TOTAL MAXIMUM DAILY LOAD for SEDIMENT

TRIBUTARY #1 to NORTH BRANCH BALL MOUNTAIN BROOK

Waterbody ID: 11-15

July, 2000

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Introduction and Waterbody Description

The impaired water for which this TMDL was developed is identified on the 1998 Vermont 303(d) List as Tributary #1 to North Branch Ball Mountain Brook and is located by the Waterbody ID VT11-15. This is an unnamed stream but is referred to as "Tributary #1" throughout this document and other supporting documentation.

This stream is located in the upper reaches of the West River Basin in subbasin 11-15, as defined by the State of Vermont River Basins map. The stream is classified as Class B in the Vermont Water Quality Standards effective April 21, 1997. This TMDL aims to restore the impaired waterbody to at least the minimum level described in these standards.

Tributary #1 and its associated watershed of 0.6 mi^2 lies almost entirely within the holdings of a single property owner. The Stratton Corporation, single owner of a ski resort and associated adjacent properties, developed a multi-year development Master Plan which was submitted for review under Vermont's Act 250 land use and development control law. According to the Act 250 review process, one aspect is to review potential effects development may have on adjacent water resources. Since waters listed on the 1998 303(d) list were identified within the area of impact, including Tributary #1, a requirement of permit approval was the development of a remediation plan to restore impaired waters. Stratton Corporation agreed to develop and implement a water quality remediation plan.

One permit requirement of Act 250 was the Stratton Master Plan-Water Quality Remediation Plan (SWQRP), developed by Pioneer Environmental Associates, LLC with review, comment and approval provided by the Vermont Department of Environmental Conservation, Division of Water Quality. This plan provides the basis for the TMDL and is referred to extensively throughout this document and provides the necessary supporting information. The SWQRP is provided as supporting documentation under a separate cover.

A description of the watershed is given in the SWQRP, Section 2.2, including stream descriptions, existing land uses and other detailed information. A site plan of the watershed is given as an Appendix map in the SWQRP where the Tributary #1 watershed is identified as the sum of the sub-basins labeled "B".

Problem Assessment and Pollutant Sources

Problem Assessment

Macroinvertebrate sampling of Tributary #1 was conducted by the State of Vermont in the fall of 1997. Results of that sampling identified the biologic integrity of the stream to be poor and that it was not meeting the minimum Class B criteria. Indications were that the impairment was based on habitat degradation primarily from excessive sand/silt loading. Habitat evaluation revealed a high substrate embeddedness. From this evaluation, Tributary #1 was placed on the

1998 303(d) List of Impaired Waters. A complete description of the biological assessment is given in Appendix A.

In addition to excessive sediment loading to the stream, significant hydrologic change has occurred in the watershed which has increased peak discharge rates during precipitation and snow melt events. The increase in peak runoff rates is the result of land use changes that have increased impervious area. These changes exacerbate the sediment loading problem and play a role in the stream habitat impairment. Remediation measures need to reduce both the sediment loading amount and the peak discharge runoff rates.

Based on the 1997 evaluation of Tributary #1, growth of filamentous algae and lack of significant portions of the riparian buffer also appeared to be having a negative impact on the macroinvertebrate community as identified in Appendix A. In addition to the observed sedimentation impacts, observations identified a shift in the macroinvertebrate community composition, in part, caused by the lack of leaf litter and by the prolific filamentous algal growth. The shifts resulted in an decrease in the shredder species typical for this stream type.

Priority Ranking

According to the 1998 Vermont 303(d) List, TMDL development for Tributary #1 was scheduled for 2002. This represents a high priority scheduling for TMDL development considering that TMDLs were scheduled over a 15 year period extending through 2013. Watershed planning efforts in the state in conjunction with the Act 250 permitting process allowed this TMDL investigation, and subsequent management plan, to be developed earlier than anticipated.

Pollutant of Concern

The Tributary #1 TMDL was developed for sediment. High degrees of substrate embeddedness, primarily from sand, have degraded macroinvertebrate habitat. However, consideration of the hydrologic conditions that significantly added to the stream's impairment also played a large role in determining the remedial measures necessary under this phased TMDL. While altered hydraulic conditions are not technically considered pollutants by EPA, those conditions play a direct role not only in sediment loading, but also stream habitat alteration.

Also identified as a source of impairment of Tributary #1 was the growth of filamentous algae. The prolific growth of algae in portions of the stream was attributed to increased available light and nutrients. Portions of the riparian buffers have been lost, thus allowing a greater amount of light to enter the stream to fuel algal growth. Also fueling algal growth are nutrients associated with elevated sediment loading.

It is anticipated that the remediation measures set forth in the SWQRP will sufficiently address the ancillary impacts other than the primary impairment of sedimentation. While there is considerable uncertainty in predicting benthic algal growth and nutrient dynamics in small mountain streams, one significant consideration is key to the overall success of the restoration of Tributary #1. Since phosphorus has such a strong affinity to particulate matter, significant and

sufficient nutrient reductions are anticipated in association with the sediment loading reductions outlined in this TMDL and the SWQRP. Also addressed in the SWQRP are plans to reestablish riparian buffer sections that when implemented will decrease light and increase leaf litter to the stream. These additional actions in conjunction with the decrease of nutrient inputs from sedimentation are expected to significantly limit instream algal growth.

Pollutant Sources

Field observations were used to document specific areas of nonpoint source sediment loading to Tributary #1. The small size of the drainage area and short length of Tributary #1 allowed a thorough investigation of sediment sources and other factors contributing to stream impairment. These sources fall into several categories including road crossings, drainage ditches and parking lots. A description of sediment sources is given in the SWQRP, Section 2.2.3. Specific areas of concern are:

- Road crossings (West Hill Rd., Stratton Mountain Rd., Maple Hill Rd., North Branch Rd., Middle Ridge Rd.)
- Stratton Wastewater Treatment Plant access drive
- Ditch below liftline lodge
- Diversion weir at Stratton Lake
- Existing parking lots #2, #3, and #4
- Vicinity of Stratton Mountain Inn
- Vicinity of Birkenhaus and Stratton Mountain School

While the sediment sources listed above are given for specific areas, they fall into several projects prioritized for management actions. Individual restoration projects were given an impact ranking (Table 1) based on field observations and measurements which consider the significance of each of the water quality impact factors identified in Section 2 of the SWQRP. These factors include existing land uses, hydrology, erosion and sediment yield, riparian vegetation, channel processes and water quality.

Table 1. Prioritized areas for management activities based on Impact Ranking.

Impact Ranking	Management areas
1	Existing parking lots
2	Village Center/Commercial Development
3	Golf Course
4	WWTF Drive
5	Stratton Mtn. Road
6	Stream relocation at old spray field
7	On-stream Pond (Snyder)
8	Ski trails/work roads
	Single family housing [1] Roads (private public) [2] Condominium projects [1]

[1] denotes activities believed to have minimal water quality impacts
[2] areas/activities to be field-evaluated during 1999

Most of the prioritized actions above deal primarily with sediment reductions, however, actions proposed for the Golf Course, WWTF Drive, and the On-stream Pond include reestablishment of the riparian buffer. Loss of portions of the riparian buffer were identified as contributing to the impairment of Tributary #1.

Natural Background

A distinction was not made between natural background loadings of sediment and the total sediment load to Tributary #1. The assumption was made that because of the small size of the watershed, the problem areas could be identified and treated to minimize sediment loading to the stream. These problem areas were observed to be major contributing factors to impairment. Any natural loading that occurred was considered to be minimal and did not contribute significantly to the impairment.

Applicable Water Quality Standards and Numeric Water Quality Target

State Water Quality Standard

There is no applicable numeric standard for the sediment load carried in streams in the Vermont Water Quality Standards, but Tributary #1 is listed as impaired based on narrative criteria. The excessive sedimentation to Tributary #1 (as measured through various biometrics) has resulted in

a violation of the Vermont Water Quality Standard's § 3-01(B)(5) which states that there shall be:

> No change from background conditions that would have an undue adverse effect on the composition of the aquatic biota, the physical or chemical nature of the substrate or the species composition or propagation of fishes.

Designated Uses

Since Tributary #1 is rated as a Class B waterbody, the Vermont Water Quality Standards state in § 3-03(A) and that:

> Class B waters shall be managed to achieve and maintain a high level of quality, that is compatible with the following beneficial values and uses:

including § 3-03(A)(1):

> Water of a quality that consistently exhibits good aesthetic value and provides high quality habitat for aquatic biota, fish and wildlife.

Since macroinvertebrate biomonitoring data did not meet the criteria for Class B standards, Tributary #1 does not support the designated uses for Class B waters.

Antidegradation Policy

In addition to the above standards, the Vermont Water Quality Standards contain, in part, the following antidegradation policy in § 1-03(A):

> The waters of the State shall be managed in accordance with the Water Quality Standards to protect, maintain and improve water quality in such a manner that the beneficial values and uses associated with their classification are attained. All waters, except mixing zones, shall be managed so that, at a minimum, a level of water quality compatible with all beneficial values and uses associated with the assigned classification are obtained and maintained.

Numeric Water Quality Target

Section 303(d)(1)(C) of the Clean Water Act states that TMDLs "shall be expressed at a level necessary to implement the applicable water quality standards..." Without specific numeric targets defining "undue adverse effect" stated in the Vermont Water Quality Standards, a set of numeric biological community criteria were established to identify when conditions were not fully supporting the standards. The VT DEC uses a variety of biological indicators to identify when conditions exist that are not fully supportive of the expected aquatic community for a particular stream type. Table 2 lists the specific macroinvertebrate biometric values used to determine compliance with the Class B Water Quality Standards. These values were adopted as

the numeric targets for the Tributary #1 TMDL. The latest results describing the condition of Tributary #1 are also include in Table 2.

Table 2. Aquatic invertebrate biometrics, water quality targets and Tributary #1 results.

Biometric	Description	Tributary #1 Results[1]	Class B Criterion (WQ Targets)
Density	Relative abundance of organisms in a sample	299	> 500
Species Richness	Number of different taxa in a sample unit	41	≥ 30
EPT	Number of water quality sensitive taxa from the insect orders Ephemeroptera, Plecoptera and Trichoptera.	11	≥ 18
EPT/Richness	Ratio of water quality sensitive EPT taxa to all taxa found in Community	0.27	> 0.45
Biotic Index	The community tolerance to organic/nutrient loading, based on the tolerances of the species found in the community	2.76	< 2.75
EPT/EPT & Chironomid	Ratio of density of EPT taxa to EPT and tolerant Chironomidae	0.20	> 0.45
% Dominant Genera	Percent of dominant genera in the community	21%	< 40%

[1] As assessed on October 1, 1997. Complete description of the assessment results is given in Appendix A.

Sediment targets were also developed as restoration goals for Tributary #1 and are given below in Table 3. While the biological criteria given in Table 2 are the ultimate measure for attainment of water quality standards, the sediment targets act as another means of tracking the effectiveness of the phased implementation measures. These targets give a relative estimation of sediment loading by evaluating resultant instream conditions. A further description of the sediment targets is given in section 5.3.2 of the SWQRP.

Table 3. Sediment Indices, Targets and Status of Tributary #1.

Sediment Index	Tributary #1 Results[1]	Target Value
% Embeddedness	50 - 75%	< 25%
% *Oligocheata*	31%	< 5%
Pebble Count	not assessed	to be determined

[1] As assessed on October 1, 1997. Complete description of the assessment results is given in Appendix A.

Perhaps the best measure for quantification of sediment loading for this TMDL is percent embeddedness. This index allows both the quantification of sediment loading and provides a measure of macroinvertebrate habitat condition. The pre-remediation percent embeddedness was measured to range from 50% to 75% and a target goal of < 25 % was developed. The target goal of 25% embeddedness was selected because it represents an "excellent" substrate condition for benthic macroinvertebrates.[1]

Linkage Analysis

The linkage analysis is a required TMDL element that establishes the cause-and-effect relationship between measurable water quality targets and identified sources. This can be accomplished through a number of methods from qualitative assumptions based on sound scientific judgement to the use of sophisticated predictive models. The method chosen should be supported by monitoring data that associate waterbody responses to specific loading conditions.

The cause of the impairment in Tributary #1 was determined to be excessive sedimentation due to sediment loading as identified by macroinvertebrate community sampling and habitat assessment. This lead to an extensive visual watershed assessment directed at locating specific sediment sources. During the qualitative assessment, sediment sources were quite clear in this small watershed and determined to be the primary cause of impairment. Best professional judgement dictated that effective control of all or most observed sediment sources contributing to the impairment would ultimately return the stream to compliance with Class B water quality standards.

This qualitative method to link the desired water quality targets to the observed sources was deemed appropriate in this watershed primarily because of its small area. A thorough survey identified significant pollutant sources that could be addressed by implementing remediation measures. Under the phased TMDL approach, incremental water quality gains are tracked by

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[1] USEPA. 1989. Rapid Bioassessment Protocols for Use in Streams and Rivers: Benthic Macroinvertebrates and Fish (EPA440/4-89/001). United States Environmental Protection Agency. Office of Water. Washington, DC.

monitoring as implementation measures are undertaken. The required level of sediment loading reductions are realized when biocriteria standards and numeric targets are met.

In addition to the above qualitative linkage, a quantitative assessment of sediment loading was also developed. The simple method employed here allows a gross estimation of instream sediment loads that result based on watershed loading conditions. This estimation represents average overall stream condition based on field observations. By using the instream sedimentation target of 25 % embeddedness as the desired endpoint, the required instream load reductions can be calculated. In other words, the current or pre-remediation condition resulted in an instream embeddedness of 50-75 %, so the necessary instream sediment reductions are those that result in an embeddedness rating of 25 % or less. It is expected that over time, with sediment control measures in place, the existing instream sediment will move through the system and a more stable equilibrium between sediment loading and the instream condition will be established. The discussion below describes these calculations.

First, the pre-remediation instream sediment load producing the 50-75 % embeddedness needs to be calculated. By knowing the median size of the dominant natural substrate, the depth of what 50-75 % embeddedness represents, the relative area between the dominant particles where the fines settle, and the physical properties of the sediment fines, in this case sand, this value can be obtained. The values used for the sediment loading calculations are given below in Table 4 and are described in the following discussion.

Field observations reveal that the dominant natural substrate particle size is cobble (64 - 128 mm diameter). While there are other natural particles both larger and smaller than cobble present, namely boulders and gravel respectively, the cobble size class dominates. For the sake of simplification, the median cobble diameter in the size class, 96 mm, is used for the calculations of sediment volumes and loadings. By using the median cobble diameter, the depth of sediment fines can be calculated for both pre-remediation and target conditions of embeddedness. The embeddedness of the pre-remediation condition of 50 - 75 % represents a sediment depth of 48 - 72 mm. The remediation target of 25% embeddedness is a sediment depth of 24 mm.

Next, by using the observed percentage of sand coverage of stream bottom, the volume of the interstitial spaces between the larger natural particles can be determined for the sediment depths of interest. Sand was observed to cover approximately 20% of the stream bottom in the areas sampled. On a per square meter basis, this represents 0.2 square meters of sand for every square meter of stream bottom. The pre-remediation volume of fine sediment ranges from 0.0096 to 0.0144 cubic meters and the target volume of for 25 % embeddedness equals 0.0048 cubic meters.

When calculating the volume of the sand in the streambed alone, consideration must be given to the porosity of sand. A loose sand mixture has a porosity value of approximately 0.4, that is, approximately 40 % of a given volume is empty space. So in calculating the volume of sand in the stream for any given condition, as done above, the volume of the interstitial space between

cobbles must be multiplied by 0.6. This product gives the actual volume of sand between the cobbles and disregards the empty spaces between the particles.

Finally, in order to convert the fine sediment volume to a mass per unit area in-stream loading, the physical characteristics of the fine sediment must be considered. Sand has a density of approximately 2.65 grams per cubic centimeter. Multiplying the density by the actual volume of sand in the interstitial spaces gives the resulting in-stream loading for any given depth of embeddedness.

Table 4. Data used to calculate pre-remediation and target sediment loading rates.

	Pre-remediation	Target
% Embeddedness	50 - 75 %	25 %
Dominant natural substrate	cobble	cobble
Median diameter of dominant natural substrate	96 mm	96 mm
Depth of fine sediment	48 - 72 mm	24 mm
Interstitial area between natural substrate	0.2 m^2	0.2 m^2
Dominant fine sediment type	sand	sand
Porosity of fine sediment - estimated	0.40	0.40
Density of fine sediment - estimated	2.65 gr/cm^3	2.65 gr/cm^3

The loading ranges for both the pre-remediation and target values for Tributary #1 are given in Table 5. Based on the methodology for determining sediment loading described above, an estimated reduction of solids loading between 50 and 67% will be necessary to meet the instream sediment target of 25 % embeddedness.

Table 5. Estimated instream sediment loading condition.

	Fine sediment (sand) loading (kg/m^2)	% reductions necessary to meet instream target
Pre-remediation	15.3 - 22.9	50 - 67%
Target	7.6	

The strength of this quantitative approach is that it estimates the actual fine sediment loading to the streambed, which is the primary cause of impairment. This approach is based on observations and eliminates many of the uncertainties and complexities involved with monitoring water column suspended solids and predicting the fate and transport of sediments originating

from the watershed. This method does not attach expected load reductions associated with the various remediation measures, however, as discussed above in the qualitative linkage approach, the size of the watershed allowed extensive visual investigations of sediment sources and utilized professional judgement to prioritize appropriate remediation measures to attain standards.

In addition to the qualitative assessment of sediment sources and the quantitative loading analysis presented above, an analysis of hydrologic alteration due to change in land use was also used to link causes of pollutant loading and the impaired condition of Tributary #1. Comparisons of peak discharge runoff rates between Tributary #1 and an adjacent, largely undeveloped watershed were used to gain a qualitative understanding of the hydrologic impacts that directly affect sedimentation and habitat alteration. By bringing peak runoff flows of Tributary #1 more in line with the reference watershed through remediation measures, there will be an expected reduction in a major contributing factor to sediment loading.

A further discussion of the hydrologic implications related to sediment loading and habitat change in Tributary #1 is given in the SWQRP, section 2.2.2.

TMDL Allocations

The TMDL is considered the loading capacity of a waterbody for a particular pollutant and EPA regulations require that a TMDL include a wasteload allocation (point sources), a load allocation (nonpoint sources) and a margin of safety. The margin of safety accounts for any lack of knowledge concerning the relationship between effluent limitations and water quality. Regulations also require that seasonal variations be considered when determining allocations.

As specified in the regulations, TMDLs may be expressed in terms of either "mass per unit time, toxicity, or other appropriate terms." Because of the nature of sediment loading and deposition in small mountain streams, this TMDL bases its allocations on "other appropriate terms."

Because sediment loading is largely a function of runoff characteristics related to rainfall and snowmelt events, expressing it as daily loading is clearly not appropriate. Annual loading may give a better overall indication of the magnitude of reductions needed, but it is not perfect either, because of the dynamics involved with sediment generation and transport in mountain streams and the role that large infrequent storms have on moving sediment. Annual loadings can fluctuate dramatically.

Instead, the sediment allocation for Tributary #1 is given as the percent reduction in sediment loading necessary to achieve an instream condition believed to provide optimal macroinvertebrate habitat conditions. As the calculations from the previous section indicate, the reduction in fine sediment loading to reduce embeddedness from the pre-remediation range of 50-75 % to 25 % is approximately 50-67 %.

Wasteload Allocations

There are no sediment point sources in the watershed discharging to Tributary #1. Therefore, the TMDL recommends a Wasteload Allocation of zero.

Percent reductions of fine sediment loading needed from Point Sources	**0 % - there are no point sources present**

Load Allocations

Nonpoint sources of sediment are considered the sole category of pollutant to the impairment of Tributary #1 and, therefore, all reductions required in this TMDL are allocated to those sources.

Percent reductions of fine sediment loading needed from Nonpoint Sources	**50 - 67 %**

The SWQRP, Section 4.0, establishes a water quality impact ranking for each of the contributing sources of impairment. For each identified problem, an associated remediation measure has been scheduled for implementation. By scheduling remediation projects according to their relative beneficial impacts, rapid improvements are be expected earlier in the remediation phase rather than later. This adaptive management approach creates an initial expectation for improvement but also allows modification as monitoring results may require.

Margin of Safety

The statute and regulations require that a TMDL include a margin of safety to account for any lack of knowledge concerning the relationship between effluent limitations (or in this case nonpoint source remediation measures) and water quality. This margin of safety can be either implicit in the analysis by using conservative assumptions or explicit as a separate loading allocation. In the case of Tributary #1, an implicit margin of safety was used.

There is an inherent margin of safety established for the Tributary #1 TMDL with the selection of a conservative percent embeddedness target of <25 %. A "good" embeddedness rating covers a wide range of values from 25% to 50% and in most instances provides adequate habitat for the expected macroinvertebrate community based on stream type. A percent embeddedness rating of less than 25 % is considered "excellent" as interpreted both by the Vermont DEC and EPA's rapid bioassessment protocols and has been selected as the target for this TMDL. With such a conservative target as the goal of the implementation measures, compliance with the Vermont water quality standards should be assured.

Also, since this phased TMDL relies on followup monitoring and adaptive management, an added level of assurance is gained. The adaptive approach being applied in Tributary #1 ensures water quality standards will ultimately be met through continued monitoring and remediation actions. If monitoring indicates that implemented projects are not enough to sufficiently improve water quality, then remediation measures continue. Also, as part of the Act 250 permit process,

future development in the impaired watershed outside the scope of the remediation plan is not allowed until the water quality standards are met.

Seasonal Variation

A TMDL is also required to consider seasonal variation in the loading analysis and resulting allocations to ensure water quality standards will be met throughout the year under various environmental conditions. Seasonal variation was inherently incorporated in the consideration of this TMDL for Tributary #1 and will be protective of water quality throughout the year.

The selected numeric water quality endpoints represent water quality conditions that are a result of the cumulative impacts of both dry and wet weather conditions that occur over extended periods. Because of this, the allocations and resulting implementation measures are directed primarily at reducing sediment sources and not at the sediment delivery mechanisms. By utilizing this approach, seasonal variations have little effect on sediment loading if the sources are no longer present. Examples include elimination of gravel parking lots and stabilization of eroding soils.

The SWQRP Implementation Plan also includes measures to treat stormwater runoff to significantly reduce sediment entering the stream. Examples include extended detention and infiltration basins and vegetated drainage areas to reduce sediment loading. The implementation measures selected will be engineered to function under all climatic conditions to sufficiently treat stormwater runoff throughout the year.

Monitoring Plan for TMDL Development Under the Phased Approach

A plan for continued monitoring is essential and required for any phased TMDL. An extensive monitoring plan has been developed and is explained in detail in the SWQRP, Section 5.4. The section below gives the overall monitoring approach and the rationale used for its development. The monitoring of Tributary #1 is only a part of an overall monitoring plan provided in the SWQRP. The described monitoring plan provides a holistic monitoring approach including not only the 303(d) listed waters of Tributary #1, but also adjacent impacted watersheds.

Since the implementation of this TMDL and water quality management plan is to be a phased process, a long-term monitoring plan was developed. The overall approach of the monitoring plan is to develop a reliable baseline documenting existing conditions, and to track future changes in water quality resulting from discrete and incremental remediation measures. A five year data collection program was established beginning in 1999. The Stratton Corporation is primarily responsible for data collection, however, all results are submitted to Vermont Agency of Natural Resources in the form of an annual performance report.

Specific to Tributary #1, nine sampling locations have been established for which a variety of parameters are monitored. Although this TMDL is developed for sediment, the SWQRP covers a broad range of parameters including water chemistry, sediment, temperature and

macroinvertebrates. Not every sampling location is monitored for all parameters, but each site is monitored for parameters specific for tracking progress of implementation measures.

In-stream measures of sediment load include the Pebble Count Procedure and Percent Embeddedness. Targets for each of these have been developed and annual monitoring results will track the progress of habitat improvement over the course of the implementation plan. Combined with the biomonitoring portion of the plan, compliance status with the Vermont Water Quality Standards will be tracked until conditions exist that can perpetuate continued compliance.

Implementation Plan

Strategies to Remediate Impairments

A number of remediation measures were identified for water quality improvement and many were meant to specifically reduce sedimentation in Tributary #1. All potential measures were ranked according to their overall impact for improving water quality and habitat condition. The ranking is based on field observations and measurements that consider relative benefit potential. A list of all proposed implementation measures is provided in the SWQRP, section 4.0 and 4.2 and includes parking lot runoff treatment and modification, land use conversion and buffer improvement among others.

To aid in identification and ranking of appropriate remediation measures, a hydrologic analysis was conducted for each subbasin within the Tributary #1 watershed. A breakdown of peak flow rates and total runoff volumes for a two year storm was conducted for existing conditions and following the proposed implementation plan measures. The results from this analysis are given in the Appendix of the SWQRP.

Implementation Schedule

A complete schedule for implementation of remedial measures is given in the SWQRP, Section 5.0. Remediation measures for Tributary #1 are expected to be completed by 2001 and biocriteria standards for Class B waters are expected to be attained by 2005.

Reasonable Assurances

In waters impaired solely by nonpoint sources, reasonable assurances that implementation measures will be carried out are not required for a TMDL to be approved. However, EPA encourages states to provide reasonable assurances whenever possible that may include regulatory, non-regulatory, and or incentive-based measures. The TMDL for Tributary #1 includes an extensive implementation plan aimed at restoring the stream to the acceptable numeric targets.

Since the SWQRP was developed as a permit requirement of the Vermont Act 250 land use and development control law, there is a strong incentive, and reasonable assurance, that the plan will