Wastewater 101

Sewers or not, it's all about collecting it, treating it and sending it safely on its way

The cost of capturing and cleaning Cape Cod's wastewater can be divided into three parts: collection, treatment and dispersal.

Most local homes have septic systems, which do all three but are not designed to prevent harmful nitrogen from flowing into the groundwater and lowering water quality in local bays and estuaries.

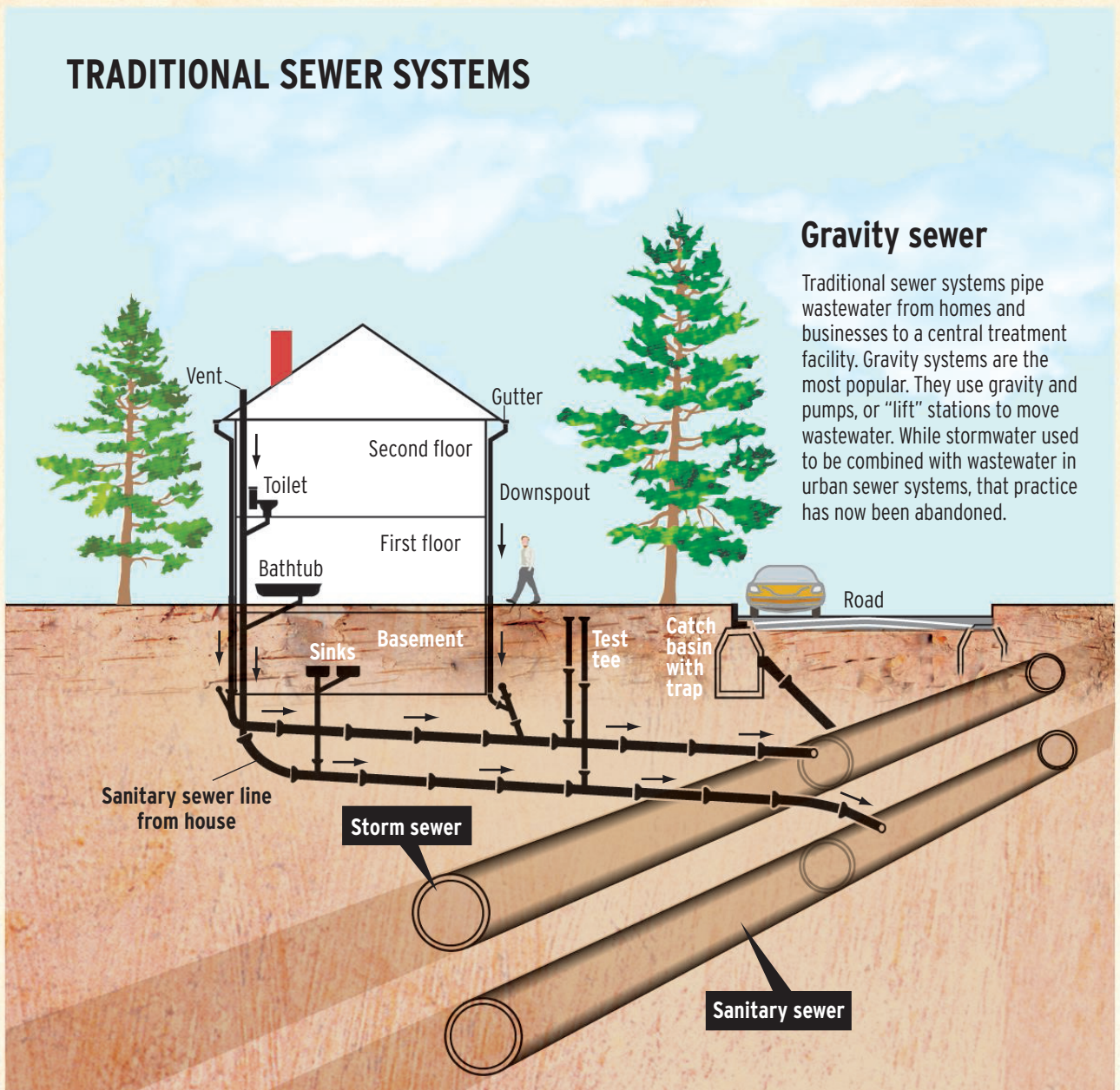
The effort to clean up the Cape's waters and meet state nitrogen standards requires a high level of treatment that can only be achieved through the latest in technology. Geography, population and effectiveness determine what can be used to meet the requirements of each town's state-mandated Comprehensive Wastewater Management Plan.

There are two basic choices: sewer systems that depend on piping wastewater to various-size treatment plants and on-site systems such as those below, that deal with nitrogen and other contaminants in wastewater closer to the source.

The Nitrex system, for example, uses carbon to remove nitrogen.

So-called polishing systems reduce nitrogen and other contaminants in the groundwater by filtering the water again. Other technologies separate liquids and solids to make transportation and treatment easier. Some experts are wary of individual systems because the maintenance may fall to the homeowner. And many newer systems are still unproven technologies with highly variable results, according to data collected at the Massachusetts Alternative Septic System Test Center at Otis Air National Guard Base.

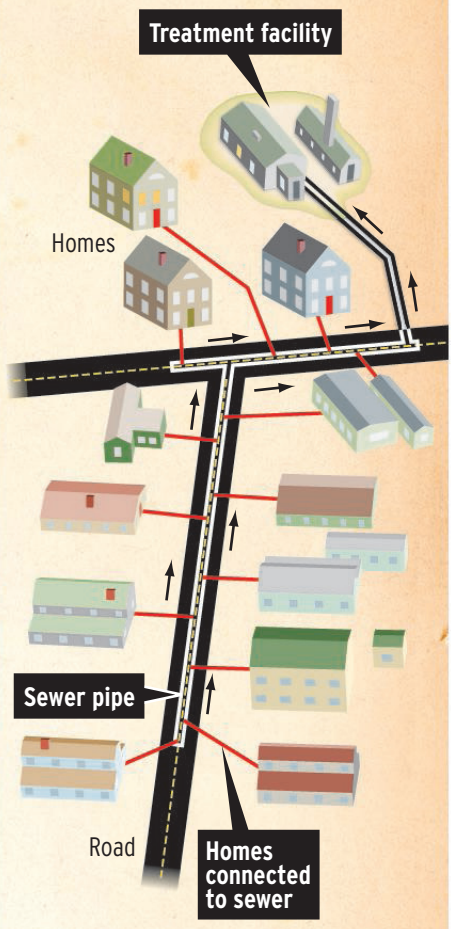
TRADITIONAL SEWER SYSTEMS



Gravity sewer

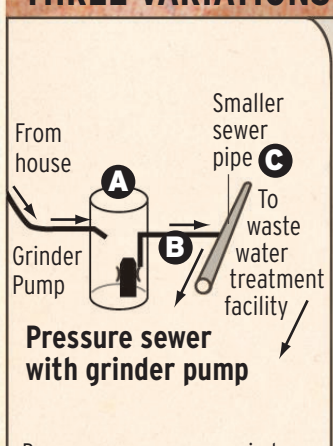
Traditional sewer systems pipe wastewater from homes and businesses to a central treatment facility. Gravity systems are the most popular. They use gravity and pumps, or "lift" stations to move wastewater. While stormwater used to be combined with wastewater in urban sewer systems, that practice has now been abandoned.

CLUSTERS



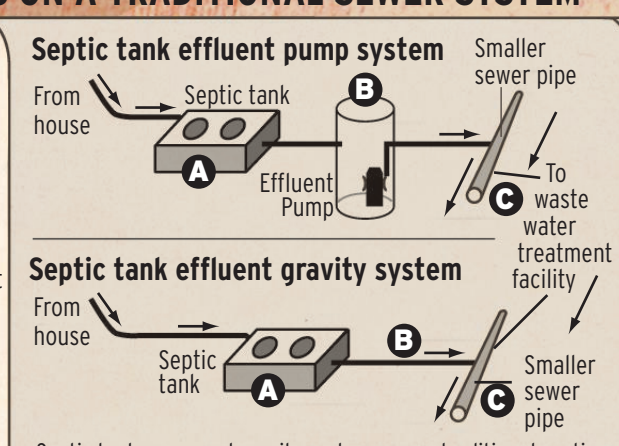
Cluster or decentralized systems can be smaller versions of their larger brethren or use different technologies to treat smaller flows of wastewater. Cluster treatment systems are often used for small developments or individual businesses.

THREE VARIATIONS ON A TRADITIONAL SEWER SYSTEM

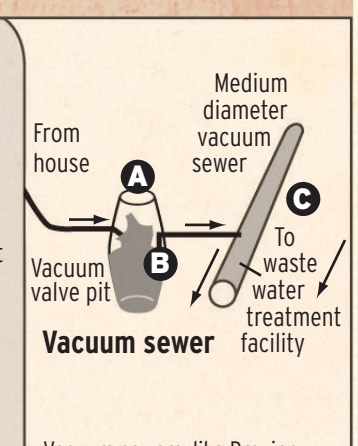


Pressure sewer with grinder pump

Pressure sewers use a grinder pump (A) to make wastewater easier to transport (B) in smaller diameter pipes (C).



Septic tank pump and gravity systems use a traditional septic tank (A) to settle most solids out of the wastewater. The remaining effluent is pumped or moved by gravity (B) into small-diameter pressure pipes. The wastewater is then moved by gravity (C) and lift stations to a treatment facility.



Vacuum sewer

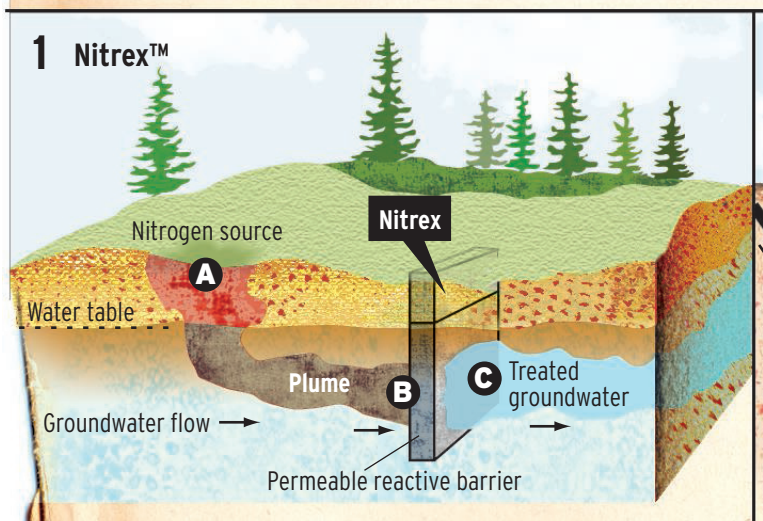
Vacuum sewers, like Provincetown's, use vacuum pressure (A) to suck wastewater (B) through medium-diameter pipes (C).

COSTS

The cost of wastewater treatment depends on many factors. Typically centralized sewer systems benefit from economies of scale, according to a draft study by the Cape Cod Commission. Population density also can affect the cost of collection systems. For example, 50 feet of pipe costs roughly $10,000 per house while 250 feet of pipe cost more than $45,000. Per-property operations and maintenance costs are lowest for Title 5 septic and centralized systems, and highest for individual nitrogen removal systems that meet state water quality requirements, according to the study of 23 systems in southeastern Massachusetts.

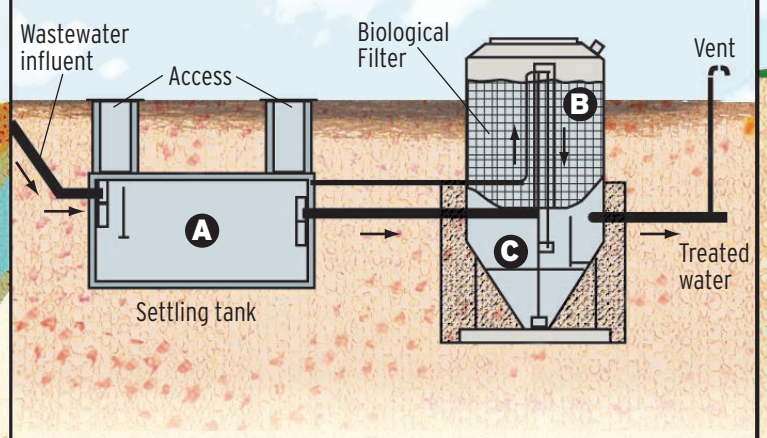
SIX ALTERNATIVES TO THE TRADITIONAL SEWER SYSTEM

1 Nitrex™



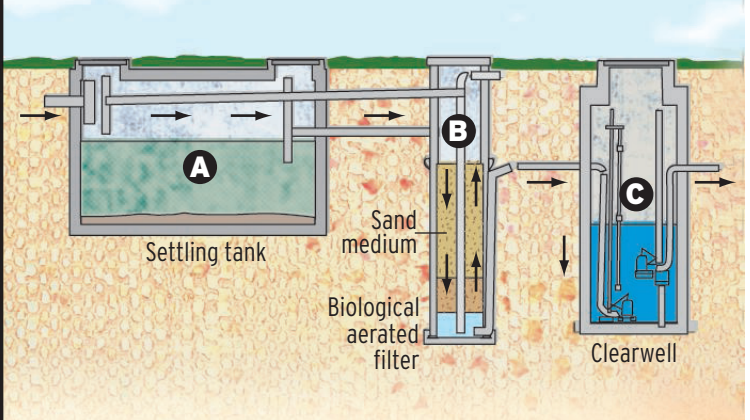
Nitrex, developed at Waterloo University in Ontario, Canada and marketed by Newton-based Lombardo Associates, Inc., uses the carbon in woodchips in a permeable reactive barrier to filter wastewater and turn nitrogen into a gas. The technology can be used in wastewater systems or to treat groundwater directly, such as is being done on a part of the Waquoit Bay shoreline. Nitrogen (A) in groundwater travels through the barrier (B) where it is converted into a gas and disperses, while the treated water (C) keeps flowing. State regulators have given Nitrex provisional-use status allowing for a limited number of the systems to be installed.

2 Bioclere™



Bioclere combines a filter with a water clarifier in a unique configuration, said Craig Lindell, chief executive officer of AquaPoint, the company that produces the system. Like many systems, it separates most of the solids in the wastewater stream in a settling tank (A) and then uses a biological filter (B) in which micro organisms feed on the nitrogen. But unlike other systems the filter is located on top of a (C) clarifier. Bioclere is also available only on a provisional-use basis.

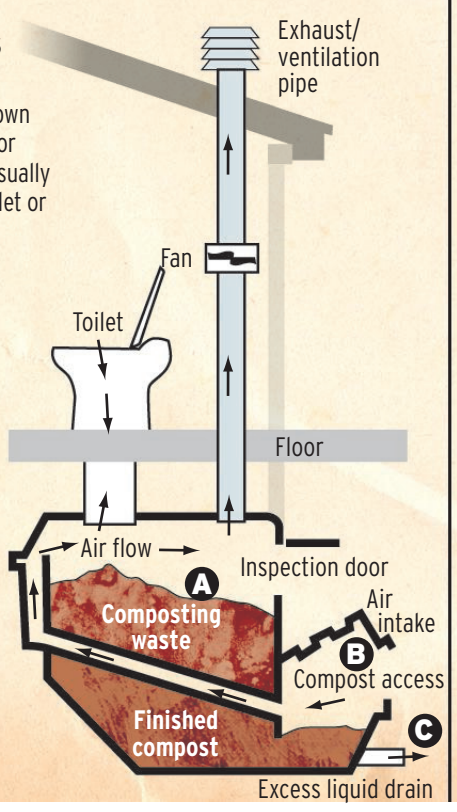
3 Amphidrome™



The Amphidrome system, manufactured by Rockland-based F.R. Mahony & Associates, Inc., also uses a settling tank (A) where solids settle to the bottom and the wastewater is stored to be fed into a biological aerated filter. The microorganisms that attach to the sand filter (B) are alternatively starved and fed oxygen making them feed at different rates on the nitrogen in the wastewater. A clear well (C) stores the treated water, including enough backwash to clean a filter. Amphidrome is approved for provisional use.

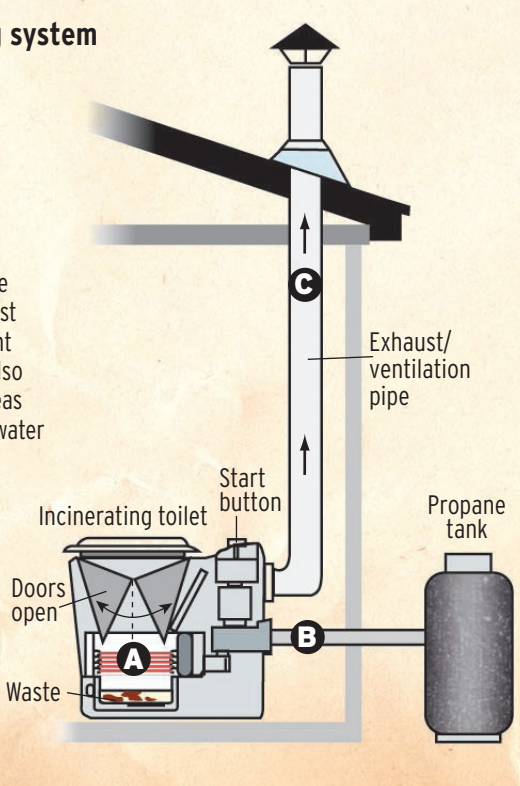
4 Composting toilets

Composting toilets break down solid waste in an "aerobic" or oxygenated environment, usually in a container below the toilet or in the basement of a home (A). The homeowner can access compost through a doorway (B) or tray. Excess liquid (C) drains away. The system requires an air vent to control smells. It is useful in areas where water-use is limited but the drawbacks include the potential for odors and the need to handle the compost once it is processed.

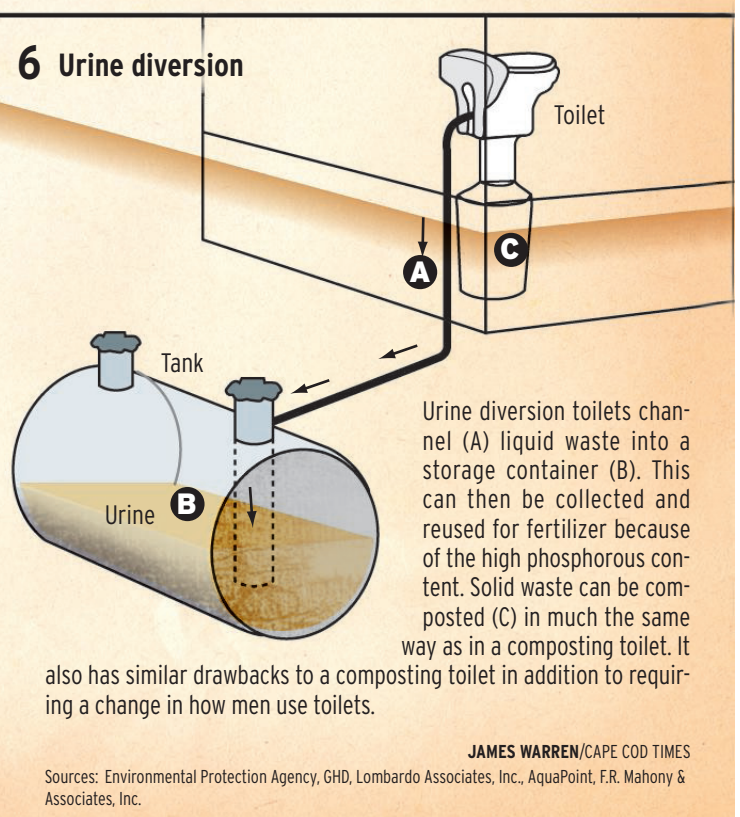


5 Incinerating system

Incinerating toilets use a gas-fired or electric heating system (A) to burn waste. A propane tank (B) may be necessary to provide fuel. The system must have an exhaust vent (C). This system is also useful in remote areas or locations where water is scarce. The ash that is produced is sterile but is not useful in replenishing soil because the incineration destroys the nutrients.



6 Urine diversion



Urine diversion toilets channel (A) liquid waste into a storage container (B). This can then be collected and reused for fertilizer because of the high phosphorous content. Solid waste can be composted (C) in much the same way as in a composting toilet. It also has similar drawbacks to a composting toilet in addition to requiring a change in how men use toilets.

JAMES WARREN/CAPE COD TIMES

Sources: Environmental Protection Agency, GHD, Lombardo Associates, Inc., AquaPoint, F.R. Mahony & Associates, Inc.