JAMAICA WATER QUALITY & SEPTIC STUDY

EXECUTIVE SUMMARY

The purpose of the Jamaica Water Quality & Septic Study was to determine the actual situation in the village regarding water quality, carrying capacity and future growth potential; and to assess these issues and make recommendations to address any existing problems. The study included a number of facets to aid in making this assessment. These were 1) water sampling and testing of drinking wells and streams in the village, 2) survey of property owners regarding their septic systems and wells, 3) identification and review of replaced systems in the village, 4) mapping of parcels, septic systems, wells and isolation distances, 5) determination of existence or extent of on-site septic and well problems, 6) determination of net useable land area in the village, 7) calculation of present and future water/sewage use, 8) assessment of the extent of capacity problems in the village, and 9) identification of potential solutions, and funding sources.

The study reveals that there are existing capacity problems in Jamaica Village and that the village is in danger of major wastewater and potable water problems. Stream water quality problems that have a high probability of being related to on-site septic disposal in the village have already been identified. There is also an increased risk of well water contamination from on-site septic systems. This situation is the result of many factors: the development density in the village, overlapping of isolation distances between wells and leach fields, poor filtration of the waste because of highly permeable soil conditions, proximity of many leach fields to the two major streams in the village, poorly functioning and possibly failed systems, and a large number antiquated systems. This creates both a health risk and a standard of living problem for our citizens as well as a negative impact upon future economic and housing growth.

The future capacity needs for the village are estimated based on present and future growth potential. Areas that may host future development and community on-site septic disposal areas in or near the village were identified using GIS data.

Five potential solutions and the advantages and disadvantages of each solution are presented in the study. The solutions range from comprehensive to temporary remedies.

A. Potential Solutions

- Village Wastewater Disposal Ordinance
- Decentralized Wastewater Management System
- Centralized Community Treatment and Disposal System
- Temporary remedies
  - Education
  - A revised on-site sewage ordinance

JAMAICA VILLAGE WATER QUALITY & SEPTIC STUDY

I. INTRODUCTION

Jamaica Village is located in the West River valley on Routes 30 & 100 at the confluence of Ball Mountain Brook and the West River, and is surrounded by steep forested hills and mountains. Jamaica State Park is adjacent to the village area and Stratton Mountain Ski Resort is within 10 miles. Jamaica Village is quintessential Vermont village with many historic buildings, most built in the early 1800s, located on small lots in a dense settlement pattern. There are 124 parcels located on 141 acres with approximately 110 residences, businesses and community buildings. The village is the governmental, cultural, social and commercial center for the town containing the elementary school, town offices, town hall, post office, Masonic hall, a church, a bank, numerous retail businesses, an inn and restaurants.

The 1996 Jamaica Town Plan expresses a concern regarding carrying capacity in the village with respect to on-site septic systems and water supplies. The Plan also expresses the desire for the village to continue to serve as the civic, cultural, social, and commercial center for the town. In the Plan's Community Facilities and Services element, Goal 14 further states

> Determine the need for public water supply or public sewage disposal system for Jamaica Village.

These concerns expressed in the Town Plan stem from recognition that difficulties in siting new septic systems are not limited to new development. Several key buildings in the village have been underutilized and business and community expansion is strictly limited by existing septic capacity. Septic system failures are not easily remedied due to the density of development with on-site septic and water systems in the village. Because failures are not uncommon and because septic systems have a limited life, it is clear that individual on-site systems will need to be replaced over time. This is especially true for older systems due to their outmoded design standards. This situation can be very difficult in areas like Jamaica Village, where inadequate space and poor soils contribute to siting problems.

This community concern over carrying capacity and continued social and economic health of Jamaica Village and the need to know more about the actual situation in the village lead the Jamaica Planning Commission (PC) to design the Jamaica Village Water Quality and Septic Study. In order to assist the town to make informed decisions, the PC designed the study to investigate carrying capacity, future growth potential, and to assess these issues and make recommendations to address any existing problems. To fund the study, the PC applied for and received a Connecticut River Valley Partnership Program Grant in the spring of 1998 and subsequently, a Vermont Municipal Planning Grant in the fall of 1998.

Through the Partnership Grant, the PC held a community forum to introduce the project to village residents, conducted a Village Capacity Survey for properties in the village, and conducted water sampling and testing program for drinking water wells and streams. Phase 2 of the study, funded through the Municipal Planning Grant, involved the identification and review of replaced systems in the village; mapping of parcels, septic systems, wells and required setbacks; the determination of existence or extent of on-site septic and well problems and an assessment of the problem; the determination of net useable land area for future development in the village, the calculation of current and estimated future water and sewer use; potential solutions; and funding sources.

Much of the scope of this study focuses on on-site septic disposal and its relationship to water quality and future growth. Septic disposal has proven to be the primary controlling factor for growth and development in unsewered areas, particularly villages. The septic issue can also effect the quality of life, threaten public health and the health of the environment. This study includes the results of the well testing, stream testing, the Village Capacity Survey, and the review of replacement system permits. This information is used to analyze the existing condition of private on-site septic and potable water systems. Maps have been developed to show the approximate location of existing systems and stream testing sites. The study also includes a description of how on-site septic systems work and the factors that control the design and placement of these systems. These factors are then used to assess the problem and make recommend alternatives to address existing and future capacity issues.

II. EXISTING CONDITIONS

A. Survey Results

During the summer of 1999, the PC sent the Village Capacity Study Survey (Appendix A) to property owners and residents of Jamaica Village. The village, as delineated in the Town Plan, consists of 124 parcels, of which 114 are presently developed or in use. Sixty four of the 114 surveys were returned equaling a 56% rate of return. With just over 50% of the owners/residents responding the survey information is very informative and useful but could be even more so with more complete response. The PC put considerable effort into collecting returned surveys but for various reasons did not have as great a success rate as they hoped.

The survey results contained some noteworthy information. 77% of the respondent parcels were 1 acre or less. Most of the properties are single family homes but over 10 % are businesses or public buildings. The majority of respondents have resided in that dwelling for over 10 years, showing a long term connection to the community. Most of the septic tanks in the village have been pumped in the last 5 years for routine maintenance. This shows a high degree of consciousness and concern from the respondents on the importance of septic system maintenance. Approximately 80 % of respondents have drilled wells, which if they are properly sealed deep bedrock wells, means they are less likely to experience infiltration of contaminants such as e-coli. A number of questions had a high "Don't Know" response rate. This can indicate that property owners do not have the basic knowledge they need to maintain or improve systems in order to keep them working properly.

VILLAGE CAPACITY STUDY SURVEY SUMMARY TABLE		
SURVEY QUESTION	#	%
A. Total number of surveys returned	64	56
B. Parcel Size:		
.25 acre or less	20	31.25
.26 to .5	17	26.6
.51 to 1	12	18.75
Over 1 to 2	6	9.4
Over 2 to 5	3	4.7
Over 5 to 10	2	3.1
Over 10	1	1.6
C. Land Use/Building Type		
single family home	39	60.9
Total number bedrooms	118	
Apartment – number of buildings	10	15.6
Total number of bedrooms	47	
Businesses including inns	7	10.9
Total number of employees	29	
Total number of rooms	15	
Combination business/Dwelling	4	6.25
Total number employees	6	
Total number of bedrooms	7	
III. Total # Bedrooms Including Inn Rooms	176	
Total # Employees	35	
Total Users		
D. Number Of Years You Have Owned Or Resided In This Dwelling		
Less than 1	2	3.1
1 to 5	9	14.1
6 to 10	6	9.4
11 to 20	20	31.25
Over 20	18	28.1
E. Year Constructed		
Before 1800	2	4.7
1801 to 1900	27	42.2
1901 to 1950	1	1.6
1951 to 1970	4	6.25
1971 to 1980	4	6.25
After 1981	3	4.7
Don't know	23	35.9
F. Potable Water Source		
Spring	8	12.5
Drilled Well	51	79.7
Other	4	6.25

G. Depth of Well		
Less than 50 feet	4	6.25
50 to 100	4	6.25
101 to 200	11	17.2
Over 200	10	15.6
Don't Know	34	53.1
H. Willing To Have A Free Water Test Done?		
Yes	51	79.7
No	7	10.9
I. Type of Septic System		
Standard in-ground	54	84.4
Mound	1	1.6
Composting toilet	0	
Don't know	1	1.6
Other	3	4.7
J. Year Septic System Installed		
After 1990	14	21.9
1980 to1989	11	17.2
1970 to 1979	9	14.1
1960 to 1969	11	17.2
1950 to 1959	0	0
Before 1950	1	1.6
Don't Know	27	42.2
K. Volume Of Septic Tank In Gallons		
Less than 500 gallons	0	0
500 to 749	8	12.5
750 to 999	12	18.75
1000 to 1500	19	29.7
Over 1500	3	4.7
Don't know	22	34.4
L. How Long since Last Pumped		
Less than 1 year	14	21.9
1-2 years	14	21.9
3-5 years	14	21.9
More than 5 years	5	7.8
Don't Know	9	14.1
Never	6	19.4
M. Reason Pumped		
Because of a problem	10	15.6
As routine maintenance	33	51.6
Don't know	5	7.8
N. Sump Pump in Basement		
Yes	6	9.4
No	48	75

TOWN OF JAMAICA PLANNING COMMISSION
VILLAGE CAPACITY STUDY SURVEY NUMERICAL DATA

TOTAL NUMBER OF SURVEYS RETURNED - 64

3. IS THIS BUILDING A
   [39] single family home
   [7] business
   [8] other ________________
   [10]apartment building
   [4] combination of business/dwelling

4. NUMBER OF YEARS YOU HAVE OWNED OR RESIDED IN THIS DWELLING:

Less than 1	2
1 to 5 -	9
6 to 10	6
11 to 20	20
Over 20	18

5. YEAR CONSTRUCTED:

Before 1800	2
1801 to 1900	27
1901 to 1950	1
1951 to 1970	4
1971 to 1980	4
After 1981	3
Don't know	23

6. NUMBER OF DWELLING UNITS PER BUILDING:

1	40
1	6
2	1
3	3
4	0
5	1
6	0
7	0
8	1
9	0

7. TOTAL NUMBER OF BEDROOMS

Single family	118
Multi-family	
Unit 1	21
Unit 2	15
Unit 3	11
Unit 4	4

List others if more than 4 units in building:
2 Inns 15

8. TOTAL NUMBER OF EMPLOYEES [35]

9. WATER SOURCE [8] spring [51] drilled well
[__] don't know [4] other ____________________

10. DEPTH OF WELL

Less than 50 feet	4
50 to 100	4
101 to 200	11
Over 200	10
Don't know	34

11. WOULD YOU BE WILLING TO HAVE A FREE WATER TEST DONE ON YOUR DRINKING WATER?
[51] yes [7] no [1] no answer

12. TYPE OF SEPTIC SYSTEM

Standard in-ground	54
Mound	1
Composting toilet	0
Don't know	1
Other	3

13. WHAT YEAR WAS YOUR SEPTIC SYSTEM INSTALLED?

After 1990	14
1980 to1989	11
1970 to 1979	9
1960 to 1969	11
1950 to 1959	0
Before 1950	1
Don't know	27

14. WHAT IS THE VOLUME OF YOUR SEPTIC TANK IN GALLONS?

Less than 500 gallons	0
500 to 749	8
750 to 999	12
1000 to 1500	19
Over 1500	3
Don't know	22

15. HOW LONG HAS IT BEEN SINCE YOUR SEPTIC TANK WAS LAST PUMPED OUT?

Less than 1 one year	14

1-2 years	14
3-5 years	14
More than 5 years	5
Don't know	9
Never	6

16. WAS THE PUMPING DONE:

Because of a problem	10
As routine maintenance	33
Don't know	5

17. DO YOU HAVE A SUMP PUMP IN YOUR BASEMENT?
[6] yes [48] no

B. Replacement Systems Permits Survey
Town septic permit information shows that since 1968 there have been 42 replacement systems installed in Jamaica Village. Three of these replacement systems are for public buildings and as such require a state permit. Public building systems must be designed by an engineer. Permit records show that four other systems of the 42 replacements also have been designed by an engineer or a certified site technician. Sixteen of the replacement systems consist of drywells rather than leachfields. The permits show the years of replacements as follows:
1968 – 1
1970s – 13
1980s – 16
1990s - 9

C. Stream Monitoring Results
In order to investigate and determine stream water quality in Jamaica Village, the Jamaica Planning Commission conducted an intensive stream monitoring program. Seven stream sampling stations were established in Jamaica village and volunteers took samples at these sites at regular intervals. Bonnyvale Environmental Education Center has been monitoring another site in the village for over 6 years. Station 1 was located on Ball Mountain Brook approximately one-quarter mile upstream of the Village test area to serve as a control point for the study. Stations 2-6 were located on Ball Mountain Brook within the Village at approximately 500 foot intervals starting at the Route 30 Bridge and continuing downstream, ending with Station 6 approximately 500 feet downstream of the Depot Street Bridge. Station 7 was located in Felton Brook just before it enters Ball Mountain Brook. These stations, as well as the BEEC monitoring station are shown on the Stream Monitoring Location Map. Each station was sampled four times at roughly monthly intervals during summer/fall of 1998 and again in summer/fall of 1999. Each sample was tested for Escherichia coli (E-coli) bacteria and nitrate which are common indicators of septic system influence.

A summary of the results is as follows:

7/29/98	sample range from all sites: (clear weather)	0 to 15 colonies/100ml E-coli 0.42 to 0.69 mg/l nitrate
8/13/98	sample range from all sites: (clear weather)	0 to 12 colonies/100ml E-coli 0.34 to 0.51 mg/l nitrate
9/15/98	E-coli found above State standard: (clear weather)	Site 3: 108 colonies E-coli Site 4: 130 colonies E-coli Site 5: 150 colonies E-coli Site 6: 120 colonies E-coli <0.30 to 0.94 mg/l nitrate
10/13/98	sample range from all sites: (clear weather)	0 to 14 colonies/100ml E-coli 0.34 to 0.51 mg/l nitrate
6/15/99	sample range from all sites: (clear weather)	0 to 38 colonies/100ml E-coli <0.30 mg/l nitrate
8/10/99	sample range from all sites: (clear weather)	0 to 18 colonies/100ml E-coli <0.30 to 0.41 mg/l nitrate
9/14/99	sample range from Sites 1-6: E-coli found above State standard: (clear weather)	0 to 14 colonies/100ml E-coli Site 7: 120 colonies 0.34 to 0.51 mg/l nitrate
10/12/99	sample range from all sites: (clear weather)	0 to 22 colonies/100ml E-coli <0.30 mg/l nitrate

Of the eight rounds of brook sampling only two had readings above the Vermont Water Quality Standards for E-coli of 77 colonies/100ml. The Vermont Water Quality Standards for Nitrate were not exceeded in any samples.

The most notable exceedence of the E-coli standard occurred in September of 1998 when four monitoring sites within the Village produced results that were 40% to 95% above the State Standard. A high reading that exceeded State Standards by 56% was also noted from the Felton Brook site in September 1999.

Bonnyvale Education Center West River Watch Project:

In addition to the data collected during this study, there is also available data from E-coli testing performed by the Bonnyvale Environmental Education Center (BEEC). Since 1994 as part of their West River Watch Project, BEEC volunteers have been monitoring a site within the Village. A summary of the BEEC data is as follows:

Date	E-coli (colonies/100ml)	
06/15/94	42	
10/15/94	1	
06/24/96	4	
07/29/96	0	
08/26/96	10	
09/16/96	60	
06/23/97	350	(exceeds Vermont Water Quality Standards)
07/28/97	350	(exceeds Vermont Water Quality Standards)
08/11/97	25	
09/09/97	350	(exceeds Vermont Water Quality Standards)
10/06/97	350	(exceeds Vermont Water Quality Standards)
11/11/97	0	
05/11/98	2	
06/15/98	24	
07/27/98	8	
08/10/98	10	
09/14/98	6	
10/19/98	4	
11/16/98	2	
06/07/99	18	
07/19/99	21	
08/16/99	10	
10/18/99	10	
11/15/99	3	

Since 1994 four high readings have been recorded by the BEEC. All four of these readings were recorded in 1997 and exceeded the State Standard by more than 450%. As can be seen from the above chart, these exceedence of state standards have not occurred since 1997.

D. Well Quality Testing Results

Through the Village Capacity Study Survey, the Planning Commission identified residents who were interested in having free drinking water testing. Of the estimated 99 water supplies within the Village, 59 have been tested for total coliform bacteria and nitrate. Samples with total coliform present were further screened for E-coli bacteria. E-coli and nitrate are common indicators of septic system influence on water quality. A summary of the results is as follows:

Estimated number of wells in study area:	99
Number of wells tested:	59
Number of wells showing total coliform:	15 (6 proved ok with retest, 8 refused retest or did privately)
Number of wells showing E-coli:	1
Number of wells showing high nitrate:	2 (one slightly below and one just over the State limit)

Although nitrate levels, in general, were found to be below State Drinking Water Maximums, there are two concentrated areas where a pattern of above-average levels were found.

III. DESCRIPTION OF CONTROLLING FACTORS

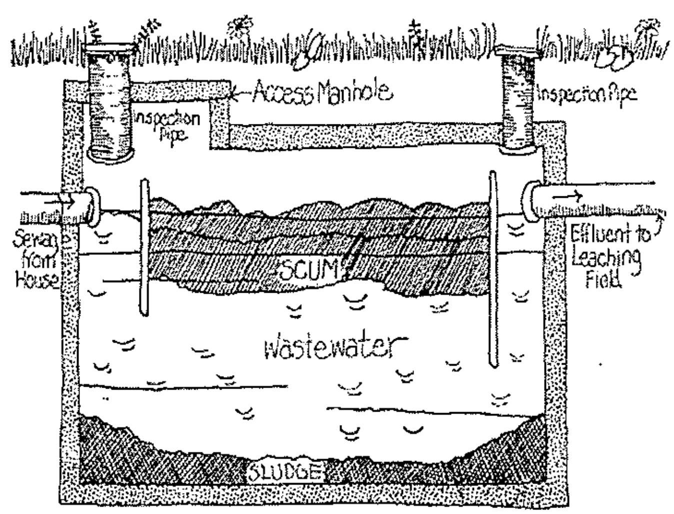
B. How A Septic System Works

A basic in-ground septic system consists of a tank, pipes and a leachfield. Sewage enters the septic tank through the building's plumbing and underground pipes. In the septic tank, solids settle, grease and light solids rise to the top and bacteria begin to decompose the organic matter. The remaining liquid, or effluent, flows through the outlet pipe and into the leachfield. A simple leachfield contains perforated pipes surrounded by crushed stone. The effluent flows from these pipes through the crushed stone into the surrounding soil where natural processes and filtering properties of the soil remove pollutants. The treated liquid eventually finds its way into groundwater. Decomposition is anaerobic in the septic and aerobic in the leachfield. This is a very simplified description of a typical system from the book, Rural Sewage Treatment in Vermont, Book 1: A Guide to the Alternatives. Many septic system variations exist, based on conditions at individual sites.

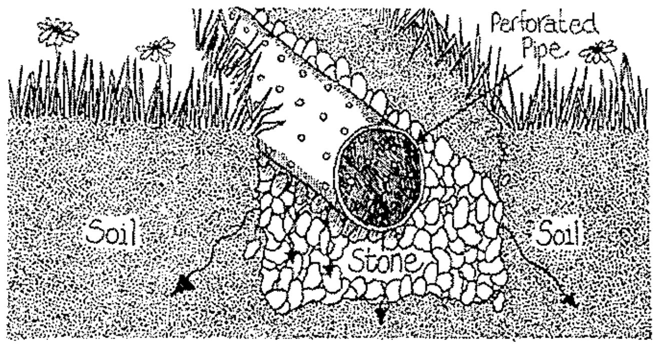
The Septic Tank

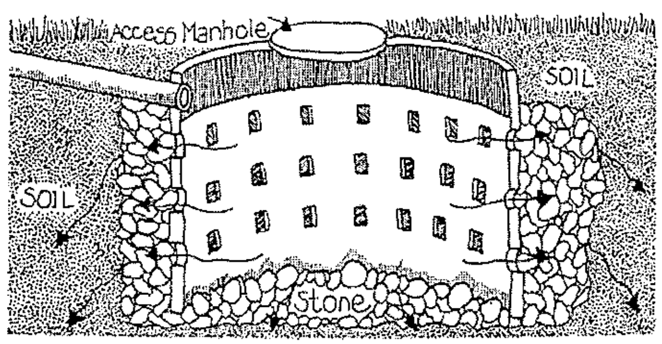
Untreated household sewage will quickly clog all but the most porous gravel if applied directly to the soil. The function of the septic tank is to condition the sewage so that it can percolate into the ground water without clogging the soil. Within the tank, illustrated below, three important processes take place:

1. The heavier, solid particles in the sewage settle to the bottom of the tank forming a layer of sludge. Lighter materials, including fat and grease, float to the surface forming a scum layer.
2. Bacteria living in the septic tank break down some of the organic solids into liquid components, helping to reduce the build-up of sludge in the tank.
3. Sludge and scum are stored within the septic tank rather than being allowed to flow out into the leaching system where they would quickly clog the soil.



Leaching System





After being in the septic tank, the effluent flows into the leaching system where it runs out through perforations into the graded or crushed stone and into the surrounding soil. The leaching system usually consists of either a network of perforated pipes laid in graded, stone-filled trenches, as in *the first illustration to the left, or of a perforated concrete chamber placed in a graded, stone lined pit as illustrated in the lower illustration to the left. Although other types of leaching systems, such as mounds and chamber systems, are used on problem soils, these systems all perform the function of discharging wastewater into the soil.

From Septic Systems How They Work and How to Keep them Working in Vermont, printed by the State of Vermont, Department of Environmental Conservation, 1982.

C. Septic System Failure

Septic systems can be quite effective and may last as long as 20 years or more. But even with the best design, construction and maintenance, septic systems may fail and need to be replaced with a new system. Premature failures can occur for a number of reasons, including lack of maintenance, overloading the system, changes in groundwater levels and poor design or construction. Garbage disposals can cause septic systems to fail and are not recommended. Proper design of the septic system for its individual site is crucial for maximizing the likelihood of the system's success.

When a septic system fails, the sewage is no longer effectively treated. Ground and surface waters may be polluted, thus creating a health hazard. This is especially significant in areas where residents rely on wells. Clean up of contaminated ground water is difficult and may be impossible. Lack of suitable water for drinking directly and immediately affects the quality of life and requires significant expense to locate new water sources. Living with a failed septic system that threatens water supplies is not safe, yet people often feel forced to do so because of the potentially high expense involved with replacing an individual system. Failed systems also threaten surface waters causing high e-coli counts in streams. High levels of e-coli in streams may cause gastro-intestinal illnesses and infections to those having direct contact with the water such as swimmers. This can be an especially dangerous situation for children, the elderly and others having compromised immune systems.

18 VSA §1218 defines on-site septic system failure.

> (3) For the purposes of this subsection, a wastewater disposal system has failed when the system is functioning in a manner:
> (A) that allows wastewater to be exposed to the open air, pool on the surface of the ground, discharge directly to surface water, or back up into a building or structure, unless the approved design of the system specifically requires the system to function in such a manner;
> (B) so that a potable water supply is contaminated or rendered not potable;
> (C) that presents an imminent hazard to human health; or
> (D) that presents a serious threat to the environment.

C. Siting Criteria – Vermont Environmental Protection Rules

There are a number of state regulations (Agency of Natural Resources Environmental Protection Rules - EPRs) which govern the design and placement of both septic systems and wells. The Vermont Agency of Natural Resources (ANR) has the responsibility and authority to protect the health, safety and welfare of its citizens. To that end, the ANR has created rules to control existing or potential health problems related to on-site sewage disposal. The purpose of these rules is to:

- prevent the creation of health hazards;
- prevent surfacing sewage or the pollution or contamination of drinking water supplies, groundwater and surface water;
- insure the availability of an adequate supply of potable water;
- insure the provision of adequate drainage as related to the proper functioning of sewage disposal or water supply systems;
- insure that facilities are designed and constructed in a manner which will promote sanitary and healthful conditions during operation and maintenance; and
- insure that once granted, a permit does not relieve the owner of the responsibility for the satisfactory functioning of the system approved[1].

New Water Supply rules became effective in September 1992 and revisions to the septic rules became effective in 1996. The following description of the regulations is a simplified explanation, intended to help the reader understand the technicalities involved in siting and designing private septic systems and wells.

The location of a septic system, especially the leachfield, is dictated by soils and topography because leachfields rely on soil to treat effluent. Some marginal sites can be modified to be acceptable for septic systems by using technologies such as soil replacement and mound systems. These often require substantial site engineering and costly construction. The soil properties that affect septic system suitability include:

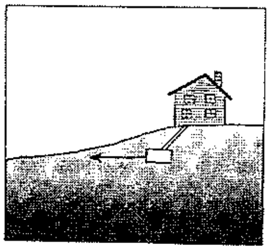
[1] Source: State of Vermont: Agency of Natural Resources, Environmental Protection Rules - Chapter 1. Small Scale Wastewater Treatment and Disposal Rules.

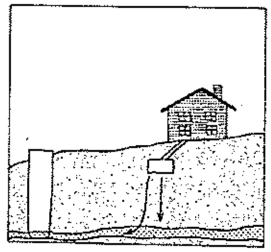
1. Slopes--Steep slopes are poorly suited for septic systems because sewage can rise to the ground's surface as it goes downhill. The Vermont EPRs allow a maximum 20% slope for both mound and in-ground systems.
2. Distance to groundwater--In order to ensure adequate treatment of effluent before it reaches groundwater, the Vermont EPRs require at least 3 feet from the bottom of the leachfield to the seasonal high water table for a conventional septic tank and leachfield. If a sand filter is used, only 18 inches to groundwater is required because a sand filter provides pre-treatment of the effluent.
3. Permeability (the ability of liquid to move through the soil)--Soils that are slowly permeable, for example: clays, will not be able to absorb all the effluent released into them. These soils may be unsuitable for septic systems or require mound systems. Rapidly permeable soils, such as sand and gravel, may let water pass through too quickly for effective treatment to occur. Such soils may also require mound systems or soil replacement below the leaching bed. All other aspects being equal, less permeable soils require a larger leaching bed.
4. Depth to bedrock or other impervious layer--A separation of 4 feet from the bottom of the leachfield to bedrock is required for conventional systems. Sand filter systems reduce this required separation distance to 2 feet.
5. Floodplains--These areas are unacceptable for septic systems because flooding saturates the soil, making treatment impossible. Septic systems must be sited on land one foot above the 100 year flood elevation at the natural grade.

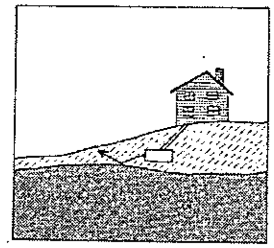
The leaching bed of the septic systems must be at least 18 inches to 3 feet above the seasonal high water table depending on the system type. This water table is distinguished by a change in the soil color. A standard leachfield can be used when the water table is 4 or more feet from the surface. A mound system, which is a leachfield constructed on a special grade of sand, can be used when the water table is 2-4 feet from the surface. A sand filter system allows for the leachfield to be only 18 inches from the water table because it provides pre-treatment of the effluent.

All new residential development septic system designs must include a location for a replacement area. This means that a parcel of land must be able to site two septic areas which meet state standards; one for current use and one to replace a failed system. The size of ones leachfield is based on usage or Gallons Per Day. The state determines this figure for a residence by the number of bedrooms. Another factor which determines the size of the field is the soil type and percolation rate. A standard leachfield and its replacement for a 3 bedroom home will require from approximately 800 square feet (SF) to 2000 SF depending on the soil's percolation rate. This size can be reduced by up to 50% when a sand filter is being used. The leachfield can be constructed on a slope of up to 20%. A mound system and replacement mound area for a 3 bedroom home will be approximately 8800 SF using the more expensive old sand, and would be approximately 10,450 SF using the newly approved cheaper sand.

SOIL PROPERTIES THAT EFFECT SEPTIC SYSTEM SITING



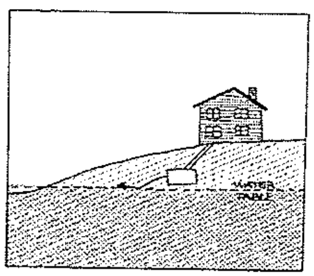


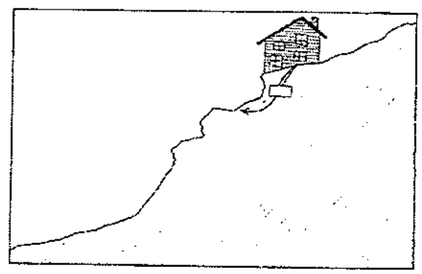


Slowly permeable soil may not be able to absorb all of the wastewater put into it. Clay is one kind of slowly permeable soil.

Rapidly permeable soils may absorb wastewater too quickly to treat it adquately. Sand is one kind of rapidly permeable soil

Shallow soils occur when the distance between the disposal field and bedrock or other impervious layer is small. These sites may be unable to treat wastewater adquately.



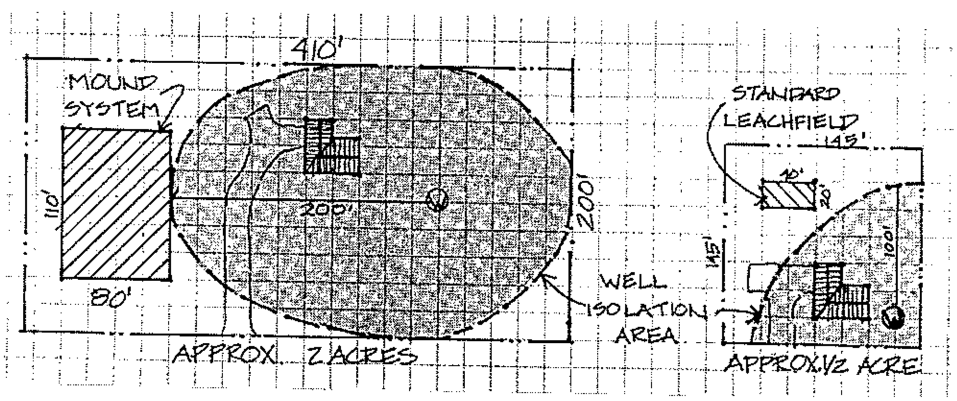


High water table: If the groundwater rises too close to the disposal field at any time during the year, the saturated soil will not be able to absorb and treat wastewater.

Steep slopes: If a disposal field is built on or a near a steep slope, the wastewater may flow out onto the surface instead of down into the ground.

Source: Rural Sewage Treatment in Vermont Book 1: A Guide to the Alternatives, 1978.

Another factor which dictates the location of the septic system is its proximity to other elements. Table 1 shows specified isolation distances for septic systems; Table 2 shows isolation distances for private water supplies. Changes in the Federal water supply standards are making these isolation distances for wells more stringent and complex (see Table 3). Generally, for private wells, a separation distance of 100 feet increasing to 200 feet up gradient is acceptable (see Table 3 and Figure 1). This distance is increased for public water supplies and shallow wells. It may also be increased if soils are highly permeable. These isolation distances combined with the area used for a septic system make it very difficult to site these systems on a small (less than 1 acre) parcel of land. Under perfect conditions, it would be possible to site a well, standard in-ground septic system, and house on a half acre of land. This arrangement does not keep the isolation distance for the well contained within the property. Vermont's regulations do not currently require that isolation distances be contained within the property line. Very few places in Vermont have perfect conditions. .



Mound system upslope from well with Isolation areas on property

Standard leachfield Down slope from well with isolation areas off property

Table 1.

HORIZONTAL DISTANCE IN FEET FOR SITES NOT REQUIRING A PERMIT			
ITEM	**DISPOSAL FIELD**	**SEPTIC TANK**	**SEWER**
Drinking water supply source			
Drilled well	b	50	50
Gravel pack well, shallow well or spring	b	75	75
Lake and pond impoundment - standing water	50	25	25
River, streams	50	25	10
Drainage swales, roadway ditches	25	-	-
Main or municipal water lines	50	50	d
Service water lines	25	25	d
Roadways, driveways, parking lots	10	5	c
Top of embankment, or slope greater than 30%	25	10	-
Property line	25	10	10
Trees	10	10	10
Other disposal field or replacement area	10[2]	-	-
Foundation, footing drains, curtain drains	35[3]	10	-
Public water supply (e)	f	f	f
Suction water line	100	50	50

Note:

These distances may be reduced when evident that the distance is unnecessary to protect an item or increased if necessary to provide adequate protection.

General Criteria Regarding Isolation Distances

a. Isolation distances apply regardless of property line location and ownership.

b. Separation between drinking water sources and leachfields shall be determined by the methods in the Vermont Water Supply Rule, Appendix 21-A, Part 11, § 11.4.

c. Sewers under roads, driveways, or parking lots may require protective conduits or sleeves.

d. Separation of pressure water lines considered as "service connections" and sewer lines shall adhere to the Vermont Plumbing Code. Separation of pressure water lines (considered to be part of a public water system as defined by the Vermont Water Supply Rule) and sewer lines shall adhere to the requirements of the Vermont Water Supply Rule.

e. This refers to Public Community Water Systems, as defined in the Vermont Water Supply Rule.

f. Contact the Department of Environmental Conservation's" Water supply division, 103 South Main Street, Waterbury, Vermont.

Specific Criteria for Isolation Distances

1. For mound systems, the limit of mound fill must be 25 feet from any downhill property line and 10 feet from all property lines on the side or uphill.

2. No disposal field or replacement area shall be closer than 10 feet to one another except as allowed for trench systems in § 1-708(A).

3. If a curtain or foundation drain is downslope of the disposal field, the disposal field cannot be closer than 75 feet to the drain. If the curtain or foundation drain is upslope of the disposal field. These distances may be reduced if the consultant provides adequate data and analysis to show that effluent from this system will not enter the drain or increased if effluent will enter the drain.

Source For Table 1: Vermont Agency of Natural Resources Environmental Protection Rules, Chapter 1, Small scale Wastewater Treatment and Disposal Rules, Effective August 1996, pp. 76 & 77.

Table 2.

Required Minimum Separation Distance

POTENTIAL SOURCE OF CONTAMINATION AND OTHER SITE LIMITATIONS	SEPARATION DISTANCE
Roadway, parking lot (outer edge of shoulder)	25
Driveway (<3 residences)	15'
Sewage system disposal fields:	a
Subsurface wastewater piping and related tanks	50'
Property line	10'b
Limit of herbicide application on utility ROW	100'c
Surface water	10'd
Floodways	e
Buildings	10'
Barnyards, livestock holding area and manure storage system	200'
Hazardous or solid waste disposal site	e
Non-sewage wastewater disposal fields	e

a. See Table 3.

b. Increased to 50' when adjacent to agricultural cropland.

c. Applies to rights-of-way (ROW) where herbicides have been applied in the past 12 months and may be applied in the future. This distance may be increased to 200' depending on the active ingredient in the herbicide according to Vermont Regulations for Control of Pesticides.

d. For public water sources, see Appendix A, Part 1, Section 3.3.8.

e. Water sources shall not be located in a floodway.

f. If a water source is potentially downgradient of a source of contamination, then the Department shall apply the criteria in 11.4.2.

Source For Table 2: Vermont Agency of Natural Resources Environmental Protection Rules, Chapter 21, Water Supply Rule, Effective September 1992, p. A 104.

Table 3.

REQUIRED SEPARATION DISTANCES

Required Minimum Separation Distances to Sewage System Disposal Fields (ft) [1,2]

Domestic Sewage System	Maximum Daily Demand (GPM)			
Disposal Fields (design flows)	0-1.9	2.0-4.9	5.0-7.9	>8.0
<2,000 GPD	100	150	200	200[A]
2,000 GPD - 6,499 GPD	150	150	200	200[a]
>=6,500 GPD	200[b]	200[b]	200[b]	200[a]

[1] The minimum separation distance, (X), is used to determine the minimum separation zone (see Figure 1)

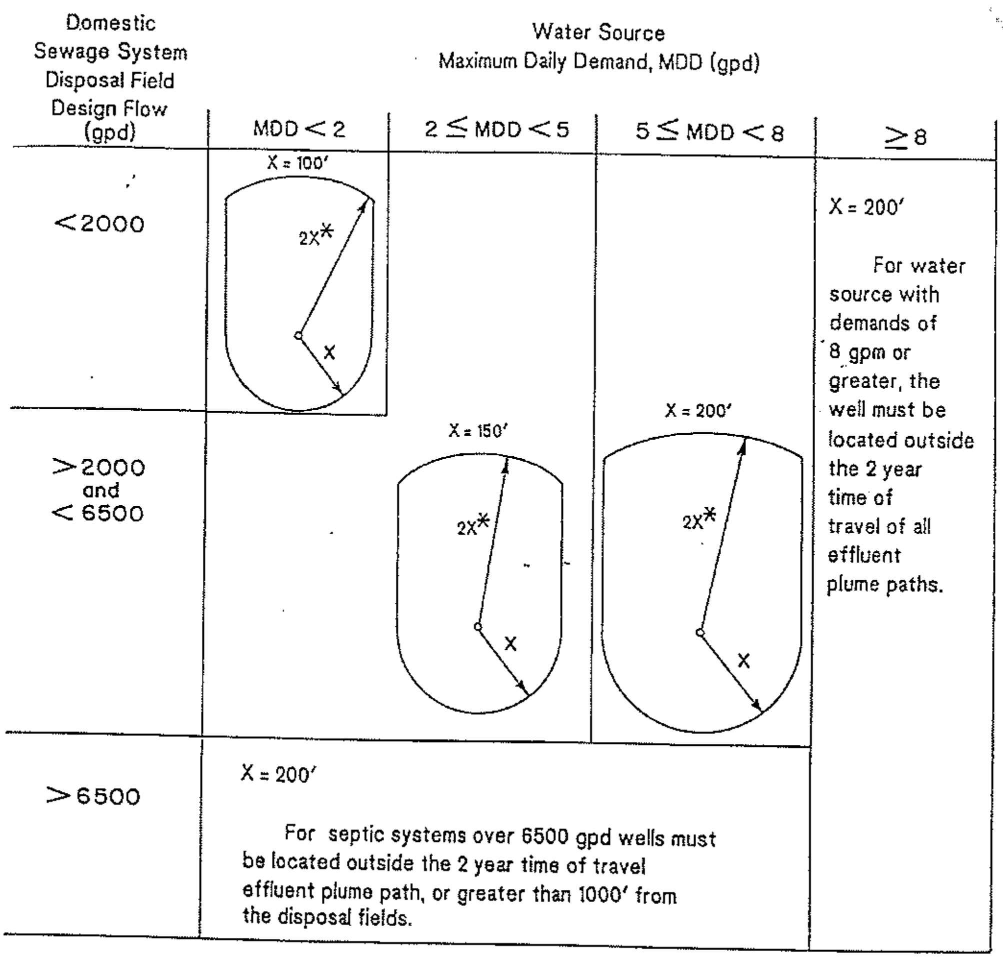
[2] For shallow water sources the minimum separation distance, X, per subpart 11.4.1 shall not be less than 150 feet, and the minimum upslope separation distance shall be 500 feet instead of 2X regardless of the minimum separation distance, X listed. In addition a disposal field may not be closer than 50 feet to a water source unless the bottom of the well or spring is higher that the ground surface at the disposal field.

[a] Hydrogeologic evaluation required to define potential recharge area of the source and two year time of travel.

[b] For all water sources less than 5 gpm maximum daily demand, the minimum presumptive upslope separation distance to greater than 6,500 gpd leachfields, per Subpart 11.4.1, shall be 1,000 feet instead of 2X.

Figure 1.

PLAN VIEW OF REQUIRED MINIMUM SEPARATION DISTANCES TO DOMESTIC SEWAGE DISPOSAL FIELDS



1 These shapes assume parallel ground surface contours horizontally across page.

* For shallow water supplies use 500' distance instead of 2x.

Source For Table 3 And Figure 1: Vermont Agency of Natural Resources Environmental Protection Rules, Chapter 21, Water Supply Rule, Effective September 1992, PP. A 105-106.

IV. CURRENT WATER AND SEWAGE USE IN JAMAICA VILLAGE

The present water use and septic discharge calculated in gallons per day (gpd) can be determined through knowledge of building uses and capacity. For example a standard three bedroom house is considered to use 450 gpd or 150 gpd per bedroom, a restaurant serving 3 meals a day is deemed to use 45 gpd per seat. These figures are supplied by the Vermont EPRs for sizing septic systems. It is assumed that water use equals sewage discharge. From information garnered through the survey, lister's records, use estimations an approximate figure for current gpd was calculated using Appendix 1-7A Flow Quantities in the EPRs (see Appendix B). The estimated present water use and septic discharge for Jamaica Village is 56,950gpd. This figure is important in planning for solutions to village capacity problems.

V. DETERMINATION OF NET USEABLE LAND AREA IN JAMAICA VILLAGE FOR DEVELOPMENT

Under current conditions, expansion of community facilities and businesses that would require increased water and septic capacities would be difficult within the Village. There are a few large parcels in or near the Village that may be capable of carrying new development. In order to determine the net useable land area for future development in or near the village, an analysis of present land use was conducted. Parcels were examined for size, existing development, slopes, soils, and location to floodplains. Much of the presently undeveloped land is either on steep slopes or in the floodplain. These areas are difficult or inappropriate for development. This analysis uncovered 42± acres in or adjacent to the village with capacity for future development. Of these 42 acres, 16± were assessed to have the potential capacity for community septic systems. The other 25 acres were not deemed appropriate for a community system but could otherwise be developed.

VI. ESTIMATED FUTURE WATER AND SEWAGE USE IN JAMAICA VILLAGE

An estimation of future water and sewage use can be made by making certain assumptions about future development on lands with development potential. An estimated gpd figure for these areas added on to the existing estimated gpd provides a future use estimate that can then be used to plan for needed water and sewer capacity. Without a community sewage treatment system the potential for future development is very limited. The approximately 42 acres available may be able to be developed at an average density of 1 unit for every three acres, equaling 14 new units. This would allow for well and septic systems that meet state standards. An additional 6300 gpd would be generated in this scenario for a total of 63,250 gpd.

With one or more community systems, 25 acres would be available for future development (an additional 16 would be devoted to the septic disposal fields). A well planned development could occur on these lands at a density of 4 units per acre. This is an average traditional village development density. This density would meet state standards because the isolation distances required for septic tanks and leachfields would not be required. Such developments could also utilize common wells. At a density of 4 units per acre, 100 new units or business could be constructed in the village. With an average of 10 bedrooms per acre and an estimated 20 additional persons at the school the increase in gpd would be 37,900. In this scenario the total water and septic use would be approximately 94,850 gpd.

VII. DETERMINATION & ASSESSMENT OF EXTENT OF ON-SITE SEPTIC SYSTEM AND WELL PROBLEM

A. Assessment Based On Survey Results

The information generated from the Village Capacity Survey is useful in analyzing the present condition of private infrastructure and Jamaica Village's potential for future growth. The village area is quite densely developed, with 64% of the parcels being one acre or less in size. Most buildings surveyed have standard septic systems (84.4%) and drilled wells (79.7%). There are, however, a number of shallow wells with 12.5% of respondents' wells being less than 100 feet deep and 53.1% not knowing the depth of their well. Shallow wells often are not drilled into bedrock and sealed. This is particularly likely in deep gravel soils like those in Jamaica Village. This makes the wells more susceptible to surface ground water pollution as the water is drawn from uncontained aquifers.

Thirty nine percent of the village's septic systems were constructed after 1980. These systems should be designed and constructed using up to date technology and should be in good working order. The review of permits for replaced systems, however, shows that only 17 % of the replacement systems were designed by a qualified designer. These permits also showed that 38% of the replacement systems were drywell disposal systems. This type of system does not provide adequate effluent cleansing in extremely porous soils. The remaining systems (61%) were probably constructed before 1980, as 42.2% of the respondents did not know when their system was built. This is not surprising since 48.5% of respondents said their buildings were built before 1950 and 35.9% did not know when the building was constructed. These old systems are very unlikely to meet current state standards and provide adequate cleansing of effluent particularly in such porous soils.

Currently, the State regulations require a 1000 gal. septic tank for a three bedroom house. Many of the respondents' septic tanks (34%) were 1000 gal. or larger, 31.25% are less than 1000 gal., and 34.4% of the respondents did not know the size of their tank. This is important as undersized septic tanks need to be pumped more often to prevent problems. The survey would indicate that many of the septic tanks in Jamaica Village may be undersized, requiring more frequent pumping or replacement with a larger tank. The majority of the surveyed systems (67%) were pumped within the past five years and as routine maintenance (52%). This high level of routine maintenance by village residents would indicate an awareness of the importance of good septic system care. Such maintenance aids in the prevention of problems and failures. Only 9% of the buildings have sump pumps in the basement. This indicates that high water table and poor drainage are not a problem in the village. The soils classifications of the area would support this indication.

The Well and Septic System Map developed from individual sketches of parcels and on-site septic and well locations graphically depicts the overlap of isolation distances in the village. The majority of the parcels are too small to accommodate both septic systems and wells. Most of the septic systems were constructed before current design standards were implemented. These systems may not be functioning at an optimal level, may be too small and the porous soils are not providing adequate treatment of effluent. The isolation distances from leachfields to private wells and streams are also too small.

Jamaica Village's soils tend to be alluvial sands and gravels. These soils are highly permeable. They are also relatively flat and have a relatively low water table (greater than 6 feet depth to water table according to the SCS Soil Survey). The presence of shallow wells in the area makes the travel time of contaminants through the soils unacceptably short. Since parcel sizes are small, it is difficult to site a new system that will not affect an existing water supply. FEMA Flood Insurance Rate Maps show that some of the Village is located within the 100 year floodplain. Siting septic systems in the floodplain is not permitted.

The survey information generally indicates that many of the Jamaica Village systems may be inadequate, that under present circumstances there is little capacity for development, and that this situation may be impacting surface waters and potable water supplies. This information is useful in determining whether septic seepage is causing ground and surface water pollution.

B. Determination of Existence of Septic Connection to Ball Mountain Brook
The Jamaica Planning Commission and their volunteers in association with Foster Engineering conducted water quality testing on Ball Mountain Brook and Felton Brook in Jamaica Village. The purpose of the testing was to determine whether or not on-site septic systems within the Village are having an effect on the water quality in Ball Mountain Brook. Other available data has also been reviewed including water quality results from the Bonnyvale Environmental Education Center's West River Watch Project and U.S. Soil Conservation Service soil survey data. The numerical results of these tests are in section V. Stream Monitoring Results on pages 9-11.

E-coli and the associated pathogens such as bacteria, viruses and parasites enter the river through failing septic systems, and domestic and wild animal manure. Directly after the high readings in 1998, a Planning Commission member hiked along the brook, and found no obvious cause. Lacking an obvious source such as surfacing septic effluent or animal waste being dumped, one would look toward a less obvious source such as groundwater affected by poorly treated septic effluent.

Additionally, the data indicate that E-coli and Nitrate levels, while not exceeding State Standards in most cases, consistently were higher at monitoring sites within the Village than they were at the upstream control site.

Soil Conservation Service Soil Survey:
The United States Department of Agriculture, Soil Conservation Service, Soil Survey of Windham County indicates that the soil within the village is mostly classified as Colton type soil (see Soils Map). This soil, due to its coarse and gravelly nature, is classified as "severely" limited for its potential for on-site septic systems. The reasoning for this is that the coarse soil readily absorbs the septic effluent but does a poor job of filtering it before it reaches the groundwater table.

With this coarse gravelly soil, current standards typically require a layer of fine sand beneath the leaching system to provide additional filtering of the septic effluent. With mostly older leachfields and drywells in the Village this filtering sand is probably not present. As a result, many of the disposal systems are likely discharging poorly filtered septic effluent straight into the water table. Consequently there is a higher risk of groundwater contamination from on-site septic systems with this same groundwater eventually reaching the Ball Mountain Brook.

Assessment

Over the past several years, water quality testing on the Ball Mountain Brook and Felton Brook done by the Jamaica Planning Commission and the Bonnyvale Environmental Education Center have periodically shown E-coli levels that exceed, sometimes significantly, the Vermont Water Quality Standards. Testing has also shown that, even at times when State Standards are not exceeded, that E-coli and nitrate levels are higher at sites within the village than they are upstream where there is little development. The soil conditions within the village are described as coarse and gravelly with severe limitations with regard to filtering septic system effluent before it reaches the groundwater table.

Based on the above, one may conclude that it is highly probable that the densely settled village with many on-site septic systems is having a negative effect on the water quality in Ball Mountain Brook. The extent of that negative effect is likely tied with how properties within the village are being used and the condition of their associated septic systems. The high readings in 1997 may have been caused by a single malfunctioning or overused septic system; or the result of many being used at above normal rates without properly treating the effluent.

The important note here is not what specifically caused these high readings, but that it is highly probable that the Village's septic systems are having a negative impact on the quality of water in the Ball Mountain Brook and Felton Brook as it flows through Jamaica Village and that there is potential for that impact to be very negative if certain conditions present themselves.

C. Determination of Existence of Septic Connection to Drinking Water Wells

The Jamaica Planning Commission and their volunteers in association with Foster Engineering conducted water quality testing on many of the drinking water wells in Jamaica Village. The purpose of the testing was to determine whether or not on-site septic systems within the Village are having an effect on the water quality of the wells that serve the Village population. Other available data has also been reviewed including, U.S. Soil Conservation Service soil survey data and well driller's reports from the Vermont Agency of Natural Resources.

Soil Conservation Service Soil Survey and Well Driller's Reports

As stated in the previous section, the United States Department of Agriculture, Soil Conservation Service, Soil Survey of Windham County indicates that the soil within the village is mostly classified as Colton type soil. With this coarse gravelly soil, current standards typically require a layer of fine sand beneath the leaching system to provide additional filtering of the septic effluent. With mostly older leachfields and drywells in the Village this filtering sand is probably not present. As a result many of the disposal systems are likely discharging poorly filtered septic effluent straight into the water table. Consequently there is a higher risk of groundwater contamination from on-site septic systems.

Well driller's reports kept by the Vermont Agency of Natural Resources indicate these coarse gravelly soil extends from near the ground surface to bedrock which varies in depth from 10 to over 90 feet.

<u>Assessment</u>
Jamaica Village is a densely settled community with many of the buildings on small lots and with septic systems and drinking water wells in close proximity to one another. In fact, there are very few wells within the village that meet the State's minimum required separation distance to a sewage disposal system.

The well testing that has been completed shows that wells nearest to the village center have nitrate levels that, while not exceeding State standards, are higher than wells located on the outer edge of the village.

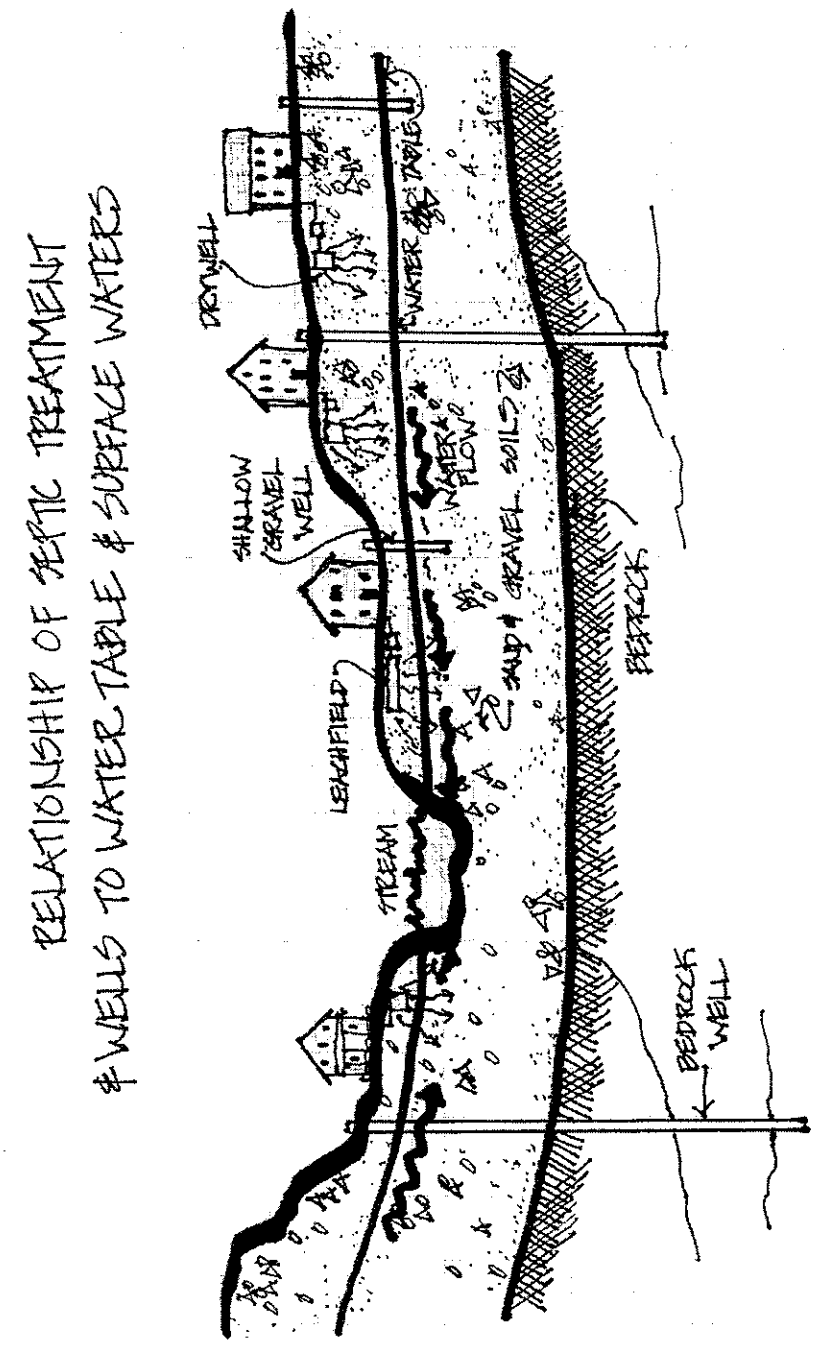
The soil conditions within the village are described as coarse and gravelly with severe limitations with regard to filtering septic system effluent before it reaches the groundwater table. Also many of the disposal systems in the Village are older leachfields and drywells without special filtering sand beneath them as would be required today in highly permeable soils.

Based on the above, it may be concluded that there is an increased risk of contamination to the Jamaica Village drinking water supplies from on-site sewage disposal systems. Additionally, because State minimum well/septic separations cannot be satisfied in most cases, it will not be possible for property owners with businesses or multi-family dwellings to expand beyond their historic use as of July 1, 1970, as described below. In fact, as with most of Vermont's villages, there may be existing businesses or multi-family properties that have been expanded or have modified their water or septic systems since July 1970 without the necessary permits. These properties are in violation of State regulation and could be required to return to a level of use at or below the historic 1970 level.

According to the Vermont Environmental Protection Rules, Chapter 1, Small Scale Wastewater Treatment and Disposal Rules, effective August 8, 1996, any building, except for a single-family residence on it's own lot, requires a Water Supply and Wastewater Disposal Permit. This is a State issued permit for multi-family and commercial uses, relating to the water and septic systems. A permit of this type should have been issued for any multi-unit or commercial building that was built, renovated or expanded after July 1, 1970. Some examples of uses that require a permit are dwellings of two or more units, places of employment, hotels, restaurants, stores, shops, offices, apartments, filling stations, boarding homes, two houses on one lot and places of public assembly.

It is very common throughout Vermont to have properties, especially in villages, that were converted from single-family to two-family or commercial use after July 1, 1970. It is also common for small business that were operating before July 1, 1970 to have added employees or expanded or to have upgraded or replaced their wells or septic systems sometime after July 1, 1970. Any of the above instances requires the State permit.

If these types of projects were not properly permitted at the time, the issue will likely arise in the future with a property transfer or mortgage refinancing when a thorough title investigation is conducted. To be legally operated, these properties will be required to be permitted in accordance with today's standards for water and septic systems. If today's standards cannot be met, then the property must revert to its historic use as of July 1, 1970 or to a use that does not require the State Water Supply and Wastewater Disposal Permit (single-family).


RELATIONSHIP OF SEPTIC TREATMENT
& WELLS TO WATER TABLE & SURFACE WATERS
DRYWELL
SHALLOW GRAVEL WELL
LEACHFIELD
STREAM
WATER FLOW
WATER TABLE
SAND & GRAVEL SOILS
BEDROCK
BEDROCK WELL

VIII. POTENTIAL SOLUTIONS

A. Village Wastewater Disposal Ordinance

This alternative would involve creating wastewater disposal ordinance specific to the village district. The ordinance could be performance based requiring that all disposal systems provide an advanced level of treatment to the wastewater before final discharge back into the groundwater.

With this approach, individual property owners would be responsible for installing and maintaining a disposal system that has been proven to meet the desired level of treatment such as nitrogen removal and disinfection. The ordinance could apply to all new and replacement systems effectively phasing in the new systems over time. Or, it could be required that all properties be in conformance by a certain date.

This approach would help to protect drinking water supplies and groundwater because the wastewater would be treated such that health threatening contaminants would be removed or neutralized before being returned to the groundwater.

The benefit of this option to the Town would be that it would only be required to enforce the ordinance. The full cost of installation and maintenance would be the responsibility of the individual landowner.

The downside would be that this option would not help multi-family and commercial properties on small lots come into conformance with State of Vermont water and wastewater requirements. Without meeting these requirements, commercial and multi-family properties will not be allowed to expand beyond their historic use as of July 1, 1970. Another disadvantage to this option is that grants and loans to implement such an option as not as readily available as they are for more proactive solutions.

Also, there are increased operation and maintenance requirements with most advanced treatment systems that individual landowners are not accustomed to. For whatever reason, whether its lack of understanding or financial constraints, these systems may not get the attention they require. Because of this, there is continued risk to drinking water supplies should individuals not monitor and maintain their disposal systems properly. A wastewater management district to implement the ordinance and oversee the required operation and maintenance of advanced treatment systems would ensure continued proper performance of such systems.

There are many types of treatment systems available (see Appendix C System Matrix). The cost for the more common ones installed with a disposal field, is approximately $10,000 to $15,000. This could total as much as 1.8 million dollars for new individual systems on all 124 parcels.

B. Decentralized Wastewater Management System

This alternative would involve creating a wastewater management district (legally a fire district) combining an off-site community disposal system, innovative/alternative on-site disposal systems and management of conventional on-site disposal systems. A management district would be set up to coordinate maintenance, fees and compliance for all users within the district.

With this approach, each property within the district would be evaluated for site conditions and septic suitability (including soils, lot coverage, lot size, proximity to water supplies and surface water and other physical data) and an area for an off-site community system would be identified and tested.

Property owners would be given as many options for their systems as possible given the site constraints. Options may include a simple scheduled maintenance program for a property with little risk to public health, the addition of an alternative treatment component to an existing system or mandatory connection to an off-site community system for a property with high risk to water supplies or no usable land for replacement septic system.

This approach will help protect water supplies by taking the highest risk properties with little or no wastewater disposal capacity and providing them with an off-site disposal area away from the existing drinking water wells. With the potential contamination sources removed, risk of contamination to wells and brooks will be greatly reduced and properties will be better able to meet State of Vermont well isolation requirements to allow increased usage of existing properties.

There are a host of benefits to this type of system. Most notably, it is not a one-size fits all approach. It allows each property more flexibility for meeting the community goals of protecting public health and the environment. It tends to be most cost effective for the community because it eliminates much of the underground piping and manholes associated with a full community system and the community off-site system can be smaller.

Also, because the State does not have jurisdiction over existing single-family septic systems for properties built before March 5, 1973 or subdivided before September 18, 1969, the Town and individual property owners have wider latitude to choose the technologies used improve individual systems around the village, again reducing costs. However, if any on-site systems larger than 6,500 gallons per day or for commercial, civic, or multi-family users are proposed, the State will have jurisdiction and will have to approve the systems and technology used.

The downside to a decentralized system is the complexity of the fire district arrangements that must be worked out. Typically all wastewater disposal in the village will fall under the jurisdiction of the fire district, including those existing conventional systems that only require scheduled maintenance and inspection. Scheduled maintenance and inspections, such as pump-outs, would be reported to the Town to ensure compliance. Operation and maintenance of the innovative/alternative and off-site community system would be the Town's responsibility.

Another issue in the use of a decentralized management system is that finding space for multi-household cluster systems in the vicinity to which they are needed may be difficult. The legalities of working out property owner agreements and easements may also present a challenge.

The cost of this type of system could be roughly estimated at 1.5 million dollars. This assumes that roughly 25 of the existing 100 potential users could be put into a maintenance program instead of connecting to the off-site community system. It also assumes that the community system utilizes an indirect discharge (soil adsorption system) with tertiary treatment before disposal. Loans and possibly grants would be available for this option. (See the next section Funding Sources)

C. Centralized Community Treatment and Disposal System

This alternative would also involve creating a fire district with a village-wide sewer collection system and an off-site community disposal system or systems. The fire district would be set up to coordinate operation, maintenance and fees for the new system.

With this approach, an area(s) for an off-site community system would be identified and tested. Three potential sites have been identified through this study. The sewer collection and off-site community system would be built to serve the entire village. Once built, each property within the district would be required to connect to the new system regardless of the condition of their existing on-site disposal system.

The off-site community system will include the installation sewer collection piping throughout the service area, a treatment system and a disposal system. The sewer collection system may be gravity, pressure or a combination of both depending on the lay of the land and the location of the final treatment and disposal site. The treatment system would include primary, secondary and tertiary treatment components. Primary treatment would be accomplished through the use of septic tanks located at either the individual properties or at the central treatment and disposal site. Secondary treament would most likely include recirculating sand filters. Other treatment systems may be considered depending on such things as wastewater strength or site constraints. Tertiary treatment involves the removal of nitrogren and phosphous from the wastewater. This may be accomplished through chemical addition and precipitation or incorporated into the primary and or secondary treatment process.

The benefit of this type of system is that it is typically easier for the Town to manage. Users are treated equally with everyone in the district connected and charged a fee based on their usage of the system. The benefit to the landowner is that they give up the majority of responsibility for their wastewater disposal.

The downside of this type of system is that it is typically more expensive. Underground piping to all areas of the village or district is required and the Town owned disposal system must be sized large enough to accommodate the entire district. Along with the larger system comes higher operation and maintenance costs.

The cost of this type of system could be roughly estimated at 2.1 million dollars. This assumes that all of the existing 100 potential users would be connecting to the off-site community system. It also assumes that the community system utilizes an indirect discharge (soil adsorption system) with tertiary treatment before disposal. Loans and possibly grants are available for these systems, particularly in areas having pollution problems and low/moderate income residents.

D. Temporary Remedies

Education

Through this study, the Jamaica PC has taken a huge step in the process of educating residents about their on-site water and septic systems. It is important that this process continue, especially in light of the potential problems. Residents need to be aware of the importance of routine maintenance. Pumping is very important to the continued functioning of undersized septic tanks and systems, and to those in marginal working order. Generally, maintenance involves pumping the septic tank every 3 years. The cost of pumping a 1000 gallon septic tank is about $165.00, or approximately 7 cents per gallon for pumping and 9 cents a gallon for processing at a sewage treatment facility. Examining a system for broken pipes or leaks, and repairing these problems will also aid to alleviate the village problem.

Residents should also be aware of potential well problems and surface water problems so that they can make informed choices regarding their use or contact with these waters. Education on the health risks associated with contaminated drinking water and swimming areas may encourage residents to test both well and surface waters regularly. Residents also need to know about the short term and long term solutions available to them to address septic and well problems.

The Town could become involved in promoting educational programs and information from creating a pamphlet for residents with pertinent information to hosting community forums on the topic. The Town could also institute a subsidized septic pumping and water testing program, which would help to get area residents thinking about septic and water issues.

Revised On-Site Sewage Ordinance

The purpose of a municipal on-site sewage ordinance is to achieve the proper performance of sewage systems. This means that systems designed to comply with an ordinance will:

- Prevent public health hazards
- Prevent surfacing sewage or the contamination of drinking water supplies, groundwater and surface water
- Promote sanitary and healthful conditions during operation and maintenance.

Having an on-site sewage ordinance provides for other benefits to individual property owners and to the community. These benefits include:

1) Dependability and consistency in the criteria for systems such as soils and site evaluation, and review of the design and installment of systems. This consistency is beneficial to both the designer and the consumer.
2) Consumer protection provided by requiring systems to be designed by qualified designers and to meet state standards ("to the fullest extent possible with performace standards"in the case of failure - EPRs pp.82).
3) Reduction in land consumption, rural sprawl and forest/wildlife fragmentation by having consistent requirements for all construction or subdivision, therefore removing the 10 acre exemption to the state design standards.

The present Jamaica On-Site sewage Ordinance was adopted in 1973. A number of municipalities' ordinances were signed by the Commissioner of Health without a Board of health vote of approval. These ordinances are slated to "sunset" on July 1, 2001. The Town of Jamaica has such an ordinance. 24 VSA §3633 enables municipalities to adopt On-Site Sewage

Ordinance. These ordinances must comply with minimum standards established by the Agency of Natural Resources, and be reviewed and approved for such compliance by the Department of Environmental Conservation.

Since 1973, there have been numerous changes in the EPRs, most recently in 1996. Septic systems that are designed to meet state standards under the state subdivision regulations (Act 249) also must meet the requirements of the municipal ordinance and receive a municipal permit. In most cases, the EPRs and the antiquated municipal ordinances do not have the same standards. Often, a system designed to meet today's EPRs and given a subdivision permit would not meet the town's ordinance requirements, but are given municipal permits anyway. These municipalities are regularly granting permits that are in violation of their own municipal on-site sewage ordinance. Jamaica is very likely in this situation.

A new ordinance would allow the municipality to legally allow some more advanced treatment systems such as sand filters, take advantage of the EPR changes in the mound sand requirements, take advantage of other improvements in technology allowed in the present EPRs, and provide permit consistency and security for property owners. Updating the Jamaica on-site sewage ordinance would ensure that new and replaced systems used the best available technology and design standards.

POTENTIAL SOLUTIONS	
ADVANTAGES	*DISADVANTAGES*
Village Wastewater Disposal Ordinance	
♦ Town would only be responsible for ordinance enforcement ♦ Property owners with properly working systems would not be impacted ♦ Low cost to town ♦ Would provide for pre-treatment in new and replaced systems	♦ Piecemeal approach – could take considerable time to improve water quality ♦ Would not resolve problem with well isolation distances ♦ Would not help multi-family & commercial properties on small lots ♦ Cost and responsibility rests with individual property owners ♦ Grants or loans not available at this time ♦ Will not allow for increased development density in the village
Decentralized Wastewater Management System	
♦ Allows for flexibility in solutions dependent on each situation ♦ Cost effective due to limited infrastructure investment ♦ Allows for flexibility in systems designs ♦ Would address isolation distance, drinking water and surface water problems ♦ Could be designed to address multi-family and commercial building expanded use issues ♦ Would allow for increased densities and new development in the village ♦ Loans are available	♦ Flexibility in solutions will make administration of the management system more complex ♦ Requires creation of a fire district ♦ Requires significant oversight ♦ Lack of consistency in solutions may cause discontent among some property owners ♦ Space for cluster systems may be difficult to find
Centralized Community Treatment and Disposal System	
♦ Easy to manage due to consistency ♦ Everyone has to do the same thing – hook - up ♦ Addresses both well and surface water problems ♦ Flush and go solution – requires little attention by individual owners ♦ Would address isolation distance, drinking water and surface water problems ♦ Long term solution ♦ Allows for future village growth and expansion of existing commercial or multi-family buildings ♦ Village has space for community systems ♦ Loans are available	♦ Most expensive solution ♦ Requires infrastructure ♦ Requires a fire district ♦ All property owners would have to pay capital and operation and maintenance costs

Education	
♦ Increased public awareness of potential and existing problems, prevention and maintenance ♦ Town involvement can be minimal or substantial as the town chooses ♦ May maximize life of systems if people act on what they have learned ♦ Grants available to provide information – much information actually exists	♦ Not a permanent solution to the problem ♦ Requires effort & coordination ♦ Does not address future growth issues ♦ Will not address existing problems ♦ Relies on citizen interest and action ♦ No enforcement ♦ Would not resolve problem with well isolation distances ♦ Would not help multi-family & commercial properties on small lots Will not allow for increased development density in the village
Revised On-Site Sewage Ordinance	
♦ Will help to prevent future problems throughout the town ♦ Would prevent problems from worsening by requiring new & replacement systems to be designed by qualified professionals ♦ Inexpensive	♦ Would not solve isolation distance, well and surface water problems in the village ♦ Requires training and expertise of the enforcement officer ♦ Not a permanent solution to the village problem ♦ Will not allow for increased development density in the village ♦ Would not help multi-family & commercial properties on small lots

IX. FUNDING SOURCES

Rural Development Administration (RDA): Formerly the Farmers Home Administration, the RDA through its Rural Economic and Community Development Service (RRCD) offers a range of programs. A number of income eligible communities, most recently Guilford, have been assisted with sewer and water issues through the Community Facilities Loans. This program has both direct and guaranteed loans available to assist communities or non-profits provide essential services to towns with populations of 20,000 or less. Funds may be used to construct extend or otherwise improve these essential facilities.

Vermont Agency of Natural Resources

1. **Clean Water State Revolving Fund (CWSRF)**

   These programs are capitalized through federal and State contributions, and operate as banks making low or no interest loans to communities and other eligible public recipients for water quality projects. The loans are repaid over terms as long as twenty years and repayments are recycled to fund other water quality projects.

   The Vermont CWSFR is as follows:

   Engineering Planning Advances (10 VSA Chapter 55, Subchapter 2)
   The department may award these interest-free advances to municipalities to cover the cost of preparing preliminary engineering plans and final drawings and specifications for pollution abatement projects. Repayment occurs when construction begins, and normally the advance is deducted from the amount of the first construction grant payment (assuming the project is grant-eligible). Although the provision for planning advances remains in statue, most planning is done with the CWSRF (see below) due to limited funds availability.

   CWSRF 100% Loans - Pollution Control (24 VSA Chapter 120)
   Awards can be made to municipalities for any pollution control related work: planning or construction. Loans are interest-free but construction loans carry a 2% administration fee. The loans are repaid in equal annual payments over a term of up to 20 years. Planning loans are typically included in the CWSRF loan for the subsequent project phase. Loan repayments are returned to the revolving fund for subsequent use as new loans. This is the Clean Water Act, State/EPA Revolving Loan Fund - or CWSRF.

   35% Grant - Dry Weather Pollution Abatement (10 VSA §1625)
   Awards may be made to municipalities for the construction of facilities which purpose is the abatement of dry-weather pollution. This may include interceptor and collection sewers, pump stations, sewage treatment plants and outfall sewers. This grant is normally not implemented unless there is tandem state or federal grant funding for the project.

2. **Drinking Water State Revolving Fund (DWSRF)**

   These programs are capitalized through federal and State contributions, and operate as banks making low or no interest loans to communities and other eligible public recipients for drinking water projects. The loans are repaid over terms as long as twenty years and repayments are recycled to fund other water quality projects.

Engineering planning Advances (10 VSA Chapter 55, Subchapter 2)
As in CWSRF, although the provision for planning advances remains in the statue, most water supply planning is done with the DWSRF (see 1000% loans below).

35% grants (10 VSA §1624)
Changes to this statue in 1997 limit these grants to projects for which bonds had been voted by April 5, 1997.

100% Loans (24 VSA Chapter 120)
Awards may be made to municipalities and certain privately-owned water systems for the planning, design, construction, repair, or improvement of the public water system to comply with state and federal standards and protect public heath. Priority for funding is given to projects that address the most serious risk to human health, are necessary to ensure compliance with requirements of the Safe Drinking Water Act and the Vermont Water Supply Rule, and assist systems most in need according to state affordability criteria. Interest rates and terms are determined by type of system (municipal or private), type of project (planning, design, construction, or source protection), user rates (less than or greater than 1.25% of median household income), and median household income. Interest rates vary from +3% to -3% and terms are between 5 and 30 years. Loan repayments are returned to the revolving fund for subsequent use as new loans. This is the Safe Drinking Water Act State/EPA Revolving Loan Fund or DWSRF.

Vermont Agency of Development and Community Affairs.

1. Vermont Community Development Program (VCDP) - Since 1983, the State of Vermont Agency of Development and Community Affairs has administered and distributed HUD Community Development Block Grant (CDBG) funds through a competitive application process to non-entitlement municipalities (less than 50,000 population) in the four project areas of Housing, Economic Development, Public Facilities and Public Services. The VCDP has two community development oriented grant programs.

a. Planning Grants - Planning Grants (PG) VCDP planning funds afford communities the technical expertise and professional resources needed to test ideas, propose strategies, develop plans, establish policies and procedures, and conduct organizational activities. They assist communities in community development planning activities and/or in conducting pre-development activities in preparation for implementing a project in one or more of the program areas; housing, economic development, public facilities or public services. VCDP funds may be used to pay the cost of developing a comprehensive community development plan and devise programs and activities to meet the specific goals and objectives set forth in such a plan. The maximum grant amount is $40,000. Planning grants require 10% match for the first $20,000 and 50% match for a request exceeding $20,000.

b. Implementation grants - Funds may be used for a range of eligible activities in the program areas noted above, which meet as least one of the National Objectives (Low and Moderate Income Benefit, Slums and Blight or Urgent Need), and address one of the state objectives (Housing, Employment and public facilities). The maximum award is $750,000. Guilford received an Implementation grant for low/moderate income sewer hook-ups in Algiers.