An Examination of Failing Private Septic Systems in Pennsylvania
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EXECUTIVE SUMMARY

More than 1.3 million housing units, or about 25 percent of all housing units, in Pennsylvania use on-lot septic systems (OLS). However, the true extent of statewide OLS failures and the associated costs for homeowners have not been quantified. Neither the Pennsylvania Department of Environmental Protection (DEP) nor most local governments have maintained effective record keeping systems that allow for the analysis of failure issues. Further, as growth continues in rural Pennsylvania municipalities, there is some concern that there is not enough suitable land for OLS, which may slow future growth.

To evaluate these issues, the researchers conducted this study in 2006 by estimating the number of private OLS in Pennsylvania; evaluating septic system repairs to quantify OLS failures, including failure rates, nature of failures, cost of repairs, and causes of failures; evaluating the amount of land available for future housing development using OLS at the municipal level; and examining the relationship between the effective date of Act 537 plans and the number of repair permits issued.

Some of the most significant findings from the study are as follows:

• About 25 percent of all households in the commonwealth use OLS.
• Approximately 20 percent to 25 percent of all OLS permits are for system repairs.
• Repairs related to improper site selection and/or installation account for less than 20 percent of all repair permits, and approximately 5 percent to 6 percent of all permits issued. This indicates that current approaches to system installation and site selection appear to be working reasonably well.
• In 2005, nearly 24 percent of all repairs were for old, pre-1972 systems that were being brought up to modern standards.
• In 2005, nearly 52 percent of all repairs were for mechanical failures (tanks, pumps etc.) that were unrelated to site selection, system installation, or system design.
• Some municipalities are facing land shortages for OLS.
• Future work is needed to evaluate the lands available for OLS and the farmland value of these lands.
• Act 537 plan adoption may have little impact on repairs of OLS problems in many municipalities.
INTRODUCTION

According to the 1990 U.S. Census, which has the most current data on wastewater systems in the United States, 27 percent of Pennsylvania’s 4.9 million housing units had a septic tank or cesspool, slightly more than 1 percent had some other means to dispose of household wastewater, and the remaining units were connected to public sewer.

According to the 2001 American Housing Survey, nationally, about 2 percent of households with a septic tank or cesspool reported a breakdown or failure within the previous three months.

In Pennsylvania, the Sewage Facilities Act (Act 537) of 1965 requires all municipalities to develop and implement comprehensive plans that provide for the resolution of existing sewage disposal problems, for future sewage disposal needs of new land development, and for the future sewage disposal needs of the municipality. The municipal planning process is not finalized until the Pennsylvania Department of Environmental Protection (DEP) approves the plan. Legally, all municipalities have an Act 537 plan, but for 47 percent of municipalities in Pennsylvania, the plan is more than 20 years old. Only 17 percent of municipalities have a plan that is less than 5 years old. If the Act 537 planning process is indeed identifying problems and resolving them, one might expect to see increased repairs in areas where the plan has been recently updated.

Data from DEP indicate that, in 2003, with approximately 50 percent of local agencies responsible for permitting activity actually reporting, there were 14,684 permits issued that related to on-lot sewage disposal. Of this number, 3,583 permits (24 percent) were issued for repairs of on-lot systems. If this number is doubled, to roughly estimate the total number of repair permits issued in Pennsylvania, there were approximately 7,000 repair permits issued statewide in 2003. Therefore, based on the number of repairs and the number of housing units served by on-lot septic systems (OLS), about 1 percent of OLS were issued a repair permit in Pennsylvania in 2003. This is significantly lower than the national average of 2 percent of households that reported a breakdown of their OLS. According to Act 537, any OLS that is repaired must receive a repair permit from DEP.

Data limitations, however, may result in an artificially low level of reported repairs. For example, while many homeowners may have systems that are technically failing, they may choose not to repair their OLS due to cost. In many municipalities, there is no inspection program to ensure that failing systems are repaired. Other explanations for the relatively low number of repair permits might be that: municipalities are underreporting the extent of OLS failures; the estimation of statewide repair rates, based on data from only 50 percent of municipalities, is producing incorrect statewide repair estimates; or the Pennsylvania OLS failure rate is actually lower than the national average.

The true extent of statewide OLS failures, including the types of failed systems, their spatial distribution, reasons for failures, or associated costs, has not been quantified. Neither DEP nor most local governments have maintained effective record keeping systems that will allow for the analysis of failure issues. In fact, DEP does not maintain a comprehensive computerized database of septic permit information. Since 2004, DEP has solicited local municipalities to voluntarily provide information regarding general OLS permit issuances, but about one-third of municipalities do not provide data. The data provided by the municipalities that do report do not document the nature of the failure, the age of the failing system, costs, and other information pertinent to analyzing the status of septic system failures. Yet, there are some general indicators of areas within the commonwealth where there are good records. Local governments who have teamed together to form Joint Local Agencies (JLA) and Delegated Joint Local Agencies (DJLA) to handle Act 537 requirements, and who have agreed to manage their on-lot sewage program together, generally have better OLS record keeping as do local governments who have Councils of Government (COG) or county health departments that monitor OLS.

Another issue in Pennsylvania is the amount of land available for future housing development using OLS. Some municipalities are concerned that there is little or no land available for future growth in the absence of public sewer because of restrictions imposed by current OLS regulations.

GOALS AND OBJECTIVES

Specific objectives of this research were to: estimate the number of private OLS in Pennsylvania; evaluate septic system repairs using detailed system installation and repair records throughout the commonwealth to answer questions related to OLS failures, including failure rates, nature of failures, cost of repairs, and
causes of failures; evaluate the amount of land available for future housing development using OLS at the municipal level; and examine the relationship between the effective date of the Act 537 plan and the number of repair permits issued.

RESULTS
Number of Septic Systems in Pennsylvania
In 2000, the Census Bureau did not specifically collect information on the number of OLS in Pennsylvania. To estimate the number, the researchers used 1980 and 1990 Census data to calculate the relative percentage of housing units served by OLS for those years. They then estimated a value for the relative percentage of housing units served by OLS for 2000 using a linear projection. No adjustments were made to the projection to compensate for areas that converted from OLS to sewer. Table 1 shows that the relative percentage of housing units served by OLS increased from 1980 to 1990, and it is reasonable to assume that this percentage continued to increase beyond 1990, as recent development in Pennsylvania has shifted into rural areas not served by public sewer. The projected value indicates that in 2000, more than 1.3 million housing units, or approximately 25 percent of all housing units, in Pennsylvania relied on OLS.

The distribution and number of OLS for each municipality in Pennsylvania is shown in Figures 1 (1980) and 2 (1990). The variability of the number of OLS is significant and numbers vary from less than 25 to more than 7,000 in individual municipalities.

The spatial distribution of changes in the total number of housing units using OLS from 1980 to 1990 is shown in Figure 3 for all municipalities. Some municipalities show decreases in the number of OLS, apparently due to expansion of public sewer systems. The largest increases were found in the high-growth regions of northeastern, southwestern, and southeastern Pennsylvania, and surprisingly large increases were found in northcentral Pennsylvania, possibly due to increased numbers of seasonal homes in some municipalities.

Data from the U.S Census Bureau were also used to determine the expansion of or decline in the number of housing units

<table>
<thead>
<tr>
<th>Table 1 – Estimated number of housing units served by septic systems in Pennsylvania for 1980, 1990, and 2000.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>1980</td>
</tr>
<tr>
<td>1990</td>
</tr>
<tr>
<td>2000</td>
</tr>
</tbody>
</table>

Note: Estimates for 1980 and 1990 are from U.S. Census Data. Estimates for 2000 are from Penn State projections.
An Examination of Failing Private Septic Systems in Pennsylvania served by public sewer systems for all municipalities in Pennsylvania (Figure 4). The number of housing units served by public sewer showed increases in many of the high-growth areas that also saw increased numbers of septic systems. Increases in housing units served by public sewer are most obvious in the metropolitan areas of Pittsburgh, Harrisburg and Philadelphia, and throughout northeast and southeast Pennsylvania.

The percentage of total housing units served by septic systems in 1990 (Figure 5 on Page 8) indicates that many rural municipalities rely almost completely on OLS for their sewage disposal, and in some cases, as many 90 percent to 100 percent of all housing units used OLS. Even municipalities near metropolitan centers with public sewer systems showed modest increases in septic systems, possibly due to increased residential growth occurring outside public sewer boundaries.

**Septic System Repair and Failure Rates**

Analysis of Data Reported by Municipalities to DEP

A repair rate is the number of OLS repairs per total number of septic systems in use. A failure rate is the number of OLS failures per total number of OLS in use. A repair rate may not be a complete estimate of overall failure rates since many systems that may be failing are not repaired in a timely manner. A failure rate is very difficult to obtain since it would require a comprehensive field-based inventory of systems and a determination of failure. Therefore, this analysis evaluated repair rates, which can be determined through an analysis of available permit records. A repair rate will be a relatively conservative estimate of overall system failure rates.

To estimate repair rates, the researchers used DEP data from 2004 and 2005 that summarized permit information from across the commonwealth. These data included the number and types of OLS permits issued by a municipality or JLA. A permit is required for every new septic system that is installed and for any repairs or modifications of an existing system. Any existing system that fails is required to obtain a repair permit before system repairs may be completed.

Approximately 65 percent of municipalities reported data in 2004 and 2005. Data were reported for all 28 JLAs in 2004 and 2005. Of the 988 non-reporting municipalities in 2004, 66 percent were cities or boroughs, and 33 percent were townships.

Many of the municipalities that reported data to DEP are those that request financial reimbursement from DEP for their sewage enforcement programs. Likewise, many that do not report OLS data to DEP do not request reimbursement. The reasons why some municipalities do not request reimbursement are not entirely clear. From discussions with DEP officials, it appears that municipal staff may not understand the reimbursement program. A fairly common misperception is that because of the 50 percent
reimbursement cap, DEP will only reimburse a local agency for one half of its “out of pocket” expenses. DEP will, in fact, reimburse a local agency for all of its “out of pocket” expenses up to one half of its total program cost. Thus, if permitting fees paid by the homeowner provide 50 percent of the program costs for a municipality, all of the remaining costs may be reimbursable by DEP, resulting in zero net costs to the municipality.

Table 2 illustrates the summary data reported to DEP for 2004 and 2005. Based on these data, repair permits accounted for about 20 percent and 24 percent of all permits issued in the commonwealth for 2004 and 2005, respectively. Data for 2005 is less complete than 2004 as fewer municipalities reported data to DEP. About 97 percent of all septic permits issued are for residential systems and about 3 percent are for commercial systems. Of the residential systems, about 86 percent are conventional systems and approximately 11 percent are alternative systems. The reporting municipalities issued nearly 16,000 permits in 2004, which projects to more than 24,000 permits issued annually for the entire commonwealth. A small portion of system permits was designated as Best Technical Guidance. These are cases where no repair solution is available that meets current standards, so a solution is implemented using a design that is most suitable to the site.

According to the data, while the relative percentage of repair permits varied significantly between municipalities in 2004 and 2005, the number of repair permits exceeded the number of permits for new OLS in 99 of the 1,644 municipalities reporting data in 2004.

Analysis of 2004 Permit Records for Northeast and Southcentral DEP Regions

Because the summary data submitted by municipalities to DEP were incomplete, the information submitted did not provide details regarding the reasons for repairs, and the number of repair permits alone do not indicate the failure rate of OLS in Pennsylvania, the researchers conducted a study to develop a more thorough understanding of repair permits for all counties in DEP’s southcentral and northeast regions. Specifically, the study was conducted to better define the nature of OLS repairs and to better quantify municipalities that did not report summary data to DEP. For example, repair permits are issued for mechanical failures, such as tank or lid replacement, pump failure, or piping failure, which are expected due to normal wear and tear on mechanical parts. Other repairs are for absorption field failures caused often by the clogging of soil pores by effluent. Other repairs are done because of a change in the use of the system. For example, an additional bedroom added to a home may require expansion of the absorption field for which a repair permit is needed.
An Examination of Failing Private Septic Systems in Pennsylvania

For this study, the researchers used all hardcopy DEP Septic Permit and Site Investigation Application forms issued in 2004 and 2005 in the northeast and southcentral DEP regions. These two regions were selected as a representative cross-section of the land use, soil, and geologic variability present in Pennsylvania. Additionally, these are regions with extensive septic system use and rapid growth in residential development. The two regions are characterized by contrasting soil and geologic conditions. For example, the northeast region has significant glacial till soils that tend to be less suitable for septic system placement, while the southcentral region contains more limestone geology with high-quality soils that are suitable for agricultural use as well as septic system placement. The researchers developed a database to record all information contained on the standard DEP Permit Application and Site Investigation forms.

Data from a total of 9,672 forms issued in 2004 were analyzed. The final database contains quantitative data on the types of systems being installed, the number of repairs, percolation rates, the nature of repairs, locations, and other pertinent data for both regions.

Table 3. Summary results for septic permit analysis for the northeast and southcentral DEP regions for 2004

<table>
<thead>
<tr>
<th>Region</th>
<th>Number of Permits Issued</th>
<th>Number of Repair Permits Issued</th>
<th>Percent of Permits that were Repair Permits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southcentral DEP Region</td>
<td>4,158</td>
<td>1,999</td>
<td>26%</td>
</tr>
<tr>
<td>Northeast DEP Region</td>
<td>5,513</td>
<td>908</td>
<td>16%</td>
</tr>
<tr>
<td>Combined DEP Regions</td>
<td>9,671</td>
<td>2,007</td>
<td>21%</td>
</tr>
</tbody>
</table>

In 2004, the number of permits issued was relatively uniform across the regions, with the exception of Pike, Monroe and Carbon counties in the northeast. Some municipalities in these counties had a much higher number of total permits issued than most other municipalities. Most of the permits issued for new OLS (not repairs or modifications of existing systems) showed patterns similar to those of total permits, with a concentration in some northeastern counties.

A total of 2,007 repair permits were issued in 2004 in the two DEP regions, accounting for about 21 percent of the total number of permits issued (Table 3). This number is reasonably close to the 2004 estimate based on the summary data provided to DEP by municipalities across the entire commonwealth (Table 2).

The percentage of repair permits in 2004 was higher in the southcentral DEP region (26 percent) compared to the northeast region (16 percent), which is somewhat counter-intuitive since the soils in the southcentral region are generally considered more suitable for OLS. One possible explanation for the discrepancy may be that much of the development in the northeast is relatively new whereas many of the repairs in the southcentral region may be of older systems that are being replaced or enhanced to meet modern standards.

Further analysis of the 2004 repair permit records indicated that many of the repair permits were issued for lots that were subdivided prior to 1972. These were for repairs that appeared to be primarily mechanical in nature, such as for pumps, tanks, lids and lines, or for repairs that did not require percolation test results. All of these observations indicate that, in many cases, the need for repair may not have been due to site failure of a modern system (post-1972), but likely from some other type of failure. Prior to 1972, there were no statewide regulations governing septic systems in Pennsylvania, so OLS on pre-1972 lots may have been very old and unregulated. Mechanical failures, such as problems with tanks, lids, and pumps, are not site installation or placement failures. Rather, these are (likely) expected failures resulting from normal wear and tear. Repairs where no perco-
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lation data were collected indicate repairs that generally do not involve the creation of a new absorption field, and were most likely related to mechanical failures.

Analysis of 2005 Permit Records for Northeast and Southcentral DEP Regions

To test the reliability of the 2004 analysis results and gain further insight into the nature of the repair permits, the researchers analyzed all permit records for 2005 from the southcentral and northeast DEP offices.

Data from a total of 7,697 permits issued in 2005 were analyzed (Table 4) for both DEP regions, including 1,874 repair permits. Just as in 2004, the percentage of repair permits issued in the southcentral DEP region (31 percent) in 2005 was higher than the percentage issued in the northeast DEP region (16 percent).

Each 2005 repair permit was assigned to one of 10 repair permit categories using information provided on the permit form, including sewage enforcement officer (SEO) comments, site plans, and other attached descriptions of the project. The repair permits were organized into the 10 categories to separate system failures that were associated with reasonable age-related issues (mechanical) from failures that could be related to site selection or system installation. Large numbers of failures that are site-related would indicate a deficiency in DEP site investigation procedures or OLS designs.

This analysis (Table 5) found that 60 percent of the repair permits did not require a site investigation to be conducted, which means that the repair did not require the selection of a new drainfield (absorption field) or the enlargement of an existing drainfield. All of these repairs were made to an existing drainfield and the majority of them were for mechanical problems. These types of repairs are generally not related to improper site selection or installation problems. Most represent normal equipment failures. For example, many of the tank replacements were due to replacements of old steel tanks with the concrete tanks required under current regulations. Also, the

<table>
<thead>
<tr>
<th>REASON FOR REPAIR</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Site Investigation NOT Conducted</td>
<td>60</td>
</tr>
<tr>
<td>Absorption field repair with or without tank or mechanical repairs</td>
<td>5</td>
</tr>
<tr>
<td>Holding tank only</td>
<td>4</td>
</tr>
<tr>
<td>Mechanical: lid, tank, pump, lines not related to absorption field</td>
<td>46</td>
</tr>
<tr>
<td>Mechanical: Reconnection of OLS to house or connection of house to sewer</td>
<td>2</td>
</tr>
<tr>
<td>Unknown Nature of repair</td>
<td>3</td>
</tr>
<tr>
<td>2. Site Investigation Conducted</td>
<td>40</td>
</tr>
<tr>
<td>Absorption field repair with or without tank or mechanical repairs</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Enlargement of system due to additional bedrooms or to bring system up to code for home sale</td>
<td>2</td>
</tr>
<tr>
<td>New absorption field created (malfunction of old one)</td>
<td>13</td>
</tr>
<tr>
<td>Repair on a pre-1972 lot</td>
<td>24</td>
</tr>
<tr>
<td>Unknown Nature of repair</td>
<td>&lt;1</td>
</tr>
</tbody>
</table>

Note: Totals and percents have been rounded.

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field repairs (about 5 percent) and the percentage of new absorption fields (13 percent), such that approximately 18 percent of the repair permits could be correctly classified as site failures.

Of the nearly 7,700 total permits issued in 2005, the researchers estimated that 5 percent were related to site selection and placement problems.

**Sewage Enforcement Officer Survey Results**

A multi-page survey to solicit reasons for OLS failures was mailed to every licensed SEO in Pennsylvania. Surveys were also distributed at the 2007 Pennsylvania Association of Sewage Enforcement Officers’ Conference. Of the 960 surveys distributed, 195 were returned (20 percent response rate and 6.25 percent margin of error). Some key findings from the survey were that repairs of pre-1972 systems are very common; a lack of adequate septic system pumping and high groundwater levels appear to be major causes of system failure as perceived by SEOs; and fewer failures appear to be due to improper system installation or improper site selection.

**Homeowner Survey Results**

To better understand the nature of OLS repairs in Pennsylvania and homeowners’ issues, the researchers conducted a telephone survey of all homeowners that had received a repair permit in 2004 in the northeast and southcentral DEP regions. Of the 2,007 homeowners surveyed, 460 responded to the survey, representing a 23 percent response rate and a margin of error equal to 4 percent.

The results indicate that about half of the homeowners were having noticeable problems with their systems prior to the repair. Only 20 percent of the respondents noticed problems during inspection; this was expected since many municipalities do not have any type of on-site inspections.

In general, only municipalities that have established Sewage Management Programs (SMPs) require periodic on-site inspections. Currently there are 203 SMPs serving at least 260 municipalities across Pennsylvania.

The most common symptoms of OLS problems noticed by homeowners were surface discharge (seepage), toilet backup, and odors. In the survey, homeowners were able to choose more than one problem. However, more than 22 percent indicated they did not have any noticeable problems and that their systems appeared to be functioning properly. Problems at these sites were most likely noticed during an on-site inspection. On-site inspections are designed to identify problems at an early stage and typically can result in repairs prior to the onset of noticeable problems. Unnoticed problems may include tank problems, such as broken baffles, leaky tanks, cracked lids and others.

More than 60 percent of repairs were on systems that were installed prior to 1972. This result corresponds with results from the SEO survey, which indicated that repairs on pre-1972 systems were very common. Yet, this number is much higher than the number of repairs on older systems that was estimated from the 2005 permit records: these indicated that roughly 24 percent of repairs were on pre-1972 lots. Part of this discrepancy may be due to homeowner uncertainty in system age. This is a positive result in terms of the Pennsylvania sewage enforcement program, since the majority of repairs are on old systems that were not installed under regulations established since 1972. Of the remaining 38 to 40 percent of repairs that occurred on post-1972 systems, less than 5 percent occurred on systems less than 10 years of age.

Nearly 25 percent of homeowners did not have any noticeable problems with their system and did not have any problems noticed during inspection, yet had repairs done on their systems. Of those homeowners, the most common reason for repair was to update their system to current standards for a home sale or home expansion.

As previously indicated, the majority of repairs were related to mechanical problems, such as pumps and tanks. About 24 percent of repairs required the installation of a new absorption field and about 6 percent required repairs to an existing absorption field. This result agrees reasonably well with the results from the permit analysis, which estimated that approximately 18 percent of repairs were related to absorption fields. This is extremely important since the absorption field repairs indicate a problem with site evaluation and placement, system installation, or post-installation inspections. This relatively low number reflects positively on the SEOs that are conducting site evaluations and inspections.

The distribution of costs to homeowners for OLS repairs is illustrated in Figure 7. Approximately 60 percent of repairs cost less than $5,000, but nearly 15 percent of repairs cost in excess of $10,000. The median repair cost for all respondents was $3,500. If homeowners across the commonwealth incur similar costs, the total annual cost to homeowners for OLS repairs can be estimated to be more than $21 million, based on 6,000 repairs per year at $3,500 per repair. The spatial variability of cost or nature of repair was not analyzed.
Land Availability for Future On-Lot Septic Systems in the Northeast and Southcentral DEP Regions

With the recent growth of housing in rural municipalities and the reliance on OLS for sewage disposal, the researchers conducted an analysis to determine the availability of lands suitable for OLS in the northeast and southcentral DEP regions.

The researchers first estimated the lands that were considered unavailable for future development. These included currently developed lands and protected lands, such as state and federal parks, state and federal forests, state gamelands, and lands protected by agricultural conservation easements.

The researchers then used the following data sources to conduct the analysis: the Protected Lands Inventory (PLI), which containing all protected lands determined through a prior analysis in Pennsylvania (Pennsylvania Department of Conservation and Natural Resources, 2005); the Pennsylvania Department of Agriculture conservation easements boundaries, obtained from the Penn State Land Analysis Laboratory; and a land cover/land use dataset, produced by Dr. Eric Warner of the Applied Research Laboratory at Penn State University.

Since the analysis was concerned with lands suitable for future development with OLS, the researchers also produced a database of sewer service areas to eliminate those areas from consideration.

The percentage of land potentially available for development is illustrated in Figure 8 for each municipality in the study area. Since much rural development consists of housing units on one-half-acre to one-acre lots, the number of acres can be used to grossly estimate the maximum number of future housing units under recent development patterns. Based on the available lands, many municipalities have less than 1,000 acres of land remaining for development, representing a relatively low percentage of their total land areas.

All of the lands potentially available for development were evaluated for OLS suitability to further evaluate potential increases in housing units served by septic systems.

From the analysis, the researchers founds that most municipalities have very little suitable land areas remaining for in-ground systems. The situation, however, improved significantly for elevated sand mound and drip-irrigation systems. Still, there were some municipalities that have less than 500 acres of suitable land remaining even for drip-irrigation systems.

In this analysis, some of the municipalities with the least amount of available land that is suitable for OLS are boroughs, which may have public sewer available. To better represent rural municipalities, and to assess the effect of including more marginal soils on the availability of land for future OLS, the researchers conducted another assessment. Urban municipalities were excluded from the analysis after applying the Center for Rural Pennsylvania’s definition of rural: a municipality that has a population density of less than 274 people per square mile or a total population of less than 2,500 unless more than 50 percent of the population lives in an urbanized area, as defined by
Figure 9. Rural and urban municipalities with moderately limited soils for OLS

Figure 10. Acres of available municipal land with slightly limited suitability for elevated sand mound systems (excluding urban areas)

the U.S. Census Bureau. Figure 9 illustrates the urban and rural municipalities in the study area. Secondly, soils that were categorized as “moderately limited” for OLS were included in the analysis to represent more marginal soils. The USDA/NRCS suitability rankings tend to be very conservative and restrictive, so including “moderately limited” soils was felt to be a more realistic representation of soil limitations.

Figure 10 illustrates the amount of available land for each rural municipality that has “slight” or “moderate” limitations for elevated sand mound septic systems. Some municipalities appear to be facing serious shortages of suitable land, especially in northern counties that are dominated by poor quality glacial soils, as well as some municipalities scattered throughout the region. Further analyses are needed to determine the real impact of these shortages on future growth. An analysis of the growth rate of new housing compared to the amount of available lands is needed to estimate what impact this shortage will have on future growth.

Other OLS Limiting Factors

There are other factors that are not soil-related that impact the installation of OLS in Pennsylvania, notably ground water nitrate levels. Through discussions with DEP regional staff and reviews of Act 537 plans, ground-water nitrate levels, in many southeastern counties especially, are the most limiting factor for OLS installations and add significantly to the cost of OLS installation. In counties dominated by karst geologies, nitrate levels exceeding 10 parts per million (ppm) are common and DEP septic system regulations require that a hydrogeologic analysis be conducted to get an OLS permitted. Most of the karst areas are located in the highly productive agricultural valleys in southeastern and southcentral Pennsylvania. This results in increased cost and delays in OLS installations in these areas.

One major issue of concern that surfaced during this study is the way that DEP determines if a hydrogeologic analysis is needed. DEP currently requires a hydrogeologic analysis if any part of a parcel being developed is located within 2,500 feet of a well that had a recorded nitrate level exceeding 10 ppm. The problem with this method is the actual site where the OLS is being installed within the parcel may fall outside of the 2,500 feet distance. Another site where an OLS is being installed may actually be closer to a well where high nitrate levels were observed, but gets DEP approval because no part of the small parcel in which it is located is within 2,500 feet of the well. This interpretation of the regulations has many developers and SEOs disturbed as it results in a large increase in the amount of land area that requires a hydrogeologic analysis and therefore increases costs significantly. Another problem is that the quality of the groundwater data that is used to make these determinations often comes from Act 537 plans and can be questionable in quality. Further study is needed to evaluate the impact of this situation on OLS permitting and cost.

Relationship Between Act 537 Adoption Dates and OLS Repair Rates

The researchers determined if there was any relationship between the date of an Act 537 plan and the repair rate of OLS. It is logical that OLS problems that
are commonly identified through surveys and field investigations conducted during Act 537 planning would trigger an increase in OLS repairs following plan adoption.

However, the researchers found that many municipalities have not updated their Act 537 plans in more than 20 years, although most in high-growth areas have. This analysis is not complete and further work needs to be done to better address the effectiveness of Act 537 plans. However, based on this analysis, it raises the question of how effective Act 537 planning is on identifying and repairing OLS problems, as these results indicate that many Act 537 plans either don’t identify problems or trigger any increase in repairs.

A further study is needed to assess not only the age of the 537 plan, but, more importantly, whether the municipality has a Sewage Management Program that includes site inspections as required maintenance.

**CONCLUSIONS AND CONSIDERATIONS**

- There are more than 1.3 million OLS in Pennsylvania, providing sewage service to about 25 percent of households in the commonwealth. Because of recent development patterns occurring outside public sewer boundaries, OLS use may be increasing.
- Approximately 20 percent to 25 percent of all OLS permits are for system repairs.
- Estimates of failure rates of OLS need to consider more than just the number of repair permits issued since repairs include significant numbers of mechanical failures and replacement of outdated systems (pre-1972).
- Repairs related to improper site selection and/or installation account for less than 20 percent of all repair permits and approximately 5 percent of all permits issued. This indicates that current approaches to system installation and site selection appear to be working reasonably well.
- In 2005, about 24 percent of all repairs were for old, pre-1972 systems that were being brought up to modern standards.
- In 2005, about 52 percent of all repairs were for mechanical failures (tanks, pumps etc.) that are unrelated to site selection, system installation, or system design.
- Some municipalities are facing land shortages for OLS. Further work is needed to identify the impact on and the relationship to growth trends.
- DEP permit forms need significant improvement to better clarify the nature of repairs, such as the age of the system, the details of repair etc.
- Future work is needed to evaluate the land available for new OLS and the farmland value of these lands. Much of the best land for OLS is also best for agriculture. It would be interesting to see how significant this potential conflict is. The Pennsylvania Departments of Agriculture, Community and Economic Development, and Environmental Protection could work together to fund a more complete study.
- Nitrate levels limit OLS installations in many counties and others with karst geology and intensive agriculture, which is generally the largest source of nitrates. Further studies are needed to evaluate how nitrate levels are used by DEP to restrict OLS. The Pennsylvania Departments of Community and Economic Development and Environmental Protection could work together to fund a more complete study.
- The identification of a “parcel” as a “site” for OLS installation may significantly increase the land area requiring expensive hydrogeologic investigations during the permitting process and further restrict OLS installations in karst areas. Further work is needed. DEP could reevaluate its policies because of the detrimental impact this may be having on septic system installation costs.
- Act 537 plan adoption may have little impact on repairs of OLS problems in many municipalities. Further work is needed to study the relationship between Act 537 plan adoption and repair rates in the commonwealth. DEP regulates sewage facility planning and Act 537 planning so it could conduct a more detailed study to evaluate this pattern.
- Relationships between the formation of Sewage Management Programs in municipalities and OLS repair rates need to be further examined. Funding and oversight for this research could be provided by DEP.

**LITERATURE CITED**


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