

Evaluating the Performance of On-Site Sewage Disposal Systems

INTRODUCTION

Evaluating the Performance of On-Site Sewage Disposal Systems reports on research commissioned by Canada Mortgage and Housing Corporation to evaluate a procedure for testing the hydraulic capacity of soil adsorption beds used for on-site wastewater disposal.

The research assesses whether the procedure, which was developed in California, can be applied in the climate and geology of other regions, specifically Nova Scotia, where failure due to ponding may occur within a disposal bed in “tight” glacial soils. The evaluation procedure has the potential to be an important tool for investigating and managing on-site sewage disposal systems.

The research report will interest municipal planners and engineers, provincial health and environment planners and regulators and others who design, approve or operate on-site sewage disposal systems. It is expected to contribute to a better understanding of the hydraulic performance of on-site sewage disposal systems under various geological and climatic conditions.

RESEARCH PROGRAM

The objectives of the research project were:

1. To document experience with the leachfield evaluation test through site visits and a literature review.
2. To apply and evaluate the tests under field conditions in Nova Scotia.

Literature review and site visits

To document other professionals’ experience with the leachfield evaluation test, the researchers studied literature held by the Centre for Water Resources Studies and other sources. They also made site visits to Questa Engineering and the Sea Ranch Development in California, where the test is routinely applied, and to Ayers Associates in Madison, Wisconsin. Ayers Associates has extensive experience in the design and operation of on-site systems.

Application and evaluation of tests

The researchers selected three sites in Nova Scotia to evaluate the testing procedure for on-site systems. These sites represented a range of soil conditions, system operations and loading rates.

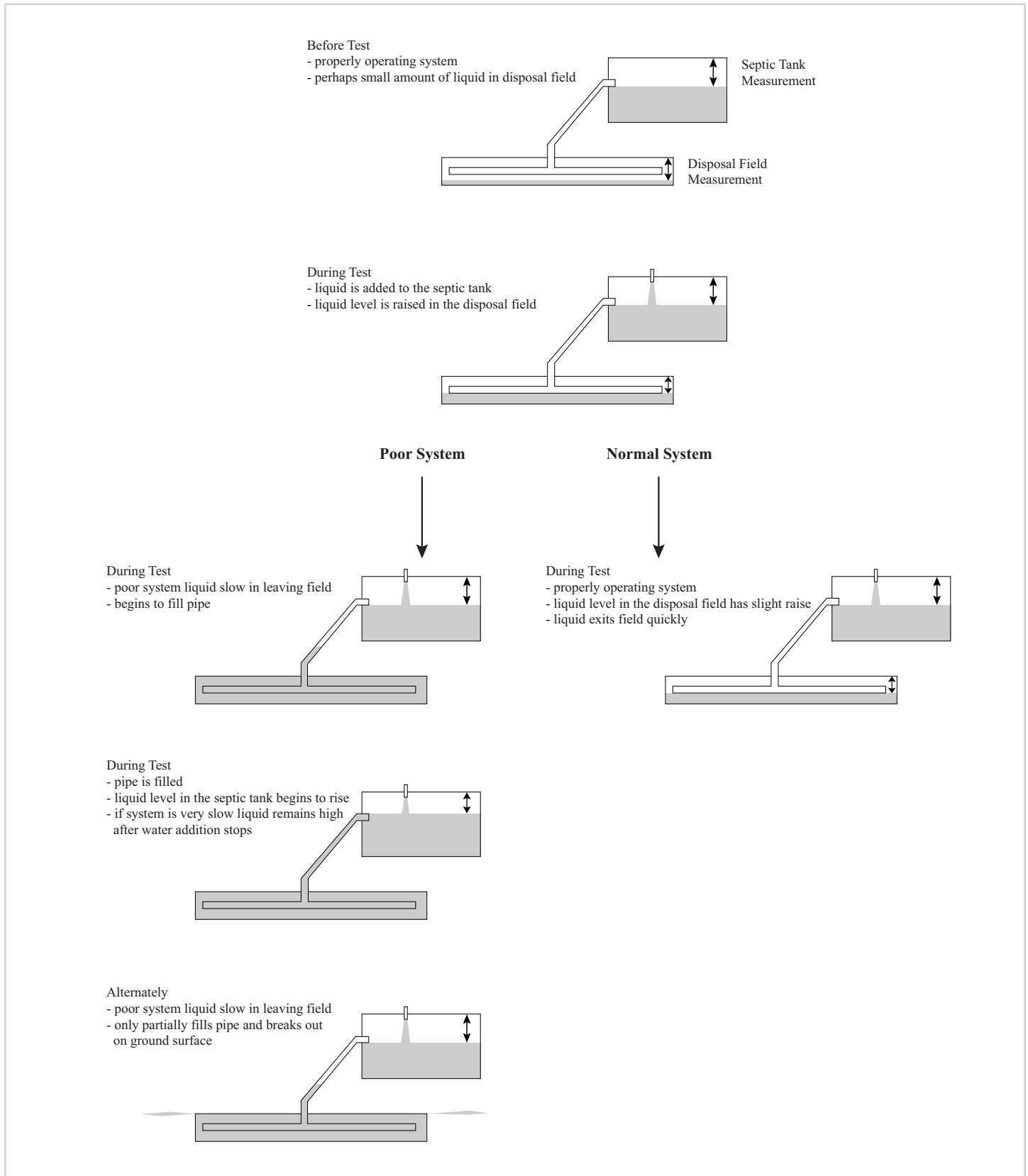
Equipment

At each site, the equipment used included an observation well in the groundwater located downhill from the disposal field, an observation well or port in the disposal field and a septic-tank riser (if needed) to allow easy access to the septic tank. At two sites, the researchers installed water meters on the main intake line to monitor the daily water use. At the third site, they obtained water-use records from the local utility company.

Method

The hydraulic load test (see Figure 1) involved surcharging the septic tank with about 550 l (121 gal.) of water for 35 to 40 minutes. Researchers observed the response in the septic tank and leachfield during surcharge and recovery afterwards. Typically, the liquid level will rise from 1 to 3 cm (0.4 to 1.2 in.), at which point it should stabilize for the remainder of the filling, and then return to the initial level in a matter of minutes after the filling is stopped. The test procedure used in this project is intended for gravity-fed leachfield systems. A similar procedure has been applied elsewhere to pump-fed systems.

Figure 1 Loading-test schematic



Before the surcharging, researchers examined the leachfield for signs of breakout or weakness. During and after surcharging, they looked for signs of surfacing effluent, wetness or odour. If any of these conditions exist, further investigation would be required to determine if the leachfield is failing and the cause of the failure.

As water is added to the septic tank, it flows out of the tank through the disposal pipe to the leachfield. In a properly operating system, the liquid will quickly drain from the disposal field as more water is added to the tank. In a poorly operating system, there may already be standing water in the field. In a worst-case scenario, in which there is very slow drainage from the disposal field, the gravel will fill to capacity with the liquid. If no other flow path can be found, the liquid will fill the disposal pipe back to the septic tank, and the liquid level in the tank will begin to rise.

In some cases, the liquid will find another flow path out of the disposal bed and spill across the property. This indicates a system in which either the biomat has developed to the point where it is resistant to the flow, the groundwater level is near the bottom of the disposal field or the host soil is impermeable.

The researchers emphasize that a lack of rise in the septic tank water level after surcharging does not necessarily indicate that the system is working well. The leachfield must also be inspected to see if water has broken out.

At each of the three sites, the researchers conducted two hydraulic load tests. The first test took place in September (the driest time of the year in Nova Scotia) and the second in May (the wettest time of the year). During these tests, they observed the rise and fall of the liquid level in the tank.

Analysis of results

The data collected from observing the rise and fall of the liquid level were then compared against a table of guidelines to evaluate the rate of effluent acceptance and the performance of the system. According to the guidelines, the ratings could vary from excellent (no noticeable rise in water level during the filling) to failed (water level rise of more than 7.5 cm—3 in.—with no noticeable decline within 30 minutes after the filling was finished).

FINDINGS

Literature review and site visits

The literature review and site visits indicated that there is little information about the hydraulic test or its use. However, site visits to Questa Engineering and the Sea Ranch development in California produced much valuable information about system inspection, monitoring and maintenance. Sea Ranch is an important example of the application of the test as part of a systematic program for the management of the on-site systems.

It is clear from the literature that the test can provide valuable information about the condition of an on-site septic system. Examination of the performance of an on-site system might occur in the context of:

- A routine inspection, as part of a management plan, for system performance evaluation, maintenance and repairs; or
- An inspection or evaluation conducted as part of a real estate transaction.

Field test results

The results of the applications of the test to the three systems indicated that:

- The test provided a useful indication of the state of these systems, two of which were on the verge of failure, while the other was performing poorly.
- The test results reflected seasonal effects: when tests were conducted in wet periods, all systems yielded poor results.
- Routine use of the test may be limited to inspection and maintenance programs where systems have been prepared for it. Because of the time involved in site and system preparation, using the test for other applications, such as real estate inspections or sanitary surveys, may be limited to sites or situations where prior knowledge or preliminary examinations indicate potential problems.
- The lack of increase in the water level of the septic tank during the test does not necessarily imply adequate system performance. An examination of the distribution system area is needed to determine if breakout has occurred.

IMPLICATIONS FOR THE HOUSING INDUSTRY

The test can serve an important role when used as part of a routine inspection and maintenance program—for example, as part of a Watershed Management District or a service contract system. It can also provide useful information as part of a real estate inspection or sanitary survey. However, given the time and cost involved for a site that has not been prepared for the test, its use might be limited to sites or situations where a preliminary inspection or prior knowledge suggests more information is necessary.

If the hydraulic loading test reveals problems, the next step would be an excavation of a portion of the disposal field to examine potential ponding or clogging of the gravel or soil.

CMHC Project Manager: Al Houston and Chris Ives

Consultant: D.H. Waller and J.D. Mooers

Housing Research at CMHC

Under Part IX of the *National Housing Act*, the Government of Canada provides funds to CMHC to conduct research into the social, economic and technical aspects of housing and related fields, and to undertake the publishing and distribution of the results of this research.

This fact sheet is one of a series intended to inform you of the nature and scope of CMHC's research.

To find more *Research Highlights* plus a wide variety of information products, visit our website at

www.cmhc.ca

or contact:

Canada Mortgage and Housing Corporation
700 Montreal Road
Ottawa, Ontario
K1A 0P7

Phone: 1-800-668-2642

Fax: 1-800-245-9274

©2001, Canada Mortgage and Housing Corporation
Printed in Canada
Produced by CMHC
Revised: 2007

31-10-07

Although this information product reflects housing experts' current knowledge, it is provided for general information purposes only. Any reliance or action taken based on the information, materials and techniques described are the responsibility of the user. Readers are advised to consult appropriate professional resources to determine what is safe and suitable in their particular case. Canada Mortgage and Housing Corporation assumes no responsibility for any consequence arising from use of the information, materials and techniques described.