A Protocol for Establishing Sediment TMDLs in Georgia

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Formation of TAG

Georgia has over 600 stream and lake segments scheduled for TMDLs. Over 100 segments are listed for impairment by sediment. TMDLs are being developed under a consent decree with a rotating basin schedule that will require completion of Phase I in 2003. Due to concern in the scientific and environmental communities that TMDLs were being established without using the best available science, The Georgia Conservancy and the University of Georgia Institute of Ecology formed a Technical Advisory Group (TAG) for sediment TMDLs in Georgia. The TAG consisted of over 40 scientists from state and federal agencies and universities.

Objective

The objective of the TAG was to develop a protocol for establishing sediment TMDLs using the best available science.

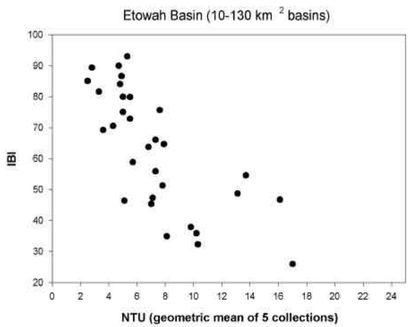
Procedure

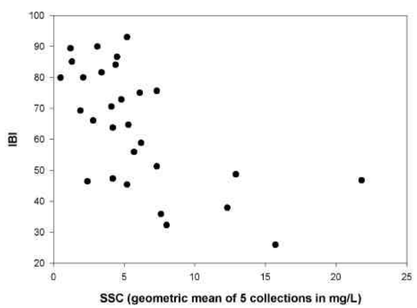
The TAG met monthly (without any funding) for approximately 18 months. We started by identifying what we thought were the major scientific issues. Then we asked experts in these areas to make presentations to the TAG and participate in discussions. During the last six months of the process we developed a draft white paper and spent the meetings discussing revisions to the draft. In January 2002, we presented the white paper at a forum of stakeholders (Keyes and Radcliffe, 2002). The white paper discussed background scientific issues and then presented a series of recommendations.

Relationship Between IBI and Sediment

Georgia does not have a numeric water quality standard for sediment, but rather a narrative standard: "to maintain biological integrity of the waters of the State". Streams are put on TMDL list for sediment because they score low on a survey of biological integrity and the low score is attributed to sediment. Georgia Wildlife Resources Division (WRD) does the surveys and uses the Index of Biotic Integrity (IBI) to score streams. IBI measures fish community structure and function and a high IBI score indicates a healthy, diverse fish community.

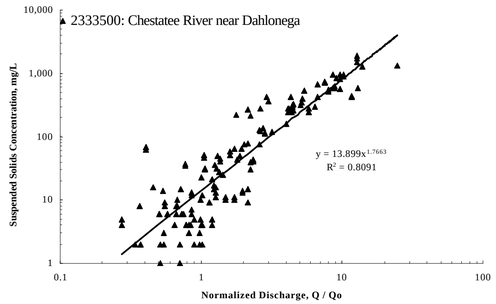
The TMDL regulations require that a sediment load be established for streams impaired by sediment. One of the most difficult issues for the TAG was finding a relationship between IBI and a quantitative measure of sediment. A study of the Etowah River basin in Georgia has shown a relationship between IBI and SSC or turbidity measured under base flow conditions (Leigh et al., 2001; Walters et al., 2001). The study examined 31 tributaries selected as representative of Piedmont physiographic region. Turbidity in nephelometric turbidity units (NTU) and suspended sediment concentrations (SSC) were measured under baseflow conditions and compared to IBI. Results showed that IBI was uniformly low when NTU or SSC was above about 10 mg/L (see graphs below).





Load Determination

The TAG recommended two methods for determining the acceptable sediment load (TMDL) for a stream that is listed as impaired. The preferred approach was to use the sediment load of an appropriate "reference stream". A reference stream is representative of the eco-region and subject to minimal human disturbance. Monitoring data would have to be available on the reference stream. The ideal way to specify the load would be in terms of a "rating curve". This is referred to as a "functional TMDL" in EPA Protocol for Developing Sediment TMDLs (EPA, 1999) in that the target SSC is a function of the standardized stream discharge (see graph below).



If a reference stream is not available, then the TAG recommended that the target long-term suspended sediment concentration (SSC_0) for an impaired stream be 25-30 mg/L. The TMDL could then be calculated as product of the long-term average discharge (Q_0), SSC_0, and a rating curve "bias factor" (estimated value between 2 and 3). The range of values for SSC_0 were developed by assuming that the TMDL should have a baseflow SSC of no more than 10 mg/L and then assuming a range of slopes for the rating curve to determine what the value of SSC was at the mean discharge rate (Q_0).

TMDL Allocation

The TAG recommended the point source allocation (WLA) include the sediment load from construction sites. Each site should require an NPDES permit that specifies the load allocation to the site. The sum of all permitted point-source loads (including construction sites) should not exceed the total allocation to point sources.

The TAG also recommended that the margin of safety (MOS) should be explicit (typically 5-20% of the TMDL) and an implicit MOS (such as a conservative estimate of some of the load parameters) should be avoided. This is because it is very difficult for the public to quantify an implicit MOS.

One of the issues discussed by the TAG was streams that seem to be impaired primarily due to historic inputs of sediment. Much of the Piedmont region of Georgia and other southeastern states was intensively cultivated for cotton in the last half of the 19th century and the first half of the 20th century. Erosion rates were very high during this period and much of the eroded sediment from this era is still stored in stream banks and flood plains (Trimble, 1974). The TAG recommended that for these streams the maximum practical limitations be imposed on current sediment inputs. Practices such as riparian buffers should be used to stabilize historic sediment sources and storm water energy limits should be considered.

The TAG recognized that implementation plans are critical to the success of the TMDL program. Given the time constraints on TMDL development, implementation plans will have to be developed separately from the establishment of TMDLs in Georgia.

Follow-up monitoring was recognized as a key component of the TMDL process. Information gathered during Phase I will be critical in developing more accurate TMDLs during Phase II. Monitoring should include both physical (SSC or turbidity) and biological (IBI) measurements.

Concluding Remarks

The TAG process has proven to be a useful way to involve the scientific community in the TMDL process. A number of areas of research that need to be pursued have been identified including:

•More research to understand the relationship between IBI and SSC/turbidity

•Identification of an appropriate set of reference streams

•Standards for acute (storm driven) sediment loads

•Reference conditions based on bed characteristics

•Development of methods to derive the MOS from model uncertainty

Two new TAGs have now been formed in Georgia. One will deal with establishment of bacteria TMDLs and the other will cover implementation plans.

References

EPA. 1999. Protocol for developing sediment TMDLs. EPA 841-B-99-004. Office of Water (4503F), Unites States Environmental Protection Agency, Washington, D.C. 132 pp.

Keyes, A.M., and D.E. Radcliffe. 2002. A protocol for establishing sediment TMDLs. Available at www.georgiaconservancy.org/WaterQuality/.

Trimble, Stanley W. 1974. Man induced soil erosion on the southern Piedmont; 1700-1970. Soil Science Society of America.