Vermont Department of Environmental Conservation

Watershed Management Division

Statewide Surface Water Management Strategy

Chapter 2. Stressors that affect Goals and Objectives for Surface Waters

Introduction

This introduction describes how the Division developed the list of ten major stressors, and how the importance of each stressor was initially evaluated as a preface to the subchapters presented below. In this introduction, a numeric evaluation of stressor importance is described, which the reader should understand as a starting point for further discussion, and not a complete statement as to the Division's view of the stressor priority. Detailed information about stressor impacts, management approaches, and gaps in the Division's ability to achieve complete management are provided in the subchapters below. In chapter 3, a more complete view of stressor priorities is provided, that relates the information presented throughout Chapter two to the Division's roles and priorities for the implementation of this Strategy.

How were stressors evaluated?

The ten stressors presented throughout this Strategy result from an internal planning process that included an initial brainstorming phase, followed by detailed technical and programmatic evaluations. In the brainstorming phase, a Division-wide exercise was conducted to collect and consider the widest possible array of potential impacts to surface waters that result from the variety of activities that occur on the Vermont landscape. From this long list of stressor sources, ten common categories, or major stressors were identified, many with several unique sources. The ten stressors, and their sources (e.g., the landscape activities that produce the stressors), are listed in Table 2-1.

Table 2-1. Activities that are sources of pollution to surface waters of Vermont, arranged within ten major stressor categories.

Major Stressor	Sources of the Stressor
	**Acidity** from: a) atmospheric deposition b) mine tailings runoff.
	**Altered hydrology** resulting in periodic dewatering or inundation of habitat (including extremely high velocities and rapidly changing flow) from: a) Non-natural variation in flows due to withdrawals, b) Decreased/altered flows from flood control and hydropower dams c) Lake or reservoir fluctuations d) Ditching of wetlands.
	**Aquatic Invasive Species** that cause loss of recreational opportunities and habitat/ecological integrity of aquatic or riparian habitats, due to: a) Human dispersion (aquaria release, ballast release, boat/trailer transfer, fish tournaments) b) natural spread (avian transfer)
	**Channel Erosion:** increased sediment & nutrient loading due to mass wasting and stream disequilibrium (erosion/transport/deposition) from: a) increased flow peaks (watershed ditching/draining, impervious cover runoff, dams, and climate change) b) sediment discontinuity (dams, diversions, and culverts) c) channelization practices (channel dredging, straightening, berming, and armoring) d) bed and bank disturbance.

	**Encroachments:** loss of habitat, equilibrium, and ecological process due to encroachments within or adjacent to floodplains, wetlands, lakes, streams, and rivers from: a) earthen fills b) roads c) buildings d) utilities e) stream crossings f) dams
	**Land Erosion:** increased fine sediment & nutrient (S&N) loading due to erosion of exposed soils and gully erosion from: a) ditching (conveyed surface flow) b) cropland c) forestland uses d) construction sites e) stormwater runoff.
	**Nutrient loading (non-erosion)** to surface waters from: a) over-fertilization (urban, agriculture) b) inadequately treated domestic waste c) animal and milk house wastes.
	**Pathogens** from anthropogenic waste attributable to: a) poorly-functioning septic systems b) domestic animals c) agricultural runoff d) nuisance wildlife.
	**Thermal Stress:** loss of habitat, equilibrium, and biological thermal reproductive cues due to: a) removal of woody and herbaceous riparian /shoreland vegetation b) impoundment c) climate change.
	**Toxic Substances** in surface water and groundwater from: a) atmospheric deposition b) inorganic and organic contaminant releases c) pesticides d) contaminants of emerging concern e) Biologically-derived toxins

In the second phase, the results of which are presented in the following stressor-specific documents, WSMD evaluated stressor importance, by evaluating four attributes using a gradient of importance. For each stressor, where available, empirical information from statewide monitoring, assessment or other scientific data were used. The four attributes of stressor importance are:

Extensiveness – how widespread is the problem

very few instances of affected areas
affected areas are discrete and effects localized
numerous occurrences, with regional (watershed or town-level) effects

widespread (basin-wide or statewide)

Intensity of Effect – what is the consequence of the problem

– none or positive
– perceived, but unquantified, effect on water resource goal(s)
– quantifiable, but limited, effect on water resource goal(s)
– substantial, quantifiable effect on water resource goal(s)

Duration of Impact – if the problem arises, then how long until the resource repairs itself?

< 5 years to heal
5 - 25 years to heal
25+ years to heal
the problem will never heal

Urgency of the Threat – what is the likelihood that the problem will arise

unlikely to occur
occurred, but not getting worse (damage has been done)
on-going
on-going and getting significantly worse over time

Thus described, the stressors were then evaluated in the context of the regulations, programs, and efforts in place within WSMD and partner organizations, within and outside of State government. Those regulations or programs, basically the "tools," were classified within five basic approaches:

- ***Monitoring and Assessment,*** which is used to document the occurrence of stressors. A robust monitoring and assessment program is necessary to document the condition of surface waters and relative importance of stressors to those specific waters.

- ***Technical Assistance,*** which may be used to provide assistance to on-the-ground practitioners in the development of specific projects or local regulations that are intended to restore or protect surface waters.

- ***Funding Programs,*** which may be used in conjunction with technical assistance efforts to directly pay for remediation or protection efforts, in whole or in part.

- ***Regulations,*** which may be in place or be established to address a particular stressor, and can take the form of permit programs or basic prohibitions.

- ***Education and Outreach*** activities which are an integral component of a comprehensive surface water management strategy. Education and outreach is differentiated from technical assistance by the intended audience. Education and outreach activities are aimed at the general public and are intended to confer a general understanding of how to protect surface waters.

Therefore, in the ten sub-chapters that follow, each of the stressors is described, using empirical evidence where available, with respect to extensiveness, intensity, urgency, and duration of impact, and in relation to the specific goals and objectives of this Plan that are met when the stressor is addressed (see Table 1-1). Existing programs that address the stressors are described within the five basic approaches, and gaps in the current program capability are identified, along with recommendations to close the gap. In chapter three, the collected recommendations are integrated to develop a roadmap of prioritized actions for the improvement of surface waters in Vermont.