PART EIGHT: ACCESSING & MANAGING DATA USED in DECISION-MAKING on the STATUS of WATERS

A) Water Quality Data

i) Chemical data

Data collected in conjunction with DEC monitoring programs, as well as some volunteer-based data, are archived to DEC's dedicated water quality data storage system. As of January 2004, this archive contains in excess of 280,000 individual data records, beginning prior to 1970. Data from all core chemical monitoring programs are archived on an annual basis, following quality assurance screening. In certain instances, project-specific data will be held outside of the data archive until a project is completed prior to submission. The Water Quality Data Archive is intended to be DEC's final repository for water chemistry and associated data.

The Water Quality Data Archive is presently maintained in a Microsoft Access© database which is carried on DEC's central file server. This database is backed up on a daily or more frequent basis with archive media also protected off-site.

ii) Biological data

Data collected in conjunction with all DEC biological monitoring programs are archived to a dedicated biomonitoring database, which is a component of the Water Quality Data Archive. As of January 2004, this database contains in excess of 99,000 individual macroinvertebrate occurrence records from 2,873 discrete sampling events. The database also holds 5,606 individual fish occurrence records representing 851 discrete sampling events. Data from all core bio-monitoring programs are archived as data become available from the laboratory, following quality assurance screening. In certain instances, project-specific data will be held outside of the data archive until a project is completed prior to submission. The Water Quality Data Archive is intended to be DEC's final repository for biomonitoring and associated data.

iii) Storet

DEC began implementing a local Storet archive in 2003. In response to USEPA requests, and with support from the National Environmental Information Exchange Network, DEC has been able to develop the largest Storet archive of all New England States, with some 231,522 records presently archived across numerous programs. The DEC Storet archive is limited to water chemistry information, although the addition of a subset of the data contained in the bio-monitoring database is currently under consideration.

B) Assessment Information

i) Lake water quality inventory

DEC maintains a database containing physical and cultural characteristics and water quality data summaries for 918 inventoried Vermont lakes. The so-named Lake Inventory is used to track information such as waterbody classification, known existing uses, lake physical attributes, counts of shoreline dwellings, and characteristics relevant to lake protection prioritization. Much of the data contained in the lake inventory database is available online through the Vermont Water Quality Division website (www.vtwaterquality.org). These data are updated on an annual basis or as warranted based on new information.

ii) Assessment database

DEC currently maintains two discrete databases that are used to track use support: one for lakes and ponds, and the other for rivers and streams. No such assessment dataset is available for wetlands. These databases are updated continually throughout the year, and each year, the database is archived prior to fulfilling EPA-required assessment data submissions. In this way, static archive copies of assessment databases for lakes and streams are maintained annually. These assessment databases are structured to be compliant with the current EPA "Assessment DataBase" database architecture. These databases are presently housed in Microsoft Access©.

iii) Priority & impaired waters database

DEC presently maintains a database of priority and impaired waters that is separate from the assessment databases. This database is presently maintained in Microsoft Access© and is relationally linked to the assessment databases. Waterbodies are identified by their priority listing status and TMDL status, as identified within the Assessment Databases.

C) Mapping

Late in 2003, the Vermont Center for Geographic Information finalized the Vermont Hydrographic Dataset (VHD). VHD is a GIS-based waterbody coverage which is based on the National Hydrographic Dataset (NHD) architecture. The VHD is fully compliant with NHD and includes all metadata requirements and reach coding. VHD differs from NHD in that it is a 1:5,000 scale water coverage. NHD is presently available in all New England states but at a 1:100,000 scale resolution.

As of this writing, Vermont's existing 210 river/stream and 558 lake/pond waterbodies have been geo-referenced to the 1:5000 VHD, permitting the development of very high resolution maps displaying assessment and listing status. For reporting purposes, the maps shown earlier in Part 4 are mapped at 1:100,000 scale.

D) Data Access

As mentioned above, lake information summaries including monitoring data summaries for two major monitoring programs are available online. Data for any specific lake, pond, river, or stream are available on request by contacting appropriate Water Quality Division staff. Appropriate contact persons can be identified in the staff listing provided by www.vtwaterquality.org. Copies of assessment information summaries can also be provided on request, and the Vermont lists of priority and impaired waters are available at the same web site noted immediately above.

PART NINE: CONCERNS & RECOMMENDATIONS

Lakes & Ponds

Atmospheric Deposition of Pollutants

Deposition of pollutants to the Vermont landscape from the atmosphere is principally responsible for the partial support of fish consumption and aquatic life uses of 15,414 inland lake acres, all 174,175 acres of Lake Champlain, and all Vermont river and stream miles. Atmospheric deposition is the principal source of two major causes of use loss in Vermont: elevated mercury and low pH. The two causes are linked, since in many instances, lakes that are vulnerable to acidification are also those which transfer atmospherically deposited mercury to the aquatic food web in the toxic methyl- form. However, other lakes that are not at risk of acidification do retain the ability to transfer mercury into the trophic chain via alternate geochemical pathways, as is discussed in Section 4.D.5.

Atmospheric deposition of mercury has resulted in the issuance of fish consumption advisories for many Vermont lakes and rivers, particularly those containing walleye. Specific advisories are in place for the five Deerfield River reservoirs, and for Moore and Comerford Reservoirs within the Fifteen Mile Falls Project (Connecticut River). The method by which the Department assesses fish consumption uses has been further refined during the reporting period, and is provided in detail in the Assessment Methodology (refer to Appendix C).

The impacts of mercury deposition are not, however, limited to loss of fish consumption uses. Reproductive and behavioral impacts to wildlife that feed on fish are common to a subset of New England lakes, including the reservoirs along the Deerfield River and Connecticut River (Fifteen Mile Falls). Potential impacts to upper trophic level biota continue to be monitored by the Vermont Institute of Natural Sciences, in collaboration with the Biodiversity Research Institute.

Loss of uses associated with atmospheric deposition result from regional and long-range emissions of acid-forming precursors. The atmospheric deposition of nitrous oxide (NO_x) and sulfate (SO_4) from Midwestern sources has resulted in acidification (low pH) of 34 lakes and six streams within Vermont. In Vermont, the potential for acidification is measured by direct measurement of pH as well as corollary measures such as acid neutralizing capacity, NO_x, SO_4 and others. Deposition of SO_4 and in-lake SO_4 concentrations are presently decreasing. During the reporting period, DEC completed and EPA approved an acidification TMDL affecting 30 lakes/ponds.

Vermont continues to work at the local, regional and national scale, to research the environmental effects associated with atmospherically deposited pollutants, reduce Vermont's locally-generated emissions, and influence the development of Federal legislation aimed at reducing atmospherically-derived pollution. Specifically, DEC has recently completed a revised mercury emissions inventory and has completed the REMAP mercury research project for Vermont and New Hampshire lakes. DEC is currently participating in several regional mercury monitoring, research, and assessment projects including a new "round" of fish tissue testing in Lake Champlain; a mass-balance modeling effort for mercury in Lake Champlain; a compilation, synthesis, and analysis of environmental mercury monitoring information across northeastern North America (the so-called "NERC" mercury workgroup); participation in a regional modeling and TMDL analysis of mercury fate and transport in New England; and a regional study to ascertain the covarying influence of water level fluctuation and trophic state on mercury bioaccumulation in fluctuated reservoirs. With significant assistance and support from DEC, the Vermont Advisory Committee on Mercury Pollution continues to identify areas

in Vermont where mercury use and emissions can be reduced, and is active in advising the Vermont General Assembly in its efforts to develop mercury-related legislation for Vermont. Finally, DEC staff continued to interact with the congressional delegation to address this issue from a national perspective.

Despite these many efforts, there remains a significant need to properly assess inland Vermont waters for mercury contamination. Specifically, funding is needed to implement a lake and stream tissue monitoring program, designed based on findings from the REMAP project, to better estimate mercury levels in fish tissue in particular lakes and to estimate overall statewide levels of contamination for species other than yellow perch. Currently, Vermont dedicates no specific funding for fish tissue monitoring. The work that DEC cooperatively implements along with the Vermont Department of Fish and Wildlife and Department of Health is essentially done as time permits, and accordingly is conducted at a modest scale. Under an optimal program, funding would be available to support temporary field and laboratory staff to implement a five-year rotating tissue assessment program that would coincide with rotating basinwide assessments. Any augmented fish testing program should also include testing for new tissue contaminants such as poly-brominated diphenyl-ethers.

Hydrologic Modifications in Lakes

Water level manipulations are another important source of use impact to lakes. There are 34 lakes and ponds (about 9,000 acres) in Vermont for which one or more uses are altered due to water level manipulations. Flow alteration affects aquatic life uses due to littoral habitat loss. In some instances, flow alteration can also affect aesthetic, swimming, and even boating uses, depending on the severity and/or timing of the drawdown.

During the upcoming biennium, DEC's Lake Bioassessment Program plans to obtain more precise and quantitative estimates of aquatic life use impairments in flow-altered lakes and reservoirs. Absent these anticipated biological data, the Assessment and Listing Methodology (refer to Appendix C) contains a decision-making tree to make preliminary assessments of use support in fluctuated lakes and reservoirs in a uniform fashion.

Exotic Aquatic Species as Pollutants

Vermont has a history of impacts related to non-native nuisance plants and animals in its lakes and, unfortunately, the number of non-native introductions to inland Vermont lakes continues to increase.
During the 2004 305b reporting period, Eurasian watermilfoil was discovered in two new lakes (Deweys Mill Pond in Hartford and Lake Elmore in Elmore). If Vermont is to be successful in slowing the rate of spread of this nuisance species, continued personnel and financial resources will need to be directed toward spread prevention efforts. Water chestnut (*Trapa natans*) was discovered in one new waterbody, North Springfield Reservoir. Of continued concern is the discovery in 2001 of a water chestnut infestation in the Pike River in Quebec. This new infestation places Missisquoi Bay of Lake Champlain in extreme jeopardy of an infestation. At the present time, zebra mussels are pervasive in Lake Champlain and Lake Bomoseen. The mussels also threaten aquatic life and swimming uses in a small set of inland lakes. One interesting hypothesized consequence of zebra mussel infestation in Lake Champlain has been the development of a declining trend in aqueous calcium concentrations lakewide, the onset of which is temporally coincident with the flourishing of zebra mussels throughout the lake during the mid-1990's.

On a more positive note, sustained hand pulling efforts appear to have eliminated the water chestnut populations in Rood Pond (Williamstown/Brookfield) and Lake Bomoseen (Castleton). The

population in Lake Paran (Bennington/Shaftsbury) is nearly eradicated as well. It is essential that DEC receive continued funding for water chestnut control at or above existing levels to maintain the ground gained in the last two years in the battle against water chestnut in Lake Champlain and the inland lakes.

During the reporting period, Beebe Pond (Hubbardton) was treated with a low concentration of the aquatic herbicide *Sonar*™ to selectively manage a dense Eurasian watermilfoil population there. Unfortunately, while recreational uses that had been severely impaired for years in Lake Hortonia (Hubbardton/Sudbury) and Burr Pond (Sudbury) showed short-term restoration following a *Sonar*™ treatment of those lakes in 2000, Eurasian watermilfoil has now fully rebounded there, and plans are being made for another *Sonar*™ treatment of those lakes perhaps as early as 2004. Lake St. Catherine (Wells/Poultney) and the associated Little Pond and Lily Pond will also be treated using *Sonar*™ in the early summer of 2004. Star Lake (Mt. Holly) may be treated with the same herbicide in 2004 as well. All of these treatments would be at a target fluidone concentration of 8 parts per billion (ppb) with 5-8 ppb of fluridone maintained in the waterbodies for a minimum of 90 days.

Herbicide treatments are expensive and time-consuming projects for local lake associations. If more than 2-3 years of relief from the impacts of dense Eurasian watermilfoil growth cannot be obtained from an herbicide treatment without unacceptable impacts to non-target organisms, it is doubtful that local groups can continue to afford to use this control method, both from a financial and a personnel resources standpoint. Vermont would like to see a national focus on enhanced research into other methods to control Eurasian watermilfoil, including potential biological control agents.

Eutrophication of Lakes

DEC commits significant resources to the management of human-caused eutrophication affecting Vermont lakes. Vermont has relatively unproductive lakes as compared to other parts of the country. This is attested to by the fact that only three inland lakes appear on Vermont's draft Year 2004 303d list as impaired due to excessive eutrophic conditions (Lake Carmi, and Shelburne Pond and Ticklenaked Pond in Franklin, Shelburne and Ryegate, respectively). Implementing protective actions to reduce human impacts on lake trophic state before impairments develop is more efficient and effective than waiting until restoration is needed. Toward this end, several lake protection projects are described elsewhere in this document, with moderate success noted in some waters. Indeed, even though the Lake Carmi TMDL has not yet been prepared, there have been notable improvements in the summer nutrient concentrations, transparency, and algal populations in the lake owing to significant watershed restoration efforts already underway there.

Eutrophication can simultaneously affect aesthetics, aquatic life, swimming, and in some instances even boating uses. The major causes related to eutrophication for inland Vermont lakes are nutrients, siltation, and organic enrichment. The major sources of these pollutants are construction, urban and suburban runoff, road maintenance and runoff, agriculture, silviculture and other nonpoint sources.

Nutrient Criteria

During the reporting period, DEC finalized its nutrient criteria development plan, and has obtained EPA funding to partially implement the plan, beginning in the 2004 field season. Vermont's nutrient criteria development plan focuses on developing quantitative relationships between nutrient parameters and designated

uses such as recreation, aesthetics, aquatic habitat, and public water supply, in lakes and rivers.

Rivers & Streams

Hydrologic Modifications

As humans develop watersheds more intensely, remove stream gravel and alter the stream channel, increased flooding, impaired water quality, and impacts to aquatic resources are the unwanted results. Land use changes and instream management activities and their relationship to adverse impacts on rivers and streams are the focus of studies either completed or currently being undertaken by DEC. The recommendations of the studies have caused DEC to develop the *Stream Geomorphic Assessment Handbook* and are likely to result in changes to the *Stormwater Management Procedures*.

It is recommended that DEC encourage municipalities to incorporate the future revised management procedures in their plans and ordinances through workshops sponsored by regional planning commissions meeting with selectboards, conservation commissions and local planning commissions. In addition, additional resources are needed to assist with channel restoration of flood-damaged rivers and streams.

Stormwater Management

Urban stormwater continues to be a focal point in Vermont for permitting, litigation and legislation. The Watershed Improvement Permit methodology developed by DEC was described in the 2002 305b Report as the principle means for water quality remediation in stormwater affected areas. The Watershed Improvement Permit process was subsequently overturned on appeal to the Water Resources Board during the 2004 305b reporting period and an investigative docket process was then initiated by the Board. The Water Resources Board's collaborative stormwater investigative docket focused on the science of stormwater management. The participants developed an innovative approach to reducing scientific uncertainty regarding clean up plans to restore biological health to stormwater-impaired streams. Participants concluded that the major adverse impact of stormwater was hydrologic – there is simply too much water flowing off the areas occupied by impervious surfaces that in turn causes excessive stream channel erosion. The collaborative recommended rigorous, detailed assessment of impaired watersheds and setting hydrologic targets for reducing water flows in impaired waters based on comparisons with "attainment streams" that are meeting standards even though development is found in their watersheds.

The Vermont Legislature enacted House Bill number 785 that implements the Water Resources Board's Docket recommendations by:

- Continuing to allow the Agency of Natural Resources to issue the existing watershed improvement general permit (WIP) without a detailed planning process in those rare circumstances where the Agency is confident that actions required by the general permit will result in attainment of water quality standards within five years.

- Requiring a rigorous hydrology-based, planning process leading to the development of either a Total Maximum Daily Load (TMDL) load allocation plan or a similarly detailed Water Quality Remediation Plan (WQRP) for each of the 17 stormwater-impaired watersheds.

- Authorizing ANR to issue watershed specific general permits implementing a TMDL or WQRP. There is no requirement that permits based on a TMDL or WQRP result in attainment of water quality standards in five years or any other fixed period of time.

DEC is currently developing new techniques, based upon hydrological model targets, to remediate these impaired streams. It is anticipated that all 17 stormwater-impaired receiving waters will have water quality remediation plans developed for them by the end of 2007.

An overview of the new stormwater remediation process as a collaborative long-term solution is provided below.

- Focus on altered hydrology as the principal source of impacts.
- Solution must be Adaptive Management based.
- Watershed-wide source modeling of hydrology.
- Watershed specific analysis for sources and stream regime.
- Watershed remediation plans – pseudo TMDL determination.
- BMP based program – not site-specific effluent limitations.
- "Stormwater Impact Area" type analysis to provide details on cost effective watershed solutions.
- Engineering Feasibility Analyses on individual properties.
- Use of Stormwater Offset Fees to fund watershed-level remediation projects.
- Selection of initial round of stormwater upgrades.
- Baseline watershed monitoring.
- Long-term monitoring and adjustment.

Polluting Discharges from Large Farms

From a water quality perspective, concerns continue to exist regarding shifts in agricultural production from a large number of smaller farms to increasing numbers of larger farms. The water pollution potential from such large farming operations is equivalent to the waste generated by a small to medium sized city. It is recommended and essential that waste management and pollution prevention efforts are well coordinated between farm operators and state and federal agencies. The Large Farm Operation Rules, regulating farms with greater than 950 animals and administered by the Vermont Agency of Agriculture, Food and Markets, will help ensure animal wastes on these larger facilities are managed effectively.

Changes at the federal level are soon to affect the Concentrated Animal Feeding Operation permit program, currently administered by DEC under the National Pollutant Discharge Elimination System. Farms that have between 200 and 750 animals will soon need a General Permit and will need to demonstrate compliance. Farms with greater than 750 animals will soon need an Individual Permit.

In order to achieve the greatest possible environmental protection benefit while supporting an important ingredient of Vermont's landscape and way of life, it is recommended these permit programs be developed or modified in a coordinated manner with various technical and financial assistance programs to address waste and nutrient management.

Lack of Strategic Statewide Vegetated Buffer Requirements

Undisturbed vegetation along rivers and streams (as well as along lake shorelines) is effective at reducing pollutants from reaching surface water. Other than Act 250 development constraints and a few regulations adopted by a small number of municipalities, there are no strategic statewide

requirements that riparian landowners maintain a minimum width of vegetation along bodies of water as there are in other states. As a result, many miles and acres of Vermont's surface waters are negatively influenced by urban runoff, sediment, increased temperature, fertilizers, manure, and other pollutants which can be reduced or eliminated by properly maintained vegetated buffers.

As the result of the recognized importance of riparian buffers to water quality in certain strategic locations, a Buffer Procedure Action Team was created in October 1999. The Team was charged with developing a revised Agency buffer policy and procedure, including general and site specific standards. The revised Buffer Procedure, once finalized, would be used by the Agency in the Act 250 process and as guidance to riparian landowners, including public and quasi-public agencies.

DEC continues to make some strides in the educational effort to inform the public and municipal planning commissions about the environmental benefits of riparian vegetation. DEC and Regional Planning Commissions (and in some cases local watershed groups) have been working with municipalities to strengthen their municipal plans and zoning regulations to maintain streamside vegetation. Workshops for town officials and the general public have been conducted regarding strategies to encourage the maintenance of existing riparian vegetation as well as promoting the planting of riparian areas lacking vegetative buffers. DEC, the Vermont Youth Conservation Corps, the various Natural Resources Conservation Districts, watershed groups and other volunteer groups have worked on many streamside planting projects around the state. However, there is still need for additional public education about the need to maintain riparian buffers for water quality protection and wildlife habitat.

It is recommended that the Agency continue to make more use of the print media, TV and radio to draw the public's attention to the benefits of maintaining riparian vegetation.

Groundwater

Groundwater is fundamental to the ecosystem and as a drinking water resource. It recharges wetlands, rivers and streams, and lakes and ponds, making it critical to wildlife. It is also source of drinking water for most of Vermont's population. While groundwater is addressed through the federal Safe Drinking Water Act, the Act's prime focus has been on treatment, operation, and infrastructure needs of public water systems. Additional regulations that address groundwater are often created in reaction to contamination. Yet, the characteristics of groundwater remain largely unknown. Characterizing the groundwater resource is overdue relative to the continuing threat of contamination, the pressures and pace of development, and the resource's importance.

To appropriately address groundwater and elevate its standing to a level that other natural resources enjoy requires a continuous commitment. Required in this commitment is a groundwater program with sufficient personnel that would define Vermont's groundwater resources. Central to this mission is a proactive approach to aquifer mapping. This mapping would not only identify potential future aquifers but would also update existing Source Protection Areas that were insufficiently delineated. Recognized in this approach is the connection between surface water and groundwater that is so often ignored. In addition, there is a need for education and technical assistance at the state level and, most importantly, at the local level.

The above approach is based on a philosophy that a comprehensive understanding of groundwater is needed to provide effective, preventative strategies to protect the resource. Without this understanding

assumptions regarding groundwater remain ill conceived or the resource is taken for granted altogether which results in inadequate groundwater protection efforts. Conversely, a groundwater program based on data that describes the resource can appropriately protect the resource for present and future needs.