

CHAPTER I: INTRODUCTION

This document is intended to provide information that groups monitoring fresh water river and lake systems¹ in the Merrimack River Watershed can use to design a monitoring study that meets their own program goals and which serves the larger watershed community. It is meant to be used with another Volunteer Environmental Monitoring Network (VEMN) guidance document: “Guidelines for Subwatershed Groups On Preparing Scientific Study Designs.”

The VEMN “Guidelines” document guides you through the *process* of developing a study design. It explains the steps you go through in deciding why, what, how, where, and when you will monitor, who will carry out the tasks, and what your quality assurance measures will be. For each step, it lists the tasks to be done, where to go to get information, and how to write up your study design.

The document you are reading is intended to provide some of the raw material you will need to do a study design in the Merrimack River watershed. It recommends specific indicators and methods, site location considerations, times of day/year and frequency, data analysis, QA/QC measures, and training needed to answer specific questions and meet specific data quality goals.

Together, these two documents should provide you with everything you need to write a study design.

Why Write a Study Design?

A study design describes your monitoring effort and the rationale behind it. We cannot emphasize enough the usefulness of preparing a written study design. It serves some very important purposes to your group and to the people you hope will use your data:

- it forces you to focus on what you are trying to accomplish with your monitoring program,
- it prevents waste of time and money on equipment and procedures that are inappropriate for your group or goals,
- it allows you to select the best monitoring strategy to address the issues that are important to you and your community,
- it allows everyone who might use your data to have confidence in the results since you clearly document your sampling and analysis methods and quality assurance procedures,

¹ Note: This booklet focuses primarily on monitoring that addresses issues and questions relating to fresh inland waters. Estuarine and marine waters are complex systems that differ substantially from fresh water, such that monitoring strategies must be tailored specifically to these waters. Estuarine or marine waters are addressed in this document only insofar as they face issues in common with fresh water, and where the sampling methodology does not greatly differ.

- it prevents changes in personnel in your organization from destroying the continuity of your monitoring plan because anyone can read your study design and pick up where the last person left off, and
- it allows your group to reevaluate your monitoring study every year and make changes as needed.

VEMN Monitoring in the Merrimack River Watershed

Volunteer river and lake monitoring groups have been active in the Merrimack Watershed and throughout New England since the 1970s. State and federal agencies have been monitoring these waters for decades. The Merrimack River Initiative (MRI) began in 1988 to examine the watershed as a whole and identify and promote actions to restore and maintain a water quality/water use balance. One of the initial recommendations of the MRI was to establish a watershed-wide citizen environmental monitoring network to collect information that can be used by state and federal agencies for planning, permitting, and flagging compliance actions.

In 1994, the MRI provided funding to develop a coordinated citizen monitoring effort. This became known as Merrimack River Volunteer Environmental Monitoring Network (VEMN). We established two basic goals for the VEMN:

- 1) To help volunteer monitoring groups generate information that is highly-valued and used by a broad range of environmental decision-makers, from individual property owners and town boards to state and federal agencies.
- 2) To help citizen groups maintain and enhance the value of their monitoring programs for their own chosen goals and objectives.

In 1997 the MRI produced a management plan for the watershed.² This plan has a number of important recommendations for monitoring in the watershed:

- *Survey and evaluate BMPs [Best Management Practices] currently being implemented in the watershed,*
- *Expand water quality monitoring to focus on non-point source impacts,*
- *Expand water quality monitoring programs to focus on preservation of non-impacted waters, and*
- *Coordinate monitoring efforts.*

This document reflects those recommendations and it provides guidance that will enable volunteer and school monitors to respond to them.

² Merrimack River Initiative, 1997. Watershed Connections: Merrimack River Initiative Management Plan, New England Interstate Water Pollution Control Commission, Wilmington MA.

Monitoring Questions Addressed In This Guide

A major goal of the VEMN is to provide information that will be useful to decision-makers at all levels. Working with a Steering Committee and relying, to some extent, on other work being done within the Merrimack River Initiative, we identified the questions of watershed-wide scope that volunteer monitors could help answer:

- 1) Is the river system supporting its uses and values?
- 2) What are the impacts of human alterations of the river system on human use and ecological integrity?
- 3) How effective are site specific and watershed-wide water and land management strategies in restoring and protecting human use and ecological integrity?
- 4) Are permit conditions effective?
- 5) Where are problem areas that should be a high priority for remediation?
- 6) Where are special natural and cultural resources?
- 7) Are conditions changing?

Each of these questions has a subset of more specific questions that monitoring can be geared to answer. These are listed in the VEMN's "Guidelines for Subwatershed Groups On Preparing Scientific Study Designs."

Data Quality Goals Addressed In This Guide

If you gather information that answers these questions, then who will use it and for what purpose? This is a key consideration in deciding what information needs to be gathered on a watershed-wide level and how rigorous the monitoring must be in order to satisfy the decision-makers. The following Data Quality Goals clarify the uses for the data and how rigorous the monitoring must be in order to satisfy the needs of the users.

- *Meets legal, regulatory and scientific peer review requirements.* This is the most rigorous level of monitoring. It provides data that can be used in court cases, regulatory proceedings, or reporting research results in scientific journals. Meeting this goal will require that monitors document a high degree of precision, accuracy, and sensitivity in their methods and that they undertake a rigorous quality control program.
- *Meets evaluation and assessment requirements of state and federal agencies.* Data in this category may be used in State Water Quality Assessments (305(b) reports) to determine if water quality standards are being met, evaluate effectiveness of pollution control programs and projects, and other water quality planning activities. Meeting this goal will require that monitors use

methods and quality control measures that are similar to those of state and federal agencies.

- *Meets requirements for evaluation, assessment, and management at the community or watershed level.* Town boards, landowners, the public, regional planning agencies, and other organizations and agencies may use this data in their resource management decisions. Methods may be geared toward identifying gross pollution problems, rather than detecting subtle trends or deviations from water quality standards.
- *Data quality sufficient to increase awareness and knowledge of resource values and conditions.* These relatively simple and low cost programs can help groups and the general public better understand how watersheds function, the condition of a local water body, and how human activities can affect watershed health. These programs do not require rigorous sampling and analysis methods, but should follow sound scientific principles of investigation.

Each of these data quality goals has a subset of more specific users and uses of the data. These are listed in the VEMN's "Guidelines for Subwatershed Groups On Preparing Scientific Study Designs."

The VEMN Monitoring Approach

Given the belief that data from monitoring at any level of rigor will be useful to someone, it was decided that a single watershed-wide monitoring protocol (indicators and methods) that all groups in the watershed could follow would be neither useful nor practical. Rather, we decided to provide a menu of options that address the question at various levels of rigor. Rather than dictating to groups what they must monitor, the VEMN recommends various approaches which are clearly connected to data uses and goals so that groups can decide the level of rigor appropriate to their goals and resources. It will also be clear who will and will not use their data. This will hopefully avoid unrealistic expectations and confusion on the part of the monitors and the decision-makers. However, we do suggest a core monitoring survey be carried out by all groups.

Monitoring Surveys Covered In this Guide

This document is a menu which includes both "core monitoring surveys" which we hope will be carried out by all groups in the watershed, and a set of "optional surveys" geared to the issues, questions, goals, and resources of groups in tributary watersheds or on specific water bodies.

The core monitoring surveys are:

- A. Preliminary Watershed Assessment** - a visual survey and evaluation of some basic watershed characteristics to help identify issues, watershed uses and values, and problem areas to guide field monitoring activities.
- B. Water Contact Health Risk Assessment** - a combination of water sampling for contaminants of concern and data gathering on exposure to contaminants and actual disease occurrence to see if there's a relationship between water quality, exposure, and illness.
- C. Water Quality Standards Assessment** - water sampling and analysis of river or lake water quality indicators that the states of Massachusetts and New Hampshire use to determine how well our waters comply with state standards for their designated uses.

The optional surveys are:

- D. Baseline Monitoring: Rivers and Lakes** - collection of information by various activities about some of the basic physical, chemical and biological conditions. This information is used as a "baseline" or benchmark against which to assess future changes. There are six surveys described that cover rigorous and basic monitoring of wadeable and non-wadeable rivers and lakes. These involve collecting and analyzing water and aquatic life samples, assessing habitat conditions and channel shape, and gathering visual information.
- E. Wastewater Treatment Plant Impact Assessment** - collection of information by various activities about the impact of a wastewater treatment plant on the river's ecological health and human use. There are two surveys described that cover rigorous and basic monitoring of rivers.
- F. Non-point Source Impact Assessment** - collection of information about the impact of runoff from a non-point pollution source on the river's ecological health and human use. There are two surveys described that cover rigorous and basic monitoring of wadeable rivers.
- G. Non-point Source Site Evaluation** - a systematic approach for trained volunteers to visually evaluate the seriousness of non-point source pollution. This evaluation takes place at a particular site and focuses on the production, transport, and control of runoff on the site.
- H. Stormwater Discharge Monitoring** - focuses on locating pipes that discharge stormwater (as opposed to sanitary wastewater) and sampling the effluent coming out of those pipes during dry and wet weather to determine its quality and potential to affect rivers and lakes.
- I. Wastewater Compliance Survey** - the review of discharge monitoring reports to determine whether the discharge complies with the NPDES permit.

Monitoring groups that are interested in optional surveys should undertake an intensive study design process with VEMN staff and partners. This process will

help the group select water quality indicators, data quality objectives and requirements, sampling and analytical methods, sampling sites, sampling frequency and times, and quality assurance/quality control measures that match one of the four data quality levels.

How To Use This Document

Use this document as a source of raw material for your study design if your interests match the questions and data quality goals listed in one of the recommended surveys.

Chapter II briefly describes the study design process. Each step is listed and how the information provided in this guide can help. Detailed guidance is contained in the “Guidelines for Subwatershed Groups On Preparing Scientific Study Designs” available from the VEMN.

Chapter III lists the options for volunteer monitoring in the Merrimack River Watershed and recommends specific sampling procedures. This chapter will be your primary source of information regarding indicators, methods, frequency, and time of day/year for your monitoring effort.

Chapter IV describes the quality assurance/quality control measures you should consider for water and benthic macroinvertebrate sampling and analysis.

Chapter V describes the complementary services that the VEMN provides along with this manual.

Appendix 1 contains general information about watershed indicators and methods. It describes each indicator recommended in the guide and briefly describes the methods for each.

Appendix 2 describes water quality standards in general and those that apply to the Merrimack River Watershed.

We recommend that people who are planning or currently coordinating a monitoring program read all of Chapters II and III. Then consult with the VEMN support team for additional help in writing or updating their own study design, using the Study Design Workbook.

By using this guidance and developing a study design, monitoring groups will learn more about their own programs, find wider audiences for their information, and receive the satisfaction of seeing their work and results affect the management decisions that affect their water bodies.