small tributary to McKee Creek within the same watershed. McKee and Clear creeks are located within Division of Water Quality (DWQ) subbasin 03-07-11. The objective of this study is to develop a fecal coliform TMDL using a watershed approach for McKee and Clear Creeks. These are the only stream segments listed in the 2000 303(d) list for the McKee Creek watershed.

Table 1. Impaired Stream Segments Listed in NC's 2000 303(d) List as Partially Supporting Because of Fecal Coliform Contamination.

Stream	Use Support Index No.	Location	Impaired Stream Miles
McKee Creek	13-17-8-4	From source to Reedy Creek	6.5
Clear Creek	13-17-8-4-1	From source to McKee Creek	1.6

This is a **rapidly urbanizing** watershed. I-485 is being extended through both the McKee and Clear Creek watersheds. Dennis Testerman of the Cabarrus Soil and Water Conservation District stated, "'all bets are off' on development. I would expect to see the potential sources of fecal coliform bacteria shift from cattle, goats, and sheep to cats, dogs, geese and horses" (Testerman, 2002). Agriculture is declining in the watershed. Rising land values and an ageing farm population are combining to increase the rate of urbanization.

The Cabarrus County Water and Sewer Authority Board, in a joint venture with Charlotte Mecklenburg Utilities, has approved plans for 110,000 linear feet of interceptor sewers to be placed along Reedy and McKee Creeks. These will range from 30-60 inches in diameter. A pump station will be constructed to pump the Reedy Creek Interceptor flow into the existing Rocky River 48 inch force main. The Mecklenburg portion of the design is completed, as of November, 2002, and the Cabarrus portion will be designed shortly thereafter. The plans are contingent upon approval by the City of Charlotte. (Furr, 2002.) It is assumed that both existing point source discharges to McKee Creek, Lamplighter Village East and Bradfield Farms, will be diverted, sometime in the future, into these interceptors. This will eliminate occasional problems associated with these dischargers, allowing a slightly greater load allocation to the nonpoint sources in the watershed.

This TMDL was developed through a number of iterative steps, each of which provided valuable insight into the entire process. In order to preserve the lessons learned and to illustrate the variety of results obtained by using different stations and different components of the water quality standards, the major iterations are included in this presentation. The reader should recognize that the first and second calculations of fecal coliform reductions are for illustration only. The third and final major reduction calculation is the basis for the final TMDL.

1.1 Background

Section 303(d) of the Clean Water Act (CWA) and EPA's Water Quality Planning and Management Regulations (40 CFR Part 130) requires states to identify waterbodies which are not meeting their designated use. A Total Maximum Daily Load (TMDL) is required for pollutants causing the use impairment. The TMDL process establishes the allowable loadings of pollutants for a waterbody based on the relationship between the pollution sources and instream water quality conditions. This allows states to establish water quality based controls to reduce pollution and restore and maintain the quality of their water resources (USEPA 1991).

TMDLs are expressed as Waste Load Allocations (WLAs) for discharges regulated by the National Pollutant Discharge Elimination System (NPDES) permit program, which includes point sources from facilities and stormwater from regulated municipalities, and Load Allocations (LAs) for all nonpoint sources. The TMDL must also provide an appropriate margin of safety (MOS), which takes into account any uncertainty concerning the relationship between pollutant loads and water quality response. A TMDL is denoted by the equation:

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

The objective of a TMDL is to allocate allowable pollutant loads to known sources so that actions may be taken to restore the water to its intended uses (EPA 1991). Generally, the primary components of a TMDL, as identified by EPA (1991, 2000) 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 potential sources contributing to the impairment are 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.

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 in the NPDES program. Similarly, the load allocation portion of the TMDL accounts for the loads associated with existing and future nonpoint 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 (2000), 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).

The goal of the TMDL program is to restore uses to water bodies. Thus the implementation of bacterial controls will be necessary to restore uses in these streams. Although an implementation plan is not included in this TMDL, reduction strategies are needed. The involvement of local governments and agencies will be needed in order to develop implementation plans.

TMDLs developed for the McKee and Clear Creek watersheds are expressed in terms of organism counts per day and as a percent reduction of instream concentration required to achieve the designated use. The TMDLs represent the maximum load the stream can assimilate to achieve water quality standards.

1.2 Watershed Description

The McKee and Clear Creek watersheds (Figure 1) are located within Mecklenburg and Cabarrus Counties, in the eastern part of the Greater Charlotte Metropolitan Area, North Carolina. Of the total 5516 acres in the McKee Watershed, 4008 acres or 73 percent of the watershed lie within Mecklenburg County and the remaining 1508 acres or 27 percent lie within Cabarrus County. The watershed is within the Hydrologic Unit Code 03040105, as designated by the U.S. Geological Survey (DWQ subbasin 03-07-11). McKee Creek originates in Mecklenburg County and flows north-northeast to its confluence with Reedy Creek in Cabarrus County. Reedy Creek discharges to the Rocky River, which in turn discharges to the Yadkin River. Clear Creek is relatively short (1.6 miles), lies entirely in the McKee Creek watershed, and is largely contained within Cabarrus County. Clear Creek flows approximately northwest to its confluence with McKee Creek. Some maps show McKee Creek as “McKees Creek.” These two are the same.

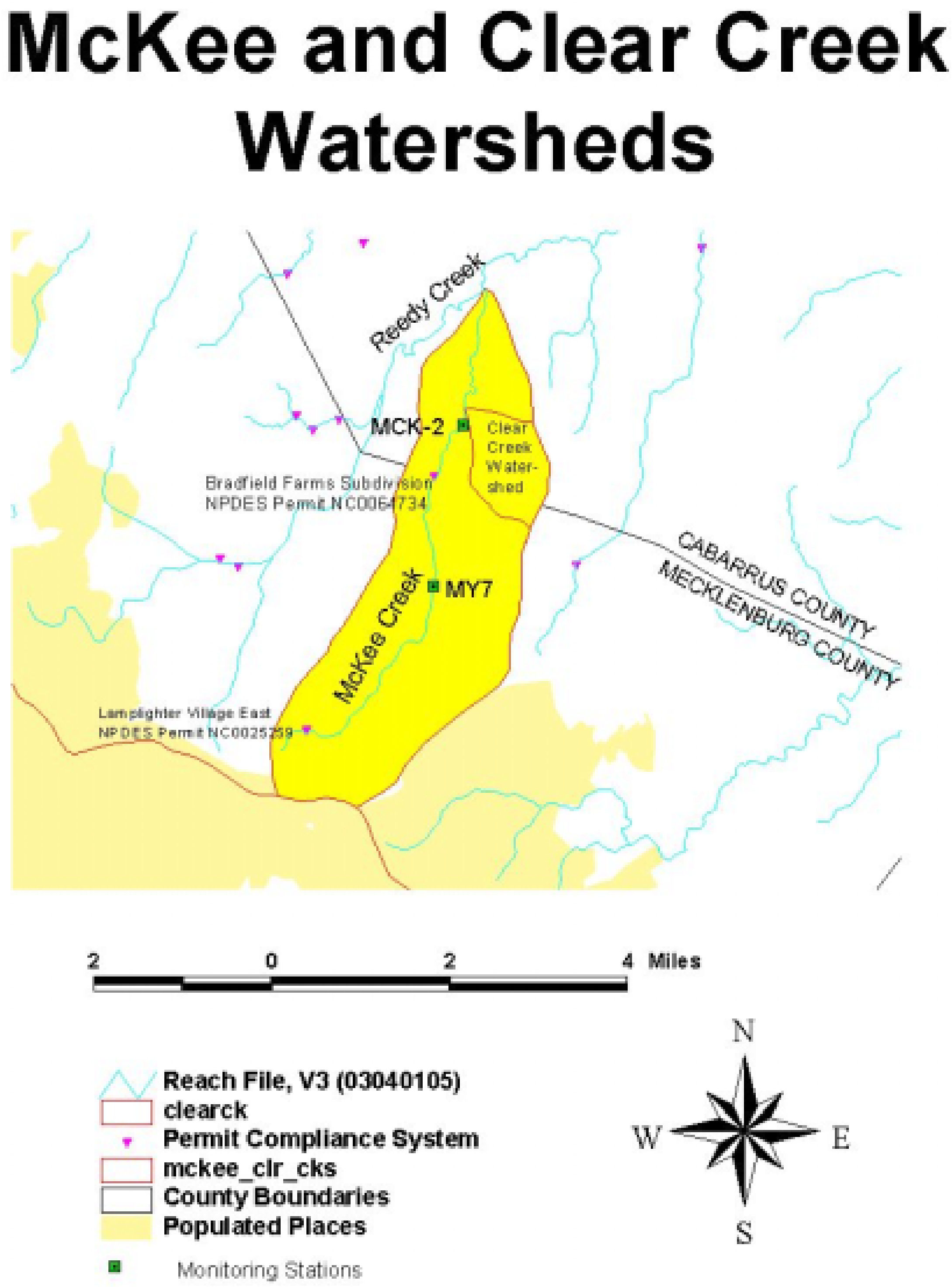

Figure 1. McKee and Clear Creek Watersheds – in bright yellow

The Watershed Characterization System (WCS) could not delineate Clear Creek because EPA's Reach File 3 does not contain Clear Creek within the streams listed in the database. Therefore, land use details for the Clear Creek watershed were approximated from delineation from USGS Quadrangle Maps (Figure 2) using Terrain Navigator, a MAPTECH program available through the EPA, Region 4 Library.

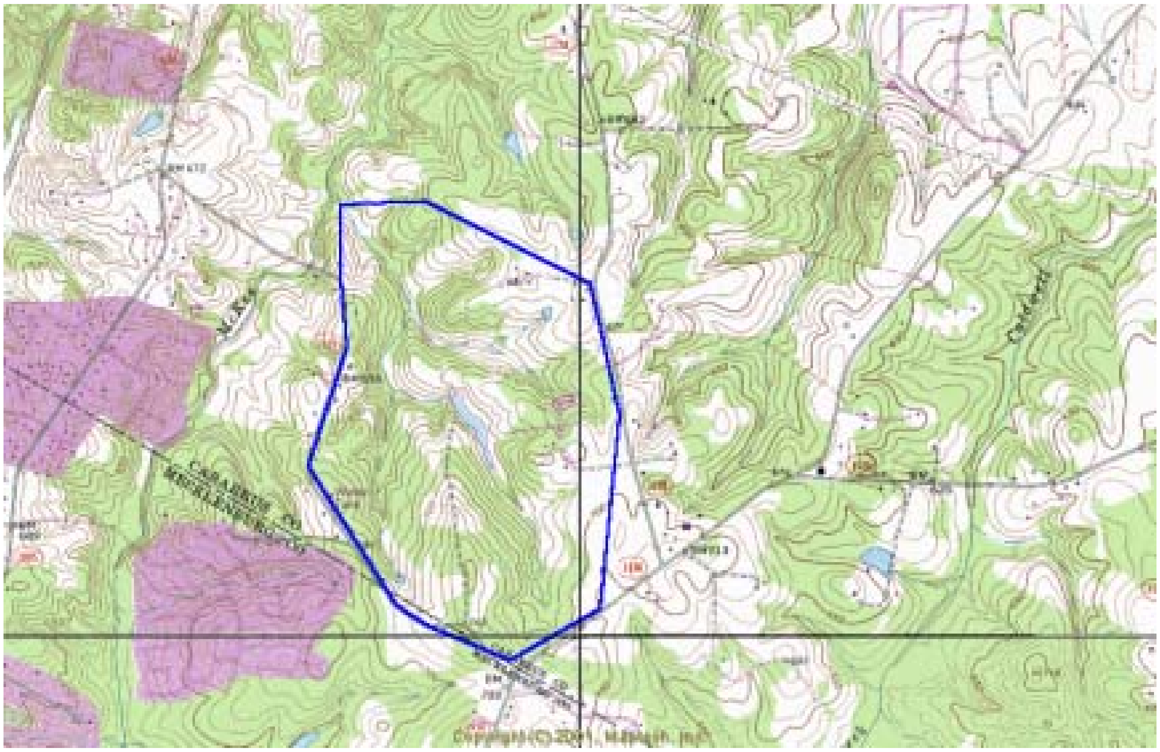

Figure 2. Clear Creek Subwatershed Boundaries

Water quality and quantity data were collected at multiple locations within this and neighboring watersheds by different agencies. For the purposes of assessing TMDL compliance, the McKee Creek stations MY7 (listed by the Division of Water Quality (DWQ) as station Q7750000) and MCK-2 were used in evaluating water quality in McKee Creek. Station MCK-2 was chosen as the evaluation point for the TMDL (see discussion on page 25-26). Data collected at these stations are shown in Appendix A.

McKee and Clear Creeks are located in the lower portion of the Yadkin River Basin. The drainage area of the combined watershed, as measured from the headwaters to the confluence with Reedy Creek, is only 8.6 square miles. From its headwaters in northeastern Mecklenburg County, North Carolina, McKee Creek flows northward from the more urban area of northeast Charlotte into the more rural countryside of Cabarrus County. Both McKee and Clear Creeks are listed as partially supporting the designated use of secondary recreation. Water quality data are not available for Clear Creek and the basis for this determination for Clear Creek is not documented. The TMDL for Clear Creek is developed by comparing loads from similar land uses within the rest of the McKee watershed.

Based on the Multi-Resolution Land Characteristic (MRLC) database of 1993, land uses in the upper (southeastern) portions of the watershed are predominately urban. The lower (northern) portions of the watershed, especially the Clear Creek Subwatershed, are predominately forest and agriculture. The detailed land use distribution for the impaired reaches is presented in Table 2 and shown spatially in Figure 3. This land use distribution should be recognized as a "snapshot" of conditions that continue to change rapidly as development accelerates, particularly in Mecklenburg County. These statistics are presented as a base for future remediation and do not affect the calculation of the TMDL, which is based entirely on stream water quality and flow data.

Table 2. Land Use Distribution in the McKee Creek Watershed

Land Use	McKee Creek, Upstream of SR 2808 (Sta. Q7750000 or MK7)		**McKee Creek, Upstream of SR 1169 (Sta. MCK-2)***		Clear Creek, Sub-watershed		McKee Creek, Downstream of SR 1169		McKee Creek, Entire Watershed	
	(Acres)	(%)	**(Acres)**	(%)	(Acres)	(%)	(Acres)	(%)	(Acres)	(%)
Bare Rock/Sand/Clay	12	0.4	**36**	0.9	1.2	0.2	0.8	0.1	38	0.7
Deciduous Forest	808	30	**1102**	26.5	88.7	14.8	109.3	14.6	1300	23.6
Emergent Herbaceous Wetlands	1	0	**2**	0.1	0.6	0.1	1.4	0.2	4	0.1
Evergreen Forest	533	20	**1020**	24.5	239	39.9	301	40.1	1560	28.3
High Intensity (Commercial/Industrial/ Transportation)	108	4	**110**	2.6	0	0	0	0	110	2
High Intensity Residential	22	0.8	**22**	0.5	0	0	0	0	22	0.4
Low Intensity Residential	346	13	**364**	8.7	0	0	0	0	364	6.6
Mixed Forest	341	13	**522**	12.5	77.9	13	98.1	13	698	12.7
Open Water	14	0.5	**19**	0.5	2.4	0.4	3.6	0.5	25	0.4
Other Grasses (Urban/recreational; e.g. parks, lawns)	56	2.1	**56**	1.3	0	0	0	0	56	1
Pasture/Hay	179	6.5	**342**	8.2	117.4	19.6	146.6	19.4	606	11
Row Crops	284	10	**476**	11.4	58.1	9.7	72	9.7	606.1	11
Woody Wetlands	31	1.1	**95**	2.3	13.8	2.3	18.2	2.4	127	2.3
Total	2735	100	4166	100	599.1	100	751	100	5516	100

*** Includes area upstream of MK7**

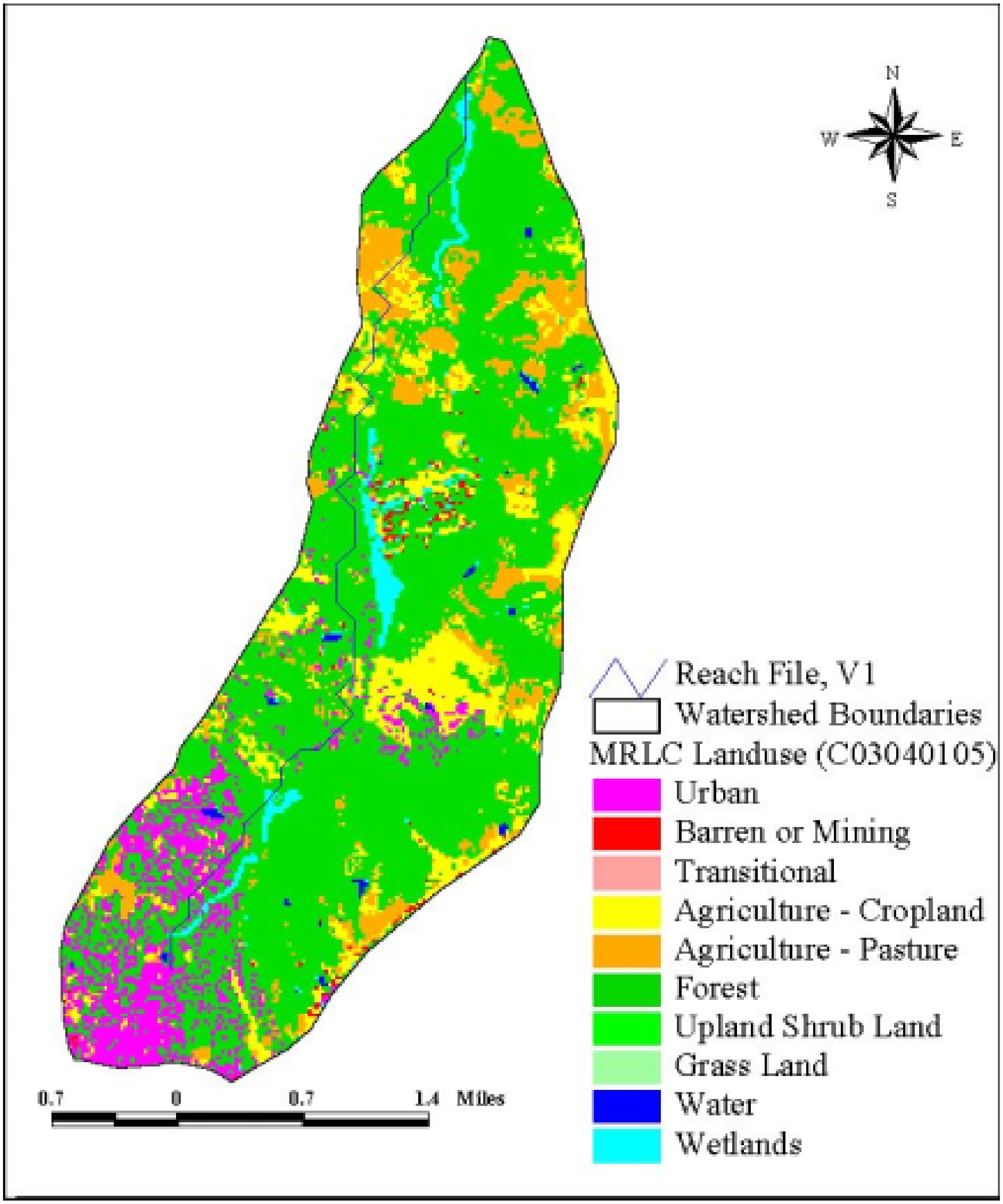

Figure 3. Landuse in the McKee Creek Watershed

For purposes of analysis these land uses are simplified as shown in Table 3.

Table 3. Simplified Land Use Distribution in McKee Creek Watershed

Land Use	McKee Creek, Upstream of SR 2808 (Sta. Q7750000 or MY7)	McKee Creek, Upstream of SR 1169 (Sta. MCK-2) to MY7	Clear Creek, Sub-watershed	McKee Creek, Downstream of SR 1169	McKee Creek, Entire Watershed
	(Acres)	(Acres)	(Acres)	(Acres)	(Acres)
Urban	532	20	0	0	552
Forest and Brush	1726	1051	421	528	3726
Open Water	14	5	2	4	25
Pasture/Hay	179	163	117	147	606
Row Crops	284	192	58	73	607
Total	2735	1431	599	751	5516

1.3 Water Quality Target

The North Carolina fresh water quality standard for fecal coliform in Class C waters (T15A: 02B.0211(3)(e)) 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 [the **"200 standard"**], nor exceed 400/100 ml in more than 20 percent of the samples examined during such period [the **"400 standard"**]; violations of the fecal coliform standard are expected during rainfall events and, in some cases, this violation is expected to be caused by uncontrollable nonpoint 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.

All TMDLs include the establishment of in-stream numeric endpoints, or targets, used to evaluate the attainment of water quality goals and designated use criteria. The target represents the restoration objective to be achieved by implementation of load reductions specified by the TMDL. For the TMDLs presented in this document, both fecal coliform criteria were evaluated as targets. Initially, the 200 standard was selected as possibly more stringent, and the first few iterations were based on this standard. Finally, the 400 standard was reevaluated and demonstrated to be by far the more stringent standard. Consequently, the final calculations for this TMDL are based on the 400 standard.

Secondary recreation is the designated use being addressed in this TMDL. Secondary recreation is defined in NC's standards (15A NCAC 2B .0202 (57)) as including "wading, boating, other uses not involving human body contact with water, and activities involving human body contact with water where such activities take place on an infrequent, unorganized, or incidental basis." It is believed that the streams addressed in this document are used for secondary recreation by the local residents predominantly during warm temperature, non-storm conditions. High stream flow activities such as white water kayaking are not known to take place on a frequent and organized basis in these small streams. Hence, the source assessment and TMDL allocation are focused on those sources and conditions which represent the highest risk to human health during the times of highest recreational use by the public.

2.0 WATER QUALITY ASSESSMENT

The North Carolina Division of Water Quality (DWQ) places waterbodies on the 303(d) list using methodologies described in the basinwide management plans. McKee Creek was rated partially supporting based on the monthly ambient monitoring data collected at SR 2808 (ambient station number Q7750000) over a 5-year period. The basis for listing Clear Creek as impaired for fecal coliform bacteria is not documented.

An intensive fecal coliform data collection effort was conducted by DWQ at two stations in the McKee Creek watershed during April through June 2001, collecting three (3) replicate samples weekly at two stations for eight (8) weeks. The replicates were collected in three separate bottles, filled one after the other from the creek. The Mecklenburg County Department of Environmental Protection (MCDEP) also collected fecal coliform samples at MY7, the more upstream station on McKee Creek, coinciding with the State Station Q7750000, from 1988 through 2001 (monthly samples through 1995 and quarterly samples thereafter).

Because the North Carolina water quality standard (WQS) for fecal coliforms specify a minimum of 5 samples per month to determine a violation of either the geometric mean or arithmetic average, these TMDLs are based on the DWQ intensive survey of 2001 as the only source of data from which to properly evaluate the standard.

The water quality assessment and subsequent TMDL analysis for this watershed considered both fecal coliform criteria. However, the TMDL calculations are based on the "400 standard" as the more stringent standard.

In Table 4, a geometric mean was calculated for each weekly sample, composed of three replicates -- or observations. A series of running 30 day periods was generated, each consisting of five samples, the minimum required by the WQS. EPA's Ambient Water Quality Criteria for Bacteria – 1986 states on page 16 that "based on a statistically sufficient number of samples (generally not less than 5 samples *equally spaced* [emphasis added] over a 30-day period . . . the geometric mean . . . should not exceed . . . ." Although this reference is specifically to E. coli and enterococci, the inference is that the same reasoning should apply to fecal coliform samples. This reasoning was used as the basis for determining that the series of three replicate observations, each of the series separated by 7 days, constituted single samples, each collected a week apart. Reporting the results of each sample as the geometric mean of three replicates was determined as the correct way of presenting the data, and the two periods of 35 and 36 days encompassing 5 samples are considered acceptable for this analysis.

The complete list of samples collected during this survey is included in Appendix A. Table 4 shows the data used to compare against the State fecal coliform standards. Note: each sample is the geometric mean of triplicate observations.

Table 4. Intensive Survey Monitoring Data at McKee Creek Stations

Summary McKee Creek Fecal Coliform

Station Description	Station Number*	Dates	Number of days	No. Samples	Geometric Mean
McKee Creek in Mecklenburg Co. at SR 2808	MY7	4/11/2001 to 5/9/2001	29	5	309
McKee Creek in Mecklenburg Co. at SR 2808	MY7	4/18/2001 to 5/16/2001	29	5	337
McKee Creek in Mecklenburg Co. at SR 2808	MY7	4/25/2001 to 5/30/2001	36	5	518
McKee Creek in Mecklenburg Co. at SR 2808	MY7	5/2/2001 to 6/5/2001	35	5	341
McKee Creek in Cabarrus Co. at SR 1169	MCK-2	4/11/2001 to 5/9/2001	29	5	155
McKee Creek in Cabarrus Co. at SR 1169	MCK-2	4/18/2001 to 5/16/2001	29	5	206
McKee Creek in Cabarrus Co. at SR 1169	MCK-2	4/25/2001 to 5/30/2001	36	5	260
McKee Creek in Cabarrus Co. at SR 1169	MCK-2	5/2/2001 to 6/5/2001	35	5	231

* Station MY7 is identical to Station Q7750000

See **Appendix A** for a complete listing of the data.

3.0 Source Assessment

An important part of the TMDL analysis is the identification of sources of fecal coliform in the watershed and an estimate of the amount of pollutant loading contributed by each of these sources. Under the Clean Water Act, sources are broadly classified as either point or nonpoint sources. This section of the TMDL describes the point and nonpoint sources of fecal coliform in the watershed.

3.1 Point Source Assessment

Under 40 CFR 122.2, a point source is defined as any discernable, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. The NPDES program regulates point source discharges. Point sources can be described by two broad categories: 1) NPDES regulated municipal and industrial wastewater treatment facilities; and 2) NPDES regulated industrial activities and MS4 discharges. A TMDL must provide WLAs for all NPDES regulated point sources.

For the purposes of the McKee Creek TMDL, the WLA includes both: 1) continuous discharge facilities (comprised of two (2) small, domestic wastewater “package” plants); and 2) wet weather discharges from the MS4, extra territorial jurisdiction (ETJ) area of Mecklenburg County, which includes the entire 4008 acres of the McKee-Clear Creek watershed within Mecklenburg County as part of the Phase I MS4 NPDES Permit (Rozell, 2003). In Cabarrus County none of the county was included in Phase I MS4 and only the communities of Concord and Kannapolis (both outside the McKee Creek watershed) are included in the initial Phase II MS4 jurisdiction. Therefore, MS4 jurisdiction does not apply to the Cabarrus County portion of the McKee-Clear Creek watershed at this time. Within the 599-acre Clear Creek watershed it is assumed that about 10 percent of the area (60 acres) are included in the Mecklenburg County ETJ and subject to MS4 requirements.

3.1.1 Continuous Discharge NPDES Facilities

Continuous discharge facilities, as the name implies, discharge treated wastewater continuously regardless of weather conditions. NPDES facilities that continuously discharge effluent containing fecal coliform bacteria include sewage treatment plants (STPs) and wastewater treatment plants (WWTPs). Two continuous discharge facilities are located within the McKee Creek watershed: (1) Lamplighter Village East (NC 0025259) discharges to the headwaters of McKee Creek and (2) Bradfield Farms (a subdivision) (NC 0064734) discharges to McKee Creek just downstream of the Mecklenburg/Cabarrus county line (see Figure 1). Both facilities have permit limits for effluent concentrations of fecal coliform equivalent to water quality criteria – a monthly geometric mean of 200 cfu/100 ml and a daily maximum of 400/100 ml.

An analysis of effluent and instream data collected at these two facilities is presented in Appendix B. The data for the years 1997 or 1998 through 2001 show that both dischargers are well within their limits for the monthly geometric mean of fecal coliforms. On a yearly basis, these permitted facilities discharged only 0.2 to 3.3 percent of their permit limits. There were, however, several exceedances of the daily maximum of 400 cfu/100 ml in the effluent measurements. Furthermore, the available instream data (from samples taken upstream and downstream of the discharges) suggest that additional upsets or bypasses occurred at times when the effluent itself was not sampled. Often, when upstream coliform concentrations exceeded water quality standards, the downstream measurements actually showed lesser coliform counts, suggesting a chlorine addition to the stream as the result of the discharges. This problem should become moot once the interceptor sewers described in the Introduction (Section 1.0) are put into service.

3.1.2 Wet Weather NPDES Facilities

Large and medium MS4s serving populations greater than 100,000 people are required to obtain an NDPES storm water permit and are covered by a Phase I MS4 Permit. As of February 2003, the City of Charlotte already has one MS4 permit regulated by the NPDES program that extends to the City Limits plus some of the ETJ area of Mecklenburg County, including the upper McKee-Clear Creek watershed. In addition, Mecklenburg County is applying for an MS4 Phase II Storm Water Permit that will include the rest of the county (Mecklenburg County, 2003).

The portion of the McKee-Clear Creek watershed in Cabarrus County is not affected by current MS4 requirements (Rowell, 2003). Only the portion of the watershed within Mecklenburg County is, therefore, included in the WLA portion of this TMDL.

3.2 Nonpoint Source and Wet Weather Point Source Assessment

Nonpoint sources of fecal coliform bacteria are diffuse sources that cannot be identified as entering the waterbody at a single location. Wet weather point sources are similar except they are conveyed to streams through pipes or open ditches in areas subject to MS4 NPDES permits. Both these sources generally involve land activities that contribute fecal coliform bacteria to streams during rainfall runoff events. Nonpoint sources are all sources not regulated by the NPDES program. The TMDL must provide a load allocation (LA) for these sources and a waste load allocation (WLA) for the wet weather point sources. Typical nonpoint and wet weather point sources of fecal coliform bacteria include:

- Agricultural runoff,
- Septic systems,
- Urban runoff, and
- Wildlife.

The Watershed Characterization System (WCS), a geographic information system (GIS) interface, was used to display, analyze and compile spatial and attribute data (EPA, 2001). Available data sources included land use category, point source discharges, soil type and characteristics, population data (human and livestock), digital elevation data, stream characteristics and flow data. Queries of the WCS and ASWCC databases provide the foundation of the watershed characterization for the McKee Creek watershed. Fecal coliform production rates were estimated using the data from these queries and literature values for fecal coliform concentrations from the various sources.

3.2.1 Runoff from Agricultural Lands

As mentioned in the introduction, "This is a **rapidly urbanizing** watershed. I-485 is being extended through both [the McKee and Clear Creek] . . . watersheds, so 'all bets are off' on development. I would expect to see the potential sources of fecal coliform bacteria shift from cattle, goats, and sheep to cats, dogs, geese and horses" (Testerman, 2002). Agriculture is declining in the watershed. Rising land values and an ageing farm population are combining to increase the rate of urbanization.

Horse farms are increasing in the watershed; and, especially if the land is rented, there is little incentive for the tenants to invest in conservation measures. Moreover, there is limited contact between agricultural officials and horse owners, and only a few cattle owners work closely with the Soil and Water Conservation Districts. Exact livestock counts are not available.

Because of these considerations, the analysis, shown below, of fecal coliforms in agricultural runoff is presented only as an example that will need to be updated as an implementation plan is developed. This analysis was based in part on the Watershed Characteristic System (WCS) database made available to EPA in 2000, supplemented by the estimate that there are probably as many horses as cows in the watershed at present. The results are estimates only because of the rapidly changing land use in the watersheds.

High fecal coliform concentrations in surface water runoff may result from improper application of animal waste on pastures and croplands and grazing livestock. Animal populations are recorded by county and reported by the National Agricultural Statistic Service (NASS, USDA, 1997). The livestock populations for the portions of the Counties in the McKee Creek watershed are shown in Table 5. These livestock counts are based on the NASS database and distributed according to Watershed Characterization System (WCS) by pasture area, supplemented by the observation about horses, mentioned above.

Table 5. Livestock Distribution by County (NASS, 1997)

Livestock	**Number of Animals per County (NASS, 1997) and Number in McKee Creek Watershed (WCS Database-modified re [Testerman, 2002])**		
	Mecklenburg	Cabarrus	McKee Creek Watershed
	Animals In County	Animals in County	No. in watershed
Total Cattle	10052	13983	205
Beef Cow	2984	7643	84
Horses (assumed to = cattle in McKee-Clear Creek watershed)			205
Hogs	26	5618	37
Sheep	91	379	4
Poultry	*	*	*

- Although poultry numbers were not given directly in the database, related data suggest current numbers of poultry (2002) may have increased. However, if the poultry litter is spread properly on pasture for the relatively larger numbers of cattle, the water quality impact from poultry may be relatively insignificant.

In the small McKee Creek watershed, cattle operations dominated the limited livestock population, although at present they may be exceeded by the horse population. The total number of 205 cattle in the watershed clearly indicates that Concentrated Animal Feeding Operations (CAFOs) are not operating in the watershed. The total count of 205 cattle is assumed to include calves and bulls as well as the count of beef cows, and is used for the basis of cattle fecal coliform estimates. In summary, total cattle, horses, hogs, and sheep are used for the livestock estimates of fecal coliform counts.

Cattle in the watershed are assumed to be grazing and not confined for long periods of time.

Hogs are typically confined and the manure is generally collected in lagoons and applied to land surfaces during the growing season. If the manure collected from confined animals is not spread at agronomic rates, then a portion of the fecal coliform present in the manure could wash off to the stream during a storm event. This does not appear to be an issue if the total count of 37 hogs is representative, and it is reported that the hog operation in the basin is decreasing in size (Testerman, 2002).

Table 6 gives the estimates of livestock numbers in the various McKee Creek subwatersheds based on the distribution of pasture land. Table 7 gives typical livestock fecal production rates.

Table 6. Estimated Distribution of Livestock in the McKee Creek Watershed

	Agricultural Animals			
REACH ID	CATTLE	SWINE (HOGS)	HORSES	SHEEP
MY7	61	11	61	1
MCK-2	55	10	55	1
Clear Ck	40	7	40	1
DownStrm	50	9	50	1
TOTAL	205	37	205	4

Table 7. Fecal Production Rates of Various Livestock (USEPA, 2000)

	Mean
Animal	**FC (#/animal/day)**
Cattle	4.57E+09
Dairy cow	1.03E+11
Beef cow	1.05E+11
Hog	1.02E+10
Sheep	1.41E+10
Horse	4.19E+08

3.2.2 Leaking Septic Systems, the Sewer System, and Urban Runoff

Failing septic systems can contribute fecal coliform bacteria into the waterbody. The number of septic systems is based on the NC Division of Environmental Health (DEH) statistics on sewer practices for the counties in the watershed (NCDEH 2003). Each household on septic systems was assumed to house 2.5 people.

The Mecklenburg County Health Department has estimated the local septic system failure rate to be 1%, (Mecklenburg, 2002), citing the following reasons:

- In general, Mecklenburg County soils are highly conducive to septic system operation;
- Areas where soil types are not conducive to septic system operation have been excluded from septic system use and existing systems in these areas have been targeted for integration to the CMU sanitary sewer system; and,
- Mecklenburg County has been a leader in enacting septic system regulation in North Carolina, which has prevented the installation of sub-standard systems.

However, for perspective – since this is much lower than the 20% failure rate often assumed by EPA, other stakeholders including Charlotte Mecklenburg Utilities, have questioned the accuracy of a 1% failure rate for these septic systems. Some personal observations and anecdotal evidence appear to indicate the likelihood of a much higher failure rate (Testerman, 2002), particularly since the soil types in the McKee watershed typically have lower percolation rates than most of the others in Mecklenburg and Cabarrus Counties. However, because there is no documentation of a local investigation to establish a more accurate or reproducible value exists; therefore, a 1% failure rate was assumed in this TMDL.

No direct accounting of the number of septic systems in use in the TMDL watersheds was available. The Watershed Characterization System (WCS) database gave an estimate of 11,176 people on septic systems (or about 4470 septic systems) in this watershed based 1997 US Census Bureau population estimates. However, NCDEH statistics, although based on older 1990 census data, indicated a much lower number. Based on an area-weighted average of 0.09 septic/acre derived from NCDEH statistics, there are nearly 500 septic systems in this 5500-acre watershed. The true number probably lies somewhere in between but closer to the lower estimate based on NCDEH.

Estimated fecal coliform load calculations are based on NCDEH numbers (Table 8), but should be viewed in light of the uncertainty in the number of septic systems in the watershed as well as the assumed failure rate. Since these results are not used directly in the TMDL calculations, this assumption does not effect the TMDL determination and allocation.

Calculations of the loadings are provided in Appendix D. Horsley and Witten (1996) estimate septic systems to have an average daily discharge of 70 gallons/person-day with concentrations ranging from 10^4 to 10^7 counts/100mL. The loads presented in Table 8 are do not account for die-off or attenuation of fecal coliforms between failing septic systems and the stream, assuming discharge directly into the stream. In general, failing septic systems discharge overland for some distance, where a portion of the fecal coliform may be absorbed on the soil and surface vegetation before reaching the stream. This assumption of direct discharge to the stream contributes to the margin of safety for the TMDL.

Table 8. Estimated Loads from Leaking Septic Systems

Subwatershed	Acres	Estimated # Septic Systems	# failing septics	Stream Load cfu/day
MY7	2735	246	3	**1.66E+08**
MCK-2	1431	129	1	**8.63E+07**
Clear Ck	599	54	1	**3.32E+07**
DownStrm	751	68	1	**4.65E+07**
Total McKee Watershed	5516			**3.32E+08**

Notes:

1. Estimated number of septic systems in a subwatershed equals area multiplied by septic density of 0.09 septic systems per acre (DEH 1999).
2. Loadings based on an effluent concentration of 10^4 counts/100mL and a daily discharge of 70 gal/person/day
3. See Appendix D for details behind this summary table.

In urban areas serviced by a wastewater treatment facility, leaking sewer lines could contribute to water quality impairment. The upper portion of the McKee watershed is sewered and serviced by two small facilities discussed in Section 3.1.1 with a total design flow of 0.53 million gallons per day (mgd). However, the actual recorded flow at both plants, combined, was only 0.18 mgd in 2001. Because of this small flow and without any evidence to the contrary, it is assumed for this TMDL that fecal coliform contributions from the sewer system are negligible. There are suggestions, however, in the data in Appendix C that fecal coliform levels in the stream are sometimes very high. This could be caused by direct discharges to the steam, leaking septic systems during heavy rains, or infiltration/inflow problems in the sewer lines with subsequent bypasses at the treatment plants. These possibilities need to be investigated during the implementation phase following this TMDL.

Urban runoff was calculated using the rates of accumulation per acre in Table 9. The results are shown in Table 10. The areas upstream of Station MCK-2 had to be lumped together to allow load allocations to be developed that are compatible with the two waste load allocations for the point sources, as discussed in Section 5.5.

Table 9. Urban Coliform Accumulation Rates (EPA, 2000)

Land Use	Coliform Accumulation in cfu/acre/day
Heavy Residential/ Institutional/ Recreational	2.00E+07
Light Residential	1.03E+07
Commercial	6.21E+06

Table 10. Urban Coliform Accumulation in the McKee Creek Watershed

Urban Land Use	McKee Creek, Upstream of SR 2808 (Sta. Q7750000 or MK7)		**McKee Creek, Upstream of SR 1169 (Sta. MCK-2 Upstream of SR 1169)***	
	(Acres)	cfu/day	**(Acres)**	cfu/day
Commercial	108	6.71E+08	**110**	6.83E+08
High Density Development	78	1.56E+09	**78**	1.56E+09
Light Residential	346	3.57E+09	**364**	3.75E+09
Total Urban	532	5.80E+09	**552**	5.99E+09

*** Includes area upstream of MK7**

3.2.3 Wildlife

Wildlife deposit waste containing fecal coliform bacteria onto the land where it can be transported during a rainfall runoff event to nearby streams. Fecal coliform loading rates due to wildlife are assumed to contribute to the background loading in the stream. In the literature, background loadings of fecal coliform bacteria range from 15 to 450,000 counts/100mL (EPA, 2001). For purposes of assigning a load to background conditions in this rapidly urbanizing area where the wildlife population is fairly low, a relatively low concentration of 50 counts/100ml is assumed to be reaching the stream. This creates the loadings shown below in the summary in Section 3.2.4. These calculations used the average study-period flows of 1.86, 0.268, 0.336, and 2.47 cfs, respectively, for McKee Creek at MCK-2, Clear Creek, the portion of McKee Creek downstream of MCK-2, and the total for McKee Creek at its mouth.

4.0 ANALYTICAL APPROACH

Establishing the relationship between instream water quality and sources of fecal coliform is an important component of the TMDL. It provides the relative contribution of the sources, as well as a predictive examination of water quality changes resulting from varying management options to meet the water quality standard. This relationship can be developed using a variety of techniques ranging from qualitative assumptions based on scientific principles and literature values to numerical modeling techniques.

4.1 Selection of Analytical Approach

A mass balance approach coupled with a series of Flow Duration and Load Duration curves (ASIWPCA, 2002; Kansas, 2002; Sheely, 2002) was used to calculate the TMDLs for the impaired streams. Limited water quality data and the small size of the watersheds of the listed tributaries warranted a simplified approach. A mass balance approach is appropriate for small watersheds with limited water quality data. Utilizing the conservation of mass principle, loads can be calculated using the following relationship:

Load (counts/day) = (**Concentration**, counts/100mL) $\times$ (**Flow**, cfs) $\times$ (Conversion Factor)

Where the conversion factor = 2.447×10^7 to obtain units of counts/day

4.2 Analytical Setup

The McKee Creek watershed was delineated into 4 subwatersheds – [1] upstream of State Road 2808 (Station MY7 or Q7750000), [2] upstream of State Road 1169 (Station MCK-2), [3] the Clear Creek watershed, and [4] downstream of Station MCK-2, excluding the Clear Creek watershed. Except for Clear Creek, the delineations were based on Reach File 3 (RF3) stream coverage, Digital Elevation Model (DEM) of the area, location of water quality monitoring stations, and the road network which was assumed to be primarily along ridge tops (see Figures 1and 2). The farthest downstream point of the delineation was the confluence of McKee Creek with Reedy Creek. The delineated watershed was used in conjunction with the WCS to quantify potential pollutant sources. Since Clear Creek was not included in RF3, it was delineated from USGS maps and correlated by land use.

The TMDL for McKee Creek is calculated in three steps, the first two using “the 200 standard,” and the final step using “the 400 standard” which proved to be more stringent. The initial calculation is based on the subwatershed area upstream from Station MY7, at State Road 2808. This calculation had to be followed with a calculation for the combined watershed area upstream of State Road 1169 (Station MCK-2), and then for MCK-2 using “the 400 standard.” This will be discussed further in the sections to follow.

Since there was no water quality or flow data available for Clear Creek, the TMDL for Clear Creek is based on a comparison of land use with that of the larger McKee Creek subwatershed upstream of MCK-2, applying the same percentage reduction for each individual land use.

River flow influences the instream fecal coliform concentration. Flow was not measured on McKee or Clear Creeks. Mean daily flows in McKee Creek were estimated by multiplying the flow at the Irwins Creek gage by the ratio of the drainage areas at the sites. The USGS operates a continuous stream flow gage on Irwins Creek at State Road 3168 (USGS 0214657975) located just east of the watershed divide from McKee Creek. The current period of record for daily flows in Irwins Creek was obtained from May 12, 2000, through May 12, 2002. The selected flow at the USGS gage on Irwins Creek and an estimate of flows at sampling station MY7 on McKee Creek are provided in Appendix E, together with a calculation of the daily fecal coliform loads at 200 cfu/100 ml in order to calculate the Load Duration Curves discussed below. The corresponding flows and loads at MCK-2 are not presented as they are similar, except proportionally greater.

4.3 Analytical Results

The Kansas TMDL Curve Methodology (Kansas, 2002) was used to evaluate the available data. First flow duration curves were developed from a ranked listing of 731 values of calculated daily flows at Stations MY7 and MCK-2, as shown below in Figures 4 and 5. The ranked data are listed in for Station MY7 in Appendix F; the data for MCK-2 are similar.

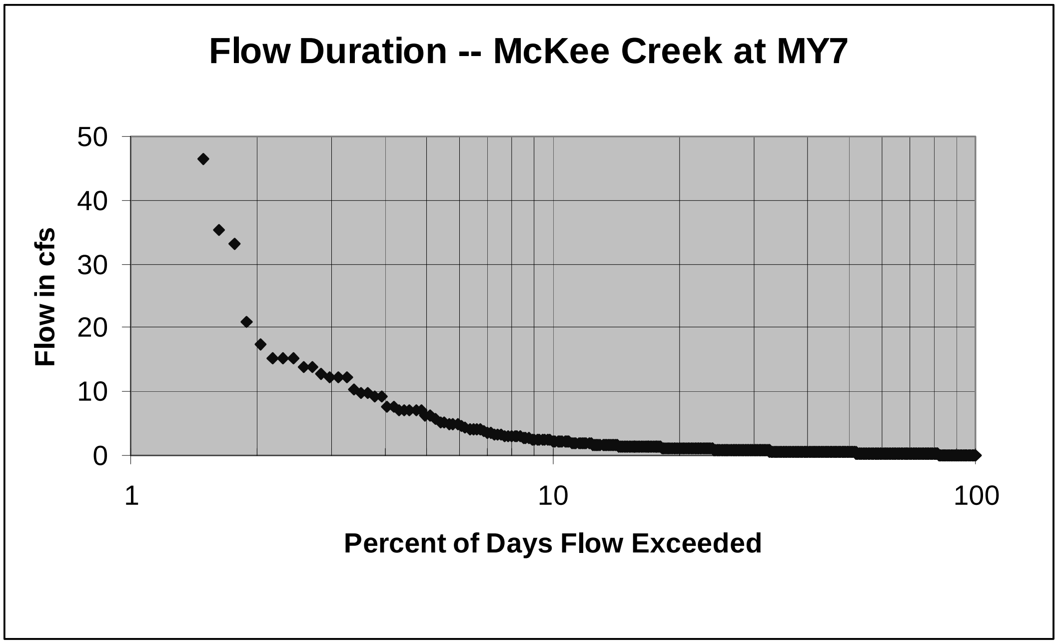

Figure 4. Flow Duration Curve for MY7

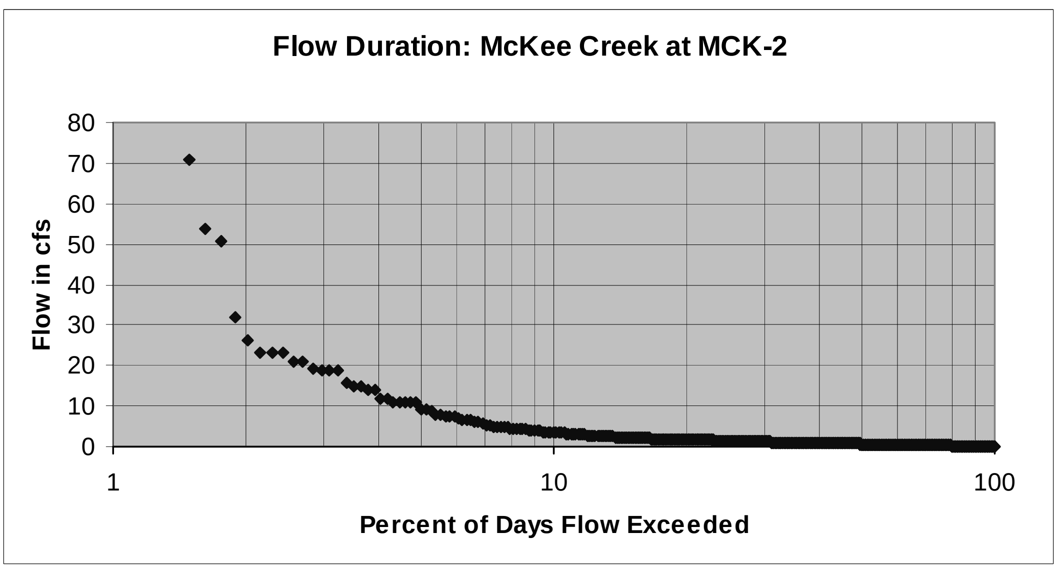

Figure 5. Flow Duration Curve for MCK-2

Note that although the Y axes in these graphs are different scales, the pattern is the same in both because the McKee Creek flows were calculated by drainage area ratios from the flows in Irwins Creek. This method of calculating flows is based on the assumption that the hydrologic characteristics of the watersheds are the same – in terms of size, slope, channel characteristics, and groundwater interactions (Sheely, 2002). It would be best to check this assumption by correlating flow data in the various watersheds, but, since no flow data were available for McKee Creek, this correlation could not be done.

It is obvious from these curves that base flows (flows exceeded more than 90 percent of the time) are very low (0.08 and 0.12 cfs, respectively, at MY7 and MCK-2); and that high flows, particularly those exceeded 5 percent of the time or less, give a more scattered or unpredictable plot that does not fit a smooth curve.

Next, these data were translated into Load Duration (TMDL) Curves by multiplying the flow in cubic feet per second (cfs) by the water quality standard (200 cfu/100 ml – or 400 cfu/100 ml) and a conversion factor. See Figures 6 and 7 for the Load Duration Curves for McKee Creek at MY7 and MCK-2 based on the 200 standard. Figure 8 shows the Load Duration Curve for MCK-2, based on the 400 standard. Appendix E shows the underlying data for Station MY7; the data for MCK-2 are similar though proportionally larger. Appendix F shows the ranked data for the Load Duration Curve at MCK-2 based on the "400 standard."

In generating these curves an approximation was used that might have to be modified for future TMDLs using Load Duration Curves for fecal coliforms. In these curves, the geometric mean of the fecal coliform data for the past 30 days was matched to the flow at the end of that 30 day period. Normally for these curves, instantaneous or daily water quality data are matched to instantaneous or daily flow. Other choices could be made for matching the coliform data to flow, but the calculations would yield the same results if the match is used consistently.

The second set of calculations below, based only on concentration, confirm this point since they give the same percent reductions as the first set of calculations based on load.

These curves confirm that most of the high coliform problems in McKee Creek are related to nonpoint sources, as discussed below.

Load duration curves provide a variety of information, including:

1. They help to identify the issues surrounding the problem (of not meeting WQS) and help to differentiate between point and nonpoint source problems. If plots of current conditions lie above 75% on the "x" axis, and especially above 90%, the problems are most likely associated with point sources. Below 75% is associated primarily with nonpoint sources, and below 10% is usually considered to represent unique high flow problems that probably exceed feasible management remedies.
2. They show seasonal water quality effects. Data that cluster within a narrow range of the percent of flow or load exceeded can be associated with the season when that range of flow typically occurs.
3. They address the frequency of deviations (how many samples lie above the curve vs. those that plot below); the magnitude (how far the deviations plot away from the curve); and duration (potentially how long the deviation is present).
4. They can be used to compare water quality conditions between multiple watersheds.
5. They can aid in establishing the level of implementation needed.

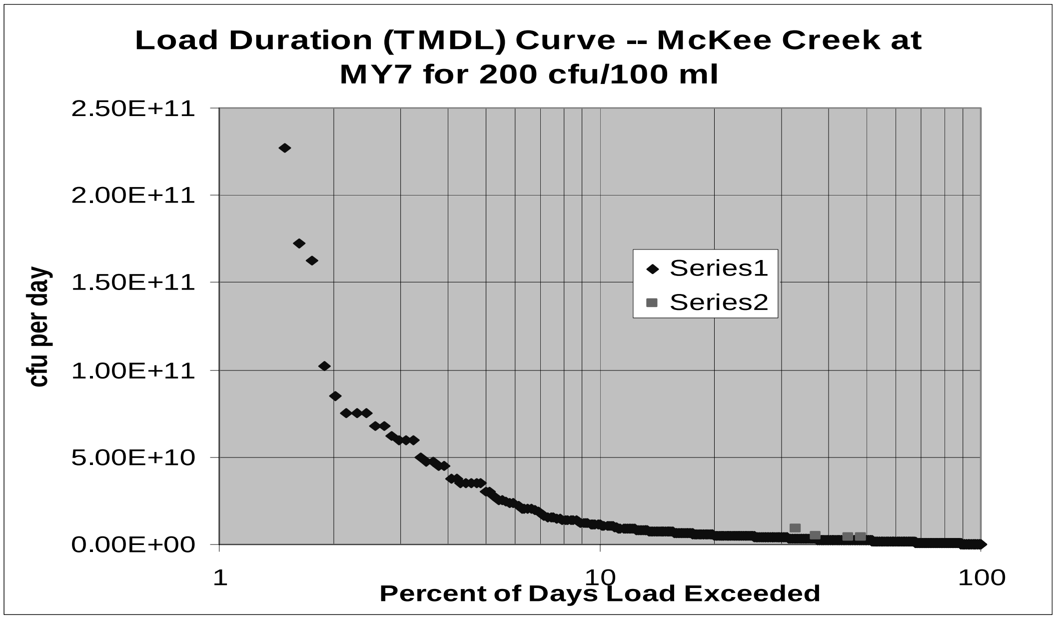

Figure 6. Load Duration or TMDL Curve for MY7 ("200 Standard").
Series1 data is the calculated maximum permissible load at 200 cfu/100 ml.
Series2 data is the actual loading calculated from intensive survey data.

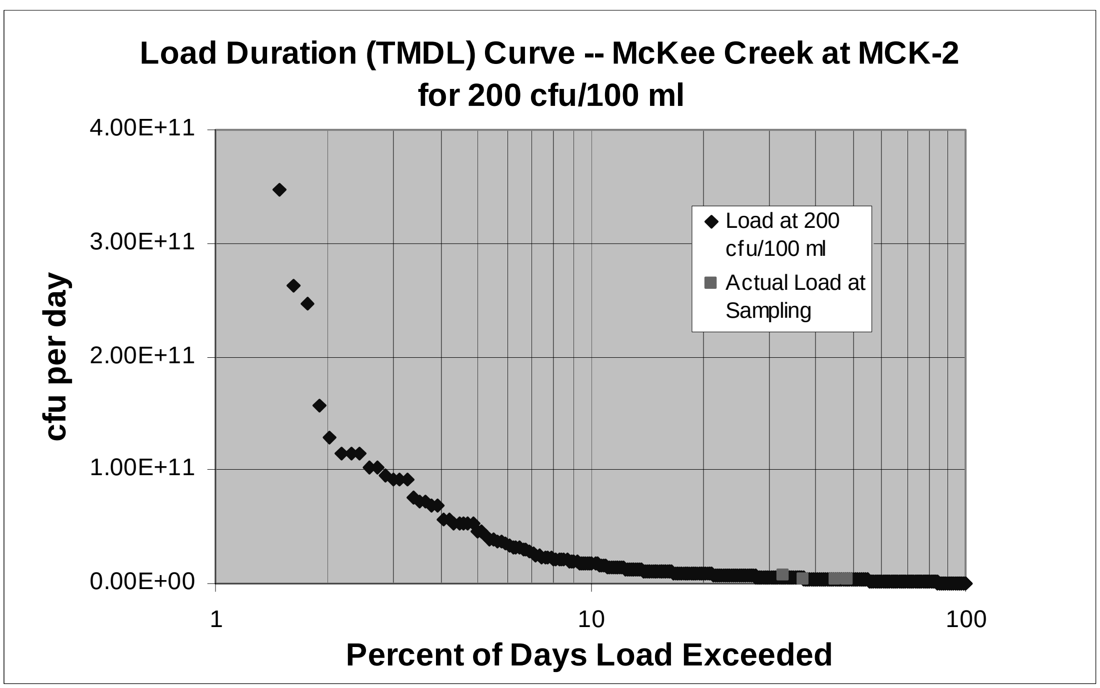

Figure 7. Load Duration or TMDL Curve for MCK-2 ("200 standard").

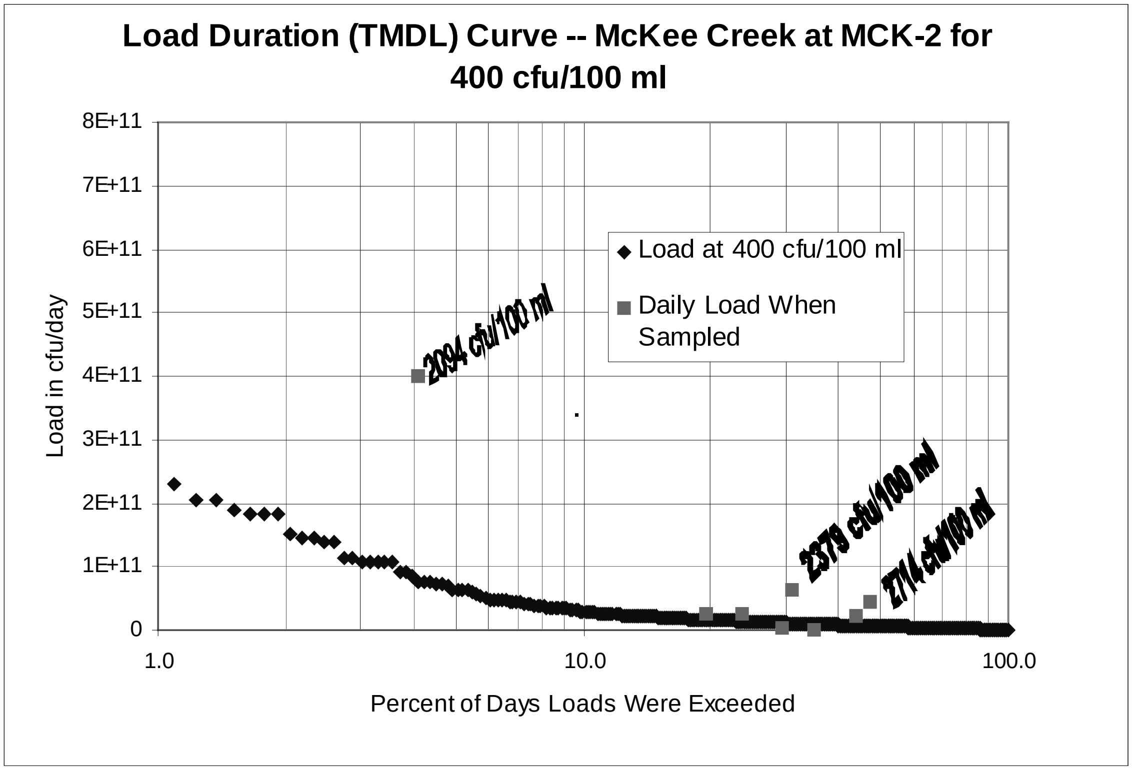

Figure 8. Load Duration or TMDL Curve for MCK-2 ("400 standard").

The three highest sample results are labeled in Figure 8 and associated with the plotted results of their calculated loads. Note that the higher flows (represented by points more to the left) when multiplied with the indicated concentrations (times the appropriate conversion factor) generated higher loads even though, in this case, the associated concentrations were slightly less toward the left. The left-most sampled load is associated with the highest 4th percentile of high flows. As a rule of thumb, all loads associated with up to the 10th percentile of high flows are probably beyond the capability of conventional treatment and BMPs to control. The remaining loads lie from just under the 20th percentile to just under the 50th percentile, representing wet weather loads associated with nonpoint runoff and wet weather point source (MS4) runoff. These are the conditions that control strategies must address. As indicated below, the highest concentration (2714 cfu/100 ml) is excluded by the "400 standard," so the percent reduction is calculated from the load represented by the 2379 cfu/100 ml sample, which is the highest point encompassed within the "400 standard."

Figures 9, 10, and 11 are enlargements of the critical portions of these load duration curves. The load reduction target, in each calculation, is 90% of the value of the TMDL curve lying directly under the data point requiring the greatest reduction. This gives an explicit Margin of Safety (MOS) of 10%. Note that the data (Series 2) lies roughly between 30 and 50 percent of the days the load is exceeded, which indicates that nonpoint sources are the most significant.

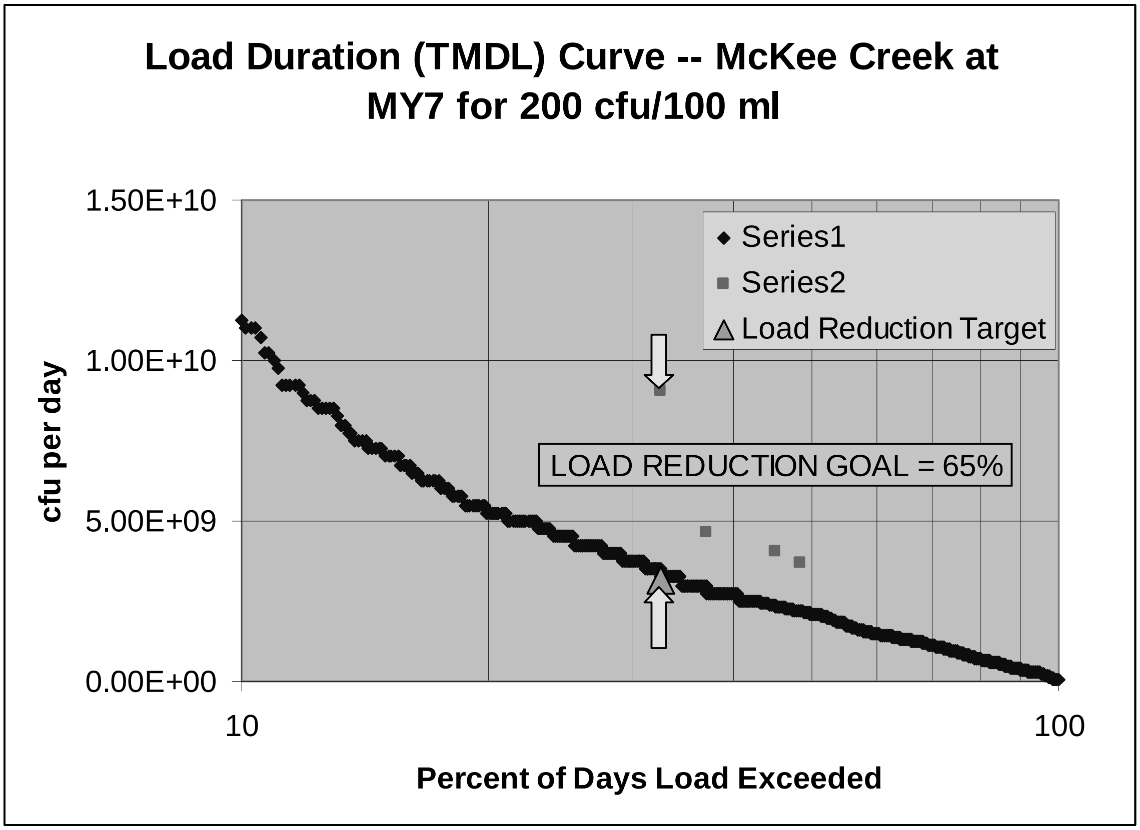

Figure 9. Enlargement of the Load Duration Curve at MY7 for the "200 Standard."

Series1 data is the calculated maximum permissible load at the WQS (the TMDL load).

Series2 data is the intensive survey data calculated according to the WQS (the actual load).

The *Load Reduction Target* is 90% of the TMDL value under the data point requiring the maximum percent reduction, equivalent to the load calculated for 180 cfu/100 ml.

The load reduction calculation for MY7 (with units in cfu/day) is:

$$\frac{9.10E+09 - (3.50E+09 \times 0.90)}{9.10E+09} \times 100 = 65\%$$

Note that this calculation is equivalent to a calculation based solely on concentration (with units in cfu/100 ml):

$$\frac{518 - 180}{518} \times 100 = 65\%$$

where 518 cfu/100 ml is the highest geometric mean of samples collected within a 30-day period, and

180 is the load reduction goal, which is 90 percent of the water quality standard of 200 cfu/100 ml.

Initially it appeared that this 65 percent reduction would require the most stringent pollution control for the watershed. Yet, because (1) this is the most upstream station, (2) the affected watershed is quite small, and (3) the upstream wasteload allocation for Lamplighter Village East is very small, the lesser percent reduction required at MCK-2 generated a negative load allocation for the portion of the watershed between MCK-2 and MY7 if the MY7 calculations were used. Once this was discovered, it was clear that the TMDL and its components must be calculated on the entire watershed upstream of MCK-2 without a separate calculation for MY7.

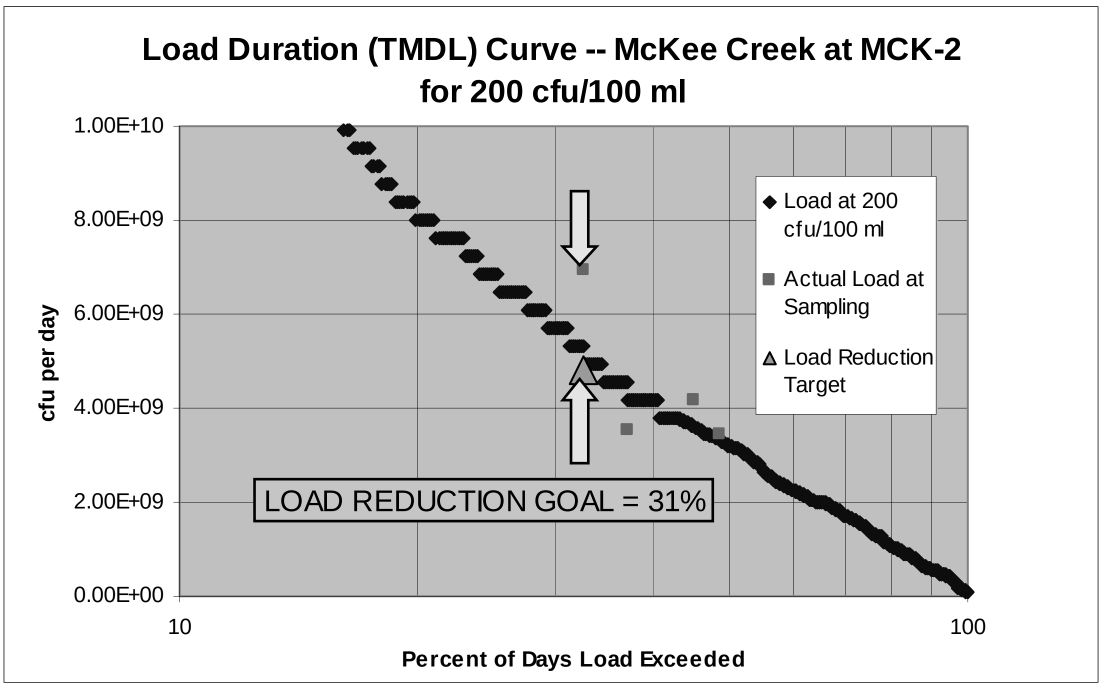

Figure 10. Enlargement of the Load Duration Curve at MCK-2 for the "200 Standard."

The *Load Reduction Target* is 90% of the TMDL value under the data point requiring the maximum percent reduction.

The load reduction calculation for MCK-2 (based on the geometric mean, with units in cfu/day) is:

$$\frac{6.90E{+}09 - (5.33E{+}09 \times 0.90)}{6.90E{+}09} \times 100 = 31\%$$

Note again that this is equivalent to a calculation based solely on concentration (with units in cfu/100 ml):

$$\frac{260 - 180}{260} \times 100 = 31\%$$

This load reduction at MCK-2, based on the 200 cfu/100 ml geometric mean, next had to be compared to the reduction required to meet the alternative water quality standard of 400 cfu/100 ml, not to be exceeded more than 20% of the time.

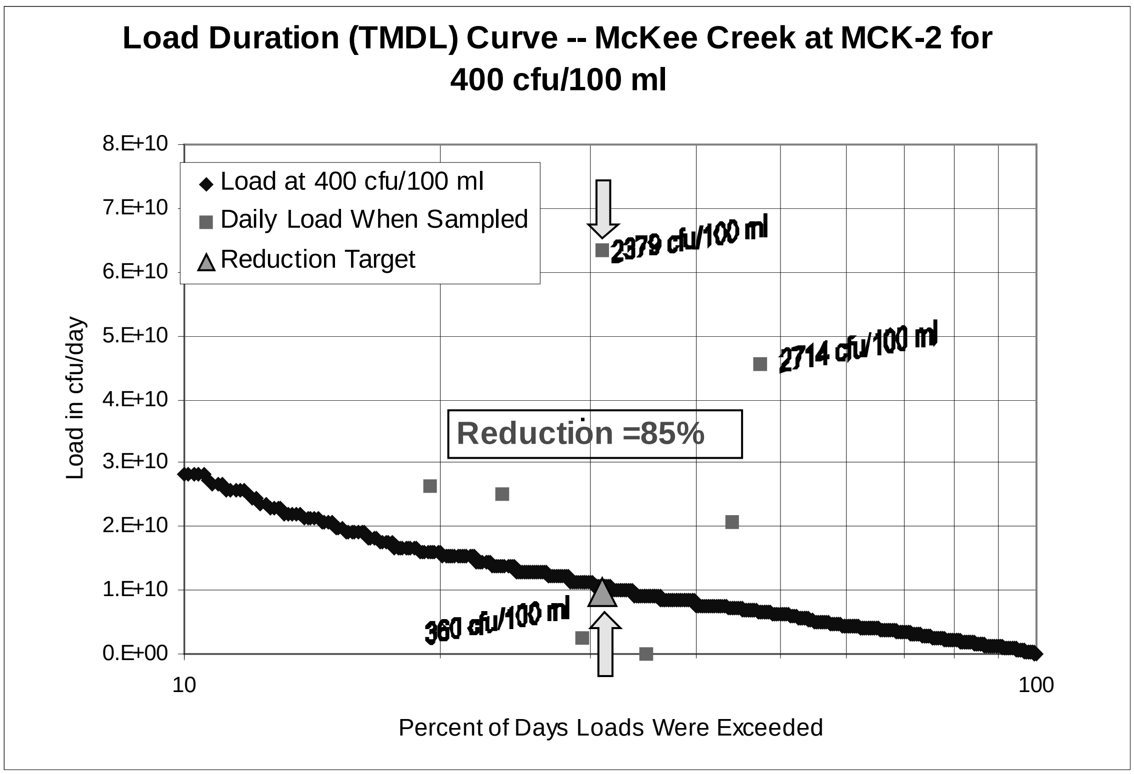

Figure 11. Enlargement of the Load Duration Curve at MCK-2 for the “400 Standard,” which must be met by at least 80% of the samples within a 30-day period.

The *Load Reduction Target* (large triangle) is 90% of the TMDL value under the data point requiring the maximum percent reduction.

This load reduction calculation for MCK-2 (after discounting up to, but not more than 20% of the samples, with units in cfu/day) is:

$$\frac{6.335E{+}10 - (1.0656E{+}10 \times 0.90)}{6.335E{+}10} \times 100 = 85\%$$

Note again that this is equivalent to a calculation based solely on concentration (with units in cfu/100 ml):

$$\frac{2378 - 360}{2378} \times 100 = 85\%$$

Meeting the alternative water quality standard of 400 cfu/100 ml, not to be exceeded more than 20% of the time, is clearly the more stringent standard in this case. **The TMDL must, therefore, be based on an 85 percent reduction in fecal coliforms.**

In Figure 11, the higher concentration of 2714 cfu/100 ml was excluded based on the concept of excluding the highest 20 percent of the data points for the "400 standard." This concentration represents a smaller load than the lesser concentration of 2379 cfu/100 ml because the corresponding flow associated with the 2714 data point is less. Even though this load is less than that used for the TMDL calculation, a percent reduction from the 2714 data point to the point below it representing 90 percent of the TMDL curve would result in a load reduction calculation of 86.7 percent. Since this data point is excluded, the lesser reduction of 85% is used for this TMDL.

A Load Duration Curve was not developed for MY7 for the "400 standard" because the same considerations that led to selecting MCK-2 as the station to develop the TMDL based on the "200 standard" would also apply to the TMDL based on the "400 standard."

4.4 Uncertainty

The lack of site specific information within this watershed required that literature values be used to calculate fecal coliform loadings from the various land uses. Because the uncertainty associated with any generalized approach is expected to be large, these results should be interpreted in the light of input limitations and prediction uncertainty. Simple approaches such as the Load Duration Curve can be used to guide initial decision making; but continued observation of the watershed and stream, as fecal coliform controls are implemented (e.g., exclusion fencing, leaky sanitary sewer repairs), is the best approach for determining the appropriate level of management.

5.0 TOTAL MAXIMUM DAILY LOAD (TMDL)

The TMDL is the total amount of pollutant that can be assimilated by the receiving water body while achieving water quality standards. The components of the TMDL are the Wasteload Allocation (WLA), the Load Allocation (LA) and a margin of safety (MOS). The WLA is the pollutant allocation to point sources while the LA is the pollutant allocation to natural background and nonpoint sources.

The TMDL for the Upper McKee Creek watershed is calculated using the water quality criterion of 400 cfu/100 ml and the calculated mean flow of 1.86 cfs at Station MCK-2 on

McKee Creek during the intensive survey period of 4/11/2001 through 6/5/2001. (Note that the mean flow during the intensive survey period is not the same as the median flow of 0.65 cfs in the flow-duration calculations, which included a much longer time period.) Using the conversion factor of 24,464,665, times 1.86 cfs, times 400 cfu/100 ml, the TMDL at MCK-2 is **1.82E+10 cfu/day**.

The TMDLs for Clear Creek, the other subwatersheds, and for the entire McKee Creek watershed are calculated by area ratios as shown in Table 11.

Table 11. Calculation of Allowable TMDL Loads, McKee Creek – Clear Creek Watershed

TMDL loads based on the 400 standard.		
Watershed	Area	TMDL
Units	Acres	Cfu/day
*MCK-2**	*4166*	*1.82E+10*
Clear Creek	**599**	**2.62E+09**
Lower McKee	751	3.28E+09
Total McKee	**5516**	**2.41E+10**
** The figures for MCK-2 include the values for MY7*		

5.1 Waste Load Allocation (WLA)

Where MS4 facilities are involved, the WLA component is divided into two components, a continuous discharge load and a wet weather load. In this case, the Mecklenburg County portion of the watershed is treated as a wet weather, MS4 facility, subject to a waste load allocation, in addition to the two, small sewage treatment plants (STPs) treating sewage from residential subdivisions. Lamplighter Village East (NPDES Permit #NC0025259) is located in the headwaters upstream of MY7 and Bradfield Farms (NPDES Permit #NC0064734) is located just above Station MCK-2 on McKee Creek.

Both NPDES permits for these sewage treatment facilities include a monthly average geometric mean limit of 200 cfu/100 ml as well as a daily maximum limit of 400 cfu/100 ml. Even though these facilities operate at only a fraction of the permitted flows and are well within the monthly geometric mean limit of 200 cfu/100 ml, both facilities occasionally exceeded their daily maximum limits. The waste load allocation for each facility is calculated from its permitted flow in million gallons per day (mgd), times 400 cfu/100 ml, times the conversion factor of 3.785E+07. The daily operation of the facilities should be monitored to ensure they meet the daily maximum limits.

The calculations and results are shown in Table 12, giving a total of 8.02E+09 cfu/day for this "continuous flow" portion of the WLA.

This portion of the wasteload allocation may not be relevant in the near future. The Cabarrus County Water and Sewer Authority Board, in a joint venture with Charlotte Mecklenburg Utilities, has approved plans for 110,000 linear feet of interceptor sewers to be placed along Reedy and McKee Creeks. These will range from 30-60 inches in diameter. A pump station will be constructed to pump the resulting interceptor flow into the existing Rocky River 48 inch force main, taking the wastewater completely out of the McKee Creek watershed. The Mecklenburg portion of the design is completed, as of November, 2002, and the Cabarrus portion will be designed in the near future. The plans are contingent upon approval by the City of Charlotte. (See Furr, 2002.) It is assumed that flows to both existing facilities for Lamplighter Village East and Bradfield Farms will be diverted into these interceptors, allowing a greater allocation to the wet weather point sources and the nonpoint sources in the watershed.

Table 12. Continuous Flow Wasteload Allocation (CFWLA) Calculations

Facility	NPDES #	Impacted Watershed	Permitted Flow (MGD)	Monthly Geo-metric Mean Permit Limit (counts/100mL)	WLAs (converted to a daily basis)[1] (counts/day)
Lamplighter Village East	NC0025259	McKee Creek	0.07	400	1.06E+09
Bradfield Farms (residential subdivision)	NC0064734	McKee Creek	0.46	400	6.96E+09
		Total flow in cfs =	0.82044	**Total CFWLA:**	**8.02E+09**

NOTES: 1. Load = Q (mgd) * Conc. (counts/100mL) * conversion factor

conversion factor = (1,000,000 gal/day *3.785 L/gal *1000 ml/l*cfu/100 ml) = 3.785E+07

Example Calculation for Bradford Farms:

Load = 0.46E+06 gal/day * 400 counts* 3.785E+07 = 6.96E+09 cfu/day

The wet weather portion of the WLA is calculated in conjunction with the LA in Section 5.2 below.

5.2 Wet Weather Wasteload Allocation (WetWxWLA) Load Allocation (LA)

The Wet Weather Wasteload Allocation (WetWxWLA) Load Allocation (LA) for the McKee-Clear Creek watershed are calculated using the water quality criterion and an estimate of mean flow (1.86 cfs) during the intensive survey. The water quality criterion of 400 cfu/100 ml, not to be exceeded by more than 20% of the samples during a 30-day period, was used as the more conservative of the two fecal coliform criteria for the data available for McKee Creek. The WetWxWLAs plus the LAs (combined) are the differences between the TMDLs for each subwatershed, less the margins of safety (MOSs), less the continuous flow waste load allocations (CFWLAs).

Because the continuous flow point source upstream of MY7 is much smaller than that just upstream of MCK-2, it was necessary to develop the TMDL based on the calculated flow and measured fecal coliform concentrations at Station MCK-2. See Table 13 in Section 5.5, "Allocation," below.

Since there are no continuous flow point source discharges in Clear Creek the combined WetWxWLA + LA equals the TMDL, less the MOS. Since there are no additional continuous flow point sources in the McKee watershed, the combined WetWxWLA + LA for the entire McKee Creek watershed is proportionally larger than that calculated at MCK-2. These combined wet weather loads are shown in Table 13 in Section 5.5, together with their separate values, which are proportional to the areas within and outside the MS4 jurisdictions.

5.3 Margin of Safety

The margin of safety (MOS) is part of the TMDL development process. There are two basic methods for incorporating the MOS (USEPA 1991):

- Implicitly incorporating the MOS using conservative model assumptions to develop allocations, and
- Explicitly specifying a portion of the total TMDL as the MOS; using the remainder for allocations.

An implicit MOS is also incorporated into the TMDL by using conservative assumptions in calculating the TMDL components: (1) Leaking septic systems are assumed in this TMDL to discharge directly into the stream, whereas septic systems typically discharge through the soil layer where the fecal coliforms absorb to the soil. (2) The WLA for continuous discharge facilities (the two "package" sewage treatment plants) is based on their permit limits for fecal coliforms. In general, these facilities use some type of disinfection and the concentration of fecal coliform in the effluent should be much less than the permit limits. (3) Calculating the needed overall load reduction from the highest data point – after excluding the top 20 percent of the samples, as specified in the "400 standard" – is very conservative, particularly given the large variation inherent in fecal coliform analyses. (4) This TMDL is based on the "400 standard," – not to be exceeded more than 20% of the time, which was proved to be much more conservative than the "200 monthly geometric mean standard."

The MOS is also incorporated explicitly in the TMDL by applying a 10 percent reduction to the instream standard. Using the applicable standard of 400 cfu/100 ml, the MOS is set to 10% of the standard, or 40 cfu/100ml, giving a load reduction target of 360 cfu/100 ml, and the allowable loads are calculated proportionally. The load assigned to the MOS is based on mean flow and the MOS concentrations as shown below in Table 13.

5.4 Seasonal Variation and Critical Period

In developing TMDLs for listed waterbodies, seasonality is typically addressed by assuming either low flow (i.e., 7Q10) for point source dominated reaches or wet weather conditions for nonpoint source areas. For fecal coliforms, the critical period is generally a dry period followed by a rainfall event. This allows bacteria to accumulate on the ground and a greater concentration available to be transported to the stream during a rainfall event.

For the listed streams, an examination of the data in Appendix C (Upstream-Downstream Data) from 4/1/1998 through 7/6/2000 shows that high, instream fecal coliform levels were common throughout the year, with no particular season representing a worst case period. The NC DENR, Division of Water Quality, from April 10 to June 5, 2001, conducted an intensive survey at McKee Creek. Since this survey provides the only available source of sufficiently frequent sampling to calculate actual violations of the fecal coliform standards, these data are assumed to be representative and were used as the basis for calculations in this TMDL.

For an additional perspective, Figure 12, below, shows the calculated flows in McKee Creek from May 2000 to May 2002, which includes the period of the intensive survey. Note that the equivalent chart for Station MCK-2 would be identical except that the y-axis will read higher by a factor of 1.52, which is the ratio of the respective areas upstream of MCK-2 and MY7.

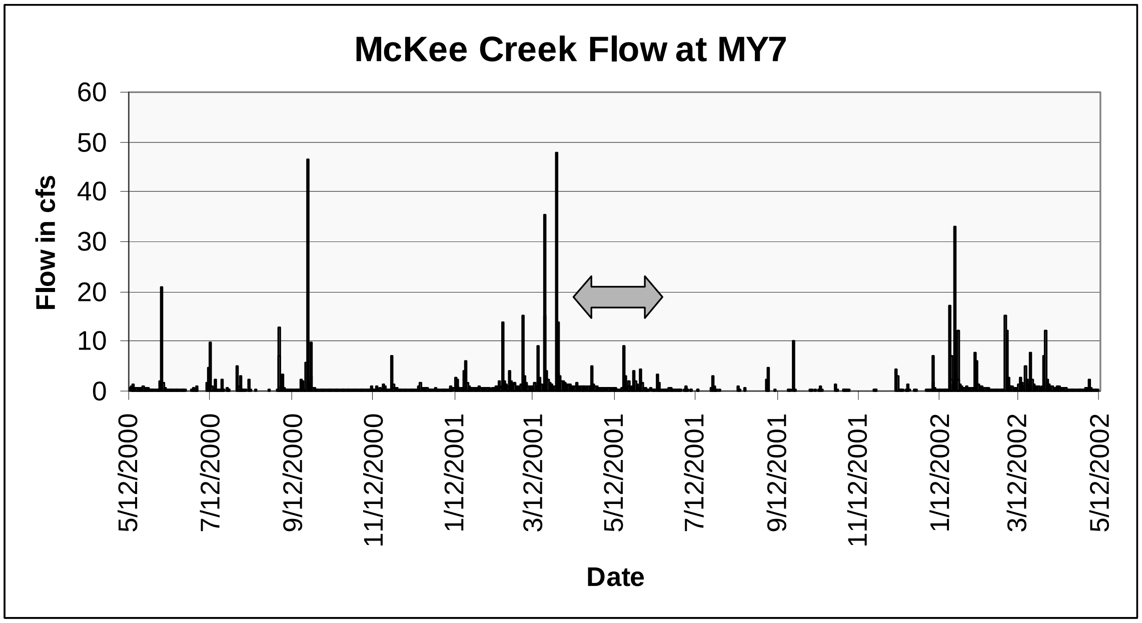

Figure 12. Daily Flows at McKee Creek
Calculated from Irwins Creek Flows for the Period May 12, 2000, through May 12, 2002. The double-headed arrow shows the period of the Intensive Survey.

The average flows shown in Figure 13 are calculated from the Mallard Creek watershed (22,144 acres) that is much larger than either the watersheds for McKee Creek (2735 acres) or Irwins Creek (5357 acres) and is shown only to illustrate seasonality. The relatively higher flows shown in Figure 13 are not considered representative of McKee Creek, but are useful, nevertheless, for examining seasonality. A 7-year period of record from the Mallard Creek watershed, located slightly north of McKee Creek, is the basis for Figure 13, which indicates that the months of April to June generally include both moderate and low flow periods. However, the flows during the intensive survey were greater than average, as indicated by the Flow Duration and Load Duration curves in Figures 4 to 9, indicating that flows during the intensive survey sampling were only exceeded 16-26% of the time. For Figure 13, as with Figure 12, the equivalent graph for MCK-2 would have the same pattern with the y-axis proportionally greater.

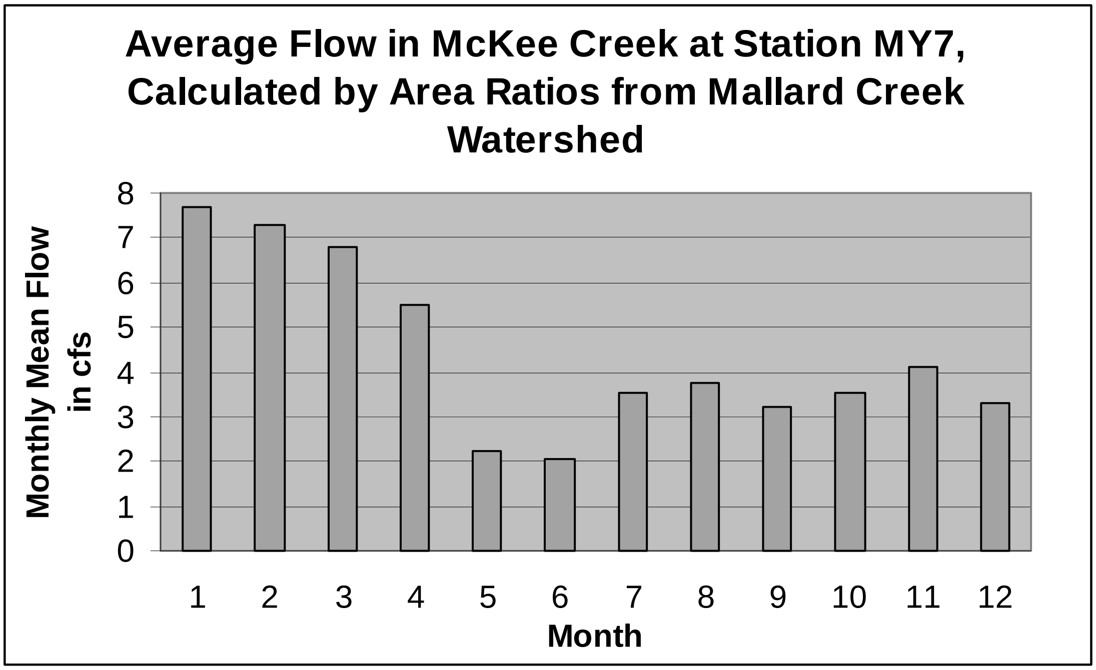

Figure 13. Monthly Average Flows at McKee Creek,
Calculated from Mallard Creek Flows – Period of Record Dec. 1994 to Sept. 2001.

5.5 Allocation

The objective of a TMDL is to allocate loads among all of the known pollutant sources throughout a watershed so that appropriate control measures can be implemented and water quality standards achieved. The Federal Register, in 40 CFR §130.2 (i), states that TMDLs can be expressed in terms of mass per time (e.g. pounds per day), toxicity, or other appropriate measure. These TMDLs are expressed in terms of counts per day (which is equivalent to colony-forming units [cfu] per day) and the required percent reduction necessary to achieve water quality standards (WQS). The TMDL represents the maximum one-day load the stream can assimilate over a 30-day period and meet the target concentration. The TMDL analysis is shown below in Table 13.

Several allocation strategies were tried in developing these TMDLs. The reductions needed to meet WQS at Station MY7, were first calculated because this station had the largest concentration exceedances of the fecal coliform water quality criteria. However, the relatively larger point source represented by the Bradfield Farms subdivision had to be considered before the LA could be developed. Finally, the “400 standard” was evaluated and proven to be much more stringent than the “200 standard.” This led to a final development of the TMDL based on the “400 standard” at MCK-2.

The combined WetWxWLAs + LAs were then extrapolated by area and land use to the entire McKee Creek watershed and also to the Clear Creek watershed. Finally, these two wet weather components were separated proportionally to the areas within and outside of the MS4 jurisdictions. The final TMDL components are shown in Table 13.

Table 13. Calculation of TMDL Components

TMDL loads based on the 400 standard.
Based on a 85% Reduction for McKee Creek at MCK-2 and by extrapolation by land area and known point sources for the remaining subwatersheds

Watershed	Area*	TMDL*	CFWLA*	LA +WLA wt wx	MOS	Wet Wx WLA	WLA Total	LA only
Units	Acres	cfu/day	cfu/day	cfu/day	cfu/day	cfu/day	cfu/day	cfu/day
MCK-2*	4166	1.82E+10	8.02E+09	8.36E+09	1.82E+09	7.92E+09	1.59E+10	4.37E+08
Clear Creek	**599**	**2.62E+09**	0	2.36E+09	**2.62E+08**	2.36E+08	**2.36E+08**	**2.12E+09**
Lower McKee	751	3.28E+09	0	2.95E+09	3.28E+08			2.95E+09
Total McKee	**5516**	**2.41E+10**	8.02E+09	1.37E+10	**2.41E+09**	8.16E+09	**1.62E+10**	**5.51E+09**

% reduction at MCK-2	84.8612	0	92.2755
% reduction at mouth of Mckee Creek			90.4609

*MCK-2 INCLUDES MY7 AREA AND LOADS

Current Load at MCK-2 1.082E+11 cfu/day

McKee CFWLA $_{\text{30-day load}}$ = 2.406e+11 cfu; McKee Wet Wx WLA $_{\text{30-day load}}$ = 2.448e+11 cfu

Wet Wx WLA = MS4 load

6.0 SUMMARY AND FUTURE CONSIDERATIONS

The sources of fecal coliform in the McKee and Clear Creek watersheds include livestock, leaking septic tanks, urban runoff, wildlife, two NPDES continuous discharge facilities, and possibly the sewers leading to them. A mass balance approach coupled with Flow Duration and Load Duration curves was used to calculate the TMDLs and allocate fecal coliform loads. In order to meet the water quality target, the final allocations were based on an 85 percent reduction of fecal coliform load at MCK-2. The MS4 WLAs were developed by their proportional areas compared to the entire watershed areas within which they lie. The TMDL allows the two continuous discharge facilities to discharge fecal coliforms at their current permit levels, comprising 33 percent of the TMDL (versus 57 percent as the combined WetWxWLA + LA). Future plans for sewer interceptors along Reedy and McKee Creeks may allow the existing discharges from these facilities to be diverted out of the basin. If this occurs, it will trigger a greater allocation to the wet weather sources. In addition, wet weather sources of fecal coliform may shift to cats, dogs, geese and horses as this area undergoes urban development.

6.1 Monitoring

Fecal coliform monitoring will continue on a monthly interval at the ambient monitoring site (SR 2808). The continued monitoring of fecal coliform concentrations will allow for the evaluation of progress towards the goal of achieving water quality standards.

To comply with EPA guidance, North Carolina plans to adopt new bacterial standards in the near future using Escherichia coli (E. coli) or enterococci. Thus, future monitoring efforts to measure compliance with this TMDL should include E. coli or enteroccoci. If future monitoring for E. coli or enteroccoci 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.

6.2 Implementation

An implementation plan is not included in this TMDL. The involvement of local governments and agencies will be needed in order to develop the implementation plan. Local agencies were very helpful in the development of this TMDL, particularly in the areas of data collection and land use trends.

The planned interceptor sewer along McKee Creek, if it is combined with repair of any infiltration or other problems with the existing sewer lines, should provide a measurable reduction in bacterial levels. The potential for leaky sewers and septic systems to be major contributors to the observed impairment should be addressed early in the implementation phase.

7.0 PUBLIC PARTICIPATION

A draft of the McKee and Clear Creek TMDL was publicly noticed through various means, including notification in two local newspapers, *The Charlotte Observer* (11/02/02) and *The Independent Tribune* (10/31/02). In October, DWQ electronically distributed a draft of the TMDL and public comment information to known interested parties. The TMDL was also available from the Division of Water Quality's website at http://h2o.enr.state.nc.us/tmdl/draft_TMDLs.htm during the comment period. The public comment period was held for the 30 days prior to November 29, 2002. A public meeting was held in Concord on November 18, 2002 to present the TMDL and offer opportunity for questions and comments by the public. Seven people attended the meeting. No comments were received.

Following a revision to the TMDL, a second public comment period was held from May 19, 2003 to June 3, 2003. Notification was made in *The Charlotte Observer* and *The Independent Tribune*. No comments were received.

REFERENCES

ASIWPCA TMDL, "Brown Bag," Conference Call on Load Duration Curve Methodology, June 12, 2002.

Code of Federal Regulations. "Water Quality Planning and Management." Title 40, Part 130, 2000 ed.

Furr, Tim. 2002. McKee and Clear Creek TMDL. E-mail from Tim V. Furr, Laboratory Supervisor, Water and Sewer Authority of Cabarrus County, sent on 11/22/2002 to Michelle Woolfolk of the North Carolina Department of Environment and Natural Resources.

Horsley & Witten, Inc. 1996. Identification and Evaluation of Nutrient and Bacterial Loadings to Maquiot Bay, New Brunswick and Freeport, Maine. Final Report.

Jedlocki, Steve, 2002, Personal Communication, City of Charlotte – Storm Sewer Services, 704-336-4398, April 17, 2002.

Kansas Department of Health and Environment, 2002. Data Analysis: Methodology Used in Kansas Lake TMDLs: Explanation of Bacteria TMDL Curves (PDF): Kansas TMDL Curve Methodology. http://www.kdhe.state.ks.us/tmdl/Data.htm.

MAPTECH, 2002. Terrain Navigator. 1 Riverside Drive, Andover, MA 01810-1122. . http://www.maptech.com

Mecklenburg County, Storm Water Management Program Report for Cornelius, Davidson, Huntersville, Matthews, Mecklenburg County, Mint Hill, Pineville, retrieved from the Internet at http://www.charmeck.org/resources/stormwatermanagementprogramreport.pdf, February 24, 2003.

Mecklenburg County Department of Environmental Protection. 2002. Fecal Coliform Total Maximum Daily Load for the Irwin, McAlpine, Little Sugar and Sugar Creek Watersheds, Mecklenburg County, North Carolina.

Metcalf & Eddy. 1991. Wastewater Engineering: Treatment, Disposal, Reuse. 3rd ed. McGraw-Hill, Inc., New York.

NC Division of Environmental Health. 2003. Septic Systems in the North Carolina. http://www.deh.enr.state.nc.us/oww/nonpointsource/NPS.htm. Accessed on May 14, 2003.

Rowell, Van. 2003. Water and Sewer Authority of Cabarrus County, 704-786-1783 x19, Personal Communication, February 25, 2003.

Rozell, Rusty. 2003. Mecklenburg County Water Quality Program, 704-336-5449, Personal Communication, February 27, 2003.

Sheely, Laura H. 2002. Load Duration Curves: Development and Application to Data Analysis for Streams in the Yazoo River Basin, MS, Special Project, Summer 2002, Jackson Engineering Graduate Program, July 15, 2002.

Testerman, Dennis 2002. E-mail note to Hill.Dave@epamail.epa.gov, dated October 24, 2002 and the 1999 results of an Agricultural Survey conducted by the Cabarrus and Mecklenburg Soil and Water Conservation Districts.

USDA. 1997. Census of Agriculture, Volume 1, Geographic Area Series, Part 42. AC97-A-42. Department of Agriculture, National Agricultural Statistics Service.

USEPA. 1986. Ambient Water Quality Criteria for Bacteria – 1986. U.S. Environmental Protection Agency, Office of Water, Washington DC. EPA 440/5-84-002. January 1986.

USEPA. 1991. Guidance for Water Quality – Based Decisions: The TMDL Process. EPA-440/4-91-001. U.S. Environmental Protection Agency, Office of Water, Washington, DC. http://www.epa.gov/owow/tmdl/decisions/dec1c.html

USEPA, 1997. Guidelines for Preparation of the Comprehensive State Water Quality Assessment (305(b) Reports) and Electronic Updates. Assessment and Watershed Protection Division, Office of Wetlands, Oceans, and Watersheds. Office of Water. September 1997.

USEPA. 1997. New Policies for Establishing and Implementing Total Maximum Daily Loads (TMDLs). August 8, 1997. Memorandum from Robert Perciasepe to Regional Administrators. U.S. Environmental Protection Agency, Washington, DC. http://www.epa.gov/owow/tmdl/policy.html.

US Environmental Protection Agency, Federal Advisory Committee (FACA), 1998, Draft final TMDL Federal Advisory Committee Report. 4/28/98

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

USEPA. 2000. EPA-Region 4. Watershed Characterization System User's Guide, Version 1.1. U.S. Environmental Protection Agency. Region 4. Atlanta, GA. May 2000.

USEPA. 2001. Protocol for Developing Pathogen TMDLs, First Edition. U.S. Environmental Protection Agency, Office of Water, Washington DC. EPA 841-R-00-002, January 2001.

APPENDIX A -- INTENSIVE SURVEY DATA, SPRING OF 2001

McKee Creek
Yadkin Basin
Mecklenburg/Cabarrus

station#		Description	date	Collector	Fecal Coliform /100ml	Remark Code	Geo-metric Mean	Arith-metic Mean	Standard Deviation
Q7750000	3	McKee Creek in Mecklenburg Co. at SR 2808	4/11/2001	B. Love	230		143	154	71
Q7750000	3A	McKee Creek in Mecklenburg Co. at SR 2808	4/11/2001	B. Love	91				
Q7750000	3B	McKee Creek in Mecklenburg Co. at SR 2808	4/11/2001	B. Love	140				
MCK-2	3	McKee Creek in Cabarrus Co. at SR 1169	4/11/2001	B. Love	1900	B1	658	1487	1271
MCK-2	3A	McKee Creek in Cabarrus Co. at SR 1169	4/11/2001	B. Love	60				
MCK-2	3B	McKee Creek in Cabarrus Co. at SR 1169	4/11/2001	B. Love	2500				
Q7750000	3	McKee Creek in Mecklenburg Co. at SR 2808	4/18/2001	B. Love	240		158	183	99
Q7750000	3A	McKee Creek in Mecklenburg Co. at SR 2808	4/18/2001	B. Love	68				
Q7750000	3B	McKee Creek in Mecklenburg Co. at SR 2808	4/18/2001	B. Love	240				
MCK-2	3	McKee Creek in Cabarrus Co. at SR 1169	4/18/2001	B. Love	720		737	737	15
MCK-2	3A	McKee Creek in Cabarrus Co. at SR 1169	4/18/2001	B. Love	750				
MCK-2	3B	McKee Creek in Cabarrus Co. at SR 1169	4/18/2001	B. Love	740				
Q7750000	3	McKee Creek in Mecklenburg Co. at SR 2808	4/25/2001	B. Love	5600		6482	6533	1006
Q7750000	3A	McKee Creek in Mecklenburg Co. at SR 2808	4/25/2001	B. Love	7600	B3			
Q7750000	3B	McKee Creek in Mecklenburg Co. at SR 2808	4/25/2001	B. Love	6400	B3			
MCK-2	3	McKee Creek in Cabarrus Co. at SR 1169	4/25/2001	B. Love	600	B1	2094	2900	2252
MCK-2	3A	McKee Creek in Cabarrus Co. at SR 1169	4/25/2001	B. Love	5100				
MCK-2	3B	McKee Creek in Cabarrus Co. at SR 1169	4/25/2001	B. Love	3000				
Q7750000	3	McKee Creek in Mecklenburg Co. at SR 2808	5/2/2001	B. Love	200		126	136	62
Q7750000	3A	McKee Creek in Mecklenburg Co. at SR 2808	5/2/2001	B. Love	130	B1			
Q7750000	3B	McKee Creek in Mecklenburg Co. at SR 2808	5/2/2001	B. Love	77	B4			
MCK-2	3	McKee Creek in Cabarrus Co. at SR 1169	5/2/2001	B. Love	98	B4	88	89	11
MCK-2	3A	McKee Creek in Cabarrus Co. at SR 1169	5/2/2001	B. Love	91	B4			
MCK-2	3B	McKee Creek in Cabarrus Co. at SR 1169	5/2/2001	B. Love	77	B4			

Q7750000	3	McKee Creek in Mecklenburg Co. at SR 2808	5/9/2001	B. Love	130	B1	152	153	21
Q7750000	3A	McKee Creek in Mecklenburg Co. at SR 2808	5/9/2001	B. Love	170	B1			
Q7750000	3B	McKee Creek in Mecklenburg Co. at SR 2808	5/9/2001	B. Love	160	B1			
MCK-2	3	McKee Creek in Cabarrus Co. at SR 1169	5/9/2001	B. Love	1	B2	1	1	0
MCK-2	3A	McKee Creek in Cabarrus Co. at SR 1169	5/9/2001	B. Love	1	B2			
MCK-2	3B	McKee Creek in Cabarrus Co. at SR 1169	5/9/2001	B. Love	1	B2			
Q7750000	3	McKee Creek in Mecklenburg Co. at SR 2808	5/16/2001	B. Love	380		220	240	125
Q7750000	3A	McKee Creek in Mecklenburg Co. at SR 2808	5/16/2001	B. Love	140	B1			
Q7750000	3B	McKee Creek in Mecklenburg Co. at SR 2808	5/16/2001	B. Love	200				
MCK-2	3	McKee Creek in Cabarrus Co. at SR 1169	5/16/2001	B. Love	4500		2714	3133	1721
MCK-2	3A	McKee Creek in Cabarrus Co. at SR 1169	5/16/2001	B. Love	1200				
MCK-2	3B	McKee Creek in Cabarrus Co. at SR 1169	5/16/2001	B. Love	3700				
Q7750000	3	McKee Creek in Mecklenburg Co. at SR 2808	5/30/2001	B. Love	1100	B1	1365	1433	577
Q7750000	3A	McKee Creek in Mecklenburg Co. at SR 2808	5/30/2001	B. Love	2100				
Q7750000	3B	McKee Creek in Mecklenburg Co. at SR 2808	5/30/2001	B. Love	1100	B1			
MCK-2	3	McKee Creek in Cabarrus Co. at SR 1169	5/30/2001	B. Love	1500	B1	2378	2500	889
MCK-2	3A	McKee Creek in Cabarrus Co. at SR 1169	5/30/2001	B. Love	2800				
MCK-2	3B	McKee Creek in Cabarrus Co. at SR 1169	5/30/2001	B. Love	3200				
Q7750000	3	McKee Creek in Mecklenburg Co. at SR 2808	6/5/2001	B. Love	2800	Q	797	1217	1371
Q7750000	3A	McKee Creek in Mecklenburg Co. at SR 2808	6/5/2001	B. Love	420	Q			
Q7750000	3B	McKee Creek in Mecklenburg Co. at SR 2808	6/5/2001	B. Love	430	Q			
MCK-2	3	McKee Creek in Cabarrus Co. at SR 1169	6/5/2001	B. Love	800	B1, Q	1146	1230	588
MCK-2	3A	McKee Creek in Cabarrus Co. at SR 1169	6/5/2001	B. Love	990	B4, Q			
MCK-2	1B	McKee Creek in Cabarrus Co. at SR 1169	6/5/2001	B. Love	1900	B1, Q			

Station Description	Dates	Number of days	Obser-vations	Geometric Mean
McKee Creek in Mecklenburg Co. at SR 2808	4/11/2001 to 5/9/2001	29	15	309
McKee Creek in Mecklenburg Co. at SR 2808	4/18/2001 to 5/16/2001	29	15	337
McKee Creek in Mecklenburg Co. at SR 2808	4/25/2001 to 5/30/2001	36	15	518
McKee Creek in Mecklenburg Co. at SR 2808	5/2/2001 to 6/5/2001	35	15	341
McKee Creek in Cabarrus Co. at SR 1169	4/11/2001 to 5/9/2001	29	29	155
McKee Creek in Cabarrus Co. at SR 1169	4/18/2001 to 5/16/2001	29	29	206
McKee Creek in Cabarrus Co. at SR 1169	4/25/2001 to 5/30/2001	36	36	260
McKee Creek in Cabarrus Co. at SR 1169	5/2/2001 to 6/5/2001	35	35	231
All Stations	4/11/2001 to 5/9/2001	29	30	219
All Stations	4/18/2001 to 5/16/2001	29	30	263
All Stations	4/25/2001 to 5/30/2001	36	30	367
All Stations	5/2/2001 to 6/5/2001	35	30	280

Remark Code Definitions

B1) Countable membranes with less than 20 colonies.
Reported value is estimated or is a total of the counts on all filters reported per 100 ml.
B2) Counts from all filters were zero.
The value reported is based on the number of colonies per 100 ml that would have been reported if there had been one colony on the filter representing the largest filtration volume (reported as a less than "<" value).
B3) Countable membranes with more than 60 or 80 colonies.
The value reported is calculated using the count from the smallest volume filtered and reported as a greater than ">" value.
Filters have counts of both >60 or 80 and < 20.
B4) Reported value is a total of the counts from all countable filters reported per 100 ml.
Q) Holding time exceeded.

This code shall be used if the value is derived from a sample that was received, prepared and/or analyzed after the approved holding time restrictions for sample preparation and analysis.

APPENDIX B -- POINT SOURCE ASSESSMENT

Summary of Discharge Data from **BRADFIELD FARMS WATER COMPANY/CENTREX HOMES**, Cabarrus County, NC – (NPDES Permit #NC0064734)
Discharging to McKee Creek downstream of the Mecklenburg/Cabarrus County line.
(from a review of daily monitoring data for 1998-2001)
Permit limits: Flow – 0.460 mgd, Fecal Coliforms – 200 cfu/100 ml (monthly geometric mean) = **3.48E9 cfu/day**
Daily Max. is 400 cfu/100 ml = **6.96E9 cfu/day**

2001 data – all fecal coliform measurements were <2 cfu (listed in the monthly summary as 1 cfu) except for a measurement of 5 cfu on 10/23/01

- Flows approximated 1/3 of permit limit
- Fecal Coliform load for the year was approx. 1/600th or **0.2%** of the permitted limit.

2000 data – most measurements were <2 cfu, except for 450 cfu on 2/3/00; 3 measurements from 18-28 cfu in 3/2000, 1400 cfu on 5/10/00, 3000 cfu on 6/22/00, 12.7 on 6/29/00, 6000 on 7/6/00; On 7/12/00 operators were changed and the plant did somewhat better for the rest of the year with only two values above <2 cfu for the remainder of the year: 60 cfu on 7/28/00 and >8000 cfu on 10/10/00 -- (yet even with this high measurement the geometric mean for the month was only 6.03 cfu)
Average monthly geometric mean for Year 2000 was approximately 18.5 cfu/100 ml

- Flows approximated <1/3 of permit limit
- Fecal Coliform load for the year was approx. **3.0%** of the permitted limit.

1999 data – the only fecal coliform values >50 cfu were: 1050 cfu on 2/24/99, 2325 cfu on 6/24/99, and 143 cfu on 8/11/99.
Average monthly geometric mean for 1999 was approximately 9.5 cfu/100 ml

- Flows remained at ~ 1/3 of the permitted limit
- Fecal Coliform load for the year was approx. **1.6%** of the permitted limit.

1998 data – the only fecal coliform values >50 cfu were: 450 cfu on 2/26/98, 1100 cfu on 5/28/98, 3100 on 6/3/98,
>3000 on 7/15/98, 161 on 8/13/98, 60 on 9/10/98, 73 on 10/8/98, and 2350 on 10/23-98
Average monthly geometric mean for 1999 was approximately 11.9 cfu/100 ml

- Flows remained at ~ 1/3 of the permitted limit
- Fecal Coliform load for the year was approx. **2.0%** of the permitted limit.

Summary of Discharge Data from **LAMPLIGHTER VILLAGE EAST**, Mecklenburg County, NC – (NPDES Permit #NC0025259)
Discharging to the headwaters of McKee Creek, or to a tributary to the headwaters of McKee Creek, in Mecklenburg County.
(from a review of daily monitoring data for 1997-2001)
Permit limits: Flow – 0.070 mgd, Fecal Coliforms – 200 cfu/100 ml (monthly geometric mean) = **5.30E8 cfu/day**
Daily Max. is 400 cfu/100 ml = **1.06E9 cfu/day**

2001 data – all fecal coliform measurements were <100 cfu/100 ml except for measurements of 340 & 580 on 7/10/01,
340 on 12/12/01, and 300 on 12/18/01.
Average monthly geometric mean for 2001 was approximately 16.3 cfu/100 ml
- Flows averaged 0.028 mgd or 40% of permit limit
- Fecal Coliform load for the year was approx. **3.3%** of the permitted limit.

2000 data – all fecal coliform measurements were <100 cfu/100 ml except for 260 on 2/1/00.
Most measurements were <2.
Average monthly geometric mean for 2000 was approximately 4.0 cfu/100 ml
- Flows averaged 0.032 mgd or 46% of permit limit
- Fecal Coliform load for the year was approx. **0.9%** of the permitted limit.

1999 data – all fecal coliform measurements were <100 cfu/100 ml except for measurements of 260 on 2/23/99,
900 on 3/2/99, >24,000 on 8/24/99, 1500 on 9/21/99, and 1800 on 10/5/99.
Average monthly geometric mean for 1999 was approximately 5.3 cfu/100 ml
- Flows averaged 0.018 mgd or 25% of permit limit
- Fecal Coliform load for the year was approx. **0.7%** of the permitted limit.

1998 data – all fecal coliform measurements were <100 cfu/100 ml except for 2500 on 10/6/98, 960 on 11/10/98, and 4100 on 12/1/98.
Most measurements were <2.
Average monthly geometric mean for 1998 was approximately 3.0 cfu/100 ml
- Flows averaged 0.027 mgd or 39% of permit limit
- Fecal Coliform load for the year was approx. **0.6%** of the permitted limit.

1997 data – all fecal coliform measurements were <100 cfu/100 ml except for 360 on 5/14/97.
Most measurements were <2.
Average monthly geometric mean for 1997 was approximately 2.4 cfu/100 ml
- Flows averaged 0.025 mgd or 35% of permit limit
- Fecal Coliform load for the year was approx. **0.4%** of the permitted limit.

APPENDIX C -- SEASONALITY AND CRITICAL PERIOD

Based on Stream Measurements Based on Stream Measurements Upstream and Downstream of Two Point Source Dischargers

The following data were reviewed with the conclusion that high, instream fecal coliform levels were common throughout the year, with no particular season representing a worst case period.

BOLD IS THE SEASONAL PERIOD OF APRIL THROUGH JUNE
Corresponding to the State Intensive Survey 4/10/01-6/5/01
DATA EXCEEDING 400 CFU/100 ml UPSTREAM OR DOWNSTREAM
NC0025259 Lamplighter Village East 100' above and 300 ' below outfall to (Unnamed Tributary to?) McKee Creek
"Unnamed Tributary" is listed for 2000 and 2001 data

			cfu/100ml	mgd	Fecal Coliform Concentration	Concentration
Day	**Mo.**	**Year**	**Effluent**	**Flow**	**Upstream**	**Downstream**
1	4	1998	2	0.019	1300	820
7	**4**	**1998**	**56**	**0.029**	**460**	**93**
30	**6**	**1998**	**33**	**0.033**	**1300**	**820**
28	7	1998	2	0.014	30000	4700
11	8	1998	18	0.022	7200	6600
25	8	1998	2	0.011	4600	10
22	9	1998	2	0.008	860	10
6	10	1998	2500	0.013	5300	4000
20	10	1998	14	0.013	450	50
3	11	1998	2	0.018	10	1200
10	11	1998	960	0.012	10	3400
1	12	1998	4100	0.015	10	3700
30	12	1998	2	0.012	590	5800
20	1	1999	2	0.011	1000	2700
27	1	1999	2	0.014	4700	390
2	2	1999	3	0.015	1000	5100
9	2	1999	84	0.019	440	24000
30	3	1999	2	0.015	10	410
28	**4**	**1999**	**2**	**0.015**	**3400**	**850**
4	**5**	**1999**	**2**	**0.017**	**1200**	**1000**
20	**5**	**1999**	**2**	**0.021**	**480**	**2400**
10	**6**	**1999**	**2**	**0.011**	**4300**	**5600**
24	8	1999	24000	0.012	38	6900
31	8	1999	2	0.012	460	10
8	9	1999	2	0.013	560	100
14	9	1999	2	0.011	10	2100
21	9	1999	1500	0.009	3100	12
28	9	1999	2	0.033	12	2700
5	10	1999	1800	0.014	200	2000
13	10	1999	2	0.035	2000	1200
2	11	1999	2	0.01	440	69
30	11	1999	2	0.012	780	1500
14	12	1999	2	0.038	4900	240

11	1	2000	2	0.018	2200	94
15	2	2000	7	0.068	1200	110

BOLD IS THE SEASONAL PERIOD OF APRIL THROUGH JUNE

DATA EXCEEDING 400 CFU/100 ml UPSTREAM OR DOWNSTEAM
NC0064734 -- Bradfield Farms 100' Above Outfall and Below Outfall at NCSR 1169 (MCK-2)

Day	Mo.	Year	Effluent cfu/100ml	Flow mgd	Eff. Cfu/day cfu/day	Upstream cfu/100ml	Downstream cfu/100ml
21	1	1999	2	0.172	13020400	213	420
18	2	1999	2	0.11	8327000	1200	380
25	3	1999	2	0.154	11657800	490	1600
15	**4**	**1999**	**8.86**	**0.138**	**46278438**	**1200**	**60**
29	**4**	**1999**	**2**	**0.184**	**13928800**	**300**	**1200**
19	**5**	**1999**	**24.1**	**0.164**	**149598340**	**200**	**600**
25	**5**	**1999**	**2**	**0.156**	**11809200**	**420**	**290**
2	**6**	**1999**	**2**	**0.168**	**12717600**	**92**	**1200**
16	**6**	**1999**	**15.6**	**0.204**	**120453840**	**6000**	**2300**
24	**6**	**1999**	**2325**	**0.116**	**10208145000**	**1200**	**410**
30	**6**	**1999**	**36.4**	**0.182**	**250748680**	**420**	**200**
7	7	1999	2	0.086	6510200	1200	1200
15	7	1999	2	0.076	5753200	290	512
29	7	1999	2	0.118	8932600	42.5	1200
5	8	1999	2	0.103	7797100	30	1200
11	8	1999	143	0.119	644093450	27.5	820
26	8	1999	2	0.13	9841000	3500	6000
2	9	1999	2	0.09	6813000	88	600
9	9	1999	2	0.116	8781200	100	547
15	9	1999	2	0.108	8175600	580	470
29	9	1999	2	0.072	5450400	6000	6000
2	11	1999	5.19	0.08	15715320	6000	6000
2	12	1999	2	0.143	10825100	520	84
15	12	1999	5.06	0.168	32175528	530	860
6	1	2000	2	0.132	9992400	52.5	450
3	2	2000	450	0.102	1737315000	620	270
23	3	2000	2	0.166	12566200	520	164
29	3	2000	27.3	0.134	138462870	470	400
13	**4**	**2000**	**2**	**0.114**	**8629800**	**520**	**1200**
19	**4**	**2000**	**2**	**0.102**	**7721400**	**480**	**920**
10	**5**	**2000**	**1400**	**0.132**	**6994680000**	**360**	**1340**
17	**5**	**2000**	**2**	**0.152**	**11506400**	**1200**	**330**
25	**5**	**2000**	**2**	**0.128**	**9689600**	**860**	**172**
5	**6**	**2000**	**2**	**0.149**	**11279300**	**500**	**73**
15	**6**	**2000**	**2**	**0.322**	**24375400**	**700**	**1180**
22	**6**	**2000**	**3000**	**0.3**	**34065000000**	**3300**	**1700**

29	**6**	**2000**	**12.7**	**0.178**	**85563710**	**6000**	**5600**
6	7	2000	6000	0.21	47691000000	3600	1600

DATA EXCEEDING 400 CFU/100 ml UPSTREAM OR DOWNSTEAM
NC0064734 -- Bradfield Farms 100' Above Outfall and Below Outfall at NCSR 1169 (MCK-2)

Day	Mo.	Year	Effluent cfu/100ml	Flow mgd	Upstream cfu/100ml	Downstream cfu/100ml	
21	1	1999	2	0.172	213	420	
18	**2**	**1999**	**2**	**0.11**	**1200**	**380**	
25	3	1999	2	0.154	490	1600	
15	**4**	**1999**	**8.86**	**0.138**	**1200**	**60**	**BOLD IS THE DATA**
29	4	1999	2	0.184	300	1200	**WHERE UPSTREAM VALUES**
19	5	1999	24.1	0.164	200	600	**EXCEED OR EQUAL**
25	**5**	**1999**	**2**	**0.156**	**420**	**290**	**DOWNSTREAM VALUES**
2	6	1999	2	0.168	92	1200	**(NONPOINT SOURCES**
16	**6**	**1999**	**15.6**	**0.204**	**6000**	**2300**	**ARE PREDOMINANT)**
24	**6**	**1999**	**2325**	**0.116**	**1200**	**410**	
30	**6**	**1999**	**36.4**	**0.182**	**420**	**200**	
7	**7**	**1999**	**2**	**0.086**	**1200**	**1200**	
15	7	1999	2	0.076	290	512	
29	7	1999	2	0.118	42.5	1200	
5	8	1999	2	0.103	30	1200	
11	8	1999	143	0.119	27.5	820	
26	8	1999	2	0.13	3500	6000	
2	9	1999	2	0.09	88	600	
9	9	1999	2	0.116	100	547	
15	**9**	**1999**	**2**	**0.108**	**580**	**470**	
29	**9**	**1999**	**2**	**0.072**	**6000**	**6000**	
2	**11**	**1999**	**5.19**	**0.08**	**6000**	**6000**	
2	**12**	**1999**	**2**	**0.143**	**520**	**84**	
15	12	1999	5.06	0.168	530	860	
6	1	2000	2	0.132	52.5	450	
3	**2**	**2000**	**450**	**0.102**	**620**	**270**	
23	**3**	**2000**	**2**	**0.166**	**520**	**164**	
29	**3**	**2000**	**27.3**	**0.134**	**470**	**400**	
13	4	2000	2	0.114	520	1200	
19	4	2000	2	0.102	480	920	
10	5	2000	1400	0.132	360	1340	
17	**5**	**2000**	**2**	**0.152**	**1200**	**330**	
25	**5**	**2000**	**2**	**0.128**	**860**	**172**	
5	**6**	**2000**	**2**	**0.149**	**500**	**73**	
15	6	2000	2	0.322	700	1180	
22	**6**	**2000**	**3000**	**0.3**	**3300**	**1700**	
29	**6**	**2000**	**12.7**	**0.178**	**6000**	**5600**	
6	**7**	**2000**	**6000**	**0.21**	**3600**	**1600**	

APPENDIX D -- FAILING SEPTIC SYSTEMS

This sheet contains information related to the contribution of failing septic systems to streams.

The following assumptions are made for septic contributions.

Assume a failure rate for septics in the watershed:	1	%	
Assume the average FC concentration reaching the stream (from septic overcharge) is:	1.00E+04	#/100 ml	**(Horsely & Whitten, 1996)**
Assume a typical septic overcharge flow rate of:	70	gal/day/person	**(Horsely & Whitten, 1996)**

Total number of people on septics comes from the septic report in WCS.

SEPTICS AS A POINT SOURCE

Subwatershed	Density people/septic	# failing septics	Total # people served	Septic flow (gal/day)	Septic flow (mL/hr)	FC rate (#/hr)	Septic flow (cfs)	Stream Load cfu/day
MY7	2.5	3	6	438	68,997	6.90E+06	6.78E-04	**1.66E+08**
MY7	2.5	1	3	228	35,879	3.59E+06	3.53E-04	**8.63E+07**
MCK-2	2.5	1	1	88	13,799	1.38E+06	1.36E-04	**3.32E+07**
Clear Ck	2.5	1	2	123	19,319	1.93E+06	1.90E-04	**4.65E+07**
Total McKee Watershed								**3.32E+08**

APPENDIX E -- FLOWS AND CALCULATED FECAL COLIFORM LOADS AT 200 CFU/100 ML; SAMPLE CONCENTRATIONS AND STREAM LOADS

Irwins Creek
Watershed area = 8.37 square miles = 5356.8 Acres

McKee Ck @ MY7
Subwatershed area = 2735 Acres

DATE	Flow in cfs MAX	MIN	MEAN	FLOW In Cfs	LOAD in cfu/day at 200/100ml	Sample Concen-tration in cfu/100 ml	Calculated Actual Load in cfu/day
5/12/2000			1.6	0.82	4.00E+09		
5/13/2000			1.7	0.87	4.25E+09		
5/14/2000			2.5	1.28	6.25E+09		
5/15/2000	1.1	1	1.1	0.56	2.75E+09		
5/16/2000	1.1	1	1.1	0.56	2.75E+09		
5/17/2000	1.2	1	1.1	0.56	2.75E+09		
5/18/2000	1.2	1	1.1	0.56	2.75E+09		
5/19/2000	1.1	0.94	1.1	0.56	2.75E+09		
5/20/2000	1	0.84	1	0.51	2.50E+09		
5/21/2000	4.8	0.84	1.2	0.61	3.00E+09		
5/22/2000	6.8	1	2.3	1.17	5.75E+09		
5/23/2000	1	0.94	0.96	0.49	2.40E+09		
5/24/2000	1.3	0.94	1.1	0.56	2.75E+09		
5/25/2000	1.2	0.94	1	0.51	2.50E+09		
5/26/2000	1.3	0.75	1	0.51	2.50E+09		
5/27/2000	0.94	0.67	0.79	0.40	1.97E+09		
5/28/2000	0.94	0.67	0.76	0.39	1.90E+09		
5/29/2000	1.1	0.67	0.86	0.44	2.15E+09		
5/30/2000	0.94	0.6	0.68	0.35	1.70E+09		
5/31/2000	0.67	0.6	0.63	0.32	1.57E+09		
6/1/2000	0.75	0.6	0.63	0.32	1.57E+09		
6/2/2000	0.6	0.54	0.58	0.30	1.45E+09		
6/3/2000	0.6	0.48	0.53	0.27	1.32E+09		
6/4/2000	11	0.48	3.7	1.89	9.24E+09		
6/5/2000	303	0.94	41	20.93	1.02E+11		
6/6/2000	8.3	1.7	3.6	1.84	8.99E+09		
6/7/2000	1.7	1.2	1.4	0.71	3.50E+09		
6/8/2000	1.2	1	1.1	0.56	2.75E+09		
6/9/2000	1	0.84	0.94	0.48	2.35E+09		
6/10/2000	0.94	0.75	0.84	0.43	2.10E+09		
6/11/2000	0.84	0.67	0.74	0.38	1.85E+09		
6/12/2000	0.75	0.6	0.65	0.33	1.62E+09		

6/13/2000	0.75	0.54	0.64	0.33	1.60E+09
6/14/2000	0.54	0.48	0.52	0.27	1.30E+09
6/15/2000	0.67	0.48	0.52	0.27	1.30E+09
6/16/2000	0.6	0.48	0.53	0.27	1.32E+09
6/17/2000	0.54	0.42	0.48	0.25	1.20E+09
6/18/2000	0.48	0.37	0.44	0.22	1.10E+09
6/19/2000	0.6	0.42	0.52	0.27	1.30E+09
6/20/2000	0.54	0.48	0.49	0.25	1.22E+09
6/21/2000	0.48	0.42	0.47	0.24	1.17E+09
6/22/2000	0.48	0.33	0.39	0.20	9.74E+08
6/23/2000	0.48	0.33	0.37	0.19	9.24E+08
6/24/2000	0.33	0.27	0.3	0.15	7.50E+08
6/25/2000	0.33	0.23	0.25	0.13	6.25E+08
6/26/2000	0.27	0.19	0.24	0.12	6.00E+08
6/27/2000	0.37	0.19	0.27	0.14	6.75E+08
6/28/2000	0.6	0.27	0.34	0.17	8.50E+08
6/29/2000	3.9	0.54	1.5	0.77	3.75E+09
6/30/2000	1.4	0.37	0.64	0.33	1.60E+09
7/1/2000	18	0.33	0.93	0.47	2.32E+09
7/2/2000	14	0.42	2.1	1.07	5.25E+09
7/3/2000	0.42	0.23	0.32	0.16	8.00E+08
7/4/2000	0.23	0.19	0.21	0.11	5.25E+08
7/5/2000	0.23	0.19	0.21	0.11	5.25E+08
7/6/2000	0.27	0.19	0.2	0.10	5.00E+08
7/7/2000	0.48	0.19	0.26	0.13	6.50E+08
7/8/2000	3.7	0.19	0.23	0.12	5.75E+08
7/9/2000	22	0.48	3.5	1.79	8.74E+09
7/10/2000	0.48	0.19	0.28	0.14	7.00E+08
7/11/2000	141	0.15	9.4	4.80	2.35E+10
7/12/2000	185	1.7	19	9.70	4.75E+10
7/13/2000	5.1	1	2	1.02	5.00E+09
7/14/2000	1	0.6	0.75	0.38	1.87E+09
7/15/2000	38	0.6	4.9	2.50	1.22E+10
7/16/2000	0.75	0.42	0.53	0.27	1.32E+09
7/17/2000	0.42	0.37	0.42	0.21	1.05E+09
7/18/2000	0.6	0.33	0.43	0.22	1.07E+09
7/19/2000	5.3	0.23	0.51	0.26	1.27E+09
7/20/2000	48	0.54	4.9	2.50	1.22E+10
7/21/2000	0.6	0.33	0.4	0.20	9.99E+08
7/22/2000	0.42	0.27	0.35	0.18	8.74E+08
7/23/2000	1.1	0.27	0.31	0.16	7.75E+08
7/24/2000	4.1	0.48	1.5	0.77	3.75E+09

7/25/2000	0.84	0.42	0.56	0.29	1.40E+09
7/26/2000	0.42	0.33	0.39	0.20	9.74E+08
7/27/2000	0.48	0.27	0.33	0.17	8.25E+08
7/28/2000	0.27	0.19	0.25	0.13	6.25E+08
7/29/2000	0.19	0.15	0.18	0.09	4.50E+08
7/30/2000	0.19	0.15	0.18	0.09	4.50E+08
7/31/2000	0.19	0.12	0.15	0.08	3.75E+08
8/1/2000	60	0.12	9.8	5.00	2.45E+10
8/2/2000	5.7	1.2	2.2	1.12	5.50E+09
8/3/2000	9.1	0.67	1.2	0.61	3.00E+09
8/4/2000	22	1.3	6.2	3.17	1.55E+10
8/5/2000	1.3	0.54	0.84	0.43	2.10E+09
8/6/2000	0.54	0.42	0.47	0.24	1.17E+09
8/7/2000	0.42	0.27	0.36	0.18	8.99E+08
8/8/2000	0.37	0.27	0.29	0.15	7.25E+08
8/9/2000	0.27	0.19	0.23	0.12	5.75E+08
8/10/2000	24	0.19	4.4	2.25	1.10E+10
8/11/2000	0.94	0.33	0.53	0.27	1.32E+09
8/12/2000	0.37	0.23	0.3	0.15	7.50E+08
8/13/2000	0.23	0.15	0.18	0.09	4.50E+08
8/14/2000	1.7	0.12	0.24	0.12	6.00E+08
8/15/2000	1.3	0.12	0.34	0.17	8.50E+08
8/16/2000	0.12	0.1	0.11	0.06	2.75E+08
8/17/2000	0.12	0.1	0.1	0.05	2.50E+08
8/18/2000	0.19	0.09	0.12	0.06	3.00E+08
8/19/2000	0.23	0.12	0.15	0.08	3.75E+08
8/20/2000	0.23	0.12	0.17	0.09	4.25E+08
8/21/2000	0.15	0.1	0.13	0.07	3.25E+08
8/22/2000	0.15	0.1	0.12	0.06	3.00E+08
8/23/2000	0.12	0.1	0.11	0.06	2.75E+08
8/24/2000	1.3	0.07	0.18	0.09	4.50E+08
8/25/2000	1.6	0.27	0.68	0.35	1.70E+09
8/26/2000	0.33	0.09	0.15	0.08	3.75E+08
8/27/2000	0.1	0.06	0.08	0.04	2.00E+08
8/28/2000	0.09	0.06	0.08	0.04	2.00E+08
8/29/2000	0.1	0.06	0.08	0.04	2.00E+08
8/30/2000	0.37	0.06	0.09	0.05	2.25E+08
8/31/2000	0.75	0.37	0.53	0.27	1.32E+09
9/1/2000	353	0.19	25	12.76	6.25E+10
9/2/2000	75	3	14	7.15	3.50E+10
9/3/2000	3	1.2	1.7	0.87	4.25E+09
9/4/2000	45	1	6.3	3.22	1.57E+10

9/5/2000	2.2	0.75	1.2	0.61	3.00E+09
9/6/2000	0.75	0.48	0.57	0.29	1.42E+09
9/7/2000	0.67	0.37	0.43	0.22	1.07E+09
9/8/2000	0.67	0.37	0.45	0.23	1.12E+09
9/9/2000	0.48	0.42	0.43	0.22	1.07E+09
9/10/2000	1.2	0.42	0.46	0.23	1.15E+09
9/11/2000	1.2	0.37	0.61	0.31	1.52E+09
9/12/2000	0.42	0.33	0.38	0.19	9.49E+08
9/13/2000	0.48	0.37	0.41	0.21	1.02E+09
9/14/2000	0.48	0.37	0.42	0.21	1.05E+09
9/15/2000	0.54	0.42	0.49	0.25	1.22E+09
9/16/2000	0.54	0.33	0.39	0.20	9.74E+08
9/17/2000	0.37	0.27	0.34	0.17	8.50E+08
9/18/2000	56	0.37	4.9	2.50	1.22E+10
9/19/2000	22	0.6	4.1	2.09	1.02E+10
9/20/2000	0.6	0.23	0.35	0.18	8.74E+08
9/21/2000	0.75	0.23	0.39	0.20	9.74E+08
9/22/2000	71	0.27	11	5.62	2.75E+10
9/23/2000	471	5.9	91	46.46	2.27E+11
9/24/2000	5.9	1.4	3	1.53	7.50E+09
9/25/2000	129	1.2	19	9.70	4.75E+10
9/26/2000	17	2.1	5.7	2.91	1.42E+10
9/27/2000	2.2	1.1	1.6	0.82	4.00E+09
9/28/2000	1.3	0.75	1.1	0.56	2.75E+09
9/29/2000	1.2	0.67	0.82	0.42	2.05E+09
9/30/2000	0.94	0.6	0.72	0.37	1.80E+09
10/1/2000	1.4	0.05	0.67	0.34	1.67E+09
10/2/2000	0.67	0.42	0.56	0.29	1.40E+09
10/3/2000	0.6	0.37	0.48	0.25	1.20E+09
10/4/2000	0.6	0.37	0.48	0.25	1.20E+09
10/5/2000	0.6	0.27	0.41	0.21	1.02E+09
10/6/2000	0.6	0.33	0.46	0.23	1.15E+09
10/7/2000	0.6	0.27	0.44	0.22	1.10E+09
10/8/2000	0.48	0.27	0.37	0.19	9.24E+08
10/9/2000	0.6	0.33	0.45	0.23	1.12E+09
10/10/2000	0.67	0.33	0.49	0.25	1.22E+09
10/11/2000	0.67	0.42	0.57	0.29	1.42E+09
10/12/2000	0.67	0.42	0.55	0.28	1.37E+09
10/13/2000	0.67	0.37	0.51	0.26	1.27E+09
10/14/2000	0.6	0.37	0.45	0.23	1.12E+09
10/15/2000	0.54	0.33	0.39	0.20	9.74E+08
10/16/2000	0.94	0.27	0.5	0.26	1.25E+09

10/17/2000	0.67	0.27	0.44	0.22	1.10E+09
10/18/2000	0.75	0.33	0.49	0.25	1.22E+09
10/19/2000	0.67	0.42	0.55	0.28	1.37E+09
10/20/2000	0.84	0.48	0.58	0.30	1.45E+09
10/21/2000	0.6	0.37	0.45	0.23	1.12E+09
10/22/2000	0.75	0.42	0.59	0.30	1.47E+09
10/23/2000	0.75	0.6	0.67	0.34	1.67E+09
10/24/2000	0.75	0.6	0.64	0.33	1.60E+09
10/25/2000	0.67	0.6	0.66	0.34	1.65E+09
10/26/2000	0.6	0.54	0.58	0.30	1.45E+09
10/27/2000	0.6	0.54	0.6	0.31	1.50E+09
10/28/2000	0.6	0.48	0.54	0.28	1.35E+09
10/29/2000	0.54	0.48	0.51	0.26	1.27E+09
10/30/2000	0.48	0.42	0.45	0.23	1.12E+09
10/31/2000	1.3	0.37	0.45	0.23	1.12E+09
11/1/2000	0.48	0.48	0.48	0.25	1.20E+09
11/2/2000	0.54	0.48	0.49	0.25	1.22E+09
11/3/2000	0.54	0.42	0.49	0.25	1.22E+09
11/4/2000	0.6	0.48	0.52	0.27	1.30E+09
11/5/2000	0.67	0.6	0.63	0.32	1.57E+09
11/6/2000	0.67	0.54	0.59	0.30	1.47E+09
11/7/2000	0.6	0.54	0.55	0.28	1.37E+09
11/8/2000	0.67	0.6	0.61	0.31	1.52E+09
11/9/2000	3.7	0.6	0.88	0.45	2.20E+09
11/10/2000	4.4	0.75	1.8	0.92	4.50E+09
11/11/2000	0.75	0.48	0.57	0.29	1.42E+09
11/12/2000	0.54	0.48	0.49	0.25	1.22E+09
11/13/2000	0.54	0.48	0.51	0.26	1.27E+09
11/14/2000	5.9	0.54	2.1	1.07	5.25E+09
11/15/2000	1.3	0.48	0.72	0.37	1.80E+09
11/16/2000	1.6	0.48	0.65	0.33	1.62E+09
11/17/2000	2.7	0.54	1.5	0.77	3.75E+09
11/18/2000	1	0.6	0.72	0.37	1.80E+09
11/19/2000	6.8	0.54	2.7	1.38	6.75E+09
11/20/2000	3.7	0.94	2.1	1.07	5.25E+09
11/21/2000	1	0.67	0.85	0.43	2.12E+09
11/22/2000	0.67	0.6	0.64	0.33	1.60E+09
11/23/2000	0.84	0.6	0.68	0.35	1.70E+09
11/24/2000	0.6	0.6	0.6	0.31	1.50E+09
11/25/2000	82	0.6	14	7.15	3.50E+10
11/26/2000	6.1	1.7	2.9	1.48	7.25E+09
11/27/2000	1.7	1.2	1.4	0.71	3.50E+09

11/28/2000	1.2	1	1.1	0.56	2.75E+09
11/29/2000	1	0.94	1	0.51	2.50E+09
11/30/2000	1	0.84	0.92	0.47	2.30E+09
12/1/2000	0.94	0.67	0.79	0.40	1.97E+09
12/2/2000	0.94	0.75	0.91	0.46	2.27E+09
12/3/2000	0.94	0.75	0.85	0.43	2.12E+09
12/4/2000	0.75	0.67	0.75	0.38	1.87E+09
12/5/2000	0.75	0.67	0.74	0.38	1.85E+09
12/6/2000	0.75	0.75	0.75	0.38	1.87E+09
12/7/2000	0.84	0.67	0.75	0.38	1.87E+09
12/8/2000	0.84	0.67	0.76	0.39	1.90E+09
12/9/2000	2.4	0.6	0.86	0.44	2.15E+09
12/10/2000	1.2	0.6	0.73	0.37	1.82E+09
12/11/2000	0.67	0.6	0.66	0.34	1.65E+09
12/12/2000	0.67	0.54	0.64	0.33	1.60E+09
12/13/2000	0.6	0.54	0.57	0.29	1.42E+09
12/14/2000	1	0.6	0.75	0.38	1.87E+09
12/15/2000	0.94	0.6	0.79	0.40	1.97E+09
12/16/2000	3	0.67	1.7	0.87	4.25E+09
12/17/2000	4.8	1.9	3	1.53	7.50E+09
12/18/2000	1.9	1.1	1.4	0.71	3.50E+09
12/19/2000	1.6	1.1	1.2	0.61	3.00E+09
12/20/2000	1.8	1	1.4	0.71	3.50E+09
12/21/2000	1.2	0.94	1	0.51	2.50E+09
12/22/2000	1.2	1	1.1	0.56	2.75E+09
12/23/2000	1	0.84	0.94	0.48	2.35E+09
12/24/2000	0.94	0.84	0.88	0.45	2.20E+09
12/25/2000	0.94	0.75	0.83	0.42	2.07E+09
12/26/2000	0.84	0.67	0.77	0.39	1.92E+09
12/27/2000	1.2	0.75	0.93	0.47	2.32E+09
12/28/2000	1.4	0.94	1.1	0.56	2.75E+09
12/29/2000	1.1	0.94	0.98	0.50	2.45E+09
12/30/2000	0.94	0.84	0.91	0.46	2.27E+09
12/31/2000	0.84	0.75	0.83	0.42	2.07E+09
1/1/2001	0.84	0.75	0.83	0.42	2.07E+09
1/2/2001	1	0.75	0.84	0.43	2.10E+09
1/3/2001	0.94	0.67	0.84	0.43	2.10E+09
1/4/2001	1	0.84	0.89	0.45	2.22E+09
1/5/2001	1	0.94	0.94	0.48	2.35E+09
1/6/2001	1	0.84	0.93	0.47	2.32E+09
1/7/2001	1.1	0.84	0.96	0.49	2.40E+09
1/8/2001	2.7	0.94	1.7	0.87	4.25E+09

1/9/2001	1.8	1.1	1.3	0.66	3.25E+09
1/10/2001	1.1	1	1.1	0.56	2.75E+09
1/11/2001	1.2	1	1.1	0.56	2.75E+09
1/12/2001	16	1	5.5	2.81	1.37E+10
1/13/2001	7.7	2.1	4.7	2.40	1.17E+10
1/14/2001	2.1	1.7	1.8	0.92	4.50E+09
1/15/2001	1.7	1.3	1.4	0.71	3.50E+09
1/16/2001	1.3	1.1	1.2	0.61	3.00E+09
1/17/2001	1.1	1	1.1	0.56	2.75E+09
1/18/2001	1.4	1	1.2	0.61	3.00E+09
1/19/2001	37	1.3	8	4.08	2.00E+10
1/20/2001	21	5.5	12	6.13	3.00E+10
1/21/2001	5.5	2.4	3.4	1.74	8.50E+09
1/22/2001	2.4	1.8	2	1.02	5.00E+09
1/23/2001	1.8	1.6	1.6	0.82	4.00E+09
1/24/2001	1.6	1.4	1.5	0.77	3.75E+09
1/25/2001	1.6	1.2	1.3	0.66	3.25E+09
1/26/2001	1.3	1.2	1.3	0.66	3.25E+09
1/27/2001	1.3	1.2	1.2	0.61	3.00E+09
1/28/2001	1.3	1.1	1.2	0.61	3.00E+09
1/29/2001	1.2	1.1	1.1	0.56	2.75E+09
1/30/2001	2.5	1.1	1.7	0.87	4.25E+09
1/31/2001	1.6	1.2	1.3	0.66	3.25E+09
2/1/2001	1.2	1	1.1	0.56	2.75E+09
2/2/2001	1.2	1	1.1	0.56	2.75E+09
2/3/2001	1	0.94	1	0.51	2.50E+09
2/4/2001	1	1	1	0.51	2.50E+09
2/5/2001	1.1	1	1	0.51	2.50E+09
2/6/2001	1	0.94	1	0.51	2.50E+09
2/7/2001	1.2	0.94	1	0.51	2.50E+09
2/8/2001	1.1	0.94	0.98	0.50	2.45E+09
2/9/2001	1.1	0.94	1	0.51	2.50E+09
2/10/2001	1.6	1	1.3	0.66	3.25E+09
2/11/2001	1.1	0.94	0.98	0.50	2.45E+09
2/12/2001	3.3	0.94	1.9	0.97	4.75E+09
2/13/2001	4.1	1.4	1.9	0.97	4.75E+09
2/14/2001	8	2.2	3.9	1.99	9.74E+09
2/15/2001	2.2	1.6	1.7	0.87	4.25E+09
2/16/2001	1.8	1.3	1.5	0.77	3.75E+09
2/17/2001	134	1.8	27	13.79	6.75E+10
2/18/2001	5.5	2.8	3.7	1.89	9.24E+09
2/19/2001	2.8	2.1	2.4	1.23	6.00E+09

2/20/2001	2.2	1.9	2	1.02	5.00E+09
2/21/2001	1.9	1.7	1.8	0.92	4.50E+09
2/22/2001	25	1.7	8.2	4.19	2.05E+10
2/23/2001	5.5	2.7	3.7	1.89	9.24E+09
2/24/2001	2.8	2.2	2.4	1.23	6.00E+09
2/25/2001	4.9	2.1	3.2	1.63	8.00E+09
2/26/2001	3.7	2.2	2.7	1.38	6.75E+09
2/27/2001	2.2	1.9	2	1.02	5.00E+09
2/28/2001	1.9	1.8	1.8	0.92	4.50E+09
3/1/2001	1.9	1.7	1.7	0.87	4.25E+09
3/2/2001	1.7	1.6	1.6	0.82	4.00E+09
3/3/2001	6.1	1.6	2.4	1.23	6.00E+09
3/4/2001	126	6.1	30	15.32	7.50E+10
3/5/2001	7.5	4.2	6	3.06	1.50E+10
3/6/2001	4.2	2.8	3.4	1.74	8.50E+09
3/7/2001	2.8	2.2	2.5	1.28	6.25E+09
3/8/2001	2.4	2.1	2.2	1.12	5.50E+09
3/9/2001	2.1	1.8	2	1.02	5.00E+09
3/10/2001	1.8	1.7	1.8	0.92	4.50E+09
3/11/2001	1.8	1.6	1.7	0.87	4.25E+09
3/12/2001	5.1	1.6	2	1.02	5.00E+09
3/13/2001	5.9	2.1	3.4	1.74	8.50E+09
3/14/2001	2.1	1.7	1.9	0.97	4.75E+09
3/15/2001	52	1.7	18	9.19	4.50E+10
3/16/2001	9.1	4.1	5.5	2.81	1.37E+10
3/17/2001	4.1	3	3.4	1.74	8.50E+09
3/18/2001	3	2.4	2.6	1.33	6.50E+09
3/19/2001	2.4	2.1	2.2	1.12	5.50E+09
3/20/2001	153	1.9	30	15.32	7.50E+10
3/21/2001	321	13	69	35.23	1.72E+11
3/22/2001	13	5.7	8.1	4.14	2.02E+10
3/23/2001	5.7	3.9	4.5	2.30	1.12E+10
3/24/2001	3.9	3.2	3.4	1.74	8.50E+09
3/25/2001	3.2	2.7	2.8	1.43	7.00E+09
3/26/2001	2.7	2.2	2.5	1.28	6.25E+09
3/27/2001	2.2	2.1	2.2	1.12	5.50E+09
3/28/2001	2.1	1.9	2	1.02	5.00E+09
3/29/2001	417	1.9	94	47.99	2.35E+11
3/30/2001	96	9.7	27	13.79	6.75E+10
3/31/2001	9.7	5.5	7	3.57	1.75E+10
4/1/2001	7.7	4.8	5.7	2.91	1.42E+10
4/2/2001	5.1	3.5	4.1	2.09	1.02E+10

4/3/2001	4.6	3.4	3.7	1.89	9.24E+09		
4/4/2001	3.7	3	3.3	1.68	8.25E+09		
4/5/2001	3.2	2.9	2.9	1.48	7.25E+09		
4/6/2001	2.9	2.6	2.7	1.38	6.75E+09		
4/7/2001	2.7	2.4	2.6	1.33	6.50E+09		
4/8/2001	2.6	2.3	2.4	1.23	6.00E+09		
4/9/2001	2.3	2.2	2.3	1.17	5.75E+09		
4/10/2001	2.2	2.1	2.2	1.12	5.50E+09		
4/11/2001	2.2	2.1	2.1	1.07	5.25E+09		
4/12/2001	2.3	2	2.1	1.07	5.25E+09		
4/13/2001	7	2	3.2	1.63	8.00E+09		
4/14/2001	2.6	2	2.1	1.07	5.25E+09		
4/15/2001	2.2	2	2	1.02	5.00E+09		
4/16/2001	2.1	1.8	1.9	0.97	4.75E+09		
4/17/2001	1.9	1.8	1.8	0.92	4.50E+09		
4/18/2001	1.9	1.7	1.8	0.92	4.50E+09		
4/19/2001	2.2	1.7	1.8	0.92	4.50E+09		
4/20/2001	1.8	1.7	1.7	0.87	4.25E+09		
4/21/2001	1.8	1.7	1.7	0.87	4.25E+09		
4/22/2001	1.8	1.7	1.7	0.87	4.25E+09		
4/23/2001	1.8	1.6	1.7	0.87	4.25E+09		
4/24/2001	4.9	1.6	2	1.02	5.00E+09		
4/25/2001	30	3.2	10	5.11	2.50E+10		
4/26/2001	3.2	2.1	2.5	1.28	6.25E+09		
4/27/2001	2.1	1.9	1.9	0.97	4.75E+09		
4/28/2001	1.9	1.7	1.8	0.92	4.50E+09		
4/29/2001	1.7	1.6	1.6	0.82	4.00E+09		
4/30/2001	1.8	1.5	1.6	0.82	4.00E+09		
5/1/2001	1.6	1.5	1.5	0.77	3.75E+09		
5/2/2001	1.5	1.4	1.5	0.77	3.75E+09		
5/3/2001	1.7	1.3	1.4	0.71	3.50E+09		
5/4/2001	1.4	1.3	1.3	0.66	3.25E+09		
5/5/2001	1.3	1.2	1.3	0.66	3.25E+09		
5/6/2001	1.2	1.2	1.2	0.61	3.00E+09		
5/7/2001	1.2	1.1	1.2	0.61	3.00E+09		
5/8/2001	1.4	1.2	1.3	0.66	3.25E+09		
5/9/2001	1.3	1.1	1.2	0.61	3.00E+09	309	4.63E+09
5/10/2001	1.3	1.1	1.2	0.61	3.00E+09		
5/11/2001	1.2	0.99	1.1	0.56	2.75E+09		
5/12/2001	1.1	0.99	1.1	0.56	2.75E+09		
5/13/2001	1.1	0.92	0.97	0.50	2.42E+09		
5/14/2001	0.92	0.85	0.91	0.46	2.27E+09		

5/15/2001	0.92	0.85	0.9	0.46	2.25E+09		
5/16/2001	0.92	0.85	0.88	0.45	2.20E+09	337	3.70E+09
5/17/2001	1.1	0.92	0.96	0.49	2.40E+09		
5/18/2001	1.1	0.92	1	0.51	2.50E+09		
5/19/2001	238	0.79	18	9.19	4.50E+10		
5/20/2001	48	1.6	5.7	2.91	1.42E+10		
5/21/2001	1.6	1.2	1.3	0.66	3.25E+09		
5/22/2001	21	1.1	3.7	1.89	9.24E+09		
5/23/2001	4.8	1.3	2	1.02	5.00E+09		
5/24/2001	2.3	1.1	1.3	0.66	3.25E+09		
5/25/2001	6.3	1.2	2.1	1.07	5.25E+09		
5/26/2001	29	1.9	8.2	4.19	2.05E+10		
5/27/2001	1.9	1.2	1.4	0.71	3.50E+09		
5/28/2001	12	1.1	4	2.04	9.99E+09		
5/29/2001	5.1	1.8	2.9	1.48	7.25E+09		
5/30/2001	1.8	1.2	1.4	0.71	3.50E+09	518	9.06E+09
5/31/2001	1.2	1.1	1.2	0.61	3.00E+09		
6/1/2001	64	1.1	8.9	4.54	2.22E+10		
6/2/2001	6.6	1.8	3.1	1.58	7.75E+09		
6/3/2001	1.8	1.1	1.4	0.71	3.50E+09		
6/4/2001	1.1	0.99	1.1	0.56	2.75E+09		
6/5/2001	0.99	0.85	0.95	0.49	2.37E+09	341	4.05E+09
6/6/2001	0.92	0.79	0.87	0.44	2.17E+09		
6/7/2001	0.99	0.79	0.81	0.41	2.02E+09		
6/8/2001	1.5	0.79	1	0.51	2.50E+09		
6/9/2001	1.1	0.85	0.97	0.50	2.42E+09		
6/10/2001	0.99	0.73	0.8	0.41	2.00E+09		
6/11/2001	0.73	0.62	0.7	0.36	1.75E+09		
6/12/2001	0.67	0.62	0.65	0.33	1.62E+09		
6/13/2001	70	0.62	6.7	3.42	1.67E+10		
6/14/2001	16	1.2	3.1	1.58	7.75E+09		
6/15/2001	1.2	0.85	0.97	0.50	2.42E+09		
6/16/2001	0.99	0.73	0.82	0.42	2.05E+09		
6/17/2001	0.99	0.62	0.77	0.39	1.92E+09		
6/18/2001	0.67	0.57	0.61	0.31	1.52E+09		
6/19/2001	0.67	0.57	0.6	0.31	1.50E+09		
6/20/2001	0.57	0.53	0.53	0.27	1.32E+09		
6/21/2001	0.53	0.48	0.51	0.26	1.27E+09		
6/22/2001	5.1	0.48	1	0.51	2.50E+09		
6/23/2001	4.1	0.62	1.3	0.66	3.25E+09		
6/24/2001	1.2	0.53	0.74	0.38	1.85E+09		
6/25/2001	0.73	0.48	0.53	0.27	1.32E+09		

6/26/2001	4.2	0.44	0.86	0.44	2.15E+09
6/27/2001	3.4	0.44	0.84	0.43	2.10E+09
6/28/2001	0.53	0.4	0.45	0.23	1.12E+09
6/29/2001	0.53	0.4	0.42	0.21	1.05E+09
6/30/2001	1.3	0.37	0.54	0.28	1.35E+09
7/1/2001	0.53	0.28	0.36	0.18	8.99E+08
7/2/2001	0.3	0.28	0.3	0.15	7.50E+08
7/3/2001	2.3	0.28	0.44	0.22	1.10E+09
7/4/2001	12	0.44	1.3	0.66	3.25E+09
7/5/2001	9.4	0.57	2	1.02	5.00E+09
7/6/2001	0.57	0.3	0.41	0.21	1.02E+09
7/7/2001	0.3	0.28	0.3	0.15	7.50E+08
7/8/2001	0.53	0.28	0.37	0.19	9.24E+08
7/9/2001	0.67	0.37	0.52	0.27	1.30E+09
7/10/2001	0.37	0.28	0.33	0.17	8.25E+08
7/11/2001	0.28	0.23	0.25	0.13	6.25E+08
7/12/2001	0.25	0.2	0.22	0.11	5.50E+08
7/13/2001	1.1	0.21	0.51	0.26	1.27E+09
7/14/2001	0.62	0.25	0.37	0.19	9.24E+08
7/15/2001	0.25	0.2	0.21	0.11	5.25E+08
7/16/2001	0.2	0.15	0.17	0.09	4.25E+08
7/17/2001	0.18	0.15	0.16	0.08	4.00E+08
7/18/2001	0.16	0.15	0.16	0.08	4.00E+08
7/19/2001	0.16	0.15	0.16	0.08	4.00E+08
7/20/2001	0.16	0.14	0.15	0.08	3.75E+08
7/21/2001	0.15	0.11	0.13	0.07	3.25E+08
7/22/2001	0.12	0.09	0.11	0.06	2.75E+08
7/23/2001	0.4	0.1	0.16	0.08	4.00E+08
7/24/2001	5.5	0.15	1.1	0.56	2.75E+09
7/25/2001	64	0.48	6.2	3.17	1.55E+10
7/26/2001	4.2	0.79	1.8	0.92	4.50E+09
7/27/2001	0.79	0.44	0.54	0.28	1.35E+09
7/28/2001	0.53	0.34	0.4	0.20	9.99E+08
7/29/2001	0.48	0.28	0.33	0.17	8.25E+08
7/30/2001	0.48	0.34	0.39	0.20	9.74E+08
7/31/2001	0.34	0.23	0.26	0.13	6.50E+08
8/1/2001	0.23	0.2	0.21	0.11	5.25E+08
8/2/2001	0.21	0.2	0.2	0.10	5.00E+08
8/3/2001	0.2	0.15	0.17	0.09	4.25E+08
8/4/2001	0.16	0.15	0.16	0.08	4.00E+08
8/5/2001	0.16	0.14	0.15	0.08	3.75E+08
8/6/2001	0.15	0.12	0.14	0.07	3.50E+08

8/7/2001	0.14	0.1	0.12	0.06	3.00E+08
8/8/2001	0.11	0.09	0.1	0.05	2.50E+08
8/9/2001	0.09	0.07	0.08	0.04	2.00E+08
8/10/2001	0.07	0.05	0.06	0.03	1.50E+08
8/11/2001	0.34	0.05	0.15	0.08	3.75E+08
8/12/2001	0.14	0.09	0.11	0.06	2.75E+08
8/13/2001	21	0.07	2	1.02	5.00E+09
8/14/2001	1.7	0.21	0.58	0.30	1.45E+09
8/15/2001	0.21	0.14	0.17	0.09	4.25E+08
8/16/2001	0.14	0.09	0.11	0.06	2.75E+08
8/17/2001	0.79	0.07	0.12	0.06	3.00E+08
8/18/2001	4.4	0.34	1.1	0.56	2.75E+09
8/19/2001	0.34	0.14	0.21	0.11	5.25E+08
8/20/2001	0.14	0.09	0.12	0.06	3.00E+08
8/21/2001	0.09	0.06	0.07	0.04	1.75E+08
8/22/2001	0.06	0.04	0.05	0.03	1.25E+08
8/23/2001	0.04	0.03	0.04	0.02	9.99E+07
8/24/2001	0.03	0.03	0.03	0.02	7.50E+07
8/25/2001	0.03	0.02	0.03	0.02	7.50E+07
8/26/2001	0.03	0.02	0.03	0.02	7.50E+07
8/27/2001	0.03	0.02	0.02	0.01	5.00E+07
8/28/2001	0.02	0.02	0.02	0.01	5.00E+07
8/29/2001	0.02	0.02	0.02	0.01	5.00E+07
8/30/2001	0.02	0.02	0.02	0.01	5.00E+07
8/31/2001	0.85	0.02	0.09	0.05	2.25E+08
9/1/2001	0.53	0.11	0.29	0.15	7.25E+08
9/2/2001	0.25	0.11	0.16	0.08	4.00E+08
9/3/2001	22	0.1	4.3	2.20	1.07E+10
9/4/2001	50	0.84	9.5	4.85	2.37E+10
9/5/2001	1.4	0.15	0.54	0.28	1.35E+09
9/6/2001	0.15	0.06	0.1	0.05	2.50E+08
9/7/2001	0.06	0.05	0.06	0.03	1.50E+08
9/8/2001	0.05	0.05	0.05	0.03	1.25E+08
9/9/2001	0.6	0.05	0.16	0.08	4.00E+08
9/10/2001	1	0.1	0.36	0.18	8.99E+08
9/11/2001	0.23	0.04	0.07	0.04	1.75E+08
9/12/2001	0.04	0.04	0.04	0.02	9.99E+07
9/13/2001	0.04	0.04	0.04	0.02	9.99E+07
9/14/2001	0.04	0.04	0.04	0.02	9.99E+07
9/15/2001	0.04	0.03	0.03	0.02	7.50E+07
9/16/2001	0.03	0.03	0.03	0.02	7.50E+07
9/17/2001	0.03	0.03	0.03	0.02	7.50E+07

9/18/2001	0.03	0.03	0.03	0.02	7.50E+07
9/19/2001	0.03	0.02	0.03	0.02	7.50E+07
9/20/2001	8.3	0.02	0.58	0.30	1.45E+09
9/21/2001	2.1	0.06	0.41	0.21	1.02E+09
9/22/2001	0.06	0.05	0.05	0.03	1.25E+08
9/23/2001	0.05	0.04	0.04	0.02	9.99E+07
9/24/2001	130	0.04	20	10.21	5.00E+10
9/25/2001	2.8	0.23	0.9	0.46	2.25E+09
9/26/2001	0.23	0.12	0.17	0.09	4.25E+08
9/27/2001	0.15	0.09	0.11	0.06	2.75E+08
9/28/2001	0.19	0.07	0.11	0.06	2.75E+08
9/29/2001	0.09	0.07	0.08	0.04	2.00E+08
9/30/2001	0.1	0.09	0.09	0.05	2.25E+08
10/1/2001	0.12	0.1	0.1	0.05	2.50E+08
10/2/2001	0.12	0.1	0.12	0.06	3.00E+08
10/3/2001	0.15	0.1	0.11	0.06	2.75E+08
10/4/2001	0.15	0.1	0.11	0.06	2.75E+08
10/5/2001	0.19	0.12	0.15	0.08	3.75E+08
10/6/2001	1.6	0.19	0.88	0.45	2.20E+09
10/7/2001	1.4	0.35	0.69	0.35	1.72E+09
10/8/2001	0.35	0.15	0.27	0.14	6.75E+08
10/9/2001	0.23	0.12	0.2	0.10	5.00E+08
10/10/2001	0.94	0.23	0.63	0.32	1.57E+09
10/11/2001	0.35	0.19	0.24	0.12	6.00E+08
10/12/2001	0.29	0.19	0.24	0.12	6.00E+08
10/13/2001	0.39	0.29	0.35	0.18	8.74E+08
10/14/2001	9.1	0.29	1.8	0.92	4.50E+09
10/15/2001	1.7	0.23	0.6	0.31	1.50E+09
10/16/2001	0.23	0.1	0.15	0.08	3.75E+08
10/17/2001	0.12	0.1	0.1	0.05	2.50E+08
10/18/2001	0.15	0.1	0.12	0.06	3.00E+08
10/19/2001	0.19	0.15	0.17	0.09	4.25E+08
10/20/2001	0.23	0.19	0.2	0.10	5.00E+08
10/21/2001	0.55	0.23	0.27	0.14	6.75E+08
10/22/2001	0.44	0.23	0.32	0.16	8.00E+08
10/23/2001	0.29	0.19	0.23	0.12	5.75E+08
10/24/2001	0.29	0.23	0.26	0.13	6.50E+08
10/25/2001	9.7	0.23	2.5	1.28	6.25E+09
10/26/2001	0.69	0.19	0.37	0.19	9.24E+08
10/27/2001	0.23	0.19	0.21	0.11	5.25E+08
10/28/2001	0.19	0.15	0.19	0.10	4.75E+08
10/29/2001	0.29	0.19	0.24	0.12	6.00E+08

10/30/2001	0.35	0.29	0.29	0.15	7.25E+08
10/31/2001	0.35	0.29	0.34	0.17	8.50E+08
11/1/2001	0.55	0.35	0.4	0.20	9.99E+08
11/2/2001	0.62	0.39	0.52	0.27	1.30E+09
11/3/2001	0.5	0.44	0.46	0.23	1.15E+09
11/4/2001	0.5	0.39	0.44	0.22	1.10E+09
11/5/2001	0.5	0.08	0.27	0.14	6.75E+08
11/6/2001	0.12	0.1	0.12	0.06	3.00E+08
11/7/2001	0.12	0.1	0.12	0.06	3.00E+08
11/8/2001	0.12	0.1	0.11	0.06	2.75E+08
11/9/2001	0.15	0.12	0.13	0.07	3.25E+08
11/10/2001	0.15	0.12	0.15	0.08	3.75E+08
11/11/2001	0.23	0.12	0.2	0.10	5.00E+08
11/12/2001	0.23	0.19	0.2	0.10	5.00E+08
11/13/2001	0.23	0.19	0.21	0.11	5.25E+08
11/14/2001	0.29	0.23	0.26	0.13	6.50E+08
11/15/2001	0.29	0.23	0.27	0.14	6.75E+08
11/16/2001	0.29	0.23	0.28	0.14	7.00E+08
11/17/2001	0.29	0.23	0.27	0.14	6.75E+08
11/18/2001	0.29	0.23	0.24	0.12	6.00E+08
11/19/2001	0.23	0.23	0.23	0.12	5.75E+08
11/20/2001	0.29	0.23	0.24	0.12	6.00E+08
11/21/2001	0.29	0.19	0.24	0.12	6.00E+08
11/22/2001	0.35	0.23	0.28	0.14	7.00E+08
11/23/2001	0.55	0.29	0.34	0.17	8.50E+08
11/24/2001	1.4	0.55	0.98	0.50	2.45E+09
11/25/2001	0.77	0.35	0.51	0.26	1.27E+09
11/26/2001	0.35	0.23	0.27	0.14	6.75E+08
11/27/2001	0.23	0.15	0.19	0.10	4.75E+08
11/28/2001	0.19	0.15	0.16	0.08	4.00E+08
11/29/2001	0.19	0.15	0.16	0.08	4.00E+08
11/30/2001	0.29	0.19	0.22	0.11	5.50E+08
12/1/2001	0.23	0.19	0.23	0.12	5.75E+08
12/2/2001	0.23	0.15	0.17	0.09	4.25E+08
12/3/2001	0.15	0.08	0.12	0.06	3.00E+08
12/4/2001	0.15	0.1	0.12	0.06	3.00E+08
12/5/2001	0.35	0.1	0.15	0.08	3.75E+08
12/6/2001	0.15	0.12	0.13	0.07	3.25E+08
12/7/2001	0.19	0.12	0.15	0.08	3.75E+08
12/8/2001	0.19	0.15	0.16	0.08	4.00E+08
12/9/2001	0.19	0.12	0.15	0.08	3.75E+08
12/10/2001	46	0.12	8.3	4.24	2.07E+10

12/11/2001	32	1.2	6	3.06	1.50E+10
12/12/2001	1.2	0.55	0.78	0.40	1.95E+09
12/13/2001	0.55	0.5	0.53	0.27	1.32E+09
12/14/2001	0.85	0.5	0.63	0.32	1.57E+09
12/15/2001	0.77	0.39	0.54	0.28	1.35E+09
12/16/2001	0.39	0.29	0.33	0.17	8.25E+08
12/17/2001	3	0.29	0.56	0.29	1.40E+09
12/18/2001	6.1	0.85	2.5	1.28	6.25E+09
12/19/2001	0.85	0.44	0.58	0.30	1.45E+09
12/20/2001	3	0.35	0.92	0.47	2.30E+09
12/21/2001	0.35	0.23	0.3	0.15	7.50E+08
12/22/2001	0.29	0.15	0.24	0.12	6.00E+08
12/23/2001	0.35	0.23	0.26	0.13	6.50E+08
12/24/2001	0.44	0.35	0.4	0.20	9.99E+08
12/25/2001	0.39	0.29	0.35	0.18	8.74E+08
12/26/2001	0.29	0.23	0.27	0.14	6.75E+08
12/27/2001	0.29	0.23	0.28	0.14	7.00E+08
12/28/2001	0.29	0.23	0.26	0.13	6.50E+08
12/29/2001	0.35	0.29	0.29	0.15	7.25E+08
12/30/2001	0.35	0.23	0.29	0.15	7.25E+08
12/31/2001	0.35	0.29	0.29	0.15	7.25E+08
1/1/2002	0.35	0.29	0.31	0.16	7.75E+08
1/2/2002	0.5	0.29	0.35	0.18	8.74E+08
1/3/2002	0.77	0.44	0.67	0.34	1.67E+09
1/4/2002	1.2	0.77	0.91	0.46	2.27E+09
1/5/2002	1.4	0.77	0.97	0.50	2.42E+09
1/6/2002	72	0.69	14	7.15	3.50E+10
1/7/2002	6.6	1.6	3	1.53	7.50E+09
1/8/2002	1.6	0.94	1.2	0.61	3.00E+09
1/9/2002	1.6	0.77	0.95	0.49	2.37E+09
1/10/2002	1.4	0.62	0.83	0.42	2.07E+09
1/11/2002	0.69	0.55	0.62	0.32	1.55E+09
1/12/2002	0.77	0.55	0.59	0.30	1.47E+09
1/13/2002	1	0.77	0.87	0.44	2.17E+09
1/14/2002	0.77	0.5	0.59	0.30	1.47E+09
1/15/2002	0.55	0.5	0.5	0.26	1.25E+09
1/16/2002	0.5	0.44	0.48	0.25	1.20E+09
1/17/2002	0.44	0.44	0.44	0.22	1.10E+09
1/18/2002	0.5	0.44	0.45	0.23	1.12E+09
1/19/2002	124	0.44	34	17.36	8.50E+10
1/20/2002	74	3.5	14	7.15	3.50E+10
1/21/2002	9.1	2.4	4.7	2.40	1.17E+10

1/22/2002	4.4	1.8	2.7	1.38	6.75E+09
1/23/2002	227	1.8	65	33.19	1.62E+11
1/24/2002	17	5.7	7.4	3.78	1.85E+10
1/25/2002	58	6.6	24	12.25	6.00E+10
1/26/2002	6.6	3.2	4.4	2.25	1.10E+10
1/27/2002	3.2	1.7	2.5	1.28	6.25E+09
1/28/2002	1.9	1.6	1.7	0.87	4.25E+09
1/29/2002	1.6	1.3	1.5	0.77	3.75E+09
1/30/2002	1.3	1.2	1.3	0.66	3.25E+09
1/31/2002	2.8	1	1.3	0.66	3.25E+09
2/1/2002	4.1	1.4	2.3	1.17	5.75E+09
2/2/2002	1.4	1.1	1.2	0.61	3.00E+09
2/3/2002	1.1	0.94	1	0.51	2.50E+09
2/4/2002	1.1	0.94	1	0.51	2.50E+09
2/5/2002	1	1	1	0.51	2.50E+09
2/6/2002	5.1	1	1.5	0.77	3.75E+09
2/7/2002	34	5.1	15	7.66	3.75E+10
2/8/2002	34	4.9	12	6.13	3.00E+10
2/9/2002	4.9	2.7	3.5	1.79	8.74E+09
2/10/2002	2.8	2.4	2.6	1.33	6.50E+09
2/11/2002	2.5	1.7	2.1	1.07	5.25E+09
2/12/2002	2.7	1.4	1.7	0.87	4.25E+09
2/13/2002	2.1	1.2	1.4	0.71	3.50E+09
2/14/2002	1.7	1.1	1.2	0.61	3.00E+09
2/15/2002	1.4	1	1.1	0.56	2.75E+09
2/16/2002	1.1	1	1.1	0.56	2.75E+09
2/17/2002	1	0.94	1	0.51	2.50E+09
2/18/2002	0.94	0.84	0.88	0.45	2.20E+09
2/19/2002	0.94	0.84	0.85	0.43	2.12E+09
2/20/2002	1	0.84	0.91	0.46	2.27E+09
2/21/2002	1	0.84	0.95	0.49	2.37E+09
2/22/2002	1	0.84	0.86	0.44	2.15E+09
2/23/2002	0.84	0.75	0.83	0.42	2.07E+09
2/24/2002	0.84	0.75	0.79	0.40	1.97E+09
2/25/2002	0.84	0.75	0.82	0.42	2.05E+09
2/26/2002	0.94	0.84	0.91	0.46	2.27E+09
2/27/2002	0.94	0.84	0.89	0.45	2.22E+09
2/28/2002	0.84	0.75	0.83	0.42	2.07E+09
3/1/2002	0.94	0.75	0.83	0.42	2.07E+09
3/2/2002	153	0.84	30	15.32	7.50E+10
3/3/2002	53	9.4	24	12.25	6.00E+10
3/4/2002	9.4	3.7	5.6	2.86	1.40E+10

3/5/2002	3.7	2.5	2.9	1.48	7.25E+09
3/6/2002	2.5	2.1	2.2	1.12	5.50E+09
3/7/2002	2.2	1.8	1.9	0.97	4.75E+09
3/8/2002	1.8	1.6	1.6	0.82	4.00E+09
3/9/2002	1.6	1.4	1.5	0.77	3.75E+09
3/10/2002	1.6	1.2	1.4	0.71	3.50E+09
3/11/2002	1.3	1.2	1.2	0.61	3.00E+09
3/12/2002	5.3	1.2	2.8	1.43	7.00E+09
3/13/2002	7.5	3.3	5.3	2.71	1.32E+10
3/14/2002	4.2	2.4	3	1.53	7.50E+09
3/15/2002	2.4	1.8	2	1.02	5.00E+09
3/16/2002	1.9	1.7	1.7	0.87	4.25E+09
3/17/2002	36	1.6	10	5.11	2.50E+10
3/18/2002	7.7	3.3	4.7	2.40	1.17E+10
3/19/2002	3.3	2.4	2.8	1.43	7.00E+09
3/20/2002	5.9	2.2	2.9	1.48	7.25E+09
3/21/2002	31	5.5	15	7.66	3.75E+10
3/22/2002	7.5	3.3	4.8	2.45	1.20E+10
3/23/2002	3.3	2.5	2.8	1.43	7.00E+09
3/24/2002	2.5	2.1	2.3	1.17	5.75E+09
3/25/2002	2.1	0	1.9	0.97	4.75E+09
3/26/2002	4.1	1.8	2.2	1.12	5.50E+09
3/27/2002	4.1	0	2.3	1.17	5.75E+09
3/28/2002	2.1	1.6	1.6	0.82	4.00E+09
3/29/2002	1.6	1.4	1.5	0.77	3.75E+09
3/30/2002	2.5	1.4	2	1.02	5.00E+09
3/31/2002	113	2.2	14	7.15	3.50E+10
4/1/2002	112	5.9	24	12.25	6.00E+10
4/2/2002	5.9	3.5	4.4	2.25	1.10E+10
4/3/2002	4.9	2.8	3.5	1.79	8.74E+09
4/4/2002	4.4	2.4	2.8	1.43	7.00E+09
4/5/2002	2.4	1.9	2.1	1.07	5.25E+09
4/6/2002	3.9	1.7	2.2	1.12	5.50E+09
4/7/2002	1.9	1.4	1.6	0.82	4.00E+09
4/8/2002	2.2	1.3	1.5	0.77	3.75E+09
4/9/2002	2.2	1.3	1.6	0.82	4.00E+09
4/10/2002	2.7	1.9	2.2	1.12	5.50E+09
4/11/2002	2.5	1.4	1.7	0.87	4.25E+09
4/12/2002	1.8	1.3	1.6	0.82	4.00E+09
4/13/2002	1.8	1.4	1.6	0.82	4.00E+09
4/14/2002	2.2	1.3	1.5	0.77	3.75E+09
4/15/2002	1.3	1.1	1.2	0.61	3.00E+09

4/16/2002	1.2	1	1.1	0.56	2.75E+09
4/17/2002	1.1	0.94	1	0.51	2.50E+09
4/18/2002	1	0.84	0.94	0.48	2.35E+09
4/19/2002	0.94	0.84	0.89	0.45	2.22E+09
4/20/2002	0.94	0	0.82	0.42	2.05E+09
4/21/2002	0.94	0.75	0.79	0.40	1.97E+09
4/22/2002	0.75	0.67	0.69	0.35	1.72E+09
4/23/2002	0.67	0.54	0.59	0.30	1.47E+09
4/24/2002	0.6	0	0.57	0.29	1.42E+09
4/25/2002	1	0.42	0.67	0.34	1.67E+09
4/26/2002	0.75	0.48	0.55	0.28	1.37E+09
4/27/2002	0.6	0.48	0.54	0.28	1.35E+09
4/28/2002	0.67	0.48	0.59	0.30	1.47E+09
4/29/2002	0.6	0.42	0.53	0.27	1.32E+09
4/30/2002	0.42	0.33	0.4	0.20	9.99E+08
5/1/2002	7.7	0.33	1.5	0.77	3.75E+09
5/2/2002	0.94	0.48	0.57	0.29	1.42E+09
5/3/2002	2.8	0.54	1.1	0.56	2.75E+09
5/4/2002	9.7	0.94	4.7	2.40	1.17E+10
5/5/2002	2.5	0.75	1.2	0.61	3.00E+09
5/6/2002	0.75	0.54	0.63	0.32	1.57E+09
5/7/2002	0.54	0.42	0.48	0.25	1.20E+09
5/8/2002	0.48	0.37	0.4	0.20	9.99E+08
5/9/2002	0.37	0.27	0.34	0.17	8.50E+08
5/10/2002	0.42	0.23	0.28	0.14	7.00E+08
5/11/2002	1	0.33	0.56	0.29	1.40E+09
5/12/2002	0.54	0	0.27	0.14	6.75E+08
Average Flow & Load at 200 cfu/100 ml				**1.22**	**5.99E+09**

APPENDIX F -- RANKED DATA USED TO GENERATE THE FLOW DURATION AND LOAD DURATION CURVES FOR BOTH THE "200" AND "400" STANDARDS

RANK	%Exceed	McKEE CREEK AT MCK-2 RANKED FLOW cfs	RANKED LOAD at 200/100ml	RANKED LOAD at 400/100ml	MCK-2 Daily Sample Geomean Concentration in cfu/100 ml	MCK-2 Calculated Actual Stream Load in cfu/day
1	99.9	0.02	7.61E+07	1.52E+08		
2	99.7	0.02	7.61E+07	1.52E+08		
3	99.6	0.02	7.61E+07	1.52E+08		
4	99.5	0.02	7.61E+07	1.52E+08		
5	99.3	0.02	1.14E+08	2.28E+08		
6	99.2	0.02	1.14E+08	2.28E+08		
7	99.0	0.02	1.14E+08	2.28E+08		
8	98.9	0.02	1.14E+08	2.28E+08		
9	98.8	0.02	1.14E+08	2.28E+08		
10	98.6	0.02	1.14E+08	2.28E+08		
11	98.5	0.02	1.14E+08	2.28E+08		
12	98.4	0.02	1.14E+08	2.28E+08		
13	98.2	0.03	1.52E+08	3.04E+08		
14	98.1	0.03	1.52E+08	3.04E+08		
15	97.9	0.03	1.52E+08	3.04E+08		
16	97.8	0.03	1.52E+08	3.04E+08		
17	97.7	0.03	1.52E+08	3.04E+08		
18	97.5	0.04	1.90E+08	3.81E+08		
19	97.4	0.04	1.90E+08	3.81E+08		
20	97.3	0.04	1.90E+08	3.81E+08		
21	97.1	0.05	2.28E+08	4.57E+08		
22	97.0	0.05	2.28E+08	4.57E+08		
23	96.9	0.05	2.66E+08	5.33E+08		
24	96.7	0.05	2.66E+08	5.33E+08		
25	96.6	0.06	3.04E+08	6.09E+08		
26	96.4	0.06	3.04E+08	6.09E+08		
27	96.3	0.06	3.04E+08	6.09E+08		
28	96.2	0.06	3.04E+08	6.09E+08		
29	96.0	0.06	3.04E+08	6.09E+08		
30	95.9	0.07	3.43E+08	6.85E+08		
31	95.8	0.07	3.43E+08	6.85E+08		
32	95.6	0.07	3.43E+08	6.85E+08		
33	95.5	0.08	3.81E+08	7.61E+08		
34	95.3	0.08	3.81E+08	7.61E+08		
35	95.2	0.08	3.81E+08	7.61E+08		
36	95.1	0.08	3.81E+08	7.61E+08		
37	94.9	0.08	3.81E+08	7.61E+08		
38	94.8	0.09	4.19E+08	8.37E+08		
39	94.7	0.09	4.19E+08	8.37E+08		
40	94.5	0.09	4.19E+08	8.37E+08		
41	94.4	0.09	4.19E+08	8.37E+08		

42	94.3	0.09	4.19E+08	8.37E+08
43	94.1	0.09	4.19E+08	8.37E+08
44	94.0	0.09	4.19E+08	8.37E+08
45	93.8	0.09	4.19E+08	8.37E+08
46	93.7	0.09	4.19E+08	8.37E+08
47	93.6	0.09	4.19E+08	8.37E+08
48	93.4	0.09	4.57E+08	9.13E+08
49	93.3	0.09	4.57E+08	9.13E+08
50	93.2	0.09	4.57E+08	9.13E+08
51	93.0	0.09	4.57E+08	9.13E+08
52	92.9	0.09	4.57E+08	9.13E+08
53	92.7	0.09	4.57E+08	9.13E+08
54	92.6	0.09	4.57E+08	9.13E+08
55	92.5	0.09	4.57E+08	9.13E+08
56	92.3	0.09	4.57E+08	9.13E+08
57	92.2	0.09	4.57E+08	9.13E+08
58	92.1	0.09	4.57E+08	9.13E+08
59	91.9	0.10	4.95E+08	9.90E+08
60	91.8	0.10	4.95E+08	9.90E+08
61	91.7	0.10	4.95E+08	9.90E+08
62	91.5	0.10	4.95E+08	9.90E+08
63	91.4	0.11	5.33E+08	1.07E+09
64	91.2	0.12	5.71E+08	1.14E+09
65	91.1	0.12	5.71E+08	1.14E+09
66	91.0	0.12	5.71E+08	1.14E+09
67	90.8	0.12	5.71E+08	1.14E+09
68	90.7	0.12	5.71E+08	1.14E+09
69	90.6	0.12	5.71E+08	1.14E+09
70	90.4	0.12	5.71E+08	1.14E+09
71	90.3	0.12	5.71E+08	1.14E+09
72	90.2	0.12	5.71E+08	1.14E+09
73	90.0	0.12	5.71E+08	1.14E+09
74	89.9	0.12	5.71E+08	1.14E+09
75	89.7	0.12	5.71E+08	1.14E+09
76	89.6	0.12	6.09E+08	1.22E+09
77	89.5	0.12	6.09E+08	1.22E+09
78	89.3	0.12	6.09E+08	1.22E+09
79	89.2	0.12	6.09E+08	1.22E+09
80	89.1	0.12	6.09E+08	1.22E+09
81	88.9	0.12	6.09E+08	1.22E+09
82	88.8	0.12	6.09E+08	1.22E+09
83	88.6	0.12	6.09E+08	1.22E+09
84	88.5	0.12	6.09E+08	1.22E+09
85	88.4	0.12	6.09E+08	1.22E+09
86	88.2	0.13	6.47E+08	1.29E+09
87	88.1	0.13	6.47E+08	1.29E+09
88	88.0	0.13	6.47E+08	1.29E+09
89	87.8	0.13	6.47E+08	1.29E+09
90	87.7	0.13	6.47E+08	1.29E+09
91	87.6	0.13	6.47E+08	1.29E+09
92	87.4	0.13	6.47E+08	1.29E+09

93	87.3	0.14	6.85E+08	1.37E+09
94	87.1	0.14	6.85E+08	1.37E+09
95	87.0	0.14	6.85E+08	1.37E+09
96	86.9	0.14	6.85E+08	1.37E+09
97	86.7	0.15	7.23E+08	1.45E+09
98	86.6	0.15	7.23E+08	1.45E+09
99	86.5	0.16	7.61E+08	1.52E+09
100	86.3	0.16	7.61E+08	1.52E+09
101	86.2	0.16	7.61E+08	1.52E+09
102	86.0	0.16	7.61E+08	1.52E+09
103	85.9	0.16	7.61E+08	1.52E+09
104	85.8	0.16	7.61E+08	1.52E+09
105	85.6	0.16	7.99E+08	1.60E+09
106	85.5	0.16	7.99E+08	1.60E+09
107	85.4	0.16	7.99E+08	1.60E+09
108	85.2	0.16	7.99E+08	1.60E+09
109	85.1	0.16	7.99E+08	1.60E+09
110	85.0	0.16	7.99E+08	1.60E+09
111	84.8	0.16	7.99E+08	1.60E+09
112	84.7	0.17	8.37E+08	1.67E+09
113	84.5	0.17	8.37E+08	1.67E+09
114	84.4	0.18	8.75E+08	1.75E+09
115	84.3	0.18	8.75E+08	1.75E+09
116	84.1	0.18	8.75E+08	1.75E+09
117	84.0	0.18	8.75E+08	1.75E+09
118	83.9	0.18	8.75E+08	1.75E+09
119	83.7	0.19	9.13E+08	1.83E+09
120	83.6	0.19	9.13E+08	1.83E+09
121	83.4	0.19	9.13E+08	1.83E+09
122	83.3	0.19	9.13E+08	1.83E+09
123	83.2	0.19	9.13E+08	1.83E+09
124	83.0	0.19	9.13E+08	1.83E+09
125	82.9	0.19	9.13E+08	1.83E+09
126	82.8	0.19	9.13E+08	1.83E+09
127	82.6	0.19	9.13E+08	1.83E+09
128	82.5	0.19	9.51E+08	1.90E+09
129	82.4	0.19	9.51E+08	1.90E+09
130	82.2	0.19	9.51E+08	1.90E+09
131	82.1	0.20	9.90E+08	1.98E+09
132	81.9	0.20	9.90E+08	1.98E+09
133	81.8	0.20	9.90E+08	1.98E+09
134	81.7	0.20	9.90E+08	1.98E+09
135	81.5	0.20	9.90E+08	1.98E+09
136	81.4	0.20	9.90E+08	1.98E+09
137	81.3	0.21	1.03E+09	2.06E+09
138	81.1	0.21	1.03E+09	2.06E+09
139	81.0	0.21	1.03E+09	2.06E+09
140	80.8	0.21	1.03E+09	2.06E+09
141	80.7	0.21	1.03E+09	2.06E+09
142	80.6	0.21	1.03E+09	2.06E+09
143	80.4	0.21	1.03E+09	2.06E+09

144	80.3	0.21	1.03E+09	2.06E+09
145	80.2	0.21	1.03E+09	2.06E+09
146	80.0	0.22	1.07E+09	2.13E+09
147	79.9	0.22	1.07E+09	2.13E+09
148	79.8	0.22	1.07E+09	2.13E+09
149	79.6	0.22	1.07E+09	2.13E+09
150	79.5	0.22	1.07E+09	2.13E+09
151	79.3	0.23	1.10E+09	2.21E+09
152	79.2	0.23	1.10E+09	2.21E+09
153	79.1	0.23	1.10E+09	2.21E+09
154	78.9	0.23	1.10E+09	2.21E+09
155	78.8	0.23	1.10E+09	2.21E+09
156	78.7	0.23	1.10E+09	2.21E+09
157	78.5	0.23	1.14E+09	2.28E+09
158	78.4	0.23	1.14E+09	2.28E+09
159	78.2	0.23	1.14E+09	2.28E+09
160	78.1	0.23	1.14E+09	2.28E+09
161	78.0	0.23	1.14E+09	2.28E+09
162	77.8	0.24	1.18E+09	2.36E+09
163	77.7	0.24	1.18E+09	2.36E+09
164	77.6	0.25	1.22E+09	2.44E+09
165	77.4	0.25	1.22E+09	2.44E+09
166	77.3	0.26	1.26E+09	2.51E+09
167	77.2	0.26	1.26E+09	2.51E+09
168	77.0	0.26	1.26E+09	2.51E+09
169	76.9	0.26	1.26E+09	2.51E+09
170	76.7	0.26	1.29E+09	2.59E+09
171	76.6	0.26	1.29E+09	2.59E+09
172	76.5	0.26	1.29E+09	2.59E+09
173	76.3	0.26	1.29E+09	2.59E+09
174	76.2	0.26	1.29E+09	2.59E+09
175	76.1	0.26	1.29E+09	2.59E+09
176	75.9	0.27	1.33E+09	2.66E+09
177	75.8	0.27	1.33E+09	2.66E+09
178	75.6	0.27	1.33E+09	2.66E+09
179	75.5	0.27	1.33E+09	2.66E+09
180	75.4	0.27	1.33E+09	2.66E+09
181	75.2	0.28	1.37E+09	2.74E+09
182	75.1	0.28	1.37E+09	2.74E+09
183	75.0	0.28	1.37E+09	2.74E+09
184	74.8	0.29	1.41E+09	2.82E+09
185	74.7	0.29	1.41E+09	2.82E+09
186	74.6	0.29	1.41E+09	2.82E+09
187	74.4	0.29	1.41E+09	2.82E+09
188	74.3	0.29	1.41E+09	2.82E+09
189	74.1	0.30	1.45E+09	2.89E+09
190	74.0	0.30	1.48E+09	2.97E+09
191	73.9	0.30	1.48E+09	2.97E+09
192	73.7	0.30	1.48E+09	2.97E+09
193	73.6	0.30	1.48E+09	2.97E+09
194	73.5	0.30	1.48E+09	2.97E+09

195	73.3	0.30	1.48E+09	2.97E+09
196	73.2	0.31	1.52E+09	3.04E+09
197	73.1	0.31	1.52E+09	3.04E+09
198	72.9	0.31	1.52E+09	3.04E+09
199	72.8	0.31	1.52E+09	3.04E+09
200	72.6	0.31	1.52E+09	3.04E+09
201	72.5	0.31	1.52E+09	3.04E+09
202	72.4	0.32	1.56E+09	3.12E+09
203	72.2	0.32	1.56E+09	3.12E+09
204	72.1	0.32	1.56E+09	3.12E+09
205	72.0	0.32	1.56E+09	3.12E+09
206	71.8	0.33	1.60E+09	3.20E+09
207	71.7	0.33	1.60E+09	3.20E+09
208	71.5	0.33	1.60E+09	3.20E+09
209	71.4	0.33	1.64E+09	3.27E+09
210	71.3	0.33	1.64E+09	3.27E+09
211	71.1	0.33	1.64E+09	3.27E+09
212	71.0	0.34	1.67E+09	3.35E+09
213	70.9	0.34	1.67E+09	3.35E+09
214	70.7	0.34	1.67E+09	3.35E+09
215	70.6	0.34	1.67E+09	3.35E+09
216	70.5	0.34	1.67E+09	3.35E+09
217	70.3	0.34	1.67E+09	3.35E+09
218	70.2	0.35	1.71E+09	3.43E+09
219	70.0	0.35	1.71E+09	3.43E+09
220	69.9	0.35	1.71E+09	3.43E+09
221	69.8	0.35	1.71E+09	3.43E+09
222	69.6	0.35	1.71E+09	3.43E+09
223	69.5	0.35	1.71E+09	3.43E+09
224	69.4	0.35	1.71E+09	3.43E+09
225	69.2	0.35	1.71E+09	3.43E+09
226	69.1	0.36	1.75E+09	3.50E+09
227	68.9	0.36	1.75E+09	3.50E+09
228	68.8	0.36	1.75E+09	3.50E+09
229	68.7	0.37	1.79E+09	3.58E+09
230	68.5	0.37	1.79E+09	3.58E+09
231	68.4	0.37	1.83E+09	3.65E+09
232	68.3	0.37	1.83E+09	3.65E+09
233	68.1	0.37	1.83E+09	3.65E+09
234	68.0	0.37	1.83E+09	3.65E+09
235	67.9	0.37	1.83E+09	3.65E+09
236	67.7	0.37	1.83E+09	3.65E+09
237	67.6	0.38	1.86E+09	3.73E+09
238	67.4	0.38	1.86E+09	3.73E+09
239	67.3	0.38	1.86E+09	3.73E+09
240	67.2	0.38	1.86E+09	3.73E+09
241	67.0	0.38	1.86E+09	3.73E+09
242	66.9	0.38	1.86E+09	3.73E+09
243	66.8	0.38	1.86E+09	3.73E+09
244	66.6	0.39	1.90E+09	3.81E+09
245	66.5	0.39	1.90E+09	3.81E+09

246	66.3	0.40	1.94E+09	3.88E+09
247	66.2	0.40	1.94E+09	3.88E+09
248	66.1	0.40	1.94E+09	3.88E+09
249	65.9	0.40	1.94E+09	3.88E+09
250	65.8	0.40	1.94E+09	3.88E+09
251	65.7	0.40	1.94E+09	3.88E+09
252	65.5	0.40	1.94E+09	3.88E+09
253	65.4	0.40	1.98E+09	3.96E+09
254	65.3	0.40	1.98E+09	3.96E+09
255	65.1	0.40	1.98E+09	3.96E+09
256	65.0	0.40	1.98E+09	3.96E+09
257	64.8	0.40	1.98E+09	3.96E+09
258	64.7	0.40	1.98E+09	3.96E+09
259	64.6	0.41	2.02E+09	4.03E+09
260	64.4	0.41	2.02E+09	4.03E+09
261	64.3	0.41	2.02E+09	4.03E+09
262	64.2	0.41	2.02E+09	4.03E+09
263	64.0	0.41	2.02E+09	4.03E+09
264	63.9	0.41	2.02E+09	4.03E+09
265	63.7	0.41	2.02E+09	4.03E+09
266	63.6	0.41	2.02E+09	4.03E+09
267	63.5	0.41	2.02E+09	4.03E+09
268	63.3	0.42	2.06E+09	4.11E+09
269	63.2	0.42	2.06E+09	4.11E+09
270	63.1	0.42	2.06E+09	4.11E+09
271	62.9	0.42	2.06E+09	4.11E+09
272	62.8	0.42	2.06E+09	4.11E+09
273	62.7	0.42	2.06E+09	4.11E+09
274	62.5	0.43	2.09E+09	4.19E+09
275	62.4	0.43	2.09E+09	4.19E+09
276	62.2	0.43	2.09E+09	4.19E+09
277	62.1	0.43	2.09E+09	4.19E+09
278	62.0	0.44	2.13E+09	4.26E+09
279	61.8	0.44	2.13E+09	4.26E+09
280	61.7	0.44	2.13E+09	4.26E+09
281	61.6	0.44	2.13E+09	4.26E+09
282	61.4	0.44	2.17E+09	4.34E+09
283	61.3	0.44	2.17E+09	4.34E+09
284	61.1	0.44	2.17E+09	4.34E+09
285	61.0	0.44	2.17E+09	4.34E+09
286	60.9	0.44	2.17E+09	4.34E+09
287	60.7	0.44	2.17E+09	4.34E+09
288	60.6	0.45	2.21E+09	4.41E+09
289	60.5	0.45	2.21E+09	4.41E+09
290	60.3	0.45	2.21E+09	4.41E+09
291	60.2	0.45	2.21E+09	4.41E+09
292	60.1	0.45	2.21E+09	4.41E+09
293	59.9	0.45	2.21E+09	4.41E+09
294	59.8	0.46	2.25E+09	4.49E+09
295	59.6	0.46	2.25E+09	4.49E+09
296	59.5	0.46	2.25E+09	4.49E+09

297	59.4	0.46	2.25E+09	4.49E+09
298	59.2	0.46	2.25E+09	4.49E+09
299	59.1	0.46	2.25E+09	4.49E+09
300	59.0	0.47	2.28E+09	4.57E+09
301	58.8	0.47	2.28E+09	4.57E+09
302	58.7	0.47	2.28E+09	4.57E+09
303	58.5	0.47	2.28E+09	4.57E+09
304	58.4	0.47	2.32E+09	4.64E+09
305	58.3	0.47	2.32E+09	4.64E+09
306	58.1	0.47	2.32E+09	4.64E+09
307	58.0	0.48	2.36E+09	4.72E+09
308	57.9	0.49	2.40E+09	4.80E+09
309	57.7	0.49	2.40E+09	4.80E+09
310	57.6	0.49	2.40E+09	4.80E+09
311	57.5	0.49	2.40E+09	4.80E+09
312	57.3	0.49	2.40E+09	4.80E+09
313	57.2	0.49	2.40E+09	4.80E+09
314	57.0	0.50	2.44E+09	4.87E+09
315	56.9	0.50	2.44E+09	4.87E+09
316	56.8	0.50	2.44E+09	4.87E+09
317	56.6	0.50	2.44E+09	4.87E+09
318	56.5	0.50	2.44E+09	4.87E+09
319	56.4	0.51	2.47E+09	4.95E+09
320	56.2	0.51	2.47E+09	4.95E+09
321	56.1	0.51	2.47E+09	4.95E+09
322	56.0	0.51	2.51E+09	5.02E+09
323	55.8	0.51	2.51E+09	5.02E+09
324	55.7	0.52	2.55E+09	5.10E+09
325	55.5	0.52	2.55E+09	5.10E+09
326	55.4	0.52	2.55E+09	5.10E+09
327	55.3	0.52	2.55E+09	5.10E+09
328	55.1	0.53	2.59E+09	5.18E+09
329	55.0	0.53	2.59E+09	5.18E+09
330	54.9	0.53	2.59E+09	5.18E+09
331	54.7	0.54	2.63E+09	5.25E+09
332	54.6	0.54	2.63E+09	5.25E+09
333	54.4	0.54	2.66E+09	5.33E+09
334	54.3	0.56	2.74E+09	5.48E+09
335	54.2	0.56	2.74E+09	5.48E+09
336	54.0	0.56	2.74E+09	5.48E+09
337	53.9	0.57	2.78E+09	5.56E+09
338	53.8	0.58	2.82E+09	5.63E+09
339	53.6	0.58	2.82E+09	5.63E+09
340	53.5	0.58	2.82E+09	5.63E+09
341	53.4	0.58	2.85E+09	5.71E+09
342	53.2	0.58	2.85E+09	5.71E+09
343	53.1	0.58	2.85E+09	5.71E+09
344	52.9	0.58	2.85E+09	5.71E+09
345	52.8	0.58	2.85E+09	5.71E+09
346	52.7	0.59	2.89E+09	5.78E+09
347	52.5	0.59	2.89E+09	5.78E+09

348	52.4	0.60	2.93E+09	5.86E+09		
349	52.3	0.60	2.93E+09	5.86E+09		
350	52.1	0.61	2.97E+09	5.94E+09		
351	52.0	0.61	3.01E+09	6.01E+09		
352	51.8	0.61	3.01E+09	6.01E+09		
353	51.7	0.61	3.01E+09	6.01E+09		
354	51.6	0.61	3.01E+09	6.01E+09		
355	51.4	0.61	3.01E+09	6.01E+09		
356	51.3	0.62	3.04E+09	6.09E+09		
357	51.2	0.63	3.08E+09	6.17E+09		
358	51.0	0.64	3.12E+09	6.24E+09		
359	50.9	0.64	3.12E+09	6.24E+09		
360	50.8	0.64	3.12E+09	6.24E+09		
361	50.6	0.64	3.12E+09	6.24E+09		
362	50.5	0.65	3.16E+09	6.32E+09		
363	50.3	0.65	3.16E+09	6.32E+09		
364	50.2	0.65	3.16E+09	6.32E+09		
365	50.1	0.65	3.16E+09	6.32E+09		
366	49.9	0.65	3.16E+09	6.32E+09		
367	49.8	0.65	3.16E+09	6.32E+09		
368	49.7	0.65	3.16E+09	6.32E+09		
369	49.5	0.65	3.20E+09	6.39E+09		
370	49.4	0.65	3.20E+09	6.39E+09		
371	49.2	0.65	3.20E+09	6.39E+09		
372	49.1	0.65	3.20E+09	6.39E+09		
373	49.0	0.65	3.20E+09	6.39E+09		
374	48.8	0.66	3.23E+09	6.47E+09		
375	48.7	0.66	3.23E+09	6.47E+09		
376	48.6	0.66	3.23E+09	6.47E+09		
377	48.4	0.67	3.27E+09	6.55E+09		
378	48.3	0.67	3.27E+09	6.55E+09		
379	48.2	0.67	3.27E+09	6.55E+09		
380	48.0	0.67	3.27E+09	6.55E+09		
381	47.9	0.68	3.31E+09	6.62E+09		
382	47.7	0.68	3.31E+09	6.62E+09		
383	47.6	0.68	3.35E+09	6.70E+09		
384	47.5	0.68	3.35E+09	6.70E+09		
385	47.3	0.68	3.35E+09	6.70E+09	2714	4.5448E+10
386	47.2	0.68	3.35E+09	6.70E+09		
387	47.1	0.68	3.35E+09	6.70E+09		
388	46.9	0.69	3.39E+09	6.77E+09		
389	46.8	0.69	3.39E+09	6.77E+09		
390	46.6	0.69	3.39E+09	6.77E+09		
391	46.5	0.70	3.43E+09	6.85E+09		
392	46.4	0.70	3.43E+09	6.85E+09		
393	46.2	0.71	3.46E+09	6.93E+09		
394	46.1	0.71	3.46E+09	6.93E+09		
395	46.0	0.71	3.46E+09	6.93E+09		
396	45.8	0.71	3.46E+09	6.93E+09		
397	45.7	0.71	3.46E+09	6.93E+09		
398	45.6	0.71	3.46E+09	6.93E+09		

399	45.4	0.72	3.50E+09	7.00E+09		
400	45.3	0.72	3.50E+09	7.00E+09		
401	45.1	0.72	3.54E+09	7.08E+09		
402	45.0	0.72	3.54E+09	7.08E+09		
403	44.9	0.72	3.54E+09	7.08E+09		
404	44.7	0.73	3.58E+09	7.15E+09		
405	44.6	0.73	3.58E+09	7.15E+09		
406	44.5	0.73	3.58E+09	7.15E+09		
407	44.3	0.73	3.58E+09	7.15E+09		
408	44.2	0.74	3.62E+09	7.23E+09		
409	44.0	0.74	3.62E+09	7.23E+09	1146	2.07E+10
410	43.9	0.74	3.62E+09	7.23E+09		
411	43.8	0.75	3.65E+09	7.31E+09		
412	43.6	0.75	3.65E+09	7.31E+09		
413	43.5	0.75	3.65E+09	7.31E+09		
414	43.4	0.75	3.69E+09	7.38E+09		
415	43.2	0.75	3.69E+09	7.38E+09		
416	43.1	0.75	3.69E+09	7.38E+09		
417	43.0	0.75	3.69E+09	7.38E+09		
418	42.8	0.76	3.73E+09	7.46E+09		
419	42.7	0.76	3.73E+09	7.46E+09		
420	42.5	0.76	3.73E+09	7.46E+09		
421	42.4	0.76	3.73E+09	7.46E+09		
422	42.3	0.78	3.81E+09	7.61E+09		
423	42.1	0.78	3.81E+09	7.61E+09		
424	42.0	0.78	3.81E+09	7.61E+09		
425	41.9	0.78	3.81E+09	7.61E+09		
426	41.7	0.78	3.81E+09	7.61E+09		
427	41.6	0.78	3.81E+09	7.61E+09		
428	41.5	0.78	3.81E+09	7.61E+09		
429	41.3	0.78	3.81E+09	7.61E+09		
430	41.2	0.78	3.81E+09	7.61E+09		
431	41.0	0.78	3.81E+09	7.61E+09		
432	40.9	0.78	3.81E+09	7.61E+09		
433	40.8	0.78	3.81E+09	7.61E+09		
434	40.6	0.78	3.81E+09	7.61E+09		
435	40.5	0.78	3.81E+09	7.61E+09		
436	40.4	0.78	3.81E+09	7.61E+09		
437	40.2	0.78	3.81E+09	7.61E+09		
438	40.1	0.78	3.81E+09	7.61E+09		
439	39.9	0.78	3.81E+09	7.61E+09		
440	39.8	0.78	3.81E+09	7.61E+09		
441	39.7	0.86	4.19E+09	8.37E+09		
442	39.5	0.86	4.19E+09	8.37E+09		
443	39.4	0.86	4.19E+09	8.37E+09		
444	39.3	0.86	4.19E+09	8.37E+09		
445	39.1	0.86	4.19E+09	8.37E+09		
446	39.0	0.86	4.19E+09	8.37E+09		
447	38.9	0.86	4.19E+09	8.37E+09		
448	38.7	0.86	4.19E+09	8.37E+09		
449	38.6	0.86	4.19E+09	8.37E+09		

450	38.4	0.86	4.19E+09	8.37E+09		
451	38.3	0.86	4.19E+09	8.37E+09		
452	38.2	0.86	4.19E+09	8.37E+09		
453	38.0	0.86	4.19E+09	8.37E+09		
454	37.9	0.86	4.19E+09	8.37E+09		
455	37.8	0.86	4.19E+09	8.37E+09		
456	37.6	0.86	4.19E+09	8.37E+09		
457	37.5	0.86	4.19E+09	8.37E+09		
458	37.3	0.86	4.19E+09	8.37E+09		
459	37.2	0.86	4.19E+09	8.37E+09		
460	37.1	0.86	4.19E+09	8.37E+09		
461	36.9	0.86	4.19E+09	8.37E+09		
462	36.8	0.86	4.19E+09	8.37E+09		
463	36.7	0.86	4.19E+09	8.37E+09		
464	36.5	0.86	4.19E+09	8.37E+09		
465	36.4	0.86	4.19E+09	8.37E+09		
466	36.3	0.86	4.19E+09	8.37E+09		
467	36.1	0.93	4.57E+09	9.13E+09		
468	36.0	0.93	4.57E+09	9.13E+09		
469	35.8	0.93	4.57E+09	9.13E+09		
470	35.7	0.93	4.57E+09	9.13E+09		
471	35.6	0.93	4.57E+09	9.13E+09		
472	35.4	0.93	4.57E+09	9.13E+09		
473	35.3	0.93	4.57E+09	9.13E+09		
474	35.2	0.93	4.57E+09	9.13E+09		
475	35.0	0.93	4.57E+09	9.13E+09		
476	34.9	0.93	4.57E+09	9.13E+09	1	2.28E+07
477	34.7	0.93	4.57E+09	9.13E+09		
478	34.6	0.93	4.57E+09	9.13E+09		
479	34.5	0.93	4.57E+09	9.13E+09		
480	34.3	0.93	4.57E+09	9.13E+09		
481	34.2	0.93	4.57E+09	9.13E+09		
482	34.1	0.93	4.57E+09	9.13E+09		
483	33.9	0.93	4.57E+09	9.13E+09		
484	33.8	0.93	4.57E+09	9.13E+09		
485	33.7	0.93	4.57E+09	9.13E+09		
486	33.5	1.01	4.95E+09	9.90E+09		
487	33.4	1.01	4.95E+09	9.90E+09		
488	33.2	1.01	4.95E+09	9.90E+09		
489	33.1	1.01	4.95E+09	9.90E+09		
490	33.0	1.01	4.95E+09	9.90E+09		
491	32.8	1.01	4.95E+09	9.90E+09		
492	32.7	1.01	4.95E+09	9.90E+09		
493	32.6	1.01	4.95E+09	9.90E+09		
494	32.4	1.01	4.95E+09	9.90E+09		
495	32.3	1.01	4.95E+09	9.90E+09		
496	32.1	1.01	4.95E+09	9.90E+09		
497	32.0	1.01	4.95E+09	9.90E+09		
498	31.9	1.01	4.95E+09	9.90E+09		
499	31.7	1.01	4.95E+09	9.90E+09		
500	31.6	1.09	5.33E+09	1.07E+10		

501	31.5	1.09	5.33E+09	1.07E+10		
502	31.3	1.09	5.33E+09	1.07E+10		
503	31.2	1.09	5.33E+09	1.07E+10		
504	31.1	1.09	5.33E+09	1.07E+10		
505	**30.9**	**1.09**	5.33E+09	**1.07E+10**	**2378**	**6.3352E+10**
506	30.8	1.09	5.33E+09	1.07E+10		
507	30.6	1.09	5.33E+09	1.07E+10		
508	30.5	1.09	5.33E+09	1.07E+10		
509	30.4	1.09	5.33E+09	1.07E+10		
510	30.2	1.09	5.33E+09	1.07E+10		
511	30.1	1.17	5.71E+09	1.14E+10		
512	30.0	1.17	5.71E+09	1.14E+10		
513	29.8	1.17	5.71E+09	1.14E+10		
514	29.7	1.17	5.71E+09	1.14E+10		
515	29.5	1.17	5.71E+09	1.14E+10		
516	29.4	1.17	5.71E+09	1.14E+10		
517	29.3	1.17	5.71E+09	1.14E+10	88	2.51E+09
518	29.1	1.17	5.71E+09	1.14E+10		
519	29.0	1.17	5.71E+09	1.14E+10		
520	28.9	1.17	5.71E+09	1.14E+10		
521	28.7	1.17	5.71E+09	1.14E+10		
522	28.6	1.17	5.71E+09	1.14E+10		
523	28.5	1.17	5.71E+09	1.14E+10		
524	28.3	1.17	5.71E+09	1.14E+10		
525	28.2	1.24	6.09E+09	1.22E+10		
526	28.0	1.24	6.09E+09	1.22E+10		
527	27.9	1.24	6.09E+09	1.22E+10		
528	27.8	1.24	6.09E+09	1.22E+10		
529	27.6	1.24	6.09E+09	1.22E+10		
530	27.5	1.24	6.09E+09	1.22E+10		
531	27.4	1.24	6.09E+09	1.22E+10		
532	27.2	1.24	6.09E+09	1.22E+10		
533	27.1	1.24	6.09E+09	1.22E+10		
534	26.9	1.24	6.09E+09	1.22E+10		
535	26.8	1.24	6.09E+09	1.22E+10		
536	26.7	1.24	6.09E+09	1.22E+10		
537	26.5	1.32	6.47E+09	1.29E+10		
538	26.4	1.32	6.47E+09	1.29E+10		
539	26.3	1.32	6.47E+09	1.29E+10		
540	26.1	1.32	6.47E+09	1.29E+10		
541	26.0	1.32	6.47E+09	1.29E+10		
542	25.9	1.32	6.47E+09	1.29E+10		
543	25.7	1.32	6.47E+09	1.29E+10		
544	25.6	1.32	6.47E+09	1.29E+10		
545	25.4	1.32	6.47E+09	1.29E+10		
546	25.3	1.32	6.47E+09	1.29E+10		
547	25.2	1.32	6.47E+09	1.29E+10		
548	25.0	1.32	6.47E+09	1.29E+10		
549	24.9	1.32	6.47E+09	1.29E+10		
550	24.8	1.32	6.47E+09	1.29E+10		
551	24.6	1.32	6.47E+09	1.29E+10		

552	24.5	1.32	6.47E+09	1.29E+10		
553	24.4	1.40	6.85E+09	1.37E+10		
554	24.2	1.40	6.85E+09	1.37E+10		
555	24.1	1.40	6.85E+09	1.37E+10		
556	23.9	1.40	6.85E+09	1.37E+10		
557	23.8	1.40	6.85E+09	1.37E+10		
558	23.7	1.40	6.85E+09	1.37E+10	737	2.52E+10
559	23.5	1.40	6.85E+09	1.37E+10		
560	23.4	1.40	6.85E+09	1.37E+10		
561	23.3	1.40	6.85E+09	1.37E+10		
562	23.1	1.40	6.85E+09	1.37E+10		
563	23.0	1.40	6.85E+09	1.37E+10		
564	22.8	1.48	7.23E+09	1.45E+10		
565	22.7	1.48	7.23E+09	1.45E+10		
566	22.6	1.48	7.23E+09	1.45E+10		
567	22.4	1.48	7.23E+09	1.45E+10		
568	22.3	1.48	7.23E+09	1.45E+10		
569	22.2	1.48	7.23E+09	1.45E+10		
570	22.0	1.48	7.23E+09	1.45E+10		
571	21.9	1.56	7.61E+09	1.52E+10		
572	21.8	1.56	7.61E+09	1.52E+10		
573	21.6	1.56	7.61E+09	1.52E+10		
574	21.5	1.56	7.61E+09	1.52E+10		
575	21.3	1.56	7.61E+09	1.52E+10		
576	21.2	1.56	7.61E+09	1.52E+10		
577	21.1	1.56	7.61E+09	1.52E+10		
578	20.9	1.56	7.61E+09	1.52E+10		
579	20.8	1.56	7.61E+09	1.52E+10		
580	20.7	1.56	7.61E+09	1.52E+10		
581	20.5	1.56	7.61E+09	1.52E+10		
582	20.4	1.56	7.61E+09	1.52E+10		
583	20.2	1.56	7.61E+09	1.52E+10		
584	20.1	1.56	7.61E+09	1.52E+10		
585	20.0	1.63	7.99E+09	1.60E+10		
586	19.8	1.63	7.99E+09	1.60E+10		
587	19.7	1.63	7.99E+09	1.60E+10		
588	19.6	1.63	7.99E+09	1.60E+10		
589	19.4	1.63	7.99E+09	1.60E+10	658	2.6295E+10
590	19.3	1.63	7.99E+09	1.60E+10		
591	19.2	1.63	7.99E+09	1.60E+10		
592	19.0	1.63	7.99E+09	1.60E+10		
593	18.9	1.63	7.99E+09	1.60E+10		
594	18.7	1.71	8.37E+09	1.67E+10		
595	18.6	1.71	8.37E+09	1.67E+10		
596	18.5	1.71	8.37E+09	1.67E+10		
597	18.3	1.71	8.37E+09	1.67E+10		
598	18.2	1.71	8.37E+09	1.67E+10		
599	18.1	1.71	8.37E+09	1.67E+10		
600	17.9	1.71	8.37E+09	1.67E+10		
601	17.8	1.71	8.37E+09	1.67E+10		
602	17.6	1.71	8.37E+09	1.67E+10		

603	17.5	1.79	8.75E+09	1.75E+10
604	17.4	1.79	8.75E+09	1.75E+10
605	17.2	1.79	8.75E+09	1.75E+10
606	17.1	1.79	8.75E+09	1.75E+10
607	17.0	1.79	8.75E+09	1.75E+10
608	16.8	1.87	9.13E+09	1.83E+10
609	16.7	1.87	9.13E+09	1.83E+10
610	16.6	1.87	9.13E+09	1.83E+10
611	16.4	1.87	9.13E+09	1.83E+10
612	16.3	1.94	9.51E+09	1.90E+10
613	16.1	1.94	9.51E+09	1.90E+10
614	16.0	1.94	9.51E+09	1.90E+10
615	15.9	1.94	9.51E+09	1.90E+10
616	15.7	1.94	9.51E+09	1.90E+10
617	15.6	1.94	9.51E+09	1.90E+10
618	15.5	1.94	9.51E+09	1.90E+10
619	15.3	2.02	9.90E+09	1.98E+10
620	15.2	2.02	9.90E+09	1.98E+10
621	15.0	2.02	9.90E+09	1.98E+10
622	14.9	2.10	1.03E+10	2.06E+10
623	14.8	2.10	1.03E+10	2.06E+10
624	14.6	2.10	1.03E+10	2.06E+10
625	14.5	2.10	1.03E+10	2.06E+10
626	14.4	2.18	1.07E+10	2.13E+10
627	14.2	2.18	1.07E+10	2.13E+10
628	14.1	2.18	1.07E+10	2.13E+10
629	14.0	2.18	1.07E+10	2.13E+10
630	13.8	2.18	1.07E+10	2.13E+10
631	13.7	2.26	1.10E+10	2.21E+10
632	13.5	2.26	1.10E+10	2.21E+10
633	13.4	2.26	1.10E+10	2.21E+10
634	13.3	2.26	1.10E+10	2.21E+10
635	13.1	2.26	1.10E+10	2.21E+10
636	13.0	2.33	1.14E+10	2.28E+10
637	12.9	2.33	1.14E+10	2.28E+10
638	12.7	2.33	1.14E+10	2.28E+10
639	12.6	2.33	1.14E+10	2.28E+10
640	12.4	2.41	1.18E+10	2.36E+10
641	12.3	2.41	1.18E+10	2.36E+10
642	12.2	2.49	1.22E+10	2.44E+10
643	12.0	2.49	1.22E+10	2.44E+10
644	11.9	2.57	1.26E+10	2.51E+10
645	11.8	2.64	1.29E+10	2.59E+10
646	11.6	2.64	1.29E+10	2.59E+10
647	11.5	2.64	1.29E+10	2.59E+10
648	11.4	2.64	1.29E+10	2.59E+10
649	11.2	2.64	1.29E+10	2.59E+10
650	11.1	2.72	1.33E+10	2.66E+10
651	10.9	2.72	1.33E+10	2.66E+10
652	10.8	2.72	1.33E+10	2.66E+10
653	10.7	2.80	1.37E+10	2.74E+10

654	10.5	2.88	1.41E+10	2.82E+10		
655	10.4	2.88	1.41E+10	2.82E+10		
656	10.3	2.88	1.41E+10	2.82E+10		
657	10.1	2.88	1.41E+10	2.82E+10		
658	10.0	2.88	1.41E+10	2.82E+10		
659	9.8	3.03	1.48E+10	2.97E+10		
660	9.7	3.11	1.52E+10	3.04E+10		
661	9.6	3.19	1.56E+10	3.12E+10		
662	9.4	3.19	1.56E+10	3.12E+10		
663	9.3	3.34	1.64E+10	3.27E+10		
664	9.2	3.42	1.67E+10	3.35E+10		
665	9.0	3.42	1.67E+10	3.35E+10		
666	8.9	3.42	1.67E+10	3.35E+10		
667	8.8	3.50	1.71E+10	3.43E+10		
668	8.6	3.66	1.79E+10	3.58E+10		
669	8.5	3.66	1.79E+10	3.58E+10		
670	8.3	3.66	1.79E+10	3.58E+10		
671	8.2	3.66	1.79E+10	3.58E+10		
672	8.1	3.73	1.83E+10	3.65E+10		
673	7.9	3.81	1.86E+10	3.73E+10		
674	7.8	3.81	1.86E+10	3.73E+10		
675	7.7	3.81	1.86E+10	3.73E+10		
676	7.5	4.12	2.02E+10	4.03E+10		
677	7.4	4.28	2.09E+10	4.19E+10		
678	7.3	4.28	2.09E+10	4.19E+10		
679	7.1	4.36	2.13E+10	4.26E+10		
680	7.0	4.43	2.17E+10	4.34E+10		
681	6.8	4.43	2.17E+10	4.34E+10		
682	6.7	4.43	2.17E+10	4.34E+10		
683	6.6	4.67	2.28E+10	4.57E+10		
684	6.4	4.67	2.28E+10	4.57E+10		
685	6.3	4.82	2.36E+10	4.72E+10		
686	6.2	4.82	2.36E+10	4.72E+10		
687	6.0	4.90	2.40E+10	4.80E+10		
688	5.9	5.21	2.55E+10	5.10E+10		
689	5.7	5.44	2.66E+10	5.33E+10		
690	5.6	5.76	2.82E+10	5.63E+10		
691	5.5	6.22	3.04E+10	6.09E+10		
692	5.3	6.30	3.08E+10	6.17E+10		
693	5.2	6.38	3.12E+10	6.24E+10		
694	5.1	6.38	3.12E+10	6.24E+10		
695	4.9	6.45	3.16E+10	6.32E+10		
696	4.8	6.92	3.39E+10	6.77E+10		
697	4.7	7.31	3.58E+10	7.15E+10		
698	4.5	7.39	3.62E+10	7.23E+10		
699	4.4	7.62	3.73E+10	7.46E+10		
700	4.2	7.78	3.81E+10	7.61E+10		
701	4.1	7.78	3.81E+10	7.61E+10	2094	3.98E+11
702	4.0	8.55	4.19E+10	8.37E+10		
703	3.8	9.33	4.57E+10	9.13E+10		
704	3.7	9.33	4.57E+10	9.13E+10		

705	3.6	10.89	5.33E+10	1.07E+11
706	3.4	10.89	5.33E+10	1.07E+11
707	3.3	10.89	5.33E+10	1.07E+11
708	3.1	10.89	5.33E+10	1.07E+11
709	3.0	10.89	5.33E+10	1.07E+11
710	2.9	11.67	5.71E+10	1.14E+11
711	2.7	11.67	5.71E+10	1.14E+11
712	2.6	14.00	6.85E+10	1.37E+11
713	2.5	14.00	6.85E+10	1.37E+11
714	2.3	14.78	7.23E+10	1.45E+11
715	2.2	14.78	7.23E+10	1.45E+11
716	2.1	15.55	7.61E+10	1.52E+11
717	1.9	18.66	9.13E+10	1.83E+11
718	1.8	18.66	9.13E+10	1.83E+11
719	1.6	18.66	9.13E+10	1.83E+11
720	1.5	19.44	9.51E+10	1.90E+11
721	1.4	21.00	1.03E+11	2.06E+11
722	1.2	21.00	1.03E+11	2.06E+11
723	1.1	23.33	1.14E+11	2.28E+11
724	1.0	23.33	1.14E+11	2.28E+11
725	0.8	23.33	1.14E+11	2.28E+11
726	0.7	26.44	1.29E+11	2.59E+11
727	0.5	31.89	1.56E+11	3.12E+11
728	0.4	50.55	2.47E+11	4.95E+11
729	0.3	53.66	2.63E+11	5.25E+11
730	0.1	70.77	3.46E+11	6.93E+11
731	0.0	73.10	3.58E+11	7.15E+11

APPENDIX G: PUBLIC NOTICE OF DRAFT McKEE AND CLEAR CREEK TMDL

Michael F. Easley
Governor
William G. Ross Jr.
Department of Environment and Natural Resources
Alan W. Klimek, P.E., Director
Division of Water Quality

Now Available Upon Request

Copies of the public review draft:

McKee and Clear Creeks Fecal Coliform Total Maximum Daily Load

Are now available upon request from the North Carolina Division of Water Quality. This list was prepared as a requirement of the Federal Water Pollution Control Act, Section 303(d). The list reports on the water quality status of North Carolina waterbodies.

TO OBTAIN A FREE COPY OF THE DOCUMENT:

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

Ms. Robin Markham
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 report by November 29, 2002. Written comments should be mailed to Ms. Michelle Woolfolk at the above address. Questions concerning the list should be directed to Ms. Michelle Woolfolk at the above number (extension 505) and address. The draft document is also located on the following website:
http://h2o.enr.state.nc.us/tmdl/draft_TMDLS.htm

A public presentation and meeting will be held at 10:00 am on November 18th, 2002 at the following location:

Cabarrus County Extension Center
715 Cabarrus Ave West
Concord NC 28027
Phone 704-920-3310

N. C. Division of Water Quality 1617 Mail Service Center Raleigh, NC 27699-1617 (919) 733-7015 Customer Service 1 800 623-7748

The Knight Publishing Co., Inc.
Charlotte, NC

North Carolina) ss Affidavit of Publication
Mecklenburg County)

THE CHARLOTTE OBSERVER

NCDENR/DWQ/BUDGET OFFICE
ACCOUNTS PAYABLE
1617 MAIL SERVICE CENTER
RALEIGH NC 27699-1617

REFERENCE: 30019881
4654145 mckee & clear creeks

Before the undersigned, a Notary Public of said County and State, duly authorized to administer oaths affirmations, etc., personally appeared, being duly sworn or affirmed according to law, doth depose and say that he/she is a representative of the Knight Publishing Company a corporation organized and doing business under the Laws of the State of Delaware, and publishing a newspaper known as The Charlotte Observer in the city of Charlotte, County of Mecklenburg and State of North Carolina and that as such he/she is familiar with the books, records, files and business of said Corporation and by reference to the files of said publication the attached advertisement was inserted. The following is correctly copied from the books and files of the aforesaid Corporation and Publication.

Public Notice
State of North Carolina
Division of Water Quality
Availability of the McKee and Clear Creeks Fecal Coliform Total Maximum Daily Load (TMDL)

Copies of the TMDL may be obtained by calling Robin Markham at (919) 733-5083, ext. 558, or on the internet at http://h2o.enr.state.nc.us/tmdl/TMDLS.htm. A public meeting will be held at 10:00 am, November 13, 2002 at the Cabarrus County Extension Center in Concord, NC. Written comments regarding the TMDL will be accepted until November 29, 2002. Please mail comments to Ms. Michelle Woolfolk, TMDL Coordinator, Water Quality Planning Branch, NC Division of Water Quality, 1617 Mail Service Center, Raleigh, NC 27699-1617.
LP4654145

PUBLISHED ON: 11/02

AD SPACE: 28 LINE
FILED ON: 11/05/02

NAME: [signature] TITLE: acct
DATE: 11-5-02

In Testimony Whereof I have hereunto set my hand and affixed my seal, the day and year aforesaid.

Notary: [signature] My Commission Expires: _/_/_
My Commission Expires May 27, 2006

The Independent Tribune

NORTH CAROLINA
CABARRUS COUNTY

NO [illegible] Oct 31, 2002
Public Notice
State of North Carolina
Division of Water Quality

Availability of the McKee and Clear Creeks Fecal Coliform Total Maximum Daily Load (TMDL).

Copies of the TMDL may be obtained by calling Robin Markham at 919-733-5083, ext. 558, or on the Internet at http: //h2o.enr.state.nc.us/tmdl/TMDLS.htm. A public meeting will be held at 10:00am, November 18, 2002 at the Cabarrus County Extension Center in Concord, NC. Written comments to Ms. Michelle Woolfolk, TMDL Coordinator, Water Quality Planning Branch, NC Division of Water Quality, 1617 Mail Service Center, Raleigh, NC 27699-1617.

On this, the 4th day of November 2002

I, Phyllis M. Smith

of The INDEPENDENT TRIBUNE, certifies that the annexed advertisement was duly inserted in the paper on the following dates:

October 31, 2002

and was published therein for 1 weeks. The total cost of this advertisement $ 37.13

Signed Phyllis M. Smith

Michael F. Easley, Governor
William G. Ross Jr., Secretary
North Carolina Department of Environment and Natural Resources
Alan W. Klimek, P.E. Director
Division of Water Quality

Now Available Upon Request

Fecal Coliform Total Maximum Daily Load for the McKee and Clear Creek Watersheds
Public Review Draft – Version March 2003

Is 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 fecal coliform.

TO OBTAIN A FREE COPY OF THE TMDL REPORT:

Please contact Mr. J. Todd Kennedy (919) 733-5083, extension 514 or write to:

Mr. J. Todd Kennedy
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 June 3, 2003. Comments concerning the reports should be directed to Mr. J. Todd Kennedy at the above address. The draft TMDL is also located on the following website: http://h2o.enr.state.nc.us/tmdl.

N. C. Division of Water Quality 1617 Mail Service Center Raleigh, NC 27699-1617 (919) 733-7015
NCDENR Customer Service 1 800 623-7748

The Knight Publishing Co., Inc.
Charlotte, NC
North Carolina) ss Affidavit of Publication
Mecklenburg County)

THE CHARLOTTE OBSERVER

NC DEHNR DIV OF WATER QUALITY
PLANNING BRANCH
1617 MAIL SERVICE CTR
RALEIGH NC 27699

REFERENCE: 20076833
4823875 Public Notice

Before the undersigned, a Notary Public of said County and State, duly authorized to administer oaths affirmations, etc., personally appeared, being duly sworn or affirmed according to law, doth depose and say that he/she is a representative of the Knight Publishing Company a corporation organized and doing business under the laws of the State of Delaware, and publishing a newspaper known as The Charlotte Observer in the city of Charlotte, County of Mecklenburg and State of North Carolina and that as such he/she is familiar with the books, records, files and business of said Corporation and by reference to the files of said publication the attached advertisement was inserted. The following is correctly copied from the books and files of the aforesaid Corporation and Publication.

Legal Notices

PUBLISHED ON: 05/19

AD SPACE: 22 LINE
FILED ON: 05/27/03

NAME: [illegible] TITLE: Acct Clerk
DATE: 5/28/03

In Testimony Whereof I have hereunto set my hand and affixed my seal, the day and year aforesaid.

Notary: Judith M. Sears My Commission Expires: __/__/__

My Commission Expires May 17, 2006

The Independent Tribune

NORTH CAROLINA
CABARRUS COUNTY

PUBLIC NOTICE
State of North Carolina
Division of Water Quality

Availability of the Fecal Coliform total Maximum Daily Load (TMDL) for the McKee and Clear Creek Watersheds

[illegible]

On this, the 19th day of May 2003

I, Phyllis M. Smith

of The INDEPENDENT TRIBUNE, certifies that the annexed advertisement was duly inserted in the paper on the following dates:

May 19. 2003

____

and was published therein for 1 weeks. The total cost of this advertisement $ 28.87

Signed Phyllis M. Smith

End of Document