TOTAL MAXIMUM DAILY LOAD
for
PATHOGENS

WINOOSKI RIVER
BELOW CABOT VILLAGE

Waterbody ID: 08-09

January, 2001

Prepared by:

State of Vermont
Department of Environmental Conservation
Water Quality Division
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Submitted to:

U.S. Environmental Protection Agency-Region 1
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Boston, MA 02114-2023

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Introduction and Waterbody Description

The impaired water for which this TMDL was developed is identified on the 1998 Vermont 303(d) List as Winooski River-Cabot Village and is located by the Waterbody ID VT08-09. The impaired segment is located in the uppermost portion of the Winooski River Basin (upstream from Lower Cabot Village) in waterbody 08-09, as defined by the State of Vermont River Basins map. The stream is classified as Class B in the Vermont Water Quality Standards effective July 2, 2000. This TMDL aims to restore the impaired waterbody to at least the minimum level described in those standards.

The Winooski River watershed at Lower Cabot Village and its associated land use is identified in Figure 1. The watershed has an area of 21 square miles, 70% of which is forested. Breakdown of the major land use categories in the watershed is given below in Table 1.

Table 1. Land use breakdown in the Winooski River watershed at Lower Cabot Village.

Land Use Category	Percent Composition
Forested	70 %
Agriculture	17 %
Urban/Developed	6 %

Source Data: LANDSAT Thematic Mapper Imagery, 1997, The Vermont Center for Geographic Information, Inc.

The above categories are the major land uses identified in the watershed and represent about 93% of its total area. The remaining uses comprise open water and non-forested wetlands.

Problem Assessment and Pollutant Sources

Problem Assessment

The area in and around Cabot, Vermont has historically had problems finding suitable sewage treatment and disposal. Possible solutions to these problems have been investigated for many years by various parties including Cabot Village, the School District, Town of Cabot, the Agency of Natural Resources and local planning groups.

In May 1992 a feasibility study was prepared for the Village by Phelps Engineering, Inc. This study discussed eight options for the Village and School District with respect to wastewater management and did not recommend any specific alternative other than to continue to work with the Department to

discuss project direction.

Due to growing concerns about possible contamination of the Winooski River in the Cabot area caused by failing septic systems and illegal discharges, a sanitary survey was conducted by the VT-DEC between November 23, 1992 and December 4, 1992 and on April 14, 1993 of the same area the feasibility study addressed. The survey found six properties with pipes that were illegally discharging untreated or improperly treated sewage directly into the Winooski River. Twelve more properties were found to have failed septic systems.

As a result of the findings of the sanitary survey the Department issued an Order under 10 V.S.A. Section 1277 to the Town of Cabot on September 15, 1993. This order required the Town to evaluate treatment options for correcting the wastewater problem, select a treatment option, and construct and operate a wastewater treatment system to correct the untreated sewage and the failed septic systems.

Based on the data generated by the sanitary surveys, impairment of the Winooski River in the area of Cabot Village was determined to exist and the waterbody was placed on the 1998 Vermont 303(d) List. The waterbody had not been listed on previous 303(d) lists. Because of the clear understanding and the magnitude the identified direct discharges and failed septic systems can have on a small river, it was determined that instream sampling was not required to determine impairment based on the Escherichia coli (E. coli) numeric standard (77 organisms/100 ml - instantaneous).

Other potential sources of E. coli contamination were not investigated for two reasons. Firstly, no further information was required to determine the violation of Vermont statutes concerning direct discharges and the need for their removal. Secondly, other possible sources were believed to be minor compared to the domestic sewage sources, which were considered the most obvious and largest sources of fecal contamination.

Priority Ranking

According to the 1998 Vermont 303(d) List, TMDL development for the Winooski River at Cabot was scheduled for 2000, which represents a high priority scheduling for TMDL development. Waters listed on the 1998 303(d) List were prioritized over a period of 15 years, through 2013.

Pollutant of Concern

The Winooski River at Cabot TMDL was developed for pathogens from fecal contamination; however, more specifically the Vermont Water Quality Standards identify E. coli as the indicator organism for which pathogens are detected. Therefore, this TMDL has been developed for E. coli.

Pollutant Sources

Sources of E. coli to a waterbody can vary greatly and can be from both point sources and nonpoint sources. Poorly treated or untreated sewage can be a major source of E. coli contamination as can untreated runoff from urban and agricultural areas. The identified as well as potential sources of E. coli contamination are discussed below.

Point Sources

As identified in the Introduction, significant point source E. coli contamination to the Winooski River in the Cabot region was identified from the investigations conducted in 1992 and 1993. These investigations revealed six (6) direct discharges of domestic sewage to the Winooski River. Subsequent investigations by the State of Vermont during 2000 discovered further direct discharges of fecal contamination from septic systems. The total point sources identified to date include thirteen (13) direct discharges of domestic wastewater to the river.

Currently there is a single NPDES permitted direct discharge in the watershed from the Cabot High School which contributes E. coli to this portion of the Winooski River. Discharge is authorized under Discharge Permit # 3-0376 which dictates a maximum flow of 6,000 gallons per day and an E. coli maximum concentration of 77 organisms/100ml. Under the proposed remediation measures of constructing a new wastewater treatment facility, this discharge will be eliminated and connected to the new facility.

Nonpoint and Background Sources

Associated with the watershed investigations conducted to identify domestic wastewater disposal irregularities, several problematic residential septic systems were identified. In addition to the direct discharges (point sources) listed above, seven (7) surfacing systems were identified with potential to

ultimately discharge to the river. As of the latest investigation, an additional 21 systems are considered problematic with significant potential for fecal contamination to the river. A distinct trend has developed as investigations of septic systems progressed. While perhaps all sources of fecal contamination to the river may not have been identified, sufficient evidence exists to document a real and significant problem and a violation of the Vermont Water Quality Standards. Considerable variation in the magnitude of contamination from such sources may exist, but a conservative loading scenario developed under critical conditions is given in the Linkage Analysis portion of this document.

No specific sampling data exists for the enumeration of nonpoint background sources of E. coli. However, there are also no indications of problematic E. coli loading from background sources and this TMDL assumes there are no significant background sources of fecal contamination. The high degree of forest cover (70%) and pervious surfaces within the watershed supports this assumption. This dominant land use is expected to produce the lowest E. coli loading rates of all land uses identified.

Applicable Water Quality Standards and Numeric Water Quality Target

State Water Quality Standard

The Winooski River at Cabot is designated as a Class B water. As a Class B water, the current Vermont Water Quality Standards state in §3-04(B)(3) that E. coli concentrations are:

> Not to exceed 77 organisms/100ml. The Secretary may, by permit condition, waive compliance with this criterion during all or any portion of the period between October 31 and April 1, provided that a health hazard is not created. The Secretary shall provide written notice to the Vermont Department of Health prior to issuing a permit waiving compliance with the Escherichia coli criterion.

Management Objectives

The Vermont Water Quality Standards in §3-04(A) state that:

> Class B waters shall be managed to achieve and maintain a level of quality that fully supports the following designated uses:

including:

> 5. Swimming and other primary contact recreation - suitable for swimming and other forms of water based recreation where sustained direct contact with the water occurs and, where attainable, suitable for these uses at very low risk of illness based on Water Management Type designation.

Numeric Water Quality Target

The water quality target for this TMDL is set equal to the E. coli water quality standard of **77 organisms/100 ml.**

Antidegradation Policy

In addition to the above standards, the Vermont Water Quality Standards contain, in part, the following antidegradation policy in § 1-03(B)(1):

> Existing uses of waters and the level of water quality necessary to protect those existing uses shall be maintained and protected regardless of the water's classification. Determinations of what constitute existing uses of particular waters shall be made either during the basin planning process or on a case-by-case basis during consideration of an application. The use of waters to receive or transport discharges of waste shall not constitute an existing use for purposes of these rules. In making a determination of the existing uses to be protected and maintained under this section and all other sections of these rules, the Secretary shall consider at least the following factors:
>
> a. Aquatic biota and wildlife that utilize or are present in the waters;
> b. Habitat that supports existing aquatic biota, wildlife, or plant life;
> c. The use of the waters for recreation or fishing;
> d. The use of the water for water supply, or commercial activity that depends directly on the preservation of an existing high level of water quality; and
> e. With regard to the factors considered under paragraphs (a) and (b) above, evidence of the use's ecological significance in the functioning of the ecosystem or evidence of the use's rarity.

Linkage Analysis

The linkage analysis is a necessary TMDL element that establishes the cause-and-effect relationship between measurable water quality targets and identified sources. This can be accomplished through a number of methods from qualitative assumptions based on sound scientific judgement to the use of sophisticated predictive models. The method chosen should be supported by monitoring data or observations that associate waterbody responses to specific loading conditions.

The cause of impairment to the Winooski River in Cabot was determined to be excess E. coli loading based on the presence of direct domestic wastewater discharges and failing septic systems. Prior to a discussion on the sources, loading and water quality targets for E. coli bacteria, it first must be understood how E. coli is used in the water quality standards. E. coli is an indicator organism used to identify the high probability of fecal contamination and human pathogens present in a waterbody. While the presence of E. coli over the state standard of 77 organisms/100ml is indeed a violation of the numeric standard, it is primarily an indicator of potentially more harmful contaminants. This type of information often prompts investigations into possible sources. In the instance of the Winooski River in Cabot, the sources of the impairment were identified without the use of the indicator organism E. coli. Direct and poorly treated domestic wastewater discharges, a violation of water quality standards themselves, were identified through direct investigation without the usual screening step of identification through water quality monitoring.

By understanding the link between pollutant sources and water quality targets, the loading capacity of the river must be understood. EPA regulations define loading capacity as the greatest amount of pollutant loading a waterbody can receive without violating water quality standards (40 CFR §130.2(f)). The loadings are required to be expressed as either mass-per-time, toxicity, or other appropriate measures (40 CFR §130.2(i)). For this TMDL, neither mass-per-time nor toxicity were seen as an appropriate means of representing the loading capacity for E. coli, so the loading capacity has been set equal to the maximum concentration of E. coli allowed in the water quality standards, 77 organisms/100 ml. This method was seen as the most appropriate method for several reasons.

Expressing the loading capacity in terms of concentration establishes a clearer link between water quality standards attainment and the allowable loading from various E. coli sources. Since the water

quality standards are expressed in terms of concentration (a maximum instantaneous concentration of 77 organisms per 100 ml) comparison of water quality data to the TMDL is simplified.

Another reason to relate the E. coli loading capacity in concentration rather than mass-per-time is that the NPDES point sources of E. coli are monitored and permitted based on concentration. Again, the correlation between their values and the standards can be more directly compared by water quality managers and the public. From the standpoint of assuring attainment of the standards, it is preferable that the bacteria sources be controlled so the magnitude of each source is equal to or less than the water quality standard that is expressed in terms of concentration.

Considering the knowledge of the untreated domestic wastewater, critical conditions are considered to occur during low-flows when they will have their greatest impact on instream E. coli concentrations. Assuming discharges from the sources are somewhat constant, low river flows will result in a higher instream E. coli (and presumably other human pathogens) concentration. Also, the potential impact of pathogens on contact recreation uses is perhaps greatest during periods of dry weather (lower river flow) rather than during wet weather. The calculated 7Q10 flow for this portion of the Winooski River is 2.8 cubic feet per second (cfs).

Quantification of the identified illicit discharges that contributed to the water quality violation was based on the following information: the number of households with direct discharges, the number of households with failing septic systems, an average of 2.5 people per household, an assumed average daily discharge of 120 gallons per person per day, and an assumed effluent discharge E. coli concentration of 10^6 organisms/100ml (Berg, 1978).

Also to be considered when determining the level of E. coli contamination in the Winooski River is the contribution from background sources. In this instance, background sources consist of all upstream nonpoint sources of E. coli. No data is available to quantify the E. coli loading from these sources but the reasonable assumption is made based on land use statistics that large nonpoint sources of E. coli or fecal pathogens are not anticipated. As the land use breakdown, Table 1, indicates 70% of the watershed is forested.

Additionally, during low flow, when the discharges have their greatest impact, impacts from upstream

background sources are expected to be minimal. Presumably, the most common mode of transport for E. coli to reach the stream is via overland runoff, and as indicated above, the most critical period for known significant contamination is during dry weather, low flows. Even though background sources are presumed to be minimal, the estimated E. coli loading under critical conditions described below in Table 2, is set at the limit of the water quality standards, 77 organisms/100 ml.

Table 2. Estimated E. coli concentrations during low-flow, 7Q10 conditions.

E. coli sources		Flow	E. coli concentration
Background			
	Winooski R. @ Lower Cabot	2.8 (cfs) (1,809,561 g/d)	77 organisms/100ml
Identified Nonpoint Sources			
	Failing Septic Systems - approx. 7	7,500 (g/d)	10^5 organisms/100ml
Identified Point Sources			
	Cabot High School	6,000 (g/d) - max	77 organisms/100ml
	Direct Discharges - 13	3,900 (g/d)	10^6 organisms/100ml
Approx. instream E. coli concentration			2,300 organisms/100ml

A slight distinction was made between direct discharges and failing surfacing systems with regard to the E. coli concentrations reaching the river. The thirteen (13) observed direct discharges were allotted an E. coli concentration of 10^6 organisms as noted in the literature. Since the other seven (7) failing systems required some overland travel and presumably incurred some E. coli die-off prior to reaching the river, their contributing concentration was considered an order of magnitude less.

The approach used in making the linkage between pollutant sources and water quality standards is most appropriate in this instance because of the clear linkage between the identified point sources and violations of the water quality standards. It is a protective approach by eliminating the problematic discharges and limiting the combined discharge of the treatment facility equal to the E. coli concentration set in the water quality standards. This approach also provides an adequate margin of safety.

Another aspect to this method was that no instream bacteria sampling was conducted. Since identification of both E. coli and pathogen sources was extensive through the sanitary surveys conducted, the usefulness of instream sampling was diminished . However, for the purposes of this TMDL, violations of the E. coli limits in the standards were shown through dilution calculations (Table 2).

The actual current condition of the enumeration of the bacteria is of little real importance, since the solution calls for a complete removal of the problematic discharges and rerouting them to a new planned wastewater treatment facility (WWTF). What is of consequence is that the discharges identified and their potentially high E. coli and pathogenic organism concentrations cause violations of the water quality standards, a problem that needs correction.

TMDL Allocations

The TMDL allocation is composed of the sum of individual waste load allocations for point sources, load allocations for nonpoint sources, and natural background levels. In addition, the TMDL must provide a margin of safety that accounts for any uncertainty in the allocation being able to attain water quality standards.

Wasteload Allocations

As a new permitted wastewater treatment facility is being proposed in the Town of Cabot, all identified direct discharges are to be connected to the new facility. This process will eliminate one of the primary sources of fecal contamination to the river. Therefore, the wasteload allocation for this group of sources is set at zero. The other existing E. coli point source, the Cabot High School, is to be connected to the new facility, so its corresponding wasteload allocation is also set at zero. Following project implementation, the Cabot wastewater treatment facility will be the sole point source E. coli contributor, and through its regulated permit limits, its wasteload allocation is set at the maximum allowable by the standards, 77 organisms/100 ml. Table 3 summarizes the wasteload allocations.

Table 3. Wasteload allocations

Current / Planned Point Sources	E. coli. Allocation
Identified direct domestic wastewater discharges (13)	0
Cabot High School	0
Proposed Cabot WWTF (50,000 gal/day - max.)	77 / 100 ml

Load Allocations and Background

No changes are currently anticipated for the background nonpoint sources and the allocation to them, divided by land use, are set equal to the Water Quality Standards of 77 organisms/100ml. The identified problematic septic systems are to be redirected to the proposed treatment facility so their load allocation is set at zero. Table 4 summarizes the load allocations.

Table 4. Load allocations

Land Use Designation	E. coli. Allocation
Identified failing or surfacing septic systems (7)	0
Forested	77 / 100 ml
Agriculture	77 / 100 ml
Urban/Developed	77 / 100 ml

As mentioned previously in the description of sources, no specific sampling data exists for the enumeration of background sources of E. coli. However, there are also no indications of problematic E. coli loading from background sources. This TMDL assumes there are no significant background sources of fecal contamination based on the low degree of development and the high degree of permeable land cover. Forested land cover represents 70% of the watershed area and is expected to produce the lowest E. coli loading rates of the land uses identified.

Margin of Safety

There is an inherent margin of safety incorporated in the TMDL allocation by setting the allowable pollutant sources (wasteload allocation and load allocation) less than or equal to the water quality standards. While the holding of discharge concentrations at the planned WWTF equal to the standards

would ensure standards attainment, it does not consider the likely instream dilution, die-off and loss due to settling of bacteria. Within these conservative assumptions is an added margin of safety.

Seasonal Variation

The expression of this TMDL in terms of concentrations set equal to the water quality standards applies for all seasons and environmental conditions. It is protective of the standards under all seasonal variations.

Monitoring Plan

As detailed in the draft NPDES permit Fact Sheet (Appendix A) for the planned WWTF, there is an E. coli effluent limitation of 77 organisms/100 ml instantaneous maximum. E. coli monitoring is required twice per month and is consistent with other similar discharges using ultraviolet disinfection in the State of Vermont.

For the purposes of this TMDL, reasonable assumptions were made indicating that background loading of E. coli from the watershed was expected to be consistently below acceptable levels. This assumption was based on the low degree of development and high level of forested land cover in the watershed. In an effort to verify these assumptions and compliance with the water quality standards, periodic ambient monitoring will be conducted at the bottom of the impaired segment. Monitoring will not be conducted until all connections to the constructed WWTF are complete. Monitoring will likely be incorporated into the Vermont Rotational Watershed Assessment Program which conducts watershed assessments on a five year rotating basis.

Reasonable Assurances

As outlined briefly in the introduction of this TMDL and more extensively in the Fact Sheet (Appendix A), issued in association with the draft NPDES permit, considerable effort and investigation by the Town of Cabot and VT-DEC has been expended to solve this wastewater discharge problem to the Winooski River. Through years of effort, a plan has been developed to construct a new WWTF to eliminate the sources of fecal contamination to this portion of the Winooski River. As required by the original 1277 Order issued to the Town of Cabot on September 15, 1993, and subsequently amended

Orders, all identified problematic discharges are to be remedied through connection to the proposed WWTF. All planning efforts and design criteria for the new facility have been finalized and a final permit for the discharge was issued on April 11, 2000.

Public Participation

Issued to the public, in association with the draft NPDES permit for the construction of the new Cabot WWTF, the Fact Sheet (Appendix A) contained notice that this project would result in the attainment of the water quality standards in this impaired waterbody as required by section 303(d) of the Federal Clean Water Act. Text of that notice is provided below:

> *V. Compliance with Water Quality Standards*
>
> *The Winooki River in Cabot Village (Waterbody ID VT08-9) is listed on the Vermont 1998 Part A list of Impaired Surface Waters due to pathogens resulting from the discharge of untreated or improperly treated sewage. Section 303(d) of the federal Clean Water Act requires that for impaired waters, states determine and implement strategies that reduce pollutant loading and achieve compliance with the applicable water quality standards. Upon completion of the Cabot Wastewater Treatment Facility (as defined by Condition A.I.4 of the permit) the discharge of untreated and improperly treated sewage will be eliminated and compliance with the Vermont Water Quality Standards will be achieved.*

In addition to the public comment period associated with the NPDES Permit, public notice was given and comments were solicited for this Total Maximum Daily Load document. A 30 day public notice was posted on the Vermont Department of Environmental Conservation web site as well as in two daily newspapers serving the area, The Burlington Free Press and The Times Argus. The period for public comment was from December 13, 2000 to January 12, 2001. No comments were received. Copies of the public notices are given in Appendix B.

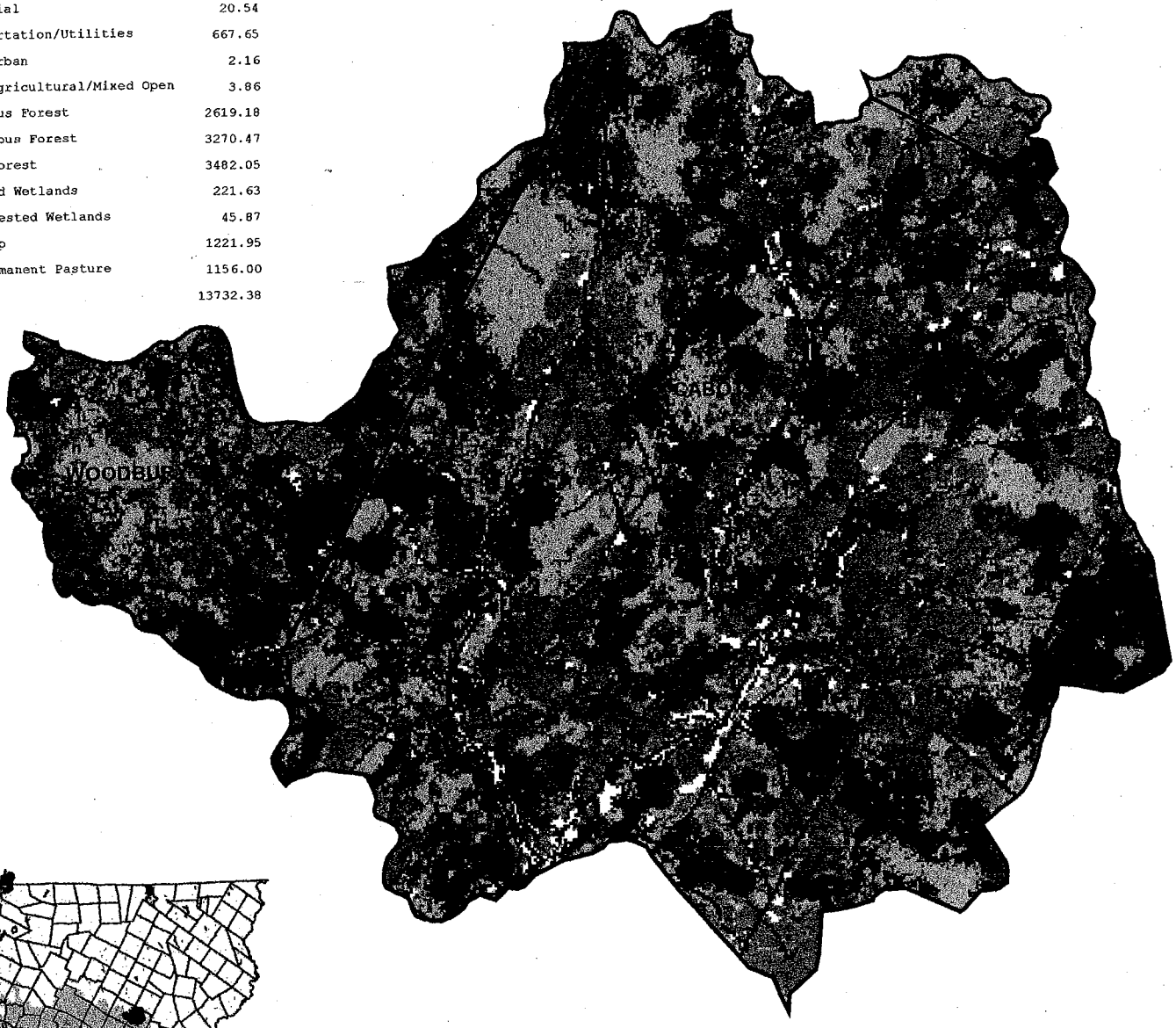
References

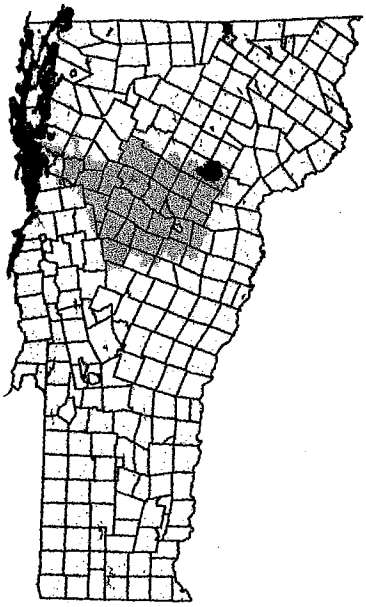
Berg, Gerald, ed.; Indicators of Viruses in Water and Food (Ann Arbor, MI: Ann Arbor Science Publishers Inc, 1978) p.179.

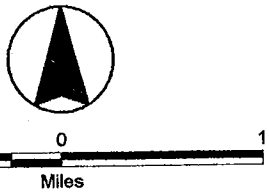
FIGURES

Figure1: Winooski River watershed at Lower Cabot and associated land uses.

Land use/land cover	acres
Brush or Transitional	4.48
Water	824.88
Residential	182.24
Commercial	9.42
Industrial	20.54
Transportation/Utilities	667.65
Other Urban	2.16
Other Agricultural/Mixed Open	3.86
Deciduous Forest	2619.18
Coniferous Forest	3270.47
Mixed Forest	3482.05
Forested Wetlands	221.63
Non Forested Wetlands	45.87
Row Crop	1221.95
Hay/Permanent Pasture	1156.00
Total	13732.38







Land cover / Land use
- Barren Land
- Brush or Transitional
- Commercial
- Coniferous Forest
- Deciduous Forest
- Forested Wetlands
- Hay/Permanent Pasture
- Industrial
- Mixed Forest
- Non Forested Wetlands
- Orchards
- Other Agricultural/Mixed Open
- Other Urban
- Residential
- Row Crop
- Transportation/Utilities
- Water

APPENDIX A

Fact Sheet for:

Draft NPDES Permit to Discharge to Waters of the United States

Cabot Wastewater Treatment Facility

AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
WASTEWATER MANAGEMENT DIVISION
103 SOUTH MAIN STREET
WATERBURY, VERMONT 05671-0405

FACT SHEET
February 2000

DRAFT NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)
PERMIT TO DISCHARGE TO WATERS OF THE UNITED STATES

FILE No. 12-105
PERMIT No. 3-1440
NPDES No. VT0101257

NAME AND ADDRESS OF APPLICANT: Town of Cabot
PO Box 36
Cabot, VT 05647

NAME AND ADDRESS OF FACILITY WHERE DISCHARGE OCCURS:
Cabot Wastewater Treatment Facility

RECEIVING WATER: Winooski River

I. Proposed Action, Type of Facility, and Discharge Location

The above named applicant applied on 4/29/99 to the Vermont Department of Environmental Conservation for a discharge permit to discharge into the designated receiving water. The facility is engaged in the treatment of municipal wastewater. The discharge will be from the proposed Cabot Wastewater Treatment Facility to the Winooski River.

II. Description of Discharge

A quantitative description of the discharge in terms of significant effluent parameters is based upon state and federal laws and regulations.

III. Limitations and Conditions

The effluent limitations of the draft permit, the monitoring requirements, and any implementation schedule (if required), may be found on the following pages of the draft permit:

Effluent Limitations	Page 2 of 15
Monitoring Requirements	Pages 4 and 5 of 15

IV. History and Alternatives

The area in and around Cabot, Vermont has historically had problems finding suitable sewage treatment and disposal. Possible solutions to these problems have been investigated for many years by various parties including Cabot Village, the School District, Town of Cabot, the Agency of Natural Resources and local planning groups.

In December 1989 a wastewater planning study, prepared for the incorporated Village of Cabot by TWM Northeast, recommended two possible wastewater solutions for the Village. The first option was a multi-stage treatment system that would accommodate a wastewater flow of 130,000 gallons per day, including 100,000 gallons per day from the Cabot Creamery. The second option was a 30,000 gallon per day community septic tank and leachfield system for the Village and School District only. (Cabot Creamery ultimately dealt with its sanitary and process wastes separately and chose not to participate in a community project).

In May 1992 a feasibility study was prepared for the Village by Phelps Engineering, Inc. This study discussed eight options for the Village and School District with respect to wastewater management and did not recommend any specific alternative other than to continue to work with the Department to discuss project direction. During the preparation of the report, nine land parcels were considered for soil testing to determine suitability for a community leachfield. Written landowner permission for further investigation could be obtained for only four sites and none of those sites were determined to be suitable.

Due to growing concerns about possible water pollution in the Cabot area due to failing septic systems and illegal discharges, a sanitary survey was conducted by the Department between November 23, 1992 and December 4, 1992 and on April 14, 1993 of the same area the feasibility study addressed. The survey found six properties with pipes that were illegally discharging

untreated or improperly treated sewage directly into the Winooski River. Twelve more properties were found to have failed septic systems.

As a result of the findings of the sanitary survey the Department issued an Order under 10 V.S.A. Section 1277 to the Town of Cabot on September 15, 1993. This order required the Town to evaluate treatment options for correcting the wastewater problem, select a treatment option, and construct and operate a wastewater treatment system to correct the untreated sewage and the failed septic systems.

As required by the Order, an engineering study was prepared for the Town by Phelps Engineering in May 1994. That report addressed three wastewater treatment options: a direct discharge from a centralized wastewater treatment facility in Lower Cabot, indirect discharge from a community leachfield system in Lower Cabot, and connection to the existing Marshfield sewer system. Concurrently a local citizens wastewater planning committee was formed to ensure that user costs would be kept manageable and not become a detrimental issue with respect to passing the bond that would be needed to fund the project. During preparation of the report, soil testing was conducted at a potential community leachfield site, and that site was determined to be inadequate. The report also addressed the prospect of a direct discharging wastewater treatment facility, but at the time it was believed that the assimilative capacity of the Winooski River was inadequate for direct discharge in the Cabot area. The report recommended that both the upper and lower villages in Cabot be tied into Marshfield wastewater treatment facility via a pipeline. That proposal was rejected by the Town and the citizens committee because of concerns about the excessive project cost, the potential for development along the pipeline in the rural agricultural area between Lower Cabot and Marshfield, and the needed modifications at the Marshfield Wastewater Treatment Facility to accommodate the wastewater from Cabot.

As a result of a request from the citizen committee, the Department agreed to fund a study to examine the feasibility of developing innovative decentralized (individual or small community) wastewater treatment systems to correct the sewage problems in Cabot. A second consulting team, a partnership of Stone Environmental, Inc, and Civil Engineering Associates, Inc, was hired to consider alternatives to a centralized wastewater system. The Department also agreed to the use of more flexible criteria for the siting of decentralized wastewater systems. Numerous alternative decentralized wastewater technologies were considered and a report was released in December 1995. The report concluded that innovative decentralized systems were not a feasible alternative in Cabot and a centralized low pressure sewer system and a recirculating sand

filtration treatment facility with direct discharge to the Winooski River would be needed to solve the sewage problem in Cabot. The recommended option consisted of centralized treatment facility with a direct discharge tentatively located on the Thompson property near Elm Street in the upper village. Concurrently the Department had completed an assimilative capacity study for the Winooski River in the Cabot area and had determined that the Winooski River had adequate assimilative capacity to accept a direct discharge.

The Selectboard endorsed the concept of a centralized wastewater system with direct discharge since even under the more flexible criteria for decentralized systems, it was determined that due to the small lot sizes, low permeability soils and proximity to surface waters a decentralized system based solution for Cabot was not feasible.

The Department also concluded that the only solution in Cabot was a new direct discharge to the Winooski River since there was no alternative for waste disposal that would have lesser impact on water quality including the quality of groundwater, or if there was an alternative it would be clearly unreasonable to require its use.

Phelps Engineering was brought back to develop the direct discharge proposal and submitted a report dated July 1996 which evaluated three potential treatment plant locations in Cabot, including the site previously recommended in the 1995 Stone/CEA report. The July 1996 report recommended a gravity sewer system serving the upper village and an aerated lagoon treatment facility with phosphorus removal. The treatment lagoons were to be located on the Grimm property between the upper and lower villages.

A sewer bond article based on the recommend option was narrowly approved by Town voters in September 1996. A petition for revote was circulated and submitted to the Selectboard after that bond vote. Also the Cabot Creamery raised concerns about the visual impact of the proposed lagoon treatment facility and potential for odor and other effects on its nearby cheese storage warehouse and USDA Rural Development, a sewer project funding agency, raised concerns about the impact of the proposed lagoon facility on wetlands. Then in November 1996, the bond vote was overturned by revote.

In order to bring a resolution to the ongoing sewage problems in Cabot, the Department then amended the September 15, 1993 1277 Order on August 1, 1997 to require the Town to:

* On or before August 6, 1997 submit to the Department a preliminary engineering

report (a.k.a. the facilities plan) defining the scope, location, and estimated cost of the proposed sewage collection and treatment system to correct the discharge of improperly treated sewage within the Town of Cabot and correct the condition at the Cabot Town School District which threatens to cause a reduction in the quality of surface waters within the Town of Cabot.

* Prior to public notice of a bond vote for the sewage collection and treatment system notify the Department of the funding sources to be used to fully finance the project identified by the Town of Cabot and approved by the Department.

* On or before November 4, 1997, hold a public vote for the purpose of authorizing the issuance of bonds in an amount which when combined with funds from other identified sources will fully finance the project identified by the Town of Cabot and approved by the Department.

* On or before September 1, 1998, submit the final design and specifications for the proposed sewage collection and treatment system.

* On or before January 1, 1999, apply for a discharge permit.

* As soon as possible but no later than July 1, 2000, commence construction of the proposed sewage collection and treatment system.

* As soon as possible but no later than December 1, 2001, complete construction of the proposed sewage collection and treatment system.

As required by the amended Order, the Town's consultant submitted a report to the Department in August 1997. That report evaluated four centralized wastewater collection and treatment options. The option recommended by this report and endorsed by the Selectboard consisted of a gravity sewer system serving the upper village and Lower Cabot and a recirculating sand filtration treatment facility to be located at the site of the abandoned Headwater Lumber sawmill on Saw Mill Road.

A bond article based on the endorsed wastewater option was approved by Town voters in November 1997, and no revote was requested. Detailed design of that recirculating sand filtration treatment system was started in response to the required September 1, 1998 design submittal. It

was discovered during the design of the building that the recirculating sand filtration system would consume a substantial portion of the selected site which caused concerns about the visual impact of a large treatment building in a rural residential area. Also the proximity of the building to surrounding wetlands on the land parcel was a concern.

Personnel changes also occurred at the Town's consulting firm. In early 1998, the Town's new project manager expressed concern about the ability of solids contact clarifiers to provide consistent phosphorus removal. That concern was based on the clarifier manufacturers' reluctance to provide assurances that adequate phosphorus removal could be achieved in the low solids environment downstream from recirculating sand filters. The new engineer recommended that consideration be given to the microfiltration wastewater treatment process which would provide a high and consistent level of treatment and allow a smaller building footprint.

On February 18, 1999, the Department agreed to amend the 1277 Order to allow for time for the investigation of the microfiltration treatment option and required the Town to:

* On or before May 1, 1999, submit the "basis of final design" specifications for the proposed sewage treatment system.

* On or before May 1, 1999, apply for a discharge permit.

* On or before August 16, 1999, submit the final design and specifications for the proposed sewage collection and treatment system.

* As soon as possible but no later than July 1, 2000, commence construction of the proposed sewage collection and treatment system.

* As soon as possible but no later than December 1, 2001, complete construction of the proposed sewage collection and treatment system.

The Department also agreed to fund a report comparing a microfiltration treatment sytem to a recirculating sand filtration treatment system at the proposed Saw Mill Road site. That report showed present worth life cycle costs of $2,770,000 and $2,053,000 for recirculating sand filtration and microfiltration, respectively. Construction costs were shown as $2,233,000 and $1,456,000, respectively. Annual operation and maintenance costs were shown as $50,200 and $55,800, respectively. Therefore microfiltration was presented as having a substantially lower

(about 35 percent) construction cost, a slightly higher (about 11 percent) operating cost and a lower (about 26 percent) life cycle cost at the then-current USEPA present worth interest rate of 6.875 percent. Non-economic factors such as space requirements and environmental impacts at the treatment plant site were also considered and this report recommended the adoption of the microfiltration treatment system.

Based on this report, the microfiltration treatment system with ultraviolet light disinfection system was endorsed by the Cabot Selectboard and the Department. The Town also purchased the recommended treatment site on Saw Mill Road in Lower Cabot.

On April 29, 1999, the Town submitted an application for a discharge permit based on the microfiltration system to the Wastewater Management Division of the Department along with the basis of final design. A review of the basis of final design was conducted on May 26, 1999 and it was determined that additional information and improvements were needed before the basis of final design would be acceptable and the discharge permit application could be considered complete. Information was then exchanged between the Town's consultant and the Department and design modifications were incorporated into the basis of final design. On January 11, 2000, the Department determined that the basis of final design was acceptable and the discharge permit application was deemed complete.

V. Compliance with Water Quality Standards

The Winooki River in Cabot Village (Waterbody ID VT08-9) is listed on the Vermont 1998 Part A list of Impaired Surface Waters due to pathogens resulting from the discharge of untreated or improperly treated sewage. Section 303(d) of the federal Clean Water Act requires that for impaired waters, states determine and implement strategies that reduce pollutant loading and achieve compliance with the applicable water quality standards. Upon completion of the Cabot Wastewater Treatment Facility (as defined by Condition A.I.4 of the permit) the discharge of untreated and improperly treated sewage will be eliminated and compliance with the Vermont Water Quality Standards will be achieved.

VI. Permit Basis and Explanation of Effluent Limitation Derivation

The Town of Cabot plans to construct and operate the Cabot Wastewater Treatment Facility (WWTF). This WWTF will receive wastewater from the upper portion of the incorporated Village, the Cabot High School and have the capability to collect and treat wastewater from the

lower portion of Cabot Village. It should be noted that the Cabot High School is currently authorized to discharge into the Winooski River under the terms and conditions of Discharge Permit No. 3-0376. Upon completion of the Town's Wastewater Treatment Facility, the discharge from the Cabot High School will be connected into the Town's collection system and the direct discharge from the school into the Winooski River will be terminated.

The proposed WWTF will provide secondary treatment with disinfection and phosphorus removal. Specifically, treatment will be provided by a series of septic tanks which will act as settling tanks for primary solids removal, followed by two aerated equalization basins operating in a parallel design. From the equalization basins the wastewater will be pumped to two bioreactors in a parallel design. The wastewater will then be pumped from the bioreactors through a series of micofiltration modules for treatment. The filtered wastewater will then be treated by ultraviolet light for disinfection prior to discharge. Alum addition has been designed into the treatment facility and will be used for phosphorus removal if the microfiltration treatment cannot produce an acceptable effluent. A chlorination system has been incorporated into the design of the facility for cleaning the microfiltration modules.

Flow: As requested in the application the draft permit contains a flow limitation of 50,000 gpd, annual average. Continuous flow monitoring is required

UOD: The draft permit contains a UOD limitation of 40 pounds per day, maximum day during the period of June 1 through September 30. This effluent limitation is based on the assimilative capacity of the Winooski River at the point of discharge. UOD monitoring is required once per month during the period of June 1 through September 30.

Total Kjeldahl Nitrogen (TKN): The draft permit does not contain a TKN limitation. However TKN is a critical component in calculating the UOD concentration of a discharge and TKN must be limited so the UOD limitation is not exceeded. Therefore TKN monitoring is required once per month during the period of June 1 through September 30.

BOD, and TSS: The draft permit contains BOD and TSS mass effluent limitation of 12.6 lbs/day, monthly average and 18.8 lbs/day weekly average and concentration effluent limitations for BOD and TSS of 30 mg/l, monthly average, and 45 mg/l weekly average. These effluent limitations are based on the secondary treatment requirements contained in 40 CFR Part 133.102.

The draft permit also contains a BOD and TSS limitation of 50 mg/l, maximum day, to protect the

receiving water from a potential short term high strength discharge from the treatment facility.

BOD and TSS monitoring is once per month and is consistent with other similar discharges in the upper portion of the Winooski River.

Phosphorus: The draft permit contains a phosphorus effluent limitation of 0.34 lbs/day monthly average and 0.8 mg/l monthly average and is based on 10 VSA Section 1266a. Phosphorus monitoring is required once per month and is consistent with other similar discharges in the upper portion of the Winooski River.

Settleable Solids: The draft permit contains a settleable solids effluent limitation of 1.0 ml/l Instantaneous Maximum and is based on the Department's interpretation of Water Quality Standards with respect to operational testing at wastewater treatment facilities. Settleable solids monitoring is required once per day.

Escherichia coli Bacteria: The draft permit contains a E. coli effluent limitation of 77/100 ml Instantaneous Maximum and is based on the Water Quality Standards. E. coli monitoring is required twice per month and is consistent with other similar discharges using UV disinfection.

pH: The draft permit contains a pH effluent limitation of 6.5 to 8.5 standard units. This limitation is based on the Water Quality Standards. pH monitoring is required once per day.

Waste Management Zone:
Currently a 6.0 mile waste management zone (formally a C-zone) exists in the Winooski River from upper Cabot Village to the confluence with Marshfield Pond Brook. This zone currently accommodates the discharge from the Cabot High School which is authorized under the terms and conditions of Discharge Permit No. 3-0376 issued to the Cabot Town School District.

The Town of Cabot proposes to utilize this zone to accommodate the discharge from the new Cabot Wastewater Treatment Facility. The discharge from the Town's proposed treatment facility will enter the existing waste management zone downstream of the School's existing discharge. On the basis of the Department's WMZ Length Determination Model, a WMZ in the Winooski River extending for 1.0 miles downstream from the Town's proposed WWTF outfall is appropriate for this discharge. This resulting WMZ will fall within the boundaries of the existing waste management zone. Consequently per 10 V.S.A. Section 1252(c) upon completion of the Town of Cabot Wastewater Treatment Facility, the current waste management zone will be

revised. The adjusted waste management will begin at the outfall of the Town of Cabot Wastewater Treatment Facility and extend downstream for 1.0 miles.

Whole Effluent Toxicity Testing: One Acute Two-Species Whole Effluent Toxicity (WET) test is required to be conducted on this discharge and the results provided to the Department by December 31, 2003. Given the small volume of this discharge, the rural nature and lack of industry within the sewered area, the Department believes that this discharge will not cause, have a reasonable potential to cause, or contribute to an instream toxic impact or instream excursion above the water quality criteria and the intent of this testing is to confirm these findings. However, if the results of this test indicates a reasonable potential to cause an instream toxic impact, the Department may require additional WET testing, establish a Whole Effluent Toxicity limit or require a Toxicity Reduction Evaluation.

ATTACHMENT A

WATER QUALITY ANTIDEGREDATION FINDINGS

(Vermont Water Quality Standards, Section 1-03)

In the matter of: Town of Cabot
Municipal Wastewater Treatment Facility

The Water Quality Division of the Department of Environmental Conservation (the Department) has reviewed the municipal discharge permit Application filed on April 29, 1999 by the Town of Cabot. The Department finds that:

Finding 1: The proposed project maintains water quality in such a manner that the beneficial values and uses associated with the classification of the receiving waters are obtained and maintained.

Facts related to or supportive of Finding #1:

a. Beneficial values of the Winooski River (Class B) in the Cabot area include aesthetics, high quality habitat for aquatic biota, fish and wildlife. Beneficial uses include swimming, tubing and fishing. As noted in the attached existing use surveys, swimming takes place in the river below the dam in Lower Cabot (Site #3, just above the proposed discharge location, upstream of the Sawmill Road bridge crossing). Some swimming also occurs more than a mile below the end of the proposed WMZ, below the cascades at the Green Mountain Power Co. Marshfield hydroelectric station (Site #6). Fishing was noted at the Sawmill Road bridge. It is believed that some tubing may take place within the proposed WMZ, below the dam.

b. Sanitary surveys conducted by the Department in 1992 and 1993 found six properties directly discharging untreated or improperly treated sewage directly into waters of the State. Twelve more properties were found to have potential problems for various reasons. The proposed 50,000 gpd (maximum, annual average) facility will collect, treat and discharge wastewater from the Town of Cabot, including these 18 properties, to the Winooski River at the site of the abandoned Headwater Lumber sawmill on Sawmill Road in Lower Cabot.

c. The proposed discharge to the Winooski River will satisfy applicable water quality criteria for Class B waters as defined in the Vermont Water Quality Standards, and meet the phosphorus loading limitation placed on discrete discharges located within the Lake Champlain basin.

Finding 2: The proposed discharge does not have a significant impact on the existing uses of the receiving water that involve use of the water by aquatic biota, fish or wildlife.

Facts related to or supportive of Finding #2:

a. The Winooski River in the vicinity of the proposed discharge supports wild (self sustaining through natural reproduction) populations of brook trout and several nongame fish species. The existing benthic community in the Winooski River in the vicinity of the proposed discharge is good to excellent.

b. The proposed discharge will satisfy water quality criteria for Class B waters as defined in the Vermont Water Quality Standards, and will have no undue adverse impact on the use of the receiving water by aquatic biota, fish or wildlife. The proposed 50,000 gpd (maximum, annual average) discharge will improve the presently-enriched water quality by secondary treatment with disinfection and phosphorus removal. The permitted discharge should not result in increased temperatures of the receiving water as defined in the water quality standards, as cool water temperatures are critical to brook trout and other stream organisms. The filtered wastewater will be treated by ultraviolet light for disinfection prior to discharge. Alum addition will be used for phosphorus removal if microfiltration cannot produce an acceptable effluent. Alum will be retained in the plant by the chemical process and will not discharged to the river.

Finding 3: The proposed discharge does not result in a significant degradation of the existing uses of the receiving water that involve the use of water for recreation in and on the water, fishing, water supply, or commercial enterprises that depend directly on the preservation of an existing level of water quality.

Facts relating to or supportive of Finding #3:

a. Field surveys for contact recreation were made on June 24, 1998 and on August 13, 1998. (Copies attached). There are no known uses for water supply or commercial enterprises that use the water that depend directly on the preservation of an existing level of water quality.

b. Existing swimming and fishing uses were found in the river above and below the proposed treated wastewater discharge point. These uses are presently taking place in an existing six-mile-long WMZ for the Cabot Elementary School. The school discharge and raw waste discharges poses health risks to the users. The proposed one-mile-long WMZ will begin just below the site with the heaviest use (just below the old dam), and will end over a mile above the next downstream documented swimming area, which is below the falls at the Green Mountain Power hydro station (Site #6). The proposed treatment of raw waste discharges and new location of the WMZ will, therefore, enhance recreational

use in and on the water.

c. The existing WMZ begins at the present Cabot School discharge and extends six miles down to Marshfield Village. The new WMZ will be one mile long, and will be within the existing WMZ. The five-miles of unused WMZ will no longer exist, and this portion of the Winooski River will revert to Class B with no WMZ overlay.

Finding 4: The proposed discharge protects and maintains the high quality of the receiving waters in the public interest to the greatest extent possible.

Facts related to or supportive of Finding #4:

a. Granting a municipal discharge permit for the proposed project is consistent with Cabot's 1994 revision of the Town Plan, the Town and Village of Cabot Zoning Regulations, as amended March 1995 and the Sewage Ordinance for the Town of Cabot.

- The Town Plan states that a required upgrade to the school's WWTF was being delayed pending the decision about the proposed municipal treatment system. The Plan remarked that the school WWTF "may be nearing the end of its use and design life."
- The Town Plan discourages large development in order to, among other things, "...retain the conditions for a high quality of water in Cabot's streams and water bodies..." This is a stated purpose of the Plan.
- The Town Plan acknowledges that, "in 1993, the Village was ordered by the State to correct failed septic systems, which has led to discussion and investigation into a sewage facility to be located either in Cabot village or Lower Cabot Village, or utilizing capacity at the existing facility in Marshfield."
- The Town Plan states that, through the Cabot Creamery, the Town has received a $2 million federal Urban Development Action Grant (UDAG), which will "....assist local economic development and community services." The Plan goes on to say, "The use of UDAG funds for a waste-water treatment facility is supported by the Planning commission."
- In concert with the Town's prohibition of large developments, the Zoning Regulations allow no more than a 2% increase in the number of housing units in any one year.
- The Zoning Regulations request that "wherever possible water and sewage disposal systems within planned residential districts..be community systems, installed by the developer and maintained by the developer or by an association of homeowners."

b. The proposed project will be consistent with the Regional Plan.

- The Central Vermont Regional Plan, adopted August 11, 1998 does not specifically address Cabot's failed septic system problems and the need for a municipal WWTF; however, under "CVRPC Land Use Goals and Polices," the Plan states, "CVRPC opposes the downgrading of surface water classifications, unless such action is required to accommodate treated effluent from new or expanded municipal sewage treatment facilities."
- The Plan also states as policy, "Where a proposed project involves a discharge into, or withdrawal from, any of the Region's surface waters, consideration should be given to the short and long term impact on such waters and to applicable health and water regulations. The potential degradation of water quality, impact on wildlife, the assimilative capacity of waters, and the effect on the region's ability to support future growth should be evaluated. Protection of the public health, safety and welfare shall be the primary objectives."
- The Plan's sewage treatment goals is: "To promote the upgrading, improvement, and expansion of sewage treatment facilities and options so as to protect public health, maximize public investment, and reinforce desired patterns of growth."
- A policy supporting the sewage treatment goal is: "This Plan supports efforts to improve wastewater collection and treatment systems."
- Another policy supporting the sewage treatment goal is: "This Plan encourages the extension of municipal sewage treatment collection systems to existing developments within unsewered aquifer protection areas in order to protect underground water supplies from harmful septic system leachate."

c. The proposed project will be consistent with State plans:

- *Individual Water Body Report.* The Water Quality Division. July, 1997. The water body report for the Upper Winooski River states: "Winooski River below Cabot Creamery - the macroinvertebrate community is good to excellent."
- The *Classification Order for the Upper Winooski River and its Tributaries*. Vermont Water Conservation Board. February 5, 1958. The Order called for the Winooski River, from the Village of Cabot to its juncture with Marshfield Pond Brook to be Class C, a distance of 6 miles. It ordered: "Private sewer systems to receive proper disposal by septic tanks and leaching lines or other approved means by 1 January, 1959." It also ordered that plans and specifications for municipal sewage systems "shall be prepared and submitted to the Water Conservation Board for approval by 1 January, 1959." (In reference to the Cabot School and other Upper Winooski River waste treatment systems).
- *Interim Act 200 Plan.* Department of Environmental Conservation. February 1, 1990. Goal 12 states, "To plan for, finance and provide an efficient system of public facilities and services to

meet future needs."

- *State of Vermont Continuing Water Quality Management Planning Process*. 1995. This document explains, among other things, the procedures the State follows in issuing NPDES permits.
- *Strategic Plan. Fiscal Years 1997-1999.* Vt. Agency of Natural Resources. Three of the Agency's seven goals deal with pollution prevention and reduction.

d. The proposed wastewater treatment facility will eliminate raw untreated discharges containing pathogens.

Finding 5: The proposed discharge will protect and maintain the existing high quality of water designated as Outstanding Resource Waters.

Facts related to or supportive of Finding #5:

a. No waters in the Upper Winooski River basin have been designated as Outstanding Resource Waters (pursuant to the Vermont Water Quality Standards, Section 1-03D).

APPENDIX B

Published Public Notice for:

Total Maximum Daily Load
for the Winooski River at Cabot Village

Agency of Natural Resources
Department of Environmental Conservation

Water Quality Division
Building 10 North
802-241-3770
Fax #:802-241-3287

NOTICE: Public comments invited on the Total Maximum Daily Load document for the Winooski River at Cabot Village

POLLUTANT OF CONCERN: Pathogens

PUBLIC COMMENT PERIOD: December 13, 2000 - January 12, 2001

DESCRIPTION: The Winooki River in Cabot Village (Waterbody ID VT08-9) is listed on the Vermont 1998 Part A list of Impaired Surface Waters due to pathogens resulting from the discharge of untreated or improperly treated sewage. Section 303(d) of the Federal Clean Water Act requires that for impaired waters, states determine and implement strategies that reduce pollutant loading and achieve compliance with the applicable water quality standards. These strategies are compiled in a Total Maximum Daily Load (TMDL) document that demonstrates how water quality standards will be achieved. This TMDL describes how upon completion of the Cabot Wastewater Treatment Facility, the discharge of untreated and improperly treated sewage will be eliminated and compliance with the Vermont Water Quality Standards will be achieved.

FURTHER INFORMATION: Copies of the TMDL document may be inspected at the Vermont Agency of Natural Resources Waterbury Office. Copies of the TMDL may be obtained by calling (802) 241-3770. Office hours are 8:00 AM to 4:30 PM, Monday through Friday.

PUBLIC COMMENT: Public comments should be submitted in writing to the address below.

Department of Environmental Conservation
Water Quality Division
TMDL Comments
103 South Main Street
Waterbury, VT 05671-0408

The comment period will close at the end of the business day (4:30PM)

Published newspaper notices soliciting public comment on the Winooski River/Cabot Village TMDL

Burlington Free Press
December 13, 2000

AGENCY OF NATURAL RESOURCES
Department of Conservation

Water Quality Division
Building 10 North
802-241-3770
Fax #: 802-241-3287

NOTICE: Public comments invited on the Total Maximum Daily Load document for the Winooski River at Cabot Village
POLLUTANT OF CONCERN: Pathogens
PUBLIC COMMENT PERIOD: December ,13, 2000 - January 12, 2001
DESCRIPTION: The Winooski River in Cabot Village [Waterbody ID VT08-9] is listed on the Vermont 1998 Part A list of Impaired Surface Waters due to pathogens resulting from the discharge of untreated or improperly treated sewage. Section 303[d] of the Federal Clean Water Act requires that for impaired waters, states determine and implement strategies that reduce pollutant loading and achieve compliance with the applicable water quality standards. These strategies are compiled in a Total Maximum Daily Load [TMDL] document that demonstrates how water quality standards will be achieved. This TMDL describes how upon completion of the Cabot Wastewater Treatment Facility, the discharge of untreated and improperly treated sewage will be eliminated and compliance with the Vermont Water Quality Standards will be achieved.
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December 13, 2000

Times Argus
December 13, 2000

Legals 101

AGENCY OF NATURAL RESOURCES
Department of Environmental Conservatio

Water Quality Division
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802-241-3770
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