

Predicting Septic System Failures

by

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INTRODUCTION

Rural growth in Rhode Island since 1960 has increased awareness at the State and local level of issues surrounding land use and environmental impacts, and stimulated policy and fiscal initiatives to accomplish associated goals. One issue related to each of these concerns is the continued dependency in many of Rhode Island's non-urban areas on individual sewage disposal systems (ISDS).¹ Conventional on-site systems remain the most viable option for household wastewater² disposal in unsewered areas, yet from a policy perspective; not much is known about their impact on rural land development patterns and infrastructure. There are 143,900 existing septic systems in Rhode Island (RIDEM, 1988), yet little is known about the individual and/or collective impact of these systems on natural resources. This paucity of information stems from the lack of performance evaluation on systems currently operating within the State. Although it is acknowledged that these systems may pose a significant threat to human health and surface and ground water quality,³ specific information about the

1. The term Individual sewage disposal systems (ISDS) is a comprehensive term used by RI Dept. of Envir. Mgt. (DEM). In this thesis, the terms ISDS, septic systems, on-site systems, systems and conventional sewage systems are interchangeable.

2. The terms domestic wastewater, sewage, effluent and waste are interchangeable in this thesis and are defined as any domestic wastewater including "blackwater" (drainage from toilets), "greywater" (drainage from all other plumbing fixtures such as sinks, showers, etc).

3. Reference here is made to the bibliography, as there are numerous references which support this statement.

explored within the context of Rhode Island's formation of wastewater management districts and other policy initiatives.

Stimulus for this research is due in part to the initiation of a stormwater management study (Dillmann, 1990) in the Narrow River⁴ watershed in southern Rhode Island (Fig. 1). One goal of the stormwater study is to determine the nature and the extent of the septic contaminant portion of the stormwater problem. For a number of years, on-site septic systems have been implicated as a source of non-point source pollution which have degraded the water quality in Narrow River (RIPE, 1980, RI CRMC, 1986). Despite these acknowledgements, extensive research, and public support⁵ for remedying the problem, the river remains polluted. One explanation for what appears to be a lack of response is that information that links the complexity (composition, magnitude and movement) of pollutants in waterways to their sources on land is still imprecise. Such information about pollutants is needed by policy makers to determine measures of accountability, and appropriate actions to resolve the problem.

4. The Narrow River is also known as the Pettasquamscutt River.

5. Acknowledgements here means general agreement that the river is polluted. Extensive research includes numerous studies on the Narrow River (see CRMC SAM Plan). The citizen's monitoring group, Narrow River Preservation Association, was formed over 10 years ago and is still active.

However, attributing non-point source pollutants in waterways to their origins on land is problematic. Different rates of transformation, attenuation mechanisms and complex pathways to a variety of hydrologic settings make it difficult to quantify the magnitude of contamination that is directly attributable to these systems even in circumstances such as the Narrow River, where there are no other significant point or nonpoint sources of contamination.⁶

This thesis accepts the premise that the Narrow River has been, and continues to be polluted by septic contaminants from on-site septic systems. However, rather than addressing cause and effect relationships between pollutants and septic systems, this research uses statistical methods and information on system performance from a sample of single family housing with ISDS from the Town of Narragansett to identify criteria that determine system performance. As such, the research is not system or pollutant specific, nor dedicated to any engineering aspects, or to the efficiency of one particular process of any particular system (e.g. removals rates, pathogens). Rather, it explores what, if anything, can be learned from the systems in this area that have been operating in different states of performance through time that can help

6. Primary, non-point sources of pollution in the Narrow River include surface water runoff, stormwater outfalls and septic systems. In some instances, particularly during periods of rain and highwater, wastewater enters the stormwater system (Dillmann, 1990).