APPENDIX C: ONSITE WASTEWATER SYSTEMS— TECHNOLOGIES, COMPONENTS, MAINTENANCE

Onsite wastewater dispersal systems, when properly sited, installed, and maintained, can be a long-term effective means of wastewater treatment and dispersal. However, they can negatively impact surface waters and groundwater when they malfunction or when they are placed too close to the groundwater table or surface waters.

C.1. Wastewater Treatment and Distribution

The traditional gravity flow onsite septic system in the study area (and around Vermont) includes at least a 1,000 gallon concrete septic tank, a concrete distribution box, and a leach bed or leach trenches. The septic tank settles out the solids and provides some treatment; the distribution box splits the flows evenly between pipes or trenches, and the leach bed or trenches (made out of crushed stone or alternative materials with perforated pipe covered with filter fabric) along with the unsaturated soils below the system provide the final distribution and treatment.

Effluent filters can now be added to the outlets of septic tanks, and are required on new tanks. These filters screen solids from the effluent when it leaves the tank. If the tank is full of solids, the filters will plug and the system will slow or back up before solids leave the tank and enter the dispersal field. This helps to protect the leachfield from solids that can carry over from the septic tank into the dispersal system from the septic tank if that tank is not pumped at appropriate time intervals. The filters need to be hosed off usually once a year.

Pump stations are added after the septic tank if the distribution box in the dispersal field is not low enough in elevation relative to the building outlet, or for mounds, at-grade systems, and advanced treatment systems. Pressurizing the dispersal field also allows for improved distribution of the effluent, making more effective use of the entire field and preventing overloading of a portion of the field.

Advanced pre-treatment components can be added after the septic tank to improve wastewater treatment prior to dispersal. Pre-treatment components may also allow for increased capacity of onsite systems, which maximizes available soil resources, or may allow for the use of sites not previously approved under the Vermont Environmental Protection Rules (Rules). Since August 2002, the Rules have contained a process through which "innovative/alternative" technologies can be approved for use in the state. Since the revised Rules were implemented, several different technologies have been approved by DEC and are available for designers to consider (a list of all approvals can be found at http://www.anr.state.vt.us/dec/ww/innovative.htm). A designer should think about the availability of component parts, local service providers, and ongoing operation and maintenance costs when considering or recommending any particular component. Pre-treatment technologies may replace, or partially off-set,

the cost of an avoided off-site system or a mound system, or depending on the site and system, may add $5,000-$10,000, or more, to the construction cost of a system. The ongoing costs of innovative/alternative systems are also often higher than those of a conventional septic system, because they need to be maintained regularly in order to operate properly.

C.2. Wastewater Dispersal Options

Traditional wastewater dispersal options in Vermont include drywells, in-ground leachfields, and mound systems. The survey responses and information in the inventory of existing wastewater systems indicated that approximately 20% of developed properties currently use drywells, which typically follow septic tanks and consist of concrete cylinders with open bottoms and holes in the sides, surrounded by stone, which holds the wastewater until it disperses into the ground. New or replacement drywells have not been permitted in Vermont since 2002. Two concerns with drywells are that they typically contain a small volume and can be undersized for their intended uses, and that they are usually quite deep in the soil profile, sometimes close to 10 feet. Therefore, they may not have sufficient separation to groundwater, impermeable soils, or bedrock, to provide adequate treatment.

Most people are familiar with in-ground leachfields and mound systems. Both systems utilize either trenches or beds that either contain distribution pipes and crushed-stone or prefabricated leaching chambers. These dispersal options both provide treatment in the vicinity of the interface between the trenches (or bed) and the soil, and in the unsaturated soil beneath the trenches (or beds). A traditional leachfield is usually dosed by gravity, where effluent flows from the septic tank to the leachfield based on how much water flows into the septic tank from the structure. An in-ground leachfield requires 36 inches of unsaturated soil between the bottom of the leachfield and groundwater, and 48 inches to bedrock. Since the trenches can be installed up to 36 inches deep, this means at least 3.5-7 feet of suitable soil are needed for an in-ground leachfield to work properly.

A mound system is used where soil conditions are more limited. Unlike in-ground leachfields, they are dosed using pressure, usually from a pump tank or siphon placed between the septic tank and the dispersal field. The “mound” is built out of specified sand fill material that meets certain technical requirements, and which provides additional unsaturated soil for wastewater treatment between the bed or trench and the limiting condition (groundwater or bedrock). To be used without any additional pretreatment, a mound system needs at least 18 inches of undisturbed, unsaturated soil between the ground surface and the groundwater or bedrock.

Some newer wastewater dispersal options in Vermont include at-grade systems and subsurface drip irrigation. At-grade systems are dosed using pressure, like a mound system, but the crushed stone infiltration areas are built on the existing soil surface and then covered with non-specified fill material and topsoil. This material can either be moved from another part of the site or brought in from off-site. Since

the trenches are built on top of the existing ground surface, they need 3 feet of unsaturated soil (less than is needed for an in-ground system). Subsurface drip irrigation was approved in Vermont in 2007, and uses small-diameter, flexible tubing with widely spaced "emitters" to distribute treated wastewater effluent. Because of the small diameter of the emitters, wastewater must be pre-treated using an advanced treatment technology if subsurface drip dispersal is to be used. However, this technology can be installed without the use of crushed stone aggregate, making it a viable option in small spaces where earth-moving equipment cannot gain access. Since pre-treatment is required, subsurface drip irrigation can be used as a filtrate system (see below).

If advanced pre-treatment technology is used on a septic system, Vermont's Rules allow the use of a dispersal system called a filtrate system. The term "filtrate" acknowledges that the pre-treatment component has already done much of the work that the soil would normally do in a traditional septic system, and so less treatment is required of the soil. Filtrate systems may consist of any approved wastewater dispersal technology, but smaller sizes are allowed (up to ½ the area of traditional in-ground leachfield, at-grade system, or mound system), which can be important on small lots. Pre-treatment may also eliminate the need for a mound system in situations with shallow groundwater or bedrock limitations, since reductions in the vertical separations to limiting soils are also gained when pre-treatment is used.

Vermont's Rules also allow for the design and permitting of performance based systems on sites with 18 inches of soil above bedrock and as little as 6 inches of soil above the seasonal high water table. These systems almost always involve advanced pre-treatment and a mound wastewater dispersal system.

C.3. Operation and Maintenance of Wastewater Treatment Systems

Operation and maintenance of conventional sewage dispersal systems is quite simple. Operation or use of the system can be greatly enhanced by the use of water conservation devices and developing appropriate habits, such as only doing one load of laundry a day and eliminating in-sink garbage disposals. Keeping records of the locations of buried components, tank pumpouts, and repairs can be crucial during a system inspection and is invaluable information for future owners of the system.

Maintenance on conventional systems consists of having someone check the levels in the septic tank and pumping it out when necessary. For the homeowner, this usually means calling the septic tank pumper and always paying for a pumpout, whether it is really necessary or not; homeowners can avoid this unnecessary expense by checking the tank themselves. Depending on the use of the system, it may need to be pumped every year to every seven years. The condition of the tank, particularly its baffles and access, should also be inspected. If there are multiple tanks or pump station tanks, these should be inspected regularly and pumped when necessary due to the accumulation of solids greater than 25-33% of the tank volume. Any mechanical or electrical parts (such as pumps, valves, switches, or alarms) should

be inspected and tested yearly. The effluent filters also should be checked and cleaned on a yearly basis, with greater or lesser frequencies in specific situations depending on use.

Maintenance of tanks is a lot easier when access to the tank is not a problem, as is the case when the tank is buried under a couple of feet of soil. New septic tanks are required to have risers to grade with adequately designed and installed lids to prevent entry by children. If the top of an existing tank is deeper than 12 inches below the surface, access risers should be installed on the tank. In the past the risers were constructed of thick heavy concrete, but lightweight plastic and fiberglass materials for risers are now available, although again, child safety must be considered.

Another maintenance item is to check the distribution box and make sure the outlet pipes are level. If this box is not level (which can easily happen in Vermont's freezing climate), one portion of the dispersal field may be overloaded while other parts go unused. There are plastic devices available that can easily be installed to make the outlet pipes level.

The dispersal field itself should be checked for seepage or surfacing of effluent, or for water loving plant growth, the roots of which can clog pipes. If there is untreated wastewater surfacing or discharging into a ditch or surface waters, there is a real public health hazard that should be addressed immediately. Although not typical in Vermont, some dispersal fields (leach fields) include monitoring pipes so that the stone in the dispersal field can be checked for ponding. Some ponding of treated wastewater in the field can be acceptable, but if the system has a thick clogged mat or is being hydraulically overused the wastewater system may surface or back up.

As septic systems become more complex, it becomes even more important to make sure that they are operating properly. Since the more complicated systems are often installed to overcome difficult site conditions, like shallow groundwater, there is less of a 'margin of safety' if the system malfunctions before sensitive resources such as shallow groundwater are negatively impacted. Systems that use pumps to distribute wastewater effluent, like at-grade or mound systems, should be checked at least once a year to make sure that the pumps are cycling and operating properly. The maintenance requirements for pre-treatment systems vary with the permit requirements of the individual technology, but should include at least one inspection per year. Most technology manufacturers sell maintenance contracts with their systems to ensure that the pre-treatment units keep functioning properly after they are installed, and most users of these technologies are required to have a current maintenance contract as a condition of the system's permit.