

Viability of Urine-Diversion Toilets in Falmouth, MA

A Wastewater Management Alternative

Background

The Town of Falmouth in Barnstable County, MA is experiencing impaired surface and ground waters from prolific nutrient leaching from septic systems. This is creating increased rates of eutrophication in fresh water ponds and coastal areas. Considering that the main sources of economic support in the area come from the tourism and fishing industries, this problem must be addressed immediately.

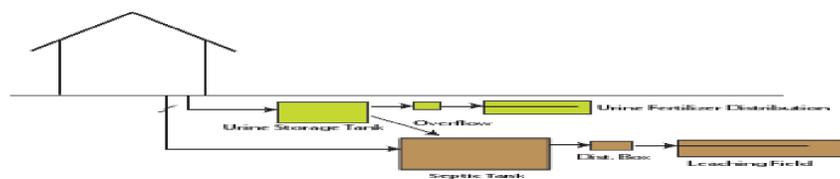
One proposed solution is to sewer the town, which is estimated to cost around 50,000 dollars per household, with construction spanning through the next 20 years (CWMP).



Project Overview

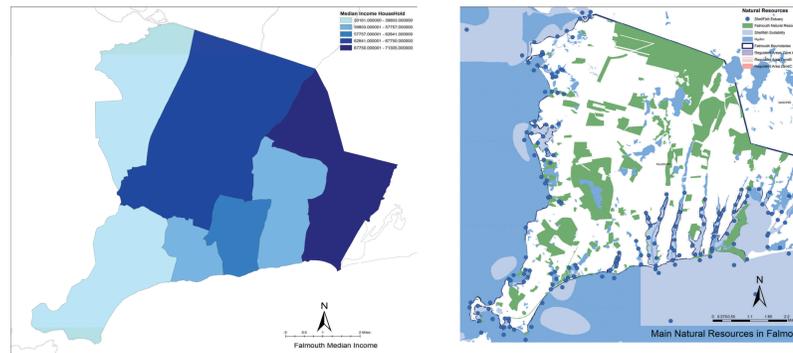
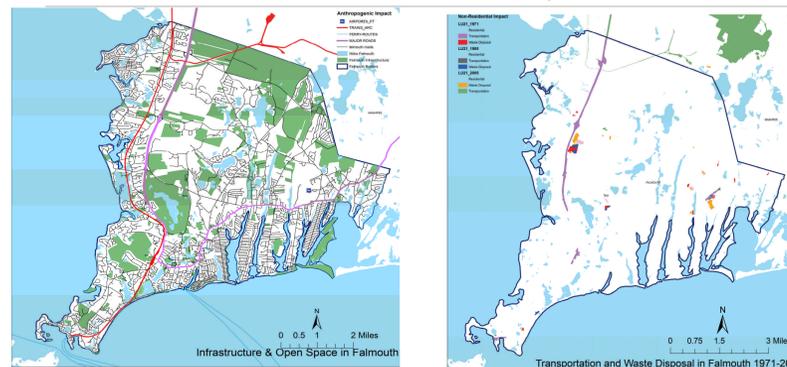
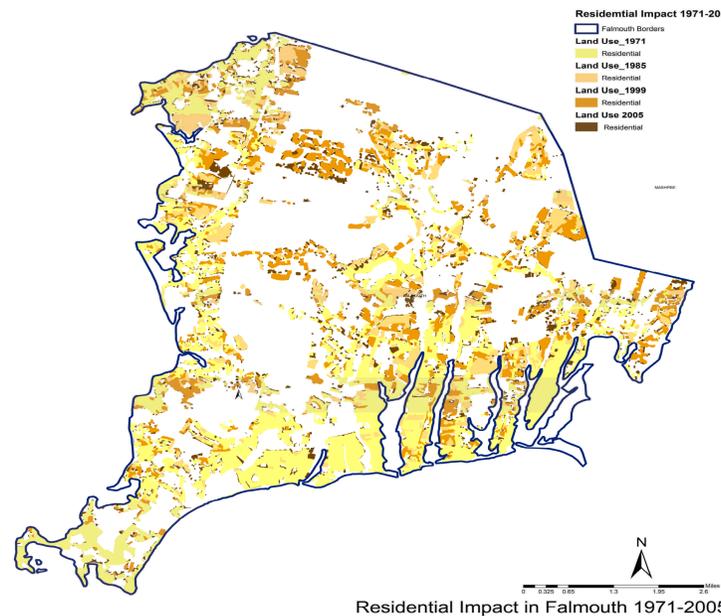
As a result, The Town of Falmouth has assembled an Eco-Toilet Subcommittee to bring together local experts, residents, and government representatives to talk about alternative approaches.

Urine-diversion toilets are an alternative technology being considered in the demonstration project to control nutrient pollution. Because the volume of human urine accounts for less than 1% of total wastewater by volume, yet contains approximately 80% of all nitrogen and up to 50% of all phosphorus, UD systems focus on collecting and processing urine separately from feces. Collected effluent can then be processed into a valuable fertilizer (Zang, 2011). UD toilets (pictured above), utilize dual flush chambers in order to separate and store effluent separately from feces.



Residential development has caused the biggest impact in Falmouth's ecosystems. Private, commercial and tourist activities are also contributing to the pollution of Falmouth and the Cape Cod area. The development of routes, train systems, ports and waste disposal are other contributors of stress to the ecosystems. As a result, local residents, which are middle class face economical challenges to adopt a sustainable wastewater management systems. UD systems has the potential to be a viable and sustainable solution.

Anthropogenic Impact in Falmouth



Our challenge for the future is that we realize we are very much a part of the earth's ecosystem, and we must learn to respect and live according to the basic biological laws of nature.

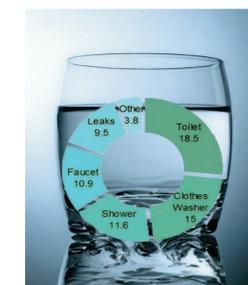
[Jim Fowler](#)

Geography	Demographics
Total Area : 54.4 sq. mi (141.0 km ²)	Total Population : 31,531
Total Land: 44.2 sq. mi (114.6 km ²)	Density: 713.4/sq. mi (275.0/km ²)
Water: 10.2 sq. mi (26.4 km ²)	Households: 13,859
Main Routes: Route 28, 151	Median Income per Household: \$48,191
	Median Income per Family: \$57,422

Methodology

For over eight months our group of four researchers conducted Economic (E), Technical (T), and Social (S) analyzes related to a demonstration project feasibility of UD toilets in Falmouth, MA. This research considers the short term feasibility of the demonstration project, and the long term efficacy of expanding toward municipal and public building level implementation. We plan on utilizing a combination of tools such as public surveying, continued literature reviews, interviews with experts, and CBA's in order to identify the E, T, and S factors related to comprehensive feasibility.

Conclusion and Considerations



U.D. Technology in the US is in its infancy. Cities such as San Francisco, Portland, Seattle, and a few coastal communities of Massachusetts have showed interest in this technology. In addition, human excreta and wastewater infrastructure are simply not hot topics amongst the public.

For this reason, public perception and interest is generally low. As UD technology slowly gains attention among neighborhood organizations and individual owners, quantitative studies are needed in order to assess the acceptance of this technology among larger domestic target groups. Our group hypothesizes that a significant education and outreach campaign, rooted in a thorough public participation process is essential for community level implementation.

Draft Comprehensive Wastewater Management Plan (2009). Town of Falmouth. Stearns & Wheeler. Retrieved November 1, 2011 from <http://www.falmouthmass.us/deppage.php?number=401>

Lienert, Judith and Larsen, Tove. "High Acceptance of Urine Source Separation in Seven European Countries." (2009): <http://pubs.acs.org/doi/abs/10.1021>

Zang, Guo-Long, Guo-Ping Sheng, Wen-Wei Li, Zhong-Hua Tong, Raymond J. Zeng, Chen Shi, and Han-Qing Yu. 2012. "Nutrient Removal an Energy Production in a Urine Treatment

Process using Magnesium Ammonium Phosphate Precipitation and a Microbial Fuel Cell Technique." *Physical Chemistry Chemical Physics* 14 (6): 1978-1984.