Total Maximum Daily Loads (TMDLs) Analysis for Chesapeake Bay Drainage Basin, Delaware: Chester River, Choptank River, Marshyhope Creek, Nanticoke River, Gum Branch, Gravelly Branch, Deep Creek, Broad Creek and Pocomoke River Watersheds

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September 2006

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1 Introduction/Background

Under Section 303(d) of the Clean Water Act (CWA), States are required to identify and establish a priority ranking for waters in which existing pollution controls are not sufficient to attain and maintain State water quality standards, establish Total Maximum Daily Loads (TMDLs) for those waters, and periodically submit the list of impaired waters (303(d) list) and TMDLs to the United States Environmental Protection Agency (EPA). If a State fails to adequately meet the requirements of section 303(d), the CWA requires the EPA to establish a 303(d) list and/or determine TMDLs for that State.

In 1996, the EPA was sued under Section 303(d) of the CWA concerning the 303(d) list and TMDLs for the State of Delaware. The suit maintained that Delaware had failed to fulfill all of the requirements of Section 303(d) and the EPA had failed to assume the responsibilities not adequately preformed by the State. A settlement in the suit was reached and the Delaware Department of Natural Resources and Environmental Control (DNREC) and the EPA signed a Memorandum of Understanding (MOU) on July 25, 1997. Under the settlement, DNREC and the EPA agreed to complete TMDLs for all 1996 listed waters on a 10-year schedule.

In the Chesapeake Bay Drainage Basin, a number of river segments, tributaries and ponds have been included on the State's Clean Water Action Section 303(d) List of Waters needing Total Maximum Daily Loads (TMDLs). TMDLs needed to be established for dissolved oxygen, nutrients (nitrogen and phosphorus) and bacteria concentrations. This proposed TMDL will address the bacteria concentrations in the watershed.

The proposed Bacteria TMDL Regulations for the Chester River, Choptank River, Marshyhope Creek, and Pocomoke River Watersheds are necessary because the existing TMDL regulations that included both nutrient and bacteria allocations, promulgated on January 11, 2006 are being revised to include nutrients only. This change is required due to a clarification in the interpretation of the EPA-required, bacteria water quality standards that result in changes to the bacteria allocations.

Overall reductions required to meet the bacteria water quality standards within the basin are:

In the Chester River Watershed, the nonpoint source bacteria load shall be reduced by 37% from the 1997 – 2004 baseline levels.

In the Choptank River Watershed, the nonpoint source bacteria load shall be reduced by 29% from the 1997 – 2005 baseline level.

In the Marshyhope Creek Watershed, the nonpoint source bacteria load shall be reduced by 21% from the 1997 – 2005 baseline levels.

In the Pocomoke River Watershed, the nonpointsource bacteria load shall be reduced by 26% from the 1997 – 2004 baseline levels.

In the Nanticoke River Drainage Basin, which includes the Nanticoke River, Gum Branch, Gravelly Branch, Deep Creek and Broad Creek watersheds, the nonpoint source bacteria load shall be reduced by 2% from the 2000 – 2005 baseline levels.

The point sources within the watershed are the Seaford STP, the Bridgeville STP, the Laurel STP, Invista Seaford, and the Mobile Garden Trailer Park. The concentration limit for these dischargers will be a maximum level not to exceed 100 CFU/100mL (geometric mean, minimum 5 samples within 30 days).

The draft proposed TMDL for this watershed was reviewed during a public workshop held on June 6, 2006. All comments received at the workshop and during the June 1st through 30th comment period were considered by DNREC. This report has been updated to address these comments and minor modifications were made in the regulations.

2 Study Area

2.1 Chester River Watershed

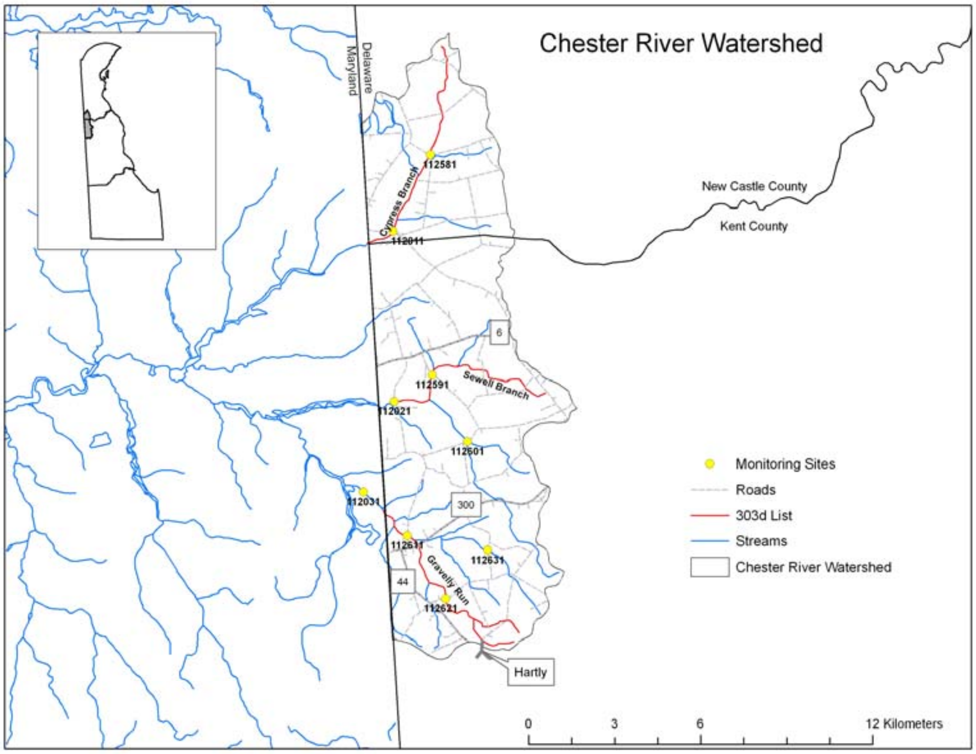

Figure 2-1 Chester River Watershed Map

Chester River Watershed is located on the western edge of Delaware and resides in both New Castle and Kent Counties. The headwaters of the Sassafras River lie to the north and the Choptank River is to the south. The Delaware portion of the Chester River Watershed contains headwater tributaries that drain to the main stem of the Chester River in Maryland. Cypress Branch, the most northerly stream, drains southwestward, while Sewell Branch directly below drains in a westerly direction. Furthest to the south in the Chester River Watershed is Gravelly Run, which drains northwestward and meets Sewell Branch several kilometers west of the Maryland-Delaware state line. The drainage area of Chester River Watershed within Delaware is approximately 103 km^2.

The streams in the northern portion of the Chester River Watershed are marsh-like due to the surrounding wetlands, while to the south, they are ditch-like, due to the agricultural influence of the area. Concerns on the watershed include low dissolved oxygen, nutrient over-enrichment, and high levels of bacteria. There are no active point sources discharging nutrients or bacteria into Chester River, therefore, all pollutants are coming from nonpoint sources.

The land use within the watershed is dominated by agriculture, wetlands, and forests. The detailed land use information for this watershed is based on 2002 Delaware Office of State Planning Coordination land cover data (9). Figure 1-2 shows the geographic distribution of different land uses in the Chester River Watershed. The land use activity in the watershed consists of 45 km^2 of agriculture (44% of the watershed), 35 km^2 of wetland (34% of the watershed), 12 km^2 of forest (12% of the watershed), 10 km^2 of residential, commercial and industrial area (9% of the watershed), and 1 km^2 of rangeland (1% of the watershed). The summary of relative distribution of land use coverage is presented in the pie chart in Figure 2-3. Hartly, which lies on the southern border of the watershed, is the only incorporated town.

Soil types in the watershed, from north to south, include grades from Mattapeake-Sassafras association (considered by the Natural Resources Conservation Service to be "well-drained, medium textured and moderately coarse textured soils on uplands"), to Keyport-Elkton and Fallsington-Mattapeake soils, to Fallsington-Pocomoke association at the border between Kent and Sussex Counties (predominantly heavier, more poorly drained), to Pocomoke-Fallsington-Sassafras association (considered by the Natural Resources Conservation Service to be "very poorly drained, poorly drained, and well drained soils that have a moderately permeable subsoil").

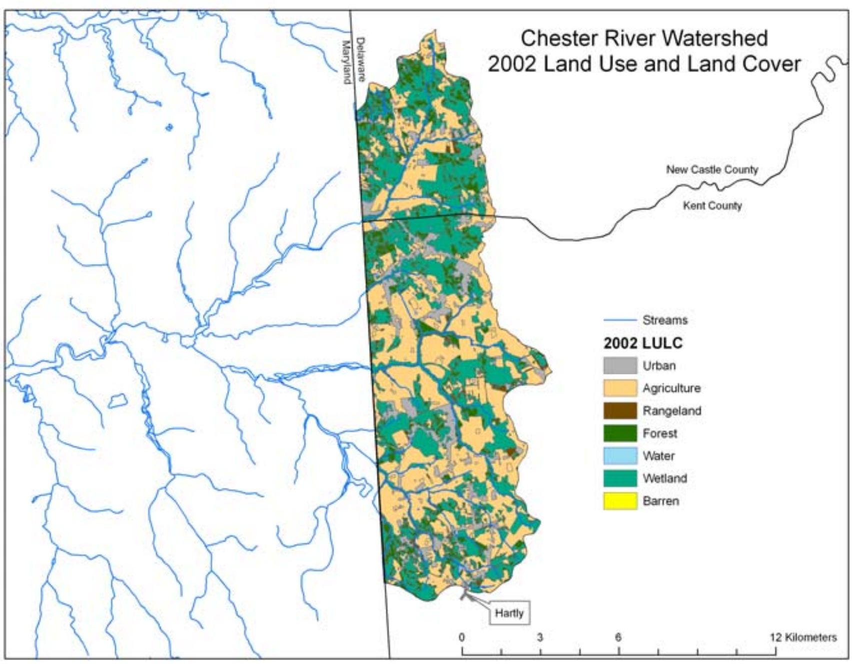

Figure 2-2 Chester River Watershed 2002 Land Use and Land Cover

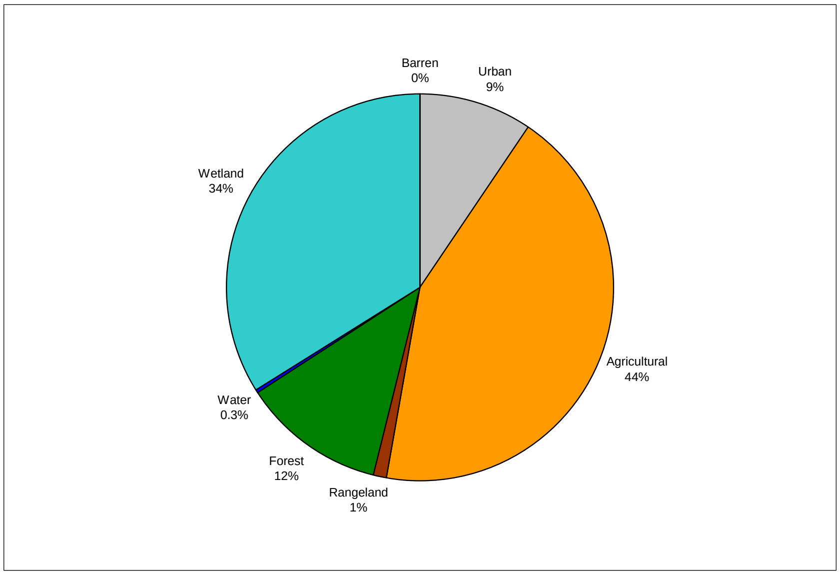

Figure 2-3 Land Use Percentages in Chester River Watershed

2.2 Choptank River Watershed

The Choptank River Watershed is located on the western edge of Delaware and resides in Kent County. The headwaters of the Chester River lie to the north and Marshyhope Creek is to the south. The Choptank River Watershed consists of Tappahanna Ditch in the northern portion of the watershed, Culbreth Marsh Ditch in the center, and Cow Marsh Creek in the lower portion. Both Tappahanna Ditch and Culbreth Marsh Ditch drain to Mud Millpond, which is situated at the Maryland-Delaware state line. The pond discharges to the Choptank River in Delaware, which meanders southward, where Cow Marsh Creek connects in before continuing into Maryland. The drainage area of Choptank River Watershed within Delaware is approximately 252 km^2.

The majority of the streams within the watershed have drainage ditch characteristics due to the surrounding agricultural practices. The exceptions are found near and downstream of Mud Millpond, which is more forested. Concerns in the watershed include low dissolved oxygen, nutrient over-enrichment, and high levels of bacteria. There are no active point sources discharging nutrients or bacteria into Choptank River, therefore, all pollutants are coming from nonpoint sources.

The land use within the watershed is dominated by agriculture, wetlands, and forests. The detailed land use information for this watershed is based on 2002 Delaware Office of State Planning Coordination land cover data. Figure 2-4 shows the geographic distribution of different land uses in the Choptank River Watershed. The land use activity in the watershed consists of

125 km^2 of agriculture (50% of the watershed), 67 km^2 of wetland (27% of the watershed), 31 km^2 of forest (13% of the watershed), 23 km^2 of residential, commercial and industrial area (9% of the watershed), and 3 km^2 of rangeland (1% of the watershed). The summary of relative distribution of land use coverage is presented in the pie chart in Figure 2-5. Hartly, which lies on the northern border of the watershed, is the only incorporated town.

Soil types in the watershed include predominantly Pocomoke-Fallsington-Sassafras soil associations described by the Natural Resources Conservation Service as “very poorly drained, poorly drained, and well drained soils that have a moderately permeable subsoil of clay loam to sandy loam,” and Fallsington-Sassafras-Woodstown associations described as “poorly drained to well drained soils that have a moderately permeable subsoil of sandy loam to sandy clay loam” .

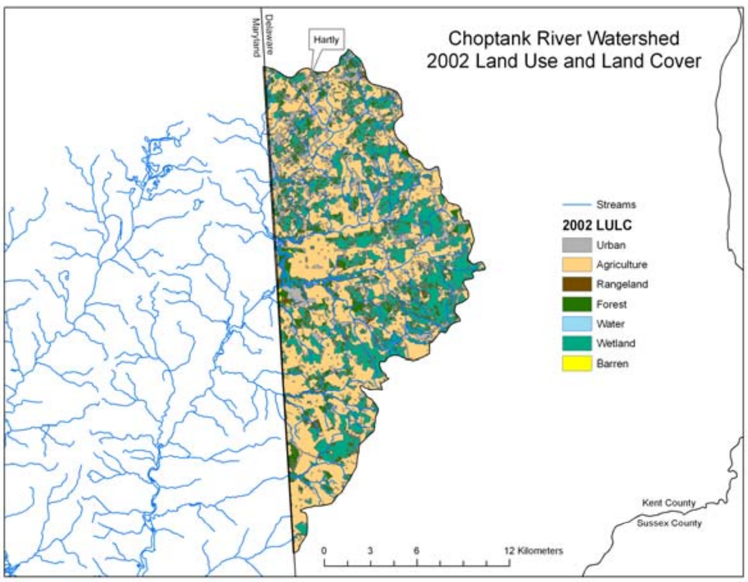

Figure 2-4 Choptank River Watershed 2002 Land Use and Land Cover

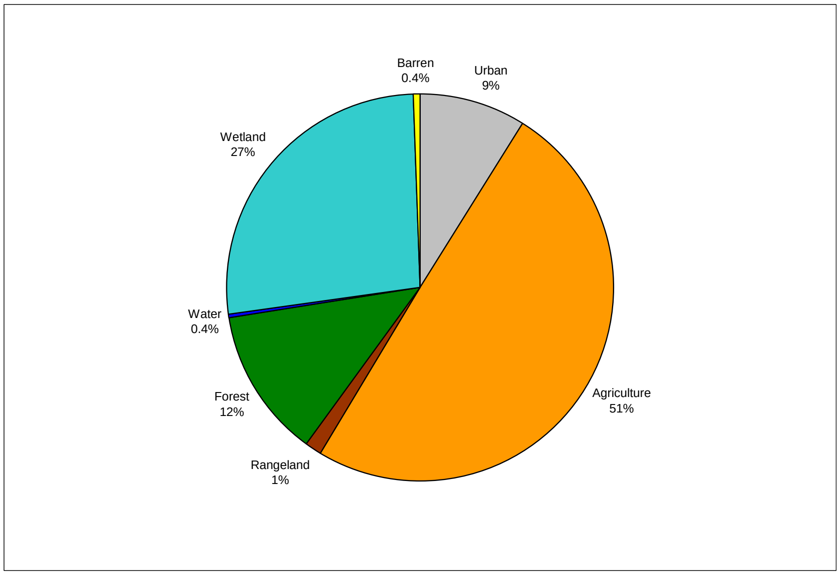

Figure 2-5 Land Use Percentages in Choptank River Watershed

2.3 Marshyhope Creek Watershed

Marshyhope Creek Watershed is located on the western edge of Delaware and resides in both Kent and Sussex Counties. The headwaters of the Choptank River lie to the north and the Nanticoke River is to the south of Marshyhope Creek Watershed. The stream flows southwestward and crosses the state line into Maryland where it eventually discharges into the Chesapeake Bay. The drainage area of Marshyhope Creek Watershed within Delaware is approximately 250 km^2.

Agricultural practices have lead to the headwaters and tributaries having drainage ditch characteristics. In addition, the middle stretch of the main stem of Marshyhope Creek was channelized in the past; however, in several sections, sediment and vegetation now cover the cement bottom. Concerns in the watershed include low dissolved oxygen, nutrient over-enrichment, and high levels of bacteria. There are no active point sources discharging nutrients or bacteria into Marshyhope Creek, therefore, all pollutants are coming from nonpoint sources.

The land use within the watershed is dominated by agriculture, wetlands, and forests. The detailed land use information for this watershed is based on 2002 Delaware Office of State Planning Coordination land cover data. Figure 2-6 shows the geographic distribution of different land uses in the Marshyhope Creek Watershed. The land use activity in the watershed consists of 138 km^2 of agriculture (55% of the watershed), 62 km^2 of wetland (25% of the watershed), 32 km^2 of forest (13% of the watershed), 10 km^2 of residential, commercial and industrial area (4% of the watershed), and 8 km^2 of rangeland (3% of the watershed). The summary of relative distribution of land use coverage is presented in the pie chart in Figure 2-7. Farmington is the only incorporated town.

Soil types in the watershed include Fallsington-Sassafras-Woodstown association described by the Natural Resources Conservation Service as “poorly drained to well drained soils that have a moderately permeable subsoil of sandy clay loam or sandy loam”.

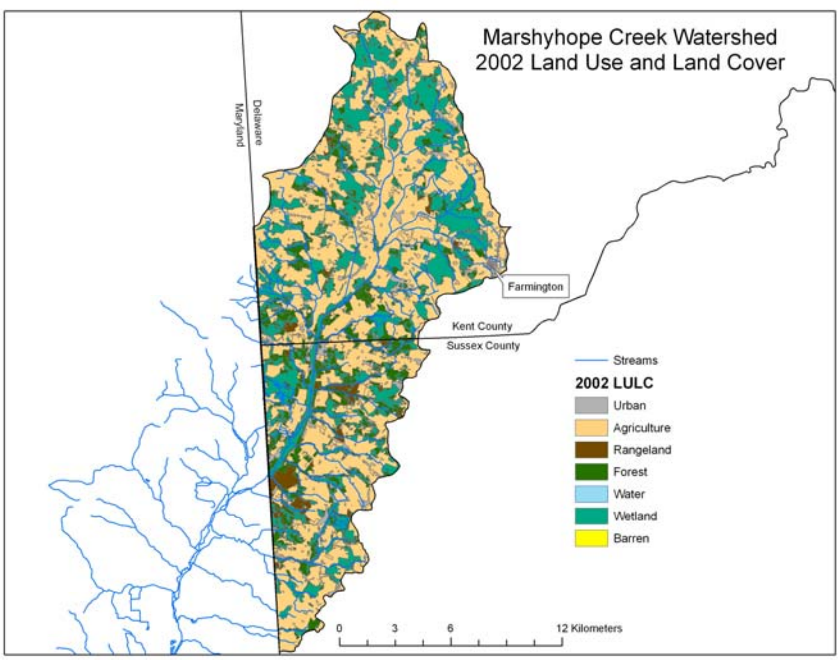

Figure 2-6 Marshyhope Creek Watershed 2002 Land Use and Land Cover

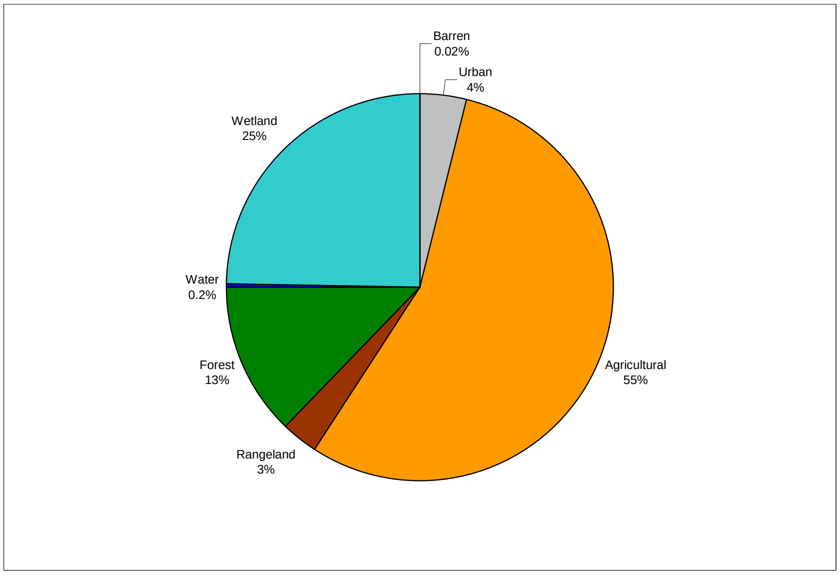

Figure 2-7 Land Use Percentages in Marshyhope Creek Watershed

2.4 Pocomoke River Watershed

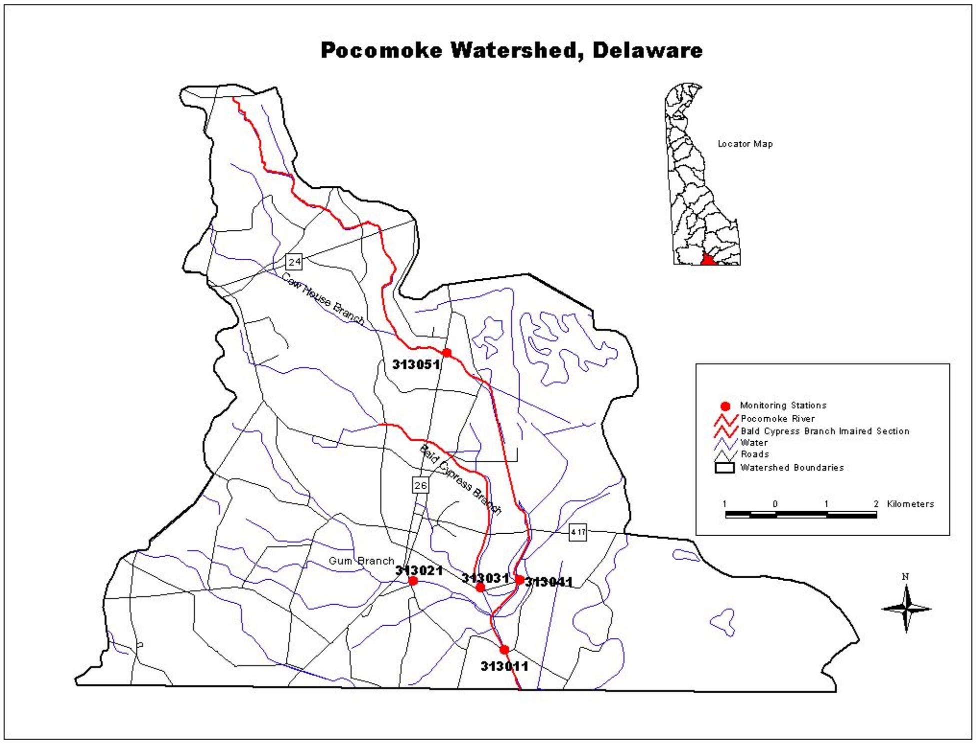

Figure 2-8 Pocomoke River Watershed Map

The Delaware portion of the Pocomoke River watershed is located centrally on the border between southern Delaware and Maryland. The mainstem of the Pocomoke is approximately 11.8 miles long and drains about 22,700 acres in Delaware before entering Maryland. The USGS describes the upper Pocomoke watershed saying: “Soils are generally moderately permeable but poorly drained (U.S. Department of Agriculture, 1970) and the water table is shallow (generally less than 2 m below land surface during wet periods). Tributaries are low gradient with sluggish flow and are typically channelized. Ditches to promote drainage of agricultural fields are common…”. Concerns in the watershed include nutrient overenrichment and high bacteria counts. There are no point sources in the watershed; therefore, all pollutants are generated from nonpoint sources within the watershed.

Land use within the watershed is dominated by agricultural uses and wetland areas that take up 45 and 38 percent of the area respectively. 2002 Delaware Office of Planning land cover data has been compiled to create Figure 2-9 and Figure 2-10 show the land use patterns in the watershed.

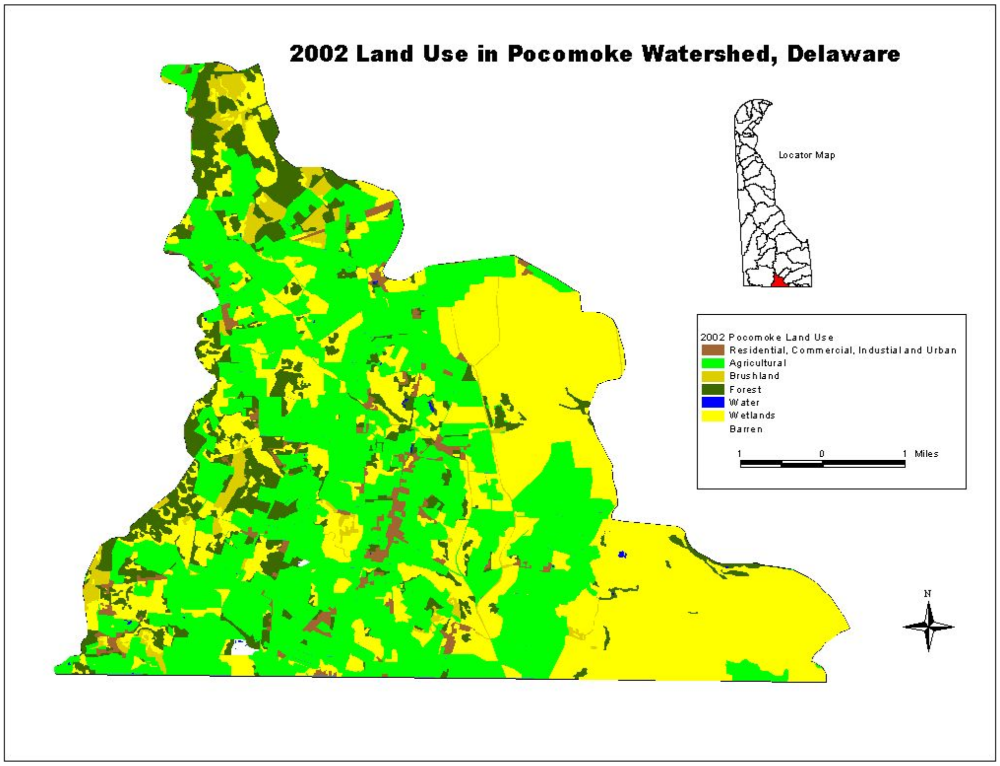

Figure 2-9 2002 Land Uses in Pocomoke River Watershed

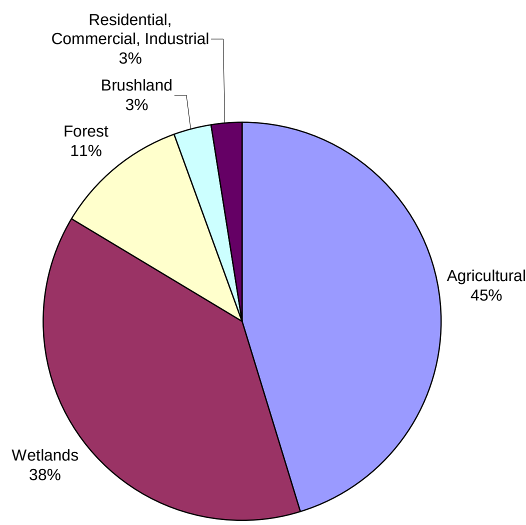

Figure 2-10 2002 Land Use Percentages in Pocomoke River Watershed

2.5 The Nanticoke River Basin

Nanticoke River basin of Delaware is located in southwestern part of the State, with major portion of the watershed in Sussex County and only a small parcel of upper Nanticoke is located in Kent County. The basin consists of Nanticoke River and its major tributary Broad Creek, as well as many other small tributaries and ponds. The majority of small tributaries are free flowing, while parts of main stems of the Nanticoke River and Broad Creek are tidal. Included within the Nanticoke River Drainage Basin are the Nanticoke River, Gum Branch, Gravelly Branch, Deep Creek, and Broad Creek Watersheds.

The topography of the basin is characterized by extremely flat lands with slight localized relief, most of which is along the middle sections of the basin and next to the River. The basin's upper most reaches are about 60 feet above sea level, while the area close to Maryland border is only 10 ft above sea level.

The basin drains an area of 397 square miles (253,906 acres). Major land use activity in this basin is agriculture, which takes 51 percent of the total land in the basin. After agriculture, wooded area takes 39%, brushland 5%, and urban areas 2.4% (**Figure 2-11**).

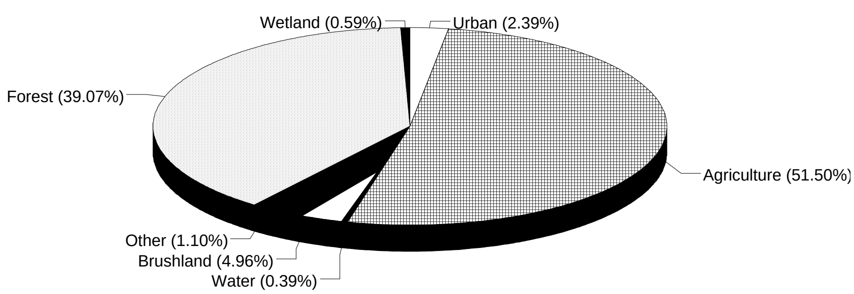

Figure 2-11 Land Use/Land Cover in the Nanticoke River Basin

Geologically, the basin lies within the Atlantic Coastal Plain, which consists of a seaward dipping wedge of unconsolidated and semi-consolidated sediments. There is no bedrock near the surface or the soil in this Basin. In addition, there are no mineral extraction or oil and gas drilling sites in the area.

The soils are generally sandy and porous and consist of the following major associations: *Tidal Marsh, Fresh, Association; Sassafras-Fallsington association; Evesboro-Rumford association*; *Fallsington- Sassafras-Woodstown association*; and *Fallsington-Pocomoke-Woodstown association.* The *Fallsington-Sassafras-Woodstown* and *Fallsington-Pocomoke-Woodstown* occur in the upper most reaches of the Nanticoke River and cover about one-third of the Basin. There are six point source NPDES facilities in the Nanticoke River basin (**Table 2-1**), their discharge concentrations will be capped at 100 CFU/100mL enterococcus (geometric mean).

Because these facilities are discharging at or below the WQS, they will not utilize any assimilation capacity of the receiving waters.

Facility Name	ID	Size	Type	Receiving Stream	Current NPDES permit limit
Seaford STP	DE0020265	Major	Municipal	Nanticoke R.	100 CFU/100mL enterococcus
Bridgeville STP	DE0020249	Major	Municipal	Nanticoke R	100 CFU/100mL enterococcus
Laurel STP	DE0020125	Major	Municipal	Broad Cr.	100 CFU/100mL enterococcus
Invista Seaford	DE0000035	Major	Industrial	DuPont Gut	200 CFU/100mL fecal coliform
S. C. Johnson	DE0050971	Minor	Industrial	Herring Run	none
Mobile Garden Trailer Park	DE0050725	Minor	Municipal	unnamed tributary	200 CFU/100mL fecal coliform

Table 2-1 NPDES Facilities and Their Current Bacteria Concentration Limits

2.6 Designated Uses

The purpose of establishing TMDLs is to reduce the pollutants to levels that result in meeting applicable water quality standards and support designated uses of the streams. Section 3 of the State of Delaware Surface Water Quality Standards, as amended, July 11, 2004, specifies the following designated uses for the waters of the Chesapeake Bay Drainage Basin:

- Primary Contact Recreation
- Secondary Contact Recreation
- Fish, Aquatic Life, and Wildlife
- Agricultural Water Supply
- Industrial Water Supply

Furthermore, Marshyhope Creek is designated as a water of Exceptional Recreation or Ecological Significance (ERES).

2.7 Applicable Water Quality Standards:

To protect the designated uses, the following sections of the State of Delaware Surface Water Quality Standards, amended July 11, 2004, provide specific narrative and numeric criteria concerning the waters in Chester River, Choptank River and Marshyhope Creek:

- Section 4 Criteria to Protect Designated Uses
- Section 5 Antidegradation and ERES Waters Policies

Based on the above sections, the following is a brief summary of pertinent water quality standards that are applicable to the waters of Chester River, Choptank River, and Marshyhope Creek:

2.7.1 Waters of Exceptional Recreational or Ecological Significance (ERES, Section 5.6.1):

Designated ERES waters shall be accorded a level of protection and monitoring in excess of that provided most other waters of the State. These waters are recognized as special natural assets of the State, and must be protected and enhanced for the benefit of present and future generations of Delawareans.

ERES waters shall be restored, to the maximum extent practicable, to their natural condition. To this end, the Department shall, through adoption of a pollution control strategy for each ERES stream basin, take appropriate action to cause the systematic control, reduction, or removal of existing pollution sources, and the diversion of new pollution sources, away from ERES waters.

2.7.2 Bacteria (enterococcus):

Geometric mean shall not exceed 100 CFU/100mL

3 Current Stream Water Quality Conditions

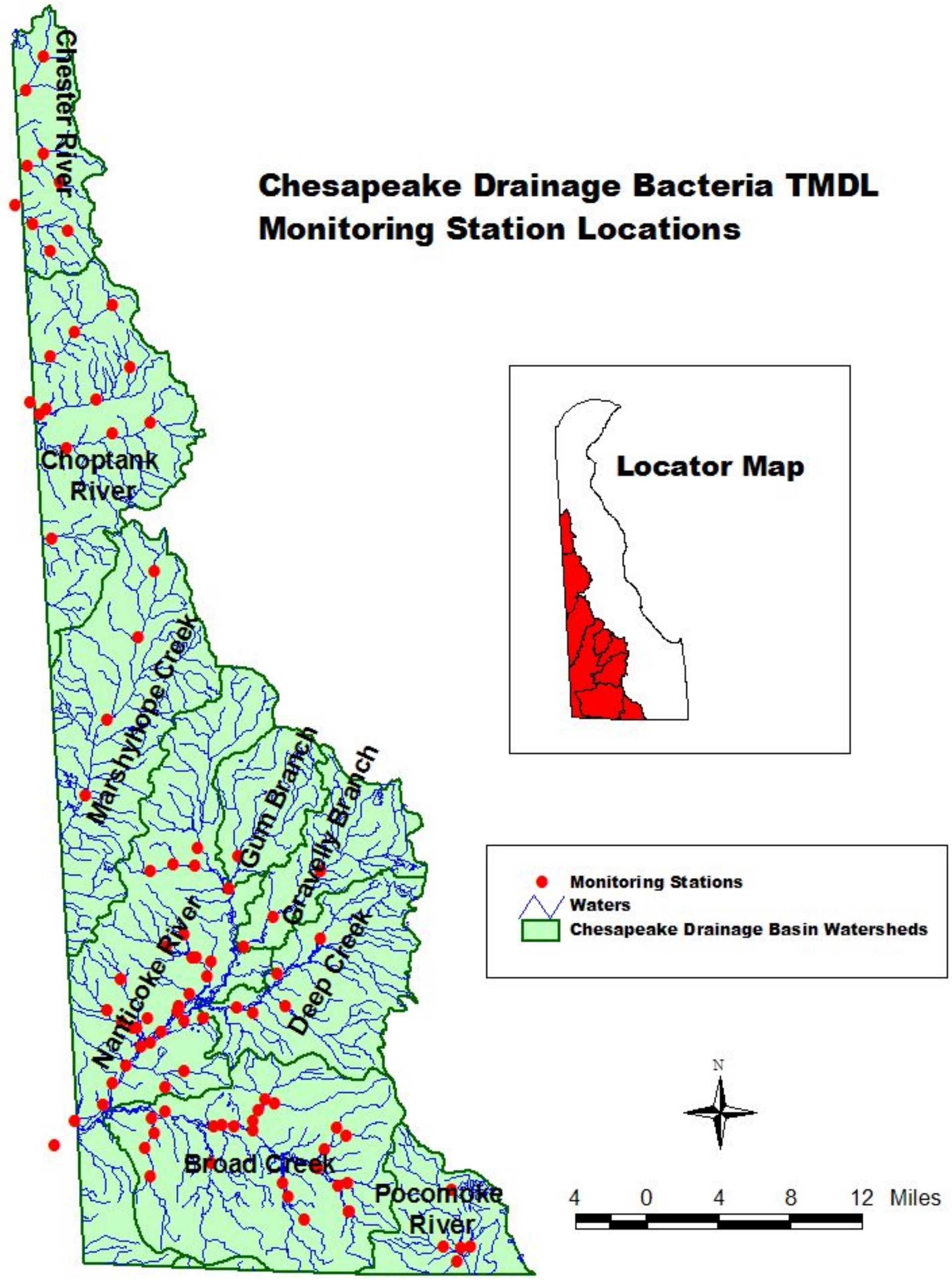

Figure 3-1 Chesapeake Drainage Water Quality Monitoring Stations

Bacteria data was obtained at 99 monitoring sites in the Chesapeake Bay Drainage basin (Figure 3-1). Precipitation data used to determine if the sample was taken on a wet vs. dry day was obtained from the Office of the Delaware State Climatologist, the closest station with an adequate daily record was located in Greenwood. Table 3-1 represents the average conditions in the drainage basin, the entire data set used is listed in the Appendix Section of this document.

Chesapeake Bay Drainage Basin	**# samples dry weather**	**# samples wet weather**	**Average (CFU/100mL)**	**Geomean (CFU/100mL)**	**Log Std Dev**
Chester River Watershed	47	29	343	**152**	**0.64**
Choptank River Watershed	80	56	425	**123**	**0.78**
Marshyhope Creek Watershed	40	30	351	**70**	**0.88**
Pocomoke River Watershed	53	25	238	**113**	**0.65**
Nanticoke River Drainage Basin (Nanticoke River, Gum Branch, Gravelly Branch, Deep Creek, Broad Creek watersheds)	310	110	109	**37**	**0.59**

Table 3-1 Average Bacteria Concentrations in the Chesapeake Bay Drainage Basin

4 Establishment of the Bacteria TMDL for the Chesapeake Bay Drainage Basin River Watersheds

Bacteria impairments were evaluated using the Cumulative Distribution Function Method to determine the reductions required in the Chesapeake Bay Drainage Basin River to achieve water quality standards (100 CFU enterococci/100mL geometric mean). This approach was developed by Lee Dunbar at the Connecticut Department of Environmental Protection and much of the following text is based upon or copied directly from documentation provided by the Connecticut Department of Environmental Protection

Overall reductions required to meet the bacteria water quality standards within the basin are:

In the Chester River Watershed, the nonpoint source bacteria load shall be reduced by 37% from the 1997 – 2004 baseline levels.

In the Choptank River Watershed, the nonpoint source bacteria load shall be reduced by 29% from the 1997 – 2005 baseline level.

In the Marshyhope Creek Watershed, the nonpoint source bacteria load shall be reduced by 21% from the 1997 – 2005 baseline levels.

In the Pocomoke River Watershed, the nonpointsource bacteria load shall be reduced by 26% from the 1997 – 2004 baseline levels.

In the Nanticoke River Drainage Basin, which includes the Nanticoke River, Gum Branch, Gravelly Branch, Deep Creek and Broad Creek watersheds, the nonpoint source bacteria load shall be reduced by 2% from the 2000 – 2005 baseline levels.

The point sources within the watershed are the Seaford STP, the Bridgeville STP, the Laurel STP, Invista Seaford, and the Mobile Garden Trailer Park. The concentration limit for these dischargers will be capped at a level not to exceed 100 CFU/100mL.

4.1 Overview of Cumulative Distribution Function Method

This analytical methodology provides a defensible scientific and technical basis for establishing TMDLs to address recreational use impairments in urban watersheds. Representative ambient water quality monitoring data for a minimum of 21 sampling dates is required for the analysis. The reduction in bacteria density from current levels needed to achieve consistency with the criteria is quantified by calculating the difference between the cumulative relative frequency of the sample data set and the criteria adopted by Delaware to support recreational use. Delaware's adopted water quality criteria for the indicator bacteria fecal enterococci are represented by a statistical distribution of geometric mean 100 and log standard deviation 0.4 for purposes of TMDL calculations.

The geometric mean criterion was derived by the EPA scientists from epidemiological studies at beaches where the incidence of swimming related health effects (gastrointestinal illness rate) could be correlated with indicator bacteria densities. Delaware's recommended criteria reflect an average illness rate of 12.5 illnesses per 1000 swimmers exposed. This condition was predicted to exist based on studies cited in the federal guidance when the steady-state geometric mean density of fecal enterococci was 100 CFU/100mL . The distribution of individual sample results around the geometric mean is such that approximately half of all individual samples are expected to exceed the geometric mean and half will be below the geometric mean.

EPA also derived a formula to calculate single sample maximum criteria from this same database to support decisions by public health officials regarding the closure of beaches when an elevated risk of illness exists. Because approximately half of all individual sample results for a beach where the risk of illness is considered "acceptable" are expected to exceed the geometric mean criteria, an upper boundary to the range of individual sample results was statistically derived that will be exceeded at frequencies less than 50% based on the variability of sample data. The mean log standard deviation for fecal enterococci densities at the freshwater beach sites studied by EPA was 0.4. Using these values, 457 CFU/100mL was calculated to represent the 95th percentile upper confidence limit (5% exceedance frequency) for this statistical distribution of data and was used as the acceptable, risk based upper boundary. TMDLs developed using this approach are expressed as the average percentage reduction from current conditions required to achieve consistency with criteria. The procedure partitions the TMDL into regulated point source wasteload allocation (WLA) and non-point source load allocation (LA) components by quantifying the contribution of ambient monitoring data collected during periods of high storm water influence and minimal storm water influence to the current condition. TMDLs developed using this analytical approach provide an ambient monitoring benchmark ideally suited for quantifying progress in achieving water quality goals as a result of TMDL implementation.

4.2 TMDL End Point Determination

The criteria can be expressed as a cumulative frequency distribution or "criteria curve" as shown in Figure 4 -1.

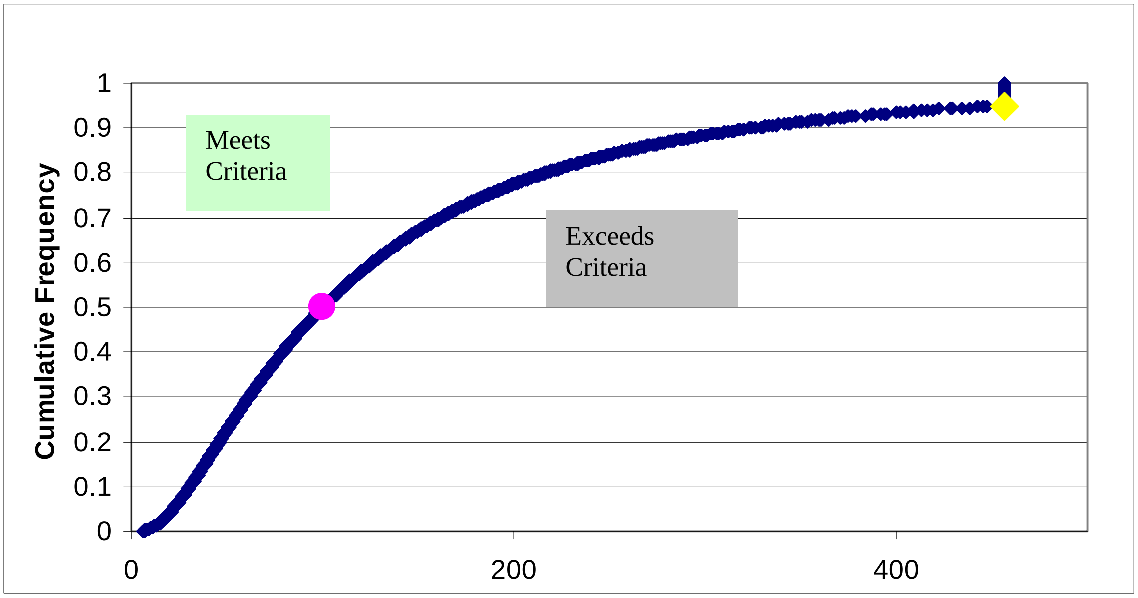

Figure 4-1 Cumulative Relative Frequency Distribution representing Delaware Water Quality Standards

As with the cumulative relative frequency curve representing the criteria shown in Figure 4 -1, a cumulative relative frequency curve can be prepared using site-specific sample data to represent current conditions at the TMDL monitoring sites. The TMDL for the monitored segments are derived by quantifying the difference between these two distributions as shown conceptually in Figure 4 -2. This is accomplished by calculating the reduction required at representative points on the sample data cumulative frequency distribution curve and then averaging the reduction needed across the entire range of sampling data. This procedure allows the contribution of each individual sampling result to be considered when estimating the percent reduction needed to meet a criterion that is expressed as a geometric mean.

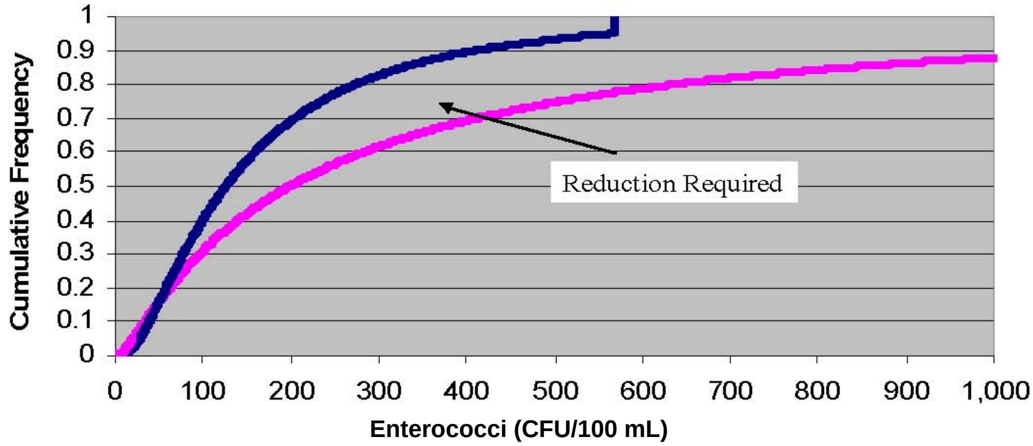

Figure 4-2 Reduction in indicator bacteria density needed from current condition (magenta line) to meet criteria (blue line) based on cumulative relative frequency distribution.

4.3 WLA and LA

Stormwater runoff in an urbanized area is considered a point source subject to regulation under the NPDES permitting program. TMDLs for indicator bacteria in waters draining urbanized areas must therefore be partitioned into a WLA to accommodate point source stormwater loadings of indicator bacteria and a LA to accommodate non-point loadings from unregulated sources. This is accomplished using the same ambient monitoring data used to establish the TMDL.

One common characteristic of urbanized areas is the high percentage of impervious surface. Much of the impervious surface is directly connected to nearby surface waters through stormwater drainage systems. As a result, runoff is rapid following rain events and flow in urban streams is typically dominated by stormwater runoff during these periods. Monitoring results for samples collected under these conditions are strongly influenced by stormwater quality. During dry conditions, urban streams contain little stormwater since urban watersheds drain quickly and base flows are reduced due to lower infiltration rates and reduced recharge of groundwater. At base flow, urban stream water quality is dominated by non-point sources of indicator bacteria since stormwater outfalls are inactive.

The relative contribution of indicator bacteria loadings occurring during periods of high or low stormwater influence to the geometric mean indicator density is estimated by calculating separate averages of the reduction needed to achieve consistency with criteria under “wet” and “dry” conditions. The reduction needed under “wet” conditions is assigned to the WLA and the reduction needed under “dry” conditions is assigned to the LA. Separate reduction goals are established for base flow and stormwater dominated periods that can assist local communities in selection of best management practices to improve water quality. The technique also facilitates the use of ambient stream monitoring data to track future progress in meeting water quality goals.

4.4 Analytical Procedure – TMDL

1. The fecal enterococcus monitoring data is ranked from lowest to highest. In the event of ties, monitoring results are assigned consecutive ranks in chronological order of sampling date. The sample proportion (p) is calculated for each monitoring result by dividing the assigned rank (r) for each sample by the total number of sample results (n): p = r / n

2. Next, a single sample criteria reference value is calculated for each monitoring result from the statistical distribution used to represent the criteria following the procedure described in steps 3-6 below:

3. If the sample proportion is equal to or greater than .95, the single sample criteria reference value is equivalent to the maximum value of 457 CFU/mL.
4. If the sample proportion is less than .95, and greater than .50, the single sample criteria reference value is calculated as:
criteria reference value = antilog_{10} [$\log_{10}$ 100 CFU/100mL + {F x 0.4}]

Note: 100 CFU/100mL is the geometric mean indicator bacteria criterion adopted into Delaware's Water Quality Standards, F is a factor determined from areas under the Normal probability curve for a probability level equivalent to the sample proportion, 0.4 is the $\log_{10}$ standard deviation used by EPA in deriving the national guidance criteria recommendations.

5. If the sample proportion is equal to .50, the single sample reference criteria value is equal to the geometric mean criterion adopted into the Water Quality Standards (100 CFU/100mL).

6. If the sample proportion is less than .50, the single sample reference criteria value is calculated as:
criteria reference value = antilog_{10} [$\log_{10}$ 100 CFU/100mL - {F x 0.4}]

7. The percent reduction necessary to achieve consistency with the criteria is then calculated following the procedure described in steps 8-9 below:

8. If the monitoring result is less than the single sample reference criteria value, the percent reduction is zero.

9. If the monitoring result exceeds the single sample criteria reference value, the percent reduction necessary to meet criteria on that sampling date is calculated as:
percent reduction = ((monitoring result – criteria reference value)/monitoring result)x100

10. The TMDL, expressed as the average percent reduction to meet criteria, is then calculated as the arithmetic average of the percent reduction calculated for each sampling date.

11. Precipitation data is reviewed and each sampling date is designated as a "dry" or "wet" sampling event. Although a site-specific protocol may be specified in an individual TMDL analysis, typically samples collected within 48 hours of a precipitation event of 0.25 inches or greater are designated as "wet".

12. The average percent reduction for all sampling events used to derive the TMDL that are designated as "wet" is computed and established as the WLA.

13. The average percent reduction for all sampling events used to derive the TMDL that are designated as "dry" is computed and established as the LA.

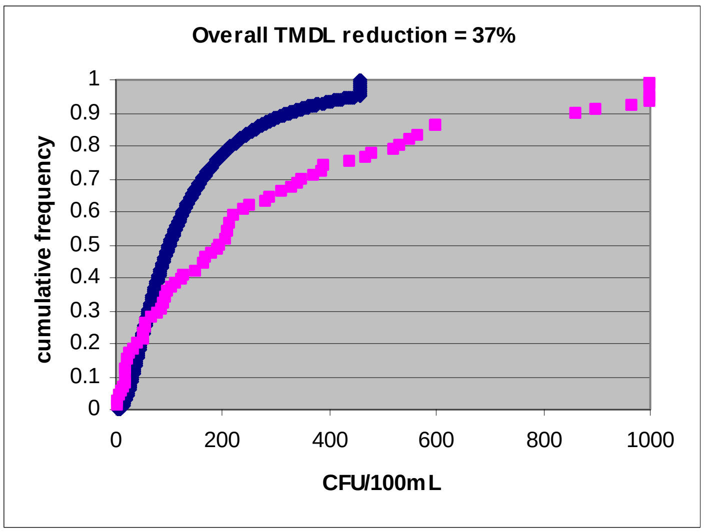

Figure 4-3 Chester River Watershed: Overall TMDL needed from current condition (magenta squares) to meet criteria (blue line). Current condition based on dry and wet weather data.

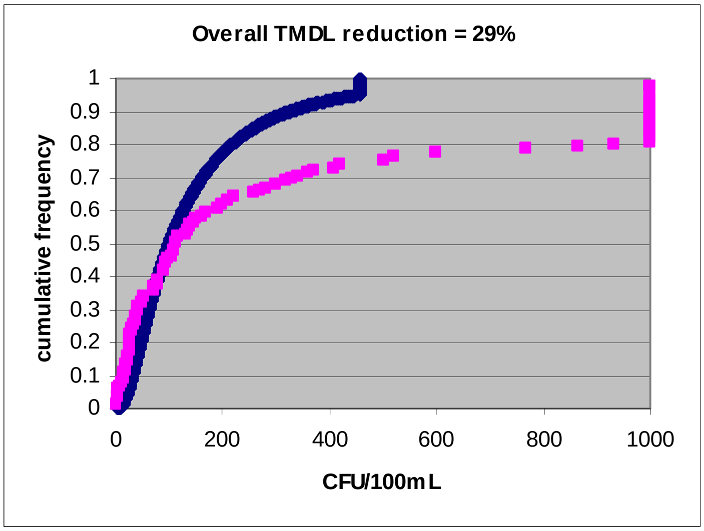

Figure 4-4 Choptank River Watershed: Overall TMDL needed from current condition (magenta squares) to meet criteria (blue line). Current condition based on dry and wet weather data

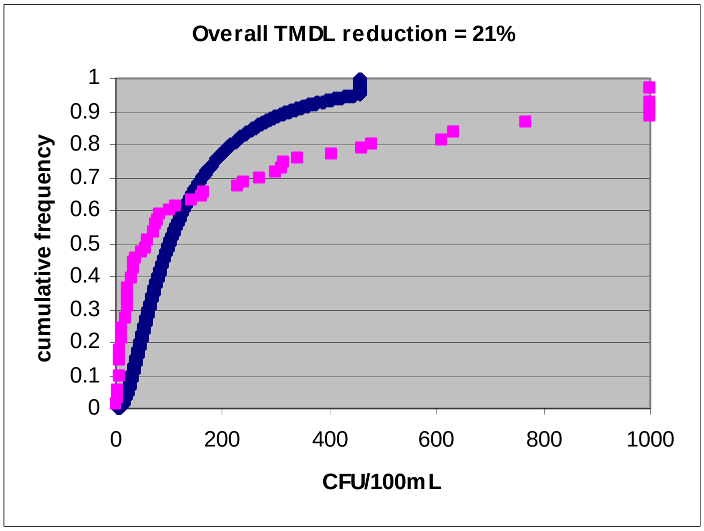

Figure 4-5 : Marshyhope Creek Watershed: Overall TMDL needed from current condition (magenta squares) to meet criteria (blue line). Current condition based on dry and wet weather data

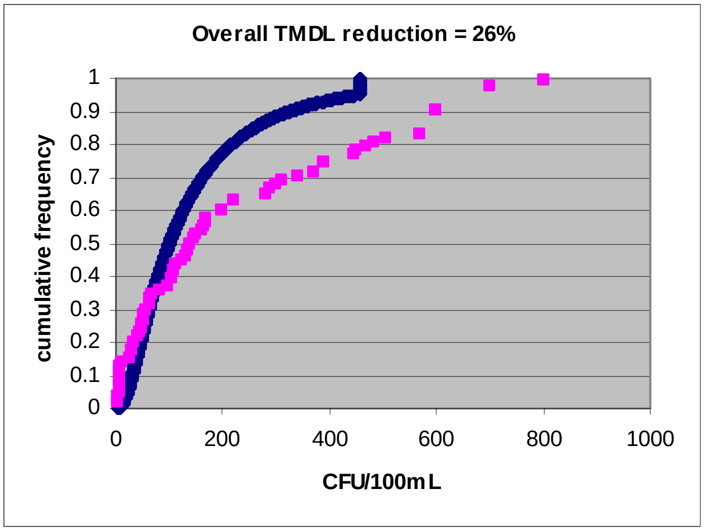

Figure 4-6 Pocomoke River Watershed: Overall TMDL needed from current condition (magenta squares) to meet criteria (blue line). Current condition based on dry and wet weather data

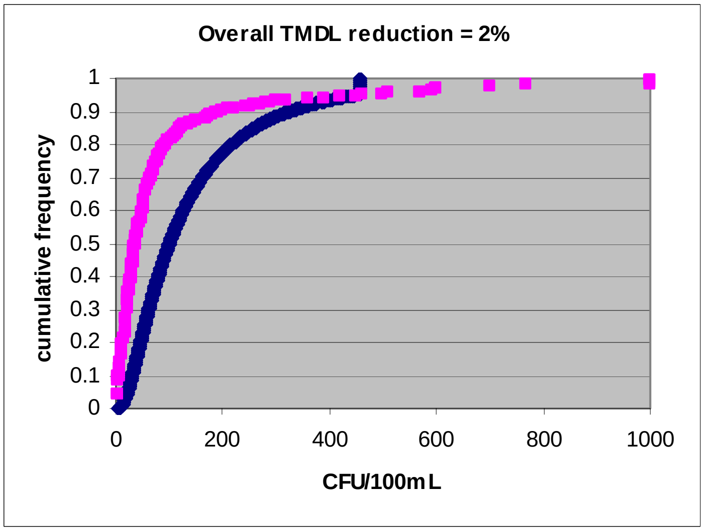

Figure 4-7 Nanticoke River Drainage Basin (Nanticoke River, Gum Branch, Gravelly Branch, Deep Creek, Broad Creek watersheds): Overall TMDL needed from current condition (magenta squares) to meet criteria (blue line). Current condition based on dry and wet weather data

4.5 TMDL Reductions

Chesapeake Bay Drainage Basin River	**Waste Load Allocation reduction**	**Load Allocation reduction**	**Overall TMDL reductions**
Chester River Watershed	50 %	29 %	**37 %**
Choptank River Watershed	48 %	15 %	**29 %**
Marshyhope Creek Watershed	43 %	5 %	**21 %**
Pocomoke River Watershed	38 %	21 %	**26 %**
Nanticoke River Drainage Basin (Nanticoke River, Gum Branch, Gravelly Branch, Deep Creek, Broad Creek watersheds)	7 %	1 %	**2 %**
NPDES facilities: S.C. Johnson	na	na	**na**
NPDES facilities: Seaford STP, Bridgeville STP, Laurel STP, Invista Seaford, Mobile Garden Trailer Park	100 CFU/100mL maximum geomean concentration (enterococcus)	na	**na**

Table 4-1 TMDL allocations for the Chesapeake Bay Drainage Basin River Watershed.

4.6 Daily Loading

With respect to bacteria, the total maximum daily load can be considered in many different ways because the water quality standard is not expressed in daily terms but as a geometric mean over time, typically a period of 30 days. A theoretical maximum, albeit an unrealistic scenario, can be calculated so that the entire loading over the 30-day period occurs in one day. A more practical approach would be to calculate the maximum load at a level corresponding to the appropriate confidence interval and risk level, e.g. a 95% confidence interval and its related single sample value. However, this approach is problematic, as it does not ensure that the geometric mean will be equal to or below the water quality standard.

An average daily maximum, calculated by multiplying the average daily flow times the water quality standard would arguably be the most appropriate measure of a daily maximum with respect to TMDL requirements. Table 4-2 illustrates all of the above maximum daily loading calculations.

	Flow (m^3/day)	Current loading – wet weather (CFU/day)	Current loading – dry weather (CFU/day)	Theoretical Maximum Daily Load (CFU/day)	95% Confidence Interval Daily Load (CFU/day)	Average Daily Maximum Load (CFU/day)
Nanticoke	294,952	2.9E+11	2.9E+11	2.9E+69	1.6E+12	2.9E+11
Chester	151,805	1.5E+11	1.5E+11	1.5E+69	8.3E+11	1.5E+11
Marshyhope	354,586	3.5E+11	3.5E+11	3.5E+69	1.9E+12	3.5E+11
Choptank	382,493	3.8E+11	3.8E+11	3.8E+69	2.1E+12	3.8E+11
Pocomoke	105,408	1.1E+11	1.1E+11	1.1E+69	5.8E+11	1.1E+11

Table 4-2 Flow and Daily Loading

4.7 Source Tracing Adjustment Factor

The Source Tracking Adjustment Factor (STAF) is a multiplier used to normalize human health risk associated with total fecal enterococci counts to enterococci counts derived exclusively from human sources. Bacteria source tracking (BST) data and the STAF, when available, will be used throughout the State to determine the sources of fecal contamination and in the development of pollution control strategies (PCSs).

5 Discussion of Regulatory Requirements for TMDLs

Federal regulations at 40 CFR Section 130 require that TMDLs must meet the following eight minimum regulatory requirements:

1. The TMDLs must be designed to achieve applicable water quality standards
2. The TMDLs must include a total allowable load as well as individual waste load allocations for point sources and load allocations for nonpoint sources
3. The TMDLs must consider the impact of background pollutants
4. The TMDL must consider critical environmental conditions
5. The TMDLs must consider seasonal variations
6. The TMDLs must include a margin of safety
7. The TMDLs must have been subject to public participation
8. There should be a reasonable assurance that the TMDLs can be met

1. The Proposed Chesapeake Bay Drainage Basin River Watershed TMDL is designed to achieve applicable water quality standards.

Cumulative frequency distribution analysis indicates that after the proposed reductions are met, the maximum bacteria concentrations in any portion of the Chesapeake Bay Drainage Basin will not fall above the water quality standards.

2. The Proposed Chesapeake Bay Drainage Basin River Watershed TMDL includes a total allowable load as well as individual waste load allocations for point sources and load allocations for nonpoint sources.

Table 4-1 lists the proposed WLA and LA for the Chesapeake Bay Drainage Basin River Watershed.

3. The proposed Chesapeake Bay Drainage Basin River TMDL considers the impact of background pollutants.

The proposed TMDL is based upon extensive water quality monitoring and precipitation databases. The water quality database included headwater streams representing background conditions. Therefore, it can be concluded that the impact of background pollutants are considered in the proposed Chesapeake Bay Drainage Basin River Watershed TMDL.

4. The proposed Chesapeake Bay Drainage Basin River Watershed TMDL considers critical environmental conditions

The proposed TMDL was established based on the achieving water quality standards at all environmental conditions. Therefore, it can be concluded that consideration of critical environmental conditions was incorporated in the Chesapeake Bay Drainage Basin River Watershed TMDL analysis.

5. The proposed Chesapeake Bay Drainage Basin River Watershed TMDL considers seasonal variations.

Data used in the cumulative frequency distribution analyses was for a period of 5-7 years and included every season. Therefore, it can be concluded that consideration of seasonal variations was incorporated in the Chesapeake Bay Drainage Basin River Watershed TMDL analysis.

6. The proposed Chesapeake Bay Drainage Basin River Watershed TMDL considers a margin of Safety.

EPA's technical guidance allows consideration of a margin of safety as implicit or as explicit. An implicit margin of safety is when conservative assumptions are considered for model development and TMDL establishment. An explicit margin of safety is when a specified percentage of assimilative capacity is kept unassigned to account for uncertainties, lack of sufficient data, or future growth.

The indicator bacteria criteria used in this TMDL analysis were developed exclusively from data derived from studies conducted at high use public bathing areas of which half were affected by point source discharges. Therefore, the criteria provide an additional level of protection when applied to water not designated for high use bathing and without point sources such as those within these watersheds. As a result, achieving the criteria results in an "implicit" MOS. A portion of this "implicit" MOS will be removed via use of the Source Tracking Adjustment Factor (STAF), a tool that will be used in the implementation and best management practice designs during development of the Pollution Control Strategies (PCS) following the adoption of the TMDL. However, the STAF incorporates an explicit margin of safety so that a portion of the "implicit" MOS remains intact. Therefore, an adequate margin of safety is included in the bacteria TMDLs.

7.0 The proposed Chesapeake Bay Drainage Basin River Watershed TMDL has been subject to public participation.

An important public participation activity regarding this TMDL was the formation of the Tributary Action Teams in the Chesapeake Bay Drainage Basin. The Tributary Action Teams, made up of concerned citizens and other affected parties within the watershed will assist the DNREC in developing pollution control strategies (PCS) to implement the requirements of the proposed Chesapeake Bay Drainage Basin River Watershed TMDL.

In addition to the public participation and stakeholder involvement mentioned above, a public workshop was held on June 6, 2006 to present the proposed Appoquinimink River Watershed TMDL to the public and receive comments prior to formal adoption of the TMDL regulation. Comments received within the June 1 through June 30 comment period were considered when finalizing this document.

8.0 There should be a reasonable assurance that the proposed Chesapeake Bay Drainage Basin River Watershed TMDL can be met.

The proposed Chesapeake Bay Drainage Basin River Watershed TMDL considers the reduction of bacteria from point and nonpoint sources. The magnitude of load reductions suggested by the proposed TMDL are feasible. Following the adoption of the TMDL, the Chesapeake Bay Drainage Basin River Tributary Action Team will assist the Department in developing a PCS to implement the requirements of the Chesapeake Bay Drainage Basin River Watershed TMDL Regulation. The DNREC is planning to finalize and adopt the Chesapeake Bay Drainage Basin River PCS within one year after formal adoption of the TMDL Regulation.

6 Appendix

6.1 Chester River Watershed Data

# sample	Date	Source	enterococcus (CFU/100 mL)	Precip.(in)[1] 24h	48h	96h	Condition[2] (WET/DRY)
1	6/10/1997	112021	103	0	0	0	DRY
2	6/10/1997	112031	93	0	0	0	DRY
3	8/5/1997	112021	180	0.1	0.5	0.5	**WET**
4	8/5/1997	112031	550	0.1	0.5	0.5	**WET**
5	12/1/1997	112021	35	0	0.3	0.3	**WET**
6	12/1/1997	112031	97	0	0.3	0.3	**WET**
7	6/3/1998	112021	193	0	0	0.1	DRY
8	6/3/1998	112031	213	0	0	0.1	DRY
9	8/12/1998	112021	967	0	2.3	2.3	**WET**
10	8/12/1998	112031	2000	0	2.3	2.3	**WET**
11	12/8/1998	112021	190	0	0	0	DRY
12	12/8/1998	112031	68.5	0	0	0	DRY
13	6/2/1999	112021	90	0	0	0	DRY
14	6/2/1999	112031	40	0	0	0	DRY
15	9/7/1999	112021	567	0.7	1.5	1.7	**WET**
16	9/7/1999	112031	2000	0.7	1.5	1.7	**WET**
17	11/15/1999	112021	113	0	0	0	DRY
18	11/15/1999	112031	290	0	0	0	DRY
19	4/18/2000	112021	600	0.3	0.3	1.4	**WET**
20	4/18/2000	112031	600	0.3	0.3	1.4	**WET**
21	5/10/2000	112021	280	0	0	0	DRY
22	5/10/2000	112031	330	0	0	0	DRY
23	8/2/2000	112021	600	0	0.1	0.4	DRY
24	8/2/2000	112031	600	0	0.1	0.4	DRY
25	10/3/2000	112021	370	0	0	0	DRY
26	10/3/2000	112031	900	0	0	0	DRY
27	5/9/2001	112011	14	0	0	0	DRY
28	5/9/2001	112021	51	0	0	0	DRY
29	5/9/2001	112031	19	0	0	0	DRY
30	5/9/2001	112591	210	0	0	0	DRY
31	5/9/2001	112601	28	0	0	0	DRY
32	5/9/2001	112611	6	0	0	0	DRY
33	5/9/2001	112621	3	0	0	0	DRY
34	5/9/2001	112631	20	0	0	0	DRY
35	5/10/2001	112581	53	0	0	0	DRY
36	6/4/2001	112011	123	0	0.4	0.7	**WET**
37	6/4/2001	112021	390	0	0.4	0.7	**WET**
38	6/4/2001	112031	480	0	0.4	0.7	**WET**
39	6/4/2001	112581	55	0	0.4	0.7	**WET**
40	6/4/2001	112591	220	0	0.4	0.7	**WET**

41	6/4/2001	112601	250	0	0.4	0.7	**WET**
42	6/4/2001	112611	205	0	0.4	0.7	**WET**
43	6/4/2001	112621	77	0	0.4	0.7	**WET**
44	6/4/2001	112631	210	0	0.4	0.7	**WET**
45	8/15/2001	112011	470	0	0.8	7.3	**WET**
46	8/15/2001	112031	310	0	0.8	7.3	**WET**
47	8/15/2001	112581	340	0	0.8	7.3	**WET**
48	8/15/2001	112591	1533	0	0.8	7.3	**WET**
49	8/15/2001	112611	240	0	0.8	7.3	**WET**
50	8/15/2001	112621	210	0	0.8	7.3	**WET**
51	8/15/2001	112631	385	0	0.8	7.3	**WET**
52	8/16/2001	112021	350	0	0	2	**WET**
53	8/17/2001	112601	530	0	0	0.8	DRY
54	10/24/2001	112031	860	0	0	0	DRY
55	10/24/2001	112581	17	0	0	0	DRY
56	10/24/2001	112591	1000	0	0	0	DRY
57	10/24/2001	112611	440	0	0	0	DRY
58	10/24/2001	112621	57	0	0	0	DRY
59	10/24/2001	112631	163	0	0	0	DRY
60	10/25/2001	112021	1033				DRY
61	10/26/2001	112601	170				DRY
62	4/3/2002	112011	23	0	0	1	DRY
63	4/3/2002	112021	20	0	0	1	DRY
64	4/3/2002	112031	520	0	0	1	DRY
65	4/3/2002	112581	23	0	0	1	DRY
66	4/3/2002	112591	220	0	0	1	DRY
67	4/3/2002	112601	20	0	0	1	DRY
68	4/3/2002	112611	53	0	0	1	DRY
69	4/3/2002	112621	5	0	0	1	DRY
70	4/3/2002	112631	10	0	0	1	DRY
71	5/4/2004	112021	163	0.3	0.5	0.5	**WET**
72	5/4/2004	112031	2000	0.3	0.5	0.5	**WET**
73	8/9/2004	112021	127	0	0	0	DRY
74	8/9/2004	112031	150	0	0	0	DRY
75	10/18/2004	112021	90	0	0.1	0.8	DRY
76	10/18/2004	112031	87	0	0.1	0.8	DRY

6.2 Choptank River Watershed Data

# sample	Date	Source	enterococcus (CFU/100 mL)	Precip.(in)[1] 24h	48h	96h	Condition[2] (WET/DRY)
1	6/11/1997	207021	26	0	0	0	DRY
2	6/11/1997	207081	117	0	0	0	DRY
3	6/11/1997	207091	133	0	0	0	DRY
4	6/11/1997	207111	80	0	0	0	DRY
5	9/30/1997	207021	31	0	0.5	0.5	**WET**
6	9/30/1997	207081	117	0	0.5	0.5	**WET**
7	9/30/1997	207091	600	0	0.5	0.5	**WET**
8	9/30/1997	207111	500	0	0.5	0.5	**WET**
9	12/15/1997	207021	10	0	0	0	DRY
10	12/15/1997	207081	21	0	0	0	DRY
11	12/15/1997	207091	16	0	0	0	DRY
12	12/15/1997	207111	41	0	0	0	DRY
13	5/5/1998	207021	53	0.1	0.4	0.6	**WET**
14	5/5/1998	207081	190	0.1	0.4	0.6	**WET**
15	5/5/1998	207091	520	0.1	0.4	0.6	**WET**
16	5/5/1998	207111	93	0.1	0.4	0.6	**WET**
17	8/27/1998	207021	133	0	0	0	DRY
18	8/27/1998	207081	1167	0	0	0	DRY
19	8/27/1998	207091	867	0	0	0	DRY
20	8/27/1998	207111	300	0	0	0	DRY
21	12/7/1998	207021	3	0	0	0	DRY
22	12/7/1998	207081	3	0	0	0	DRY
23	12/7/1998	207091	3	0	0	0	DRY
24	12/7/1998	207111	7	0	0	0	DRY
25	5/10/1999	207021	10	0	0	0	DRY
26	5/10/1999	207081	37	0	0	0	DRY
27	5/10/1999	207091	50	0	0	0	DRY
28	5/10/1999	207111	90	0	0	0	DRY
29	9/7/1999	207021	190	0.7	1.5	1.7	**WET**
30	9/7/1999	207081	410	0.7	1.5	1.7	**WET**
31	9/7/1999	207091	2000	0.7	1.5	1.7	**WET**
32	9/7/1999	207111	2000	0.7	1.5	1.7	**WET**
33	11/10/1999	207021	33	0	0	0	DRY
34	11/10/1999	207081	73	0	0	0	DRY
35	11/10/1999	207091	70	0	0	0	DRY
36	11/10/1999	207111	43	0	0	0	DRY
37	4/12/2000	207021	4.5	0	0	0.7	DRY
38	4/12/2000	207081	3	0	0	0.7	DRY
39	4/12/2000	207091	1	0	0	0.7	DRY
40	4/12/2000	207111	3	0	0	0.7	DRY
41	5/10/2000	207021	107	0	0	0	DRY

42	5/10/2000	207081	90	0	0	0	DRY
43	5/10/2000	207091	113	0	0	0	DRY
44	5/10/2000	207111	220	0	0	0	DRY
45	8/2/2000	207021	280	0	0.1	0.4	DRY
46	8/2/2000	207081	370	0	0.1	0.4	DRY
47	8/2/2000	207091	600	0	0.1	0.4	DRY
48	8/2/2000	207111	420	0	0.1	0.4	DRY
49	10/3/2000	207021	107	0	0	0	DRY
50	10/3/2000	207081	160	0	0	0	DRY
51	10/3/2000	207091	320	0	0	0	DRY
52	10/3/2000	207111	220	0	0	0	DRY
53	10/3/2000	207111	360	0	0	0	DRY
54	4/2/2001	207021	25	0	0	1.3	DRY
55	4/2/2001	207081	28	0	0	1.3	DRY
56	4/2/2001	207091	42	0	0	1.3	DRY
57	4/2/2001	207111	25	0	0	1.3	DRY
58	4/2/2001	207111	28	0	0	1.3	DRY
59	4/2/2001	207121	50	0	0	1.3	DRY
60	4/2/2001	207131	18	0	0	1.3	DRY
61	4/2/2001	207141	16	0	0	1.3	DRY
62	4/2/2001	207151	15	0	0	1.3	DRY
63	4/2/2001	207161	37	0	0	1.3	DRY
64	4/2/2001	207171	25	0	0	1.3	DRY
65	4/2/2001	207181	14	0	0	1.3	DRY
66	4/2/2001	207191	1	0	0	1.3	DRY
67	6/18/2001	207021	1000	0.1	4.2	4.2	**WET**
68	6/18/2001	207081	1367	0.1	4.2	4.2	**WET**
69	6/18/2001	207091	1600	0.1	4.2	4.2	**WET**
70	6/18/2001	207111	1033	0.1	4.2	4.2	**WET**
71	6/18/2001	207121	1800	0.1	4.2	4.2	**WET**
72	6/18/2001	207131	1767	0.1	4.2	4.2	**WET**
73	6/18/2001	207141	1400	0.1	4.2	4.2	**WET**
74	6/18/2001	207151	1100	0.1	4.2	4.2	**WET**
75	6/18/2001	207161	933	0.1	4.2	4.2	**WET**
76	6/18/2001	207171	2000	0.1	4.2	4.2	**WET**
77	6/18/2001	207181	1500	0.1	4.2	4.2	**WET**
78	6/18/2001	207191	767	0.1	4.2	4.2	**WET**
79	8/13/2001	207021	150	1.2	6.5	7.2	**WET**
80	8/13/2001	207021	1067	1.2	6.5	7.2	**WET**

81	8/13/2001	207081	1133	1.2	6.5	7.2	**WET**
82	8/13/2001	207091	2000	1.2	6.5	7.2	**WET**
83	8/13/2001	207111	147	1.2	6.5	7.2	**WET**
84	8/13/2001	207121	2000	1.2	6.5	7.2	**WET**
85	8/13/2001	207131	1167	1.2	6.5	7.2	**WET**
86	8/13/2001	207141	1567	1.2	6.5	7.2	**WET**
87	8/13/2001	207151	1200	1.2	6.5	7.2	**WET**
88	8/13/2001	207161	1567	1.2	6.5	7.2	**WET**
89	8/13/2001	207171	1267	1.2	6.5	7.2	**WET**
90	8/13/2001	207181	210	1.2	6.5	7.2	**WET**
91	8/13/2001	207191	420	1.2	6.5	7.2	**WET**
92	10/30/2001	207021	23	0	0	0	DRY
93	10/30/2001	207081	200	0	0	0	DRY
94	10/30/2001	207091	30	0	0	0	DRY
95	10/30/2001	207111	260	0	0	0	DRY
96	10/30/2001	207121	340	0	0	0	DRY
97	10/30/2001	207131	167	0	0	0	DRY
98	10/30/2001	207141	20	0	0	0	DRY
99	10/30/2001	207161	20	0	0	0	DRY
100	10/30/2001	207171	77	0	0	0	DRY
101	10/30/2001	207181	210	0	0	0	DRY
102	10/30/2001	207191	330	0	0	0	DRY
103	4/1/2002	207021	20	0.6	1	1	**WET**
104	4/1/2002	207081	80	0.6	1	1	**WET**
105	4/1/2002	207091	520	0.6	1	1	**WET**
106	4/1/2002	207111	130	0.6	1	1	**WET**
107	4/1/2002	207121	33	0.6	1	1	**WET**
108	4/1/2002	207131	113	0.6	1	1	**WET**
109	4/1/2002	207141	93	0.6	1	1	**WET**
110	4/1/2002	207151	140	0.6	1	1	**WET**
111	4/1/2002	207161	37	0.6	1	1	**WET**
112	4/1/2002	207171	53	0.6	1	1	**WET**
113	4/1/2002	207181	107	0.6	1	1	**WET**
114	4/1/2002	207191	27	0.6	1	1	**WET**
115	4/13/2004	207021	1470	2.2	2.4	2.6	**WET**
116	4/13/2004	207081	2000	2.2	2.4	2.6	**WET**
117	4/13/2004	207091	1770	2.2	2.4	2.6	**WET**
118	4/13/2004	207111	1815	2.2	2.4	2.6	**WET**

119	6/21/2004	207021	70	0	0	0.2	DRY
120	6/21/2004	207081	160	0	0	0.2	DRY
121	6/21/2004	207091	2000	0	0	0.2	DRY
122	6/21/2004	207111	90	0	0	0.2	DRY
123	8/9/2004	207021	50	0	0	0	DRY
124	8/9/2004	207081	36	0	0	0	DRY
125	8/9/2004	207091	107	0	0	0	DRY
126	8/9/2004	207111	93	0	0	0	DRY
127	10/18/2004	207021	300	0	0.1	0.8	DRY
128	10/18/2004	207081	97	0	0.1	0.8	DRY
129	10/18/2004	207091	137	0	0.1	0.8	DRY
130	10/18/2004	207111	270	0	0.1	0.8	DRY
131	1/3/2005		27	0	0	0	DRY
132	1/19/2005		80	0	0	0	DRY
133	1/31/2005		27	0.2	0.5	0.5	**WET**
134	2/15/2005		90	0.7	0.7	0.7	**WET**
135	2/28/2005		23	0	0	0.4	DRY
136	3/9/2005		103	0.8	1.1	1.1	**WET**

6.3 Marshyhope Creek Watershed Data

# sample	Date	Source	enterococcus (CFU/100 mL)	Precip.(in)[1] 24h	48h	96h	Condition[2] (WET/DRY)
1	6/11/1997	302021	6	0	0	0	DRY
2	6/11/1997	302031	3	0	0	0	DRY
3	9/30/1997	302021	30	0	0.5	0.5	**WET**
4	9/30/1997	302031	24	0	0.5	0.5	**WET**
5	12/15/1997	302021	22	0	0	0	DRY
6	12/15/1997	302031	9	0	0	0	DRY
7	5/5/1998	302021	6	0.1	0.4	0.6	**WET**
8	5/5/1998	302031	10	0.1	0.4	0.6	**WET**
9	8/27/1998	302021	270	0	0	0	DRY
10	8/27/1998	302031	230	0	0	0	DRY
11	12/7/1998	302021	3	0	0	0	DRY
12	12/7/1998	302031	7	0	0	0	DRY
13	5/10/1999	302021	13	0	0	0	DRY
14	5/10/1999	302031	7	0	0	0	DRY
15	9/7/1999	302021	405	0.7	1.5	1.7	**WET**
16	9/7/1999	302031	310	0.7	1.5	1.7	**WET**
17	11/10/1999	302021	70	0	0	0	DRY
18	11/10/1999	302031	23	0	0	0	DRY
19	4/12/2000	302021	1	0	0	0.7	DRY
20	4/12/2000	302031	17	0	0	0.7	DRY
21	5/10/2000	302021	6	0	0	0	DRY
22	5/10/2000	302031	3	0	0	0	DRY
23	8/2/2000	302021	163	0	0.1	0.4	DRY
24	8/2/2000	302031	78	0	0.1	0.4	DRY
25	10/3/2000	302021	767	0	0	0	DRY
26	10/3/2000	302031	70	0	0	0	DRY
27	4/3/2001	302021	9	0	0	0.1	DRY
28	4/3/2001	302021	24	0	0	0.1	DRY
29	4/3/2001	302031	7	0	0	0.1	DRY
30	4/3/2001	302041	2	0	0	0.1	DRY
31	4/3/2001	302051	10	0	0	0.1	DRY
32	6/18/2001	302021	633	0.1	4.2	4.2	**WET**
33	6/18/2001	302021	1800	0.1	4.2	4.2	**WET**
34	6/18/2001	302031	1700	0.1	4.2	4.2	**WET**
35	6/18/2001	302041	1233	0.1	4.2	4.2	**WET**
36	6/18/2001	302051	633	0.1	4.2	4.2	**WET**
37	8/13/2001	302021	2000	1.2	6.5	7.2	**WET**
38	8/13/2001	302031	2000	1.2	6.5	7.2	**WET**
39	8/13/2001	302041	315	1.2	6.5	7.2	**WET**
40	8/13/2001	302051	767	1.2	6.5	7.2	**WET**
41	10/30/2001	302021	300	0	0	0	DRY

42	10/30/2001	302031	17	0	0	0	DRY
43	10/30/2001	302041	17	0	0	0	DRY
44	10/30/2001	302051	47	0	0	0	DRY
45	4/1/2002	302021	142	0.6	1	1	**WET**
46	4/1/2002	302031	480	0.6	1	1	**WET**
47	4/1/2002	302041	2000	0.6	1	1	**WET**
48	4/1/2002	302051	2000	0.6	1	1	**WET**
49	4/13/2004	302021	1330	2.2	2.4	2.6	**WET**
50	4/13/2004	302031	2000	2.2	2.4	2.6	**WET**
51	6/21/2004	302021	83	0	0	0.2	DRY
52	6/21/2004	302031	33	0	0	0.2	DRY
53	7/19/2004	302031	240	0.1	0.6	0.6	**WET**
54	8/9/2004	302021	22	0	0	0	DRY
55	8/9/2004	302031	57	0	0	0	DRY
56	11/3/2004	302031	30	0	0	0	DRY
57	12/1/2004	302031	113	0.2	0.2	1.5	**WET**
58	12/1/2004		160	0.2	0.2	1.5	**WET**
59	1/3/2005	302031	10	0	0	0	DRY
60	1/3/2005		100	0	0	0	DRY
61	1/19/2005	302031	23	0	0	0	DRY
62	1/19/2005		60	0	0	0	DRY
63	1/31/2005	302031	33	0.2	0.5	0.5	**WET**
64	1/31/2005		35	0.2	0.5	0.5	**WET**
65	2/15/2005	302031	460	0.7	0.7	0.7	**WET**
66	2/15/2005		60	0.7	0.7	0.7	**WET**
67	2/28/2005	302031	74	0	0	0.4	DRY
68	2/28/2005		37	0	0	0.4	DRY
69	3/9/2005	302031	340	0.8	1.1	1.1	**WET**
70	3/9/2005		610	0.8	1.1	1.1	**WET**

6.4 Pocomoke River Watershed Data

# sample	Date	Source	enterococcus (CFU/100 mL)	Precip.(in)[1] 24h	48h	96h	Condition[2] (WET/DRY)
1	5/12/1997	313011	46	0	0	0.4	DRY
2	7/9/1997	313011	445	0	0	0	DRY
3	10/7/1997	313011	280	0	0	0	DRY
4	5/12/1998	313011	370	0.6	0.7	1.8	**WET**
5	7/17/1998	313011	170	0	0	0	DRY
6	9/10/1998	313011	800	0	0	0.8	DRY
7	10/6/1998	313011	340	0	0.2	0.6	DRY
8	5/27/1999	313011	97	0	0	0.1	DRY
9	8/23/1999	313011	450	0	0	1.8	DRY
10	11/30/1999	313011	83	0	0	0.7	DRY
11	3/28/2000	313011	49	1.2	1.2	1.5	**WET**
12	5/22/2000	313011	310	0.1	0.4	0.4	**WET**
13	8/14/2000	313011	600	1.5	1.6	1.6	**WET**
14	8/14/2000	313021	600	1.5	1.6	1.6	**WET**
15	8/14/2000	313031	600	1.5	1.6	1.6	**WET**
16	8/14/2000	313041	600	1.5	1.6	1.6	**WET**
17	8/14/2000	313051	600	1.5	1.6	1.6	**WET**
18	10/4/2000	313011	470	0	0	0	DRY
19	10/4/2000	313021	505	0	0	0	DRY
20	10/4/2000	313031	290	0	0	0	DRY
21	10/4/2000	313041	390	0	0	0	DRY
22	10/4/2000	313051	390	0	0	0	DRY
23	4/4/2001	313011	9	0	0	0	DRY
24	4/4/2001	313021	11	0	0	0	DRY
25	4/4/2001	313031	6	0	0	0	DRY
26	4/4/2001	313041	8	0	0	0	DRY
27	4/4/2001	313051	8	0	0	0	DRY
28	6/5/2001	313011	600	0.1	0.1	0.8	**WET**
29	6/5/2001	313021	600	0.1	0.1	0.8	**WET**
30	6/5/2001	313031	600	0.1	0.1	0.8	**WET**
31	6/5/2001	313041	600	0.1	0.1	0.8	**WET**
32	6/5/2001	313051	600	0.1	0.1	0.8	**WET**
33	8/8/2001	313011	220	0	0	0	DRY
34	8/8/2001	313021	200	0	0	0	DRY
35	8/8/2001	313031	63	0	0	0	DRY
36	8/8/2001	313041	57	0	0	0	DRY
37	8/8/2001	313051	800	0	0	0	DRY
38	10/29/2001	313011	133	0	0	0	DRY
39	10/29/2001	313021	103	0	0	0	DRY
40	10/29/2001	313031	113	0	0	0	DRY
41	10/29/2001	313041	110	0	0	0	DRY
42	10/29/2001	313051	140	0	0	0	DRY

43	4/2/2002	313011	163	0	0.6	1	**WET**
44	4/2/2002	313021	133	0	0.6	1	**WET**
45	4/2/2002	313031	40	0	0.6	1	**WET**
46	4/2/2002	313041	570	0	0.6	1	**WET**
47	4/2/2002	313051	147	0	0.6	1	**WET**
48	6/4/2002	313011	110	0	0	0	DRY
49	6/4/2002	313021	200	0	0	0	DRY
50	6/4/2002	313031	130	0	0	0	DRY
51	6/4/2002	313041	50	0	0	0	DRY
52	6/4/2002	313051	123	0	0	0	DRY
53	7/25/2002	313011	167	0	1.5	1.5	**WET**
54	7/25/2002	313021	390	0	1.5	1.5	**WET**
55	7/25/2002	313031	160	0	1.5	1.5	**WET**
56	7/25/2002	313041	300	0	1.5	1.5	**WET**
57	7/25/2002	313051	150	0	1.5	1.5	**WET**
58	12/3/2002	313011	52	0	0	0.1	DRY
59	12/3/2002	313021	103	0	0	0.1	DRY
60	12/3/2002	313031	30	0	0	0.1	DRY
61	12/3/2002	313041	30	0	0	0.1	DRY
62	12/3/2002	313051	33	0	0	0.1	DRY
63	4/2/2003	313011	7	0	0	0.5	DRY
64	4/2/2003	313021	5	0	0	0.5	DRY
65	4/2/2003	313031	7	0	0	0.5	DRY
66	4/2/2003	313041	7	0	0	0.5	DRY
67	4/2/2003	313051	3	0	0	0.5	DRY
68	6/23/2003	313011	65	0	0	1.2	DRY
69	6/23/2003	313021	67	0	0	1.2	DRY
70	6/23/2003	313031	63	0	0	1.2	DRY
71	6/23/2003	313041	33	0	0	1.2	DRY
72	6/23/2003	313051	53	0	0	1.2	DRY
73	8/27/2003	313011	485	0.3	0.3	0.3	**WET**
74	10/22/2003	313011	3	0	0	0	DRY
75	3/2/2004	313011	27	0.1	0.1	0.1	**WET**
76	5/17/2004	313011	700	0	0	0	DRY
77	7/20/2004	313011	280	0	0.1	0.6	DRY
78	9/27/2004	313011	200	0	0	0	DRY

6.5 Nanticoke River Drainage Basin Data (Nanticoke River, Gum Branch, Gravelly Branch, Deep Creek, Broad Creek Watersheds)

# sample	Date	Source	enterococcus (CFU/100 mL)	Precip.(in)[1] 24h	48h	96h	Condition[2] (WET/DRY)
1	3/20/2000	304031	36	0	0	1.1	DRY
2	3/20/2000	304041	19	0	0	1.1	DRY
3	3/20/2000	304191	29	0	0	1.1	DRY
4	3/20/2000	304291	25	0	0	1.1	DRY
5	3/20/2000	304311	29	0	0	1.1	DRY
6	3/20/2000	304321	11	0	0	1.1	DRY
7	3/20/2000	304471	31	0	0	1.1	DRY
8	3/20/2000	307011	52	0	0	1.1	DRY
9	3/20/2000	307171	24	0	0	1.1	DRY
10	3/20/2000	316011	26	0	0	1.1	DRY
11	3/21/2000	304011	47	0.3	0.3	0.3	**WET**
12	3/21/2000	304021	33	0.3	0.3	0.3	**WET**
13	3/21/2000	304071	18	0.3	0.3	0.3	**WET**
14	3/21/2000	304091	15	0.3	0.3	0.3	**WET**
15	3/21/2000	304101	29	0.3	0.3	0.3	**WET**
16	3/21/2000	304141	25	0.3	0.3	0.3	**WET**
17	3/21/2000	304151	29	0.3	0.3	0.3	**WET**
18	3/21/2000	304171	93	0.3	0.3	0.3	**WET**
19	3/21/2000	304461	69	0.3	0.3	0.3	**WET**
20	6/26/2000	304031	67	0.1	0.1	0.1	DRY
21	6/26/2000	304041	31	0.1	0.1	0.1	DRY
22	6/26/2000	304191	36	0.1	0.1	0.1	DRY
23	6/26/2000	304291	20	0.1	0.1	0.1	DRY
24	6/26/2000	304311	4	0.1	0.1	0.1	DRY
25	6/26/2000	304321	20	0.1	0.1	0.1	DRY
26	6/26/2000	304471	63	0.1	0.1	0.1	DRY
27	6/26/2000	307011	31	0.1	0.1	0.1	DRY
28	6/26/2000	307171	24	0.1	0.1	0.1	DRY
29	6/26/2000	316011	113	0.1	0.1	0.1	DRY
30	6/27/2000	304011	30	0	0.1	0.1	DRY
31	6/27/2000	304021	34	0	0.1	0.1	DRY
32	6/27/2000	304071	17	0	0.1	0.1	DRY
33	6/27/2000	304091	27	0	0.1	0.1	DRY
34	6/27/2000	304101	43	0	0.1	0.1	DRY
35	6/27/2000	304141	42	0	0.1	0.1	DRY
36	6/27/2000	304151	51	0	0.1	0.1	DRY
37	6/27/2000	304171	70	0	0.1	0.1	DRY
38	6/27/2000	304461	104	0	0.1	0.1	DRY
39	7/26/2000	304031	80	0.1	0.1	0.1	DRY
40	7/26/2000	304041	460	0.1	0.1	0.1	DRY
41	7/26/2000	304191	570	0.1	0.1	0.1	DRY

42	7/26/2000	304291	280	0.1	0.1	0.1	DRY
43	7/26/2000	304311	23	0.1	0.1	0.1	DRY
44	7/26/2000	304321	36	0.1	0.1	0.1	DRY
45	7/26/2000	304471	137	0.1	0.1	0.1	DRY
46	7/26/2000	307011	600	0.1	0.1	0.1	DRY
47	7/26/2000	307171	180	0.1	0.1	0.1	DRY
48	7/26/2000	316011	270	0.1	0.1	0.1	DRY
49	7/27/2000	304011	289	1.2	1.3	1.4	**WET**
50	7/27/2000	304021	600	1.2	1.3	1.4	**WET**
51	7/27/2000	304071	97	1.2	1.3	1.4	**WET**
52	7/27/2000	304091	143	1.2	1.3	1.4	**WET**
53	7/27/2000	304101	460	1.2	1.3	1.4	**WET**
54	7/27/2000	304141	600	1.2	1.3	1.4	**WET**
55	7/27/2000	304151	600	1.2	1.3	1.4	**WET**
56	7/27/2000	304171	600	1.2	1.3	1.4	**WET**
57	7/27/2000	304461	600	1.2	1.3	1.4	**WET**
58	10/16/2000	304031	87	0	0	0	DRY
59	10/16/2000	304041	40	0	0	0	DRY
60	10/16/2000	304191	50	0	0	0	DRY
61	10/16/2000	304291	127	0	0	0	DRY
62	10/16/2000	304311	3	0	0	0	DRY
63	10/16/2000	304321	10	0	0	0	DRY
64	10/16/2000	304471	70	0	0	0	DRY
65	10/16/2000	307011	117	0	0	0	DRY
66	10/16/2000	307171	20	0	0	0	DRY
67	10/16/2000	316011	63	0	0	0	DRY
68	10/17/2000	304011	77	0	0	0	DRY
69	10/17/2000	304021	73	0	0	0	DRY
70	10/17/2000	304071	50	0	0	0	DRY
71	10/17/2000	304091	127	0	0	0	DRY
72	10/17/2000	304101	123	0	0	0	DRY
73	10/17/2000	304141	60	0	0	0	DRY
74	10/17/2000	304151	20	0	0	0	DRY
75	10/17/2000	304171	57	0	0	0	DRY
76	10/17/2000	304461	53	0	0	0	DRY
77	4/24/2001	304031	73	0	0	0	DRY
78	4/24/2001	304041	28	0	0	0	DRY
79	4/24/2001	304191	35	0	0	0	DRY
80	4/24/2001	304291	7	0	0	0	DRY

81	4/24/2001	304311	38	0	0	0	DRY
82	4/24/2001	304321	32	0	0	0	DRY
83	4/24/2001	304471	49	0	0	0	DRY
84	4/24/2001	307011	32	0	0	0	DRY
85	4/24/2001	307171	20	0	0	0	DRY
86	4/24/2001	316011	33	0	0	0	DRY
87	4/25/2001	304011	7	0.3	0.3	0.3	**WET**
88	4/25/2001	304021	15	0.3	0.3	0.3	**WET**
89	4/25/2001	304071	4	0.3	0.3	0.3	**WET**
90	4/25/2001	304091	4	0.3	0.3	0.3	**WET**
91	4/25/2001	304101	7	0.3	0.3	0.3	**WET**
92	4/25/2001	304141	37	0.3	0.3	0.3	**WET**
93	4/25/2001	304151	32	0.3	0.3	0.3	**WET**
94	4/25/2001	304171	53	0.3	0.3	0.3	**WET**
95	4/25/2001	304461	53	0.3	0.3	0.3	**WET**
96	6/19/2001	304031	260	0	0.1	4.2	**WET**
97	6/19/2001	304041	210	0	0.1	4.2	**WET**
98	6/19/2001	304191	497	0	0.1	4.2	**WET**
99	6/19/2001	304291	767	0	0.1	4.2	**WET**
100	6/19/2001	304311	50	0	0.1	4.2	**WET**
101	6/19/2001	304321	220	0	0.1	4.2	**WET**
102	6/19/2001	304471	260	0	0.1	4.2	**WET**
103	6/19/2001	307011	43	0	0.1	4.2	**WET**
104	6/19/2001	307171	33	0	0.1	4.2	**WET**
105	6/19/2001	316011	300	0	0.1	4.2	**WET**
106	6/20/2001	304011	175	0	0	4.2	**WET**
107	6/20/2001	304021	700	0	0	4.2	**WET**
108	6/20/2001	304071	1100	0	0	4.2	**WET**
109	6/20/2001	304091	220	0	0	4.2	**WET**
110	6/20/2001	304101	200	0	0	4.2	**WET**
111	6/20/2001	304141	113	0	0	4.2	**WET**
112	6/20/2001	304151	107	0	0	4.2	**WET**
113	6/20/2001	304171	123	0	0	4.2	**WET**
114	6/20/2001	304461	180	0	0	4.2	**WET**
115	7/10/2001	304031	87	0	0.1	0.1	DRY
116	7/10/2001	304041	115	0	0.1	0.1	DRY
117	7/10/2001	304191	83	0	0.1	0.1	DRY
118	7/10/2001	304311	97	0	0.1	0.1	DRY

119	7/10/2001	304321	23	0	0.1	0.1	DRY
120	7/10/2001	304471	33	0	0.1	0.1	DRY
121	7/10/2001	307011	90	0	0.1	0.1	DRY
122	7/10/2001	307171	60	0	0.1	0.1	DRY
123	7/10/2001	316011	103	0	0.1	0.1	DRY
124	7/11/2001	304011	35	0.1	0.1	0.2	DRY
125	7/11/2001	304021	73	0.1	0.1	0.2	DRY
126	7/11/2001	304071	37	0.1	0.1	0.2	DRY
127	7/11/2001	304091	47	0.1	0.1	0.2	DRY
128	7/11/2001	304101	43	0.1	0.1	0.2	DRY
129	7/11/2001	304141	63	0.1	0.1	0.2	DRY
130	7/11/2001	304151	60	0.1	0.1	0.2	DRY
131	7/11/2001	304171	40	0.1	0.1	0.2	DRY
132	7/11/2001	304461	57	0.1	0.1	0.2	DRY
133	9/12/2001	304011	30	0	0	0	DRY
134	9/12/2001	304021	40	0	0	0	DRY
135	9/12/2001	304071	20	0	0	0	DRY
136	9/12/2001	304091	10	0	0	0	DRY
137	9/12/2001	304101	20	0	0	0	DRY
138	9/12/2001	304141	23	0	0	0	DRY
139	9/12/2001	304151	53	0	0	0	DRY
140	9/12/2001	304171	77	0	0	0	DRY
141	9/12/2001	304461	73	0	0	0	DRY
142	3/18/2002	304031	180	0.7	0.7	0.7	**WET**
143	3/18/2002	304041	70	0.7	0.7	0.7	**WET**
144	3/18/2002	304191	1933	0.7	0.7	0.7	**WET**
145	3/18/2002	304291	64	0.7	0.7	0.7	**WET**
146	3/18/2002	304311	27	0.7	0.7	0.7	**WET**
147	3/18/2002	304321	83	0.7	0.7	0.7	**WET**
148	3/18/2002	304471	570	0.7	0.7	0.7	**WET**
149	3/18/2002	307011	37	0.7	0.7	0.7	**WET**
150	3/18/2002	307171	3	0.7	0.7	0.7	**WET**
151	3/18/2002	316011	590	0.7	0.7	0.7	**WET**
152	3/20/2002	304011	20	0.3	0.6	1.2	**WET**
153	3/20/2002	304021	23	0.3	0.6	1.2	**WET**
154	3/20/2002	304071	10	0.3	0.6	1.2	**WET**
155	3/20/2002	304091	10	0.3	0.6	1.2	**WET**
156	3/20/2002	304101	10	0.3	0.6	1.2	**WET**

157	3/20/2002	304141	53	0.3	0.6	1.2	**WET**
158	3/20/2002	304151	60	0.3	0.6	1.2	**WET**
159	3/20/2002	304171	87	0.3	0.6	1.2	**WET**
160	3/20/2002	304461	107	0.3	0.6	1.2	**WET**
161	5/22/2002	304011	5	0	0	0.6	DRY
162	5/22/2002	304021	23	0	0	0.6	DRY
163	5/22/2002	304031	13	0	0	0.6	DRY
164	5/22/2002	304041	27	0	0	0.6	DRY
165	5/22/2002	304071	3	0	0	0.6	DRY
166	5/22/2002	304091	3	0	0	0.6	DRY
167	5/22/2002	304101	10	0	0	0.6	DRY
168	5/22/2002	304141	30	0	0	0.6	DRY
169	5/22/2002	304151	43	0	0	0.6	DRY
170	5/22/2002	304171	37	0	0	0.6	DRY
171	5/22/2002	304191	17	0	0	0.6	DRY
172	5/22/2002	304291	13	0	0	0.6	DRY
173	5/22/2002	304311	10	0	0	0.6	DRY
174	5/22/2002	304321	7	0	0	0.6	DRY
175	5/22/2002	304461	27	0	0	0.6	DRY
176	5/22/2002	304471	23	0	0	0.6	DRY
177	5/22/2002	307011	30	0	0	0.6	DRY
178	5/22/2002	307171	10	0	0	0.6	DRY
179	5/22/2002	316011	33	0	0	0.6	DRY
180	7/16/2002	304031	83	0	0.1	0.2	DRY
181	7/16/2002	304041	77	0	0.1	0.2	DRY
182	7/16/2002	304191	22	0	0.1	0.2	DRY
183	7/16/2002	304291	2000	0	0.1	0.2	DRY
184	7/16/2002	304311	7	0	0.1	0.2	DRY
185	7/16/2002	304321	27	0	0.1	0.2	DRY
186	7/16/2002	304471	47	0	0.1	0.2	DRY
187	7/16/2002	307011	53	0	0.1	0.2	DRY
188	7/16/2002	307171	57	0	0.1	0.2	DRY
189	7/16/2002	316011	173	0	0.1	0.2	DRY
190	7/17/2002	304011	34	0	0	0.2	DRY
191	7/17/2002	304021	40	0	0	0.2	DRY
192	7/17/2002	304071	23	0	0	0.2	DRY
193	7/17/2002	304091	20	0	0	0.2	DRY

194	7/17/2002	304101	10	0	0	0.2	DRY
195	7/17/2002	304141	23	0	0	0.2	DRY
196	7/17/2002	304151	47	0	0	0.2	DRY
197	7/17/2002	304171	30	0	0	0.2	DRY
198	7/17/2002	304461	93	0	0	0.2	DRY
199	9/24/2002	304031	47	0	0	0	DRY
200	9/24/2002	304041	53	0	0	0	DRY
201	9/24/2002	304191	47	0	0	0	DRY
202	9/24/2002	304291	20	0	0	0	DRY
203	9/24/2002	304311	40	0	0	0	DRY
204	9/24/2002	304321	3	0	0	0	DRY
205	9/24/2002	304471	30	0	0	0	DRY
206	9/24/2002	307011	53	0	0	0	DRY
207	9/24/2002	307171	7	0	0	0	DRY
208	9/24/2002	316011	57	0	0	0	DRY
209	9/25/2002	304011	32	0	0	0	DRY
210	9/25/2002	304021	23	0	0	0	DRY
211	9/25/2002	304071	23	0	0	0	DRY
212	9/25/2002	304091	27	0	0	0	DRY
213	9/25/2002	304101	17	0	0	0	DRY
214	9/25/2002	304141	33	0	0	0	DRY
215	9/25/2002	304151	40	0	0	0	DRY
216	9/25/2002	304171	33	0	0	0	DRY
217	9/25/2002	304461	37	0	0	0	DRY
218	3/11/2003	304041	7	0	0	0	DRY
219	3/11/2003	304191	20	0	0	0	DRY
220	3/11/2003	304291	37	0	0	0	DRY
221	3/11/2003	304311	17	0	0	0	DRY
222	3/11/2003	304321	3	0	0	0	DRY
223	3/11/2003	304381	7	0	0	0	DRY
224	3/11/2003	304471	10	0	0	0	DRY
225	3/11/2003	304661	3	0	0	0	DRY
226	3/11/2003	304671	3	0	0	0	DRY
227	3/11/2003	307011	7	0	0	0	DRY
228	3/11/2003	307171	27	0	0	0	DRY
229	3/11/2003	316011	40	0	0	0	DRY
230	3/12/2003	304011	17	0.1	0.1	0.1	**WET**
231	3/12/2003	304071	20	0.1	0.1	0.1	**WET**

232	3/12/2003	304091	20	0.1	0.1	0.1	**WET**
233	3/12/2003	304151	23	0.1	0.1	0.1	**WET**
234	3/12/2003	304461	37	0.1	0.1	0.1	**WET**
235	6/24/2003	304041	27	0	0	0.8	DRY
236	6/24/2003	304191	57	0	0	0.8	DRY
237	6/24/2003	304291	20	0	0	0.8	DRY
238	6/24/2003	304311	43	0	0	0.8	DRY
239	6/24/2003	304321	3	0	0	0.8	DRY
240	6/24/2003	304381	133	0	0	0.8	DRY
241	6/24/2003	304471	37	0	0	0.8	DRY
242	6/24/2003	304661	20	0	0	0.8	DRY
243	6/24/2003	304671	53	0	0	0.8	DRY
244	6/24/2003	307011	47	0	0	0.8	DRY
245	6/24/2003	307171	53	0	0	0.8	DRY
246	6/24/2003	316011	27	0	0	0.8	DRY
247	6/25/2003	304011	29	0	0	0	DRY
248	6/25/2003	304071	47	0	0	0	DRY
249	6/25/2003	304091	47	0	0	0	DRY
250	6/25/2003	304151	57	0	0	0	DRY
251	6/25/2003	304461	77	0	0	0	DRY
252	7/9/2003	304011	35	0	0.1	0.1	DRY
253	7/9/2003	304041	33	0	0.1	0.1	DRY
254	7/9/2003	304071	40	0	0.1	0.1	DRY
255	7/9/2003	304091	50	0	0.1	0.1	DRY
256	7/9/2003	304151	33	0	0.1	0.1	DRY
257	7/9/2003	304191	30	0	0.1	0.1	DRY
258	7/9/2003	304291	32	0	0.1	0.1	DRY
259	7/9/2003	304311	30	0	0.1	0.1	DRY
260	7/9/2003	304321	13	0	0.1	0.1	DRY
261	7/9/2003	304381	320	0	0.1	0.1	DRY
262	7/9/2003	304461	53	0	0.1	0.1	DRY
263	7/9/2003	304471	73	0	0.1	0.1	DRY
264	7/9/2003	304671	140	0	0.1	0.1	DRY
265	7/9/2003	307011	63	0	0.1	0.1	DRY
266	7/9/2003	307171	17	0	0.1	0.1	DRY
267	7/9/2003	316011	30	0	0.1	0.1	DRY
268	9/24/2003	304011	87	0.6	0.8	0.8	**WET**
269	9/24/2003	304041	80	0.6	0.8	0.8	**WET**

270	9/24/2003	304071	90	0.6	0.8	0.8	**WET**
271	9/24/2003	304091	70	0.6	0.8	0.8	**WET**
272	9/24/2003	304151	83	0.6	0.8	0.8	**WET**
273	9/24/2003	304191	87	0.6	0.8	0.8	**WET**
274	9/24/2003	304291	83	0.6	0.8	0.8	**WET**
275	9/24/2003	304311	63	0.6	0.8	0.8	**WET**
276	9/24/2003	304321	300	0.6	0.8	0.8	**WET**
277	9/24/2003	304381	80	0.6	0.8	0.8	**WET**
278	9/24/2003	304461	67	0.6	0.8	0.8	**WET**
279	9/24/2003	304471	53	0.6	0.8	0.8	**WET**
280	9/24/2003	304671	57	0.6	0.8	0.8	**WET**
281	9/24/2003	307011	70	0.6	0.8	0.8	**WET**
282	9/24/2003	307171	53	0.6	0.8	0.8	**WET**
283	9/24/2003	316011	73	0.6	0.8	0.8	**WET**
284	3/29/2004	304011	5	0	0	0	DRY
285	3/29/2004	304041	37	0	0	0	DRY
286	3/29/2004	304071	3	0	0	0	DRY
287	3/29/2004	304091	3	0	0	0	DRY
288	3/29/2004	304151	3	0	0	0	DRY
289	3/29/2004	304191	13	0	0	0	DRY
290	3/29/2004	304291	7	0	0	0	DRY
291	3/29/2004	304311	17	0	0	0	DRY
292	3/29/2004	304321	3	0	0	0	DRY
293	3/29/2004	304381	20	0	0	0	DRY
294	3/29/2004	304461	3	0	0	0	DRY
295	3/29/2004	304471	7	0	0	0	DRY
296	3/29/2004	304671	20	0	0	0	DRY
297	3/29/2004	307011	7	0	0	0	DRY
298	3/29/2004	307171	10	0	0	0	DRY
299	3/29/2004	316011	150	0	0	0	DRY
300	6/1/2004	304011	45	0.1	0.1	0.1	DRY
301	6/1/2004	304041	120	0.1	0.1	0.1	DRY
302	6/1/2004	304071	57	0.1	0.1	0.1	DRY
303	6/1/2004	304091	20	0.1	0.1	0.1	DRY
304	6/1/2004	304151	187	0.1	0.1	0.1	DRY
305	6/1/2004	304191	50	0.1	0.1	0.1	DRY
306	6/1/2004	304291	170	0.1	0.1	0.1	DRY
307	6/1/2004	304311	120	0.1	0.1	0.1	DRY

308	6/1/2004	304321	117	0.1	0.1	0.1	DRY
309	6/1/2004	304381	200	0.1	0.1	0.1	DRY
310	6/1/2004	304461	167	0.1	0.1	0.1	DRY
311	6/1/2004	304471	170	0.1	0.1	0.1	DRY
312	6/1/2004	304671	170	0.1	0.1	0.1	DRY
313	6/1/2004	307011	33	0.1	0.1	0.1	DRY
314	6/1/2004	307171	67	0.1	0.1	0.1	DRY
315	6/1/2004	316011	510	0.1	0.1	0.1	DRY
316	7/26/2004	304011	17	0	0.2	0.2	DRY
317	7/26/2004	304041	73	0	0.2	0.2	DRY
318	7/26/2004	304071	20	0	0.2	0.2	DRY
319	7/26/2004	304091	23	0	0.2	0.2	DRY
320	7/26/2004	304151	50	0	0.2	0.2	DRY
321	7/26/2004	304191	83	0	0.2	0.2	DRY
322	7/26/2004	304291	57	0	0.2	0.2	DRY
323	7/26/2004	304311	13	0	0.2	0.2	DRY
324	7/26/2004	304321	20	0	0.2	0.2	DRY
325	7/26/2004	304381	420	0	0.2	0.2	DRY
326	7/26/2004	304461	360	0	0.2	0.2	DRY
327	7/26/2004	304471	53	0	0.2	0.2	DRY
328	7/26/2004	304671	93	0	0.2	0.2	DRY
329	7/26/2004	307011	5	0	0.2	0.2	DRY
330	7/26/2004	307171	40	0	0.2	0.2	DRY
331	7/26/2004	316011	97	0	0.2	0.2	DRY
332	8/4/2004	304191	120	0.4	0.4	1.7	**WET**
333	8/30/2004	304011	32	0	0	0	DRY
334	8/30/2004	304071	27	0	0	0	DRY
335	8/30/2004	304091	23	0	0	0	DRY
336	8/30/2004	304151	27	0	0	0	DRY
337	8/30/2004	304311	20	0	0	0	DRY
338	8/30/2004	304321	10	0	0	0	DRY
339	8/30/2004	304461	20	0	0	0	DRY
340	8/30/2004	304471	50	0	0	0	DRY
341	8/30/2004	304671	450	0	0	0	DRY
342	8/30/2004	307011	27	0	0	0	DRY
343	8/30/2004	307171	13	0	0	0	DRY
344	8/30/2004	316011	70	0	0	0	DRY
345	8/31/2004	304041	390	1.8	1.8	1.8	**WET**

346	8/31/2004	304191	2000	1.8	1.8	1.8	**WET**
347	8/31/2004	304291	2000	1.8	1.8	1.8	**WET**
348	8/31/2004	304381	2000	1.8	1.8	1.8	**WET**
349	10/27/2004	304191	60	0	0	0	DRY
350	11/15/2004	304191	150	0	0	1.8	DRY
351	12/1/2004	304191	115	0.2	0.2	1.5	**WET**
352	1/3/2005	304191	77	0	0	0	DRY
353	2/15/2005	304191	245	0.7	0.7	0.7	**WET**
354	3/15/2005	304011	10	0	0	0.1	DRY
355	3/15/2005	304041	70	0	0	0.1	DRY
356	3/15/2005	304071	7	0	0	0.1	DRY
357	3/15/2005	304091	3	0	0	0.1	DRY
358	3/15/2005	304151	10	0	0	0.1	DRY
359	3/15/2005	304191	10	0	0	0.1	DRY
360	3/15/2005	304291	5	0	0	0.1	DRY
361	3/15/2005	304311	7	0	0	0.1	DRY
362	3/15/2005	304321	3	0	0	0.1	DRY
363	3/15/2005	304381	33	0	0	0.1	DRY
364	3/15/2005	304461	13	0	0	0.1	DRY
365	3/15/2005	304471	13	0	0	0.1	DRY
366	3/15/2005	304671	7	0	0	0.1	DRY
367	3/15/2005	307011	3	0	0	0.1	DRY
368	3/15/2005	307171	3	0	0	0.1	DRY
369	3/15/2005	316011	23	0	0	0.1	DRY
370	4/27/2005	304191	64	0.3	0.3	0.7	**WET**
371	5/10/2005	304011	15	0	0	0.2	DRY
372	5/10/2005	304041	3	0	0	0.2	DRY
373	5/10/2005	304071	17	0	0	0.2	DRY
374	5/10/2005	304091	7	0	0	0.2	DRY
375	5/10/2005	304151	13	0	0	0.2	DRY
376	5/10/2005	304191	7	0	0	0.2	DRY
377	5/10/2005	304291	9	0	0	0.2	DRY
378	5/10/2005	304311	3	0	0	0.2	DRY
379	5/10/2005	304321	3	0	0	0.2	DRY
380	5/10/2005	304381	3	0	0	0.2	DRY
381	5/10/2005	304461	113	0	0	0.2	DRY
382	5/10/2005	304471	23	0	0	0.2	DRY
383	5/10/2005	304671	33	0	0	0.2	DRY

384	5/10/2005	307011	3	0	0	0.2	DRY
385	5/10/2005	307171	3	0	0	0.2	DRY
386	5/10/2005	316011	3	0	0	0.2	DRY
387	6/14/2005	304191	60	0	0	0	DRY
388	7/11/2005	304011	15	0	0	2.2	**WET**
389	7/11/2005	304041	250	0	0	2.2	**WET**
390	7/11/2005	304071	3	0	0	2.2	**WET**
391	7/11/2005	304091	3	0	0	2.2	**WET**
392	7/11/2005	304151	3	0	0	2.2	**WET**
393	7/11/2005	304191	40	0	0	2.2	**WET**
394	7/11/2005	304291	13	0	0	2.2	**WET**
395	7/11/2005	304311	120	0	0	2.2	**WET**
396	7/11/2005	304321	23	0	0	2.2	**WET**
397	7/11/2005	304381	53	0	0	2.2	**WET**
398	7/11/2005	304461	23	0	0	2.2	**WET**
399	7/11/2005	304471	23	0	0	2.2	**WET**
400	7/11/2005	304671	80	0	0	2.2	**WET**
401	7/11/2005	307011	53	0	0	2.2	**WET**
402	7/11/2005	307171	2000	0	0	2.2	**WET**
403	7/11/2005	316011	190	0	0	2.2	**WET**
404	8/1/2005	304191	50	0	0	0.8	DRY
405	9/13/2005	304011	32	0	0	0	DRY
406	9/13/2005	304041	90	0	0	0	DRY
407	9/13/2005	304071	3	0	0	0	DRY
408	9/13/2005	304091	20	0	0	0	DRY
409	9/13/2005	304151	33	0	0	0	DRY
410	9/13/2005	304191	3	0	0	0	DRY
411	9/13/2005	304291	20	0	0	0	DRY
412	9/13/2005	304311	10	0	0	0	DRY
413	9/13/2005	304321	13	0	0	0	DRY
414	9/13/2005	304381	3	0	0	0	DRY
415	9/13/2005	304461	23	0	0	0	DRY
416	9/13/2005	304471	3	0	0	0	DRY
417	9/13/2005	304671	2000	0	0	0	DRY
418	9/13/2005	307011	3	0	0	0	DRY
419	9/13/2005	307171	97	0	0	0	DRY
420	9/13/2005	316011	3	0	0	0	DRY