

**TABLE 14-2**

**SUMMARY OF ON-SITE DRINKING WATER AND WASTEWATER TREATMENT TECHNOLOGIES**

**DRINKING WATER: NITRATE REMOVAL SYSTEMS**

TECHNOLOGY	REGULATORY REQUIREMENTS	SUITABILITY	EASE OF IMPLEMENTATION	PERFORMANCE	LONG-TERM MAINTENANCE	LAND REQUIREMENTS	AESTHETIC APPEAL	PUBLIC ACCEPTANCE	RELATIVE CAPITAL COSTS	RELATIVE O&M COSTS
<b>On-Site – Drinking Water Treatment Technologies</b>										
Point of Use - Reverse Osmosis (Distilled Water, Ion Exchange)	Eastham Board of Health (private wells not under MassDEP regulations)	High removal rates of nitrates (> 90%) for reverse osmosis.	Reverse osmosis would require new plumbing in homes and large areas for filter components and storage basins.	High nitrate removal in drinking water for reverse osmosis.	Long-term maintenance is required. May require pH adjustments to protect pipes and fixtures for some processes like reverse osmosis.	Land use would not increase from this technology.	Modifications to home would be necessary.	Expect opinions to be mixed, these technologies do not solve the water supply issue.	Low to moderate depending on plumbing required to support technologies.	Dependent on water quality, expect filter replacement, chemical needs, electrical needs, maintenance costs and service contracts required.
Bottled Water Purchase	Bottled water must be tested and meet FDA regulatory standards before it can be sold in the U.S. FDA must keep standards updated to correspond EPA's drinking water standards.	Meets/exceeds FDA regulatory standards for physical, chemical, microbial and radiological contaminants.	Very low.	Very good.	Low, replenish home stock.	N/A	Water cooler in home if preference is for water delivery service versus store purchase.	Public acceptance expected to be high as many residents already use this technology.	Very low for typical family, approximately \$40 - \$50 per month.	No purchase of water cooler required, thus rental cooler is replaced if inoperable or leaking.

**TABLE 14-2 (continued)**  
**SUMMARY OF ON-SITE DRINKING WATER AND WASTEWATER TREATMENT TECHNOLOGIES**

**WASTEWATER: NON-NITROGEN REMOVAL<sup>(1)</sup> SYSTEMS**

TECHNOLOGY	REGULATORY REQUIREMENTS	SUITABILITY	EASE OF IMPLEMENTATION	PERFORMANCE	LONG-TERM MAINTENANCE	LAND REQUIREMENTS	AESTHETIC APPEAL	PUBLIC ACCEPTANCE	RELATIVE CAPITAL COSTS	RELATIVE O&M COSTS
<b>General Systems – Wastewater Treatment Technologies</b>										
Septic system (Certified Title 5)	In accordance with 310 CMR 15.00, Title 5 regulations.	Primary means of wastewater disposal in Eastham; will not result in improved conditions.	Well known technology; no regulatory changes necessary.	Poor nitrogen removal of approximately 23 percent.	Does not require energy if site does not require pumping for operation.	Moderate compared to other systems. Not allowed for use with reduced leaching area.	High groundwater areas may require raised leaching fields.	Well-known technology with minimal potential problems.	Low, no filters are required and usually no pumps are required.	No training or equipment operation required. Tank must be pumped every few years.
<b>MassDEP-Approved I/A Systems</b>										
JET aerobic wastewater systems	Approved for General Use. Not credited for nitrogen removal.	High quality effluent (BOD and TSS); currently only suitable for flows less than 1,500 gpd.	More complicated system than typical Title 5 due to numerous moving parts. Would require maintenance agreement.	Nitrogen removal information not available for this technology.	Moderate energy use due to pumps and other mechanical equipment.	Similar to other I/A systems, may allow for reduction in leaching area.	May be high.	Similar to Title 5 systems, although will be more expensive.	Moderate to High, will be more expensive than a standard Title 5 system.	Pumping requirements, maintenance of equipment, and additional electrical requirement add to moderate O&M costs.
Orengo intermittent sand filter	Approved for General Use. Not credited for nitrogen removal.	May achieve nitrogen reduction when properly maintained.	Can be installed in new septic system or retrofit into existing one.	Flexible operation; may reduce nitrogen; may be sensitive to winter temperatures	Moderate energy use due to pumps and other mechanical equipment.	Similar to other I/A systems, may allow for reduction in leaching area.	May be high.	Similar to Title 5 systems, although will be more expensive.	Moderate to High, will be more expensive than a standard Title 5 system.	Pumping requirements, maintenance of equipment, and additional electrical requirement add to moderate O&M costs.
Notes:										
(1) These systems remove nitrogen to varying degrees. However, none of them are credited by MassDEP for nitrogen removal in nitrogen-sensitive areas.										

**TABLE 14-2 (continued)**  
**SUMMARY OF ON-SITE DRINKING WATER AND WASTEWATER TREATMENT TECHNOLOGIES**

**WASTEWATER: NON-DISCHARGE SYSTEMS**

TECHNOLOGY	REGULATORY REQUIREMENTS	SUITABILITY	EASE OF IMPLEMENTATION	PERFORMANCE	LONG-TERM MAINTENANCE	LAND REQUIREMENTS	AESTHETIC APPEAL	PUBLIC ACCEPTANCE	RELATIVE CAPITAL COSTS	RELATIVE O&M COSTS
Tight tanks	MassDEP will only approve as a short-term solution.	Suitable as a short-term solution.	Simple installation; regulatory approval required.	Moves problem to a different location.	Tanks may leak after many years.	Minimal, leaching system is not used.	High potential for odors due to frequent pumping.	Poor to moderate acceptance due to odors and frequent pumping requirements.	Low installation costs.	High pumping and disposal costs.
Waterless toilets (Composting/Incinerating)	May require BOH approval.	High removal for black water only.	Requires some repiping and remodeling for existing homes or structures.		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.	Low installation cost, but must handle gray water separately.	Moderate; weekly maintenance and removal of solids required.
Urine source separating toilets	Technology manufacturer must apply for MassDEP review and approval. No known municipal precedence in the U.S.	Unknown.	Requires plumbing modification and remodeling for existing homes or structures.	Unknown.	Unknown.	Same land use as Septic system (Certified Title 5) with the exception of a separate urine collection tank.	Potential for odors if not properly maintained (urine scale buildup).	Poor due to behavior modifications and homeowner modifications to bathrooms and plumbing.	Unknown installation costs in the U.S.	Moderate; removal of urine and solids required for two separate collection systems.

**TABLE 14-2 (continued)**  
**SUMMARY OF ON-SITE DRINKING WATER AND WASTEWATER TREATMENT TECHNOLOGIES**

**WASTEWATER: NITROGEN REMOVAL SYSTEMS<sup>(3)</sup>**

TECHNOLOGY	REGULATORY REQUIREMENTS	SUITABILITY	EASE OF IMPLEMENTATION	PERFORMANCE	LONG-TERM MAINTENANCE	LAND REQUIREMENTS	AESTHETIC APPEAL	PUBLIC ACCEPTANCE	RELATIVE CAPITAL COSTS	O&M COSTS
<b>Approved for General Use</b>										
Recirculating sand filter (non-proprietary)	Certified for use in nitrogen-sensitive areas when designed in accordance with MassDEP guidelines.	Capable of nitrogen removal.	Most have moderate to long track records.	Nitrogen removal of approximately 50 percent. Good BOD and TSS removals. Sensitive to winter temperatures.	Require energy for pump operation.	Land requirements are slightly more than for Title 5.	High.	High, proven technology.	Moderate due to additional components including filters and pumps.	Moderate; pumping requirements and replacement and maintenance of filter media add costs.
RUCK® System	Certified for use in nitrogen sensitive areas when designed in accordance with MassDEP guidelines.	Capable of nitrogen removal. Approved for flows less than 2,000 gpd.	Most have moderate to long track records.	Nitrogen removal of approximately 50 percent. Good BOD and TSS removals.	Require energy for pump operation.	Land requirements are slightly greater than Title 5.	High.	High, proven technology.	\$15,000	Moderate; pumping requirements and replacement/maintenance of filter media add costs and required annual inspection adds cost of \$250. Additional monitoring required if systems located in Zone II

**TABLE 14-2 (continued)**  
**SUMMARY OF ON-SITE DRINKING WATER AND WASTEWATER TREATMENT TECHNOLOGIES**

**WASTEWATER: NITROGEN REMOVAL SYSTEMS<sup>(3)</sup> (continued)**

TECHNOLOGY	REGULATORY REQUIREMENTS	SUITABILITY	EASE OF IMPLEMENTATION	PERFORMANCE	LONG-TERM MAINTENANCE	LAND REQUIREMENTS	AESTHETIC APPEAL	PUBLIC ACCEPTANCE	RELATIVE CAPITAL COSTS	O&M COSTS
<b>Approved for Provisional Use In Nitrogen-Sensitive Areas</b>										
Bioclere <sup>(2)</sup>	O&M Agreement, quarterly monitoring. 50 system limit has been reached.	Capable of nitrogen removal.	Well established, reliable technology.	Nitrogen removal of approximately 50 percent. Good BOD and TSS removals.	Energy for pumping; maintenance contract is possible.	Similar to Title 5. Eligible for reduced leaching area outside nitrogen-sensitive areas.	Tops of tanks are above ground; blowers can be noisy.	High.		
FAST <sup>(2)</sup>	O&M Agreement, quarterly monitoring. 50 system limit has been reached.	Capable of nitrogen removal.	Well established, reliable technology.	Nitrogen removal of approximately 50 percent. Good BOD and TSS removals.			Tops of tanks are above ground; blowers can be noisy.	High.	\$4,100 to \$4,500	Energy costs for pumps and blowers, maintenance contract
Waterloo	O&M Agreement, quarterly monitoring, limit of 50 systems.	Capable of nitrogen removal.	Well established, reliable technology. Approaching Provisional Use installation limit.	Nitrogen removal of approximately 50 percent. Good BOD and TSS removals.			Blowers can be noisy.	High.	\$11,255 (includes technician to oversee installation)	\$1,500 per year for inspection and monitoring, energy costs for pumps, control panel, etc.
Amphidrome	O&M Agreement, quarterly monitoring, limit of 50 systems.	Capable of nitrogen removal.	Has General, Provisional, and Remedial use approvals.	Can get significantly greater than 50 percent removal.			Blowers can be noisy.	High.	\$8,000 (assuming standard Title 5 tank is 2,000 gallons)	\$1,100 per year for inspection and monitoring, energy costs estimated to be \$2 per month per occupant.
AdvanTex	O&M Agreement, quarterly monitoring, limit of 50 systems.	Capable of nitrogen removal.	Established technology. Requires use of I/A before to address high level of nitrification.	Good BOD and TSS removals.			Filter lid is at ground level.	High.		An average of \$2 per month for electricity.
NITREX™ (Note: this technology is not stand alone, needs above I/A systems previous to process)	O&M Agreement, quarterly monitoring, limit of 50 systems.	Capable of nitrogen removal.		Can get significantly greater than 50 percent removal.			High.	High.	\$4,000 for NITREX™ components.	Maintenance contract
Notes:										
(2) These systems are also reviewed technologies in Chapter 8 for small (cluster/community) wastewater treatment facilities.										
(3) The following technologies: SeptiTech, Norweco, RUCK® CFT, Cromaglass, Omni, Bio Barrier MBR and NITREX™-Plus are approved for only pilot use in nitrogen-sensitive areas and will not be screened due to limit of installations to 15 systems.										