South Carolina Department of Health and Environmental Control
Total Maximum Daily Load Development for
Grassy Run Branch CW-088
Fecal Coliform

July 9, 1999
Bureau of Water

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health
and Environmental Control

Grassy Run Branch
03050103-090

BASIS FOR 303(d) LISTING

Introduction:

Levels of fecal coliform can be elevated in water bodies as the result of both point and nonpoint sources of pollution. Section 303(d) of the Clean Water Act and EPA's Water Quality Planning and Management Regulations (40 CFR Part 130) require states to develop total maximum daily loads (TMDLs) for their water bodies that are not meeting designated uses under technology-based controls for pollution. The TMDL process establishes the allowable loadings of pollutants or other quantifiable parameters for a water body based on the relationship between pollution sources and in-stream water quality conditions, so that states can establish water-quality based controls to reduce pollution from both point and nonpoint sources and restore and maintain the quality of their water resources (USEPA, 1991).

Problem Definition:

Waterbody Impaired:	Grassy Run Branch
Water Quality Standards Being Violated:	Fecal Coliform
Pollutant of Concern:	Fecal Coliform
Water Classification:	Freshwaters

The impaired stream segment, Grassy Run Branch, is classified Class Freshwater. Waters of this class are to be:

> "Freshwaters suitable for primary and secondary contact recreation and as a source for drinking water supply after conventional treatment in accordance with the requirements of the Department. Suitable for fishing and the survival and propagation of a balanced indigenous aquatic community of fauna and flora. Suitable also for industrial and agricultural uses." (R.61-68)

Fecal Coliform Criteria:

> "Not to exceed a geometric mean of 200/100 ml, based on five consecutive samples during any 30 day period; nor shall more than 10% of the total samples during any 30 day period exceed 400/100 ml." (R.61-68)

The water quality assessment published in the South Carolina Watershed Water Quality Management Strategy: Catawba Santee Basin (1996) was used for determining the stream segment impairment

and for listing the water on the South Carolina 1998 303(d) list. Waters in which less than or equal to 10 percent of the samples collected over a five year period are greater than 400 colonies/100 ml are considered to comply with South Carolina water quality standard for fecal coliform bacteria. Waters with greater than 10 percent of samples greater than 400 colonies/100 ml are considered impaired and listed for fecal coliform bacteria on South Carolina's 303(d) List. DHEC has data from one ambient monitoring station, CW-088, on Grassy Run Branch at SC highway 72, 1.6 miles NE of the Town of Chester. This station shows recreational uses are not supported due to fecal coliform violations of the 400/100 ml standard. Ninety seven percent of the samples in a five year period do not meet the fecal coliform standard. Data at this station also indicate that Grassy Run Branch does not fully support aquatic life uses due to dissolved oxygen excursions. Twenty seven percent of the samples in a five year period do not meet the dissolved oxygen standard. This TMDL will not address the dissolved oxygen excursions as that may involve a permitted discharge and the fecal coliform excursions are considered to be solely from nonpoint sources.

TMDL TECHNICAL BASIS

Target Identification:

The target levels are the fecal coliform levels established in South Carolina's Water Quality Standards, Regulation 61-68. This TMDL will use criteria 'not to exceed a geometric mean of 175/100 ml', to allow an explicit margin of safety of 25/100 ml to ensure that the 200/100 ml standard will be met. This target of 175/100 ml as a geometric mean is expected also to satisfy the criterion, 'nor shall more than 10% of the total samples during any 30 day period exceed 400/100 ml.'

Based on a review of water quality assessments in South Carolina, over 75% of waters having a fecal coliform geometric mean of 175/100ml also meet the criterion "not more that 10% of samples exceed 400/100ml" (SCDHEC unpublished data). Most of the data in those assessments, however, reflect fecal coliform concentrations in areas that do not have sufficient best management practices (BMPs) in place. Thus, implementation of BMPs as described in this TMDL will likely achieve an even greater rate of compliance with the latter criterion since the BMPs are generally focused on reducing fecal loadings during runoff events, the condition most likely to result in an exceedence of the 400/100ml criterion.

Source Assessment:

General Sources of Fecal Coliform:

Both point and nonpoint sources may contribute fecal coliform to a given water body. Potential sources of fecal coliform are numerous, and often occur in combination. Nationwide, poorly treated municipal sewage comprises a major source of fecal coliform, but data presented below suggest this is not the case here. Urban storm water runoff, sanitary sewer overflows, and combined sewer overflows can be sources of fecal coliform. Rural storm water runoff can transport significant loads of fecal coliform from livestock pastures and animal feedlots. Wildlife can also contribute fecal coliform. Most sources of fecal coliform loads can be assigned to two broad classes: point source loads, and nonpoint source loads.

Point Sources in Grassy Run Branch Watershed:

Permitted Dischargers in Area of Concern

Permit #	Old NPDES	Facility	Receiving Water	Type	Flow (mgd)
SCG250138	SC0003301	Springs Ind/Eureka	Grassy Run Branch	General Permit	Monitor & Report
SCG250038	SC0033545	Eagle Family Foods	Grassy Run Branch	General Permit	Monitor & Report

These facilities were recently changed from coverage under an individual NPDES permit to coverage under a general NPDES permit. These facilities discharge airwash and chiller water or once through non-contact cooling water. Fecal coliform is not typically a pollutant added in airwash and chiller water and non-contact cooling water; it is not addressed in the NPDES permit. Therefore these facilities will not be considered in this TMDL.

The City of Chester operates three waste water treatment facilities. The service area of these facilities includes the urban in the Grassy Run watershed. The City of Chester's WWTF discharge to waterbodies outside the Grassy Run Watershed including Rocky Creek, Fishing Creek and Sandy River.

Nonpoint Sources in Grassy Run Branch Watershed:

Due to the absence of point sources with fecal coliform in their discharge, nonpoint sources are believed to be the source of fecal coliform in this watershed. The land use in this watershed is 81% urban (the Town of Chester), 19% forested and less than 1% scrub/shrub.

Fecal coliform bacteria have been detected in storm water runoff from urban areas at densities high enough to suggest a potential health risk (Novotny, 1994). Fecal coliform concentrations in urban storm water may be higher than concentrations in treatment plant effluent (Novotny, 1994; Metcalf, 1979). The origins of urban bacterial loads are diverse, and may include leakage or overflows from sanitary sewers, failing septic tanks and direct loading of human fecal matter, as well as bacteria derived from dog and cat feces and other domestic and non domestic animals.

Fecal coliform also originate in forested areas. Generally the sources are wild animals such as deer, racoons, wild turkeys, water fowl, etc. Controls of these sources will be limited to land management BMPs, although forested areas are not specifically targeted in this TMDL.

Linkage Between Numeric Targets and Sources:

Due to the land use in this small watershed, the major source of fecal coliform is urban runoff. Urban land will be the land use targeted for reductions in loading. While the forested land is contributing to the loading, the loading from forested land is very small compared to the load from the urban area. Therefore, the load from the forested area will be considered background conditions. Several facts validate these assumptions. First, wildlife is the source of fecal coliform in forested lands. The primary means for directly controlling fecal coliform from forested lands would include relocating or killing wildlife. These are not acceptable management alternatives. Second, the percent forested land

use is small compared to the dominating urban land use. Finally, fecal coliform loading from forested areas in South Carolina is estimated to be at least 450% less than other land uses (SCDHEC unpublished data).

Data Availability and Analysis:

Watershed Characteristics:

Grassy Run Branch is a tributary to Rocky Creek and located in the Catawba River Basin in watershed unit 03050103-090. Grassy Run Branch watershed is located in Chester County. It flows through the Town of Chester. The watershed considered for TMDL development is 523 acres in the Piedmont region.

Landuse

Landuse	Acres	Percentage
Urban	424	81.1%
Forest	97	18.5%
Scrub/shrub	2	0.4%

Existing Data:

Fecal Coliform: South Carolina Department of Health and Environmental Control monitors water chemistry on Grassy Run Branch at secondary ambient monitoring station CW-088 once a month from May through October. Existing data from this monitoring station is available through STORET and included in the appendix. The geometric mean of fecal coliform using the most current data available (1994-1998) is 1219 colonies/100ml (for these warm weather months).

Flow data: Flow information for Grassy Run Branch was estimated using flow data from USGS gaging station 02147500 on Rocky Creek at Great Falls, SC for water years 1951-1997. A warm weather generation coefficient was established by dividing the average flow from May - October at the USGS station by the drainage area for the station. The warm weather generation coefficient (Gc) is established as follows:

$$Gc = \frac{\text{Mean flow from May-Oct in cfs}}{\text{Drainage area in square miles}}$$

Gc = 111/194 cfs/square mile = 0.572 cfs/square miles

The warm weather generation coefficient is multiplied by the Grassy Run drainage area (0.817 square miles) to obtain the average warm weather flow for Grassy Run Branch of 0.467 cfs.

Critical Conditions:

Novotny & Olem find statistically lower fecal coliform counts in cold weather urban runoff samples than in warmer weather urban runoff (1994). To substantiate this, winter and summer fecal coliform values were compared at ambient water quality monitoring stations in the Piedmont Region in South Carolina impacted by nonpoint sources. This analysis reveals similar or higher values in the summer than the winter. Therefore, summer months (May-October) are considered critical conditions. This can be explained by the nature of storm events in the summer versus the winter. Thunderstorms are typical in the summer months. This pattern of rainfall allows for the accumulation and washing off of fecal coliforms into the streams resulting in spikes of fecal coliform concentrations. In the winter, long slow rain events are the norm. This pattern of rainfall does not allow for the high build-up of coliform that characterizes the summer. Rather, coliform are washed into the stream at a more even rate. This, coupled with the increased winter flows that provide more dilution, results in lower fecal coliform concentrations.

Load Calculations:

Using the observed geometric mean of 1219 colonies/100 ml and the average warm weather flow calculated above, the current loading at CW-088 is 1.39E+10 colonies/day:

Fecal Coliform * Qa * Factor = Loading

Where fecal coliform = # colonies/100ml
Qa = average warm weather flow in cfs
factor = conversion factor = 24468984
Loading = # colonies fecal coliform/day

The allowable load (geometric mean of 200 colonies/100 ml) during average warm weather flow is 2.29E+09.

TMDL Development:

Total maximum daily loads (TMDLs) comprise the sum of individual wasteload allocations (WLAs) for point sources, and load allocations (LAs) for both nonpoint sources and natural background levels for a given watershed. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relation between pollutant loads and the quality of the receiving water body. Conceptually, this definition is denoted by the equation:

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

The TMDL is the total amount of pollutant that can be assimilated by the receiving water body while achieving water quality standards. TMDLs establish allowable water body loadings that are less than or equal to the TMDL and thereby provide the basis to establish water-quality-based controls.

For some pollutants, TMDLs are expressed on a mass loading basis (e.g., pounds per day). For bacteria, however, TMDLs can be expressed in terms of organism counts (or resulting concentration), in accordance with 40 CFR 130.2(l).

Margin of Safety:

There are two basic methods for incorporating the MOS (USEPA, 1991): 1) implicitly incorporate the MOS using conservative model assumptions to develop allocations, or 2) explicitly specify a portion of the total TMDL as the MOS; use the remainder for allocations.

The MOS is implicit in this TMDL process through the use of a critical period and explicit by establishing a target TMDL level of 175 colonies/ 100 ml. This level is below the state standard of 200 colonies/ 100 ml.

Since there are no contributing point sources and the MOS is included, this TMDL comprises solely the load allocations from nonpoint sources and natural conditions.

TMDL

Allocation of Load:

The existing load of 1.39E+10 colonies/day must be reduced by 86% to obtain the TMDL of 2.00E+09 colonies/day (loading at 175 colonies/ 100 ml).

An allocation strategy that will allow the target TMDL of 175 colonies/100ml to be maintained is

as follows:

86% reduction in fecal coliform loading and/or resultant instream concentrations from urban land uses.

Implementation Strategy:

As discussed in the Implementation Plan for Achieving Total Maximum Daily Load Reductions From Nonpoint Sources for the State of South Carolina, South Carolina has several tools available for implementing this nonpoint source TMDL. Specifically, SCDHEC's Catawba Environmental Quality Control District and the Bureau of Water Enforcement Section will address collection system, overflowing manhole and/or leaky sewer line problems as necessary in the watershed. The State Revolving Fund offers low interest rate loans for improvements to waste water treatment facilities including sewer line and pump station maintenance. It is available to local governments. In addition, SCDHEC will work with the existing agencies in the area to provide nonpoint source education in the Grassy Run Branch watershed. Local sources of nonpoint source education include Clemson Extension Service, the Natural Resource Conservation Service and the South Carolina Department of Natural Resources. Clemson Extension Service offers a 'Home-A-Syst' package to home owners. Home-A-Syst allows the homeowner to evaluate practices at their home and determine the nonpoint source impact they may be having. It recommends best management practices (BMPs) to correct nonpoint source problems at a residence. SCDHEC employs a nonpoint source educator who can also provide BMP information.

SCDHEC's nonpoint source program has identified Grassy Run Branch as a priority stream in the fall 1998 and spring 1999 section 319 grant guidance for fecal coliform reduction projects. This guidance was sent to Chester municipal and Chester county officials. In addition, other interested parties (universities, local watershed groups, etc.) may apply for section 319 grants to install BMPs that will reduce fecal coliform loading to Grassy Run Branch.

DHEC will continue to monitor the effectiveness of implementation measures and evaluate stream water quality as the implementation strategy progresses.

References

Metcalf & Eddy, Inc. 1979. Wastewater Engineering: Treatment Disposal Reuse. McGraw Hill, New York.

Novotny, Vladimir. Olem, Harvey. 1994. Water Quality Prevention, Identification, and Management of Diffuse Pollution. Van Nostrand Reinhold, New York.

South Carolina Department of Health and Environmental Control. 1998. Implementation Plan for Achieving Total Maximum Daily Load Reductions From Nonpoint Sources for the State of South Carolina.

South Carolina Department of Health and Environmental Control. 1997. Watershed Water Quality Management Strategy: Catawba and Santee River Basins. Technical Report No. 002-96.

United States Environmental Protection Agency. 1991. Guidance for Water Quality-Based Decisions: The TMDL Process, Office of Water, EPA 440/4-91-001.

Public Participation

Public Notice

The public notice on page 12 was sent to a mailing list of over 300 individuals statewide interested in water quality issues. In addition, the notice was sent to local organizations and county and city officials in Chester with a possible interest in this TMDL. This notice was also posted on the Internet on DHEC's web site at "http:/www.state.sc.us/dhec/eqpubnot.htm".

The public notice on page 13 was published in the Chester News and Reporter newspaper on Friday, April 30, 1999.

Responsiveness Summary

The opportunity for public comment began on April 30, 1999 and continued for over 30 days closing on June 4, 1999. During this period, no comments were received.

NOTICE OF AVAILABILITY OF PROPOSED TMDL
FOR WATERS AND POLLUTANTS OF CONCERN IN SC

The South Carolina Department of Health and Environmental Control (DHEC) has developed a proposed total maximum daily load (TMDL) for fecal coliform bacteria for Grassy Run Branch in South Carolina and is proposing to establish this as a final TMDL. This TMDL has been developed in accordance with Section 303(d) of the Clean Water Act.

Persons wishing to offer comments or new data regarding the proposed TMDL may submit data and comments in writing no later than June 4, 1999 to Anne Runge, DHEC, Bureau of Water, 2600 Bull Street, Columbia, SC 29201. For more information, please contact Ms. Runge at (803) 898-3701 or visit our website at www.state.sc.us/dhec/eqpubnot.htm.
April 30, 1999

Data Appendix

CW-088 (Grassy Run Branch) Watershed
Flow and Fecal Coliform Loading Calculations

CW-088 (Grassy Run) drainage

acres		square mi
523	0.001562	0.816926

Rocky Creek at Great Falls USGS 02147500

average annual flow water yrs 1951-1997	191	
drainage area in sq miles	194	
Generation coefficient 191/194	0.984536	
average may-Oct	110.9167	
warm months generation coefficient	0.571735	
warm months generation coefficient *Grassy Run drainage	0.467066	Grassy Run mean for May-Oct in CFS

geo mean	factor	flow cfs	#/day
1219	24468984	0.467066	1.39E+10
200	24468984	0.467066	2.29E+09
difference			1.16E+10
%difference			0.835931

geo mean	factor	flow cfs	#/day
1219	24468984	0.467066	1.39E+10
175	24468984	0.467066	2E+09
difference			1.19E+10
%difference			0.85644

Fecal Coliform Data
CW-088

TIME	DEPTH	31616 FEC COLI MFM-FCBR /100ML		
1143	,	2900	,"@",	remark cod
1230	,	160	,"J",	@ no code
1130	,	6600	,"J",	J estimated
1204	,	900	,"@",	L greater th
1213	,	780	,"@",	
1141	,	940	,"@",	
1320	,	2000	,"L",	
1200	,	600	,"@",	
1232	,	6600	,"J",	
1346	,	4500	,"@",	
1254	,	980	,"@",	
1338	,	10000	,"J",	
1145	,	1700	,"@",	
1315	,	1900	,"@",	
1055	,	2600	,"@",	
1250	,	10000	,"J",	
1005	,	1100	,"@",	
1125	,	860	,"@",	
1200	,	3300	,"J",	
1250	,	500	,"@",	
1325	,	1400	,"@",	
1515	,	1200	,"@",	
1150	,	3300	,"J",	
1130	,	1200	,"@",	
1155	,	3600	,"J",	
1300	,	1700	,"@",	
1205	,	3300	,"J",	
1125	,	1980	,"J",	
1100	,	3300	,"J",	
1020	,	2200	,"J",	
1035	,	2000	,"J",	
1215	,	6200	,"J",	
1128	,	2600	,"@",	
1120	,	1000	,"@",	
1402	,	300	,"@",	
1350	,	90	,"J",	
1245	,	1500	,"@",	
1120	,	1200	,"@",	
1127	,	980	,"@",	
1135	,	980	,"@",	
1423	,	500	,"@",	
1343	,	490	,"@",	
1232	,	1900	,"@",	
1050	,	3400	,"J",	
1020	,	7400	,"J",	
1330	,	1100	,"@",	
1414	,	740	,"@",	
1330	,	3300	,"J",	
1350	,	3000	,"@",	
1105	,	1200	,"@",	
1020	,	2200	,"J",	
1035	,	600	,"@",	
1205	,	6600	,"L",	
1235	,	2400	,"J",	
1455	,	400	,"@",	
1530	,	170	,"@",	
1030	,	880	,"@",	