UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029
4/9/2001

Mr. James M. Seif, Secretary
Pennsylvania Department of Environmental Protection
Rachel Carson State Office Building
400 Market Street
Harrisburg, PA 17101

Re: Total Maximum Daily Loads (TMDLs) for the Quittapahilla Creek Watershed

Dear Mr. Seif:

The U. S. Environmental Protection Agency (EPA) Region III, is pleased to approve the Total Maximum Daily Loads (TMDLs) for the Quittapahilla Creek Watershed, submitted by the Pennsylvania Department of Environmental Protection (PADEP) by letter to EPA dated February 16, 2001. The TMDLs were established and submitted in accordance with Section 303(d)(1)© and (2) of the Clean Water Act. The TMDLs were established to address impairments of water quality as identified in Pennsylvania's 1996 and 1998 Section 303(d) lists. Pennsylvania identifies the impairments based on exceedances of nutrients, siltation and suspended sediments. The Quittapahilla Creek Watershed is located in Lebanon County, Pennsylvania.

In accordance with Federal regulations found in 40 CFR '130.7, a TMDL must: be designed to meet water quality standards; include, as appropriate, both wasteload allocations (from point sources) and load allocations (from nonpoint sources); consider the impacts of background pollutant contributions; take critical stream conditions into account (the conditions when water quality is most likely to be violated); consider seasonal variations; include a margin of safety (which accounts for any uncertainties in the relationship between pollutant loads and instream water quality); and be subject to public participation. The enclosure to this letter further describes how the TMDLs for the Quittapahilla Creek Watershed satisfy each of these requirements.

Following the approval of a TMDL, PADEP shall incorporate it into the state's Water Quality Management Plan pursuant to 40 CFR '130.7(d)(2). As you know, any new or revised National Pollution Discharge Elimination Systems permits with applicable effluent limits must be consistent with the TMDL's Waste Load Allocation (WLA) pursuant to 40 CFR '122.44(d)(1)(VII)(B).

Customer Service Hotline: 1-800-438-2474

Any such permit should be submitted to EPA for review consistent with our letter dated October 1, 1998. Please note that PADEP determined there are currently no point source dischargers in the Quittapahilla Creek watershed. If you have further questions, please call me or have your staff contact Mr. Thomas Henry, the TMDL Program Manager, at (215) 814-5752.

Sincerely,

/S/

Rebecca W. Hanmer, Director
Water Protection Division

Enclosure

cc: **Mr. Lawrence Tropea, Jr., PADEP**
Mr. Terry Fabian, PADEP
Mr. Fred Morrocco, PADEP
Mr. Edward Brezina, PADEP

Decision Rationale
Total Maximum Daily Load
for phosphorus and sediments
in the Quittapahilla Creek Watershed
Lebanon County, Pennsylvania

I. Introduction

This document will set forth the Environmental Protection Agency's (EPA) rationale for approving the Total Maximum Daily Load (TMDL) for nutrients and sediments in the Quittapahilla Creek watershed in Lebanon County, Pennsylvania. A TMDL for sediment was developed for the Quittapahilla Creek. TMDLs for phosphorus were developed for the tributaries of Bachman Run, Beck Creek, Killinger Creek and Snitz Creek. The document was submitted by the Pennsylvania Department of Environmental Protection (PADEP) for final Agency review, by letter dated February 16, 2001, and received by EPA on February 20, 2001. Our rationale is based on the TMDL document and information contained in Appendices to the document to determine if the TMDL meets the following eight regulatory conditions pursuant to 40 CFR §130.

1) The TMDL is designed to implement applicable water quality standards.
2) The TMDL includes a total allowable load as well as individual waste load allocations (WLA) and load allocations (LA).
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.
7) The TMDL has been subject to public participation.
8) There is reasonable assurance that the TMDL can be met.

II. Summary

The Quittapahilla Creek Watershed encompasses 77 square miles and is located in Lebanon County, Pennsylvania. Landuse in the watershed is dominated by agriculture (67%) with the remainder of the land divided between development and forested land uses. The entire basin, including its tributaries, is designated a trout stocking fishery (TSF) as listed in 25 PA Code Chapter 93, Section 93.9o.

As a result of chemical sampling and an aquatic biological survey using kick-screen analysis and habitat surveys, PADEP included the 23.7 miles of the Quittapahilla Creek basin on the 1996 Clean Water Act (CWA) section 303(d) list of water quality impaired waterbodies. Four tributaries in the Quittapahilla basin were listed in 1996 as impaired by excess nutrients from agricultural sources. TMDLs developed for waters listed in 1996 are for (1) Bachman Run for 4.7 miles (2) Beck Creek for 7.5 miles (3) Killinger Creek for 5.5 miles and (4) Snitz Creek for 6 miles.

In 1998, changes in impaired stream mileage occurred to the previous listings due to PADEPs employment of a Geographic Information Systems (GIS) approach. In addition, 4.09 miles of Gingrich Run, a tributary to Killinger Creek, was listed as impaired by suspended solids from agriculture. The stream was also noted to be impaired by organic enrichment and low dissolved oxygen from urban runoff and storm sewers. However, further investigation found the source of the problem to be a lumber mill. Under order of a 1997 Consent Decree corrective actions were taken to eliminate the impact. Follow-up surveys by the Department found that organic enrichment and low dissolved oxygen was not a cause of impairment in Gingrich Run. A TMDL was developed for Gingrich run to address total suspended solids through reductions of nutrients and sediment.

For the draft 2000 303(d) list unnamed tributaries to previously listed streams were individually represented in the report with further stream miles added. For the purposes of TMDL development, these segments were aggregated with that of their receiving stream in the sub-watersheds. This is an acceptable application due to the manner in which the TMDL evaluation, analysis, and allocation is developed. Landuses above the impairments and the source of impairments of these smaller un-named tributaries are common to that of the receiving stream and its sub-watershed. The primary source of data for the analysis are GIS layers derived from data on landuse and other watershed characteristics including livestock density, topographic relief, groundwater contributions and cropping practices. The landuse data sets used for this analysis are 30 by 30 meter grids from satellite imagery. The aggregation of segments and sources effectively ensures that the level of precision in the analysis is as close as possible to that of the GIS information. Furthermore, this aggregate watershed analysis approach is consistent with Federal recommendations. Streams and the impairments addressed by the TMDLs for the Quittapahilla watershed are listed in Table 1.

TABLE 1 - WATERS FOR WHICH TMDLS WERE DEVELOPED IN THE QUITTAPAHILLA WATERSHED					
STREAM NAME (STREAM CODE)	GIS KEY	MILES	YEAR LISTED*	Source	Cause
Bachman Run (09724)	1401	4.87	1996	Agriculture	Nutrients
Bachman Run, Unt (09725)	990318-1000-MSE	1.15	2000	Crop Related Agric	Siltation
Bachman Run, Unt (09726)	990318-1000-MSE	0.79	2000	Crop Related Agric	Siltation
Beck Creek (09728)	1404	7.14	1996	Agriculture	Nutrients
Buckholder Run (09711)	990311-0928-MSE	1.69	2000	Agriculture	Siltation
Gingrich Run (09710)	7037	4.09	1998	Agriculture	Suspended Solids
Gingrich Run, Unt (09712)	990311-0928-MSE	1.45	2000	Agriculture	Siltation
Gingrich Run, Unt (09713)	990311-0928-MSE	0.33	2000	Agriculture	Siltation
Killinger Creek (09705)	1399	5.27	1996	Agriculture	Nutrients
	990311-0928-MSE	1.26	2000	Agriculture	Siltation
Killinger Creek, Unt (09706)	990311-0928-MSE	0.7	2000	Agriculture	Siltation
Killinger Creek, Unt (09707)	990311-0928-MSE	0.91	2000	Agriculture	Siltation
Killinger Creek, Unt (09708)	990311-0928-MSE	0.8	2000	Agriculture	Siltation
Killinger Creek, Unt (09709)	990311-0928-MSE	0.98	2000	Agriculture	Siltation
Killinger Creek, Unt (09714)	990311-0928-MSE	0.37	2000	Agriculture	Siltation
Killinger Creek, Unt (09715)	990311-0928-MSE	0.09	2000	Agriculture	Siltation
Killinger Creek, Unt (09716)	990311-0928-MSE	0.09	2000	Agriculture	Siltation
Killinger Creek, Unt (09717)	990311-0928-MSE	0.73	2000	Agriculture	Siltation

TABLE 1 - continued					
STREAM NAME (STREAM CODE)	GIS KEY	MILES	YEAR LISTED*	Source	Cause
Quittapahilla Creek, Unt (064063)	990311-1213-MSE	1.15	2000	Agriculture	Siltation
Quittapahilla Creek, Unt (09692)	990311-1213-MSE	0.6	2000	Agriculture	Siltation
Quittapahilla Creek, Unt (09693)	990311-1213-MSE	0.43	2000	Agriculture	Siltation
Quittapahilla Creek, Unt (09694)	990311-1213-MSE	0.16	2000	Agriculture	Siltation
Quittapahilla Creek, Unt (09696)	990311-1213-MSE	0.48	2000	Agriculture	Siltation
Quittapahilla Creek, Unt (09697)	990311-1213-MSE	2.12	2000	Agriculture	Siltation
Quittapahilla Creek, Unt (09698)	990311-1213-MSE	0.05	2000	Agriculture	Siltation
Quittapahilla Creek, Unt (09699)	990311-1213-MSE	0.26	2000	Agriculture	Siltation
Quittapahilla Creek, Unt (09701)	990311-1213-MSE	0.58	2000	Agriculture	Siltation
Quittapahilla Creek, Unt (09702)	990311-1213-MSE	0.51	2000	Agriculture	Siltation

TABLE 1 - continued					
STREAM NAME (STREAM CODE)	**GIS KEY**	**MILES**	**YEAR LISTED***	**Source**	**Cause**
Quittapahilla Creek, Unt (09704)	990311-1213-MSE	0.49	2000	Agriculture	Siltation
Quittapahilla Creek, Unt (09718)	990311-1213-MSE	1.36	2000	Agriculture	Siltation
Quittapahilla Creek, Unt (09719)	990311-1213-MSE	0.18	2000	Agriculture	Siltation
Quittapahilla Creek, Unt (09720)	990311-1213-MSE	0.5	2000	Agriculture	Siltation
Quittapahilla Creek, Unt (09721)	990311-1213-MSE	0.7	2000	Agriculture	Siltation
Quittapahilla Creek, Unt (09722)	990311-1213-MSE	0.54	2000	Agriculture	Siltation
Quittapahilla Creek, Unt (09723)	990311-1213-MSE	0.06	2000	Agriculture	Siltation
Quittapahilla Creek, Unt (09727)	990311-1213-MSE	0.76	2000	Agriculture	Siltation
Snitz Creek (09729)	1405	6.59	1996	Agriculture	Nutrients
Snitz Creek, Unt (09730)	990318-1110-MSE	1.79	2000	Crop Related Agric	Siltation
Snitz Creek, Unt (09731)	990318-1110-MSE	0.64	2000	Crop Related Agric	Siltation
Snitz Creek, Unt (09732)	990318-1110-MSE	1.44	2000	Crop Related Agric	Siltation
Snitz Creek, Unt (09733)	990318-1110-MSE	1.11	2000	Crop Related Agric	Siltation

***** YEAR LISTED – When these TMDLs were written (Sept. 2000), the 2000 303(d) list had not been submitted to EPA. Segments identified as listed in 2000 are in the 305(b) report database and will appear on any final 2000 303(d) list submitted to EPA.

Section 303(d) of the CWA and its implementing regulations require a TMDL to be developed for those waterbodies identified as impaired by the state where technology-based and other controls did not provide for attainment of water quality standards. These TMDLs were developed to address the impairments caused by excess sediment and nutrients in waters of the Quittapahilla basin. PADEP did not develop TMDLs for waters listed on the 303(d) list in the category of 'flow alterations'. The impairments caused by 'flow alterations' are not due to excess concentration of pollutants, but rather a change in flow regime. PADEP ascertains that for these flow related impairments, the development of a TMDL is not a suitable method to determine restoration needs. There is no pollutant for which the amount allowable to attain standards can be determined. EPA believes this to be consistent with current regulations as set forth in CFR §130.7. Table 2 summarizes the reductions in sediment and phosphorus required for waters in the Quittapahilla basin as determined by the TMDLs.

According to Federal regulations at 40 CFR §130.2(g), load allocations are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading**.** Table 2 below summarizes the elements of the TMDLs for phosphorus and sediments developed by PADEP. Despite the fact that EPA believes that annual loads are an appropriate measure for these TMDLs, for the sake of consistency we are breaking the annual TMDL loads down into daily loads.

Table 2.

Summary of TMDLs for the Quittapahilla Creek Watershed							
Watershed	**Pollutant**	LA	WLA	MOS	TMDL		**% Reduction**
		lbs/yr	lbs/yr	lbs/yr	lbs/yr	lbs/day	
Quittapahilla Creek*	Sediment	8,850,361	-	983,373	9,833,734	26941.73	73%
Bachman Run*	Phosphorus	2,621	-	291	2,912	7.97	62%
Beck Creek*	Phosphorus	2,761	-	307	3,067	8.40	58%
Killinger Creek**	Phosphorus	3,421	1,128.5	506	5,055	13.85	66%
Snitz Creek*	Phosphorus	4,147	-	461	4,608	12.62	42%

* includes unnamed tributaries to these streams as broken out on the 2000 305(b) report
** includes Gingrich Run and unnamed tributaries to these streams as broken out on the 2000 305(b) report

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 a 'margin of safety' value. Conditions, available data and the understanding of the natural processes can change more than anticipated by the margin of safety. The option is always available to refine the TMDL for re-submittal to EPA for approval. The unassessed waters protocol, a method of conducting biological assessments of Pennsylvania's waters, was developed in 1996 and began implementation in 1997. PADEPs goal is to achieve a comprehensive, statewide assessment of surface waters in Pennsylvania. After completion of the initial assessments, the long-range goal is to reassess all waters on a five-year cycle. Therefore, while the TMDL should not be modified at the expense of achieving water quality standards expeditiously, the TMDL may be modified when warranted.

III. Discussion of Regulatory Conditions

EPA finds that Pennsylvania has provided sufficient information to meet all of the eight basic requirements for establishing phosphorus and sediment TMDLs for tributaries in the Quittapahilla Creek basin. EPA therefore approves the TMDLs and information contained in the appendices for phosphorus and sediments in Quittapahilla Creek basin. EPA's rationale for approval is set forth according to the regulatory requirements listed below.

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

Water Quality Standards consist of three components: designated and existing uses; narrative and/or numerical water quality criteria necessary to support those uses; and an anti-degradation statement. The designated use of the entire Quittapahilla Creek basin is Trout Stocking Fishery (TSF). Pennsylvania does not currently have numeric water quality criteria for nutrients (nitrogen or phosphorus) or sediments. Therefore, Pennsylvania utilized it's general water quality criteria, which states "water may not contain substances attributable to point or non-point source waste discharges in concentrations or amounts sufficient to be inimical or harmful to the water uses to be protected or to human, animal, plant, or aquatic life"[1], to establish an endpoint for phosphorus and sediments such that the designated uses of the Quittapahilla Creek watershed are attained and maintained.

In order to numerically express this endpoint consistent with the general water quality criteria, PADEP uses a Reference Watershed approach in combination with the AVGWLF[2] watershed loading model. The Reference Watershed approach consists of comparing the biologically impaired watershed with a reference watershed that is meeting its designated uses for aquatic life

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[1] Pennsylvania Code, Title 25., Environmental Protection, Chapter 93. Water Quality Standards, Section 93.6(a).

[2] Arcview Generalized Watershed Loading Function model, the Environmental Resources Research Institute of Pennsylvania State University's Arcview based version of the GWLF model developed by Cornell

to determine an appropriate level of nutrient and sediment loading to the waterbody. This approach is based on comparing the impaired watershed to one with similar designated uses, geology, land uses, physiographic province, land area, soils, and which is within a reasonable proximity to each other for meteorological purposes. The AVGWLF model provides a powerful and accurate means of estimating the dissolved and total nutrient loadings to a stream from complex watersheds with added GIS capabilities. The model provides monthly stream flow, soil erosion, and sediment yield values and includes both surface runoff and groundwater sources as well as nutrient loads from point sources and onsite wastewater disposal (septic) systems[3]. Calibration of this model is not required, however, it has been applied and validated to an 85,000 hectare watershed in upstate New York. The rationale of this method is that achieving nutrient and sediment loadings in the impaired watershed similar to those loadings of the reference watershed will ensure that the impaired watershed will attain and maintain it's designated uses and general water quality criteria.

The Conococheague Watershed is used as the reference watershed for comparison with the Quittapahilla Creek watershed sediment TMDL. A tributary to the Conococheague, Falling Branch, is used as the reference for the phosphorus TMDLs for the tributaries to the Quittapahilla Creek.. Further ground truthing of both the Conococheague and the Quittapahilla watersheds by Department biologists in preparation for TMDL development resulted in adjustments of model parameters in both watersheds to account for the difference in cropping practices, vegetative cover and the existence of point source contributions. EPA finds the use of the Conococheague watershed and its tributary, Falling Branch, as reference watersheds to be reasonable for these TMDLs.

Using the continuous simulation AVGWLF model, PADEP modeled the nutrient and sediment loads originating from nonpoint sources in the Reference Watersheds. As previously mentioned, AVGWLF has the ability to estimate dissolved and total monthly nutrient loads to streams from watersheds including surface runoff, groundwater sources, point sources, septic systems, monthly streamflow, soil erosion, and sediment yield values. In order to make these estimates, AVGWLF requires daily precipitation and temperature data, runoff sources and transport and chemical parameters. The AVGWLF model is a combined distributed/lumped parameter watershed model. In terms of surface loading, this means that the model allows the user to distribute multiple land use/cover scenarios in the watershed, however, the loads originating from the watershed are lumped and spatial routing of nutrient and sediment loads is not available. In terms of sub-surface loading, the load contributions from sub-surface areas are not distinct and are considered lumped using a water balance approach. The AVGWLF model relies on the Soil Conservation Service Curve Number (SCS-CN) to estimate surface runoff and the Universal Soil Loss Equation (USLE) to estimate erosion and sediment yield. Monthly estimates of nutrient and sediment loadings, applicable to each watershed, are generated by using

[3] Haith, D.A., R. Mandel and R.S. Wu, Generalized Watershed Loading Functions, Version 2.0, Cornell University, Dec. 15, 1992.

watershed specific local daily weather inputs and USLE factors[4]. The following average existing load values for sediment, illustrated in Table 3, were determined for Conococheague and the Quittapahilla Creek watersheds using watershed specific data**.**

Table 3, Existing sediment loading values for Conococheague watershed and Quittapahilla Creek Watershed

	Area (Acres)	Sediment Load lbs/yr	Unit Area Sediment Loading Rate lbs/acre/yr
Conococheague Watershed	39,316	7,901,478	200.98
Quittapahilla Creek Watershed	48,928.92	36,740,900.00	750.90

Table 4 illustrates the average existing load values for phosphorus as determined for Falling Branch and the Quittapahilla Creek tributaries of Bachman Run, Beck Creek Gingrich Run phosphorus and sediment), Killinger Creek and Snitz Creek using watershed specific data.

Table 4, Existing phosphorus load values for Falling Branch and Tributaries of the Quittapahilla Creek

	Area (Acres)	Total Phosphorus lbs/year	Unit Area P Loading Rate lbs/acre/yr
Falling Branch	6,145.07	3,633.70	0.59
Bachman Run	4, 925.04	7,724.45	1.57
Beck Creek	5,187.24	7,302.20	1.41
Killinger Creek	8,548.88	15,028.41	1.76
Snitz Creek	7,792.31	7,903.08	1.01

Although both nutrients (phosphorus and nitrogen) are listed as the causes of impairment and are subsequently modeled, only a TMDL for phosphorus is being established to help restore the designated uses of the Quittapahilla Creek basin. This is due to PADEP's finding that phosphorus is the limiting nutrient in all waters of the Quittapahilla Creek basin. Phosphorus is often the major nutrient in shortest supply and is frequently a prime determinant of the total

[4] Local daily weather inputs include temperature and precipitation. The USLE factors are KLSCP; K=changes in soil loss erosion, LS=length slope factor, C=vegetation cover factor, P=conservation practices factor.

biomass[5]. It is also the most effectively controlled using existing engineering technology and land use management[6]. EPA finds this to be reasonable determination.

The final step in the process is to determine the appropriate pollutant loading for each water. For the entire Quittapahilla Creek watershed, the tributaries of Bachman Run, Beck Creek Killinger Creek and Snitz Creek, and the smaller lower order unnamed tributaries, the values generated for sediment loading are based on those found in the reference Conococheague watershed. To determine the nutrient reductions for the tributary streams, values generated for phosphorus are based on those in the Falling Branch reference watershed. The Gingrich Run segment listed for impairment due to suspended solids was addressed through a combination of load reductions under the Quittapahilla Creek sediment TMDL and the Killinger Creek phosphorus TMDL. Total suspended solids (TSS) include both an inorganic and an organic component. The sediment TMDL will reduce the inorganic portion of the suspended solids, while the organic fraction of TSS is addressed through the prescribed phosphorus reduction.

In the process of determining the total phosphorus and sediment loadings in the reference watersheds, a unit area loading coefficient for the parameter of concern was calculated. Those aerial loading coefficients were applied to the Quittapahilla Creek watershed and its tributaries to determine the allowable (TMDL) sediment and phosphorus loadings, respectively. EPA finds this application reasonable to implement the applicable water quality standards.

Table 5, illustrates the sediment TMDL calculations. The target TMDL value for sediment is determined by multiplying the unit area loading value of the reference watershed by the total area in acreage of the impaired watershed.

Table 5, Sediment TMDL calculations

Watershed	Unit area loading rate in Reference Conococheague Run (lbs/acre/year)	Total watershed area in Impaired Quittapahilla Creek basin (acres)	TMDL value for sediment (lbs/year)
Quittapahilla Creek Basin	200.98	48,928.92	9,833,734.34

Table 6, illustrates the phosphorus TMDL calculations. The target TMDL value for phosphorus is determined by multiplying the unit area loading value of the reference watershed by the total area in acreage of the impaired watershed.

[5] U.S. EPA. 1980. Modeling Phosphorus Loading and Lake Response under Uncertainty: A Manual and Compilation of Export Coefficients. EPA 440/5-80-011.

[6] Id.

Table 6, Phosphorus Calculations

Watershed	Unit area loading rate in Reference Falling Branch sub-watershed (lbs/acre/year)	Total watershed area in impaired sub-watershed (acres)	TMDL value for phosphorus (lbs/year)
Bachman Run	0.5913	4,925.04	2,912
Beck Creek	0.5913	5,187.24	3,067
Killinger Creek	0.5913	8,548.88	5,055
Snitz Creek	0.5913	7,792.31	4,608

2) *The TMDLS include a total allowable load as well as individual waste load allocations and load allocation.*

Tables 2, 4 and 5 indicate the total allowable loads for phosphorus and sediment as determined using the Reference Watershed Approach and the AVGWLF model.

<u>A. Waste load Allocations</u>

Pennsylvania indicates that there are no known point source discharges of sediment in the Quittapahilla Creek watershed. Therefore, the WLA is set at zero for the sediment TMDL.

Pennsylvania indicates that there are no point source discharges of phosphorus in the Bachman Run watershed, the Beck Creek watershed, or the Snitz Run watershed. Therefore the WLA for phosphorus in these watersheds is set to zero.

Pennsylvania indicates that in the Killinger Creek watershed, two point sources (PS) are currently discharging into Killinger Creek.

1) One PS discharges downstream of the segment being addressed in this TMDL.

2) The phosphorus contributions from the second facility were considered in the computations. In determining the current contribution of phosphorus loading from this PS to Killinger Creek, the model parameters were adjusted to account for existing contributions based on current discharge monitoring reports. This allows the model to determine the contributions from the sources of the pollutants based on actual current conditions. In determining the WLA however, the maximum permitted load for the PS discharger is used. This ensures that the TMDL can still be met even if the discharger increases his load from the current levels to the permit levels The WLA for Killinger Creek is set to equal the maximum permit limit of this (South Londonderry township) discharger, with no reductions assigned. EPA finds that point source discharges have been adequately accounted for in these TMDLs.

B. Load Allocations

The TMDLs include LAs for nonpoint sources. According to federal regulations, 40 CFR §130.2(g), load allocations are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading. The AVGWLF process enables the LA to be distributed to sources based on landuse type.

The process of allocating phosphorus and sediment loads to distinct land uses in Quittapahilla Creek basin begins by subtracting 10% from the TMDL value for the margin of safety. For example, the allocable load for sediment in the Quittapahilla watershed of 9,833,734 lbs/year is reduced by 983,373 lbs/year to 8,850,361 lbs/year (9,833,734 lbs/year x 0.1 = 983,373 lbs/year). The allocable load for phosphorus for Bachman Run, Beck Creek, Killinger Creek and Snitz Run are each also reduced by 10% to allow for a margin of safety. See below for further discussion on the application of a margin of safety in TMDLs.

As discussed earlier, load allocations for phosphorus were determined by multiplying the unit area loading rate for phosphorus of the reference Falling Branch watershed by the total area in each of the for sub-watersheds of Bachman Run, Beck Creek, Killinger Creek and the Snitz Run. These reductions were then applied and distributed individually to each of the four watersheds. The Killinger Creek watershed was further delineated so to assign specific phosphorus reductions to the tributary of Gingrich Run in order to address the organic fraction of the suspended solids impairment. Load allocations for sediment were determined by multiplying the unit area loading rate of the reference Conococheague basin by the total area the impaired Quittapahilla basin. These reductions were then applied and distributed individually for eight sub-watersheds as determined by the identification of impairment in these waters and their un-named tributaries. These allocation units include the 1) the lower Quittapahilla Creek watershed, 2) the upper Quittapahilla Creek watershed, 3) Killinger Creek, 4) Gingrich Run, 5) Bachman Run, 6) Beck Creek, 7) Snitz Creek, and 8) Brandywine Creek.

To determine the distribution of the sediment and/or phosphorus load allocation between contributing land based sources, PADEP uses a method called the Equal Marginal Percent Reduction (EMPR)[7]. This method equitably assigns the largest contributing source, the greater reduction requirements. Table 7 below shows the load allocations of sediment in Quittapahilla Creek watershed. The table shows the overall average reductions in sediment for each land use and is useful in demonstrating the EMPR method employed by PADEP to distribute the allocable loads of phosphorus and sediment in these TMDLs.

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[7] Pennsylvania Department of Environmental Protection. June 1986. Implementation Guidance for the Water Quality Analysis Model 6.3. Document 391-2000-007.

Table 7, Summary of Load Allocations for Sediment in Quittapahilla Watershed

Land Use	Sediment (lbs/yr)						
	Acres		Baseline Reduction	Baseline Load	EMPR reduction	TMDL Load allocation	% Reductio n
Hay/pasture	11,460	1,688,356.39	0	1,688,356.4	41,1958	1,276,397	24.4
Cropland	21,536	31,450,090.31	26,202182	5,247,908	1,280,489	3,967,418	87.4
Coniferous	565	3,157.49	0	0	0	3,157.49	0
Mixed Forest	693	3,969.82	0	0	0	3,969.82	0
Deciduous	7,488	224,464.76	0	0	0	224,464.76	0
Quarry	501	2,254,748.90	0	0	0	2,254,780.90	0
Coal Mines	155	1,089,103.96	0	0	0	1,089,103.96	0
Transition	8	4,096.04	0	0	0	4,096.04	0
Low Intensity Development	3,614	13,203.08	0	0	0	13,203.08	0
High Intensity Development	2,903	9,709.25	0	0	0	9,709.25	0
Total	48,928	36,740,900.00	26,202,182	6,936,264	1,692,447	8,850,361	73

The total allocable load of sediment is 8,850,361 lbs/year after subtracting the margin of safety value. The EMPR method is then used to distribute the remaining sediment load and works in the following manner. PADEP allocated certain land use loadings similar to their existing loads. In the Quittapahilla Creek watershed, those land uses are forested, quarry, coal mines, transitional lands, low intensity development and high intensity development. Reasons that the loads for these landuse types remain constant include an extremely limited ability to affect the sediment loading processes, insufficient reasonable assurance to make substantial reductions, or the previous designation as forested. This is appropriate because sediment loading from forested lands represent the natural condition which would be expected to exist. It was appropriate to make these allocations for transitional lands, low intensity development and high intensity development because these loads are small in comparison to the total loading and would not significantly improve water quality even if completely eliminated. Therefore, the allocable load for sediment of 8,850,361 lbs/yr is further reduced by 3,602,453 lbs/yr to 5,247,908 lbs/yr. The value of 3,602,43 lbs/yr is the sum of the sediment load from low intensity development (13,203 lbs/yr), high intensity development (9,709 lbs/yr), transitional lands (4,096 lbs/yr), coal mines (1,089,104 lbs/yr), quarry (2,254,749 lbs/yr), deciduous forest (224,465 lbs/yr), mixed forest (3,970 lbs/yr) and coniferous forest (3,157 lbs/yr). The remaining "active land use" current loads (hay/pasture and row crops) are then compared with the remaining allocable load of 5,247,908 lbs/yr to determine if any one contributor would exceed this load by itself. If the remaining allocable load is exceeded by any land use, it will be reduced to the allocable load value of 5,247,908lbs/yr. If the allocable load is not exceeded, the existing load becomes the baseline load. In table 7 above, only the ‘row-crop’ land use with an existing load of 31,450,090 lbs/yr exceeds this value. Therefore, ‘row-crops’ is reduced to 5,247,908 lbs/yr which becomes the baseline load. The actual value of the reduction is represented in the ‘Baseline Reduction’ column of table 7. The baseline loads are then summed to determine the equal percent reduction that must occur in the “active land uses” to achieve the allocable load value of 5,247,908 lbs/yr. The total baseline load is 6,936,264 lbs/yr, which must be reduced approximately 24.3% to equal 5,247,908 lbs/yr. This reduction can be seen in the ‘EMPR Reduction’ column of table 7 which is then subtracted from the baseline load value to determine the TMDL load allocation value for each land use.

This same method was used to determine the phosphorus reductions in each of the sub-watersheds. EPA finds that PADEP appropriately applied the EMPR method for phosphorus and sediment in the Quittapahilla Watershed TMDLs. According to federal regulations at 40 CFR §130.2(g), load allocations are best estimates of the loading, which may range form reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading. While it is not necessary to specifically approve an allocation method, EPA believes that the EMPR method used by PADEP is acceptable because it supports 3 main objectives: 1) to assure compliance with the applicable water quality standard; 2) to minimize the overall cost of compliance and; 3) to provide maximum equity among competing discharges.

3) The TMDLS consider the impacts of background pollutant contributions.

The state has included natural background as a component of the load allocations, as required by 40 CFR §130.2(g). There are two separate considerations of background pollutants within the context of these TMDLs. First, there is the inherent assumption of the Reference Watershed Approach that because of the similarities between the reference and impaired watershed, the background pollutant contributions will be similar. Therefore, the background pollutant contributions will be considered when determining the loads for the impaired watershed which are consistent with the loads from the reference watershed. Secondly, the AVGWLF model implicitly considers background pollutant contributions through the groundwater component of the model process.

4) The TMDL considers critical environmental conditions.

EPA regulations at 40 CFR §130.7(c)(1) require TMDLs to take into account critical conditions for streamflow, loading, and water quality parameters. The intent of this requirement is to ensure that the water quality of Quittapahilla Creek is protected during times when it is most vulnerable.

Critical conditions are important because they describe the factors that combine to cause a violation of water quality standards and will help in identifying the actions that may have to be undertaken to meet water quality standards.[8] In specifying critical conditions in the waterbody, an attempt is made to use a reasonable "worst-case" scenario condition. Critical conditions are the combination of environmental factors (e.g., flow, temperature, etc.) that results in attaining and maintaining the water quality criterion and has an acceptably low frequency of occurrence. For example, stream analysis often uses a low-flow (7Q10) design condition as critical because the ability of the waterbody to assimilate pollutants without exhibiting adverse impacts is at a minimum.

Within the context of the Reference Watershed Approach, the assumption is that the reference watershed is achieving its designated use even during critical environmental conditions. Thus, achieving sediment and/or phosphorus loadings in the impaired watershed consistent with that of the reference watershed will effectively consider critical conditions. To account for different flow conditions, the AVGWLF model uses daily average temperature, daily time step and total precipitation values for each year simulated. PADEP modeled each watershed for a period of up to 20 years to develop the existing loading values for each watershed. The length of the model time period will also effectively consider critical environmental conditions. EPA finds that Pennsylvania adequately considered critical conditions in the TMDL analysis of the Quittapahilla basin.

5) The TMDLS consider seasonal environmental variations.

Seasonal variations involve changes in streamflow as a result of hydrologic and climatological patterns. In the continental United States, seasonally high flow normally occurs during the colder period of winter and in early spring from snowmelt and spring rain, while seasonally low flow typically occurs during the warmer summer and early fall drought periods[9]. The model considers seasonal changes requiring specifications of the growing season, hours of daylight for each month, the months in which manure is applied to the land and by using daily time steps for weather data and water balance calculations. EPA finds that both the AVGWLF model and the assumptions of the Reference Watershed Approach effectively consider seasonal environmental variations.

6) The TMDLS include a margin of safety.

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[8] EPA Memorandum regarding EPA Actions to Support High Quality TMDLS from Robert H. Wayland III, Director, Office of Wetlands, Oceans, and Watersheds to the Regional Water Management Division Directors, August 9, 1999.

[9] U.S. EPA. 1997. Technical Guidance Manual for Developing Total Maximum Daily Loads, Book 2, Part 1, Section 2.3.3. EPA 823-B-97-002.

This requirement is intended to add a level of safety to the modeling process to account for any uncertainty. Margins of safety (MOS) may be implicit, built into the modeling process, or explicit, taken as a percentage of the wasteload allocation, load allocation, or TMDL.

PADEP reserves 10% of the TMDL value for both phosphorus and sediments as the margin of safety. This accounts for uncertainty in the data and computational methodology used in the analysis. Table 2 indicates the actual value of the MOS for each TMDL. EPA finds this explicit MOS acceptable

7) There is reasonable assurance that the TMDL can be met.

The proposed reductions in phosphorus and sediment loadings all come from agricultural areas. PADEP believes that the implementation of BMPs throughout the Quittapahilla Creek watershed will allow the TMDL to be achieved. The TMDL report highlights several management practices installed in the Quittapahilla basin by local watershed associations. The TMDL indicates noticeable reductions in bank erosion and sediment deposition are already evident.

Pennsylvania's Growing Greener funding has provided more than $65 million dollars to environmental initiatives through out the Commonwealth. Section 319 grant funding, supported by the Unified Watershed Assessment and the Watershed Restoration Action Strategies, is designed to focus resources towards the implementation of Best Management Practices for non-point source pollutants. Pennsylvania has intensified efforts to involve stakeholders early on in the TMDL development process so to sustain the interest of the local public through to implementation.

EPA finds that the involvement of various organizations, the availability of funding and the implementation of BMPs provide reasonable assurance that the TMDL can be met.

8) The TMDLS have been subject to public participation.

Pennsylvania published a notice of availability for the Quittapahilla Creek Basin TMDLs for public review and comment in the Pennsylvania Bulletin on December 2, 2000, and in local newspapers. The public comment period extended from the required 30 days to 60 days, and began December 2, 2000, ending January 31, 2001. The TMDLs were also posted on the PADEP website. A public meeting was held on December 21, 2000 at the Lebanon County Court House.

Written comments as well as comment during the public meeting were received. The organizations, which submitted written comments, include the Quittapahilla Watershed Association, the Swatara Creek Watershed Association, and the Mid-Atlantic Environmental Law Center. Responses from PADEP to those comments were provided in the TMDL submittal. EPA finds that PADEP conducted adequate public participation.