TABLE 6-3

SUMMARY OF DECENTRALIZED TREATMENT TECHNOLOGIES

ALTERNATIVE	REGULATORY REQUIREMENTS	EFFLUENT QUALITY	MAINTENANCE REQUIREMENTS AND COMPLEXITY OF OPERATION	FLEXIBILITY	ENERGY USE	LAND REQUIREMENTS	POTENTIAL FOR AIR EMISSIONS	ANTICIPATED PUBLIC ACCEPTANCE	EASE OF IMPLEMENTATION	RELATIVE CAPITAL COSTS	RELATIVE O&M COSTS	CONSIDERED FOR USE IN CHATHAM
NON-NITROGEN REMOVAL SYSTEMS												
Septic system (Certified Title 5)	In accordance with 310 CMR 15.00, Title 5 regulations.	Nitrogen removal range 10 to 25 percent primarily within the soil/leaching system.	Long operating track record and widely used. Simple system.	Low, but can be expanded for additional flow.	Does not require energy if site does not require pumping.	Moderate compared to other systems. Not allowed for use with reduced leaching area.	Low potential for odors.	Well-known technology with minimal potential problems.	Simple Construction.	Low, no pumps or filters are required.	No training or equipment operation required. Tank must be pumped every few years.	Yes. In areas where nutrient removal is not required.
JET aerobic wastewater systems and Orenco Intermittent sand filter	Application to MassDEP required. If accepted it would require full-scale piloting. Not Credited for Nitrogen Removal.	Nitrogen removal information not available for this technology.	More complicated system than typical Title 5 due to numerous moving parts. Would require maintenance agreement.	Most systems can be expanded for additional flow.	Moderate energy use due to pumps and other mechanical equipment.	Similar to other I/A systems, larger than standard Title 5 system.	Low potential for odors.	Similar to Title 5 systems, although will be more expensive.	Similar to Title 5 systems; but may require additional tanks and excavation.	Moderate to High, will be more expensive than a standard Title 5 system.	Pumping requirements and maintenance of equipment and additional electrical requirement add to moderate O&M costs.	Yes. In areas where nutrient removal is not required.
Peat system	MassDEP may require additional full-scale testing. Not an approved I/A technology.	Nitrogen removal range 60 to 90 percent. Test sites on Cape Cod have variable quality. Good BOD and TSS removals.	Long track record in Maine. Simple system, no moving parts.	Low, but can be expanded for additional flow.	Does not require energy if site does not require pumping.	Similar to septic system.	Low potential for odors.	Known technology on Cape Cod with minimal maintenance.	Similar to Title 5.	Moderate due to peat transportation costs.	Minimal training requirements. Pumping tank every few years.	Yes. In areas where nutrient removal is not required.
NON-DISCHARGE SYSTEMS												
Tight Tanks	MassDEP will only approve as a short-term solution.	Not applicable, effluent is pumped and hauled to local or remote treatment facility.	Tanks may leak after many years.	Moderate; can handle additional flow by increasing the pumping frequency.	None.	Minimal, leaching system is not used.	High potential for odors due to frequent pumping.	Poor to moderate acceptance due to odors, frequent pumping requirements, and lack of MassDEP approval.	Simple installation, requiring only a tank and connections.	Low installation costs.	High pumping and disposal costs.	No, typically this would only be approved by MassDEP as a short-term solution.
Waterless Toilets	May require BOH approval	High removal for black water only.	Must be sized for use due to clogging problems.	Low; requires additional units for increased flow.	High energy use for incinerating type.	Land required for gray water disposal systems are less than a standard Title 5 system.	High potential for odors.	Poor to moderate, since it is a non-traditional system.	Requires some re-piping and remodeling for existing homes or structures.	Low installation cost, but must handle gray water separately.	Moderate; weekly maintenance and removal of solids required.	No.
NITROGEN REMOVAL SYSTEMS												
Recirculating Sand Filter (non-proprietary)	Certified for use in nitrogen sensitive areas when designed in accordance with MassDEP guidelines.	48-49% of Cape systems achieved median conc. of 19 mg TN/L[(1)]. Good BOD and TSS removals.	Most have moderate to long track records.	Can be expanded for additional flow.	Require energy for pump operation.	Land requirements are comparable to Title 5.	Low potential for odors.	High, proven technology.	Simple system, installation similar to Title 5.	Capital costs for recirculating filter systems are higher than those of a septic system due to additional components including filters and pumps.	Pumping requirements and replacement and maintenance of filter media add to moderate O&M costs.	Yes.
RUCK® System	Certified for use in nitrogen sensitive areas when designed in accordance with MassDEP guidelines.	40-43% of Cape systems achieved median conc. of 19 mg TN/L[(1)]. Good BOD and TSS removals.	Most have moderate to long track records.	Can be expanded for additional flow.	Require energy for pump operation.	Land requirements are slightly greater than Title 5.	Low potential for odors.	High, proven technology.	More difficult to install in existing homes and structures because of separate piping for black and gray water.	Capital costs are higher than those of a septic system due to additional components and piping modifications.	Pumping requirements and replacement and maintenance of filter media add to moderate O&M costs.	Yes.
Recirculating filters approved for "Provisional" use in nitrogen sensitive areas: Bioclere™, FAST®, Amphidrome®, Nitrex™ [(2)], Waterloo®, ZenoGem.	Depending on the system, MassDEP may require additional full-scale testing.	66-78% of Cape systems using these technologies achieved median conc. of 19 mg TN/L.[(1)] Good BOD and TSS removals.	Most have moderate to long track records. Bioclere, Waterloo, and FAST have reliable records in the U.S.	Most systems can be expanded for additional flow.	These systems require energy for pumping.	Land requirements are slightly larger than Title 5. Systems eligible for reduced leaching area outside nitrogen sensitive areas.	Low potential for odors.	Power outage for some systems can cause flow backup in individual homes.	Similar to Title 5 systems; but may require additional tanks and excavation.	Capital costs for recirculating filter systems are moderate and higher than those of a septic system due to additional components including filters and pumps.	Pumping requirements and replacement and maintenance of filter media add to moderate O&M costs.	Yes.
Recirculating approved by MassDEP for "Pilot" use in nitrogen sensitive areas: OAR, RUCK® CFT, Cromaglass, MicroSeptec Norweco®, SeptiTech.	Depending on system, MassDEP may require additional full-scale testing.	13-64% of Cape systems using these technologies achieved median conc. of 19 mg TN/L.[(1)] Good BOD and TSS removals.	Most have moderate to long track records.	Most systems can be expanded for additional flow.	Most systems require energy for pumping.	Land requirements are slightly larger than Title 5. Systems eligible for reduced leaching area outside nitrogen sensitive areas.	Low potential for odors.	Power outage for some systems can cause flow backup in individual homes.	Similar to Title 5 systems, but may require additional tanks and excavation.	Capital costs for recirculating filter systems are moderate and higher than those of a septic system due to additional components including filters and pumps.	Pumping requirements and replacement and maintenance of filter media add to moderate O&M costs.	Yes
SMALL WASTEWATER TREATMENT FACILITIES (NITROGEN REMOVAL)												

TABLE 6-3 (continued)

SUMMARY OF DECENTRALIZED TREATMENT TECHNOLOGIES

ALTERNATIVE	REGULATORY REQUIREMENTS	EFFLUENT QUALITY	MAINTENANCE REQUIREMENTS AND COMPLEXITY OF OPERATION	FLEXIBILITY	ENERGY USE	LAND REQUIREMENTS	POTENTIAL FOR AIR EMISSIONS	ANTICIPATED PUBLIC ACCEPTANCE	EASE OF IMPLEMENTATION	RELATIVE CAPITAL COSTS	RELATIVE O&M COSTS	CONSIDERED FOR USE IN CHATHAM
Alternative	**Regulatory Requirements**	**Effluent Quality**	**Maintenance Requirements and Complexity of Operation**	**Flexibility**	**Energy Use**	**Land Requirements**	**Potential for Air Emissions**	**Anticipated Public Acceptance**	**Ease of Implementation**	**Relative Capital Costs**	**Relative O&M Costs**	**Considered for Use in Chatham**
Activated Sludge / MLE Process	Needs MassDEP and BOH approval. Requires typical effluent discharge permit.	Nitrogen removal range 80 to 90 percent. Effluent N, 8 to 10 mg/l.	Good reliability and proven performance.	High flexibility with good process control.	High energy use for aeration.	Relatively small building and equipment footprint required.	Not considered a significant source of odors.	Moderate; obtaining an acceptable site may be difficult. Processes have many successful installations.	Easy to moderate; construction using prefabricated or cast in place tanks.	Moderate, compared to other facilities.	Moderate, compared to other facilities.	Although these technologies are capable of meeting various levels of performance, in order to achieve the TMDLs, use of multiple small WWTF may be difficult to implement and even more difficult to site and provide sufficient treated water recharge capacity without using a remote site. These factors and O&M associated with the management of multiple town facilities, when the Town already has a site with sufficient size and treated water recharge capacity, eliminate these systems from consideration.
Packaged Biological Treatment (RBC, SBR, Amphidrome®, MBR, FAST®, Bioclere®).	Needs MassDEP and BOH approval. Requires typical effluent discharge permit.	Nitrogen removal range 80 to 90 percent. Effluent N, 8 to 10 mg/l.	Some technologies are relatively new and emerging.	Operator control of processes allows flexibility.	Aeration and pumping requirements.	Relatively small building and equipment footprint required depending on the system.	Not considered a significant source of odors.	Moderate; obtaining an acceptable site may be difficult. Processes have many successful installations.	Easy to construct, most systems are modular or are designed using prefabricated tanks.	Varies with particular technology. Generally less than a concrete facility because it is manufactured off-site.	Moderate, automated processes reduce costs, maintenance of mechanical equipment increases cost.	
Solar Aquatics	MassDEP may require pilot testing due to limited data on this technology. Would also require effluent discharge permit.	Not expected to reliably produce a high quality effluent year-round.	Likely to have lower quality effluent in winter.	Minimal process control.	Energy needed for heat in winter, and pumping and blower requirements.	Extremely high compared to other centralized alternatives.	Odors are possible, although treatment is spread over a large area.	Moderate; systems are typically popular because they use natural processes, but have high capital costs and use large land areas.	More complicated, requires construction of additional tanks and establishing of natural systems.	High costs for land purchase and facility construction.	Low due to low energy use and simple operations.	
Constructed Wetlands	MassDEP may require pilot testing due to limited data on this technology. Would also require effluent discharge permit.	Not expected to reliably produce a high quality effluent year-round.	Likely to have lower quality effluent in winter.	Moderate; can be expanded for additional flows.	Minimal.	Extremely high compared to other centralized alternatives.	Odors are possible if flooding occurs.	Moderate; systems are typically popular because they use natural processes, but have high capital costs.	High costs for land purchase and facility construction.	Low due to low energy use and simple operations.	Low, must remove biomass from system and harvest vegetation every few years.	

Note:

1. Based on data collected and reported in the "*Performance of Innovative Alternative Onsite Septic Systems for the Removal of Nitrogen in Barnstable County, Massachusetts 1999-2007*" by the Barnstable County Department of Health and Environment. Data based on the single-family systems reported in this document. Range based on either all units or units with larger data sets (more than a certain number of samples collected). Systems with either no or minimal number of systems or samples not reported here (Advantex, Amphidrome®, Waterloo®, Nitrex™, ZenoGem).
2. MassDEP requires pretreatment to nitrify the wastewater prior to the Nitrex™ system. This would typically be accomplished using one of the other MassDEP approved I/A technologies identified here.