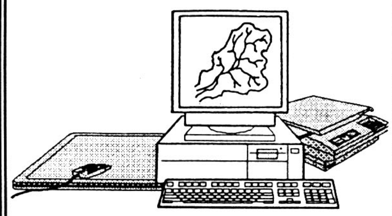
Environmental Indicator Profile Sheet



Indicator Profile No. 3

Nonpoint Source Loadings

Category: **Water Quality**

Tools Used to Measure Indicators:

- Computer Simulation Models (HSPF, SWMM, SLAMM, ILLUDAS, WASP)

Description:

Nonpoint source (NPS) pollutant loadings represent the amount of pollutant in stormwater runoff from various land uses. NPS loadings are not directly measured, but instead are estimated based on empirical monitoring data, land use imperviousness and cover, area, and rainfall volume. NPS loadings can be used to estimate baseline water quality or to determine the relative decrease or increase in NPS pollutant loads due to changes in land use or implementation of restoration efforts.

NPS loading estimates can be calculated using the simple method or simulation models. The simple method is appropriate for small-scale studies. Comprehensive NPS loading estimates may be obtained with simulation models such as HSPF, SLAMM, or SWMM. Changes in NPS pollutant loadings in response to changes in watershed land use (typically pre-developed, existing, and anticipated future conditions) can be estimated using simulation models. Estimates may be reported on an average annual or seasonal mass basis or for a single storm event.

Utility of Indicator to Assess Stormwater Impacts:

- Trends in NPS pollutant loadings can be compared with land use changes or implementation of BMPs to assess potential increases or reduction in NPS pollution.
- Can be used to help identify major land uses which are significant sources of NPS pollution.
- Can be used as a planning tool to evaluate loads associated with different development options.
- Can be used to help identify portions of a watershed where loadings may be concentrated and pollutant accumulation is likely.

Indicator Useful for Assessing:

* Aquatic Integrity of:	
Lakes	◖
Streams	◖
Estuaries	◖
* Land Use Impacts	◖
* Stormwater Mgmt Programs	◖
* Whole Watershed Quality	◖
* Industrial Sites	◖
* Municipal Programs	◖

Key:

Very Useful	●
Mod. Useful	◖
Not Useful	○

Indicator Advantages

* Geographic Range	●
* Baseline Control	○
* Reliable	◖
* Accuracy	◖
* Low cost	○
* Repeatable	●
* All Watershed Scale	◖
* Familiar to Practitioners	◖
* Easy to use & Low training	○

Key

Very Advantageous	●
Mod. Advantageous	◖
Not Advantageous	○

Cost

See Table 3.3A

Advantages of Method:

- Calibrated NPS loading models can quickly and efficiently evaluate many different land use development options.
- Good method for evaluating pollutant load distribution throughout a watershed with respect to various land uses and restoration strategies.
- Allows for geographic analysis of watersheds and priority ranking of possible nonpoint sources.
- Identifies which NPS pollutants are most prevalent, allowing for programs targeted at reducing those specific pollutants.
- Calibrated NPS loading models partially alleviate the need for additional water quality monitoring.

Disadvantages of Method:

- Accuracy in estimating NPS pollutant load may vary from method to method and model to model.
- Development and calibration of watershed NPS loading models can be relatively expensive and time consuming. It may take several years to accurately evaluate trends in NPS loads.
- Accurate modeling requires fairly sophisticated data collection conducted over several years and a reasonably in-depth personnel training program.
- BMP pollutant removal efficiencies used in modeling may substantially differ from actual removal rates.
- Focus on urban stormwater loading and in-stream pollutant concentrations can be misleading in assessing land use impacts since these indicators do not address critical hydrological impacts and effects.

Case Study: Wulliman, J.T., 1994

Application of Nonpoint Source Loading Relationships to Lake Protection Studies in Denver, Colorado

Pawlukiewicz, J.; et. al. (eds.), 1994. Proceedings from Watershed '93: A National Conference on Watershed Management., Alexandria, VA., Mar 21-24, 1993., USEPA No. 840-R-94-002

The paper evaluates various approaches to estimate nonpoint source loads from watershed areas to help assist watershed managers in selecting alternative options. Ten loading estimation options, consisting of 4 basic methods are presented. They consist of various levels of analysis ranging from simple calculations to complex approaches which require hydrologic modeling and site-specific monitoring. The four methods are: the Unit Load Method, where loads are calculated based on a unit loading rate multiplied by the upstream drainage area; the EMC Method, where loads are expressed as the product of the constituent concentration and the runoff volume; the Regression Method, where watershed loads are estimated using regression relationships developed from local, regional, or national stormwater monitoring data; the Sediment Method, where loads are expressed as the product of the constituent concentration and the sediment volume. A number of these options have been used effectively in lake protection studies in the Denver area. In selecting which option to use, it is important to keep in mind the accuracy required and the budgetary limits. In general, there is a direct relationship between the accuracy and the level of complexity of the method. The Unit Load Method, for example is relatively quick and simple to calculate loads but does not incorporate physical hydrologic processes or site specific data and therefore may yield highly uncertain results. The other methods may be much more accurate but require a more sophisticated approach and are more difficult and costly to perform.

Method References:

- Simulation models (HSPF): Dinicola, R.S., 1990. *Characterization and Simulation of Rainfall-Runoff Relations for Headwater Basins in Western King and Snohomish Counties, Washington State.* 55 pp.
- Simulation models (HSPF, ILLUDAS, SWMM): Dendrou, S.A., 1982. Overview of Urban Stormwater Models., *In: Urban Stormwater Hydrology*, American Geophysical Union, Washington, DC. Water Resources Monograph 7, 1982. p. 219-247
- Simulation models (WASP): DiToro, D.M.; J.J. Fitzpatrick; R.V. Thomann, 1983. *Documentation for Water Quality Analysis Simulation Program (WASP) and Model Verification Program (MVP).* Westwood, New Jersey. Hydroscience, Inc. EPA600381044.
- Simulation models (SLAMM): Pitt, R.; J. McLean, 1986. *Toronto Area Watershed Management Strategy Study - Humber River Pilot Watershed Project.* Toronto, Canada. Ontario Ministry of the Environment, June 1986.
- Simulation models (general): Hoos, A.B.; J.K. Sisolak, 1993. *Procedures for Adjusting Regional Regression Models of Urban-Runoff Quality using Local Data.* USGS, Open File Report 93-39, 1993, 39p.
- Simple method: Schueler, T.R., 1987. *Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMP's.* Metropolitan Washington Council of Governments, Publication No. 87703