Comment Response Document
Regarding the Total Maximum Daily Loads of Fecal Coliform for the Restricted Shellfish Harvesting Areas in Whitehall and Meredith Creeks, Mill Creek, and the Severn River Mainstem of the Severn River Basin in Anne Arundel County, Maryland

The Maryland Department of the Environment (MDE) has conducted a public review of the proposed Total Maximum Daily Loads of Fecal Coliform for the Restricted Shellfish Harvesting Areas in Whitehall and Meredith Creeks, Mill Creek, and the Severn River Mainstem of the Severn River Basin. The public comment period was open from June 25, 2007 to July 24, 2007. MDE received 4 sets of written comments.

Below is a list of commentors, their affiliation, the date comments were submitted, and the numbered references to the comments submitted. In the pages that follow, comments are summarized and listed along with the corresponding MDE response.

Author	Affiliation	Date	Comment Number
Ms. Mary L. Searing	Anne Arundel County Department of Public Works	July 24, 2007	1-6
Mr. John G. Leocha	Maryland Department of Planning Water and Sewerage Planning Unit	July 2, 2007	7
Mr. Kurt Riegel	Severn River Association	July 24, 2007	8-15
Ms. Sally Horner	Severn River Commission	July 24, 2007	16-21

Comment 1 The commentor asks when the Bacteria Source Tracking (BST) data will be made available and requests that the Maryland Department of the Environment (MDE) informs Anne Arundel County of this matter at that time.

Response 1 BST results for the Severn River watershed will be available in 2009. BST monitoring will begin in November of 2007 and will continue until October of 2008. This will conclude the monitoring period, and consequently the BST analysis and results from this monitoring data are expected in March of 2009. Below is a table summarizing the schedule for the BST monitoring and analysis for all of the tidal bacteria impairments.

Schedule for BST Monitoring and Analysis for the Tidal Bacteria Impairments

Watershed	Station	2002 - 2003	2003 - 2004	2004 - 2005	2005 - 2006	2006 - 2007	2007 - 2008	2008 - 2009	2009 - 2010
Patuxent River lower	26		MON	BST					
Potomac River L tidal	4			MON	BST				
St. Mary's River	7			MON	BST				
Breton Bay	2			MON	BST				
St. Clement Bay	6			MON	BST				
Wicomico River	2			MON	BST				
Honga River	1					MON	BST		
Little Choptank	1					MON	BST		
Lower Choptank	16					MON	BST		
Eastern Bay	2					MON	BST		
Kent Narrows-Prospect Bay	1					MON	BST		
Miles River	3					MON	BST		
Wye River	7	BST							
Lower Chester River	1				MON	BST			
Corsica River	1				MON	BST			
Isle of Wight Bay	1				MON	BST			
Lower Pocomoke River	7				MON	BST			
Tangier Sound	2				MON	BST			
Manokin River	3				MON	BST			
Lower Wicomico River	5	MON	BST						
Monie Bay	1						MON	BST	
Nanticoke River	7	MON	BST						
Magothy River	10						MON	BST	
Severn River	9						MON	BST	
South River	11						MON	BST	
West River	4						MON	BST	
West Chesapeake Bay	2						MON	BST	

Notes:

MON = Monitoring year (Nov - Oct)

BST = BST ARA analysis results due (March)

Comment 2 The commentor states that Anne Arundel County has developed both land use/land cover and impervious area datasets based on IKONOS satellite imagery, which was captured in May of 2004. This data shows somewhat different results than the land use/land cover data used within the Total Maximum Daily Load (TMDL). In particular, the amount (in acres) of crop, forest, and residential urban land uses are different between the two data sets. The commentor reports that Anne Arundel County had provided MDE with this data, but it was not used in the TMDL analysis. The commentor then asks for an explanation as to why this data was not used. Next, the commentor states that this different land use analysis will affect the Wasteload Allocations (WLAs) within the

document, as it was determined that WLA loads will be best estimated assuming equitable diffuse loads from all land use categories. The commentor further reports that since the stormwater load is calculated by multiplying the diffuse load by the proportion of urban land use within the watershed, if incorrect values of urban land are used, then incorrect stormwater loads can be calculated.

Response 2 The land use data generated by the county contained within the *Severn River Watershed Management Master Plan Current Conditions Report* were provided to MDE. The Department reviewed the descriptions of the land use data in the report, which on page 2 states that "GIS data updates are current as of January 2000, the date of the orthophotography used. Information from mapping and GIS analysis is based on a variety of sources, created at various times by various agencies. It is generally at a planning level of accuracy and should be used for spatial analysis at a scale that aggregates to catchments, at the 50 to 100 acre level." For the purpose of Severn watershed TMDL, in order to be consistent with other bacteria TMDLs developed by MDE, the 2000 Maryland Department of Planning (MDP) land use data was used instead.

All land use/land cover data will vary based on the classification scheme applied and the method used to develop the data (cadastral data (i.e., property data), aerial photography, satellite imagery (i.e., IKONOS, etc.). MDE used a different land use classification technique than the one used by the County, resulting in a slight discrepancy between the two land use data sets. Based on the County land use data, the total estimated urban land use in the three restricted shellfish harvesting area watersheds is 24,166 acres. The total urban land use area based on MDP data is 23,649 acres. Therefore, the stormwater loads estimated based on the urban land use will not cause large discrepancies. The County land use data provides more detailed information of residential areas, which is useful for implementation. Crop land estimated by the County and MDP land use data are 2,353 and 3,403 acres, respectively. MDP land use data gave a larger estimated Crop land acreage. Crop land use was only used to estimate fecal coliform sources from livestock, and since total crop land is about 7% of the total area, the discrepancies in estimating fecal coliform sources due to land use data will not affect the overall results.

Comment 3 The commentor states that Anne Arundel County has produced several documents regarding work that has been done as part of the Severn River watershed study. These documents include the *Severn River Watershed Management Master Plan Current Conditions Report*, which was created in 2002, and the *Severn River Watershed Management Master Plan Final Report*, which was produced in February of 2006. These studies are a requirement of the County's Municipal Separate Storm Sewer (MS4) permit. The commentor further states that even though these studies and consequent reports were required by the MS4 permit, the information contained in these reports was not included in the draft TMDL. The commentor concludes by asking MDE to explain why these reports were not used in the development of the draft TMDL.

Response 3 MDE has reviewed the documents mentioned by the commentor. However, since the reports did not provide fecal colifrom source information, and did not explain how model parameters were used for estimating fecal coliform loads, MDE did not directly use the information provided by these reports. While, the County reports were not used for the purpose of this TMDL, they provide a highly detailed analysis at the subwatershed level, which will be useful during the TMDL implementation process. To estimate the fecal coliform loads to the Severn watershed, MDE used an inverse method. The estimated loads, although in the same order of magnitude, do not always agree with the County model results.

Comment 4 The commentor reports that the TMDL does not account for the bacterial contribution from recreational vessels. The commentor then asks whether or not MDE has investigated other jurisdictions across the country to see if this potential contribution has been addressed. According to the commentor, it is not adequate to simply state that no attempt to quantify this potential source will be made, when all other bacterial sources have been estimated. MDE should at least cite sources that were investigated to determine whether or not this source could be estimated. The commentor looked into whether or not other states had addressed this source within their bacteria TMDLs and discovered that some states did include bacterial loads from recreational vessels within the WLA of the TMDL.

Response 4 During the time of TMDL development, no documented data regarding the amount of fecal coliform discharged from recreational vessels was identified by MDE. Since contributions from recreational vessels are location dependent, the information from other states is not applicable for waterbodies within Maryland. Based on the best information available, contributions from overboard discharges are negligible, impossible to document, and cannot be captured in MDE's routine monitoring of shellfish waters for fecal coliform.

Comment 5 The commentor states that the portion of the load allocation attributed to humans seems very low given that only 26% of the watershed is currently served by sanitary sewer systems, which was estimated in the *Severn River Current Conditions Report*. The commentor then asks MDE to clarify how the loads were determined to incorporate 74% of the watershed as being on septic systems.

Response 5 The estimation of septic systems has been updated in the final document. About 71% of households within the watershed are served by a sanitary sewer system and 29% are on septic systems. The total number of septic systems is estimated based on MDP 2004 GIS data. As stated in Appendix C, the estimated fecal coliform loading from septic systems was calculated as follows:

$$Load = P\ S\ F_r\ C\ Q\ C_V$$

Where
P = number of people per septic system
S = number of septic systems in the restricted area
F_r = failure rate of septic systems
C = fecal coliform concentration of wastewater
Q = daily discharge of wastewater per person
C_V = unit conversion factor (37.854)

The number of people using each septic system is estimated by the ratio of the population to the number of septic systems. In the absence of a shoreline sanitary survey data, the estimated septic system failure rate of 3% for coastal restricted shellfish harvesting areas was used. This rate is in the same range as that in the upper Chesapeake Bay.

Comment 6 The commentor references Appendix C, which states that the nonpoint source wildlife load was calculated by first multiplying the population density of a species by the associated amount of habitat area for that species within the watershed, as represented by an estimated proportion of the watershed's acreage or an estimated number of stream miles. This value was subsequently multiplied by the fecal coliform production rates for that species to produce a total load. The commentor then questions whether the equation used to calculate the wildlife contribution takes into consideration the fact that not all of the fecal coliform produced by various animal species is actually deposited directly into the stream or carried to the stream via runoff. Finally, the commentor references a bacteria TMDL developed for the Shenandoah River in Virginia (found at http://www.deq.virginia.gov/tmdl/apptmdls/shenrvr/nfshen.pdf), which assumes that only a certain percentage of the wildlife bacteria load is deposited into the river reach.

Response 6 The analysis used in this TMDL would be more precise if it took into consideration the fact that only a portion of the fecal coliform produced by various animal species actually reaches the edge of the stream. However, since about 70% of the wildlife in this watershed is composed of waterfowl (i.e., ducks and geese) and there is large uncertainty related to (1) the fecal coliform production rates and (2) the proportion of waste that is deposited on land (as opposed to directly into the stream), the wildlife contribution used in this TMDL is the best-available estimation rather than a precise quantification of this source. In the future, these loads will be reevaluated with the aid of BST results that are expected to become available in 2009 (see Response 1).

Comment 7 The commentor states that Figure C-1, which shows the distribution of septic systems within the Severn River basin, is misleading, particularly in the Annapolis, Arnold, and Severna Park areas. The commentor then asks MDE to review the sewer service area maps for Annapolis and Broadneck and reduce the point symbol used to represent septic systems in Figure C-1 in order to give a more accurate portrayal. The

commentor also points out that data regarding the number of households in the watershed served and not served by a public sewer system is available, and this data shows that 70% of all households in the watershed are served by public sewer systems.

Response 7 The nature of Figure C-1 does not lend itself towards giving an accurate portrayal of the percentage of households served by public sewer systems. Rather, the purpose of the figure is to merely present the distribution and location of households served by septic systems. The total number of septic systems is estimated based on the MDP 2004 GIS layer, in which individual properties are represented by point symbols. The map was updated and the point symbols used to represent septic systems were reduced. The estimated households in the watershed served by the public sewer system is about 71%.

Comment 8 The commentor states that the information contained in the TMDL is but one of many factors, perhaps not the most important one, that ought to influence a decision to permit wider shellfish harvesting. The commentor continues to say that minimum shellfish population levels should also be dictated by ecosystem requirements, since water quality itself depends upon the existence of robust shellfish populations. Shellfish harvest rates must also depend on species diversity and yield sustainability constraints. For theses reasons, the commentor states that compliance with the approved TMDL, while important, cannot be the only criterion for harvesting shellfish.

Response 8 The factors listed by the commentor, such as ecosystem requirements, species diversity, and yield sustainability are components of fishery management plans, which are the responsibility of Maryland Department of Natural Resources (DNR). MDE is required to assess attainment of water quality criteria. For shellfish harvesting waters, this includes bacteriological criteria for fecal coliform and does not address shellfish resources.

Comment 9 The commentor states that the Severn River Association is concerned about the relative fecal coliform contributions estimated from dogs and humans. The commentor then states that even though there is a limited amount of reliable data regarding potential loadings from failing septic systems, boat heads, and leaking sewer pump stations, there must be some basis to come up with an estimate from these sources. Furthermore, the commentor states that the literature value of 3% in relation to the failure rate for septic systems may not be representative of the situation in the Severn River watershed, where many former summer homes with inadequate septic fields have been converted to year round residences. Due to these reasons, the commentor believes that the wildlife and pet loads are overestimated, with respective contributions between 9-71% and 17-87% of the total load, and the human load is an underestimate at 0.6-2.4% of the total load.

Response 9 The method used to estimate fecal coliform contributions from each source category in this document is based on the most recent data available at the time of

the project's inception. In the future, these loads will be validated with the aid of BST results that are expected to become available in 2009 (see Response 1).

Response 5 explained how the Department estimated fecal colifrom loads from failing septic systems. The Department welcomes and will review any information the Association has regarding a more accurate septic system failure rate to be applied in the watershed in order to account for the former summer homes with inadequate septic fields, if such data is available. This information will be useful during TMDL implementation.

MDE used the best data available to estimate the fecal coliform nonpoint source load from pets. MDE applied data published by the Center for Watershed Protection in the document entitled *A Survey of Residential Nutrient Behaviors in the Chesapeake Bay*. Based on the information provided in this document (i.e., the percent of households that own a dog, walk their dog, and clean up their pet's waste), MDE calculated expected fecal coliform pet loads.

Comment 10 The commentor states that Anne Arundel County has a pet waste litter law, and that many of the Association's members have seen dog owners pick up after their pets. Consequently, this should result in a lower estimate of the fecal coliform pet contribution to the watershed system.

Response 10 See Response 9.

Comment 11 The commentor informs MDE that the hyperlink on page 35 to the BST schedule is not working.

Response 11 The hyperlink on page 35 has been edited and now works properly.

Comment 12 The commentor states that research has proven that using antibiotic resistance patterns to conduct BST analyses is one of the least reliable methods in identifying sources of fecal coliform. The commentor concludes by asking whether the State will be able to apply a more reliable and affordable method should one be developed.

Response 12 Some investigators have suggested that molecular methods are more accurate than non-molecular techniques, and the antibiotic resistance analysis (ARA) method has been criticized as being too variable a characteristic for reliable source identification. However, scientific reports published to date have not yet established whether molecular methods are more reliable or accurate than ARA as a fecal sourcing methodology. The science is still emerging and no sufficient verification studies have been conducted for either the molecular or non-molecular techniques to determine if one technique is more reliable than another. To date, ARA appears to be the best method available for rapid source identification on the large numbers of isolates that are needed

to obtain a statistically valid sample size. In addition, to minimize the potential of any unreliability, MDE works with the same laboratory for all BST analysis. Furthermore, sample collection for the known source library and the water samples collected representing unknowns are conducted at the same time from the same watershed. Thus, the Department is confident in using the ARA method for BST analysis.

Comment 13 The commentor states that TMDL implementation is a major concern for the Severn River Association. Furthermore, the commentor points out that according to the TMDL document, watersheds where wildlife is the primary source of fecal coliform might not be able to meet the associated water quality standards. While the commentor agrees that eliminating wildlife is not a desirable goal, the commentor mentions that the document does not make any references to implementing stormwater controls or riparian buffers, both of which could reduce wildlife and pet contributions.

Response 13 An implementation plan is beyond the scope of this TMDL report; however, the Department recognizes that stormwater controls may be important in achieving the fecal coliform TMDLs. Stormwater controls are expected to be instituted via the MS4 permitting process, which regulates runoff on a BMP basis.

Comment 14 The commentor points out that there are great variations among the reported fecal coliform concentrations highlighting that this is most likely a result of capturing rain events. The commentor proceeds to state that data on the input of enteric bacteria following rain events gathered by the Anne Arundel County Health Department will confirm the need for both a reduction and treatment of stormwater bacteria loads to the watershed following heavy rain events. The commentor further states that the Severn River Association has sponsored the program *Operation Cleanwater*, which monitors the number of enteric bacteria found at beaches and marinas throughout the Severn River watershed, for over thirty years. Furthermore, the commentor points out that these data can be found at the association's website (http://www.severnriver.org) under "Operation Cleanwater Results." According to the commentor, the single most striking aspect of the data is the correlation between recent rainfall events and the numbers of enteric bacteria, which further confirms not only the need to retrofit stormwater controls for existing developments, roads, and parking lots but also the need for better systems of controlling stormwater in future developments.

Response 14 See Response 13.

Comment 15 The commentor states that the Severn River Association encourages MDE to utilize current and emerging resources to both monitor and model environmentally significant parameters in the Severn River watershed. The commentor provides an example of an emerging resource that MDE may be able to apply to future projects as well as an example of a currently available resource that MDE could apply for ongoing projects. Resources mentioned by the commentor include the U.S. Naval Academy's

Center for Chesapeake Bay Observation and Modeling (being developed by David L. Kriebel) and the *Severn River Management Tool*.

Response 15 MDE is always looking for new methods and resources that can be utilized in TMDL development and will consider using the specific resources mentioned above for future TMDLs.

Comment 16 The commentor states that the Severn River Commission's primary concern relates to the bacteria source estimates to the Severn River watershed. The commentor states that, at the moment, we do not have data indicating whether fecal coliform recovered from the Severn River are from human or other sources. The commentor also states that we know that dogs and wildlife are important non-human sources of bacteria to the watershed system, and that potential human sources include failing septic systems, leaks in public sewer systems, which include power failures at pumping stations, and boat heads. The commentor then reiterates that fecal coliform may be harbored in legacy sediments where bacteria may be redistributed into the water column, thereby providing an additional source contribution that cannot be estimated due to a lack of data. Furthermore, the commentor points out that MDE recognizes four potential non point sources of fecal coliform: livestock, pets (dogs), humans, and wildlife. The commentor then discusses the use of 3% as the estimated septic system failure rate, and states that this average may not be reflective of the true failure rate within the Severn River watershed, where many former summer houses have been converted to year round residences with inadequate septic fields.

Response 16 Routine monitoring for fecal coliform does not distinguish the source of bacteria. The assumption of the monitoring program is that the bacteria are originally from warm-blooded animal sources and not sediments. As stated in Response 1, the BST data will be available by March of 2009 and will help to further characterize the sources of fecal coliform to the waterbody. As for the methods used to account for failing septic system rates, please see Response 5 and Response 9.

Comment 17 The commentor compares the average daily human and dog fecal coliform contributions used in the document, which are 28 million fecal coliform per day and 5 billion fecal coliform per day respectively. The commentor then states that the Center for Watershed Protection estimates the average daily contributions from humans and dogs to be about the same at 2 billion fecal coliform per day. Combining the low average daily human contribution with the low septic system failure rate of 3% results in a low human bacterial contribution of 1.5% of the total load. Because of these low human contribution assumptions applied in the calculation, the subwatersheds of the Severn River basin are estimated as having between 17-87% pet contributions and 9-71% wildlife contributions. The commentor states that only 0.6-2.4% of the total nonpoint source load is estimated to be human, and concludes by stating that it appears as if low estimates were used for the human sources of bacteria while the highest literature values were used to estimate the dog and wildlife contributions.

Response 17 See Response 9. The fecal coliform concentrations from humans and dogs used in this document are from USEPA's fecal coliform TMDL development documents (*Bacteria Indicator Tool User's Guide* (2000) and *Protocol for Developing Pathogen TMDLs* (2001)). The human fecal cloiform concentration ranges from 1x10^5 to 1x10^6 MPN/100mL. The commentor is right in stating that the value used in the TMDL analysis can be considered as a low estimate for the human contribution. In the future, these loads will be validated with the aid of BST results that are expected to become available in 2009 (see Response 1).

Comment 18 The commentor states that the analysis does not take into account contributions from the transport of bacterial loads through the public sewer system, despite knowing that frequent power failures at pumping stations lead to sewage leaks into nearby waters. Additionally, due to a lack of data, the analysis does not consider source contributions from boat heads, thereby discounting this potential source.

Response 18 Anne Arundel County has an excellent record for quickly responding to sewage spills and for minimizing sewage overboard discharges from pump station failures. The county has vacuum trucks on hand for quick response to minimize any overflows into shellfish harvesting waters. In addition, all pumping stations in Anne Arundel County are connected to a 24-hour telemetering system, have dual systems for back up pumps, and have a minimum of 2-hour holding in the event of failure. Reporting of sewage spills to the Department is required and our records indicate that contributions of untreated sewage from public sewers to the shellfish harvesting areas included in this TMDL are negligible. For information related to discharge from recreational vehicles see Response 4.

Comment 19 The commentor points out that the hyperlink to the online BST schedule in the document does not work. The commentor also points out that the TMDL document reports that the Department is using antibiotic resistance patterns to conduct BST analyses. The commentor then declares that this method is one of the least reliable methods used to determine sources of fecal coliform, and that new methods of conducting BST are currently being developed. The commentor states that according to MDE, the antibiotic resistance method was selected because it is one of the least expensive techniques available in conducting BST analyses. The commentor then states that this is an area that needs further investigation and points out that research on the subject is currently being conducted at Salisbury University, but it will require many years to complete. The commentor concludes by asking MDE whether or not the State will be able to apply a more reliable and cost effective method should one be developed?

Response 19 See Response 11 & Response 12.

Comment 20 The commentor points out that the method for determining the margin of safety is based on a conservative estimate of the decay rate of fecal coliform in receiving

waters. The document also reports that the highest fecal coliform concentrations are found during the warmer months, and some literature suggests that fecal coliform may survive for long periods of time in warm water or sediment. Finally, the commentor states that due to these findings, even assuming a conservative value for decay may not provide an adequate margin of safety during the warm summer months.

Response 20 The fecal coliform die-off rate in the aquatic environment depends on a number of factors (i.e., sunlight, predation, turbidity). In addition, there are many questions associated with bacteria decay in sediment, which are still being studied by a number of research institutions. MDE welcomes any data the Commission may have or is aware of with regards to Severn River watershed fecal coliform sediment concentrations. Regarding the effects of temperature on bacterial decay rate, while bacteria may reproduce faster in warm water, it is also known that increased sunlight can kill more bacteria. Thus, MDE believes that the selection of a decay rate at the low end of the range of literature values is a reasonable method of incorporating a MOS.

Comment 21 The commentor is concerned with the Assurance of Implementation section of the TMDL document, which states that if wildlife are found to be a primary source of fecal coliform in some subwatersheds, then these waterbodies may not be able to meet water quality standards. In watersheds where wildlife is found to be one of the major contributors of bacteria, the elimination of wildlife to reduce this source is clearly not a desirable goal. The commentor states that in spite of this, the document does not mention anything about riparian buffers or stormwater controls being implemented in an effort to control wildlife sources of bacteria to the watershed system. Then, the commentor states that a review of the Anne Arundel County Health Department's data on the input of enteric bacteria following major precipitation events will confirm the need for stormwater reductions and treatments to reduce fecal coliform levels in the Severn River basin following heavy rain storms.

Response 21 See Response 13.