Massachusetts Septage Management Study

PREPARED FOR THE MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION

PFAS and Residuals Technology and Management Study, Part 1

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BOD	biochemical oxygen demand
CMR	compliance monitoring report
COD	chemical oxygen demand
EGAD	Environmental and Geographic Analysis Database
EPA	Environmental Protection Agency
GLSD	Greater Lawrence Sanitary District
GPD	gallons per day
MA	Massachusetts
MassDEP	Massachusetts Department of Environmental Protection
MGD	million gallons per day
ng/g	nanograms per gram
NPDES	National Pollutant Discharge Elimination System
OWTS	on-site wastewater treatment systems
PFAS	per- and polyfluoroalkyl substances
POTW	publicly owned treatment works
RV	Recreational Vehicle
TM	technical memorandum
WPCF	water pollution control facility
WPCP	water pollution control plant
WRF	water reclamation facility
WQD	water quality district
WWTF	wastewater treatment facility
WWTP	wastewater treatment plant

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Executive Summary

This report, representing the first part of a two-part "PFAS and Residuals Technology and Management Study" produced for the Massachusetts Department of Environmental Protection (MassDEP), aims to establish the current landscape for managing septage from the Commonwealth of Massachusetts. Septage is "the liquid, solid, and semi-solid contents of privies, chemical toilets, cesspools, holding tanks, or other sewage waste receptacles." The overall project was broken into Part 1 and Part 2; Part 1 focuses on the collection of data regarding sludge and septage, and Part 2 will focus on state-wide assessments of options for per- and polyfluoroalkyl substances (PFAS) management. This technical memorandum (TM) specifically discusses the management of Massachusetts septage and includes the results of data gathering and analysis of septage management volumes.

Tighe and Bond, and Brown and Caldwell were hired to perform this residuals management study. The consultant team collaborated with MassDEP and relevant stakeholders to develop surveys to be sent to Massachusetts publicly owned treatment works (POTWs) regarding residuals management. If a POTW identified themselves as receiving septage, they were also asked to take the septage-specific survey. This survey covered issues such as service area, volume of septage received, and septage-specific operations and maintenance. Additionally, 74 haulers were asked to take the septage hauling survey, which covered hauling operations, sensitivity to price or offload timing, and general comments. The results of these surveys were used to quantify septage receiving within the Commonwealth and develop a broad understanding of Massachusetts septage management. Data from the surveys were analyzed, and a literature review of septage management was also included to provide background to this project. Septage stakeholders were identified, contacted, and interviewed for additional data and context regarding septage management in Massachusetts.

Survey results indicated that at least 209.3 million gallons of septage are treated at Massachusetts POTWs every year. This includes septage from out-of-state that is treated at Massachusetts POTWs. Septage receiving volumes by region are seen in Figure ES-1. **It has been estimated that about 28% of Massachusetts's population relies on on-site wastewater treatment systems (OWTS), or septic systems, which equates to about 2 million people in 2023.**

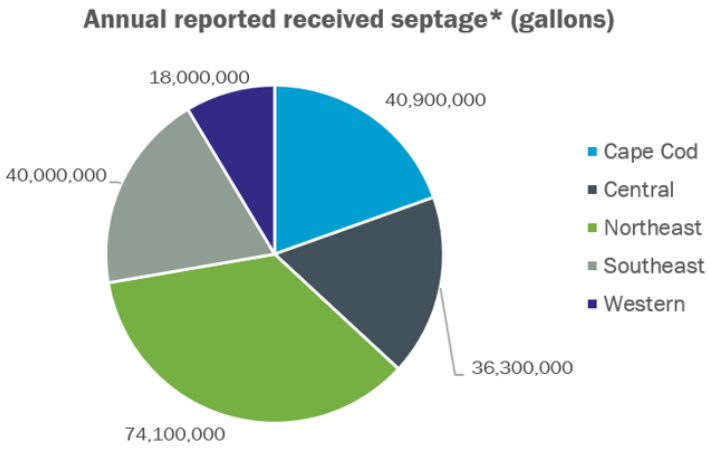

Figure ES-1. Total reported received septage, by region

**Does not include septage sent out of state for management, does include out-of-state septage treated in MA.*

Based on survey responses, these data are assumed to also include septage produced in Connecticut, New Hampshire, Rhode Island, and Vermont. The largest receiving volumes are found at Greater Lawrence Sanitary District (GLSD) in the Northeast and Yarmouth Septage Receiving on Cape Cod. The relative receiving volumes by POTW are shown in Figure ES-2. There is one privately owned septage treatment facility currently in operation in Massachusetts. Stewart's Septic Service in Bradford operates a septage receiving facility with an industrial pre-treatment permit to discharge to the City of Haverhill. Some volume of Massachusetts' septage is treated out of the state, primarily at two of Rhode Island's incinerator POTWs – Cranston and Woonsocket. However, this volume is difficult to quantify due to the proprietary nature of this data for these two private outlets. Additionally, around five million gallons of septage is sent to Allenstown, New Hampshire. When traditional outlets are unavailable, septage is sent to the Manchester, New Hampshire incinerator or the POTW in Concord, New Hampshire.

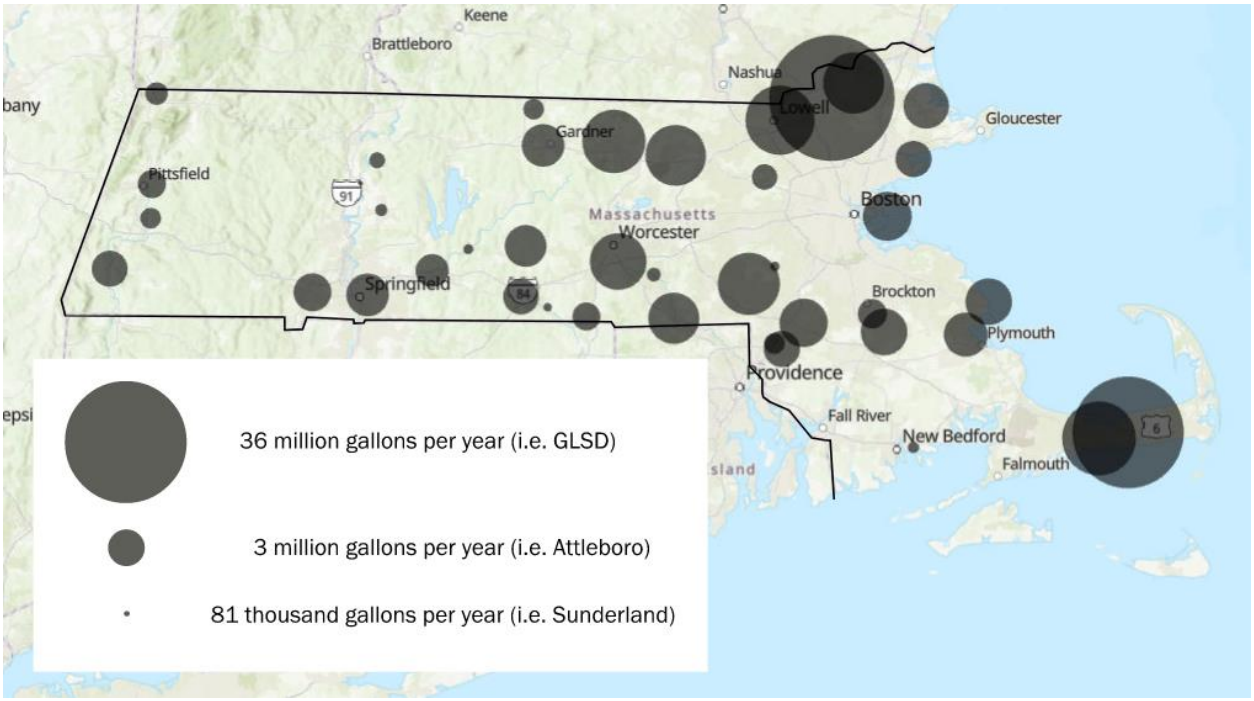

Figure ES-2. Septage received by facility

While there are approximately 37.5 million gallons of surplus capacity for septage treatment in the state, septage management is dependent on reasonable hauling distances and, thus, is a local issue. Therefore, while at the state level septage processing capacity appears to meet demand, the results from this study indicated that there are local areas that lack resiliency and redundancy in case of any shock to current conditions including changing state or federal regulations, short- or long-term POTW outages, or shifts in POTW operation decisions.

Since POTWs are primarily responsible for septage treatment, any pressures to POTWs in the region directly impact septage receiving at these facilities. Recent changes in regulations in Maine have significantly limited the available land for biosolids causing POTWs to shift their end-use programs to rely on incinerators, which have limited capacity and need repairs and upgrades. For example, Cape Cod, which is dominated by OWTS, used to send a portion of their septage to Maine. However, as Maine is no longer an option, Cape Cod must now rely on the Cranston incinerator to receive both

septage pumped from tanks as well as sewage sludge from Cape Cod POTWs. The Woonsocket incinerator had been a backup option for the Cranston incinerator, but Woonsocket recently announced their plan to shift to dewatered solids receiving only. That leaves the incinerator at Cranston as Cape Cod's only reliable outlet for septage or sludge management. In survey responses, POTWs reported they are feeling the strain of limited outlets for sludge discharge. If sewage sludge end-use options continue to decrease due to new regulations, POTWs may be forced to stop receiving septage as a way of reducing their solids as well as potential sources of regulated contaminants. In turn, septage haulers will have to travel farther to find outlets, and these transportation costs will be passed down to customers. In extreme cases, this may lead to increased time between pump outs and an increased risk of OWTS failure. Cape Cod's struggles are a heightened reflection of what may happen to other vulnerable parts of Massachusetts and demonstrate the direct relationship between septage and sludge management.

The results of this planning-level study indicate that the Northeast region and the Central region of Massachusetts are the most vulnerable areas besides Cape Cod and the Islands. From survey results, these regions reported minimal amounts of surplus septage processing capacity and sometimes rely on out- of- state POTWs to process septage. Again, since septage management is predominantly a local issue, driven by the physical limitations of hauling septage, the large amounts of surplus septage capacity in Western Massachusetts reported by survey respondents will do little to offset the need in the East. Additionally, several haulers who operate in those vulnerable regions reported not having enough sites for offloading. Even across the Commonwealth, half of the facilities are limited in their ability to receive septage by the significant operational impacts of treating septage, further restricting surplus capacity in the state. While the septage management situation is not as dire as Cape Cod, the Central and Northeast regions would especially benefit from additional septage processing capacity to ensure consistent septage offloading locations, as well as to add buffer capacity in case of POTW wastewater processing or incinerator outages.

There are several options for bolstering septage management in the Commonwealth such as additional storage on hauler sites or at POTWs to add operational flexibility. Other options include septage transfer stations, improvements to septage-receiving facilities at POTWs such as card-readers, additional lanes, or expanded hours, and regional septage-receiving facilities with some type of primary treatment and dewatering. Ultimately, these solutions serve as options to improve septage hauling and receiving throughout the Commonwealth. However, they do not directly address a POTW's overall decision to receive and process septage. The incentives for POTWs to receive septage and in what quantities are driven by broader techno-economic decisions that include biosolids end-use outlet security. Thus, ensuring both consistent and backup end-use options for sludge from POTWs within the state will best alleviate pressures that trickle down and impact septage processing.

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Section 1: Introduction

1.1 Project Objectives

The Massachusetts Department of Environmental Protection (MassDEP) commissioned this per- and polyfluoroalkyl substances (PFAS) and Residuals Technology and Management Study to address the significant residuals management challenges faced by publicly owned treatment works (POTWs) in Massachusetts. Over the past several years, Massachusetts POTWs have experienced rapidly escalating management costs and, at times, temporary shutdowns of their off-site sludge management locations. The wastewater industry faces pressure on all fronts, including landfill capacity reductions, regional incinerator outages due to aging infrastructure, and biosolids land application site limitations due to concerns with PFAS.

Sludge management options in the northeastern United States have been decreasing due to various factors, including legislative actions and limited in-state and regional landfill capacity. Reduced disposal options and solids carryover at treatment facilities pose a threat to water quality and permit compliance. Public concern over the presence of PFAS in Massachusetts sludge, septage, and leachate, originating from various sources, necessitated a comprehensive study to establish a statewide residuals management strategy.

This report is one of two that summarizes Part 1 of the PFAS and Residuals Technology and Management Study. Part 1 focuses on surveying POTWs and sludge and septage management facilities to document and quantify current conditions, as well as to develop projections for management of Massachusetts sludge and septage five years into the future. Part 2, which will be completed in 2025, focuses on sludge treatment technologies for PFAS reduction, PFAS source reduction strategies, and regulatory issues. The overall PFAS and Residuals Technology and Management Study has the following principal objectives:

1. Conduct a detailed assessment of sludge and septage disposal practices in POTWs across Massachusetts.
2. Assess Sludge Management Alternatives
   - Landfill Disposal - Examine the capacity and long-term viability of in-state and out-of-state landfills for sludge and incineration ash disposal.
   - Incineration – Investigate the current capacity, reliability, and long-term use of in-state and out- of- state incinerators handling disposal of Massachusetts sludge.
   - Land Application - Investigate the current capacity, reliability, and long-term use of in-state and out- of-state facilities producing biosolids from Massachusetts sludge for land application.
3. Compile data on sludge and septage volumes, costs, and recommend adjustments to waste reporting for POTWs, addressing data gaps from previous studies.
4. Evaluate Technologies
   - Assess PFAS treatment methodologies for POTWs, including concentration, encapsulation, and destruction technologies for PFAS in leachate, sludge, and septage.
   - Evaluate sludge volume reduction technologies.
   - Examine PFAS reduction methodologies for POTWs and MassDEP within the legal, regulatory and policy framework.

5. Propose alternatives and recommendations for short-term and long-term sludge management in Massachusetts, tailored for utilities of varying sizes.
6. Provide insights to assist POTWs and MassDEP in advancing sludge capital projects, as necessary.

The PFAS and Residuals Technology and Management Study is crucial for establishing a sustainable path forward, ensuring compliance with regulations, protecting human health and the environment, and addressing the economic, technical, and logistical realities of waste management. The study will guide decision-making for utilities of different sizes and aid in the development of effective sludge management strategies in Massachusetts.

This project seeks to provide a holistic understanding of the current state of PFAS-contaminated residuals, proposing viable solutions that balance environmental protection, regulatory compliance, and practical considerations. The fundamental objective is to assist MassDEP in developing strategies for a more sustainable and resilient residuals management framework in Massachusetts. This technical memorandum (TM) will discuss the analysis done to quantify Massachusetts septage receiving and its integration into the broader sludge management picture in Massachusetts.

1.2 Septage in Massachusetts

Approximately 28% of the population in Massachusetts is served by on-site wastewater treatment systems (OWTS), or septic systems (Beecher et al. 2018). Code of Massachusetts Regulations (CMR), 310 CMR 15.000, define septage as “the liquid, solid, and semi-solid contents of privies, chemical toilets, cesspools, holding tanks, or other sewage waste receptacles” (MassDEP 2016). Grease (i.e., restaurant grease traps) is often associated with septage as it is usually transported to treatment facilities by septage haulers. Additionally, sludge pumped from private, non-POTW groundwater discharges are also associated with septage. However, grease and groundwater discharge sludge was not considered as part of this MassDEP study, though some survey responses did still discuss the acceptance of these wastes. When septage is pumped from septic tanks it is hauled to sites in Massachusetts and surrounding states for management. As mentioned above, PFAS is commonly used in many household products and can be found in septage from OWTS.

Dropoff at POTWs and direct land application are the approved avenues for treated septage management within Massachusetts. Septage transportation and disposal within the Commonwealth are regulated by 310 CMR 15.000, also known as Title 5. 310 CMR 32.00 regulates land application of septage, but there are currently no septage land application sites in Massachusetts. Haulers must be licensed with the local Boards of Health in each locale in which they operate, which includes both pumping septage from tanks as well as offloading septage for disposal. These permits must include agreements with POTWs for offloading and are renewed annually with the relevant health boards. Municipalities will often post the list of approved septage haulers on their town website. POTWs are also required to have existing agreements with haulers and actively manage the haulers and their trucks that offload at their facilities. In many cases, individual POTWs may have strict rules about the origins of the septage they accept, such as “all septage must be domestic only” or “grease can only originate from within the municipality.” Septage is overseen at the municipal level, therefore septage management throughout the state is decentralized, and haulers bear the responsibility for permitting and approvals (sometimes multiples of both). While MassDEP has minimal authority over septage management in the Commonwealth due to the regulatory arrangement, this study is being conducted to gain additional insight into Massachusetts septage management and to bring further context to the broader issue of sludge management for the Commonwealth.

1.3 Project Approach

Tighe and Bond, and Brown and Caldwell were hired to perform Part 1 of the residuals management study. The consultant team collaborated with MassDEP and relevant stakeholders to develop surveys to be sent to POTWs regarding sludge management. For wastewater POTWs, the surveys included a general survey regarding operations and sludge management, a survey for septage-receiving POTWs, and a survey for POTWs that incinerate. Additionally, specific surveys were developed for landfill facilities, biosolids land application sites, and septage haulers. For the septage portion of Part 1, the survey requests were sent to every POTW in Massachusetts. If a POTW identified themselves as receiving septage, they were also asked to take the septage-specific survey. Of the POTWs that reported receiving septage, 82 percent of them responded to the septage-receiving survey. This survey covered issues such as service area, volume of septage received, septage-specific operations and maintenance.

Additionally, seventy-four haulers were asked to take the septage hauling survey, which covered hauling operations, sensitivity to price or offload timing, and general comments. In Massachusetts, septage haulers are licensed and monitored by the local Boards of Health. As such, no centralized list or database of hauling companies exists, and haulers were identified through manual online search. These seventy-four haulers do not include all licensed haulers in Massachusetts and, due to the online format of the survey, only hauling companies with posted email addresses were asked to participate. Of these seventy-four haulers, 28 percent of them responded to the survey.

MassDEP officially recognizes four regions in Massachusetts: Central, Northeast, Southeast, and Western. For this project, however, a fifth region, Cape Cod and Islands, was created by separating it from the Southeast region. This distinction was made to address the unique challenges Cape Cod and the Islands face in wastewater treatment and septage management. All five regions were represented in both the outreach efforts and survey responses. Data were analyzed for regional trends based on these five regions, shown in Figure 1-1. The survey questions are provided in Appendix A: . The results of these surveys were used to quantify septage receiving within the Commonwealth and develop a broad understanding of Massachusetts septage management. A literature review of septage management was also included to provide background.

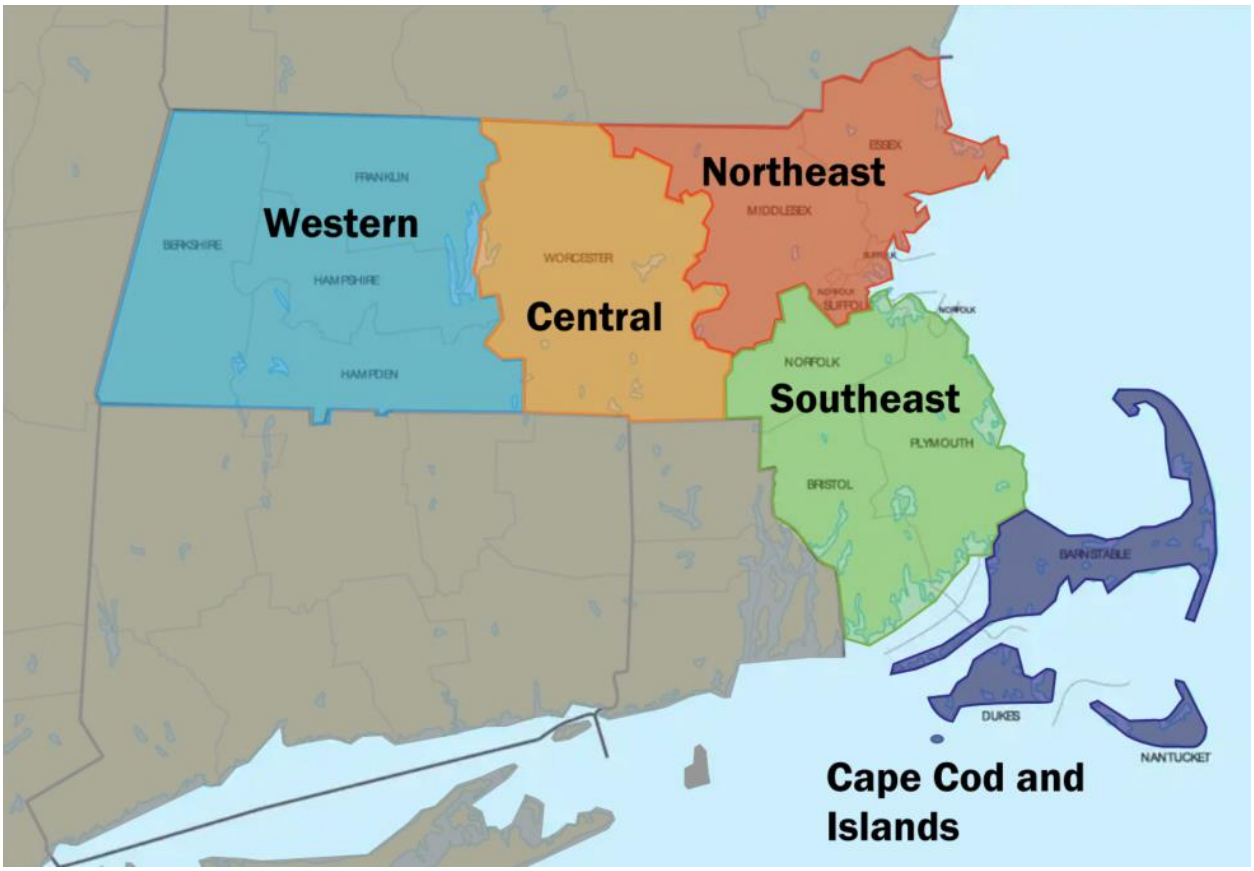

Figure 1-1. Five regions of Massachusetts, as defined for this project

Through surveys and communication with MassDEP, septage stakeholders were identified, contacted, and interviewed for additional data and context regarding septage management in Massachusetts. The list of stakeholders who were contacted and engaged for this study is provided in Appendix B: . The stakeholders provided additional information regarding regional challenges to septage management, the processing of out-of-state septage within the Commonwealth, and Massachusetts septage managed outside of the state. An analysis of the data gathered through the surveys and stakeholder conversations, as well as a general discussion of future septage disposal options and opportunities, are provided in this TM.

Section 2: Literature Review

Massachusetts septage regulations define septage as “the liquid, solid, and semi-solid contents of privies, chemical toilets, cesspools, holding tanks, or other sewage waste receptacles” (MassDEP 2016). Common sources of septage include residential tanks, portable toilets, recreational vehicles (RVs), and commercial sources not on sewer networks. MassDEP defines a septage hauler as “a person licensed by an Approving Authority to remove septage from on-site sewage disposal systems and transport it to an approved disposal location in accordance with 310 CMR 15.500” (310 CMR 15.500). In Massachusetts, these are primarily small private businesses with networks of trucks that must be permitted at each municipality in which they pump or offload septage.

There are three primary methods of septage treatment: land application, treatment at POTWs, and treatment at independent septage treatment facilities (USEPA, 1994). All are approved avenues for septage management in Massachusetts from a regulatory standpoint, but there are no permitted direct land application sites for septage or private septage treatment facilities with National Pollutant Discharge Elimination System (NPDES) approval within the Commonwealth. In the Decentralized Systems Technology Fact Sheet on Septage Treatment/Disposal, the Environmental Protection Agency (EPA) characterizes "septage [as] highly variable and organic, with significant levels of grease, grit, hair, and debris…a tendency to foam upon agitation, and a resistance to settling and dewatering…As a result, septage requires special handling and treatment" (USEPA 1999). The treatment of septage can pose several challenges to POTWs due to its higher biochemical oxygen demand (BOD), nutrient concentrations, and its irregularity in characteristics.

Table 2-1 presents a comparison between the characteristics of domestic wastewater and septage that were obtained from various literature sources (Appendix C:). Of particular interest are parameters that may have direct implication on septage management options. These are indicated in the table below and include concentrations of organics (BOD and chemical oxygen demand), solids content (total suspended solids and total solids), nutrient levels [nitrogen and phosphorus concentrations]), PFAS, and metals. Note that septage has higher concentrations for most parameters when compared with domestic wastewater. In addition, the range of septage values for each parameter is relatively wide, indicating variability in septage characteristics. Septage has been observed to alter overall wastewater characteristics when mixed with POTW influent.

Table 2-1. Comparison of Septage and Domestic Wastewater Characteristics

Parameters	Units	Septage (See Appendix C: for full list)		Domestic Wastewater (Metcalf & Eddy, 2003; unless otherwise indicated)
		Average	Range [c]	Typical Range (Low to High Strength)
pH	NA	5.5	1.5 to 12.6	--
Biochemical Oxygen Demand (BOD)*	mg/L	6,490	165 to 78,600	110 to 350
Chemical Oxygen Demand (COD)	mg/L	36,718	181 to 703,000	250 to 800
Ammonia as N*	mg/L	168	3 to 441	12 to 45
Total Kjeldahl Nitrogen (TKN)	mg/L	588	9 to 1,060	20 to 70
Total Phosphorus*	mg/L	210	20 to 810	4.0 to 12
Phosphate as P	mg/L	25	5.4 to 60	--
Total Solids (TS)	mg/L	34,100	328 to 130,475	390 to 1,230
Total Suspended Solids (TSS)*	mg/L	12,862	76 to 93,378	120 to 400
Volatile Suspended Solids (VSS)	mg/L	9,027	95 to 51,500	95 to 315
Oil and Grease (O&G)	mg/L	5,600	208 to 82,320	50 to 100
Perfluorooctanoic acid (PFOA)*	ng/g	11	0.822 to 49.6	Non-detect [a]
Perfluorooctane sulfonate (PFOS)*	ng/g	16	1.24 to 70.8	0.003 [a]
Perfluoroalkyl substances (Sum of 6 Compounds[b])*	ng/g	26	2.23 to 85.6	0.003 [a]
Arsenic	mg/kg	4.1	0 to 8.6	--

Table 2-1. Comparison of Septage and Domestic Wastewater Characteristics				
Parameters	Units	Septage (See Appendix C: for full list)		Domestic Wastewater (Metcalf & Eddy, 2003; unless otherwise indicated)
		Average	Range [c]	Typical Range (Low to High Strength)
Cadmium	mg/kg	2.1	0.097 to 81	--
Copper	mg/kg	4.8	0.01 to 725	--
Zinc	mg/kg	10	<0.001 to 1,113	--

** Parameters with direct impacts on septage management options and POTW operations.*

[a.] Data from Sevee & Maher Engineers, Inc. and Crawford Engineers report, 2023. East Millinocket Wastewater Treatment Plant Influent, May-June 2022. Note: Samples were taken upstream of leachate addition.

[b.] Sum of perfluorooctane sulfonic acid (PFOS), perfluorooctanoic acid (PFOA), perfluorohexane sulfonic acid (PFHxS), perfluorononanoic acid (PFNA), perfluoroheptanoic acid (PFHpA) and perflurodecanoic acid (PFDA).

[c.] Non-detects shown as the reporting limit.

As observed in the results of this MassDEP study, septage consistently travels across state lines within New England for treatment, highlighting the importance of taking a holistic approach when evaluating the region. Both Vermont and Maine are part of New England, so considering the findings of these past reports provides valuable regional context. For instance, in Maine's study on septage, it was found that septage management capacity was most limited in Northern Maine where hauling distances were the longest and alternatives were the fewest (Rebodos 2023). In this case, septage transfer facilities offered the opportunity to minimize travel distance and time for individual septage haulers and reduce overall costs but also minimized logistical and operational challenges at POTWs through a more controlled transfer of septage. In Vermont, an in-depth analysis of septage generation volumes and their locations led to the identification of tailored septage management solutions for each region within the state. Similar to Northern Maine, septage production was concentrated in Northwest Vermont, but there was not sufficient POTW receiving capacity to adequately meet septage processing needs (Ma and Chouinard 2024). Therefore, the report recommended septage transfer facilities or merchant facilities in that region to increase septage processing capacity, as well as equipment and facility upgrades to bolster the region's existing septage-receiving facilities.

While it could be inferred that solutions for septage management in other New England states may be successful in Massachusetts, it is important to consider the highly localized nature of septage treatment networks. That is, if a septage hauling network has sufficient outlets, the radius of septage management for a given area should be dictated by the closest few septage-receiving facilities. However, the challenges associated with septage management may be further complicated by the day-to-day operational challenges of operating hours, accessibility, and daily acceptance, as well as broader factors such as state or local regulations and governance structures.

Section 3: Septage Surveys and Stakeholder Conversations

3.1 POTW Survey

To gather information about residuals management in and around the Commonwealth, surveys concerning residuals, incineration, septage, and landfill management were sent to POTWs and relevant facilities to gather data and operational information. This TM will discuss the results from the surveys sent to POTWs who responded and receive septage as well as the survey results from septage haulers who operate in Massachusetts.

The questions on the POTW survey were designed to capture the quantitative data of septage-receiving capacity and tipping fees as well as the qualitative description of septage management in Massachusetts. The qualitative questions were intended to capture the challenges and growth potential of the existing treatment facilities. While the POTW responses will help reveal trends in septage management overall, these values are based on self-reported survey responses and do not capture all the data regarding septage production or receiving in the Commonwealth.

The POTW Sludge Management Survey was sent to all 127 POTWs in Massachusetts. Within this first survey, POTWs who receive septage were prompted to fill out the additional Massachusetts DEP Septage Management Survey. Fifty Sludge Management Survey respondents indicated that they receive septage and forty-one of these POTWs responded to the additional Septage Management Survey request by the April 30, 2024, deadline, for an overall Septage Management Survey response rate of 82%. Notably, over half of the POTWs in Massachusetts that have a design flow of over five million gallons per day (MGD) responded to the septage survey. A list of POTW respondents to the septage survey can be found in Appendix D: . The regional distribution of the responses is outlined in Table 3-1, and the locations of the respondents is illustrated in Figure 3-1.

Table 3-1. Septage Management Survey POTW Response Totals, by Region

Region	Number of Respondents
Cape Cod and Islands	2
Central	11
Northeast	7
Southeast	11
Western	10
TOTAL	**41**

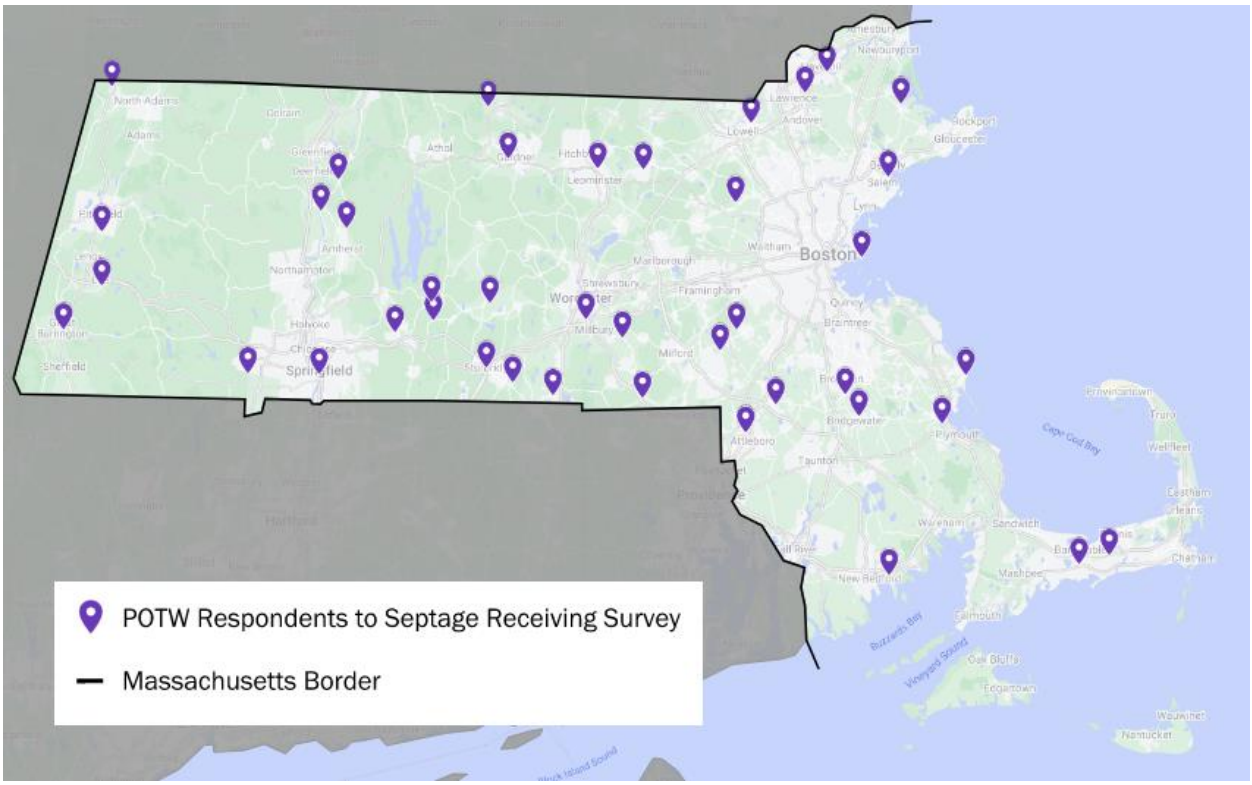

Figure 3-1. Map of POTW septage survey respondents

3.1.1 Septage-receiving Volumes

The total amount of septage received in 2023, as reported by MA POTW survey respondents, was 209.3 million gallons. This value does not take into account septage sent out-of-state and includes out- of- state septage that received/treated by MA POTWs. Additionally, this estimate is likely an underestimate of the total amount of septage both received and produced in Massachusetts due to the reliance on survey results.

Figure 3-2 illustrates how septage receiving is divided among the five regions of Massachusetts. The Northeast Region reported the largest volume of received septage followed by Cape Cod and Islands, the Southeast, and the Central regions, with the smallest volume reported by the Western region. A planning- level estimate of total septage production in Massachusetts is presented in Section 4.1.

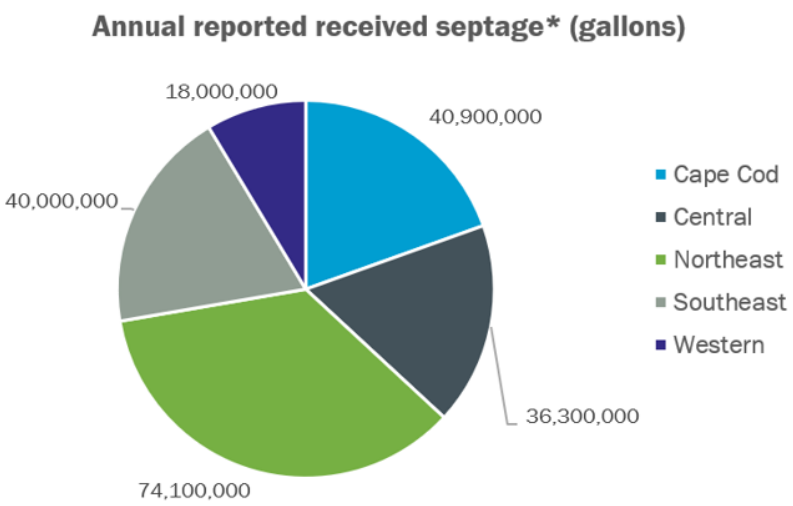

Figure 3-2. Total reported received septage, by region

**Does not include septage sent out of state for management, does include out-of-state septage treated in MA.*

The facility that reported the largest volume of received septage was the Greater Lawrence Sanitary District (GLSD) in North Andover (Northeast). The second and third largest volumes were reported by the two respondents in the Cape Cod and Islands Region: the Yarmouth Septage Treatment Facility and Barnstable Water Pollution Control Facility (WPCF). According to the Cape Cod Commission, there are 125,000 septic systems across Cape Cod, which account for about 20% of the septic systems in the Commonwealth (Cape Cod Commission 2019). The volume of septage received by each facility is illustrated in Figure 3-3, and additional information can be found in Appendix E: . More figures comparing regional septage volume received by facility can be found in Appendix F: .

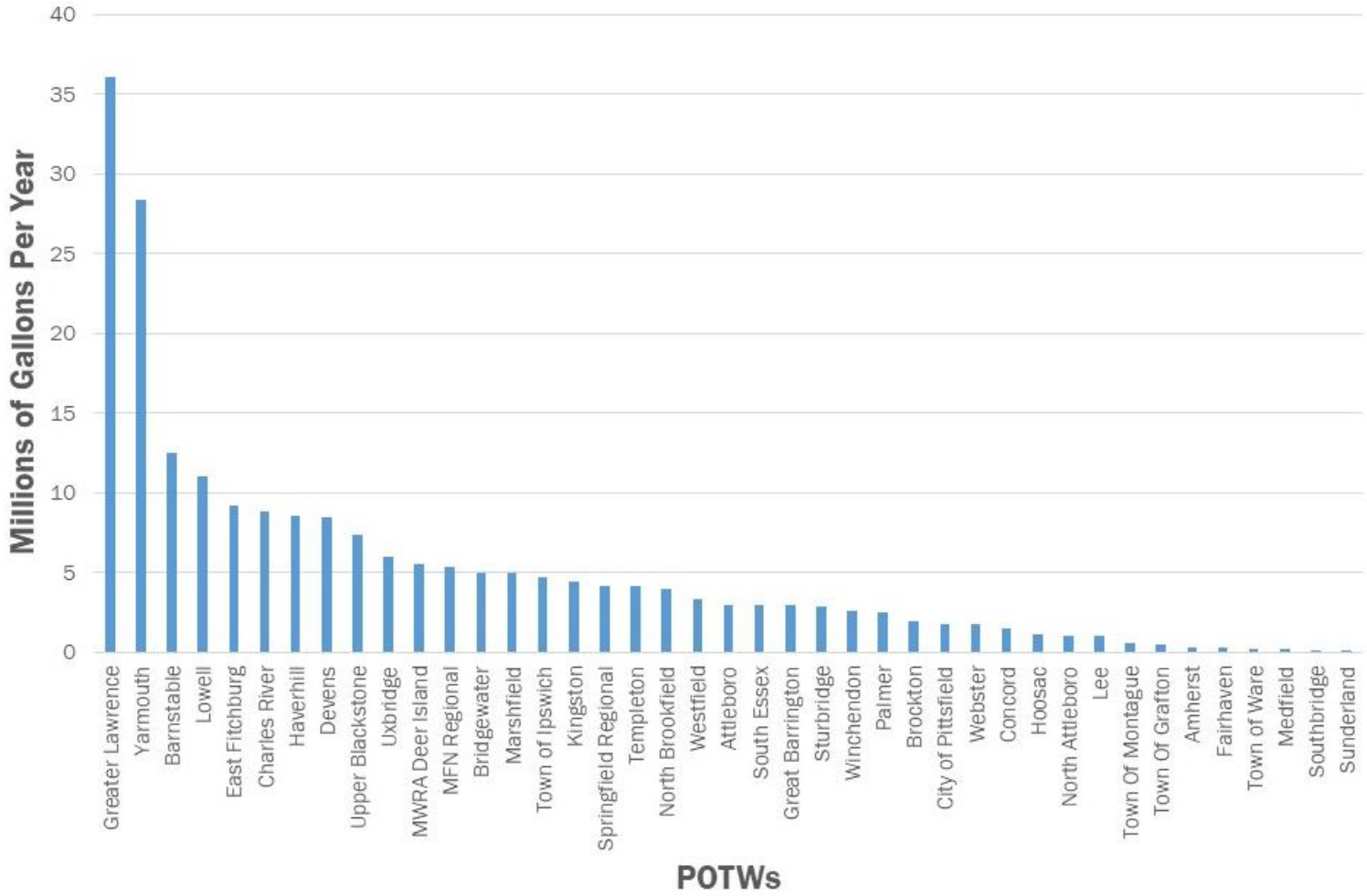

Figure 3-3. Septage received by facility, based on 2023 reported data

Forty-six percent of facilities (19 facilities) reported implementing septage-receiving limits. These limits include values for gallons per day (GPD) (seven facilities; range of 10,000 to 72,000 GPD, gallons per hauler (one facility; 10,000 gallons) and loads per hauler (one facility; three loads per week).

POTWs are also limited by the terms and conditions of their NPDES permits, which are issued by the US EPA to reduce point source contamination from wastewater treatment facilities. The NPDES permit translates the general requirements of the Clean Water Act into specific provisions tailored to the operations of each facility discharging pollutants. A POTW's NPDES permit regulates the general characterization of their effluent discharge levels including total phosphorous, total nitrogen, BOD, etc. NPDES permits in Massachusetts do not explicitly set an acceptable septage-receiving volume but, due to the higher concentration and variability of septage, many POTWs would likely fall out of compliance with their approved effluent characteristic ranges if they significantly increased their septage intake. Additionally, the NPDES permit prohibits septage receiving during periods when secondary treatment is bypassed. This rule is modified slightly for facilities who accept septage into storage tanks rather than directly into their treatment systems; in this case, facilities are prohibited from adding the septage into the waste stream during these periods but are allowed to receive it into storage tanks.

Some broad guidelines of "healthy" septage-receiving volumes include 3% of total flow or 5% of design BOD. Table 3-2 presents septage-receiving volumes as a percentage of average daily flow, However, the interpretation or implementation of septage-receiving limits derived from NPDES requirements is highly unique for each facility. These decisions would be heavily dependent on facility processes, equipment conditions, operator experience, septage storage or receiving equipment, and average flows and loads. Additionally, even if a facility does not have explicit septage-receiving limits, they may choose to functionally limit septage receiving through high tipping fees or limited operational hours. Septage-receiving volumes can also be limited by public nuisance considerations like truck traffic or odors.

Table 3-2. Percent of Average Daily Flow as Septage, in Descending Order

POTW	Average daily flow (MGD)	Annual Septage Receiving (MG/year)	% Septage of Daily Flow
Yarmouth	NA*	28.4	NA*
Kingston	0.32	4.4	3.80%
Templeton	0.32	4.2	3.60%
North Brookfield	0.40	4.0	2.74%
Barnstable	1.54	12.5	2.22%
Town of Ipswich	0.80	4.7	1.62%
Uxbridge	1.03	6.0	1.59%
Sturbridge	0.51	2.9	1.56%
Devens	1.50	8.5	1.54%
Bridgewater	1.10	5.0	1.25%
Marshfield	1.23	5.0	1.11%
Winchendon	0.78	2.6	0.91%

Table 3-2. Percent of Average Daily Flow as Septage, in Descending Order			
POTW	Average daily flow (MGD)	Annual Septage Receiving (MG/year)	% Septage of Daily Flow
Great Barrington	1.08	3.0	0.76%
MFN Regional	2.35	5.3	0.62%
Charles River	5.10	8.9	0.48%
Lee	0.70	1.0	0.39%
Palmer	1.80	2.5	0.38%
Concord	1.20	1.5	0.34%
East Fitchburg	7.70	9.2	0.33%
Greater Lawrence	32.00	36.0	0.31%
Westfield	3.85	3.3	0.23%
Town Of Montague	0.80	0.6	0.21%
Haverhill	12.00	8.6	0.20%
Attleboro	4.68	3.0	0.18%
Webster	3.10	1.8	0.16%
Town of Ware	0.60	0.2	0.11%
Sunderland	0.21	0.1	0.10%
Hoosac	3.40	1.2	0.09%
Lowell	34.00	11.0	0.09%
North Attleboro	3.75	1.0	0.07%
Town Of Grafton	2.00	0.5	0.06%
Medfield	0.90	0.2	0.06%
Upper Blackstone	34.00	7.3	0.06%
City of Pittsfield	12.10	1.8	0.04%
Brockton	16.62	2.0	0.03%
South Essex	26.00	3.0	0.03%
Springfield Regional	37.00	4.2	0.03%
Fairhaven	3.00	0.3	0.03%
Amherst	4.30	0.3	0.02%
Southbridge	2.25	0.2	0.02%
MWRA Deer Island	340.00	5.5	0.004%

**Yarmouth currently receives only septage and no sewered wastewater flow.*

While 31 facilities indicated they receive septage solely from within their sewer service area, 27 facilities exclusively receive septage from outside their sewer service area, and 18 facilities receive septage from both inside and outside their service area. Twelve percent of POTWS

(five facilities) indicated that they accept out-of-state septage: two Central POTWs (Webster Wastewater Treatment Facility (WWTF), Sturbridge WPCF, one Northeast POTW (Haverhill WWTP), and two Western POTWs (Great Barrington WWTP, Hoosac Water Quality District (WQD)). These facilities are assumed to accept out-of-state septage from the state nearest to their borders including Connecticut, New Hampshire, Rhode Island, and Vermont. POTWs reported that the typical distance that septage is hauled to them ranges five to seventy-five miles, with the most common hauling distances being five to ten miles (19 facilities) and 10 to 25 miles (16 facilities). GLSD reported a higher typical range of 25 to 50 miles.

3.1.2 Septage-receiving Operations

State-wide, one-third of POTW respondents reported that they have operational capacity to receive more septage than they typically do. This capacity is concentrated in certain regions: none in Cape Cod and Islands, one in Central, two in Northeast, four in Southeast, and seven in Western. According to respondents who provided additional capacity values, the Western region can accept at least 60,000 GPD and the Southeast can accept at least 26,000 GPD with current receiving facilities. The reported additional capacity of these facilities is summarized in Table 3-3. A table with the following information for all POTW survey respondents can be found in Appendix E: .

Table 3-3. Summary of POTW Septage Additional Capacity, Annual

Name of Wastewater Facility	City	State	Septage Received (gal)	Region	Additional Septage Capacity?	Estimated Additional Septage Capacity Volume
Sturbridge WPCF	Sturbridge	MA	2,914,433	Central	Yes	Unknown
Greater Lawrence Sanitary District	North Andover	MA	36,026,350	Northeast	Yes	Unknown
South Essex Sewerage District	Salem	MA	3,000,000	Northeast	Yes	Unknown
Brockton Advanced Water Reclamation Facility	Brockton	MA	1,968,245	Southeast	Yes	20,000 GPD
Charles River Pollution Control District	Medway	MA	8,865,000	Southeast	Yes	Unknown
Kingston WWTF	Kingston	MA	4,442,839	Southeast	Yes	2,000 GPD winter 4,500 GPD summer
Medfield WWTP	Medfield	MA	200,000	Southeast	Yes	3,000 GPD
Amherst WWTP	Amherst	MA	341,550	Western	Yes	5,000 GPD
City of Pittsfield WWTP	Pittsfield	MA	1,802,000	Western	Yes	25,000 GPD
Great Barrington WWTP	Great Barrington	MA	2,970,420	Western	Yes	15,000 GPD
Hoosac Water Quality District	Hoosac	MA	1,176,000	Western	Yes	650,000 gallons per year
Springfield Regional WWTF	Springfield	MA	4,172,842	Western	Yes	Unknown
Town Of Montague Clean Water Facility	Montague	MA	600,000	Western	Yes	One 20,000 gallon frack tank; Two 10,000-gallon storage tanks
Westfield WPCP	Westfield	MA	3,300,000	Western	Yes	10,000 - 15,000 GPD

"Unknown" indicates that a POTW reported additional capacity but did not report a specific volume for additional receiving capacity.

POTWs charge septage haulers a fee to dispose of septage at their facility. This disposal rate is called a "tipping fee" and is charged per gallon and can vary by point of origin of septage (i.e., in-district vs out- of- district; in-state vs out-of-state). The average reported septage-receiving tip fee is 13 cents per gallon, with a range of 5 cents to 66 cents per gallon and is outlined by region in Table 3-4. To estimate septage revenue to a POTW, the tip fee is multiplied by septage-receiving volume, and there is little correlation between septage revenue and facility size as receiving volumes vary widely across all facility sizes. However, it is worth mentioning that while the cost to treat septage can often be higher than the tip fee, economies of scale have been found to lower the cost of treatment at facilities that choose to invest significantly in septage-receiving capabilities.

Table 3-4. Average Septage Tipping Fees, by Region

Region	Average Tipping Fee ($/gallon)
Cape Cod and Islands	$0.11
Central	$0.11
Northeast	$0.19
Southeast	$0.11
Western	$0.13

Facilities have many restrictions on allowable septage sources; one-fifth of facilities (nine) mentioned pH limits, one-fourth of facilities (ten) mentioned regional restrictions, two prohibit portable toilet waste – Haverhill WWTP (Northeast) and Pittsfield WWTP (Western), and two facilities mention accepting industrial/commercial septage – Templeton WWTP (Central) and Town of Montague Clean Water Facility (Western). While this study did not address restaurant grease management, several facilities mentioned it during the discussion on receiving restrictions. Eleven facilities have outright bans on grease receiving. Westfield Water Pollution Control Plant (WPCP) (Western) accepts limited amounts of grease, and Barnstable WPCF (Cape Cod) only accepts grease from Barnstable, Sandwich, and Mashpee.

Overall reported receiving hours are typically Monday through Friday, starting between 7:00 and 8:00 am and ending between 2:30 and 4:00 pm. Two facilities reported 24/7 receiving hours – East Fitchburg WWTF (Central) and Lowell WWTF (Northeast). Eight facilities (20% of respondents) are open seven days a week. Seventy percent of POTWs do not coordinate with haulers before they arrive at the facility. Nine facilities coordinate with all haulers, while four haulers only sometimes coordinate with haulers in crisis events or with particularly large offload volumes. Haulers appear to drop off at any time, without clear trends. It takes haulers 20 minutes on average to empty their truck at the POTWs, with an overall reported range of 10 to 30 minutes. Seventy percent of facilities offload one hauling truck at a time (28), while one-quarter of facilities can offload two trucks (11) and two facilities can offload three trucks at one time - Yarmouth Septage Treatment Facility (Cape Cod and Islands) and Upper Blackstone Clean Water (Central).

3.1.3 Facility Operations and Equipment

Day-to-day septage receiving at facilities is limited by several factors including impacts to organic/nutrient loading and receiving limitations of staff and equipment. One facility (Webster WWTF, Central) mentioned that they have been limited by the "recent sludge disposal capacity crisis in region." Eighteen facilities (44%) indicate that nothing limits their septage receiving on a day-to-day basis. When asked about impacts to their septage receiving on a broader scale, half (21) of facilities are limited by operational impacts and one- quarter (12) indicate that nothing limits their

septage receiving (neither day-to-day, nor on a larger scale). Effects from septage receiving were mixed with over half of facilities reporting nutrient loading impacts and excessive debris and rags (24 and 22, respectively), and one-quarter reported nutrient loading impacts and excessive foam/scum (12). Seven facilities reported no observed impacts to operations. The POTWs that were surveyed are split on whether they provide septage treatment for revenue or as a service to the community; 22 report it as necessary income for operations, 26 describe it as a service to the community, and 14 indicate it as both.

Septage receiving at POTWs is predominantly through specialized areas and equipment. Most facilities (35) have dedicated septage-receiving stations and about half (23) have septage storage tanks. Facilities use a combination of processes for septage treatment. One-quarter (10) of facilities treat septage with a septage holding tank with flow equalization and pre-aeration. Over half of facilities use headworks with coarse screening and a main liquid process treatment path (24 and 22, respectively). One facility (North Brookfield WWTP, Central) uses headworks without screening.

POTWs reported that septage-receiving equipment is in fair to very good condition except for Southbridge WWTP (Central), Brockton Advanced Water Reclamation Facility (WRF) (Southeast), and Town of Montague Clean Water Facility (Western) where the conditions were reported as poor. Southbridge has no planned upgrades, while the City of Brockton is currently reviewing a proposal to repair their septage-receiving station, and the Town of Montague plans to build a new receiving station and update other facility equipment.

Seventy-five percent of facilities (31) do not anticipate any changes to their septage-receiving program in the near future. Five facilities anticipate changes such as upgrades to the system and receiving facilities – all resulting in greater capacity. Barnstable WPCF (Cape Cod) is upgrading their system/process. North Brookfield WWTP (Central) is currently under construction for a new septage-receiving station consisting of septage-receiving screen, flow meter, holding tanks, and septage pumps. Kingston WWTF (Southeast) moved from a two-tank to a three-tank sequential batch reactor and changed filtrate flow from entering the septage tanks which they anticipate will allow them to accept 2,000 – 4,500 more GPD The Town of Montague Clean Water Facility (Western) will be installing a new receiving station. Hoosac WQD (Western) is planning to rebuild to be able to receive larger trucks.

3.2 Hauler Survey

Another MassDEP Septage Management Survey was sent to septage haulers to gain insight into how septage is transported across the Commonwealth, as well as the challenges and concerns of these stakeholders. This survey was emailed to 74 haulers across the five regions of Massachusetts, from which 21 responses were received, for an overall response rate of 28%. The geographic distribution of these survey requests and responses are illustrated in Figure 3-4.

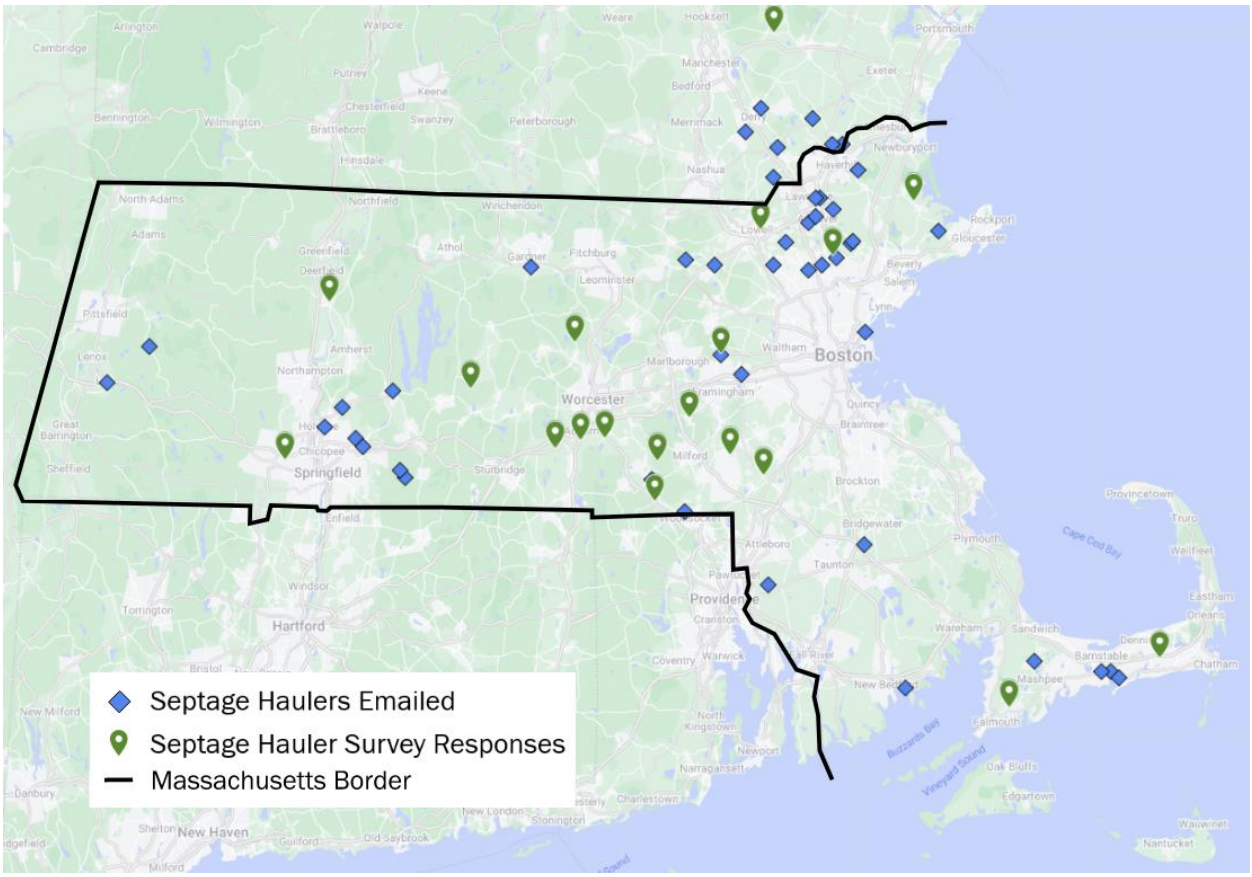

Figure 3-4. Map of septage haulers contacted and respondents

Haulers were asked about their service regions to draw regional conclusions about septage management throughout Massachusetts. Service coverage is shown in Figure 3-5. While respondents largely covered all five regions of Massachusetts, it is important to note that none of them serve Nantucket and Berkshire County as well as parts of Franklin and Hampden counties.

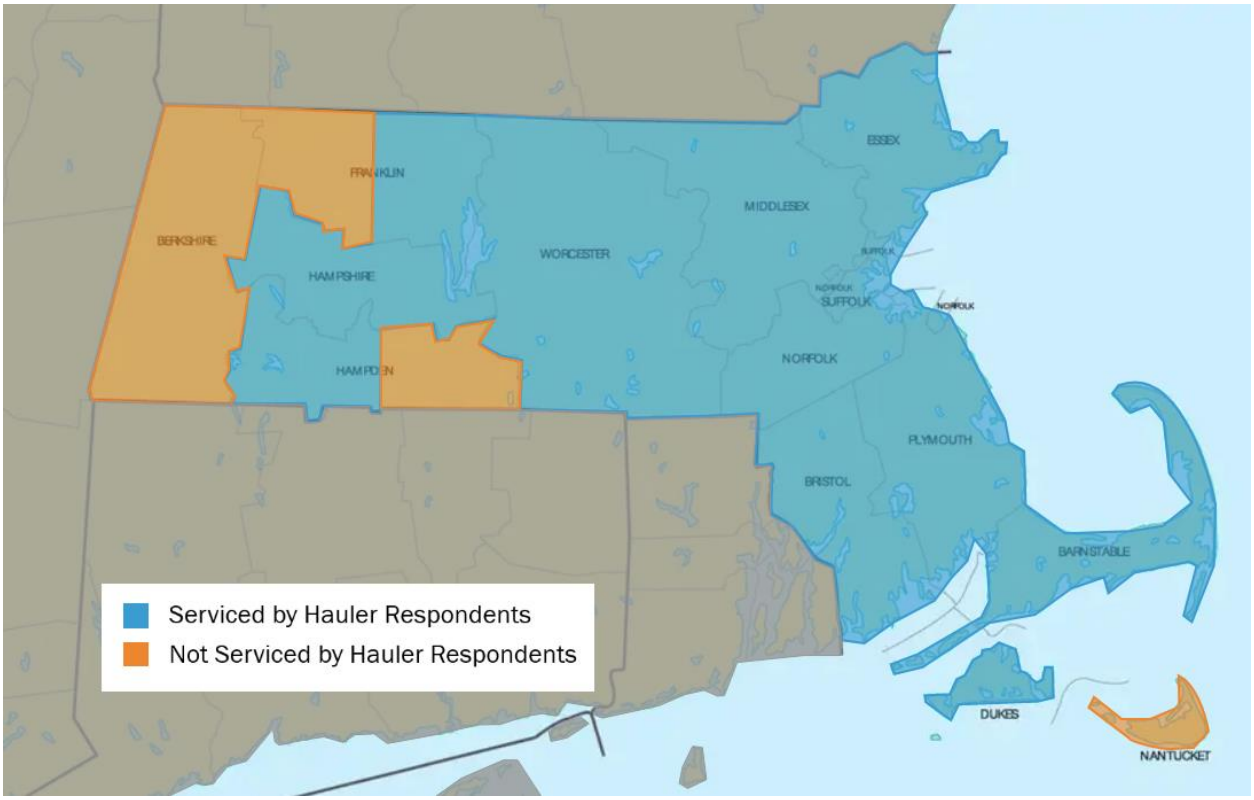

Figure 3-5. Map of hauler service regions, by county

3.2.1 Hauler Operations

The respondents collect septage from a mixture of residential (95%), commercial (76%), tight tank waste (water-tight wastewater storage tank; 71%), institutional sites (48%), campsites (24%), and portable toilet waste (19%). Only one respondent does not accept residential waste, as they only accept portable toilet waste. Ninety percent (19) of haulers operate in-state. Three haulers also operate out-of-state, with the three haulers operating in New Hampshire and one hauler (the aforementioned portable toilet hauling company) also operating in Connecticut, Rhode Island, and Southern Maine.

The number of vehicles that hauling companies usually operate ranges from one to seven, with 75% of companies normally operating three or less vehicles (Figure 3-6). The total vehicle hauling capacity of the companies ranges from 3,000 to 31,500 gallons (Figure 3-7); this value was calculated by multiplying the number of vehicles by the vehicles' reported capacities.

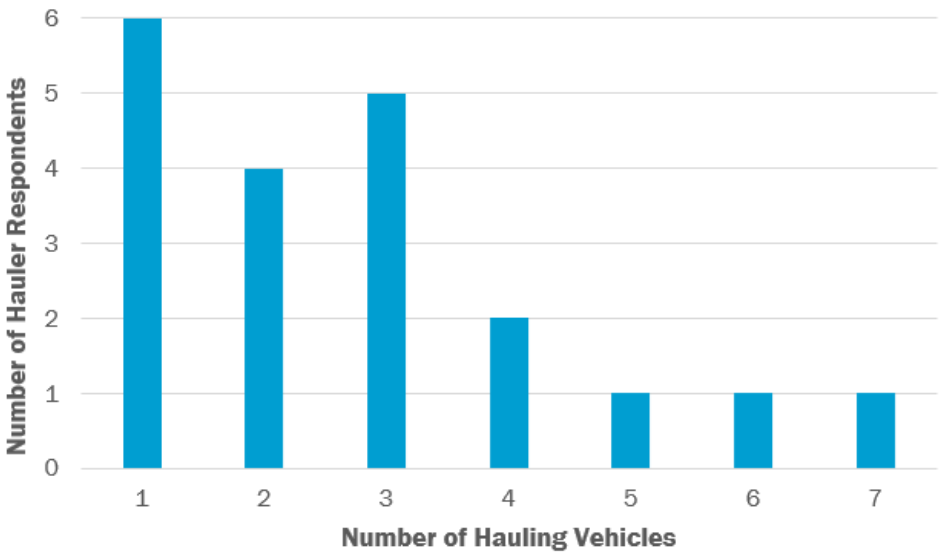

Figure 3-6. Number of hauling vehicles in operation, by company

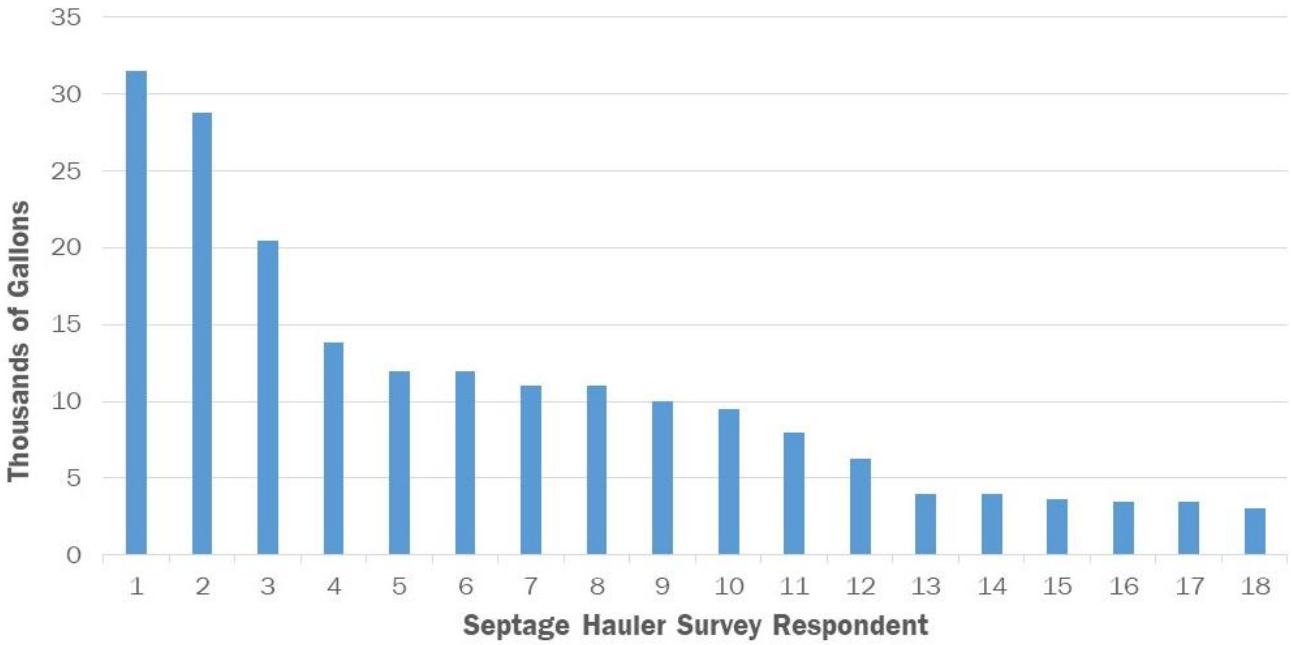

Figure 3-7. Total septage hauling capacity, by respondent

The average distance that haulers currently travel to disposal sites ranges from 3 to 60 miles, with an overall average of 17 miles. Regional averages were similar – between 10 (Cape Cod) and 20 (Southeast) miles. Half of haulers (10) report not having enough outlets for their septage disposal needs. Six of these haulers service the Central region and five service the Northeast region, indicating a need for increased septage disposal capacity in the Central and Northeast regions.

Haulers were asked how long they would be willing to wait to offload at a tipping site and the distance they would be willing to drive to a disposal site. Two-thirds (14) of haulers are not willing to

drive more than 25 miles, while one-quarter (5) are willing to drive up to 50 miles. Two haulers were willing to drive up to 75 miles to a disposal site. The tolerated offloading wait times of haulers are illustrated in Figure 3-8.

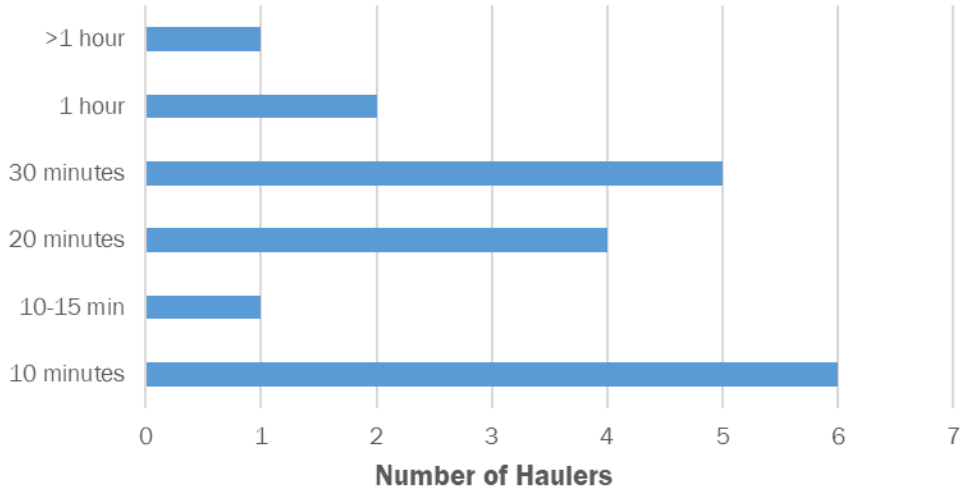

Figure 3-8. Hauler offload wait tolerance

3.2.2 Receiving Operations

In terms of cost, seven haulers stated that they would avoid using a facility if the tip fees were 12 cents to 14 cents per gallon, four haulers stated that they would avoid usage at 14 cents to 16 cents per gallon, one hauler would be willing to pay up to 20 cents per gallon of septage, while two haulers were willing to pay over 20 cents per gallon. Four haulers gave additional answers, including that they generally balance cost and travel time, would transfer whatever fee to their customers, would not pay more than 12 cents per gallon, or would ultimately pay whatever was required if they had no other feasible alternatives. However, many respondents indicated that due to the limited availability of nearby disposal sites haulers seldom choose their tipping site by any criteria other than proximity or total offloading time (driving to and offloading at POTW).

Approximately half of respondents (10) reported being turned away by a tipping site unexpectedly; the provided reasons for these incidents include facility technical malfunctions, high pH, rain events, and facility daily capacity limits. Common septage offloading issues are further outlined in Figure 3-9.

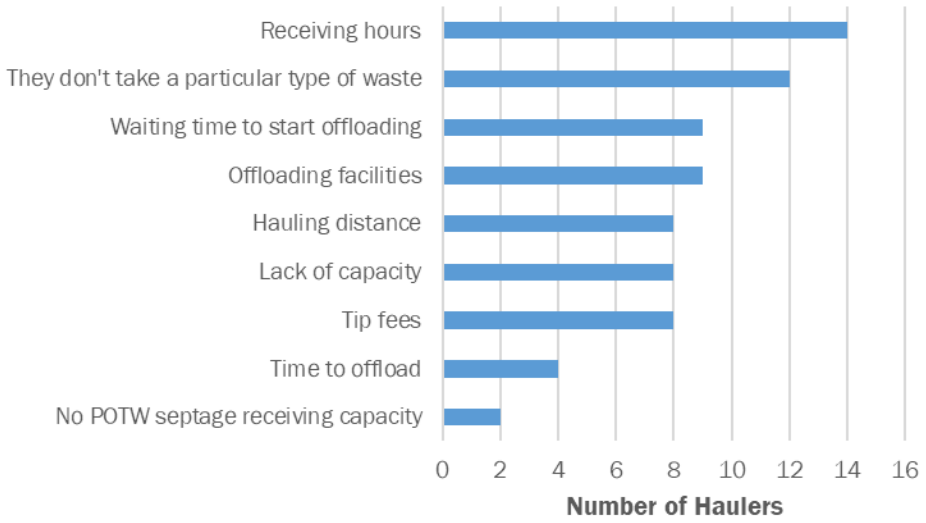

Figure 3-9. Common septage offloading issues

In the open-ended call for septage comments, haulers advocated for a variety of systemic improvements including state funding to upgrade smaller local facilities to accept septage, increased grease and portable toilet waste treatment options, and more after-hours/weekend disposal options ("emergencies happen 24/7"). Additionally, several haulers urged against reducing POTW septage receiving and expressed preferences that higher rates be negotiated instead. With higher rates, septage outlets are still available to haulers and, in turn, their customers. While the higher rates would likely be passed to their customers, this option is preferable to haulers compared to logistical and financial uncertainty of being left without any feasible options.

3.3 Takeaways

The total estimate of septage received and processed in Massachusetts by survey respondents is 209.3 million gallons per year, with POTWs in the Northeast region processing the greatest overall volume. This estimate reflects the septage that is processed within the Commonwealth for management and also includes septage from neighboring states that is processed in Massachusetts. This estimate is likely lower than the total production of septage in Massachusetts as the value is based on POTWs who chose to respond to the survey call. With this collection method, there may be POTWs who did not take the survey but receive septage that are not reflected here.

GLSD and the Yarmouth Septage Treatment Facility receive the highest volumes of septage, accounting for 30% of the total septage processed within the Commonwealth. The receiving trends of these two facilities likely reflect concentrations of septage production in those regions: an area of relatively high population density with OWTS (Northeast MA) and an area where nearly all of the population have OWTS (Cape Cod and Islands). Responses from haulers and conversations with stakeholders have indicated that Central and Northeast Massachusetts are limited in septage-receiving capacity based. Additionally, only a few POTWs in these regions indicated that they have additional septage-receiving capacity. This indicates that techniques to increase the overall volume of septage management would be valuable in the Central and Northeast regions, as the nearby POTWs do not have capacity to treat additional septage volumes.

The average tipping fee among respondents was 13 cents per gallon, though a planning-level estimate performed for a Vermont septage study found that these tipping fees are unlikely to cover

the cost to treat septage at a POTW (Ma and Chouinard 2024). Additionally, haulers indicated that two major factors in deciding offloading location are distance and time for offloading. For instance, the project team spoke with a septage hauler from Southern New Hampshire who often chooses to offload at GLSD instead of within New Hampshire. For this hauler, driving to GLSD on the weekend (since GLSD has weekend hours) took significantly less time than driving to Allenstown, New Hampshire during weekday receiving hours. Some POTWs have had success with 24/7 keycard access to the septage-receiving facilities, though the benefits depend on existing septage-receiving capabilities. Seventy percent of POTWs reported that they do not coordinate with haulers for offloading times. Yet, haulers have indicated that they have turned away on occasion due to equipment malfunction or capacity limits. In these cases, prior communication between POTWs and haulers may save time and effort for haulers. Vermont instituted an SMS text-based system to facilitate communication, though usage of the system is POTW-dependent.

One-quarter of POTWs and one-third of haulers indicated concern regarding PFAS and its effects on septage management. Of the survey respondents, those in both parties indicated concerns that connect to broader conversations surrounding residuals management in the region. Specifically, biosolids land application opportunities are already limited in New England. Depending on the nature of the federal or state guidance, PFAS regulations could exacerbate this issue by limiting application rates or reducing available acreage for land application. These types of regulations put pressure on regional incinerators for disposal, as well as on POTWs to reduce the volume of their residuals or the potential inputs of PFAS. In response, POTWs may reduce or eliminate septage receiving at their facility, leaving haulers to find outlets further away and passing the additional costs to the customer.

This sewage sludge and septage management dependency is especially evident in geographically isolated locations like Cape Cod and the islands. On Cape Cod, the vast majority of sewage sludge that leaves the area begin as septage (not from sewered wastewater) since almost the entire Cape relies on OWTS currently. Previous out-of-state land application options have been reduced due to other states' regulations, and the region currently solely relies on two to three out-of-state incinerators with aging equipment to dispose of their sewage sludge, leaving them in a very vulnerable position. However, the issues facing these locations are a representation of the broader issues throughout Massachusetts and New England broadly.

Section 4: Septage Data

Survey results and stakeholder conversations were aggregated to produce an estimate of total septage processing in Massachusetts, as well as out of state processing of Massachusetts septage.

4.1 Estimate of Total Septage Production

Estimates for total septage production are challenging due to poor data on average septage produced per person using an OWTS. In this case, septate is defined as the amount of material pumped from an OWTS, rather than the wastewater volume estimates used to design the size of an OWTS tank. From the VT septage planning study, an estimate of 130 gallons of septage per person was calculated based on septage receiving data and assumptions regarding the population of VT using OWTS. This value can vary and is solely being used to provide a general estimate for Massachusetts in lieu of more in-depth analysis. Assuming a 2023 Massachusetts population of 7,001,399 and that 28% of Massachusetts uses OWTS, a planning-level estimate of 255 million gallons of septage are produced each year (Massachusetts Population Estimates Program 2023; Beecher et al. 2018).

This estimate can be used to gain a general understanding of septage management in Massachusetts and in neighboring states. From the septage surveys, a total estimate of 209.3 million gallons of septage are processed in Massachusetts a year. However, as mentioned in Section 3, this estimate of septage processed in Massachusetts is likely an underestimate due to the reliance of survey responses to collect these data. Comparing septage production with septage-receiving values or total septage-receiving capacity estimates may offer some insight into the capacity for Massachusetts to manage its septage. However, because septage is low solids (3 to 13% total solids), its transportation and processing are highly localized, making any state-level estimate of total processing capacity a highly speculative exercise. In other words, an excess of septage-receiving capacity in Western Massachusetts will not help issues with limited septage- receiving capacity in the Northeast. Without in-depth geographic analysis of septage processing supply and demand, the results of the POTW and septage hauler surveys and stakeholder conversations were used to identify regions for further investigation.

4.2 In-state Facilities

From the septage surveys, a total estimate of 209.3 million gallons of septage are processed in Massachusetts a year. Figure 4-1 displays relative septage-receiving volumes by facility, and the data are presented in Appendix E: . Of the respondents, GLSD receives the largest volume of septage at 36 million gallons a year, while Sunderland WWTP receives the smallest amount at 81 thousand gallons a year. The legend of Figure 4-1 displays associated sizes of the largest, median, and smallest volumes for reference.

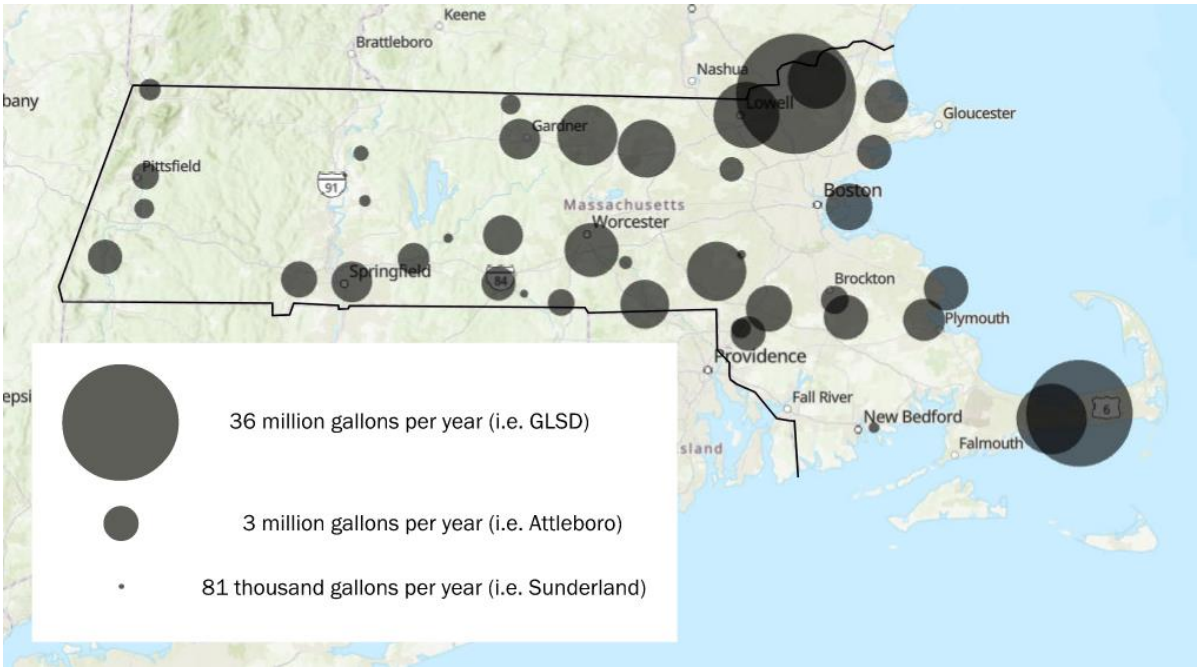

Figure 4-1. Relative septage receiving, by facility

The northeast region is responsible for receiving 35% of the Commonwealth's total in-state volumes. Cape Cod and the Islands and the Southeast each receive 19% of the Commonwealth's total septage, the Central region receives 18%, and the Westen region is only responsible for 9%. Broadly,

these trends match what has been found in other states, in which septage production is greater in areas with greater population but not close enough to be within sewer networks.

There are some cases where Massachusetts POTWs receive septage from outside the Commonwealth. For instance, Hoosac WWTF received an average of 250,000 gallons of septage from Vermont from 2019-2022. POTWs in Fitchburg, Lowell, Webster, Sturbridge, Haverhill, and Great Barrington also indicated that they receive out of state septage in their survey results, likely from Connecticut, New Hampshire, and New York. Additionally, GLSD accepts septage from several cities in southeast New Hampshire. The additional septage received is included in the receiving volumes shown above.

During the study, two non-POTW facilities within the Commonwealth were identified. Stewart's Septic Service in Bradford operates a septage receiving and treatment facility, which has an industrial pre-treatment permit to discharge to the City of Haverhill. Septage received at Stewart's is dewatered and sent to a landfill in New Hampshire. There was a septage and grease-receiving facility called Earthsource Inc. based in Raynham, which pasteurized, dewatered, and lime-treated the residuals before land application. However, this facility was plagued with odor complaints from the local area, with more than 60 complaints called into MassDEP in two years and closed in 2022. The complaints prompted MassDEP to perform inspections where storage and processing violations were found (MassInsider 2022). Since the closure of the Earthsource facilities, Stewart's appears to be the only septage-only receiving facility in Massachusetts.

4.3 Out-of-State Facilities

Several facilities outside of Massachusetts receive Massachusetts septage. Most notably, the Woonsocket WWTF and Cranston WWTF in Rhode Island receive significant amounts of both septage and sludge from the Commonwealth. Unfortunately, due to their private management, any detailed data regarding septage- receiving volumes from Massachusetts could not be shared with the project team. However, as of June 2024, the Woonsocket WWTF announced that it will begin phasing out acceptance of liquid sludge, which would include septage. From stakeholder conversations, all portable toilet waste from Gillette Stadium in Foxborough, MA is taken to the Cranston WWTF for processing.

Cape Cod also heavily relies on these out of state facilities in Rhode Island to manage septage from the region. Only around 15% of Cape Cod is on a sewer network, though there are significant efforts underway to increase this number. However, it is likely that even with sewer upgrades, a significant amount of the local and tourist population will rely on OWTS for wastewater management. The five POTWs on Cape Cod receive and process the majority of this septage produced on the Cape; thus, the majority of the sewage sludge from these five POTWs originate from OWTS and not from the sewer network. Sludge from these Cape Cod POTWS as well as pumped septage are sent to Cranston or Woonsocket based on hauling contracts, receiving capacity, and incinerator operations. If there are outages at either of these facilities, septage and solids are hauled to the incinerator at Naugatuck in Connecticut.

To the north, Massachusetts septage is occasionally processed in New Hampshire. Allenstown, New Hampshire is a major receiver of septage for New Hampshire, and takes significant amounts of portable toilet waste from Massachusetts. The Allenstown facility has a robust screening system and significant septage storage that allows the facility to trickle in septage when appropriate for operations. Approximately five million gallons of Massachusetts septage are estimated to be processed at Allenstown. Based on stakeholder conversations, septage is occasionally hauled to the

incinerator in Manchester, New Hampshire and the Hall Street WWTP in Concord, New Hampshire, which accepts domestic septage and RV waste.

No out-of-state non-POTW facilities that receive Massachusetts septage were identified. Vermont has one non-POTW septage dewatering facility in the center of the state, but it is unlikely to receive any septage from Massachusetts. New Hampshire does have several privately owned facilities that receive septage, but the POTW in Allenstown is the dominant receiver for the region and receives some Massachusetts septage. Connecticut has several incinerators that process their and the region's sludge and septage. Two of these incinerators are non-POTW facilities – Naugatuck and Waterbury. However, it was confirmed that neither of these take pumped septage from Massachusetts on a regular basis.

4.4 Future Disposal Options

Septage management in Massachusetts is served by POTWs within the Commonwealth and in the region. While septage management is closely tied to sewage sludge end-use and those concerns, transportation and processing of septage at these POTWs appears adequate for now. However, the regulatory landscape in New England is constantly shifting with many interdependencies among the states in the region. While there are not currently limits on septage receiving at POTWs in the region, there may be significant repercussions if Massachusetts or another state enact more stringent regulations. In that light, there are always opportunities to bolster septage operations and further encourage septage acceptance at POTWs.

4.4.1 Septage Projections

Due to the decentralized nature of septage regulations, data regarding septage production are very difficult to collect. However, the following data and assumptions were made to provide septage production values for 2028.

Data

- Twenty-eight percent of Massachusetts population on OWTS, approximately 1.9 million people (National Biosolids Data Project, 2018 data).
- Massachusetts population increase by an average of 0.5% each year (UMass Donahue Institute)
  - 2010 Population = 6,566,307
  - 2023 Population = 7,001,399
  - Longer data set utilized to minimize the impact of anomalous population changes from the COVID pandemic over the past several years
- Septage Management Survey estimate of total reported septage treated in Massachusetts (2023) = 209,300,000 gallons per year

Assumptions

- Massachusetts population will continue to change at a similar rate over the next five years for a projected 2.5% total increase → Projected 2028 total population of 7,176,434
- Constant OWTS population of 28%
  - Assumed 2023 OWTS Population of 1,960,392
  - Projected 2028 OWTS Population of 2,009,402
- Septage production rate of 130 gallons per person (Ma and Chouinard 2024)

These data and assumptions lead to a projected septage-receiving volume of approximately 261 million gallons (septage production rate multiplied by 2028 OWTS population), if one assumes a constant percentage of the population with OWTS.

However, there are some projects that will convert OWTS to sewer within the five-year planning period. In 2015, Governor Charlie Baker certified the Cape Cod Area Wide Water Quality Management Plan Update, also known as the 208 Plan, which was developed pursuant to Section 208 of the Clean Water Act. This update was created in response to the declining embayment water quality in Cape Cod. It is estimated that septic systems contribute 85% of the nitrogen pollution to Cape Cod coastal waters (Cape Cod Commission, 2019). This is because the sandy soil composition of Cape Cod is less effective at treating nutrients such as nitrogen. The 208 Plan framework requires all communities on Cape Cod to update their wastewater management either with the construction of sewerage networks or the implementation of alternative septic systems (which are designed to reduce pollution from contaminants like nitrogen and phosphorous).

Through this plan, many communities in Cape Cod are in the process of planning/constructing sewerage systems such as Mashpee, Falmouth, Barnstable, Orleans, Chatham, Harwich, Provincetown, Dennis, and Yarmouth. It is estimated that these projects will account for an additional 15.57 MGD of wastewater treatment capacity within the next five years, which is approximately equivalent to a 31-million-gallon reduction in septage each year, assuming a rate of 65 residential gallons per person per day. Incorporating the expected progress of Cape Cod sewer projects during the planning period, a total of 230 million gallons of septage is projected to be produced in 2028. Despite these updates and due to the long-term timelines of wastewater system planning and construction, Cape Cod POTWs will continue to process significant volumes of septage for the region for the near future.

4.4.2 Additional Future Capacity

In the survey, POTWs were asked about existing and additional septage-receiving capacity. Fourteen POTWs, mostly in the Western and Southeast regions reported having additional capacity (Table 3-3). However, several of these respondents only reported additional capacity equivalent of one or two additional septage hauling trucks per day. Five POTWs discussed upgrades to their existing operations and septage-receiving facilities that would increase receiving capacity. Several construction projects include upgrades to septage-receiving stations such as additional truck lanes or additional holding tanks, which will increase overall receiving capacity and efficiency. From these survey results, an estimated 37.5 million gallons per year of surplus septage capacity is estimated to be available throughout the Commonwealth, but mostly in the Western region of the Commonwealth. However, this is an estimate that may not be available all the time. Issues may still occur during the evening, weekends, holidays, or if a critical POTW is turning away haulers.

Septage hauling and receiving is a location-dependent network as haulers are often unwilling to drive further than 25 miles to offload septage. This means that only New York may be an option for septage outside of New England, and only for Western Massachusetts. However, survey results have indicated that Western Massachusetts does not need additional septage processing capacity beyond what they currently offer. In Eastern Massachusetts, it is most likely that Cranston, Woonsocket, Allenstown, and other outlets described earlier in this section are the most feasible for continued septage receiving outside the Commonwealth. Additionally, the land application of septage is highly limited in all states surrounding Massachusetts. Maine, Connecticut, and Rhode Island do not allow septage land application, and Vermont and New Hampshire are phasing out septage land application. Generally, this indicates that there are few additional options for septage drop-off beyond the current established locations.

4.4.3 Capacity Expansion

There are several solutions for increasing septage processing capacity within Massachusetts, depending on regional needs and resources, including new septage-receiving facilities or new equipment to increase a particular POTW's overall receiving capacity.

For example, New Hampshire recently increased on-site hauler septage storage permitted capacities from 30,000 gallons to 40,000 gallons. This accommodation allows for load consolidation and extra storage in the case of POTW outages, while not limiting a hauler's ability to continue pumping locally. Broadly speaking, additional storage either at the hauler's facility or at POTWs has the capacity to significantly improve septage transportation and treatment operations.

While the amount of septage a POTW chooses to accept is highly dependent on several factors outlined in Section 3.1.1, there are opportunities for on-site upgrades to increase septage receiving and processing capacity. An optimized receiving facility could significantly smooth operations for facility operators and haulers. This upgrade would be a septage-receiving facility that is built alongside existing septage-receiving infrastructure and has a card-reader enabled septage-receiving facility located by the POTW for off-hours receiving, additional septage storage tanks for peak shaving, and odor control. Improving receiving equipment would help increase hauler usage, while storage would allow the POTW to meter out septage processing at appropriate times for their overall operations. This option is appropriate for POTWs with sufficient hydraulic or organic capacity to process additional septage, compared to their historic receiving volumes.

A regional septage transfer facility, located separately from the POTW, could be another option for increasing septage management. A centralized transfer station could either have the same features as the optimized receiving facility described above or could also include pre-processing in the form of primary treatment and dewatering. Consolidated septage could be hauled later to a POTW for processing, while the dewatered solids would be hauled offsite or could be hauled to a digester if one with capacity and solids receiving was available. The liquid stream would be discharged through the sewer to the POTW for further treatment. Ideally, a facility like this would be on a sewer line but easily accessible from major highways for hauler drop-off. A facility like this could be publicly or privately owned. Vermont has one such facility near Route 66 run by NewTech Enviro LLC., which dewaters solids and discharges to the Randolph WWTF across the street. Additional post-dewatering processing is also an option and could include a drying system such as those provided by Sedron Technologies.

Section 5: Conclusions

At the broadest level, based on survey results and discussions with stakeholders, Massachusetts POTWs and nearby POTWs in other states can adequately process Massachusetts' current septage volumes. The average travel distance for septage haulers surveyed for this study was seventeen miles, which can be interpreted that, on average, septage haulers have a facility within a reasonable travel distance from their center of operations. However, this also demonstrates the universal fact that septage hauling and management are local to the regions where septage is produced and dependent on a tolerable radius of hauling distance. Therefore, while at the state level septage processing capacity appears to meet demand, the results from this study indicated that there are regions that lack resiliency and redundancy in case of any shock to current conditions including changing state or federal regulations, short- or long-term POTW outages, or shifts in POTW operation decisions.

The findings from this assessment are planning-level for the state as a whole, as they are based on broad survey results. To perform an actual gap analysis would require a consolidated database of septage processing data and OWTS locations. This would require a consolidated effort from local Boards of Health, POTWs, and septage haulers to report to MassDEP on a regular basis. Vermont recently completed a geographic constraint analysis of septage processing based on this type of data, allowing them to identify regions with high septage production and low septage processing capacity and quantify the discrepancy to inform potential state investment. Given the de-centralized governance structure of Massachusetts' septage authority, this would require significant coordination and investment on the part of MassDEP to gain this next level of detail.

Facilities throughout New England support the region's sludge and septage management. At least 210 million gallons of septage were reported to be treated in Massachusetts, which includes out-of-state septage that is treated within Massachusetts. GLSD and the Yarmouth Septage-Receiving Facility on Cape Cod reported the greatest amounts of septage receiving, together treating 30% of the state's septage volumes. However, GLSD receives significant amounts of out-of-state septage due to its overall capacity and flexible operating hours, while the solids from the Yarmouth Septage-Receiving facility and any other Cape Cod facilities are sent to Rhode Island for incineration. These facilities are just two points in a widely interconnected network of New England facilities that manage the region's septage.

However, because POTWs are primarily responsible for septage treatment, any pressures to POTWs in the region directly impact septage receiving at these facilities. Therefore, recent changes in regulations in Maine have significantly limited the available land for biosolids, and POTWs have had to shift their end-use programs to rely on incinerators, which are over-committed and in need of repairs and upgrades. For example, Cape Cod, which is dominated by OWTS, used to send a portion of their septage to Maine. However, as Maine is no longer an option, Cape Code must now rely on the Cranston incinerator to receive both septage pumped from tanks as well as sewage sludge made from septage at Cape Cod POTWs. The Woonsocket incinerator had been a backup option for when Cranston's incinerator was offline, but now Woonsocket has announced their plan to shift to dewatered solids receiving only. That leaves Cranston's incinerator as Cape Cod's only reliable outlet for septage or sludge management. In survey responses, POTWs reported that they are feeling the strain of limited outlets for sludge discharge and if sewage sludge end-use options continue to decrease due to new regulations, they may be forced to stop receiving septage as a way of reducing their solids as well as potential sources of regulated contaminants. In turn, septage haulers will have to travel farther to find outlets, and these transportation costs will be passed down to customers. In extreme cases, this may lead to increased time between pump outs and an increased risk of OWTS failure as a result. Cape Cod's struggles are a heightened reflection of what may happen to other vulnerable parts of Massachusetts and demonstrate the relationship between septage and sludge management.

The results of this planning-level study indicate that the Northeast region and the Central region of Massachusetts are the most vulnerable areas besides Cape Cod and the Islands. From survey results, these regions reported minimal amounts of surplus septage processing capacity and sometimes rely on out-of-state POTWs to process septage. Again, since septage management becomes a local issue, the large amounts of surplus septage capacity in Western Massachusetts reported by survey respondents will do little to offset the need in the East. Additionally, several haulers who operate in those vulnerable regions reported not having enough sites for offloading. Even across the Commonwealth, half of the facilities are limited in their ability to receive septage by the significant operational impacts of treating septage, further restricting surplus capacity in the state. While the septage management situation is not as dire as Cape Cod, the Central and

Northeast regions would especially benefit from additional septage processing capacity to ensure consistent septage offloading locations, as well as to add buffer capacity in case of POTW wastewater processing or incinerator outages.

There are several options for bolstering septage management in the Commonwealth such as additional storage on hauler sites or at POTWs to add operational flexibility. Other options include septage transfer stations, improvements to septage-receiving facilities at POTWs such as card-readers, additional receiving lanes, or expanded hours, and regional septage-receiving facilities with some form of primary treatment and dewatering. Ultimately, these solutions serve as options to improve septage hauling and receiving throughout the Commonwealth. However, these solutions do not directly address a POTW's decision to receive and process septage at all. The incentives for POTWs to receive septage and in what quantities are driven by broader techno-economic decisions that include biosolids end-use outlet security. Thus, ensuring both consistent and backup end-use options for sludge from POTWs within the state will best alleviate pressures that trickle down and impact septage processing.

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Appendix A: Septage Survey Questions for POTWs and Septage Haulers

Massachusetts DEP Septage Management Survey (POTW)

Purpose: Thank you for taking the time to answer this survey from the Department of Environmental Protection. By completing this survey, you will be helping Massachusetts and its consultants, Tighe & Bond and Brown and Caldwell, to develop a state-wide strategy for how Massachusetts manages sludge and biosolids. This survey will be used for information only and will not be used for compliance.

For the purposes of this planning project: Septage is defined as the liquid, solid, and semi-solid contents of privies, chemical toilets, cesspools, holding tanks, or other sewage waste receptacles.

Instructions: The survey cannot be saved and must be completed in one sitting. It will take approximately 15 minutes to complete. Please follow instructions carefully.

- Provide data from 2023.
- Contact us if you wish to edit your responses.
- Your identity and contact information will not be shared and will only be used for essential follow-up. The information you provide will contribute to a publicly available report for MassDEP.

Before you start: Please have the following information handy:

- Septage hauler agreements/contracts
- Septage pumping records

Please contact Persephone Ma (pma@brwncald.com or (773) 943-7583) with any questions or comments.

* Required

General POTW Information

1. Name of Wastewater Facility *

2. Contact Name *

3. Job Title *

4. Email and Phone Number *

Septage Receiving

Questions? Email pma@brwncald.com.

5. How much septage (in gallons) does your facility receive per year? *

6. Does your facility have any quantity limits for septage receiving? (E.g. gallons per day) *
If "Yes," please specify in the "Other" field.

- [ ] Yes
- [ ] No
- [ ] Other

7. Where does your septage usually come from? *
Select all that apply.

- [ ] Inside your sewer service area
- [ ] Outside your sewer service area
- [ ] Out of state
- [ ] Other

8. What's the typical distance that septage is hauled to you? *

- ◯ 5-10 miles
- ◯ 10-25 miles
- ◯ 25-50 miles
- ◯ 50-75 miles
- ◯ >75 miles
- ◯ Other

9. Do you have operational capacity to receive more septage than you currently/typically do? *

- ◯ Yes
- ◯ No
- ◯ Other

10. If so, how much more?
E.g. gallons/day, gallons/week

11. Please list the septage haulers who drop off at your facility. (Most common or on approved list) *
Or, please email your approved hauler list to pma@brwncald.com.

12. Do septage haulers need to be pre-approved or have a contract with your facility prior to offloading contents? *

- ◯ Yes
- ◯ No
- ◯ Other

13. What are your septage receiving tip fees ($/gallon)? *

If there are different rates for different waste types (residential, commercial, portable toilets) or sources (in-town/out-of-town), please indicate.

14. Does your facility have any restrictions for dropping off septage, based on the source? *

E.g., Out of town sources prohibited, certain septage sources prohibited

15. What are your typical septage receiving days? *

- ☐ Sundays
- ☐ Mondays
- ☐ Tuesdays
- ☐ Wednesdays
- ☐ Thursdays
- ☐ Fridays
- ☐ Saturdays

16. What are your septage receiving hours? *

- ☐ Before 8am
- ☐ 8-11am
- ☐ 11am-1pm
- ☐ 1-4pm
- ☐ After 4pm
- ☐ Other

17. When do haulers typically offload? *

- ☐ Before 8am
- ☐ 8-11am
- ☐ 11am-1pm
- ☐ 1-4pm
- ☐ After 4pm
- ☐ Other

18. Do you coordinate with septage haulers before they arrive?
E.g. Texts or calls from haulers to check availability or capacity

- ◯ Yes
- ◯ No
- ◯ Other

19. How long does it take, on average, to empty a septage truck at your POTW? *

- ◯ 10 minutes
- ◯ 20 minutes
- ◯ 30 minutes
- ◯ 40 minutes
- ◯ 50 minutes
- ◯ Other

20. What is the maximum number of trucks that can offload at a time? *

- ◯ One
- ◯ Two
- ◯ Three
- ◯ Four
- ◯ Five
- ◯ Other

Impacts from Septage Receiving

Questions? Email pma@brwncald.com.

21. What kinds of impacts have you seen to your operation because of septage receiving? *
Select all that apply.

- [ ] Impacts to organics loading
- [ ] Impacts to nutrient loading
- [ ] Excessive foam/scum
- [ ] Excessive ragging
- [ ] Other

22. What types of things have limited your ability to receive septage on a day-to-day basis? *
Select all that apply.

- [ ] Impacts to organics loading
- [ ] Impacts to nutrient loading
- [ ] Receiving limitations - staff
- [ ] Receiving limitations - equipment
- [ ] Nothing
- [ ] Other

23. What types of things have limited your ability to receive septage on a broader scale? *
Select all that apply.

- [ ] Odor concerns
- [ ] Ease of access for haulers (e.g., proximity to highway or small roads to the WWTP)
- [ ] Operational impacts
- [ ] Community concerns
- [ ] Nothing
- [ ] Other

24. Please elaborate on the previous question.

25. Is septage receiving a necessary income source for the operation of the POTW? Or does the POTW accept septage as a service to the community? *

- [ ] Necessary income source
- [ ] Service to the community
- [ ] Other

26. Do you anticipate any changes to your septage receiving program in the near future? *

- ◯ Yes
- ◯ No
- ◯ Maybe

27. If yes or maybe, please elaborate.

28. Do you have any PFAS concerns with septage receiving? *

Current Septage Treatment Assets

Questions? Email pma@brwncald.com.

29. What equipment is involved in your septage receiving process? *

Select all that apply.

- [ ] Dedicated receiving station
- [ ] Septage storage tank
- [ ] Metering
- [ ] Manhole/no dedicated receiving station
- [ ] Collection system receiving upstream of POTW
- [ ] Other

30. Please select the processes that your facility uses to treat septage (process flow from receipt to discharge) *

- [ ] Main liquid process treatment path
- [ ] Headworks without screening
- [ ] Headworks with coarse screening
- [ ] Dewatering only
- [ ] Septage holding tank with flow equalization and pre-aeration
- [ ] Other

31. What is the condition of the septage-receiving equipment? *

- ◯ Very good
- ◯ Good
- ◯ Fair
- ◯ Poor

32. Do you have any planned upgrades designed to address septage receiving or processing?

- ◯ Yes
- ◯ No
- ◯ Other

33. If yes, please elaborate and provide an estimate of capital costs if available.

Thank you!

Thanks so much for your time and effort in completing this survey.

34. Would you be willing to provide any additional supporting data (E.g., septage receiving records)?

    If so, please email records to pma@brwncald.com or leave a note here and a member of the team will reach out to you.

35. Is there anything else you would like us to know regarding septage in the state of Massachusetts?

    This can include suggestions for improvement. Feedback is welcome.

Massachusetts DEP Septage Management Survey (Haulers)

Purpose: Thank you for taking the time to answer this survey from the Department of Environmental Protection. By completing this survey, you will be helping Massachusetts and its consultants, Tighe & Bond and Brown and Caldwell, to develop a state-wide strategy for how Massachusetts manages sludge and biosolids. This survey will be used for information only and will not be used for compliance.

Instructions: The survey cannot be saved and must be completed in one sitting. It will take approximately 15 minutes to complete. Please follow instructions carefully.

- Provide data from 2023.
- Contact us if you wish to edit your responses.
- Your identity and contact information will not be shared and will only be used for essential follow-up. The information you provide will contribute to a publicly available report for MassDEP.

Please contact Persephone Ma (pma@brwncald.com or (773) 943-7583) with any questions or comments.

* Required

1. Company Name *

2. First and Last Name *

3. What town(s) do you service? *

4. What types of facilities do you collect septage from? *

Select all that apply.

- [ ] Residential
- [ ] Commercial
- [ ] Portable Toilet Waste
- [ ] Campsites
- [ ] Institutional Sites (e.g., hospitals, schools)
- [ ] Tight Tank Waste
- [ ] Other

5. What is the service cost to septic tank owners?

6. Which regions do you service? *

E.g., Counties, parts of counties; Select all that apply.

- [ ] North Berkshire
- [ ] South Berkshire
- [ ] West Franklin
- [ ] East Franklin
- [ ] West Hampshire
- [ ] East Hampshire
- [ ] West Hampden
- [ ] East Hampden
- [ ] North Worcester
- [ ] South Worcester
- [ ] North Middlesex
- [ ] South Middlesex
- [ ] North Essex
- [ ] South Essex
- [ ] Suffolk
- [ ] West Norfolk
- [ ] East Norfolk
- [ ] North Bristol
- [ ] South Bristol
- [ ] North Plymouth
- [ ] South Plymouth
- [ ] Barnstable
- [ ] Dukes
- [ ] Nantucket
- [ ] Out of state, please indicate where in "Other" below.
- [ ] Other

7. When do you pump out and haul septage? *

Select all that apply.

- [ ] Spring
- [ ] Summer
- [ ] Winter
- [ ] Fall
- [ ] All the same
- [ ] Other

8. On average, how much septage do you pump a week (gallons)? If it is seasonal, please indicate by season. *

9. On average, how many sites do you service a week? If it is seasonal, please indicate by season. *

10. How many septage hauling vehicles does your company normally operate?

11. What capacities are your septage trucks? (gallons)

12. On average, what distances do you travel to dispose of your septage? (miles) *

13. Do you have enough outlets to meet your hauling needs? *

- ◯ Yes
- ◯ No
- ◯ Other

14. At which types of facilities do you usually offload your septage? *

Select all that apply.

- ☐ In-state wastewater treatment
- ☐ Out-of-state wastewater treatment
- ☐ High strength waste receiving (food waste or FOG receiving)
- ☐ Septage-only receiving
- ☐ Other

15. Please include the names of the facilities where you normally offload. *

16. What are the most common issues you run into when offloading septage? *

Select all that apply.

- [ ] Receiving hours
- [ ] Tip fees
- [ ] Lack of capacity
- [ ] They don't take a particular type of waste
- [ ] Offloading facilities (E.g., only one receiving lane, hard to use facilities)
- [ ] Hauling distance
- [ ] Waiting time to start offloading
- [ ] Time to offload
- [ ] No POTW septage receiving capacity on arrival
- [ ] Other

17. At what cost would you avoid using a septage receiving facility? (ex. WWTP) *

- ◯ 10-12 cents/gallon
- ◯ 12-14 cents/gallon
- ◯ 14-16 cents/gallon
- ◯ 16-18 cents/gallon
- ◯ 18-20 cents/gallon
- ◯ >20 cents/gallon
- ◯ Other

18. What is the longest you would you wait to offload? *

- ◯ 10 minutes
- ◯ 20 minutes
- ◯ 30 minutes
- ◯ 40 minutes
- ◯ An hour
- ◯ Other

19. How far are you willing to drive to dispose of septage? *

- ◯ 1-25 miles
- ◯ 25-50 miles
- ◯ 50-75 miles
- ◯ 75-100 miles
- ◯ >100 miles
- ◯ Other

20. Have you ever been turned away from a tipping site unexpectedly? *

- ◯ Yes
- ◯ No

21. Please explain what happened, when it happened, and how long it was before you could return to offload.

22. Do you have any concerns about PFAS affecting your septic hauling business?

23. Anything else you would like us to know regarding septage in Massachusetts?
This can include suggestions for improvement. Feedback is welcome.

24. Would you be willing to be contacted by the team to share additional information or thoughts about septage management in Massachusetts?
If so, please enter your email below.

Appendix B: List of Septage Stakeholders

Table B-1. Septage Stakeholders	
Contact Name	**Organization**
Anthony Drouin	New Hampshire Department of Environmental Services
Bradley Furlon	Hoosac Water Quality District
David Robbins	Cranston POTW / Veolia
David Bernier	Yarmouth Septage Facility / Weston and Sampson
Ed Miles	Robert B Our Company
George Heufelder	Massachusetts Alternative Septic System Test Center
James Wilusz	Tri-Town Health Department
Janine Burke-Wells	New England Biosolids and Residuals Association
Jerry Becker	Becker Hauling

Appendix C: Septage Quantity and Quality Data

Septage Characterization

Table C-1 presents detailed septage characterization and list of references. Of particular interest are parameters that may have direct implication on septage treatment and/or management options. These include general parameters (pH, alkalinity, conductivity) organics concentration (biochemical oxygen demand [BOD]) and chemical oxygen demand (COD), solids content (total suspended solids (TSS) and total solids [TS]), and nutrient levels (nitrogen and phosphorus concentrations), PFAS, and metals. In addition, the range of septage values for each parameter are relatively wide, indicating variability in septage characteristics.

Note: One of the septage samples from the Environmental and Geographic Analysis Database (EGAD) database (Reference three in Table C-1) had significantly higher PFAS concentrations than the other samples, possibly indicating that the sample may not be solely from domestic septage. The sample was included in the range, however, to show all septage data obtained from the database at the specified time.

Table C-1. Typical Septage Characteristics														
Parameters	Units	Reference 1			Reference 2	Reference 3	Reference 4	Reference 5	Reference 6			Reference 7	Average	Observed Range
		Min	Average	Max					Min	Average	Max			
Alkalinity	mg/L	--	--	--	--	--	--	--	522	970	4,190	--	970	522 to 4,190
Conductivity	us/cm	2,230	3,400	5,920	--	--	--	--	--	--	--	--	3,400	2,230 to 5,920
pH	s.u.	6.9	7.3	7.7	6.9 to 7.5	--	--	--	1.5	--	12.6	--	5.5	1.5 to 12.6
Biochemical Oxygen Demand (BOD)	mg/L	--	--	--	165 to 1,107	--	--	--	440	6,480	78,600	--	6,490	165 to 78,600
Chemical Oxygen Demand (COD)	mg/L	20,020	46,255	60,763	181 to 9,315	--	--	--	1,500	31,900	703,000	--	36,718	181 to 703,000
Ammonia as N	mg/L	175	308	441	5 to 155	--	--	--	3	97	116	--	168	3 to 441
Total Kjeldahl Nitrogen (TKN)	mg/L	--	--	--	9 to 525	--	--		66	588	1,060	--	588	9 to 1,060
Total Phosphorus	mg/L	469	606	810	--	--	--	--	20	210	760	--	210	20 to 810
Phosphate as P	mg/L	36	48	60	5.4 to 24.2	--	--	--	--	--	--	--	25	5.4 to 60
Total Solids (TS)	mg/L	--	--	--	328 to 23,028	213,000	23,900	18,700	1,132	34,106	130,475	--	34,100	328 to 130,475
Total Suspended Solids (TSS)	mg/L	6,704	26,955	45,020	76 to 13,444	--	--	--	310	12,862	93,378	--	12,862	76 to 93,378
Volatile Suspended Solids (VSS)	mg/L	--	--	--	212 to 11556	--	--	--	95	9,027	51,500	--	9,027	95 to 51,500
Oil and Grease (O&G)	mg/L	--	--	--	264 to 82,320	--	--		208	5,600	23,368	--	5,600	208 to 82,320
Arsenic	mg/kg	--	--	--	--	--	7.56	8.6	0.0	0.141	3.5	--	4.1	0 to 8.6
Cadmium	mg/kg	--	--	--	--	--	5.34	2.75	0.005	0.097	81	--	2.1	0.097 to 81
Copper	mg/kg	--	--	--	--	--	725	500	0.010	4.84	261	--	4.8	0.01 to 725
Zinc	mg/kg	--	--	--	--	--	1,113	912	<0.001	9.97	444	--	10	<0.001 to 1,113
Hydrogen Sulfide (H_2S)	mg/L	--	--	--	52 to 79	--	--	--	--	--	--	--	66	52 to 79
Sulfate	mg/L	--	--	--	33 to 738	--	--	--	--	--	--	--	386	33 to 738
Total PFOA	ng/g	--	--	--	--	7.252	--	--	--	--	--	11.2	11	0.822 to 49.6
Total PFOS	ng/g	--	--	--	--	3.1	--	--	--	--	--	16.4	16	1.24 to 70.8
Perfluoroalkyl substances (Sum of 6 Compounds)	ng/g												26	2.23 to 85.6

Note: Non-detects are shown as the reporting limit

1. Troesch, S., Lienard, A., Molle, P., Merlin, G. and Esser, D., 2009. Treatment of septage in sludge drying reed beds: a case study on pilot-scale beds. Water Science and Technology, 60(3), pp.643-653.

2. Al-Sa'ed, R.M. and Hithnawi, T.M., 2006. Domestic septage characteristics and co-treatment impacts on Albireh wastewater treatment plant efficiency. Dirasat: Engineering Sciences, 33(2), pp.187-198.

3. Regional Facilities in Maine (Maine Department of Environmental Protection, EGAD (Environmental and Geographic Analysis Database), https://www.maine.gov/dep/maps-data/egad/March 3rd, 2023).

4 & 5. Kelley, E. and Twohig, E., 2018. Wastewater Treatment Sludge and Septage Management in Vermont. Vermont Department of Environmental Conservation (https://dec.vermont.gov/sites/dec/files/wmp/residual/RMSWhitePaper20180507.pdf)

6. USEPA, 2018. https://www.epa.gov/sites/default/files/2018-11/documents/guide-septage-treatment-disposal.pdf

7. Data obtained from report provided by Maine DEP, 2023, (https://www.maine.gov/dep/maps-data/egad/June 2023) using only septage samples.

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Appendix D: List of Survey Respondents

Table D-1. POTW Survey Respondents, By Region			
Region	Name of Wastewater Facility	Region	Name of Wastewater Facility
Cape Cod and Islands	Barnstable WPCF	Southeast	Attleboro WWTF
Cape Cod and Islands	Yarmouth Septage Treatment Facility	Southeast	Bridgewater Sewer Dept
Central	East Fitchburg WWTF	Southeast	Brockton Advanced Water Reclamation Facility
Central	North Brookfield WWTP	Southeast	Charles River Pollution Control District
Central	Southbridge WWTP	Southeast	Fairhaven Sewer Dept
Central	Sturbridge WPCF	Southeast	Kingston WWTF
Central	Templeton WWTF	Southeast	Marshfield WWTF
Central	Town Of Grafton WWTF	Southeast	Medfield WWTP
Central	Town of Ware WPCP	Southeast	MFN Regional Wastewater District
Central	Upper Blackstone Clean Water	Southeast	North Attleboro WWTF
Central	Uxbridge WWTF	Southeast	Town of Ipswich WWTP
Central	Webster WWTF	Western	Amherst WWTP
Central	Winchendon WPCF	Western	City of Pittsfield WWTP
Northeast	Concord WWTP	Western	Great Barrington WWTP
Northeast	Devens POTW	Western	Hoosac Water Quality District
Northeast	Greater Lawrence Sanitary District	Western	Lee, MA WWTP
Northeast	Haverhill WWTP	Western	Palmer Wastewater
Northeast	Lowell MA WWTF	Western	Springfield Regional WWTF
Northeast	MWRA Deer Island WWTF	Western	Sunderland WWTP
Northeast	South Essex Sewerage District	Western	Town Of Montague Clean Water Facility
		Western	Westfield WPCP

Appendix E: Septage Volume Received, by Facility

Table E-1. Summary of POTW Septage Receiving, Annual						
Name of Wastewater Facility	City	State	Septage Received (gal)	Region	Additional Septage Capacity?	Estimated Additional Septage Capacity Volume
Barnstable WPCF	Barnstable	MA	12,500,000	Cape Cod and Islands	No	-
Yarmouth Septage Treatment Facility	Yarmouth	MA	28,400,000	Cape Cod and Islands	No	-
East Fitchburg WWTF	East Fitchburg	MA	9,200,724	Central	No	-
North Brookfield WWTP	North Brookfield	MA	4,000,000	Central	No	-
Southbridge WWTP	Southbridge	MA	170,000	Central	No	-
Sturbridge WPCF	Sturbridge	MA	2,914,433	Central	Yes	Unknown
Templeton WWTF	Templeton	MA	4,160,900	Central	No	-
Town Of Grafton WWTF	Grafton	MA	450,000	Central	No	-
Town of Ware WPCP	Ware	MA	230,000	Central	No	-
Upper Blackstone Clean Water	Millbury	MA	7,344,970	Central	No	-
Uxbridge WWTF	Uxbridge	MA	6,000,000	Central	No	-
Webster WWTF	Webster	MA	1,800,000	Central	No	-
Winchendon WPCF	Winchendon	MA	1,000,000	Central	No	-
Concord WWTP	Concord	MA	1,500,000	Northeast	No	-
Devens POTW	Devens	MA	8,458,000	Northeast	No	-
Greater Lawrence Sanitary District	North Andover	MA	36,026,350	Northeast	Yes	Unknown
Haverhill WWTP	Haverhill	MA	8,600,000	Northeast	No	-
Lowell MA WWTF	Lowell	MA	11,000,000	Northeast	No	-
MWRA Deer Island WWTF	MWRA	MA	5,500,000	Northeast	N/A	-
South Essex Sewerage District	Salem	MA	3,000,000	Northeast	Yes	Unknown
Attleboro WWTF	Attleboro	MA	3,000,000	Southeast	No	-
Bridgewater Sewer Dept	Bridgewater	MA	5,000,000	Southeast	No	-
Brockton Advanced Water Reclamation Facility	Brockton	MA	1,968,245	Southeast	Yes	20,000 GPD
Charles River Pollution Control District	Medway	MA	8,865,000	Southeast	Yes	Unknown
Fairhaven Sewer Dept	Fairhaven	MA	300,000	Southeast	No	-
Kingston WWTF	Kingston	MA	4,442,839	Southeast	Yes	2000 GPD winter 4500 GPD summer
Marshfield WWTF	Marshfield	MA	4,976,000	Southeast	No	-
Medfield WWTP	Medfield	MA	200,000	Southeast	Yes	3000 GPD

Table E-1. Summary of POTW Septage Receiving, Annual						
Name of Wastewater Facility	City	State	Septage Received (gal)	Region	Additional Septage Capacity?	Estimated Additional Septage Capacity Volume
MFN Regional Wastewater District	Mansfield	MA	5,349,300	Southeast	No	-
North Attleboro WWTF	North Attleboro	MA	1,015,000	Southeast	No	-
Town of Ipswich WWTP	Ipswich	MA	4,737,577	Southeast	No	-
Amherst WWTP	Amherst	MA	341,550	Western	Yes	5,000 GPD
City of Pittsfield WWTP	Pittsfield	MA	1,802,000	Western	Yes	25,000 GPD
Great Barrington WWTP	Great Barrington	MA	2,970,420	Western	Yes	15,000 GPD
Hoosac Water Quality District	Hoosac	MA	1,176,000	Western	Yes	650,000 gallons per year
Lee, MA WWTP	Lee	MA	1,000,000	Western	No	-
Palmer Wastewater	Palmer	MA	2,516,820	Western	No	-
Springfield Regional WWTF	Springfield	MA	4,172,842	Western	Yes	Unknown
Sunderland WWTP	Sunderland	MA	81,082	Western	No	-
Town Of Montague Clean Water Facility	Montague	MA	600,000	Western	Yes	One 20,000-gallon frac tank and two 10,000-gallon storage tanks
Westfield WPCP	Westfield	MA	3,300,000	Western	Yes	10,000 - 15,000 GPD

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Appendix F: Septage Volume Received, by Region

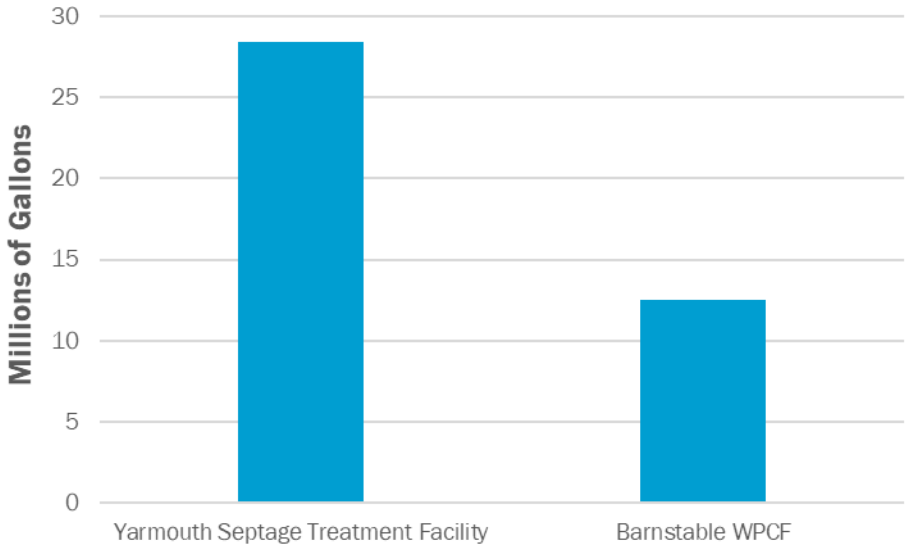

Figure F-1. Septage volume received - Cape Cod and Islands

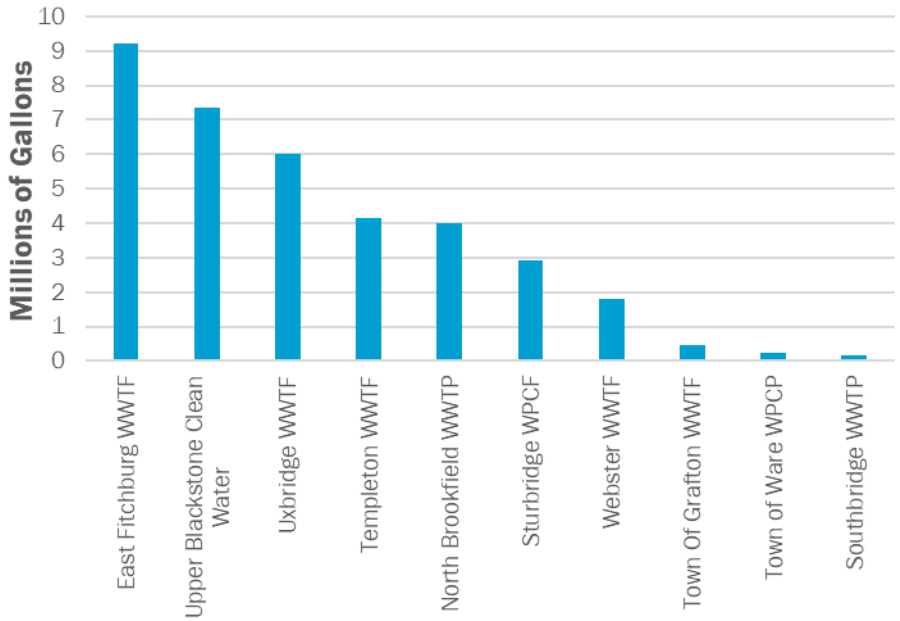

Figure F-2. Septage volume received - Central

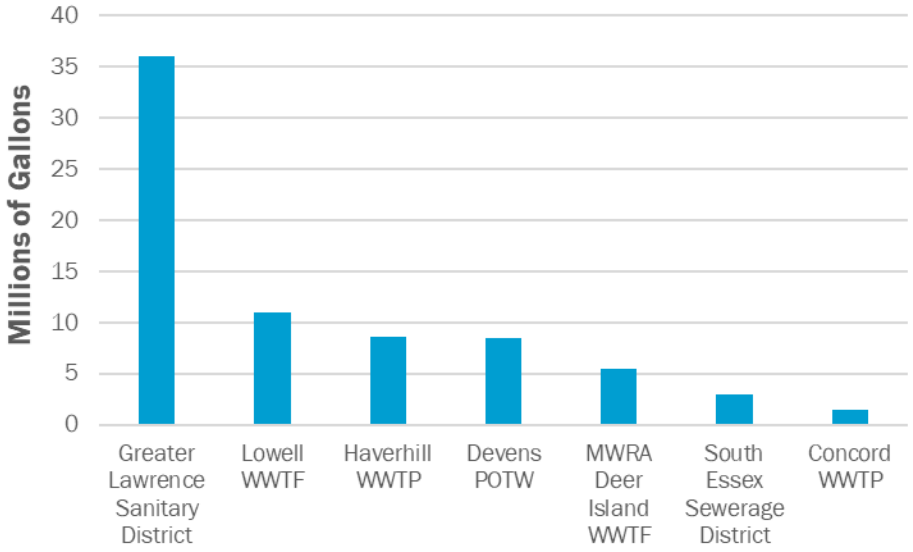

Figure F-3. Septage volume received - Northeast

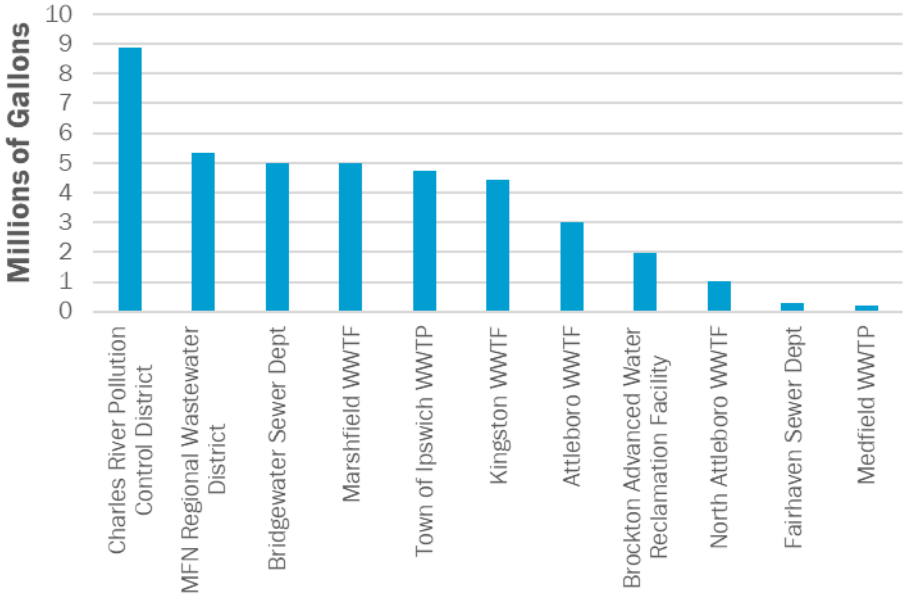

Figure F-4. Septage volume received - Southeast

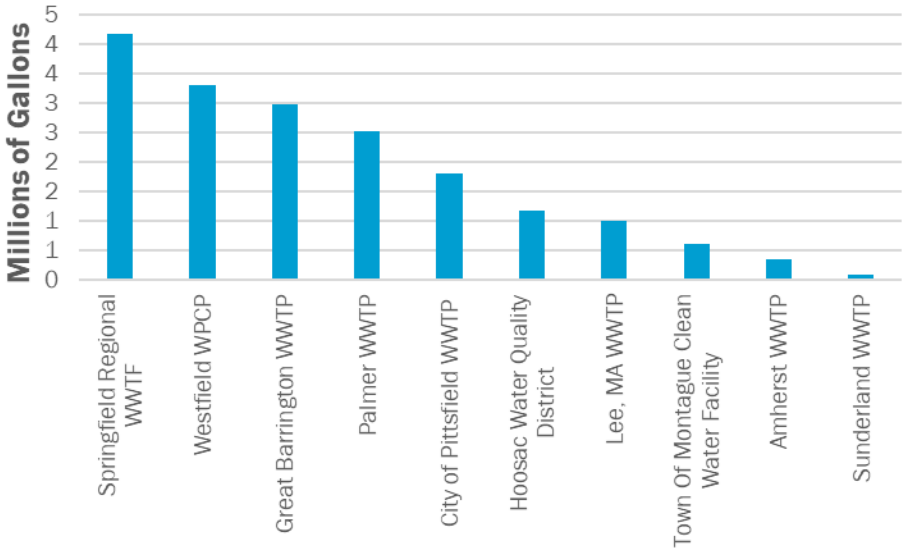

Figure F-5. Septage volume received - Western

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