TOTAL MAXIMUM DAILY LOADS
FOR
TURKEY RUN LAKE, WEST VIRGINIA

Introduction

Section 303(d) of the Clean Water Act and EPA's Water Quality Planning and Management Regulations (40 CFR Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for waterbodies that are not meeting designated uses under technology-based controls. The TMDL process establishes the allowable loadings of pollutants or other quantifiable parameters for a waterbody based on the relationship between pollution sources and in-stream water quality conditions. By following the TMDL process, states can establish water quality-based controls to reduce pollution from both point and nonpoint sources and to restore and maintain the quality of their water resources (USEPA, 1991).

The West Virginia Division of Environmental Protection (WVDEP) has determined that the use designation of Turkey Run Lake for aquatic life has been impaired by nutrients, siltation, aluminum, and iron and the human health designation has been impaired by iron . The United States Environmental Protection Agency (USEPA) conducted this study to analyze the loadings to the lake and to establish TMDLs that will restore and maintain the quality of Turkey Run Lake for the uses designated by West Virginia.

The report (including the attached technical report), also provides a description of the waterbody and associated pollution sources, provides a summary of water quality monitoring data, and describes the analytical approach used to develop the TMDL. This report specifically addresses each of the elements of a TMDL, including the following:

1. The TMDLs are designed to implement applicable water quality standards.
2. The TMDLs include a total allowable load as well as individual waste load allocations and load allocations.
3. The TMDLs consider the impacts of background pollutant contributions.
4. The TMDLs consider critical environmental conditions.
5. The TMDLs consider seasonal environmental variations.
6. The TMDLs include a margin of safety.
7. The TMDLs has been subject to public participation.
8. There is reasonable assurance that the TMDLs can be met.

II. Background

The Turkey Run Lake watershed is located within the Upper Ohio-Shade hydrologic cataloging unit (05030202), as shown in Figure 2.1. The land area of the watershed is approximately 869 hectares (2,147 acres) contained solely within Jackson County. Runoff from the watershed flows into Turkey Run Lake from Turkey Run. The lake is used for recreational activities such as fishing and picnicking. Only boats with electric motors are permitted on the on the lake. The lake's watershed is primarily rural, and the main land uses are forest and hay/pasture.

Turkey Run Lake is a 6.1-hectare (15-acre) impoundment located just north of Ravenswood in Jackson County, West Virginia (WVDNR, 1983). The impoundment structure for Turkey Run Lake was completed in 1964 and opened for fishing in 1966.

The water quality uses that are impaired are aquatic life (impaired by nutrients, siltation, aluminum, and iron) and human health (impaired by iron). The primary source column provides the "general source descriptions, if confirmed" (WVDEP, 1998). WVDEP assumed that the lake impairments are due to a variety of sources including petroleum activities. Petroleum activities refer to access roads which are in poor conditions and contribute to sedimentation in the reservoir (Stutler, personal communication, June 1999).

West Virginia classifies a waterbody as impaired for the listed pollutants based on the following considerations:

- Nutrients: West Virginia uses a trophic state index when considering lakes for listing due to nutrient impairment. Lakes with a total phosphorus or chlorophyll *a* trophic state index greater than or equal to 65 were considered to be impacted by nutrients (WVDEP, 1998).

- Siltation: West Virginia considers lakes to be impaired by siltation if sediments are visually observed to accumulate to a depth approaching the lake normal pool elevation.

- Metals: Observed data violate specific aluminum and iron criteria at a frequency greater than 10%.

To evaluate the relationship between the sources, their loading characteristics, and the resulting conditions in the lake, a combination of analytical tools were used. Assessments of the nonpoint source loading into the lake were developed for Turkey Run Lake watershed using the Generalized Watershed Loading Function (GWLF) computer program. GWLF provided estimates of nutrients and sediments transported to the lake for individual land use categories. The lake was evaluated using the BATHTUB water quality simulation computer model to estimate the concentrations of nutrients and chlorophyll *a*. The lake was segmented into four cells to represent characteristics of the system. The results of the watershed and reservoir models were compared with observed water quality data, literature values, previous studies, and reservoir conditions to evaluate the models' performance.

TMDLs are composed of the sum of individual waste load allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources, and natural background levels. A hydrologic period from 1978 to 1997 was used to derive the TMDL. The resulting allocation for the four listed pollutants includes a 20 percent reduction of nutrients (expressed as total phosphorus) and a 40 percent reduction of sediment load. The aluminum and iron loads are believed to occur from their natural presence in clay sediments. The aluminum and iron TMDLs are set consistent with the sediment loading for the sediment TMDL.

The loads are described as average annual load reductions, which is typically appropriate for reservoirs and impoundments. An explicit margin of safety has been identified for each pollutant. The load reductions can be achieved through a combination of land use and restoration practices such as erosion and sediment control practices, forest management, and stream restoration.

III. Discussion of Regulatory Conditions

EPA developed these TMDLs consistent with statutory and regulatory requirements and EPA policy and guidance. The Turkey Run Lake TMDLs address the following eight regulatory requirements.

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

These TMDLs ensure that Turkey Run Lake will meet applicable water qulaity criteria for nutrients and sediment, thus ensuring that the water supports its designated use. West Virginia has only narrative criteria related to nutrients, sediment, aluminum, and iron..

The state water quality standards include water use categories, antidegradation criteria, numeric criteria, and narrative descriptions of conditions in waters of the state.

The relevant water use categories for Turkey Run Lake include the following:

- Propagation and Maintenance of Fish and Other Aquatic Life (Category B-1)
- Water Contact Recreation (Category C)

No special exceptions or use designations are identified for Turkey Run Lake.

1.1 Nutrients

No numeric criteria are available in the West Virginia water quality standards relevant to the 303(d) listing of this waterbody for nutrient impairment. The relevant narrative description of condition includes the following:

> §46-1.3 Conditions Not Allowable in State Waters.
> 3.2 No sewage, industrial wastes or other wastes present in any of the water of the State shall cause therein or materially contribute to any of the following conditions thereof:
> a. Distinctly visible floating or settleable solids, suspended solids, scum, foam or oily slicks;
> b. Deposits or sludge banks on the bottom;
> ...
> i. Any other condition ... which adversely alters the integrity of the waters of the State including wetlands; no significant adverse impact to the chemical, physical, hydrologic, or biological components of aquatic ecosystems shall be allowed. (Title 46, Series 1, Requirements Governing Water Quality Standards, 1999)

WVDEP identifies lakes as impaired due to nutrients on the state's 303(d) list

> "...if summer total phosphorus or chlorophyll *a* levels in surface waters resulted in a trophic state index value of $ 65 (highly eutrophic) or summer algal blooms or excessive aquatic vegetation were noted." (WVDEP, 1998).

The concept of trophic states was developed by Einar Naumann to characterize the condition of lakes (Naumann 1919). The principle behind trophic states is that physical and chemical factors control the production of algae which in turn affects the biological structure of the lake. The amount of algal production plays an important role in lake conditions such as color, visible light penetration, dissolved oxygen concentrations, and odor. Common trophic state classifications include oligotrophic (low production, low nitrogen and phosphorus, oxygenated hypolimnion), mesotrophic (moderate production, moderate nitrogen and phosphorus), and eutrophic (high production, high nitrogen and phosphorus, anoxic hypolimnion).

The Carlson Trophic State Index (TSI) (Carlson 1977) was developed to estimate the algal production and determine trophic state based upon chlorophyll pigments, secchi depth, and total phosphorus. The TSI is a logarithmic scale that ranges from approximately 0 to 100. The three index variables chlorophyll pigments (CHL), Secchi depth (SD), and total phosphorus (TP) use regression equations to estimate the index value and algal production. These three index variables are interrelated and should produce the same index value for a given combination of variables values. The regression equations used to calculate the TSI are shown in equations 1.1 to 1.3.

$$TSI(SD) = 60 - 14.41 \ln (SD) \quad (1.1)$$
$$TSI(CHL) = 9.81 \ln (CHL) + 30.6 \quad (1.2)$$
$$TSI (TP) = 14.42 \ln (TP) + 4.15 \quad (1.3)$$

The trophic state can be related to the trophic state index and lakes conditions as shown in Table 1.

Table 1 Trophic state, trophic state index and lakes conditions

TSI	**Trophic State**	**Attributes**	**Aquatic Life**
< 30	Oligotrophic	Clear water, low production, oxygenated hypolimnion.	Trout possible in deep lakes.
30-50	Mesotrophic	Moderately clear water, possible anoxia in summer.	Warm Water Fishery
50-70	Eutrophic	Low transparency, anoxic hypolimnion in summer.	Warm Water Fishery
>70	Hypereutrophic	Dense algae and macrophytes, noticeable odor, fish kills possible.	

Review of the available water quality monitoring information from 1993 to 1996 and 1998 indicates the likely source of impairment is periodic nuisance algal blooms. Based on monitoring (14 samples), observed chlorophyll *a*, an indicator of algae, is periodically elevated during the growing season, ranging from 11.52 ug/l to 102.2 ug/l, with a mean of 42.6 ug/l (see section 5.2 of the attached report). In addition, based on the evaluation of the lake monitoring and modeling analysis and evaluation of the nitrogen-phosphorus ratio (see section 5.2 of the attached technical report), phosphorus is determined to be the limiting nutrient for the reservoir.

For Turkey Run Lake, the total phosphorus and chlorophyll *a* TSI were calculated from the available sampling information. Insufficient monitoring data was available to calculate the secchi depth TSI. The phosphorus TSI is 69.1 and the chlorophyll TSI is 67.4. Both TSI clearly exceed the West Virginia listing guideline of 65.

The lake is characterized by a shallow depth and a high watershed to surface area ratio. On the basis of the site specific characteristics of the lake a target is selected which is consistent with the best water quality that this lake can be expected to achieve. The identified target is less than the state listing guidelines of a TSI of 65. In this case the selected target is a TSI index of 61.4, with an associated chlorophyll *a* concentration of 63.8 ug/l.

In the absence of a relevant numeric criterion, a numeric endpoint is selected consistent with the use description, the narrative condition, and West Virginia listing guidelines.

1.2 Sediment

Turkey Run Lake is listed as impaired due to siltation on the 303(d) list. Siltation is the excessive accumulation of sediment in the reservoir. The accumulation of sediment can impair the water uses of Fish and Other Aquatic Life and Recreation. The excessive accumulation of sediment can adversely affect aquatic life by creating thick mud deposits, filling habitat, and increasing turbidity. The excessive accumulation of sediment impairs recreational use by reducing access and degrading the aesthetic character of the lake.

The state has no numeric criteria related to the impairment of siltation in lakes. The relevant narrative conditions specify the following:

> §46-1-3.3.2 No sewage, industrial wastes or other wastes present in any of the water of the State shall cause therein or materially contribute to any of the following conditions thereof:
> ...
> c. Deposits or sludge banks on the bottom.
> ...
> i. Any other condition ... which adversely alters the integrity of the waters of the State including wetlands; no significant adverse impact to the chemical, physical, hydrologic, or biological components of aquatic ecosystems shall be allowed. (Title 46, Series 1, Requirements Governing Water Quality Standards)

In the absence of numeric criteria for lake siltation in West Virginia EPA derived as follows, a numeric limit is selected for the development of Turkey Run Lake siltation TMDL. This numeric limit is selected to be protective of the lake uses and serves as a target for identifying achievement of water quality standards associated with the lake listing. The selection of this numeric limit was based on several considerations:

- The selected endpoint, expressed as a long-term sedimentation rate for Turkey Run Lake, is consistent with the causes of the Lake listing. Excessive siltation is reported by the state as the main cause of the lake impairment.

- The long-term annual siltation rate should not be excessive and should allow for a reasonable life span of the lake before deposits become evident at normal pool elevations or create barrier to recreational uses. For small impoundments such as Turkey Run Lake draining a relatively large watershed and in the absence of the design specifications of the lake, a minimum 40-year life span is selected as a target and is used in derivation of siltation rate limit for this TMDL.

- Siltation does not occur uniformly over the entire lake bottom. Selected locations within the lake experience high siltation rates compared to other locations within the lake. The selected locations are the areas most likely to create barrier for recreational uses. Specifically for this

lake, characterized by a small area (6.1 hectares) and a shallow depth (1.2 meters mean depth), the high siltation locations are assumed to correspond to 20,400 cubic meters (less than 10% of the lake volume).

Based on the above considerations regarding the life span of the impoundment and the siltation volume (or critical volume), a long-term average annual siltation rate limit of 0.33 cm was calculated and established as the numeric criteria for this siltation TMDL.

1.3 Metals

Turkey Run Lake is on the 303(d) list as impaired due to elevated iron and aluminum. The West Virginia water quality standards establish numeric criteria for chronic and acute levels of metals. The currently applicable numeric criteria for waters designated as category B-1 are presented in Table 2.

Table 2 Metals Numeric criteria for Aquatic Life

Averaging Period	Iron - measured as total (mg/l)	Aluminum - measured as total (ug/l)
Acute	--	750
Chronic	1.5	—[a]

[a] These criteria may change as a result of EPA's review of the 1998 West Virginia Water Quality Standards Triennial Review. These TMDLs may need to be reviewed following these water quality standards revision to determine if water quality standards can still be met.

Review of the water quality data and discussion with WVDEP led to the conclusion that the soils in the Turkey Run Lake watershed are naturally rich in metals. The increased metals concentration in the lake and tributary are related to the inputs of sediment and associated metals. The following information was reviewed:

- Existing water quality monitoring information
- Inventory of potential sources of aluminum and iron in the contributing watershed
- Regional geology and soil aluminum and iron content

The review revealed that concentration was not significantly elevated in the lake or tributary when compared with other undeveloped watersheds.

The inventory of potential sources failed to identify any activities, current or historical, that are likely sources of elevated metals. No existing or past records of mining activities were identified. However, evaluation of USGS report *Isopleth Maps of Titanium, Aluminum, and Associated Elements in Stream Sediments of West Virginia* indicates that elevated metals concentrations, greater than the 85th percentile of all streams in West Virginia, occur in stream sediments in the Upper Ohio-Shade cataloging unit (USGS, 1994). These enriched sediments occur naturally in areas with aluminous host rocks.

The recommendation for TMDL development for metals for Turkey Run Lake is to set the criteria to an annual loading value resulting from managed condition (assuming controls are implemented according to the sediment loading allocation identified in the sediment TMDL). This recommendations is in accordance with §46-1-7.7.2. which states

> c. Exceptions: Numeric water quality standards shall not apply: ...
>
> D. Where lesser quality is due to natural conditions. In such cases the naturally occurring values shall be the applicable criteria.

2. The TMDLs include a total allowable load as well as individual waste load allocations and load allocations.

A) Wasteload Allocation

No point sources were identified within the drainage area of the listed water after review of several databases from WVDEP and EPA . Therefore the wasteload allocation is set to zero.

B) Load Allocation

2.1 Nutrients

Nonpoint sources of pollutants within the watershed can generally be associated with the different types of land uses and land activities within the watershed. For example, sediment loadings can originate from silvicultural activities and road construction. Expansion of residential and commercial/industrial areas can also cause an increase in storm water flows and sediment loads through soil erosion and sediment transport. In addition, the erosion rate can potentially increase phosphorus loads since phosphorus is readily adsorbed onto soil particles. For nutrient enrichment, animal waste handling, manure and fertilizer application, and septic systems are the key potential sources.
The primary land uses within Turkey Run Lake watershed is forest with minor components of agriculture and residential land uses.

Nutrient loading capacity was evaluated using the water quality simulation model BATHTUB based on simulated phosphorus and chlorophyll *a* concentrations and resulting estimates of the Trophic State Index (TSI) for phosphorus and chlorophyll *a*.

The 1999 bathymetry data was used to setup the lake model under existing conditions. The designated use of the lake was specified using the as-built volumetric conditions. Original bathymetric data was not available to determine the as-built conditions of the lake. The allocation scenarios were simulated using the 1980 bathymetry data to represent the as-built conditions.

Based on the evaluation of the lake monitoring and modeling analysis and evaluation of the nitrogen-phosphorus ratio (see section 5.2 of the technical report), phosphorus is determined to be the limiting

nutrient for the reservoir. Table 4 summarizes the existing loading, the loading capacity, the projected load reductions, and the load allocation for the nutrient TMDL.

Table 4. Turkey Run Lake nutrient TMDL (in kilograms per year)

Source	Existing Loading Total Phosphorus (kg)	Estimated Percent Reduction	Load Allocation (kg)	Comments
Forest	204.8	27	149.5	
Agriculture	27.5	35	17.9	
Groundwater	55.6	0	55.6	
Septic Systems	0.8	80	0.2	
Total Load	**288.7**	**3 Load Allocation**	**223.2**	
Loading Reduction = 57.7 (20%)		**Waste Load Allocation**	**0**	**No point sources**
		Margin of Safety	**8.0**	**3.5% of Loading Capacity[a]**
TMDL = Loading Capacity = 231.2				

2.2 Sediment

The sediment allocation was derived based on the endpoint. The target value for sediment load was derived based on analysis of lake siltation. Access areas and selected shores are critical to recreational uses of the lake. Using a conservative assumption, sedimentation volume in these critical areas was estimated to be 20,353 cubic meters. In addition, these areas are assumed to experience high siltation rates compared to deep pools. Table 5 estimates the mean siltation rate of the lake and number of years for these critical areas to be filled with sediment. The table compares the life span of this critical volume under predevelopment conditions **(**natural forested watershed). The table also presents the loading scenario used in deriving the allocation.

Table 6 summarizes the sediment load allocation scheme corresponding to an overall reduction of 40% and extending the useful life of the lake from 25 to 41 years.

Table 5. Siltation Analysis of Turkey Run Lake

	Existing Conditions	Predevelopment Conditions	Loading Scenario
Mean annual load (kg)	518,593	202,914	311,155
Siltation rate (cm)	0.54	0.4	0.33
Fill time (years)[a]	25	63	41
Loading scenario for 41 year time span corresponds to a 40% load reduction (see Table 6)			

[a]based on a siltation critical volume of 20,353 cubic meters

Table 6. Turkey Run Lake sediment TMDL (in metric tons per year)

Source	Existing Loading Sediment (metric tons/yr)	Percent Reduction	Load Allocation (metric tons/yr)	Comments
Forest	472.7	45	260.0	
Agriculture	45.8	45	25.2	
Urban	0.03	0	0.03	
Total Load	**518.5**	**3 Load Allocation**	**285.2**	
Load Reduction = 207.4 (40%)		**Waste Load Allocation**	**0**	**No point sources**
		Margin of Safety	**25.9**	**8% of Loading Capacity**
TMDL = Loading Capacity = 311.1 metric tons/yr				

2.3 Metals

Analysis of the Turkey Run watershed did not identify any point and nonpoint source discharges of metals. Evaluation of USGS report *Isopleth Maps of Titanium, Aluminum, and Associated Elements in Stream Sediments of West Virginia* indicates that elevated metals concentrations occur in stream sediments in the Turkey Run watershed (USGS, 1994). The sediment load allocation derived from the sediment TMDL was multiplied by an enrichment ratio to quantify the sediment- associated metals loadings (see section 7.3 of technical report). Table 7 summarizes the computation of loading capacity and presents a loading reduction scenario. Aluminum and iron TMDL allocations are shown in Table 8 and 9.

Table 7. Loading allocation for metals in Turkey Run Lake

Metal	Sediment Concentration (mg/kg)	Existing Sediment Load (kg/yr)	Enrichment Ratio	Loading Capacity (kg/yr)	LoadAllocation (kg/yr)
Aluminum	7,980	285,200	1.5	3,414	3,414
Iron	11,500	285,200	1.5	4,920	4,920

Table 8. Turkey Run Lake aluminum TMDL (in kilograms per year)

Total Load	**3414**	**3 Load Allocation**	**3414**	**Comments**
		Waste Load Allocation	**0**	**No point sources**
		Margin of Safety	**0**	**0% of Loading Capacity**
TMDL = Loading Capacity = 3414				

Table 9 Turkey Run Lake iron TMDL (in kilograms per year)

Total Load	**4,920**	**3 Load Allocation**	**84,920**	
		Waste Load Allocation	**0**	**No point sources**
		Margin of Safety	**0**	**0% of Loading Capacity**
TMDL = Loading Capacity = 8,946				

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

Background Conditions for Nutrients

The TMDL load allocation should include, when possible as a separate allocation, the natural background loading of the pollutant. In this analysis natural background is included as an allocation to groundwater or baseflow loadings, and the forest loadings. Note that the forest category also includes some additional loads due to forestry activities, which are in addition to the naturally occurring runoff and erosion from forested areas. The monitoring data were insufficient to separate natural forest loadings from other forest sources.

Background Conditions for Sediment

The TMDL load allocation should include, when possible as a separate allocation, the natural background loading of the pollutant. For sediment natural background is included as an allocation to the forest loadings. Note that the forest category also includes some loads due to forestry activities, which are in addition to the naturally occurring runoff and erosion from forested areas. The monitoring data were insufficient to separate natural forest loadings from other forest sources.

Background Conditions for Metals

The TMDL load allocation should include, when possible as a separate allocation, the natural background loading of the pollutant. Metals naturally occur in the existing sediments in the watershed and no other contributing sources were identified. All metals loadings defined in the TMDL are considered background under the TMDL. If additional sources are defined in the future, through reconnaissance and monitoring, a revision to the TMDL could establish separate LAs or WLAs as appropriate.

4. The TMDLs consider critical environmental conditions.

Critical Conditions for Nutrients

The critical conditions for the nutrient TMDL are selected to evaluate the type of impairment (eutrophication) and the type of waterbody (reservoir). Protection of the lake condition requires the control of long term loadings and accumulation of phosphorus. The lake condition is evaluated based on trophic state indices in response to long-term annual loading of nutrients (phosphorus).

Critical Conditions for Sediment

The critical conditions for the sediment TMDL are selected to evaluate the type of impairment (siltation) and the type of waterbody (reservoir). Protection of the lake condition requires the control of long term loadings and accumulation of sediment. The lake condition is evaluated based on mean siltation rates, in selected locations, in response to long-term annual loading and trapping of sediments in the reservoir.

Critical Conditions for Metals

The critical conditions for the metals TMDL are selected consistent with the delivery mechanism of the metals and the type of waterbody (reservoir). The metals loads are expected to be delivered with fine grained, naturally occurring sediment. Variability in the fined grained sediment load is expected to occur due to natural fluctuations in the hydrology. Periodic elevated concentrations of iron and aluminum are expected to occur due to the high concentration of metals in local sediments. The TMDL

sets a site specific criteria under the sediment loading conditions defined by the sediment TMDL. This will results in controlling long term loadings and accumulation of sediment and associated metals. The lake condition is evaluated based on annual metals loading associated with reduced sediment loading, under the sediment load allocation.

5. The TMDLs consider seasonal environmental variations.

Seasonality for Nutrients

The nutrient analysis considered seasonality in the loading through the simulation of monthly watershed loadings based on historic precipitation records. The evaluation of nutrient impacts in the reservoir was considered for the average annual conditions representing the response to long term, cumulative nutrient loading. The TMDL and load allocation are presented as annual average loading consistent with the type of impairment (eutrophication) and waterbody type (reservoir). Reduction of the average annual load is expected to result in achievement of water quality standards.

Seasonality for Sediment

The sediment analysis considered seasonality in the loading through the simulation of monthly watershed loadings based on historic precipitation records. The evaluation of sediment impacts in the reservoir was considered for the average annual conditions representing the response to long term, cumulative siltation. The TMDL and load allocation are presented as annual average loading consistent with the type of impairment (siltation) and waterbody type (reservoir). Reduction of the average annual load is expected to result in achievement of water quality standards.

Seasonality for Metals

The sediment analysis considered seasonality in the loading through the simulation of monthly watershed loadings based on historic precipitation records. The TMDL and load allocation are presented as annual average loading consistent with the available information, the transport mechanism (metals associated with sediment) and waterbody type (reservoir).

6. The TMDLs include a margin of safety.

Margin of Safety for Nutrients

The MOS one of the required elements of a TMDL. There are two basic methods for incorporating the MOS (USEPA 1991):

Implicitly incorporate the MOS using conservative model assumptions to develop allocations.
Explicitly specify a portion of the total TMDL as the MOS; use the remainder for allocations.

The margin of safety for this TMDL was expressed as an explicit number, calculated as a percentage of the total loading capacity. A 3.5 percent margin of safety was selected to reflect the uncertainty in the modeling analysis and the selection of the TMDL endpoint. Other implicit conservative assumptions provide an additional margin of safety. Specific assumptions which are conservative include:

The endpoint for the reservoir is defined as a TSI less than 65. The selected load reduction is below 65 providing an additional margin of safety.

The loadings calculated by the nonpoint source model (GWLF) were derived using conservative assumptions in the selection of nutrient potency factors. The use of conservative assumptions in developing the loading model results in relatively highly loads and slightly larger required load reductions.

Margin of Safety for Sediment

The margin of safety for this TMDL was expressed as an explicit number, calculated as a percentage of the total loading capacity. A 8 percent margin of safety was selected to reflect the uncertainty in the modeling analysis and the selection of the TMDL endpoint. Other implicit conservative assumptions provide an additional margin of safety. Specific conservative assumptions include:

- The endpoint for the reservoir is defined based on a 40 year lifespan for a selected volume of the lake.

- The loadings calculated by the nonpoint source model (GWLF) were derived using conservative assumptions in the selection of soil erosion factors. The use of conservative assumptions in developing the loading model results in relatively highly loads and slightly larger required load reductions.

Margin of Safety for Metals

The margin of safety for this TMDL was expressed as an implicit conservative assumption in the analysis. The analysis of the metals' TMDL takes into account the sediment load allocation derived under the sediment TMDL. Therefore all specific conservative assumptions made in the development of the sediment TMDL apply to the metals TMDL as well. In addition, other conservative assumptions associated with the metals TMDL include:

- Fine sediment particles have larger surface areas for adsorption and contain higher levels of metals' coarser particles. The trap efficiency for fine sediment, with associated metals, is likely to be lower than the total sediment trap efficiency identified for the sediment TMDL. This results in relatively less accumulation of metals in the reservoir than identified under the selected TMDL.

7. The TMDLs has been subject to public participation.

EPA published and requested comments on the proposed TMDLs on July 1, 1999 in the Charleston Gazette , which has statewide distribution. In addition, a press release was sent to most of the newspapers in West Virginia. The public comment period closed on August 16, 1999, and EPA did not receive comments from any individual or organization for the Turkey Run Lake TMDL.

8. There is reasonable assurance that the TMDLs can be met.

Management Practices

There are number of best management practices that can be adopted to minimize the nutrient, sediment and metals loadings in accordance with the identified TMDLs and load reduction targets.

Nutrient

The nutrient TMDL identifies load allocations and reductions from forested land, agricultural operations, urban, transition/ barren areas, construction areas, and septic systems. Some of the management practices that can be used to achieve the identified load reductions include:

Current regulations of the WV Dept of Health require correction of all straight pipes and failed septic systems, and it is recommended in the TMDL allocation that all such sources be brought into compliance. Because it is difficult to obtain accurate numbers for these sources during development of a TMDL, ground proofing may be needed as part of the implementation.

Forestry management: forestry practices including preharvest planning, streamside area management and buffers, road construction/reconstruction/management, timber harvest management, site preparation, erosion and sediment control, and forest regeneration. Wildlife and water fowl control can also be used to manage nutrient loads.

Agricultural management: Agricultural management practices can reduce sediment and associated nutrient loads. Typical practices include conservation tillage, terraces, crop rotations, and stream buffers. A nutrient management plan can be adopted for individual farms. The plan addresses the methods to utilize manure nutrient and to apply manure and fertilizers at agronomic rates. Fencing or alternative water supplies can assist in reducing the time where livestock are in or near streams.

Urban areas: Sediment and associated nutrient loads can be reduced through management of new developments, site planning, pollution prevention, and stormwater management.

Maintenance and inspection of septic systems: By properly maintaining septic systems, the failure rate and associated nutrients loadings could be greatly reduced.

Sediment

The sediment TMDL identifies load allocations and reductions from forest land, agricultural operations, and construction areas. Some of the management practices that can be used to achieve the identified load reductions include:

Forestry management: forestry practices including preharvest planning, streamside area management and buffers, road construction/reconstruction/management, timber harvest management, site preparation, erosion and sediment control, and forest regeneration.

Agricultural management: Agricultural management practices can reduce erosion and sediment delivery. Typical practices include conservation tillage, terraces, crop rotations, and stream buffers. Fencing or alternative water supplies can assist in reducing the time when livestock are in or near streams. Trampling of stream corridors can increase erosion and turbidity.

Construction: Sediment loads can be reduced through management of new developments, erosion and sediment control practices, site planning, and stormwater management.

Metals

Sediment is the dominant, and only apparent source, of the listed metals in the Turkey Run watershed. Control of the listed metals in the watershed can only be achieved by reducing the disturbance of sediment in the watershed and thereby reducing erosion and transport of sediment to the lake.

The West Virginia Division of Environmental Protection-Office of Water Resources, as the lead agency for West Virginia's nonpoint source program, coordinates with other cooperating state agencies to address nonpoint source impacts, develop and implement best management practices reducing pollutant loads for agricultural, silvicultural, oil and gas, abandoned mines and construction activities. Activities in the various categories include education, technical assistance, financial assistance, research, regulatory and enforcement. WV, through the Nonpoint Management Program, has been successful in initiating the land use controls and BMP's for controlling NPS pollution and protecting the designated uses of the states waterbodies.