



# Household Sewage Treatment System Failures in Ohio



**A report on Local Health Department survey responses  
for the 2012 Clean Watersheds Needs Survey**

January 2013

Ohio Department of Health  
Bureau of Environmental Health  
Residential Water and Sewage Program

# Household Sewage Treatment System Failures in Ohio

## Abstract

**Introduction:** The Clean Watersheds Needs Survey is conducted by Ohio EPA every four years as required by the Clean Water Act (1972) Sections 205(a) and 516(b) (1). Data for each state is compiled by US EPA into a Report to Congress. Congress, US EPA, and the state use the data to formulate policy decisions and establish wastewater infrastructure funding levels to states. The Ohio Department of Health (ODH) assists Ohio EPA by collecting information on household sewage treatment systems and failures in Ohio. As the agency with regulatory authority for household systems, ODH and the local health departments have first-hand knowledge of the types of systems and issues associated with the design, installation, operation, and failure of household treatment systems. In addition to providing data for Ohio EPA's report, ODH also uses the completed surveys to gather information about the types of sewage treatment systems installed and sewage treatment system failures to demonstrate the status of household sewage treatment throughout Ohio.

**Methods:** Survey forms were distributed to the 130 local health departments in Ohio.

**Results:** Eighty-eight (88) local health departments responded to the survey for a response rate of 68%. Of the 88 county health districts, 74 responded to the survey (84%). Response rates ranged from 65-96% of counties in each district. The reported overall failure rate of household sewage treatment systems was estimated at approximately 31%. The southeast and southwest districts reported significantly lower failure rates (15% and 18%, respectively) than their three counterparts to the north, whose failure rates ranged 37%-39%. The poor quality of discharge from systems and age of systems were the most commonly cited reasons for failure at 43% and 44%, respectively. Soil limitations (33%) and site limitations (25%) were also cited as significant contributing factors for system failure.

**Conclusions:** Approximately 31% of all household sewage treatment systems throughout the state of Ohio are experiencing some degree of failure. This is an increase from the 23% failure rate reported by ODH in the 2008 *Survey of Household Sewage Treatment Systems Operation and Failure Rates in Ohio* report. The number of reported household sewage treatment system failures continues to increase, thereby increasing the impact of wastewater on public health and the environment. Factors contributing to the failure of systems vary throughout the state, but it is clear that the age of existing systems and the limitations of residential lots are issues that need to be addressed through technology and rule development.

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## Introduction

The significance of household sewage treatment systems' operation in Ohio is high because of the potential impact on public health and the environment. The Ohio Department of Health (ODH) is in the process of developing new administrative rules for household sewage treatment systems to ensure that systems are being designed, installed, operated, and maintained to protect public health and the environment.

The possibility of direct or indirect exposure to human waste increases considerably when a household sewage treatment system (HSTS) is not functioning properly. Human waste contains high amounts of pathogens that often lead to illness upon exposure. Proper functioning of HSTS is also important to limit the environmental impact of human waste. The most commonly identified impact from failing HSTS in Ohio has been contamination of surface water, particularly in areas with large numbers of discharging sewage systems.

The Clean Watersheds Needs Survey (CWNS) is a tool used by the US EPA to evaluate the infrastructure of water and wastewater treatment and identify areas of need across the country. This includes the treatment of wastewater in both urban and rural areas throughout the country. The CWNS is conducted by Ohio EPA every four years as required by the Clean Water Act (1972) Sections 205(a) and 516(b) (1). Data for each state is compiled by US EPA into a Report to Congress. Congress, US EPA, and the state use the data to formulate policy decisions and assess the funding needs to meet the water quality goals set in the Clean Water Act. The report provides Congress, as well as state legislatures, with information to assist their budgeting efforts.

In 2008, the Ohio Department of Health (ODH) assisted Ohio EPA by collecting information on household sewage treatment systems (HSTS) and failures in Ohio. As the agency with regulatory authority for household systems, ODH and the local health departments have first-hand knowledge of the types of systems and issues associated with the design, installation, operation, and failure of household treatment systems. The data collected for that survey was also used in the *Survey of Household Sewage Treatment Systems Operation and Failures Rates in Ohio* report released by ODH in 2008.

For the 2012 CWNS, Ohio EPA again partnered with the Ohio Department of Health to collect data on HSTS and failures in Ohio. ODH surveyed local health departments on the types of existing HSTS and failures within each district. This report summarizes the findings of the survey.

## Methods

The data collected in 2012 is primarily for use by Ohio EPA to assess funding needs to meet the goals of the Clean Water Act, so less detailed data is needed compared to the 2008 survey, which doubled as a survey tool for the *Report to the Household Sewage and Small Flow On-Site Sewage Treatment System Study Commission* and the *Survey of Household Sewage Treatment Systems Operation and Failure Rates in Ohio*. The survey form used to collect data for the 2008 CWNS and the Study Commission reports was modified to consolidate some categories, streamline the information collected, and ease data entry for local health districts completing the survey.

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The main categories of information collected for the survey include: Number of Systems & Failures, Principle Reasons for Failure, and Solutions for the Area. Local health districts were encouraged to identify specific or cluster areas (e.g. housing subdivisions, unsewered communities, etc.) within their jurisdictions as well as provide summary data on the status of existing systems for the remainder of the jurisdiction that was not included in a specific identified cluster area.

In the 2008 survey for the Study Commission Report and CWNS, the survey separated septic tank from pretreatment on the various system types. For the purpose of the 2012 survey, it was determined that no distinction between septic tank and pretreatment systems was necessary, so they were combined and system types were based on where the septic tanks and pretreatment components discharge effluent for dispersal. Types of systems included on the survey form included: septic tank or pretreatment to leaching (trench or bed configuration), septic tank or pretreatment to mound system, septic tank or pretreatment to sand filter, septic tank or pretreatment to discharge, septic tank or pretreatment to unknown, privy, dry wells, unknown, and other. Users were asked to specify or describe any systems included in the "Other" category.

Respondents were asked to indicate the source for data submitted for each identified area in survey responses. There were three standard responses included in a drop-down list on the survey form: 1) Estimated using census data or general county knowledge; 2) Estimated using alteration/replacement permit data and/or complaints; 3) Counts based on surveys and inspections or engineering studies and detailed analyses. The list also included an "other" choice, and requested health departments to identify or explain other methods used to estimate or collect data, when applicable. These were the same choices included in the 2008 survey form.

In 2008, the survey form was developed in an Excel spreadsheet. A separate Excel spreadsheet file was completed for each targeted area. For 2012, the Excel spreadsheet form was reformatted to incorporate the changes made to condense and streamline data entry for responding health districts. Separate columns were used for each targeted area within the jurisdiction, allowing each health department to submit a single Excel file for their survey response.

Responding districts were asked to upload their completed survey files to a designated SharePoint site hosted by ODH. This would provide Ohio EPA direct access to the completed survey forms and eliminate the need to transmit the data through email attachments, thus alleviating some burden on local email servers. The SharePoint site has been used frequently by the ODH sewage program to disseminate program information, so many local health department personnel already had access to the site. For those who had not already registered for the site, detailed instructions with screen shots were distributed to everyone receiving the survey.

The survey form was distributed electronically using ODH's local health department distribution list, which includes an email contact for each local health department in the state. This was supplemented by also distributing the survey to local health departments using a distribution list compiled by the Residential Water and Sewage Program for the purpose of disseminating information to environmental divisions and sewage program staffs at local health districts. The survey file was attached to an introductory email along with attached detailed instructions on completing the survey. Included in the

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instructions were a list of important dates, including two scheduled LiveMeeting conference calls and deadline for submission of data.

Initial distribution of the survey began with an email sent to all local health districts on Thursday, February 16, 2012. Local health districts were asked to complete the survey and upload it with any supporting documents to the ODH sewage program SharePoint site by Friday, March 30, 2012. LiveMeeting conference calls were scheduled on February 22, 2012 and March 23, 2012. The purpose of these calls was to provide information about the survey, review the form and provide explanation of how to upload data to the SharePoint site. Those who logged on to the meeting were able to view the form as it was being discussed and sample data was entered, as well as how to navigate the SharePoint site to which completed surveys were to be uploaded.

Reminder emails were sent out to local health districts on March 12, March 23, March 28, and March 30. Verbal reminders were also given during the ODH sewage program monthly conference calls in February and March, and also during the MidWest Workshop, an annual conference held in Columbus for sanitarians across Ohio.

Once the deadline had passed, the survey coordinator contacted nine health districts that had responded for the 2008 survey but did not complete the 2012 survey. To facilitate responses from these districts, the survey coordinator offered to translate data from the 2008 survey to the reformatted 2012 survey form for review by the local health district. The local health districts were then asked to consider reviewing the translated data, update the information, and return the forms. Of the nine, six accepted the data, made corrections, and returned the forms.

### Results

A total of eighty-eight (88) survey responses were received out of 130 local health districts for an overall response rate of approximately 68 percent. Fifteen more responses were received this year than in 2008, resulting in an 11 percent higher response rate. Two local health districts elected not to complete the survey but did indicate verbally to the ODH survey coordinator that they did not have any reportable data. Seventy-four of the 88 county health districts responded to the survey. Data from two of the county survey responses could not be used because of partial or inadequate information. Eleven of the responding county districts did not respond in 2008, while three that did not respond for the 2012 survey had responded in 2008, resulting in a net gain of eight county health districts responding to the survey.



Figure 1. District Office Map

## Household Sewage Treatment System Failures in Ohio

District	Central	Northeast	Northwest	Southeast	Southwest	Total
Counties Responding	9	13	23	15	14	73
Counties in District	10	15	24	23	16	88
District Response Rate	90%	87%	96%	65%	88%	83%
Change from 2008	+1 (7%)	-	+3 (13%)	+2 (9%)	-	+8 (9%)

*Table 1. County Response Rate by District*

For the purpose of comparing data, responses from local health departments were divided into five districts (see Figure 1). This was the same method used to compile and analyze data in 2008, so following suit for this survey facilitated comparative analysis of 2008 and 2012 survey results. Response rates from the individual districts ranged from 65 to 96 percent.

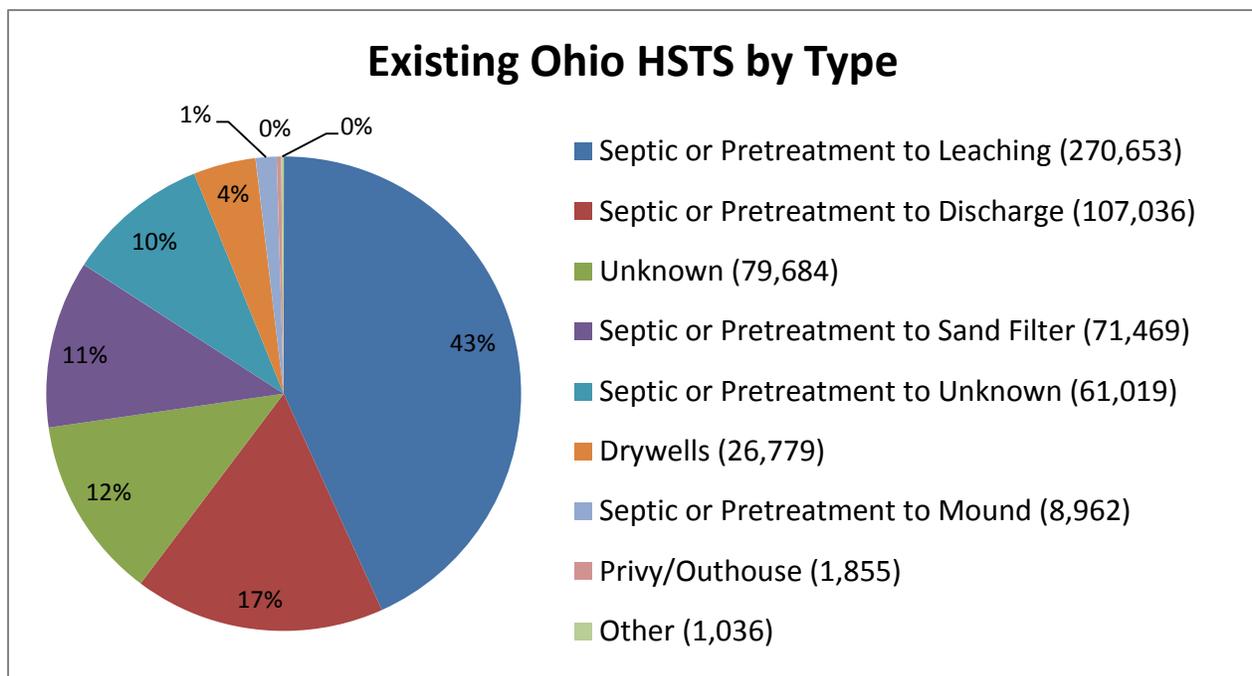
A total of 628,493 existing household sewage treatment systems were reported by the 88 responding health districts, with 193,988 (31%) identified as failing. Failure rates were reported to be significantly lower in the southeast district (15%) and southwest district (18%) compared to the failure rates of the districts to the north, whose failure rates ranged 37-39 percent.

District	Central	Northeast	Northwest	Southeast	Southwest	Total
Existing Systems Reported	54,813	236,386	117,819	87,943	131,532	628,493
Failing Systems Reported	20,512	90,380	45,560	13,267	24,269	193,988
Failure Rate (calculated)	37%	38%	39%	15%	18%	31%

*Table 2. Existing Systems & Failures by District*

## Household Sewage Treatment System Failures in Ohio

Septic tank or pretreatment to leaching (270,653) is by far the most common type of system reported in the state at 43 percent, more than double the second-most common type, septic tank or pretreatment to discharge systems (107,036), which totaled seventeen (17) percent of all existing systems reported. It should be noted that septic tank or pretreatment to sand filters (11%) are also a discharging system, so when combined with the former, a total of 28 percent of all existing systems reported across Ohio are designed to discharge effluent to surface waters. Survey results indicate that dry wells, a system that is no longer permitted by the Ohio Revised Code, constitute approximately four (4) percent of the household sewage treatment systems in Ohio, and account for approximately six (6) percent of all failing systems.



**Figure 2. Existing HSTS by System Type**

During analysis of survey results, system types were combined into three general categories: soil-based (onsite), discharging (off-lot), and “other,” to facilitate comparison to 2008 survey results. Septic tank or pretreatment to leaching and septic tank or pretreatment to mounds were combined to form the onsite category; septic tank or pretreatment to discharge and septic tank or pretreatment to sand filter were combined to form the discharging systems category; privies, holding tanks, unknowns, and “other” systems reported were combined to form a third category. Data from survey responses in 2008 were organized using the same categories.

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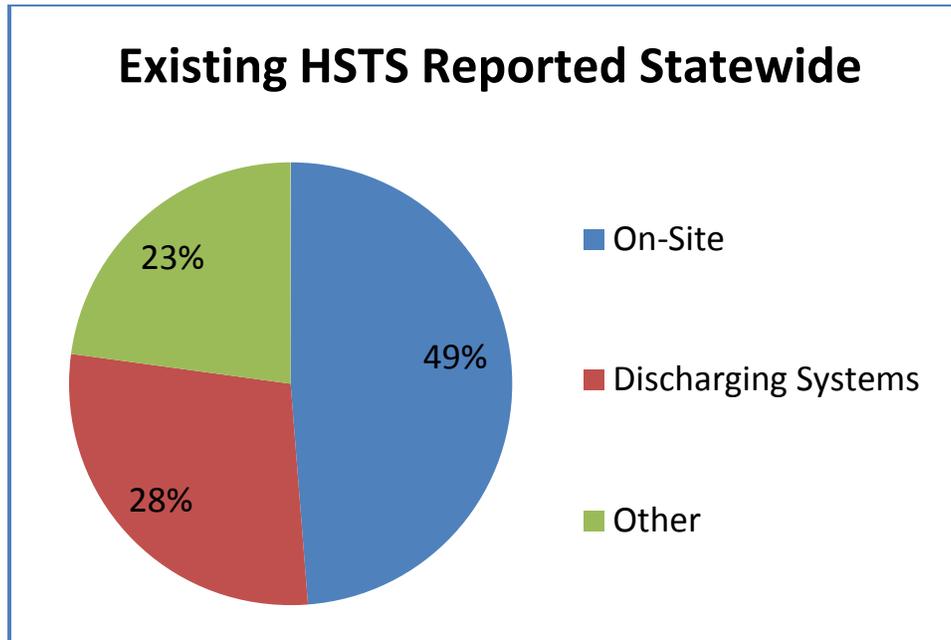


Figure 3. On-site Systems vs Discharging Systems

Survey results indicate that nearly half of all existing systems are soil-based or on-site systems, while 28 percent of the existing systems are designed to discharge effluent off-lot, with the remaining 23 percent of systems reported placed in the “Other” category that contains privies, holding tanks, unknowns, or HSTS reported as another type of system (e.g. drip distribution). It can be reasonably hypothesized that a portion of the unknown systems are likely discharging off-lot as well.

	Central	Northeast	Northwest	Southeast	Southwest	Statewide Total
<b>Total Existing Systems Reported</b>	54,813	236,386	117,819	87,943	131,532	628,493
<b>Total Failing Systems Reported</b>	20,512	90,380	45,560	13,267	24,269	193,988
<b>Discharging Systems Reported</b>	17,722	69,551	37,895	24,267	29,070	178,505
<b>Failing Discharging Systems Reported</b>	7,960	26,426	15,617	6,258	13,060	69,321
<b>% of All Existing Systems that are Discharging</b>	32%	29%	32%	28%	22%	28%
<b>Discharge System Failure Rate</b>	45%	38%	41%	26%	45%	<b>39%</b>
<b>% of Overall Existing Failures</b>	39%	29%	34%	47%	54%	36%

Table 3. Discharging Systems by District

## Household Sewage Treatment System Failures in Ohio

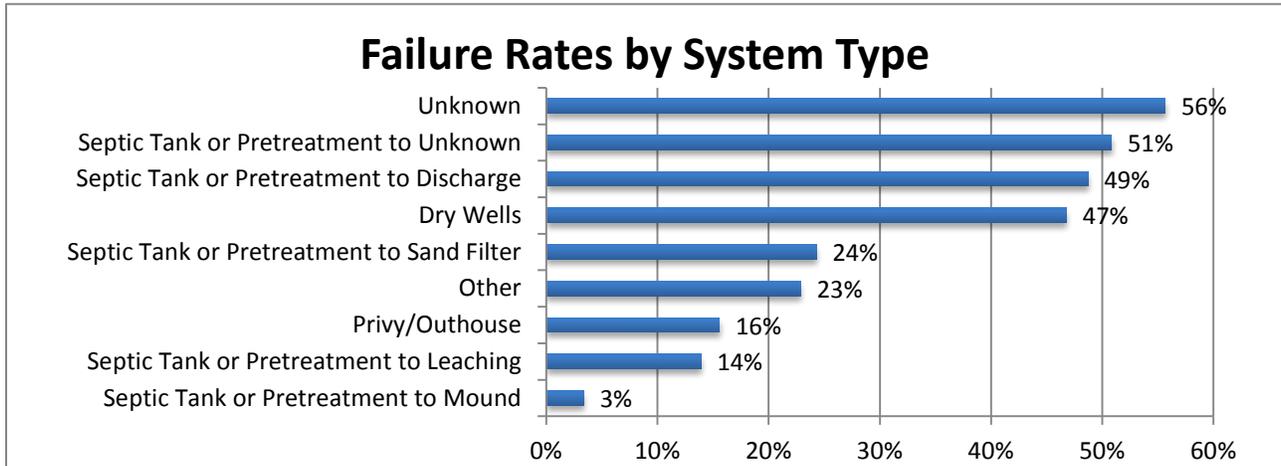


Figure 4. System Failure Rates by Type

Unknown systems were reported to have the highest rates of failure, with approximately 56 percent of existing unknown household sewage treatment systems reported to be failing, and 51 percent of septic tank or pretreatment to unknown failing. Of the “known” systems reported across Ohio, septic tank or pretreatment to discharge systems have the highest rate of failure, with approximately 49 percent reported to be failing. Septic tank or pretreatment to dry wells had a failure rate of approximately 47 percent, followed by septic tank or pretreatment to sand filters at 24 percent.

Septic tank or pretreatment to leaching, the most common type of system in Ohio, has a failure rate of approximately fourteen (14) percent. Septic tank or pretreatment to mound systems have the lowest failure rate, with only three (3) percent reported to be failing.

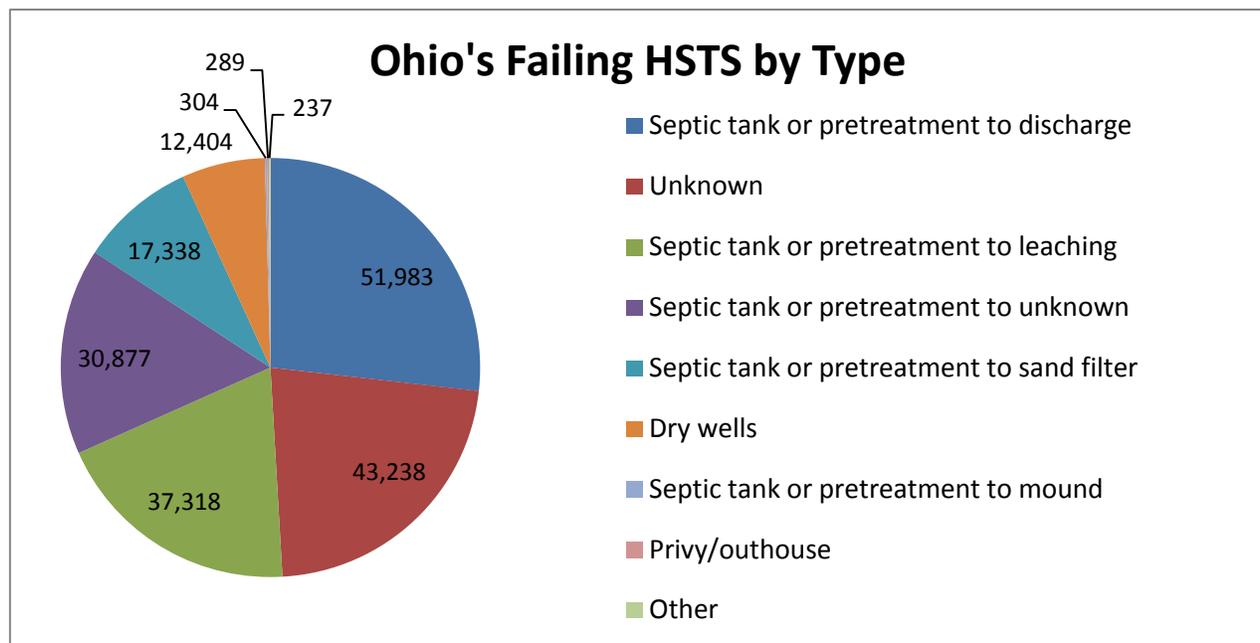


Figure 5. Failed HSTS by System Type

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Discharging systems account for about 36 percent of all systems reported to be failing throughout Ohio, with 27 percent of the reported failures classified as septic tank or pre-treatment to discharge and nine (9) percent as septic tank or pre-treatment to sand filter systems. Nineteen (19) percent of the reported HSTS failures are septic tank or pretreatment to leaching systems.

Discharges exceeding NPDES standards for quality and old age of systems were the two most common cited factors contributing to failure of a system (43% and 44%, respectively). Soil limitations (33%) and site limitations (25%) were also cited as common factors that contribute to system failure.

Soil limitations include shallow water table (seasonal or apparent), permeability, drainage issues, or inadequate thickness (quantity) of soil. Site limitations include steep slopes, insufficient space for required soil-based system, or damage to soil absorption area (e.g. compaction, excavation, etc.).

Principle Reasons for Failure	
Old System (age)	44%
Direct discharge exceeds limits	43%
Soil Limitations	33%
Site Limitations	25%
System Owner Abuse	17%
Design Issues	14%
No Leach Field	14%
Unapproved System	7%
Installation Issues	3%
Other	1%

*Table 4. Reported Reasons for HSTS Failure*

### Discussion

The numbers of each type of system reported may be skewed slightly by some deficiencies identified in the survey form after the initial distribution of the survey to local health departments. On the initial form distributed to local health districts, the category headings for two of the categories (“septic tank pretreatment to discharge” and “septic tank pretreatment to unknown”) omitted the word “or” between septic tank and pretreatment. This may have confused some responding districts, resulting in exclusion of pretreatment systems (i.e. aeration treatment units) in their counts for the respective categories. The error was corrected in subsequent reminder distributions of the survey, but some survey responses had already been received when the error was identified, and others continued to use the original form distributed, which included the error. Some responding districts included aeration units of these types in the “other” category of their survey response. During compilation and analysis of data, any system type totals that could be identified as aeration units that were excluded from system types because of this error were recalculated in the appropriate category.

Another issue identified affected data collection on drip distribution systems, which are becoming more common in Ohio. Drip systems should have been identified as a separate category, but were not included on the survey. Some health departments recognized this omission and included drip systems in the “other” category. Examples of other types of systems reported in the “Other” category include evapotranspiration systems, holding tanks, wetlands, peat, Presby, gravel filter beds, and direct discharge (no tank).

The survey form described a “failure” as a situation that should result in necessary alteration or replacement of the existing household system, and not simple maintenance items. Provided examples of failure included: surfacing of effluent, sewage backup into the home, positive dye test, structural

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failure (e.g. collapsed tank, disintegrated concrete), and discharges that are public health nuisances. Although some guidance was provided, the designation of a “failing” system is subjective, based on the criteria of the local health district making the designation. For example, some health districts would consider a dry well system failing only if visible manifestation of failure (e.g. surfacing of effluent) is observed. Others however, may consider a dry well system failing, regardless of whether visible signs of failure are evident, because it is a system that is no longer permitted by statute. Some health districts also assumed old systems and unknown systems to be failing, even if manifestations of failure were not observed. This must be considered when looking at the reported failures of systems throughout Ohio.

The total number of failing systems reported (193,899) is assumed to be lower than the actual number of failing systems in the responding districts because 31 of the 88 surveys returned – 28 of which were from counties – did not include summary data on the status of existing systems for the remainder of each district that was not included in the identified cluster areas.

Ten of the survey responses indicated “unknown” as a response to the number of failing systems for one or more system type. It is assumed that there are some systems failing, but the local health district was not able to identify or estimate the number of systems, which means that the overall number of failing systems for each of these types should be higher, and subsequently, so should be the failure rate. In an effort to account for this, the survey coordinator manipulated the data by recalculating failure rates without using any responses that included “unknown,” but this yielded no significant change in overall failure rates for each system type.

### Conclusion

Considering that 31 of the 88 survey responses (35%) did not include summary data for the entire district, compounded by the fact that fourteen counties did not respond to the survey and two responding counties provided data that was incomplete and thus not included, it can be reasonably surmised that the total number of failing systems is significantly higher than the 193,899 that are reported in 2012, and likely close to or in excess of the 250,000 estimated failing systems reported from 2008.

The 2008 *Survey of Household Sewage Treatment Systems Operation and Failure Rates in Ohio* report concluded that approximately 23 percent of the existing household sewage treatment systems were failing, with approximately 124,000 failing systems throughout Ohio. The results of the 2012 survey indicate that the failure rate has increased significantly, with a reported overall failure rate of 31 percent.

The most significant change in system type failure rate was reported in the “unknown” system category, which more than doubled, increasing from 21 percent failure rate to 56 percent. Other notable increases in system type failure rate include dry wells (+10), and privies, outhouses, and holding tanks (+11).

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Type of System	Failure Rates		
	2008	2012	Change
Septic tank or pretreatment to leach	9%	14%	+5
Septic tank or pretreatment to mound	3%	3%	-
Septic tank or pretreatment to sand filter	33%	24%	-9
Septic tank or pretreatment to discharge	55%	49%	-6
Septic tank or pretreatment to unknown	56%	51%	-5
Privies, outhouses, and holding tanks	5%	16%	+11
Dry wells	37%	47%	+10
Unknown	21%	56%	+25
Other	17%	23%	+6
<b>Overall Failure Rate</b>	<b>23%</b>	<b>31%</b>	<b>+8</b>

Table 5. Comparison of Failure Rates by System Type

Although the 2012 survey results indicate that the overall failure rate of household sewage treatment systems has increased across Ohio, the responses do indicate that there has been an improvement in the reported failure rate of the combined discharging systems, decreasing from a reported failure rate of 44 percent in 2008 to 39 percent in 2012. This includes septic tank or pretreatment to discharge and septic tank or pretreatment to sand filter. Many factors could play a role in decreasing the failure rate, including the required service contracts on new or replacement discharging systems, the availability of funds for HSTS repair and replacement, and the implementation of operation and maintenance (O&M) programs across the state. Many O&M programs focus on mechanical or complex systems, which include many discharging systems.

2008 Survey Results				2012 Survey Results			
	Onsite*	Discharge	Others/ Unknown		Onsite*	Discharge	Others/ Unknown
Existing	284,800	139,482	107,833	Existing	306,394	178,505	143,594
Failing	29,652	62,149	32,364	Failing	50,026	69,321	74,641
Failure Rate	10%	44%	30%	Failure Rate	16%	39%	52%

Figure 6. Comparison of Failure Rates by Category

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The Household General NPDES permit issued by Ohio EPA's prohibits the installation of new discharging systems and only allows the installation of replacement discharging systems when a soil based system is not feasible on a lot. Replacement discharging systems have continual operation and maintenance, sampling and permitting costs which is a substantial financial burden to discharging systems owners. The challenge to reduce the number of existing discharges is leading ODH to explore new technologies and methods for using soil for treatment and dispersal of wastewater.

While septic tank or pretreatment to leaching was the most common reported system type, with a modest overall failure rate of approximately 14 percent, the failure rate of leaching systems was considerably higher in the northeast and northwest districts (27% and 20%, respectively) than the central, southeast, and southwest districts (12%, 7%, and 4%). This is likely due to the flat land and shallow seasonal water table that is prevalent across the northern part of the state. This serves as clear illustration that there is no single system type that can be utilized across the state and that administrative rules for household sewage treatment systems must be expanded to include technological advances and provide flexibility to address varied site and soil conditions throughout Ohio.