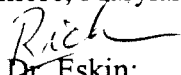


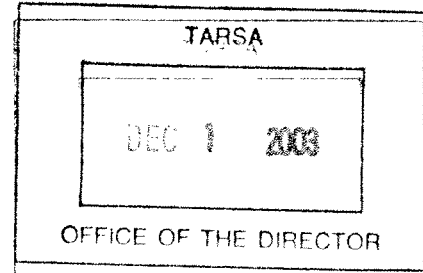


UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

NOV. 26 2003

Dr. Richard Eskin, Acting Director
Technical and Regulatory Services Administration
Maryland Department of the Environment
1800 Washington Boulevard, Suite 540
Baltimore, Maryland 21230-1718


Dear Dr. Eskin:



The Environmental Protection Agency (EPA) Region III is pleased to approve the report, "Total Maximum Daily Loads to Address Low pH in Cherry Creek in the Deep Creek Watershed, Garrett County, Maryland." The TMDL report was submitted to EPA for final review on December 17, 2002, and a Revised Draft Final version was submitted to EPA on October 17, 2003. The TMDL was established and submitted in accordance with Section 303(d)(1)(c) and (2) of the Clean Water Act to address impairments of water quality as identified in Maryland's Section 303(d) list. Cherry Creek, as part of the Deep Creek Watershed, was first identified on Maryland's 1996 Section 303(d) list for low pH and nutrient impairments. The TMDL described in this document was developed to address localized water quality impairments identified within the watershed, specifically low pH stressors in the Cherry Creek watershed that are not naturally occurring. Maryland is to address the nutrients impairment at a later date.

In accordance with Federal regulations at 40 CFR §130.7, a TMDL must comply with the following requirements: (1) designed to attain and maintain the applicable water quality standards, (2) include a total allowable loading and as appropriate, wasteload allocations (WLAs) for point sources and load allocations for nonpoint sources, (3) consider the impacts of background pollutant contributions, (4) take critical stream conditions into account (the conditions when water quality is most likely to be violated), (5) consider seasonal variations, (6) include a margin of safety (which accounts for uncertainties in the relationship between pollutant loads and instream water quality), (7) consider reasonable assurance that the TMDL can be met, and (8) be subject to public participation. The enclosure to this letter describes how the low pH TMDL for Cherry Creek satisfies each of these requirements.

Following the approval of this TMDL, Maryland shall incorporate the TMDL into the Water Quality Management Plan pursuant to 40 CFR § 130.7(d)(2). As you know, all new or revised National Pollutant Discharge Elimination System permits must be consistent with the TMDL wasteload allocations pursuant to 40 CFR §122.44 (d)(1)(vii)(B). Please submit all such permits to EPA for review as per EPA's letter dated October 1, 1998.



If you have any questions or comments concerning this letter, please don't hesitate to contact Ms. Susan Sciarratta at (215) 814-5733.

Sincerely,



Jon M. Capacasa, Director
Water Protection Division

Enclosure

cc: James George, MDE - TARSA
Robert Summers, Director, Water Management Administration, MDE
Melissa Chatham, MDE-TARSA



**Decision Rationale
Total Maximum Daily Loads
to Address Low pH in
Cherry Creek in the Deep Creek Watershed
Garrett County, Maryland**

I. Introduction

The Clean Water Act (CWA) requires a Total Maximum Daily Load (TMDL) be developed for those waterbodies identified as impaired by the state where technology-based and other controls will not provide for attainment of water quality standards. A TMDL is a determination of the amount of a pollutant from point, nonpoint, and natural background sources, including a margin of safety, that may be discharged to a water quality-limited water body without violating water quality standards.

The Maryland Department of the Environment (MDE) submitted the *Total Maximum Daily Loads to Address Low pH in Cherry Creek in the Deep Creek Watershed, Garrett County, Maryland*, dated December 2002 (TMDL Report), to EPA for final Agency review on December 17, 2002.¹ This report included a Total Maximum Daily Loads (TMDL) for acidity expressed as calcium carbonate (CaCO₃), and addresses one segment on Maryland's 1996 Section 303(d) list of impaired waters. Cherry Creek (sub-basin code 05-02-02-03-0029) is a sub-basin of the Deep Creek watershed (basin code 05-02-02-03). Deep Creek Lake is listed for additional impairments, including bacteria, biological, nutrients, and methylmercury in fish tissue. MDE submitted a mercury TMDL to EPA on December 31, 2002. MDE will address the remaining impairments at a later date.

EPA's rationale is based on the TMDL Report and information contained in the Appendices to the report. Our review determined that the TMDL meets the following eight regulatory requirements pursuant to 40 CFR Part 130.

1. The TMDL is designed to implement the applicable water quality standards.
2. The TMDL includes a total allowable load as well as individual Wasteload Allocations (WLAs) and Load Allocations (LAs).

¹Subsequently, MDE submitted a response to EPA's final comments on June 2, 2003 and submitted a revised version of the TMDL Report on October 17, 2003 to correct the description of the designated use of Cherry Creek.

3. The TMDL considers the impacts of background pollutant contributions.
4. The TMDL considers critical environmental conditions.
5. The TMDL considers seasonal environmental variations.
6. The TMDL includes a Margin Of Safety (MOS).
7. There is reasonable assurance that the proposed TMDL can be met.
8. The TMDL has been subject to public participation.

II. Summary

The TMDL was developed using a statistical procedure to ensure that water quality criteria are met at all times as required by Maryland's water quality standards in the Code of Maryland Regulations 26.08.02. Table 1 summarizes the TMDL for Cherry Creek as determined by MDE.

Table 1 - TMDL Summary

<i>Segment</i>	<i>Parameter</i>	<i>TMDL (kg/yr)</i>	<i>WLA¹ (kg/yr)</i>	<i>LA² (kg/yr)</i>	<i>MOS³ (kg/yr)</i>
Cherry Creek ⁴	Acidity (as CaCO ₃)	271155	0	271155	implicit

¹WLA = Wasteload Allocation,

²LA = Load Allocation

³MOS = Margin of Safety

⁴The final TMDL represents the overall load to the entire segment. TMDL computations on a monitoring station basis are shown in Appendix E and summarized in Appendix F

The TMDL is a written plan and analysis established to ensure that a waterbody will attain and maintain water quality standards. The TMDL is a scientifically-based strategy which considers current and foreseeable conditions, the best available data, and accounts for uncertainty with the inclusion of an MOS. Conditions, available data, and the understanding of the natural processes can change more than anticipated by the MOS. The option is always available to refine the TMDL for resubmittal to EPA for approval. Maryland monitors /evaluates its waters based on a rotating five-year watershed cycling strategy. Therefore, while the TMDL should not be modified at the expense of achieving water quality standards expeditiously, the TMDL may be modified when warranted by additional data or other information.

III. Background

Cherry Creek is a subwatershed of the Youghiogheny River basin and flows into Deep Creek Lake. The basin is located in the far western portion of Maryland. A map of the watershed and additional information about the general setting is found in Section 3.0 of the TMDL Report. The land use in the watershed are divided into pasture and forest (69 %), wetlands (12 %), mixed agriculture (10%), and urban uses (9 %).

There are several factors that contribute to the acidic conditions in Cherry Creek. Cherry Creek receives naturally acidic water from peat bogs, in which acidic peat deposits build up. More information about peat bogs is included in Section 3.1.1.a of the TMDL report. The Cherry Creek watershed lies within the Allegheny Formation and Pottsville Formation; both formations lack acid-neutralization capacity such as that found in limestone. An additional description of the geology is included in Section 3.1.1.b of the TMDL report. Because the local geology lacks mineral buffering capacity, the acidic waters originating from the peat bogs remain acidic as they flow down stream.

The anthropogenic sources contributing to the acidic conditions in Cherry Creek include acid mine drainage (AMD) and atmospheric deposition of acidic compounds, where AMD is the dominant of these processes. According to the TMDL report (Section 3.2) coal mining in the Cherry Creek watershed dates back to the early 1800's. The reaction of water and air (oxygen) with the sulfide minerals exposed in the former coal mines produces an acidic discharge known as AMD. These mines all have since been abandoned.

As mentioned above, there are no active mining operations in the watershed. All of the mine-related discharges in the watershed are from abandoned mines and will be treated as nonpoint sources. The distinction between nonpoint and point sources in this case is determined on the basis of whether or not there is a responsible party subject to a National Discharge Pollutant Elimination System (NPDES) permit for the discharge. Where there is no responsible party the discharge is considered to be a nonpoint source. The TMDL was established for one segment, Cherry Creek. The TMDL is expressed as an annual loading rate. The Appendices to the TMDL report contain the detailed TMDL calculations and associated data.

The Surface Mining Control and Reclamation Act of 1977 (SMCRA, Public Law 95-87) and its subsequent revisions were enacted to establish a nationwide program to, among other things, protect the beneficial uses of land or water resources, and public health and safety from the adverse effects of current surface coal mining operations, as well as promote the reclamation of mined areas left without adequate reclamation prior to August 3, 1977. SMCRA requires a permit for the development of new, previously mined, or abandoned sites for the purpose of surface mining. Permittees are required to post a performance bond that will be sufficient to ensure the completion of reclamation requirements by

the regulatory authority in the event that the applicant forfeits. Mines that ceased operating by the effective date of SMCRA, (often called "pre-law" mines) are not subject to the requirements of SMCRA. All of the former mines in the Cherry Creek watershed are no longer active, and therefore, not subject to these permitting requirements. Any future mining would require permit holders to improve water quality in the region.

This TMDL was completed by MDE to meet the calendar year 2002 TMDL commitments under the existing terms of the 1998 Memorandum of Understanding between MDE and EPA, which calls for 28 TMDLs to be developed during 2002.

Computational Procedure

Maryland's water quality standards provide that normal pH values may not be less than 6.5 or greater than 8.5. The regulations do not assign a frequency and therefore, this criterion is in effect at all times. However, Maryland's water quality standards provide a natural conditions clause that states if the natural water quality of a stream segment is not consistent with the criteria established for that stream, then: 1) the natural conditions do not constitute a violation of the water quality standards; and 2) the water quality to be maintained and achieved is not required to be substantially different from that which would occur naturally. Thus, the Cherry Creek TMDL was established with consideration given to both the anthropogenic and natural conditions. MDE determined that maintaining a pH of 4.3 in Cherry Creek would be consistent with the natural conditions of the Creek and that a lower pH would interfere with the designated uses of Cherry Creek, including protection of aquatic life.

The TMDLs were developed using a statistical procedure to ensure that water quality endpoint is met at all times as required by Maryland's water quality standards. The Cherry Creek TMDL iteratively calculates loadings / required reductions for the eight individual monitoring stations, and ultimately establishes one TMDL based on the sum of these individual calculations. The TMDL uses water quality data collected between 1988 and 1994 (12 samples at each of 8 stations along Cherry Creek and its tributaries). Data from a 1972 water quality survey were considered but were not used in the TMDL analysis because an analysis of variance conducted by MDE showed that the conditions represented by the 1972 data were significantly different than the conditions represented by the more current data.

Maryland's TMDL analysis incorporates three basic steps. First, Maryland plots the relationship between acidity and pH in order to convert the pH endpoint of 4.3 to an acidity goal (i.e., 30 mg/l or less). Second, based on the statistical parameters of the actual monitoring data for each monitoring station, Maryland generates synthetic data having the same statistical properties; these data are intended to represent the current conditions of Cherry Creek. Third, Maryland conducts iterative calculations starting at the upstream monitoring station, and continuing downstream, in order to simulate the reductions in acidity that would be required along the creek in order to attain the water quality goal

at all times. Details of these procedures are described in Section 4.0 of the TMDL Report, and the results of the calculations are presented in the Appendices.

The second step of the TMDL analysis described above involved a Monte Carlo Simulation using the @RISK² software program. For this statistical procedure, the analysis assumed that the observed data were lognormally distributed. The simulation was applied under average annual stream flow conditions. Average annual flows were estimated using a regression analysis on historical average flow data from a nearby USGS flow gage. The existing and allowable long-term average loads were computed using the mean concentration from @RISK multiplied by the average flow. Using the sample parameters, mean and standard deviation of the actual collected data, the simulation generates 5000 synthetic data sets for each of the eight sampling stations in the Cherry Creek basin. These data are used to evaluate the distribution of acidity concentrations and allow the estimation of percentile values (e.g., 90th percentile) along a lognormally-distributed curve. This analysis shows whether or not the existing data is from a population where water quality standards are ever exceeded. The third step of the TMDL analysis requires the simulation of reductions in acidity loads, proceeding from upstream to downstream stations, on an iterative basis until the 100th percentile value of acidity for a given station is equal to or less than the endpoint of 30 mg/l. Once the required percent reduction for acidity was determined at each monitoring station, Maryland used mass balance equations to determine the actual load reduction needed at each station.

IV. Discussions of Regulatory Requirements

EPA has determined that these TMDLs are consistent with statutory and regulatory requirements and EPA policy and guidance.

1. The TMDLs are designed to implement the applicable water quality standards.

Water quality standards are state regulations that define the water quality goals of a water body. Standards are comprised of three components, including designated uses, criteria necessary to protect those uses, and antidegradation provisions that prevent the degradation of water quality. The designated use for Cherry Creek is Use I: water contact recreation and protection of aquatic life. For this designated use, the water quality criteria in Code of Maryland Regulations (COMAR) 26.08.02 require that pH may not be less than 6.5 or greater than 8.5 (at all times). For this TMDL, Maryland applied its pH criterion in conjunction with its natural conditions clause (COMAR 26.08.02.03(A)(2)) which is stated in Section III above. The rationale for invoking the natural conditions clause is the

²@RISK - Risk Analysis and Simulation Add-in for Microsoft Excel®, Palisade Corporation, Newfield, NY 2001.

presence of acidic peat bogs throughout the Cherry Creek basin. As a result, Maryland determined the water quality endpoint to be a pH of 4.3 (or greater), which was shown to correspond to a net alkalinity of -30.2 mg/l as CaCO₃ or an acidity of 30.2 mg/l. EPA believes this to be an appropriate determination and application of Maryland's water quality standards.

Maryland does not have a frequency component to its water quality standards with respect to pH, and thus the applicable water quality criteria must be achieved at all times. The TMDL expressed as long-term average concentrations, are expected to meet these requirements. That is, the statistical Monte Carlo simulation used to develop TMDLs and LAs for each parameter results in a determination that any required percent pollutant reduction assures that the water quality criteria will be met instream at 100 percent of the time (i.e., based on the selection of the 100th percentile value). The Monte Carlo simulation used 5000 iterations where each iteration was independent of all other iterations, and the observed data were assumed to be lognormally distributed for each source and pollutant.

EPA finds that these TMDLs will attain and maintain the applicable narrative and numerical water quality standards.

As mentioned above, the target pH value of 4.3 was converted to an acidity endpoint of 30 mg/l, in order to account for the naturally acidic conditions of Cherry Creek. Maryland selected a pH value of 4.3 because that was the average value of the range of pH values in areas of the basin that are unaffected by AMD. The parameter of pH, a measurement of hydrogen ion acidity computed as the negative algorithm of effective hydrogen ion concentration, is not conducive to standard statistics. Additionally, pH does not measure latent acidity that can be produced from hydrolysis of metals. For these reasons, MDE used the following approach to address the stream impairments noted on the Section 303(d) list due to low pH. Based on the observed relationship between net alkalinity and pH, the target pH value was converted to a net alkalinity value of -30 mg/l as CaCO₃. Since the alkalinity of the system is zero, this net alkalinity value equates to an acidity of 30 mg/l. Appendix A of the TMDL report provides additional information on this methodology. This methodology assures that the standard for pH will be met because net alkalinity is able to measure the reduction of acidity. When acidity in a stream is restored to natural levels, the pH will be acceptable (i.e., 4.3 or greater). Therefore, the measured in-stream alkalinity at the point of evaluation in the stream will serve as the goal for reducing total acidity at that point. EPA finds this approach to be reasonable.

2. *The TMDLs include a total allowable load as well as individual WLAs and LAs.*

For purposes of this TMDL, point sources are identified as permitted discharge points and nonpoint sources are other discharges from abandoned mine lands which includes tunnel discharges, seeps, and surface runoff. Abandoned and mine lands were treated in the allocations as nonpoint sources because there are no NPDES permits associated with these areas. As such, the discharges

associated with these landuses were assigned LAs (as opposed to WLAs). The decision to assign LAs to abandoned and reclaimed mine lands does not reflect any determination by EPA as to whether there are unpermitted point source discharges within these landuses. In addition, by approving these TMDLs with mine drainage discharges treated as LAs, EPA is not determining that these discharges are exempt from NPDES permitting requirements. There are no permitted dischargers in the watershed, therefore, the allocations are to nonpoint sources only.

The allowable load for each of the eight sampling stations was computed using water-quality sample data collected from that station. Maryland estimated the existing and allowable concentrations at each station based on the Monte Carlo Simulation described above. The allowable load for each individual station was determined by multiplying the estimated flow at each station by the allowable concentration (i.e., that would attain the water quality standard 100% of the time). The total load to be reduced at that station was computed as the difference between the existing load and the allowable load. The final allowable load for each station was computed by subtracting the sum of the total load reduced upstream of that station and any additional load reduction needed at that station, from the existing load. These calculations are presented in Appendix F of the TMDL report. The calculations show that an overall 88.6% reduction in acidity (as CaCO_3) would be required in order to maintain water quality standards at all times.

It is important to note that MDE calculated the TMDLs using pollutant concentrations instead of loadings and determined the long-term average concentration that could occur, and still attain and maintain water quality standards. The resultant concentration was converted to a long-term average load by multiplying by the annual average flow. Assuming the sample set is lognormally distributed, the long-term average is related to the LA (or WLA) by the coefficient of variation of the sample set. EPA finds this approach reasonable.

MDE allocated only to nonpoint sources as there are no current mining operations within the watershed. Federal regulations require that subsequent to TMDL development and approval, point sources permitted effluent limitations be water quality-based.³ Therefore, no new mining may be permitted within the watershed without reallocation of the TMDL.

3. *The TMDLs consider the impacts of background pollutant contributions.*

Cherry Creek is located in an area that was extensively mined in the past, and abandoned mines are located throughout the watershed. As a result, Cherry Creek has been significantly affected

³It should be noted that technology-based permit limits may be converted to water quality-based limits according to EPA's *Technical Support Document For Water Quality-based Toxics Control*, March 1991, recommendations.

by AMD. The TMDLs were developed using instream data which would account for existing background conditions. In addition, areas of the Cherry Creek watershed that are unaffected by AMD were sampled and evaluated in order to determine and account for the presence of naturally occurring acidic conditions.

4. *The TMDLs consider critical environmental conditions*

The reductions specified in this TMDL apply at all flow conditions. Maryland analyzed acidity data for other watersheds near Cherry Creek and found that there was no significant correlation between source flows and acidity concentration. Thus, a single critical flow condition could not be identified from the data used for this analysis (see Appendix G of the TMDL report). The average annual flow for each sampling station was used to derive loading values for the TMDL.

5. *The TMDLs consider seasonal environmental variations.*

All sample sets included data points from various seasons, which together with the lack of correlations between flow and acidity concentration, indicate that MDE considered seasonal variations.

6. *The TMDLs include an MOS.*

The CWA and Federal regulations require TMDLs to include an MOS to take into account any lack of knowledge concerning the relationship between effluent limitations and water quality. EPA guidance suggests two approaches to satisfy the MOS requirement. First, it can be met implicitly by using conservative model assumptions to develop the allocations. Alternately, it can be met explicitly by allocating a portion of the allowable load to the MOS.

MDE used an implicit MOS in these TMDLs by assuming the treated instream concentration variability to be the same as the untreated stream's concentration variability. This is a more conservative assumption than the general assumption that a treated discharge has less variability than an untreated discharge. By retaining variability in the treated discharge, a lower average concentration is required to meet water quality criteria at all times than if the variability of the treated discharge is reduced. The small number of samples at each station resulted in a large estimated variance in the data set. Consequently, the Monte Carlo Simulation provided large extreme values in the synthetic data sets. In order to assess this effect, Maryland conducted a sensitivity analysis by examining the 99th and 90th percentile values and associated allowable loadings. The difference between the 100th percentile and 90th percentile-based loading estimates, for example, is 21%.

Also, Maryland selected the average observed background pH as the natural conditions endpoint, instead of the minimum observed pH. This results in a more conservative analysis for allowable acidity concentrations and loadings.

7. *There is reasonable assurance that the proposed TMDLs can be met.*

Section 5.0 of the TMDL report outlines the factors that provide a reasonable assurance of TMDL implementation. These include previous studies that provide recommended abatement measures, including strip mine reclamation. MDE's Abandoned Mine Reclamation Program is intended to restore eligible environments that have been degraded by past coal mining practices. Also, any future mining activities in the Cherry Creek watershed would require permit holders to improve water quality in the region. Since the wasteload allocation is zero, no future mining would be allowed unless the TMDL is revised or effluent discharges meet water quality standards.

Maryland also has a five-year watershed cycling strategy which ensures that intensive follow-up monitoring would be performed and the TMDL implementation to be evaluated.

8. *The TMDLs have been subject to public participation.*

MDE public noticed the draft TMDL and offered a public comment period from October 24, 2002 to November 22, 2002. MDE also posted the draft TMDL on its website and routinely posts the final TMDL on its website and provides the written comment response document to all commentors.

MDE received no written comments other than review comments provided by EPA on the preliminary drafts and draft final TMDL reports.

EPA initiated consultation with the United States Fish and Wildlife Service (USFWS) and the United States National Marine Fisheries Service (USNMFS) on March 26, 2002, pursuant to the Endangered Species Act, about the availability of the TMDL. EPA received concurrence from the USFWS on December 21, 2002 and from the USNMFS on July 29, 2003 on the proposed TMDL for Cherry Creek of no adverse impacts to endangered species.