Lake Luxembourg TMDL

Prepared by the Pennsylvania Department of Environmental Protection
Bureau of Watershed Conservation

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Attachments

Acknowledgements

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TMDL for Lake Luxembourg

Introduction

This TMDL document for Lake Luxembourg was completed to address the impairments noted on the PA 1996 303(d) list. The impairments were caused by sedimentation, and excess nutrient loads to the lake. PA does not currently have water quality criteria for nutrients or sediment. For this reason Carlson's Trophic Status Index (TSI) is used as the indicator of lake water quality. TSI analysis is used to determine the necessary phosphorus reduction targets for this TMDL. Since Lake Luxembourg is a phosphorus limited lake (see Attachment A), the established relationship between in-lake phosphorus concentration and TSI to estimate the load reductions that will meet the water quality objectives have been used. Suspended Solids reduction targets are set based on the life design of the lake and its sediment filling rate.

All information used for the TMDL computations is taken from the Phase One Clean Lakes Study conducted by Coastal Environmental Services, and was completed in 1994.

The Lake Luxembourg TMDL Information sheet that is attached to the front of this document provides a primer for TMDLs (What are they and why are we doing them?) and water quality standards. (What makes up a water quality standard?)

Background

Lake Luxembourg is located in Middletown Township, Bucks County, PA, and is the recreational and aesthetic focal point of the popular multi-use Core Creek Park. Water quality problems arose in the lake within just a few years after its impoundment in the 1970's. Reduced depth, turbid water, and excessive algae growth have interfered with the quality of aquatic and lakeside recreation, water supply and flood control uses of the lake. The reservoir reached its 100-year sediment capacity in just nine years. Agricultural practices and rapid urbanization combined with a highly erodible soil type contribute to high sediment loads to the lake during storm events.

The Lake Luxembourg watershed is a unique and valuable asset to lower Bucks County. The watershed contains some of the last actively farmed agricultural land in lower Bucks County and the Core Creek Park provides a valuable open space amid a rapidly expanding residential area.

TMDL Endpoints

All pollutant contributions to Lake Luxembourg are from non-point sources. Based on land use and accepted land use runoff coefficients, estimated loadings for each land use category have been computed. Load reductions for phosphorus were based on the necessary reduction of the in-lake phosphorus concentration needed to achieve the target TSI. Load reductions for suspended solids were based on the lake's design sediment filling rate.

Water quality objectives for phosphorus are set using PA Title 25 Chapter 93.5(c) which governs the use of ambient or natural conditions as water quality criteria. The natural or ambient TSI and in-lake phosphorus concentration was based on the forest runoff coefficient used in the Clean

Lakes Study. This value, 0.176 lb/ac-yr, was developed for use during the preparation of the Clean Lakes Study. This value is appropriate for use as representing the ambient condition. This value was verified in the sources used for the Clean Lake Study. This value represents the uncontrollable load (the load that would always be present), and does not account for any anthropogenic activity. To account for anthropogenic activity the allowable loading was increased by twenty percent. This quantity is the controllable load. A portion of the controllable load is reserved as the margin of safety for the TMDL computation. This is further explained in the section on page five.

The water quality objective for sediment was based on the lake's original design sediment storage capacity. The lake's original design sediment storage capacity was set at 261 ac-ft of sediment over a life span of 100 years. This allowed for a sediment filling rate of 2.6 ac-ft per year. Lake Luxembourg accumulated sediment at the rate 19.6 ac-ft per year during its first ten years of existence, and the accumulation rate has dropped to approximately 9.8 ac-ft per year since 1987. For Lake Luxembourg the objective is to reduce the present sedimentation rate to 2.6 ac-ft per year (this is the original sediment filling rate anticipated by the designers of the lake)This is further explained in the section on page seven.

Data Compilation

This section is separated into lake information and pollutant source information.

Lake samples were taken each month for a full year during 1991 and 1992. Samples were collected bimonthly from June to August 1991. Lake samples were collected from the surface, middle and bottom depths at two stations. Watershed samples were taken during both wet and dry conditions. All Clean Lakes projects follow the Clean Lakes Program requirements for temporal and spatial sampling, and parameters to be sampled (40 CFR Part 35 Subpart H and 40 CFR Part 31 attached as attachment C). The diagnostic/feasibility study done in this watershed was a Clean Lakes Phase I study funded under Section 314 of the Federal Clean Water Act.

The following table shows lake data used for TSI computations.

Table 1. Lake Information

Data	**Value**	**Source**
Lake Type	Anoxic	Attached excerpt from Lake Guidance
Lake Status	Regular	There is no special protection designation for this lake
Existing P Conc.	.1846 mg/l	This was computed by plugging load into the anoxic lake equation(phosphorus load from Unit Areal Loading method/lake surface area) and solving for concentration
Hydraulic Residence Time	45.5 days	Info from Phase 1 Lake study(average value)
Surface Area	174 acres	Info from Phase 1 Lake study(average value)
Mean Depth	2.1 meters	Info from Phase 1 Lake study(average value)

The existing phosphorus concentration above represents the average annual concentration in the lake based on the unit area loadings shown in Table 2. This value is consistent with the

measured values recorded in the Phase I Clean Lakes Study showing a range between 0.16 and 0.20 mg/l of phosphorus. The value accounts for background loads such as waterfowl. This value also accounts for seasonal variation because the measured values were collected monthly for a one year period.

Biomonitoring was completed on Lake Luxembourg and included chlorophyll a, phyto- and zooplankton densities, and an assessment of the fisheries.

Phosphorus was found to be the limiting nutrient in the lake (Attachment A). The lake is hypereutrophic at present; high phosphorus levels and sedimentation are major sources of impairment to the lake.

Pollutant Source Information

The pollutant loadings were developed for each type of land use in the watershed, and by monitoring some of the lake inlets during dry and storm events (p.31). Inlets monitored routinely included Core Creek (the major tributary), Park drain tile, two wells, and the lake outlet. For storm samples, the following were sampled: Core Creek (lake inlet), a Park storm sewer, and a storm sewer draining agricultural land. Monitoring was also done at two stations on the lake. The chart on the following page depicts the unit area loading values for the land use categories considered in this evaluation.

Table 2. Unit Area Loading for Lake Luxembourg				
Land Use	Area (Acres)	% of Total Land	Parameter	lb/yr
Row Crops	2,019.05	33.5	Total P	2,881.9
			Total N	72,068.2
			TSS	517,665.6
Pasture/Grass	206.08	3.4	Total P	110.3
			Total N	2,575.4
			TSS	152,634.5
Nurseries	306.40	5.1	Total P	436.6
			Total N	10,936.8
			TSS	747,803.7
Park	315.79	5.2	Total P	83.8
			Total N	1,409.0
			TSS	233,893.2
Institutional	148.26	2.5	Total P	66.2
			Total N	926.1
			TSS	109,809.0
Residential	1,794.69	27.9	Total P	800.4
			Total N	6,405.5
			TSS	1,329,237.9
Commercial	455.65	7.5	Total P	650.5
			Total N	4,066.0
			TSS	337,479.7
Forested	635.29	10.5	Total P	112.5
			Total N	1,417.8
			TSS	25,511.9
Barren	35.34	0.6	Total P	37.5
			Total N	630.6
			TSS	86,239.8
Wetland	102.30	1.7	Total P	-22.1
			Total N	0.0
			TSS	-18,257.4
Open Water	17.05	0.3	Total P	-4.4
			Total N	0.0
			TSS	-3,042.9
Ducks & Geese			Total P	44.1
			Total N	165.4
			TSS	
Internal Loading			Total P	364
			Total N	1,817
			TSS	
Totals			**Total P**	**5,561**
			Total N	**102,418**
			TSS	**3,518,975**

Consideration of Critical Conditions

It is not practical with existing data and resources to explicitly consider critical conditions in terms of both pollutant loading and in-lake conditions. Such an explicit approach would require continuous model simulation of the watershed and lake. Further, by expressing the TMDLs for sediment and nutrients as annual loads, both the storm loads and the dry weather loads have been implicitly included. Given that there is generally a significant lag time between the introduction of sediment and nutrients to a waterbody and the resulting impact on beneficial uses, establishing this TMDL using average annual conditions is protective.

Explanation of TMDL Computations for Phosphorus

The TMDL was computed by the following methods.

1. An existing TSI and Phosphorus loading were computed using the equations contained in the Lake for Windows program "TSI Only " option (see attachment D, excerpt from the Implementation Guidance for Section 95.6 Management of Point Source Phosphorus Discharges to Lakes Ponds and Impoundments (Section shows the Reckhow Models and the TSI equation). Refer to page 10 to the TSI analysis titled, "Existing conditions".

Table 3. Summary of TSI Scenarios

Scenario	In-Lake P concentration	TSI	Load(lb/yr)
Existing Conditions	0.1846	79.40	5561
All Forest	0.0474	59.79	1429
Target TMDL	0.0569	62.43	1714 **

** - The target TMDL represents the uncontrollable load + the controllable load + margin of safety (mos)
uncontrollable load = 1429 lb/yr
controllable load = (1714 - 1429)*(1-0.1) = 257 lb/yr
mos = 10% of the controllable load (1714 - 1429)* 0.1 = 28 lb/yr

2. To establish the controllable and non-controllable contributions of phosphorus to the lake, a TSI and loading was computed based on all of the land in the lake watershed being forested. The all forest scenario is an estimate of natural conditions, with no influence from man. This all forest scenario also represents the best possible condition for lake water quality. This represents the non-controllable load.

   Refer to page 11 to the TSI Analysis titled "All Forest Scenario".

3. To determine the target TMDL loading for the lake, the in-lake concentration from the all forest scenario was multiplied by a factor of 1.2. This allows for a 20 % increase in the in-lake phosphorus concentration.

   The scientific justification for the 20% change in the allowable in-lake phosphorus concentration is based on relationships observed from Vollenweider-OECD eutrophication

results by Lee and Jones (1982). These results indicated that a 20% change in the normalized phosphorus loading to a waterbody must occur before a change in the plankton algal chlorophyll concentrations due to a change in the phosphorus load would be discerned. These studies also indicated that the percent change that must occur in phosphorus load to produce a detectable change in water quality is independent of the trophic state of the waterbody. The 20% change in phosphorus concentration equates to an approximate 5% change in the lake Trophic Status Index (TSI).

The preceding paragraph states that a 20% change in phosphorus loading must occur before there is a discernable change in lake water quality. This is an aesthetic criteria defined by sight, using plankton algal chlorophyll as the indicator. The paragraph also states that this premise holds true at any given trophic state.

Pennsylvania is using the 20% change in load above the estimated natural condition, to allow for man induced activity. We feel this establishes a reasonable target for setting phosphorus controls. Our estimates show that it would be much more difficult to reduce the phosphorus loading rate to the baseline, all forest condition.

Research to verify these relationships was conducted in September, 1998. Original documentation, and literature citations from the rationale documents were reviewed along with M.W. Marsden 1989[1].

4. The load from the all forest scenario is subtracted from the target TMDL load. This is quantity of phosphorus that is allocated among the land use categories. The categories of forest, wetland, open water, waterfowl, and internal loading were held constant from the all forest scenario. The other land use categories are allocated 90% of the available load. This applies a 10% margin of safety. The category of barren land is also held constant because there is no BMP implementation planned for that land use.

   This resets the controllable phosphorus load to the following
   Controllable load (from 1 above) = 257 lb/yr
   P load adjustment for barren land = 31 lb/yr(37 lb/yr existing load - 6 lb/yr accounted for in forest load)
   Controllable load = 257 lb/yr - 31 lb/yr = 226 lb/yr.

5. The TMDL load for phosphorus is divided by the existing phosphorus load to determine the percent reduction. Table 4 shows individual land use phosphorus reductions and Table 5 shows the cumulative phosphorus loading and percent reduction.

   %reduction = 1- (TMDL load/existing load)

   The EMPR allocation method was used (see attachment E).

[1] Lake Restoration by reducing external Phosphorus Loading: the influence of sediment phosphorus release, Freshwater Biology (1989) volume 21, pages 139-162, Martin W. Marsdan.

Explanation of TMDL Computations for Sediment

Previously mentioned in the background section, Lake Luxembourg's design sediment storage capacity was exceeded in less than 10 years. The storage capacity of 261 ac-ft of sediment was expected to last 100 years. This would allow for the entrapment of 2.6 ac-ft per year of sediment. From bathymetric analysis it was determined that the sediment fill rate from 1987 to 1992 was 9.6 ac-ft per year. From 1977, when the lake was filled, to 1987 the fill rate was more than double the 1992 rate. Management activities have helped to cut the sedimentation rate. Plans have been made to complete selective dredging operations and other alternative measures to combat this problem. For purposes of setting a target for a reduction in sedimentation the original design of 2.6 ac-ft per year is used.

The TMDL for sediment is based on yearly accumulation. The required reduction is to drop from the current sedimentation rate to 2.6 ac-ft per year. It will be assumed that the current sedimentation rate is 9.6 ac-ft per year as was measured from 1987 to 1992. The required reduction is as follows:

(1-[actual rate/current rate]) x 100 = percent reduction
(1-[2.6/9.6]) x 100 = 73%

The 73% reduction is assigned to the following land use categories: Row Crops, Pasture/Grass, Nurseries, Parks, Institutional, Residential, Commercial.

The total reduction necessary, in pounds, is equal to 73% of the current suspended solids runnoff load.

(1 - .73) x current TSS load = TMDL
(1 - .73) x 3,518,975 lb/yr = 950,123 lb/yr

The margin of safety is set at 10%. This requires that an additional 10% of the load be targeted for removal to account for uncertainty in the calculation of this TMDL.

MOS = 0.10 x 950,123
MOS = 95,012 lb/yr

TMDL = LA +WLA + MOS

TMDL = 855,111 + 0 + 95,012
TMDL = 950,123

% Reduction = (1- (LA / TSScurrent) x 100
% Reduction = (1- (855,111 / 3,518,975) x 100
% Reduction = 76%

Percent Reductions for the appropriate land use categories are shown in Table 4. The EMPR allocation method was used (see attachment E).

Table 4. Annual Loading Values (lb/yr)

		Phosphorus				Total Suspended Solids		
Land Use Category	**Area (ac)**	**current load (lb/yr)**	**forest load (lb/yr)**	**TMDL Target**	**% Reduction of Annual P Load**	**current load (lb/yr)**	**TMDL Target**	**% Reduction of Annual TSS Load**
Row Crops	2,019	2,882	357	401	86	517,666	138,214	73
Pasture/Grass	206	110	36	58	47	152,635	40,753	73
Nurseries	306	437	54	98	78	747,804	199,660	73
Park	316	84	56	72	14	233,893	62,448	73
Institutional	148	66	26	39	41	109,809	29,318	73
Residential	1,795	800	318	362	55	1,329,238	204,160	85
Commercial	456	650	81	125	81	337,480	90,105	73
Forested	635	112	112	112	0	25,512	25,513	0
Barren	35	37	6	37	0	86,240	86,240	0
Wetland	102	-22	-22	-22	0	-18,257	-18,257	0
Open Water	17	-4	-4	-4	0	-3,043	-3,043	0
Waterfowl		44	44	44	0			
Internal Loading		364	364	364	0			
Totals	**6,036**	**5,561**	**1,429**	**1,686**	**70**	**3,518,975**	**855,111**	**76**

Negative numbers shown in this table represent pollution sinks that account for removal of nutrients and sediment.

Table 5. Summary of Load Reductions			
Parameter	Existing Load (lb/yr)	TMDL Load (lb/yr)	% reduction to meet TMDL
Total Phosphorus	5,561	1686	70
Total Suspended Solids	3,518,975	855,111	76

Table 6. TMDL Summary				
Parameter	WLA (lb/yr)	LA	MOS	TMDL
Total Phosphorus		1,686[2]	28[3]	1714
Total Suspended Solids		855,111	95,012	950,123

These TMDLs implicitly consider seasonal variation by expressing the loads as annual averages. The annual loads encompass both storm flow and dry weather loads associated with the different seasons.

[2] The load allocation for Phosphorus can be broken down into the Uncontrollable Load (UL), which is the load resulting from an all-forested watershed absent of anthropogenic sources, and the Controllable Load (CL), which is the result of anthropogenic impacts. The UL is equal to 1429 lbs. And the CL is equal to 257 lbs.

[3] The explicit margin of safety is calculated as 10% of the difference between the computed TMDL loading and the loading computed from the all-forested watershed scenario, which is referred to as the controllable load.

Assessment of Measures and Follow-up Monitoring

The recommendations contained in the Phase I Clean Lakes Study completed by Coastal Environmental Services in 1994, are currently being Implemented. The Phase 1 Clean Lakes study will be the basis for remediation in Lake Luxembourg. Remediation activities to reduce nutrient and sediment contributions to the lake have already begun. The following is a list of practices that have or will be installed through the FY95 workplan. Table 7 shows projects that have been completed to date.

Table 7. Completed Projects

Practice Installed/Task Completed	Number Installed	Approximate Cost
Animal Waste Facility	1	$2,790
Barnyard Runoff Control	1	$11,240
Diversion	7,875 Ft.	$12,980
Other Practices	5	$12,450
Sediment Basin	9	$112,705
Terrace	22,935 Ft.	$31,990
Underground Outlet	3	$8,000
Waterway	40,190 Ft.	$103,150
Total		$297,000

All of the projects listed in table 7 are agricultural best management practices (BMPs). All of these BMPs are designed to reduce sediment runoff, and address a significant portion of the work toward meeting the TDML objectives for agricultural land uses. However, there is much more work to be done.

The Clean Lakes Study has identified other sources of nutrient and sediment runoff that need to be addressed. Runoff from residential and commercial land use areas need to be addressed along with the other land use categories targeted for load reductions. To support this effort, education of the public concerning nutrient and sediment runoff needs to occur.

There are funding sources available to support the development of site-specific implementation plans and remediation projects that address sources of water quality impairment. One of the primary sources is the Section 319 grant program that is specifically designated for addressing non-point source pollution. Pennsylvania has placed more emphasis on funding projects slated for implementation on waterbodies where TMDLs have been completed

There is currently a funding request that plans for the completion of more agrcultural BMPs, water quality sampling, public education, and documentation. The water quality sampling will help determine if the assumptions for phosphorus loading are correct and also measure performance efficiency of various BMPs.

Public Participation

The Lake Luxembourg study documented several meetings held during the course of the Phase I project to obtain information from the Bucks County Conservation District, the Bucks County Parks Dept., the USDA, the Soil Conservation Service and the ASCS. Recommendations from those meetings were included in the proposed management plan. A public meeting to discuss the findings and recommendations of the Lake Luxembourg Phase I study was held on April 14, 1994 at Core Creek Park (the Bucks County Parks Department Office). Comments received at the meeting concerning the Phase I study and the proposed Phase II projects were incorporated into the final report.

Public notice of the draft TMDL was published in the *Bucks County Courier Times* on January 20, 1999 and January 27, 1999 and in the *Pennsylvania Bulletin* on January 23, 1999 to foster public comment on the allowable loads calculated, which were not part of the original Phase I study. A public meeting was held on February 3, 1999 at the Middletown Township Building in Levittown, PA to discuss the proposed TMDL. Notice of final plan approval will be published in the *PA Bulletin*.

Existing Conditions

LAKE for Windows: Lake TSI Evalution

Lake Name: Lake Luxembourg Exist

Type: Anoxic

Status: Regular

Existing Phosporous Concentration (mg/l): 0.1846

Residence Time (days): 45.5

Surface Area (acres): 174

Mean Depth (meters): 2.1

Comment: Lake is currently Hyper-Eutrophic

Expected TSI: 79.40

Expected Load (lb/ac/yr): 31.96

The existing TSI was computed by using the total load value for Phosphorus that was calculated using the Unit Area Loading method in the Phase I Clean Lakes Study and dividing it by the surface area of the lake.

5561 lbs./yr. / 174 ac = 31.96 lb/ac/yr

The Lake for Windows model uses the units of lb/ac/yr to describe the expected Phosphorus load. The concentration associated with this load using the equation for an anoxic lake is 0.1846 mg/l. This concentration value falls within the range of measured in-lake P values of 0.16 to 0.20 mg/l.

The load from waterfowl is included, and the load reductions for wetlands and open water are taken (See table 4).

All Forest Scenario

LAKE for Windows: Lake TSI Evalution

Lake Name: Lake Luxembourg Forrest

Type: Anoxic

Status: Regular

Existing Phosporous Concentration (mg/l): 0.0474

Residence Time (days): 45.5

Surface Area (acres): 174

Mean Depth (meters): 2.1

Comment: Lake is currently Eutrophic.

Expected TSI: 59.79

Expected Load (lb/ac/yr): 8.21

The all forest Load is computed for use as a baseline condition. This is accomplished by taking all of the land use categories with the exception of wetlands, open water and the background loading for waterfowl and converting it to forest.

This represents the expected TSI and loading for the lake if it had no influence from man. All wetlands and open water are assumed to exist at their current state in the all forest scenario. The load from waterfowl is also included at its current rate.

The All Forest TSI was computed by using the acreage for each land use and multiplying it times the run off coefficient for the forest land use. These loads were summed and divided by lake surface area to obtain the loading in lb/ac/yr (See table 4).

1429 lbs./yr. / 174 ac = 8.21 lb/ac/yr

TMDL Target

LAKE for Windows: Lake TSI Evalution

Lake Name: Lake Luxembourg TMDL

Type: Anoxic

Status: Regular

Existing Phosporous Concentration (mg/l): 0.0569

Residence Time (days): 45.5

Surface Area (acres): 174

Mean Depth (meters): 2.1

Comment: Lake is currently Eutrophic.

Expected TSI: 62.43

Expected Load (lb/ac/yr): 9.85

The TMDL Target was computed using 1.2 times the all forest in-lake Phosphorus concentration. The scientific justification for using the multiplier of 1.2 is explained on page 4 of the written documentation.

The expected load for the existing condition will be divided into the expected load of the TMDL target scenario to determine the percent reduction of Phosphorus needed to attain the TMDL target TSI.

The allowable load for Phosphorus to meet the TMDL TSI for Phosphorus is as follows:

1714 lbs./yr. / 174 ac = 9.85 lb/ac/yr

The body of this paper explains how the margin of safety and the loads that will remain constant (waterfowl, barren land, internal loading) are accounted for.

Comment and Response

Name: Delaware Riverkeeper Network, Received 2/19/99

Comment
Residential development represents the largest source of suspended solids, and second largest source of phosphorus. A more aggressive reduction target for phosphorus is warranted because residential land use is a significant source of phosphorus.

Response
The reduction of phosphorus specified for the residential land use is significant. A significant portion of the land in the watershed falls in the residential land use category. For this reason the uncontrollable load from the residential land use is large. Specifying a greater reduction for this land use category would not make a significant difference in the TMDL.

Comment
Nutrient Management is missing from the list of proposed management techniques. This applies to agricultural activities as well as residences.

Source reduction and source control must be included in the implementation plan for the lake. This needs to be addressed for all land uses.

Response
All of the large farms in the watershed have recently completed nutrient management plans. It is in the best interest of the farmer to use the minimal amount of fertilizer to achieve the desired effect. Over fertilizing will cost the farmer money. The start of a source reduction program for the other land uses will come through education of the public. A Section 319 Non-point source grant proposal has been submitted to address this need by the Bucks County Conservation District.

Comment
PADEP does have a responsibility to take action to actually implement the Lake Luxembourg TMDL once issued. What is your position on this?

Response
PADEP has a responsibility to oversee the implementation of the TMDL, however, the effort to develop and implement restoration plans and apply pollution prevention measures must be locally driven and sponsored. PADEP, along with other agencies and organizations, can assist in this effort by providing funding through grant programs and by providing technical assistance, facilitation, and guidance to local residents.

Comment
Public education should focus on how citizens and communities can diminish non-point source pollution and stormwater runoff.

Response
We agree. To initiate this public education focus the Bucks County Conservation district has applied for a Section 319 Non-point source grant for the upcoming fiscal year that includes a major educational component.

Comment
The TMDL should include enforcement of the Neshaminy Creek watershed stormwater management plan.

Response
The three municipalities located within the boundaries of the core creek watershed have all adopted ordinances that are contained in the Neshaminy Creek stormwater management plan. Enforcement of these ordinances is the responsibility of the local government.

Comment
What are meant by the following terms: 41,960 ft. Of waterway, 29,450 ft. of terrace, 8,000 ft. of diversion

Response
These all describe agricultural best management practices and the extent of their implementation. The appropriate definitions are as follows:

Waterway (grassed waterway) - A natural or constructed channel that is shaped or graded to required dimensions and established in suitable vegetation for the stable conveyance of runoff. The purpose of a waterway is to convey runoff from terraces, diversions or there water concentrations without causing erosion or flooding and to improve water quality.

Terrace - An earth embankment or ridge and channel constructed across the slope at a suitable spacing and acceptable grade. The purpose of a terrace is to reduce erosion, reduce sediment content in runoff water, intercept and conduct surface runoff of a nonerosive velocity to a stable outlet, prevent gully development, improve farmability, reduce flooding and increase soil moisture.

Diversion - A channel constructed across the slope with a supporting ridge on the lower side. The purpose of a diversion is to diver excess water from on area for use or safe disposal in another.

Comment
There is a pipe that sticks out into the lake near Woodburne Road. The pipe is capped, however, area citizens have seen this pipe leak. Has DEP identified what comes out of the pipe and is it affecting the nutrient loading?

Response
The DEP Southeast Region Office will investigate the nature an use of this pipe and respond appropriately. The inspection will take place by 04/01/99. You will be contacted regarding the results of the inspection.

Comment
Stormwater infiltration practices are the most effective method for reducing sediment and Phosphorus pollution contained in stormwater runoff. Use of this method for remediation needs to be a priority.

Response
Infiltration can be an effective, environmentally sound means of controlling stormwater. We agree that this measure should be closely evaluated during restoration plan development and implemented where feasible.

Comment
Sediment basins will not give needed pollution reductions. The primary method to be used to address the sediment and Phosphorus problems facing the lake are 11 sediment basins.

Response
The sediment basins as shown in table 7 are agricultural best management practices and are not meant to be the answer for all the pollution sources in the watershed. They are only part of a list of control practices that have already been constructed on the watershed.

Comment
Section 303(d) of the Clean Water Act calls for a total maximum "daily" load, not an "annual" load. Therefore, the proposed TMDL which only calls and provides for "annual" load reductions and requirements does not fulfill the requirements of section 303(d) of the Clean Water Act which mandates total maximum "daily" load requirements.

We respectfully request that you redevelop your proposed Lake Luxembourg TMDL so it is in accordance with the requirements of the Clean Water Act, providing for "daily" load requirements. The TMDL as proposed cannot be said to fulfill PA DEP's obligation pursuant to section 303(d) of the Clean Water Act as it pertains to Lake Luxembourg. Approval of this proposed document by EPA could not be said to fulfill their obligations under section 303(d) of the Clean Water Act nor their litigation settlement obligations.

Response
40 CFR Section 130.2(h) states, in part, "...TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measure." Furthermore, in EPA's response to comments on the Federal Register of January 11, 1985 Water Quality Planning and Management; Final Rule, they stated "Therefore, TMDLs and water quality-based effluent

limitations may be expressed in terms of an appropriate averaging period, such as weekly or monthly, as long as compliance with applicable WQS is assured."

Name: **Chesapeake Bay Foundation**, Received 2/22/99

Comment
There was no plan of action delineating the activities DEP would take to control the sources of pollutants causing degradation of these waters.

Response
The TMDL is designed to quantify the allowable loading to the waterbody. This TMDL had a Phase I Clean Lakes Study as an attachment to the document. The Clean Lakes Study outlines remediation activities that should be undertaken. Additional measures to meet the TMDL objectives must come from the local level, PADEP, along with other agencies and organizations, can assist in this effort by providing funding through grant programs and by providing technical assistance, facilitation, and guidance to local residents.

Comment
The comment period for the TMDL of thirty days was too short.

Response
In the future we will try to allow for a longer comment period of up to 60 days. It should be noted that the TMDL was also posted on our internet site on January 14, 1999 providing a 39 day period of public accessibility. Notice was run in local newspaper on January 20, 1999 and January 27, 1999.

Name: **Hyman, Julius and Helen**, Received 2/23/99

Comment
The Hymans identified several potential sources of sediment and phosphorus loads to Lake Luxembourg, and suggested practices for reducing sediment and phosphorus loads.

Response
The TMDL establishes allowable sediment and phosphorus loads to Lake Luxembourg. Its purpose was not to define individual non-point sources nor propose a comprehensive restoration plan. Although a list of existing and anticipated management practices were a component of the TMDL report, the detailed information necessary to categorize individual non-

point sources and recommend additional specific remediation measures must be developed during preparation of a comprehensive restoration plan for the lake. The information submitted by the Hymans will be a valuable information source for those who will be responsible for local restoration plan development.