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Desludging Rates and Mechanisms for Domestic Wastewater Treatment System Sludges in Ireland

Authors: Laurence Gill, Joanne Mac Mahon, Jan Knappe, Salem Gharbia and Francesco Pilla

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Rialtas na hÉireann
Government of Ireland

ENVIRONMENTAL PROTECTION AGENCY

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- Office of Communications and Corporate Services

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EPA RESEARCH PROGRAMME 2014–2020

Desludging Rates and Mechanisms for Domestic Wastewater Treatment System Sludges in Ireland

(2016-W-DS-26)

EPA Research Report

Prepared for the Environmental Protection Agency

by

Trinity College Dublin

Authors:

Laurence Gill, Joanne Mac Mahon, Jan Knappe, Salem Gharbia and Francesco Pilla

ENVIRONMENTAL PROTECTION AGENCY
An Ghníomhaireacht um Chaomhnú Comhshaoil
PO Box 3000, Johnstown Castle, Co. Wexford, Ireland

Telephone: +353 53 916 0600 Fax: +353 53 916 0699
Email: info@epa.ie Website: www.epa.ie

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The EPA Research Programme addresses the need for research in Ireland to inform policymakers and other stakeholders on a range of questions in relation to environmental protection. These reports are intended as contributions to the necessary debate on the protection of the environment.

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Project Partners

Laurence Gill, Principal Investigator
Department of Civil, Structural and Environmental Engineering
Trinity College Dublin
Ireland
Tel: +353 1 896 1047
Email: laurence.gill@tcd.ie

Joanne Mac Mahon, Postdoctoral Researcher
Department of Civil, Structural and Environmental Engineering
Trinity College Dublin
Ireland
Email: macmahoj@tcd.ie

Jan Knappe
Department of Civil, Structural and Environmental Engineering
Trinity College Dublin
Ireland
Email: jan.knappe@tcd.ie

Salem Gharbia
School of Architecture, Planning and Environmental Policy
University College Dublin
Ireland
Email: salem.gharbia@ucd.ie

Francesco Pilla
School of Architecture, Planning and Environmental Policy
University College Dublin
Ireland
Email: francesco.pilla@ucd.ie

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Executive Summary

The aim of this Environmental Protection Agency (EPA)-funded research was to identify and quantify the current pressures and future trends associated with the management of domestic wastewater treatment system (DWWTS) sludge in Ireland. The research focused on householder perception and the communication of key messages on the operation and maintenance of DWWTSs; evaluated the potential environmental pressures on soil and water resources and the required desludging frequency, from both field measurements at DWWTS sites in Ireland and a review of international research; and evaluated infrastructural requirements in terms of transport of sludge and location of sludge processing plants using geospatial analysis.

This report first summarises the findings of a literature review on international sludge accumulation rates and desludging frequencies (in addition to the main points gathered from the stakeholder advisory workshop that was held in Ireland in May 2017). Householder perception and the need to educate DWWTS owners on the correct operation and maintenance of their systems is then discussed, particularly with respect to the protection of soil treatment systems and the critical need for regular desludging. Clear evidence-based messaging was produced in the form of an Operation and Maintenance Manual, giving guidelines to householders on how to manage septic tanks and packaged treatment systems, as well as how to modify behaviours in the home in order to protect both their systems and the environment.

Field studies were carried out at 14 DWWTS sites across Ireland to determine sludge accumulation rates. These were found to be very high in the first 12 months of system operation (approximately 250 L/person/y) but dropped off to below 150 L/person/y after approximately 2 years. Rates were high compared with those reported internationally, which are generally between 65 and 125 L/person/y. Measured solids accumulation rates were low, however, ranging from 1 to 10 kg/person/y, compared with international estimates, which are typically between 11 and 26 kg/person/y. A desludging frequency of 3 years was deemed appropriate for tanks sized over 3.5 m^3 and a table of desludging frequencies was produced for various tank sizes and household occupancies based on the literature review findings, as well as the measured sludge accumulation rates. Field visits indicated that 5 years is the maximum allowable interval between desludging before the limiting volume of 50% sludge in the tank is reached.

Finally, geographic information system (GIS) analysis was carried out in order to assess the infrastructural pressure that would be put on existing systems, should scheduled desludging of DWWTSs be implemented on a 3-, 4- or 5-year cycle. Estimated total national sludge loads were between 663,297 m^3/y (13,531 tonnes of dry solids per year or tds/y) and 397,978 m^3/y (10,839 tds/y), depending on desludging frequency. These figures are significantly higher than current removal rates of DWWTS sludge from households to waste treatment facilities, with current average figures at approximately 70,000 m^3 of DWWTS sludge per year (based on 2015–2016 records). Further GIS analysis of existing wastewater treatment plant (WWTP) facilities with sludge acceptance facilities (90 in total) gave average annual loading figures of between 2000 and 38,000 m^3/y to each plant for a 3-year cycle, depending on the plant location. Some western counties, such as Galway, Clare and Donegal, were shown to have a critical lack of capacity, in terms of both transport and treatment of DWWTS sludge. The analysis found that only a small number of households (under 35,000) were outside the sustainable transport distance of 25 km from DWWTS to WWTP, but again these coincided to some degree with the areas that are estimated to have the greatest sludge load and which are underserviced in terms of transport and waste treatment facilities.

1 Introduction

The domestic wastewater of approximately one-third of the population in Ireland (489,069 dwellings) is treated on site by domestic wastewater treatment systems (DWWTSs), of which approximately 90% are septic tanks (CSO, 2017). The recent introduction of the National Inspection Plan [under the Water Services (Amendment) Act, 2012] following Ireland's prosecution by Europe (case C-188/08), means that records now need to be kept to prove that tanks have been desludged at the recommended frequency, which is currently every year. It is well known, however, that most people very rarely desludge their tanks and the results from the first year of the Environmental Protection Agency (EPA) national monitoring campaign (EPA, 2016) revealed that 48% of on-site systems failed their inspection over that period, with the most common reasons for failure being related to desludging and/or operation and maintenance issues. It is therefore forecast that the impact of this new inspection regime will produce much higher sludge loads in the future.

The aim of this research was to identify and quantify the current pressures and future trends associated with the management of DWWTS sludge in Ireland. This was carried out from a number of perspectives:

1. Targeting householder perception and highlighting the need for homeowners to be more proactive with respect to the operation and maintenance of their own DWWTS. Simple instructions were compiled for households in the form of a comprehensive Operation and Maintenance Manual, using evidence-based information on the need for correct operation and maintenance, including regular system desludging. In addition, a series of infographics on different aspects of DWWTS operation and maintenance was produced to complement the information in the manual.
2. Evaluation and recommendation of the required desludging frequency using primary field data as well as an assessment of the potential environmental pressures on soil and water resources from DWWTSs. Sludge accumulation rates were measured and sludge quality samples were taken at 14 different DWWTS sites in Ireland. These measurements revealed typical accumulation rates and sludge quality over time and were compared with the findings of a comprehensive literature review of international research in the area of sludge accumulation.
3. Evaluation of infrastructural requirements in terms of transport of sludge and location of sludge processing plants using geospatial analysis. This involved analysis of the optimum distances for transport of DWWTS sludge and optimum locations of wastewater treatment plants (WWTPs) for DWWTS sludge disposal, taking into account DWWTS locations, required desludging frequencies, transport constraints and the Irish Water National Wastewater Sludge Management Plan (Irish Water, 2016).

2 Review of Sludge Accumulation and Desludging Practices

2.1 International Literature Review

A comprehensive review of international literature in the area of sludge accumulation and recommended desludging frequencies was carried out. The general consensus in the literature showed that a sludge accumulation volume of 0.18 to 0.34 L/person/day is typical, with volumetric accumulation rates found to be higher for newer systems and those that have just been desludged. However, significantly higher sludge accumulation rates of 0.79 L/person/day have also been indicated in the literature (Mancl, 1984). An important point to note is that volumetric rates of accumulation have been shown, by some authors, to decline steadily over time (Philip *et al*., 1993; Bounds, 1995; Gray, 1995) for a number of reasons, including improved degradation of solids in the tank (due to progression of anaerobic processes), increased compaction of settled solids and loss of solids as a result of carry over (Gray, 1995). Authors also report the influence of hydraulic retention time (Brandes, 1978; Elmitwalli, 2013) and organic strength (chemical oxygen demand) of the influent (Elmitwalli, 2013) on accumulation rates. In particular, Brandes (1978) found that systems with longer hydraulic retention times were more effective at digesting solids within the tank, leading to less accumulation. This is an important point to consider when sizing DWWTSs, whereby slightly oversizing septic tank systems may be advantageous to ensure adequate hydraulic retention times. It should be noted that the sizing of primary chambers in packaged treatment systems is outside these recommendations, as these are bespoke designs according to individual manufacturers.

The literature for the most part concludes that a desludging frequency of 1 year is too frequent for septic tanks and disrupts the development of the biological processes required for optimal digestion of organic matter. (Packaged systems, however, require desludging according to manufacturers' guidelines, which generally recommend that their systems need to be desludged at least once per year.) Anything from 2 to 5 years is required for the biological processes to develop fully within a septic tank and allow the system to operate properly (Philip *et al*., 1993; Bounds, 1995). Desludging frequency is also dependent on tank size and household occupancy, however, and larger tank sizes (greater than 3.8 m^3) generally allow greater flexibility in terms of less frequent desludging (Bounds, 1995). If a septic tank is running optimally, sludge accumulation rates are reduced and more than 45% of ultimate treatment can take place within the tank; the digestion process can reduce solids by as much as 80% (Bounds, 1995). From the information compiled in the literature review, a desludging frequency of between 3 and 5 years would seem reasonable for most septic tank systems and will be addressed again later in this report in the context of the field measurements carried out. Special consideration may need to be given to old septic tanks that are operating beyond their design capacity, and also tanks with volumes of less than 3.8 m^3, which may require more frequent desludging.

The findings from the literature review suggest that the volume of sludge and scum should not exceed 50% of the total contents of the tank (limiting volumes in the literature range from 30% to 50% of the total working volume of the system). This allows for significant build-up of sludge in the first chamber in the first year or two, which is discussed later in Chapter 4 with respect to the findings of the field studies. In terms of solids accumulation, it is estimated that globally people generally produce 30–70 g of solids per day (Bitton, 2010; Karia and Christian, 2013; Polprasert and Koottatep, 2017), which is approximately 11–26 kg per person per year.

2.2 Stakeholder Advisory Group Workshop

A stakeholder advisory group workshop was held at Trinity College Dublin in May 2017 to help inform the direction of research over the project period. Attendees included representatives from academia, local authorities, Irish Water, wastewater treatment system providers, government departments and the

National Federation of Group Water Schemes. The workshop covered the National Inspection Plan; public perception and behaviour with regard to maintenance and desludging of DWWTSs; current procedures, frequencies and costs of desludging; treatment, disposal and reuse options for sludge; and future trends in sludge treatment, disposal and management. The workshop proved to be very useful with regard to identifying barriers to regular desludging/maintenance and possibilities for improved communication and incentivisation for homeowners, as well as suggestions for online maintenance management systems. In addition, the challenges of sludge treatment and disposal were highlighted in the context of the need for greater capacity for these services.

The main points from the workshop under various categories are outlined in Table 2.1.

Table 2.1. Stakeholder advisory group workshop: summary of findings

Category	Issues
National Inspection Plan	• Inspections identify risks to health or the environment but do not address planning/compliance issues. • The initial awareness brought about by the National Inspection Plan has declined because of the introduction of the grant scheme, the low inspection rates and the targeted nature of the inspection plan.
Public perceptions	• The O'Neill *et al.* (2016) study found that extreme symptoms of failure were generally needed before people sought assistance. It also found a lack of awareness around the design loading of systems. • People generally do not make a connection between a malfunctioning DWWTS and possible contamination of their own or neighbours' well water.
Desludging operators	• Many private desludging operators do not have tankers of sufficient volume to fully empty and clean tanks. • People use desludging contractors without permits to save money. • Approximately 12–15 dewatering trucks are currently operating in Ireland.
Design specifications/ maintenance	• People with packaged systems are often not aware that these have different maintenance requirements from septic tanks and should be inspected and desludged annually. Maintenance guidelines are not always provided to homeowners in the case of new builds. • The opt-out clause for statutory certification of one-off new builds has had a negative impact on the quality of DWWTSs being installed and the likelihood of proper maintenance.
Communication/ incentivisation	• There is a lack of awareness of homeowners' legal responsibility not to pollute. Legal obligation can be a motivator. • There is a need to communicate the cost–benefit of regular maintenance compared with very expensive remedial works for a failed system. • There is a need to communicate the health benefits for both household members and neighbours. • Financial incentives, such as a tax break, could motivate increased maintenance. • Comparison was made with the Hevey study (2016) on radon gas screening uptake and home remediation – 14 steps were identified before people were likely to take action. People might be aware of the risks of not maintaining their DWWTS and motivated to take action but something extra might be needed to "push them over the line". There is a need to make desludging easier for the homeowner. • Group water schemes could help to mobilise homeowners to conduct regular maintenance/ desludging. Local coordination of desludging is likely to be more successful than targeting individuals, as well as being more economical.
Systems for maintenance	• An IT system (possibly run by a private body), which includes information from permitted desludging contractors, could be introduced to reduce workload at local authority level and capture more households than is possible through the National Inspection Plan. • Simple maintenance reminders by email or text could encourage regular maintenance.
Disposal/reuse	• The Bord Bía Quality Assurance Scheme eliminates large areas of agricultural land for biosolids reuse. If a farm is split into land covered by the Bord Bía scheme and land suitable for biosolids reuse, none of the land can be used for biosolids spreading. • Many private waste treatment operators are permitted to take wastewater sludge but choose not to because of the more stringent requirements for biosolids treatment. • Bord na Móna sites previously used for peat drying may be suitable for drying sludge.

3 Operation and Maintenance Manual for Homeowners

A review of operation and maintenance guides available internationally for DWWTSs was carried out and the recommendations from these were compiled in a comprehensive and detailed Operation and Maintenance Manual. This manual can serve as a reference guide for homeowners and was the basis for creating a series of easy-to-read infographics on different aspects of DWWTS operation and maintenance. A section on troubleshooting problems with septic tank systems was included in the manual for homeowners' information but it is recommended that professional advice be sought in the case of any system malfunction.

Inspection of DWWTSs during field work, along with the findings from the National Inspection Plan reports, confirms that there is a real lack of understanding among homeowners on how to operate and maintain their systems. This ranges from lack of basic knowledge of what can and cannot be broken down by a DWWTS, to basic care of the percolation area (i.e. the soil treatment unit) to ensure proper treatment of effluent from the tank, as well as to the required frequency of desludging. As pointed out in previous studies (e.g. O'Neill *et al*., 2016), the fact that the system is generally out of sight compounds the problem, as homeowners simply do not think about the DWWTS until issues arise and even then there is a reluctance to seek professional assistance unless the malfunction is causing major inconvenience. Homeowners also do not seem to perceive any difference between reliance on a DWWTS, where wastewater is stored and treated near the home, and being connected to a public sewerage system, which can cope with excessive solids and water loadings much better than a stand-alone domestic system. There is therefore a need to educate homeowners on the design limits of their DWWTS, in terms of both the volume and type of waste that their systems are designed to cope with.

The major areas identified in this study that require improvement by households with DWWTS are outlined below.

- What can and cannot be put into the DWWTS? – simple guidelines on "dos and don'ts" for flushing items down sinks and toilets.
- How should the soil percolation area be maintained? – emphasis on the importance of the percolation area as the main component of wastewater disinfection and the need to care for this area (e.g. do not plant trees, etc. in the percolation area).
- How often should the system be inspected and desludged? – specific and easy-to-understand desludging guidelines for septic tanks and packaged systems.
- Guidelines for modifying household behaviour in key areas such as the kitchen, bathroom and garden in order to improve DWWTS operation and prolong the life of the system (e.g. how to reduce water loading to the system; the importance of not overusing household detergents).

Behavioural changes in these areas by householders could lead to considerable improvements in the operation and maintenance of DWWTSs and should be the focus of messaging to homeowners.

4 Field Studies

4.1 Site Selection

A total of 14 households with existing on-site septic tank systems discharging into soakaways were chosen for sludge quality sampling and sludge depth measurement. Accumulation rates were determined based on the length of time since the previous desludging. The tanks ranged in age from 1 to 7 years and had capacities between 3 and ~5 m^3 (see Table 4.1). Of these, four households were chosen for repeat sludge accumulation rate measurements, whereby two sets of measurements and samples were taken with an interval of 8 months between visits. These sites had all previously been part of research at Trinity College Dublin and so installation and desludging details were available.

The quality of sludge sampled at all sites was tested using the APHA (2005) Standard Methods for total solids, volatile solids and fixed solids. An average accumulation rate per person was determined for each system based on the number of occupants, the dimensions and working volume of the system, the period since installation/previous desludging and the depth of sludge measured.

4.2 Results of Field Measurements

4.2.1 Volumetric and mass loadings

The total volumetric and mass loadings for each system per person per year, calculated from the site samples, are shown in Figure 4.1. The average solids loading per person per year was observed to be between 1 and 10 kg/person/y, while volumetric loadings varied dramatically between 50 and 500 L/person/y. Volumetric loadings were much higher for newer systems that had been in service for less than 2 years and in general the average solids and volumetric loading per year tended to decrease significantly over time, as per the findings in the literature review (Chapter 2), suggesting considerable compression and decomposition of solids over time. In addition, the very high volumetric loadings (greater than 300 L/person/y) observed in some of the new systems, which had been in service for less than a year, occurred in tanks with working volumes greater than 4000 L. There may therefore be some relation between the size of the tank and the level of decomposition/compression of solids that occurs during the first year or two of service.

Table 4.1. Details of sites sampled during field studies

Site number	Name	Working volume (L)	Occupants	Time since desludging/installation (years)
1	Duncormick, Wexford	3000	5	5
2	Ballask, Wexford	4700	4	7
3	Killinick, Wexford	3600	4	6.5
4	Killenagh, Wexford	3370	3	1
5	Drumcar, Louth	3000	4	0.67
6	Jealoustown, Meath	4500	5	0.5
7	Killamallock, Limerick	4757	5	1.67
8	Crecora, Limerick	4757	4	1
9	Lusk, Dublin	4000	2	2
10	Lusk, Dublin	4757	2	0.5
11	Carbury, Meath	3700	4	1
12	Killbeggan, Meath	3600	3	7
13	Castledaley, Westmeath	3800	4	1
14	Stepaside, Dublin	3370	4	5

Average rates of volumetric and mass sludge accumulation over time were calculated from the results for various time periods and are shown in Table 4.2 and Figures 4.2 and 4.3. Unfortunately, there were no representative samples taken for the time periods between 3 and 5 years since installation or desludging. The total average mass and volumetric rates are shown to decline steadily after the first year of operation, as do the rates of accumulation in chamber 1. The rate of accumulation in chamber 2, however, fluctuates slightly over the first 3 years of operation but is much lower than accumulation rates observed in chamber 1, as expected. Beyond 5 years of operation the rate of volumetric and mass accumulation in chamber 2 rises above that of chamber 1, which would indicate that desludging is probably required before this point.

A volumetric sludge accumulation curve per person based on the data collected is shown in Figure 4.4, given by the equation $y = 337.24\ln(x) + 243.51$ (where y is the volume accumulated in litres and x is the time in years). This is compared with existing models for volumetric sludge accumulation, the Bounds and Weibel equations.

Bounds equation: $y = 47\,t^{0.675}$ (US gallons)

Weibel equation: $y = 13.39\,t + 50.86$ (US gallons)

(1 US gallon = 3.785 L)

Table 4.2. Average volumetric and mass sludge accumulation rates for various time periods

Years	Average vol/p/y chamber 1 (L/p/y)	Average vol/p/y chamber 2 (L/p/y)	Average total vol/p/y (L/p/y)	Average mass/p/y chamber 1 (L/p/y)	Average mass/p/y chamber 2 (kg/p/y)	Average total mass/p/y (kg/p/y)
<1	251	36	269	5.9	0.5	6.1
1–2	141	46	177	4.1	1.3	5.1
2–3[a]	129	23	152	3.7	0.4	4.1
3–4[b]						
4–5[b]						
5+	30	33	58	1.0	1.9	2.7

[a]Only one data point for all measurements in this time period, not an average value.

[b]No samples taken for the 3- to 5-year period.

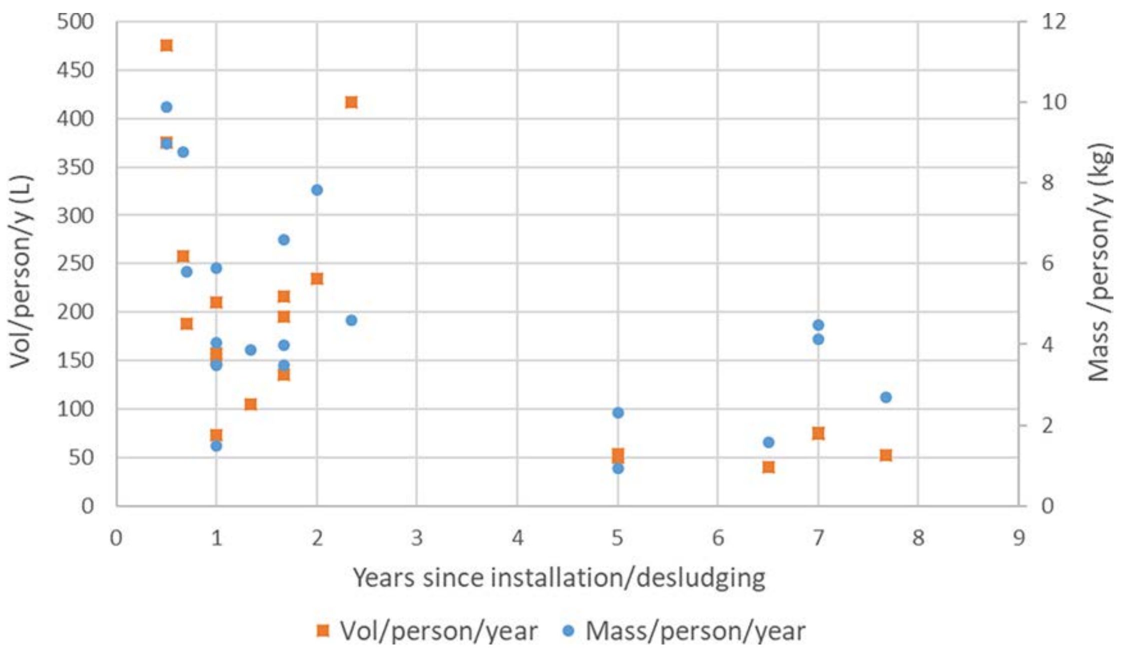

Figure 4.1. Mass and volumetric loadings per person per year at sampled sites in terms of years since installation/desludging.

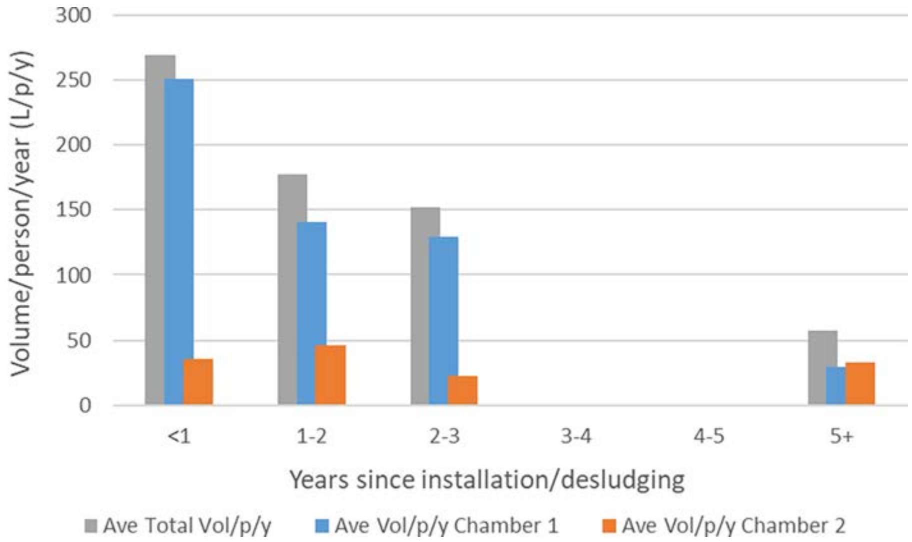

Figure 4.2. Average volumetric rates of sludge accumulation (L/person/year) for specific time periods since desludging/installation, calculated from site measurements.

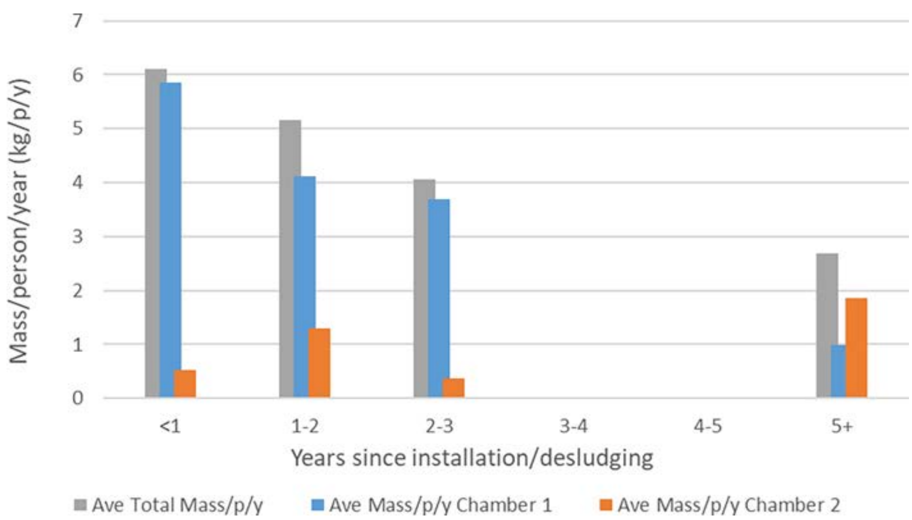

Figure 4.3. Average mass rates of sludge accumulation (kg/person/year) for specific time periods since desludging/installation, calculated from site measurements.

All models predict the total volumetric accumulation of sludge for one person after a particular period of time. Measured average volumetric accumulation rates from field data are also included in Figure 4.4. (Note: as no measured accumulation rates were available between 3 and 5 years, results had to be extrapolated for this time period.)

Similarly, Figure 4.5 shows a curve for mass (kg) accumulation per person at any point in time based on field measurements, with the curve $y = 10.99\ln(x) + 4.61$. Measured average mass accumulation rates from field data are also included in the graph. Mass accumulation rates from field measurements were found to be below those suggested in the literature (between 11 and 26 kg/person/y), with between 1 and 10 kg per person found to accumulate per year. This lower than expected rate may reflect the fact that often people are absent from the home during weekdays and so do not occupy the home full time. In addition, households with garbage disposal units (which are prohibited in Ireland) produce much higher rates of sludge, which would account for the higher end of the international estimates.

The volumetric accumulation per person predicted by the field data model yields a similar accumulation to the Weibel model in the first year but is 70 litres higher than the Bounds model in year 1. The accumulated

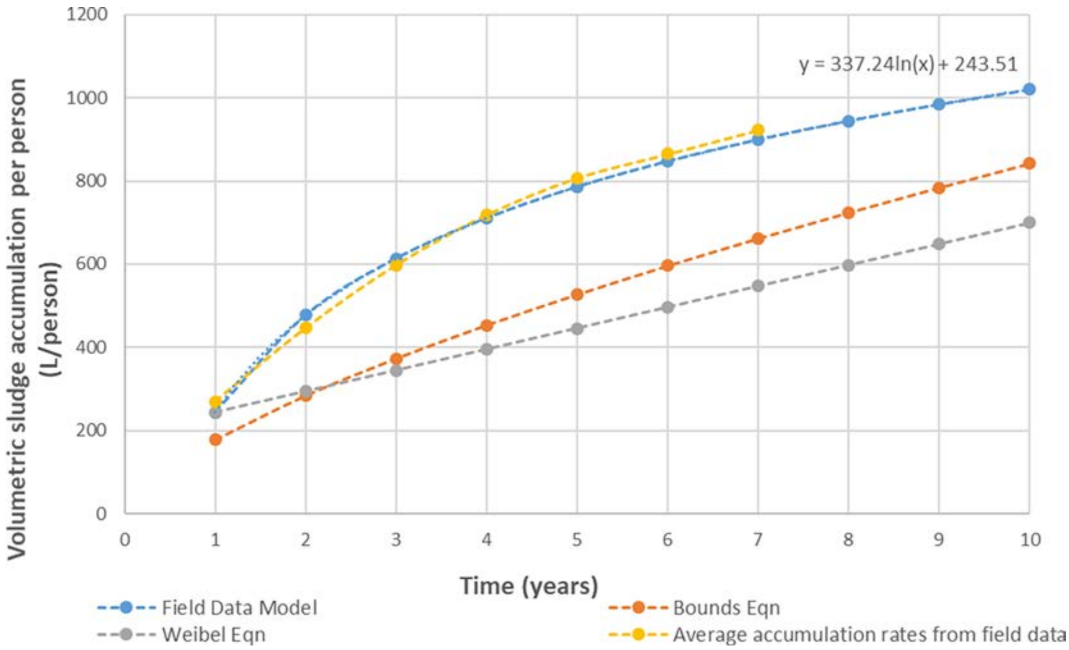

Figure 4.4. Predicted volumetric accumulation of sludge per person at a particular point in time (L/person) using the model derived from average accumulation rates measured in the field. Model compared with Bounds equation, Weibel equation and average field measurements.

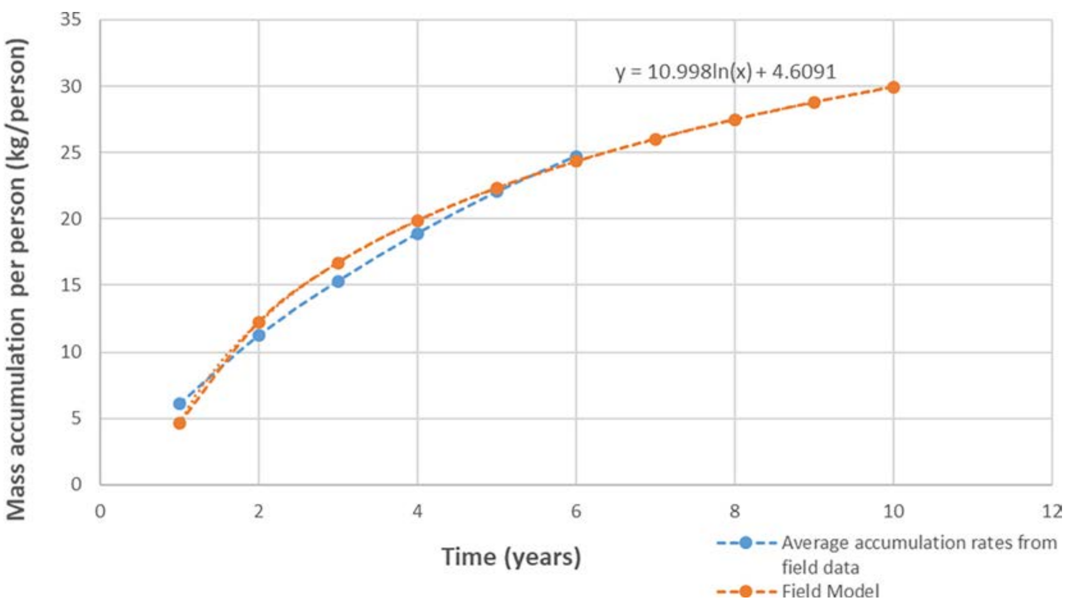

Figure 4.5. Predicted mass accumulation of sludge per person at a particular point in time (L/person) from average measured accumulation rates in the field. Average field measurements are also shown.

volume predicted by the field model beyond year 1, however, is significantly higher than both the Bounds and Weibel models. This was because of results from some of the new systems sampled, which showed very high accumulation rates, particularly in the first year of operation. The field data model predicts approximately 250 L/person in the first year, 230 L/person in the second year and 130 L/person in the third year. From this point on, accumulation rates in each subsequent year are under 100 L/person. These accumulation rates are higher than those typically found in the literature, which tend to be between 65 and 125 L/person/y. However, Mancl (1984) assumes sludge accumulation rates of 290 L/person/y.

The field data model is limited by the amount of data sets available from sampling, particularly for the periods from years 2 to 5. If new data points are added to the overall data set in the future, the model can be modified and improved.

4.2.2 Predicted desludging frequency from field data

Suggested desludging frequencies for various tank sizes and household occupancy rates, based on the field data model (shown in Figure 4.4) and the findings of the literature review, are given in Table 4.3. These frequencies assume that the tank must be desludged once the sludge volume reaches 50% of the overall working volume of the tank. Given the limited number of data points used to produce the field data model, it was decided to use both this and the Bounds model, which is based on much larger data sets, in order to identify suitable desludging intervals. The table shows the average of the interval predicted by the Bounds and field data models for each tank size and household occupancy rate. Typical septic tank sizes in Ireland, designed for up to 8 population equivalent (PE), tend to be between 3.5 and 4.5 m^3, and are highlighted in the table.

Predictions suggest a 3-year desludging frequency for a four-person household with a 3.5 m^3 septic tank. This is deemed to be a sensible frequency based on both the observations of field work during this study and the findings in the literature review. These desludging frequencies also tie in well with the Mancl (1984) table for desludging frequencies, which is widely used, and assumes a sludge accumulation rate of 290 L/person/y, which is much higher than most estimates in the literature. In addition, it should be noted that Bounds (1995) qualifies the desludging frequency needed for tanks under 3.8 m^3 (1000 US gallons) in that they may require more frequent desludging than suggested by the Bounds equation because of the limited space for hydraulic retention. Annual inspections are therefore recommended in order to monitor accumulation rates in smaller tanks.

4.2.3 Sludge accumulation in terms of working volume

Figure 4.6 shows the volumetric levels of sludge accumulation in chambers 1 and 2 of each system expressed as the depth of sludge as a percentage of the depth of liquid in the tank and is compared with the number of years since installation or desludging.

High sludge depths were measured in chamber 1 of some newer systems and little decomposition of the sludge was also observed in these cases. Sludge was observed to be more decomposed, however, as the length of time since desludging increased, particularly in chamber 2 (see Figures 4.7 and 4.8 for percentage total solids and volatile solids in sampled sludge). The volume of sludge in chamber 2 was seen to increase dramatically beyond 5 years since installation/desludging, with most tanks measuring over 40% of the working volume of the chamber at this stage. This indicates that, for these tanks, desludging of the whole tank is required before 5 years have elapsed since either installation or the last desludging.

Table 4.3. Recommended required desludging frequencies for septic tank systems (years) based on field data model and Bounds equation for sludge accumulation

Tank working volume (m^3)	Number of occupants						
	2	3	4	5	6	7	8
2.5	4.8	2.6	1.8	1.3	1.1	0.9	0.8
3	6.5	3.4	2.2	1.7	1.3	1.1	1.0
3.5	8.5	4.3	2.8	2.0	1.6	1.3	1.1
4	11.2	5.3	3.4	2.5	1.9	1.6	1.3
4.5	14.5	6.5	4.0	2.9	2.2	1.8	1.5
5	18.9	7.8	4.8	3.4	2.6	2.1	1.8
5.5	24.7	9.4	5.6	3.9	3.0	2.4	2.0
6	32.5	11.2	6.5	4.5	3.4	2.7	2.2

Typical tank sizes in Ireland are highlighted in dark blue.

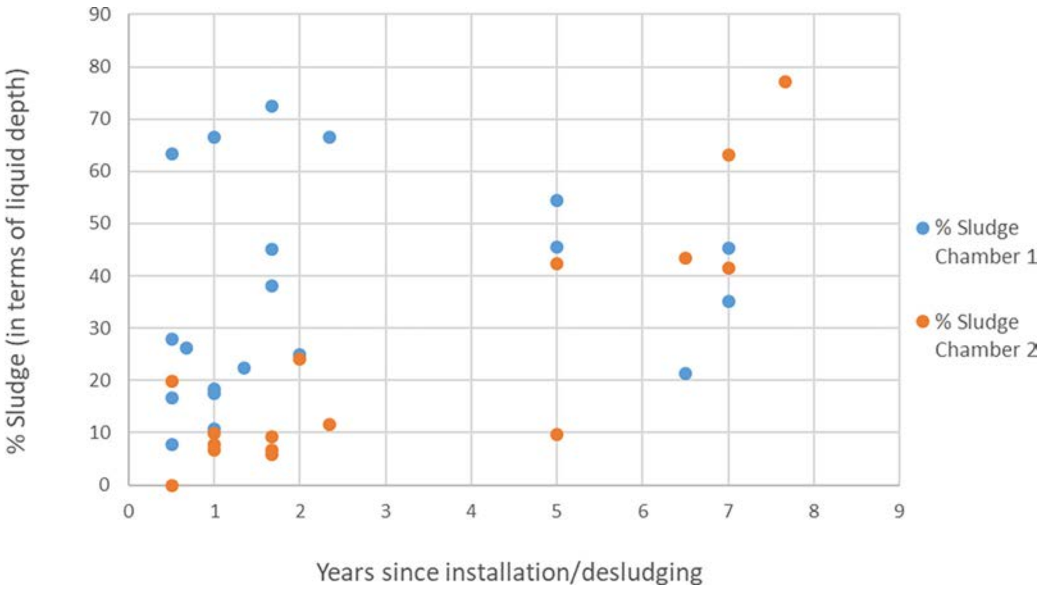

Figure 4.6. Percentage sludge in chambers 1 and 2 in terms of liquid depth.

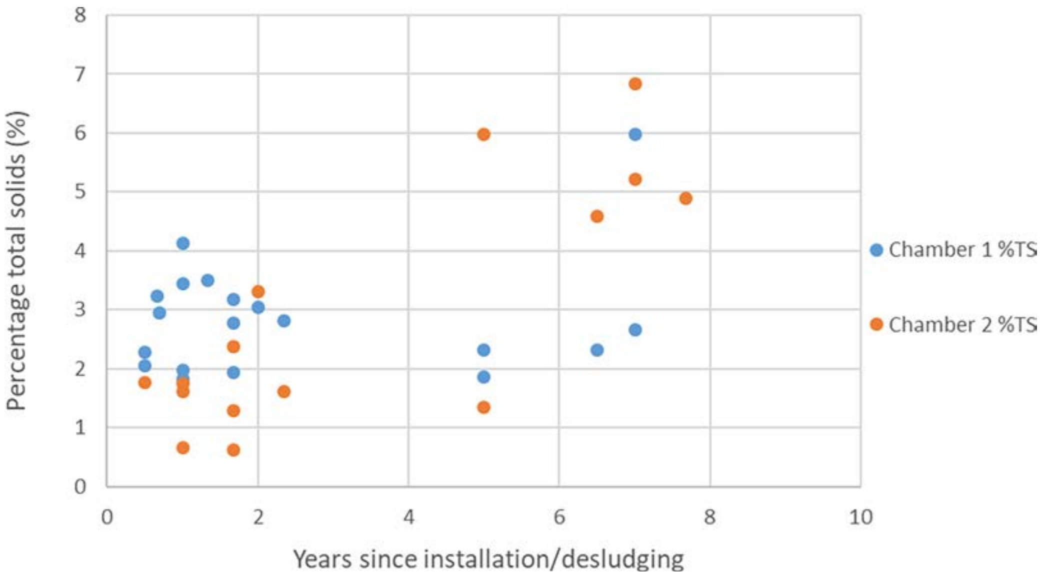

Figure 4.7. Percentage total solids in each chamber compared with time since installation or desludging.

4.2.4 Percentage total solids, volatile solids and fixed solids

Figures 4.7 and 4.8 show the percentage total solids, volatile solids and fixed solids in chambers 1 and 2 for each system compared with the number of years since installation or desludging. (Fixed solids are not shown in Figures 4.7 or 4.8 for ease of reading the graphs, as they are the remaining percentage of the 100% total solids once volatiles are removed.)

The percentage of total solids in the sludge remained reasonably stable in chamber 1 over time but increased significantly in chamber 2, although large differences were observed between the total solids content of sludge across various systems. In general, and as expected, sludge tended to be more decomposed in the second chamber, particularly in tanks that had been operating for longer periods, and so the percentage of fixed solids tended to be higher (and the percentage of volatile solids was therefore lower).

4.2.5 Repeat samples

Four sites were sampled twice with an interval of 8 months between the samples. Two of these

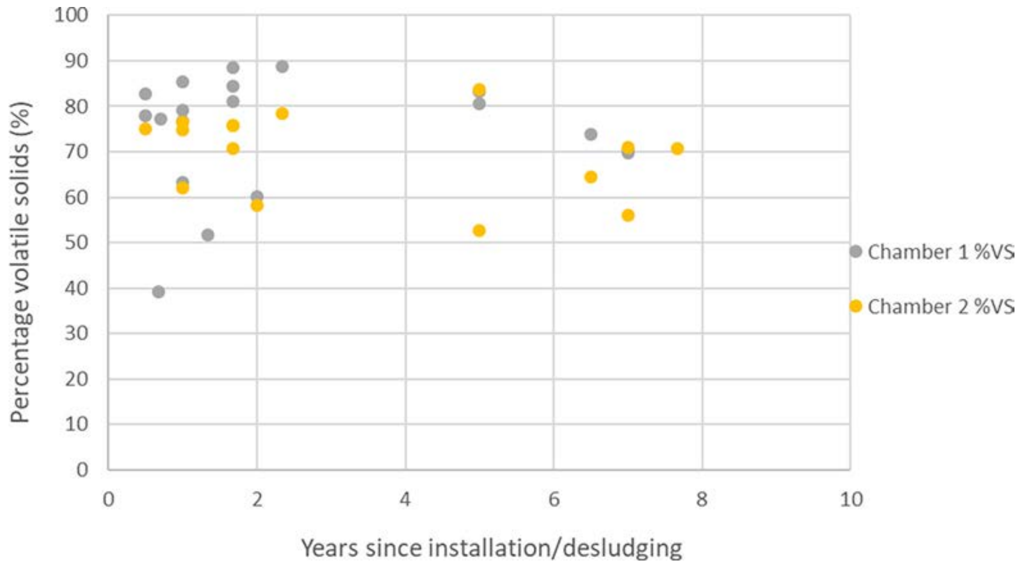

Figure 4.8. Percentage volatile solids in each chamber compared with time since installation or desludging.

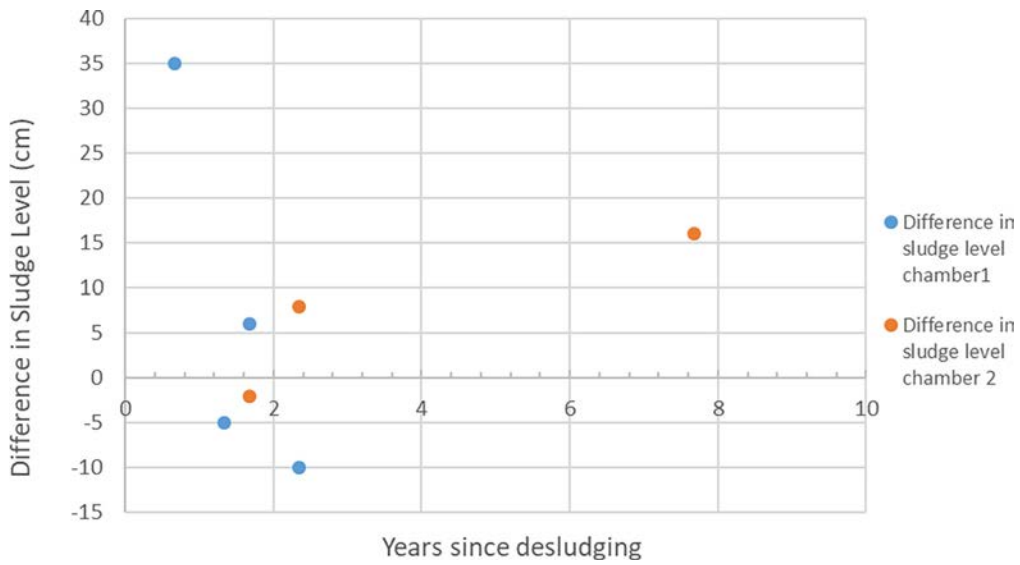

Figure 4.9. Depth accumulation/decrease over an 8-month period at sampled sites. Note: accumulation period for first point on the graph (at 35 cm) is 6 months, as the chamber was desludged after initial measurements were taken.

sites saw a decrease in volumetric accumulation in chamber 1 over this period and one site saw a drop in the accumulation in chamber 2. Two sites saw an increase in the sludge volumes of chambers 1 and 2. The results are shown in Figures 4.9 and 4.10. (Note: one site was a single chamber system – labelled as chamber 1 here – and another site had the contents of chamber 1 desludged during the interim period and had an accumulation period of 6 months.)

The decrease in sludge volume observed in some of the tanks is most likely due to decomposition and compression of solids during the period of time between measurements being taken. It shows how sludge accumulation rates generally settle down over the first 2 years that the system is in use, from initially high rates of accumulation. The high increase in volume that was observed in one of the systems was because this chamber had been desludged after the initial sample had been taken and was effectively starting from zero again. The level of increase in this tank chamber (30% of working volume) over the first 6 months since desludging ties in with observations

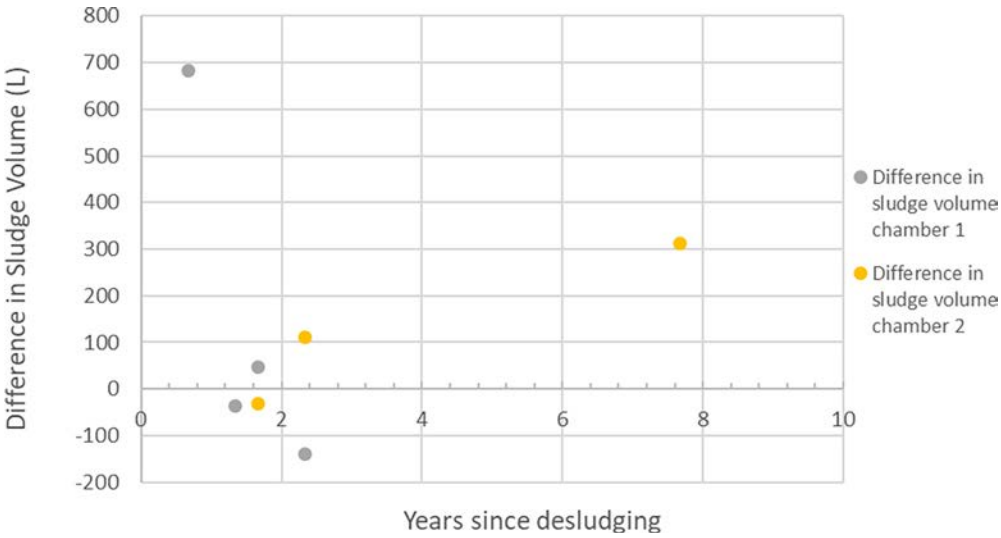

Figure 4.10. Volumetric accumulation/decrease over an 8-month period at sampled sites. Note: accumulation period for first point on the graph (at 683 L) is 6 months, as the chamber was desludged after initial measurements were taken.

from other tanks that were sampled just 6 months after the systems had been installed. The increase in volume observed in chamber 2 for the tank that had been in operation beyond 7 years confirms the need to desludge the entire tank contents at least every 5 years.

5 Geographic Information System Analysis

5.1 Input and Assumptions

A geospatial analysis was carried out using the location of all DWWTSs in Ireland in order to compare optimum locations of new sludge processing facilities with respect to collection distances. This analysis of the sludge management requirements for DWWTS sludge in Ireland was based on a map detailing the locations of all DWWTSs in the country. Other data sources included the National Waste Collection Permit Office (NWCPO) records for DWWTS waste in 2015 and 2016, the Irish Water National Wastewater Sludge Management Plan (2016), the EPA-commissioned report by Joyce and Carney (2014), and information on private desludging contractors and waste facilities from the NWCPO and EPA.

An average DWWTS size of 3.5 m^3 was assumed and national volumetric and solids loadings (including from farm households, as landspreading of raw DWWTS waste is not recommended according to the Codes of Good Practice for the Use of Biosolids in Agriculture; Fehily *et al*., 1999) were estimated based on the findings from the field work (Chapter 4), as follows.

Assuming an average DWWTS of 3.5 m^3, a total of 1,711,742 m^3 of DWWTS waste needs to be collected every 3, 4 or 5 years for 489,069 DWWTS (CSO, 2017). This is equivalent to:

- 570,581 m^3/y or 11,640 tds/y based on a 3-year cycle;
- 427,935 m^3/y or 10,170 tds/y based on a 4-year cycle;
- 342,348 m^3/y or 9,324 tds/y based on a 5-year cycle.

NWCPO records from 2015 and 2016 show average total figures of approximately 70,000 m^3 of DWWTS sludge collected from households per year. This is only 12–20% of the predicted loads detailed above.

5.2 Analysis

Because of the lack of up-to-date spare capacity data available for WWTPs, the analysis was approached from a first principles basis, starting with a basic analysis of where WWTPs accepting DWWTS sludge would be most suitably located and progressing from this using the above available data.

5.2.1 Location of WWTPs

A base map was generated of the most suitable locations for WWTPs in Ireland based on Irish Water location selection criteria for sludge treatment plants, as detailed in the National Wastewater Sludge Management Plan (2016). All existing Irish Water WWTPs were then ranked according to the location suitability criteria. This was then narrowed down further to the 90 Irish Water WWTPs and private facilities that currently have, or plan to have, suitable sludge acceptance facilities as shown in Figure 5.1. Nineteen of the 90 plants are considered to be in excellent locations according to the location selection criteria.

Using the base map of the 90 Irish Water and private WWTPs that currently have acceptable sludge acceptance facilities or are recommended for upgrade of their sludge acceptance facilities, a 25-km transport buffer zone was created around the WWTPs in order to identify DWWTSs within this recommended transport distance to a WWTP. This is the estimated maximum economically viable distance for a regular desludging (i.e. not dewatering) tanker to transport sludge from a DWWTS to a WWTP according to the EPA STRIVE report by Joyce and Carney (2014). Only 34,132 DWWTSs (out of the 570,157 points in the map) were found not to be within this transport distance to a WWTP facility with sludge acceptance facilities. Note: the geographic information system (GIS) analysis included holiday homes, and so the total number of DWWTS used in the analysis (570,157) is approximately 80,000 higher than CSO figures, which exclude homes that are not permanent residences. The GIS analysis therefore gives a slight overestimate, as it treats holiday homes the same as full-time residences.

5.2.2 Estimated DWWTS sludge loads to WWTPs

Estimated DWWTS sludge loads to each WWTP based on using the plant with the shortest distance

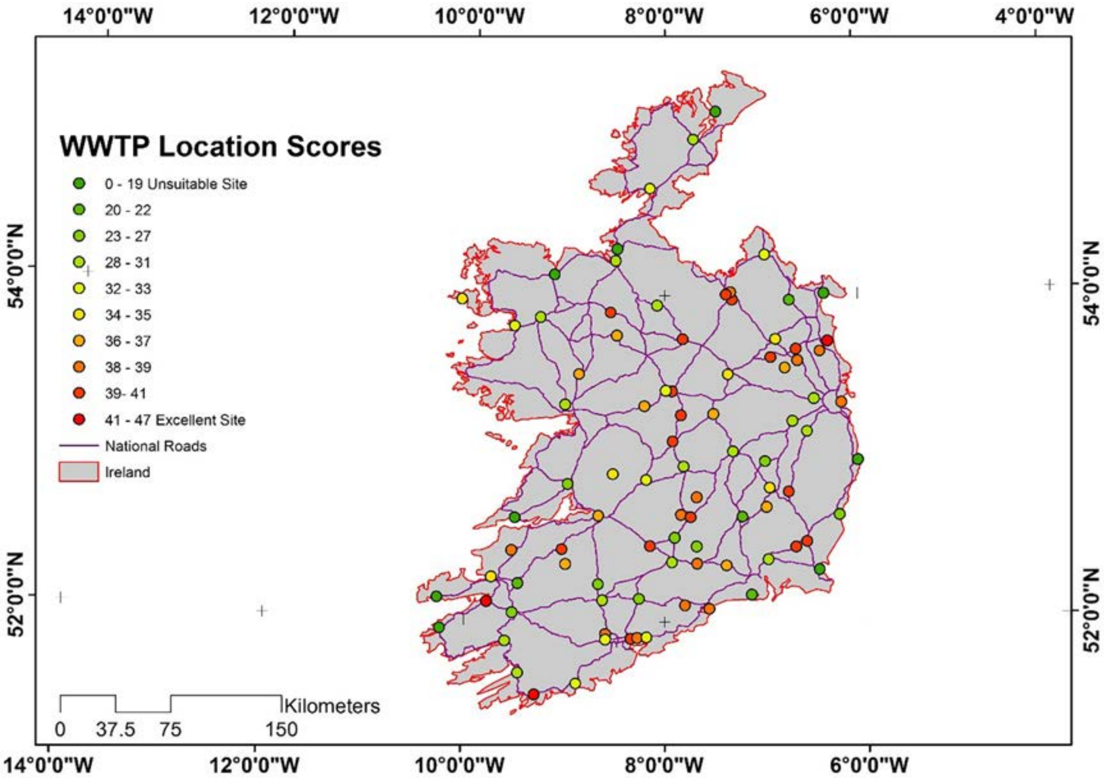

Figure 5.1. Irish Water and private WWTPs (90 in total) with existing or planned sludge acceptance facilities ranked according to location selection criteria.

to each DWWTS were calculated for 3-, 4- and 5-year desludging frequencies (see Figure 5.2 as an example). Note: only one WWTP was selected for each DWWTS.

Volumetric loadings to WWTPs ranged from approximately 2000 to 38,000 m^3/y for a 3-year cycle. WWTPs that would expect very high loads, based on the 25-km transport distance, are mostly located near the areas that contain additional DWWTSs that are currently beyond the 25-km radius, such as Counties Galway, Clare and Donegal, indicating a need for increased treatment capacity in these areas.

Detailed tables are included in a GIS analysis report[1] showing each WWTP, with predicted volumetric and solids loadings for each desludging frequency, design capacity where available and current intakes according to NWCPO records. Volumetric loadings were found to be well within the design capacity of all WWTPs, with predicted DWWTS sludge loadings well under 5% (assuming a design loading of 150 L/y/PE for WWTPs). However, when volumetric loadings were converted to solids loadings, the predicted annual DWWTS loadings exceeded the total design capacity of many plants.

The estimated average solids loading to a WWTP was 121 to 151 tds/y, depending on frequency of desludging. Solids loading estimates were over 50% of the design capacity for approximately 50% of the WWTPs included in the analysis (assuming a design loading of 15 kg/y of dry solids per PE for WWTPs).

5.2.3 Spatial distribution of DWWTS sludge loads

In order to get an idea of the spatial distribution of DWWTS waste loadings across the country, a map was generated that showed the estimated DWWTS sludge load for each local authority area. (Although Irish Water plans consider the country as a whole, and do not divide according to local authority areas, this analysis is still considered useful in terms of identifying the areas with the highest loadings and therefore the greatest need for desludging and WWTP services.) The analysis was based on the number of DWWTSs

1 Available online: http://www.epa.ie/researchandeducation/research/safer/

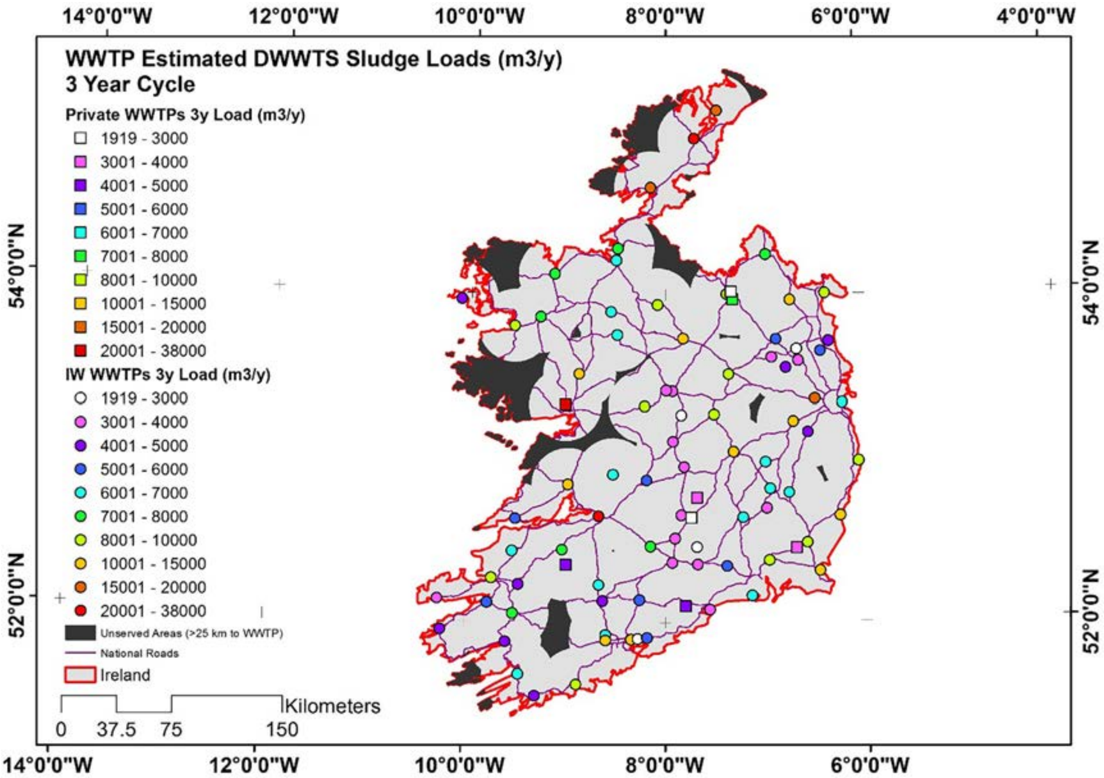

Figure 5.2. Estimated sludge loads (m³/year) to Irish Water and private WWTPs based on 3-year desludging cycle for DWWTS. (Private facilities shown with square icon. Areas outside 25-km sustainable transport zone in dark grey.)

in each area and assumed an average DWWTS size of 3.5 m³ and no dewatering of the waste collected. Loads were estimated for 3-, 4- and 5-year desludging frequencies. Figure 5.3 shows the volumetric loadings for a 3-year cycle.

The total estimated load for the country for a 3-year cycle is 663,297 m³/y (13,531 tds/y); for a 4-year cycle is 497,473 m³/y (11,823 tds/y); and for a 5-year cycle is 397,978 m³/y (10,839 tds/y). This is higher than the estimate based on CSO figures given previously in section 4.1, as the CSO numbers exclude holiday homes.

The local authority areas with the heaviest predicted loads coincide to some extent with the WWTPs that would receive the highest sludge loads based on the maximum sustainable transport distance of 25 km, and so there is a clear need for increased capacity in these areas, e.g. Cork City and Counties Cork, Donegal, Galway, Limerick and Clare. A full list of estimated loading figures for each local authority is given in the full GIS analysis report.[2] Figure 5.4 illustrates the estimated volumetric loadings per area and includes estimates detailed in the Irish Water National Wastewater Sludge Management Plan for DWWTS sludge production per area.

5.2.4 *Current collection capacity and possible locations for new facilities*

The GIS analysis also included a review of DWWTS waste logged with the NWCPO by area, as well as the numbers of permitted contractors working in each area, shown in Figures 5.5 and 5.6. This shows a huge gap between the current collection figures by permitted desludging contractors to wastewater treatment facilities and what would be required if scheduled desludging of DWWTSs was implemented properly, with current recorded removal and treatment of DWWTS sludge only 10–18% of the predicted loads for 3- to 5-year desludging cycles. In addition, the number of permitted desludging contractors operating

2 Available online: http://www.epa.ie/researchandeducation/research/safer/

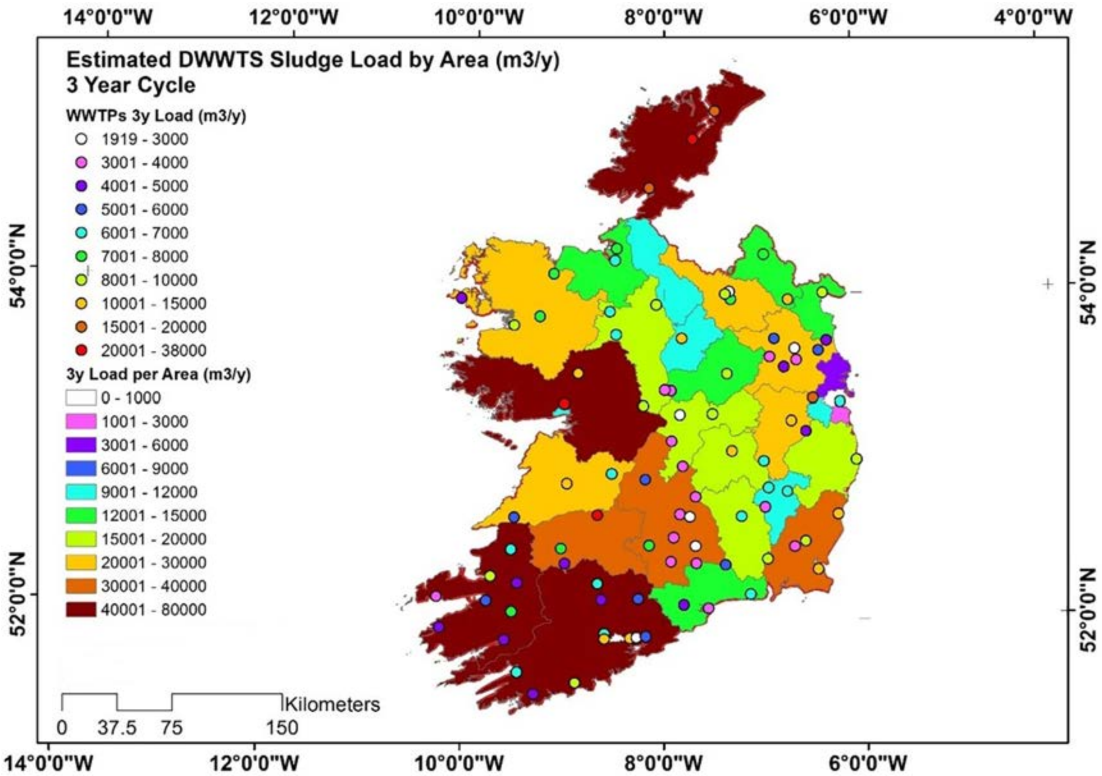

Figure 5.3. Estimated DWWTS sludge load in each local authority area (m³/year) for a 3-year desludging cycle. (WWTPs also shown.)

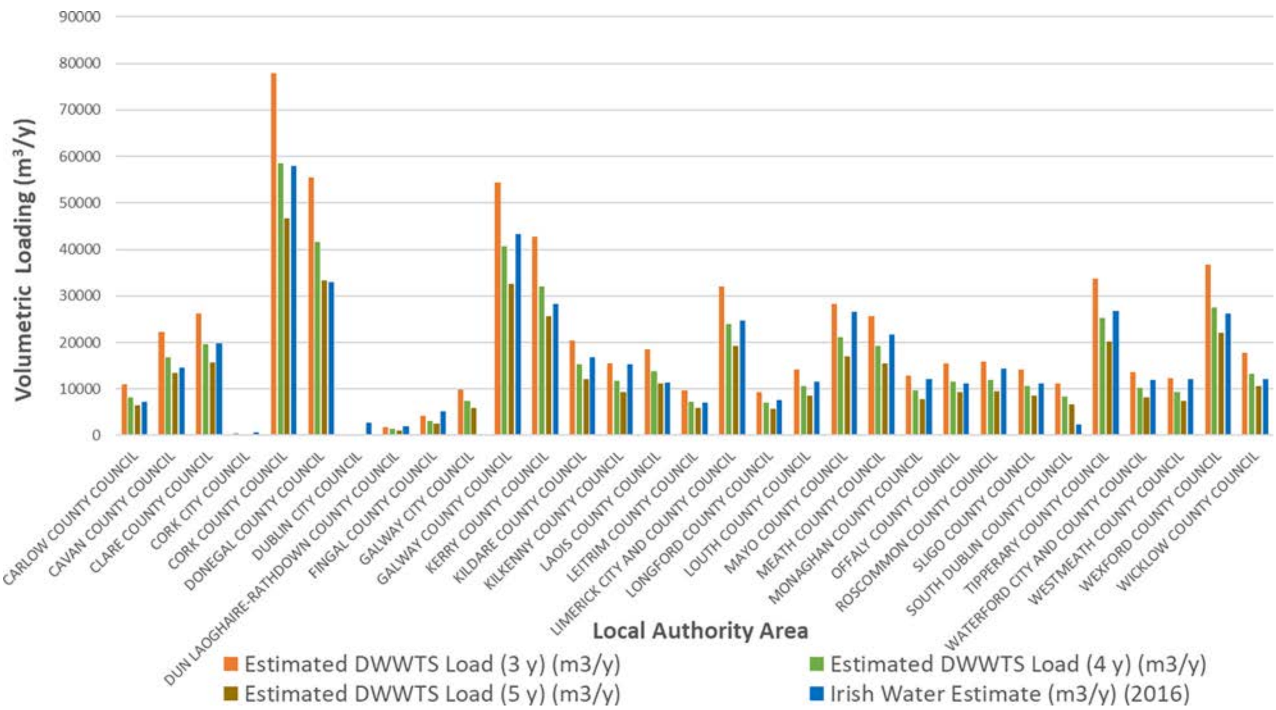

Figure 5.4. Estimated DWWTS sludge volumetric loading per local authority area (m³/year).

in some of the areas with highest predicted DWWTS sludge loadings is quite low, for example in Counties Cork, Clare and Donegal.

A location suitability analysis (based on the Irish Water location selection criteria for a sludge facility) was also carried out on the areas that are currently

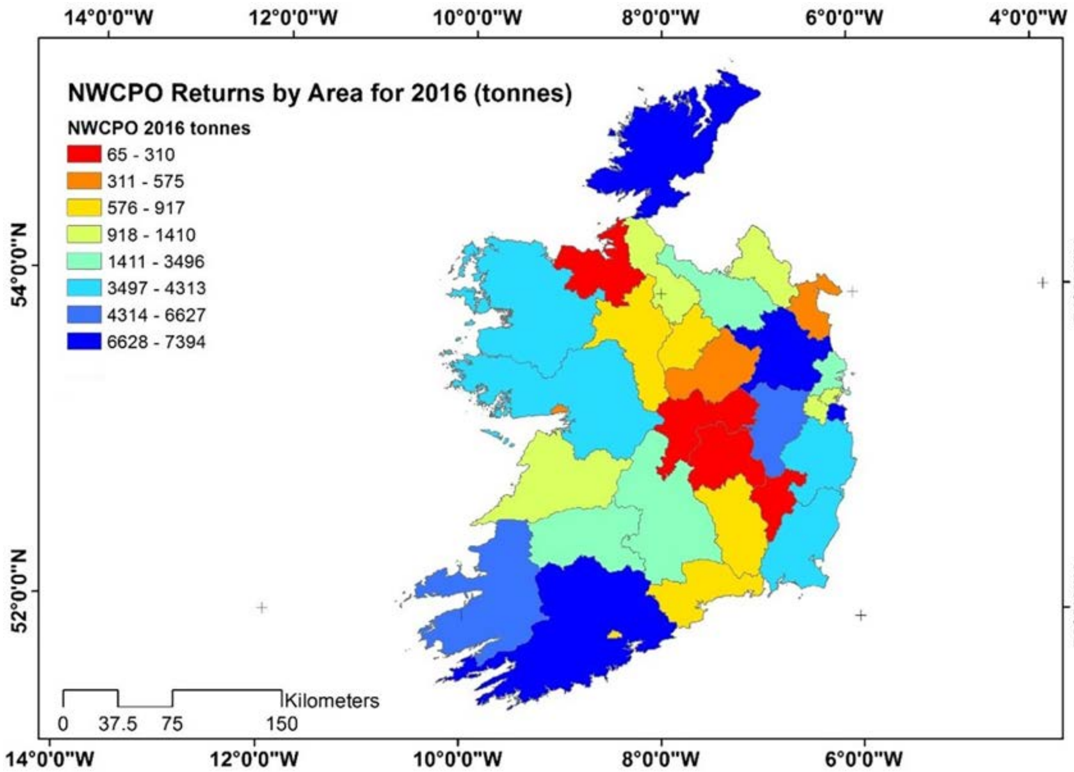

Figure 5.5. DWWTS waste loads logged with NWCPO in 2016 by local authority area (tonnes). (These were the loads transported by permitted desludging contractors to permitted wastewater treatment facilities. Note: quantity in tonnes is approximately equal to volume in m^3.)

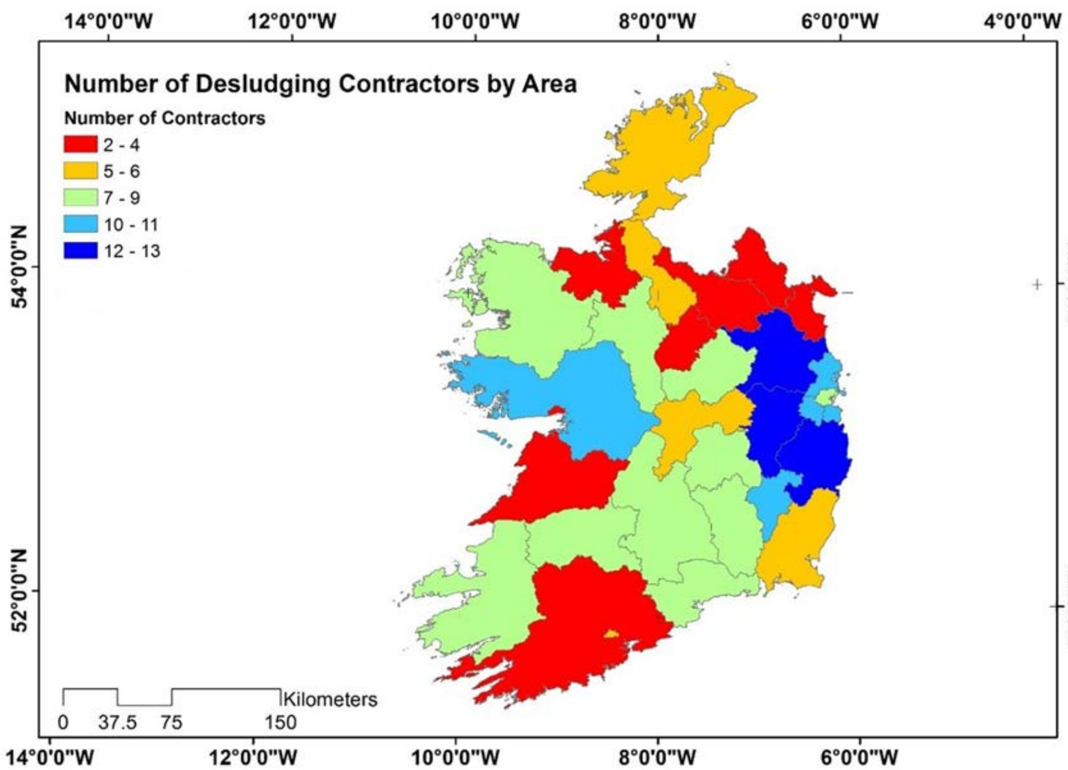

Figure 5.6. Number of permitted desludging contractors operating in each local authority area, which logged returns with NWCPO in 2015 and 2016.

outside the 25-km sustainable transport distance. The areas identified could be used in conjunction with the information on estimated loadings for existing WWTPs, with current or planned sludge acceptance facilities, in order to assess the need for new facilities or for the expansion of existing treatment facilities. It should be noted that the cost of accepting DWWTS waste at WWTPs is a considerable factor when desludging contractors assess which WWTPs to utilise. Currently the fees are not standardised across WWTPs and so contractors tend to use the cheapest option, even if it requires longer travelling distance.

Overall, the GIS analysis confirmed a clear lack of capacity, in terms of both transport of sludge from households to WWTPs by private desludging contractors and treatment capacity at WWTPs with suitable sludge acceptance facilities. Certain areas of the country are particularly vulnerable in this regard and more detailed strategic assessment of facilities in these areas is needed.

6 Conclusions and Recommendations

The conclusions and recommendations have been informed by both the desk and field studies carried out during this project. Field measurements were compared with international research and standards, and all conclusions and recommendations are aimed at addressing the specific needs in Ireland, in terms of both services currently available and the regulatory context.

6.1 Conclusions

6.1.1 Householder perception and the need for homeowners to be more proactive with respect to the operation and maintenance of their own DWWTS

There is an urgent need to educate homeowners further on the basic workings of DWWTSs and the operation and maintenance requirements of these systems. The Operation and Maintenance Manual and infographics produced during this study provide a solid set of guidelines based on international standards, current international research and field studies carried out in Ireland.

Key areas identified to focus on in messaging to households include:

- simple guidelines on "dos and don'ts" in relation to what a DWWTS can process;
- guidelines for the care of soil percolation areas, which are often ignored or incorrectly managed;
- specific desludging guidelines for septic tanks and packaged systems;
- guidelines for modifying household behaviour in key areas such as the kitchen, bathroom and garden.

This set of messages specifically focuses on the system and on behaviour patterns within the household, rather than looking at wider issues of the community or environment. If households are given clear recommendations in these four key areas, the long-term operation of DWWTSs could be significantly improved, protecting and prolonging the life of these systems.

It is also important for householders to understand the design limits of their own particular system, in terms of both what and how much it can handle. Owners of packaged systems, for instance, seem to be unaware that these have specific maintenance requirements and cannot be treated like a septic tank system. The key message for owners of packaged systems is that manufacturers' guidelines for operation and maintenance must be followed and desludging is required at least once per year. Owners of septic tanks must be aware of their tank size in order to assess desludging frequency requirements.

As well as messaging around behavioural change to improve operation and maintenance, messaging is also needed in other key areas including:

- the homeowner's legal obligation to ensure systems are operating properly and not causing environmental or health hazards;
- the potential health and environmental hazards created by poor maintenance, if systems are allowed to discharge insufficiently treated effluent;
- the need to think of the broader environment and community, e.g. neighbours' wells, local waterways;
- the cost–benefit of regular inspections and desludging compared with the very expensive remedial works required if a system fails.

This set of messages focuses on the householder's responsibility in the context of the wider community and environment, as well as the economic advantages of investing in regular maintenance.

6.1.2 Evaluation of the potential environmental pressures on soil and water resources from DWWTSs and required desludging frequency

Sludge accumulation rates were measured and sludge quality samples taken at 14 different DWWTS sites across Ireland. These measurements revealed typical sludge accumulation rates and quality over time. Volumetric accumulation rates were found to be particularly high in the first year of operation (average of approximately 250 L/person/y). Sludge was generally not decomposed to a large degree over the first 12 months but beyond this time volumetric rates of accumulation were observed to drop significantly (to under 150 L/person/y after 2 years), indicating both decomposition and compression of solids.

The results of field measurements combined with the findings of the literature review indicate that a desludging frequency of 3 years is optimal for septic tank systems over 3.5 m^3, depending on household occupancy. If tanks are desludged more frequently than every 3 years, there is insufficient time for significant decomposition of solids to take place. Field results revealed that all systems were within allowable sludge volume levels (up to 50% of the total tank working volume) up to 5 years and so these systems did not pose any environmental risk to soil and water sources up to this point. Beyond 5 years, however, the sludge volume in some systems had exceeded the recommended volume limit, and so an upper limit of desludging within at least a 5-year period is essential.

Based on field measurements and the well-established Bounds model for sludge accumulation, a table of desludging frequency based on tank size and household occupancy has been compiled. The frequencies recommended in this table are comparable to those outlined in the widely used Mancl (1984) table for desludging frequency and can be considered conservative compared with both the Bounds and Weibel models for sludge accumulation, particularly for tanks larger than 3.5 m^3.

Typical tank sizes in Ireland are between 3 and 4 m^3 for a design PE of 8 or under. The required septic tank capacity, C (in litres) for a household is calculated using the following equation from the EPA Code of Practice (2010), where P is the design population with a minimum of four people:

$$C = 150 \times P + 2000$$

This gives a minimum tank capacity of 2600 L for four people with 150 L added for every extra person thereafter (EPA, 2010). In the UK, the minimum septic tank size for a four-person household is 2720 L, with 180 L added for every extra person.

In terms of desludging requirements, special consideration must be given to smaller septic tank systems (under 3.8 m^3, 1000 US gallons), due to the limited space for hydraulic retention (Bounds, 1995), and also tanks which are being operated beyond their design capacity, particularly older tanks. In general, a degree of oversizing for septic tanks is advantageous, as it ensures long hydraulic retention times, which have been shown to improve the decomposition rates of solids (as well as settling rates). Annual inspections are recommended for both septic tanks and packaged systems in order to assess the level of sludge accumulation. All packaged systems need to be desludged at least once per year or according to the manufacturer’s guidelines.

6.1.3 Evaluation of infrastructural requirements in terms of transport of sludge and location of sludge processing plants using geospatial analysis

The GIS analysis, based on existing DWWTS and WWTP locations in Ireland, revealed a lack of capacity, in terms of both transport of DWWTS sludge by permitted contractors from households to WWTPs and sludge treatment availability throughout the country, should sludge removal levels reach those predicted if households were to desludge every 3–5 years. Certain pressure zones were revealed in the analysis, where sludge loads dramatically exceeded the sludge services that are currently available. These were located mostly in western counties, such as Counties Galway, Clare and Donegal.

The GIS analysis gives estimated volumetric and solids loads per local authority area and estimated volumetric and solids loads for existing WWTPs with current or planned sludge acceptance facilities for 3-, 4- and 5-year desludging cycles. It also identifies areas that are outside the recommended sustainable maximum transport distance from DWWTSs to WWTPs of 25 km for non-dewatering tankers (it was assumed that the vast majority of sludge collections would continue to be carried out using standard rather than dewatering tankers in the medium to long term). This information, combined with the analysis of suitable locations for sludge treatment systems, can be used to assess increased sludge treatment needs through either the expansion of existing facilities or the creation of new facilities. In addition, should a scheduled rota system for desludging be introduced, the sustainable transport distance could potentially be increased, as tankers would be operating on full loads for each trip. This could provide much greater flexibility in terms of spreading the sludge load across WWTP facilities.

An important point revealed during the analysis was the need to assess solids loadings as well as volumetric loadings on treatment facilities. Because of the more concentrated nature of septic tank waste, compared with wastewater effluent from a mains sewer, DWWTS waste puts a significantly higher solids burden on WWTPs.

6.2 Recommendations

A list of recommendations is provided in Table 6.1 in order to address the issues identified in this study. These are based on the findings from the literature review, the stakeholder advisory group workshop, field studies and the GIS analysis.

Table 6.1. Recommendations

Issue	Recommendations	Target	Time frame
DWWTS operation and maintenance	• Operation and maintenance guidelines (set out in a manual and series of infographics) need to be communicated to owners of DWWTS.	• Owners of septic tanks and packaged systems. • Permitted desludging contractors. • Suppliers of DWWTSs.	2018–2019
Communication/incentives	• Communicate the legal responsibilities not to pollute to homeowners. • Communicate the importance to householders of both using registered contractors and requesting a receipt for desludging services. • Consider tax incentives for regular desludging. • Communicate the cost–benefit of regular maintenance compared with expensive remedial works. • Communicate the health and environmental benefits for household members, neighbours and the wider community. • Establish local coordination of desludging through group water schemes in order to mobilise homeowners.	• Owners of septic tanks and packaged systems. • Local authorities. • Department of Housing, Planning and Local Government. • National Federation of Group Water Schemes.	2018–2019
Desludging frequency	• Desludging frequency table, based on limiting sludge volume to 50% of the working volume of the tank, to be made available to homeowners. • Desludging frequency of 3 years for tanks over 3.5 m^3. • Special consideration needed for smaller septic tanks (under 3.5 m^3) and older systems. Annual monitoring of sludge levels. • Annual desludging for packaged systems.	• Owners of septic tanks and packaged systems. • Permitted desludging contractors. • Local authorities.	2018–2019
Inspection frequency	• Annual inspections for septic tanks and packaged systems.	• Owners of septic tanks and packaged systems. • Permitted desludging contractors. • Suppliers of DWWTSs.	2018–2019
Maintenance systems	• Maintenance contracts for packaged systems. • Incentives for owners of septic tanks to take out maintenance contracts. • A central IT system to manage desludging and maintenance records for all households with DWWTS permits. • Text/email reminders for households to desludge.	• Owners of septic tanks and packaged systems. • Permitted desludging contractors. • Suppliers of DWWTSs. • Local authorities.	2018–2020

Table 6.1. Continued

Issue	Recommendations	Target	Time frame
Desludging services	• Engage with desludging contractors, private waste treatment facilities and Irish Water to assess feasibility of scheduled desludging.	• Private permitted desludging contractors. • Private permitted waste treatment facilities. • Irish Water.	2018–2019
Sludge treatment facilities	• Review the existing capacity of WWTPs to accept predicted levels of DWWTS sludge, particularly in terms of solids loading. • Engage with private waste treatment facilities to assess current capacity and obstacles to accepting DWWTS sludge. • If possible, review and standardise the costs of accepting DWWTS waste at WWTPs.	• Irish Water. • Private permitted desludging contractors. • Private permitted waste treatment facilities.	2018–2020

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Abbreviations

DWWTS	Domestic wastewater treatment system
EPA	Environmental Protection Agency
GIS	Geographic information system
NWCPO	National Waste Collection Permit Office
PE	Population equivalent
tds	Tonnes of dry solids
WWTP	Wastewater treatment plant

AN GHNÍOMHAIREACHT UM CHAOMHNÚ COMHSHAOIL
Tá an Ghníomhaireacht um Chaomhnú Comhshaoil (GCC) freagrach as an gcomhshaol a chaomhnú agus a fheabhsú mar shócmhainn luachmhar do mhuintir na hÉireann. Táimid tiomanta do dhaoine agus don chomhshaol a chosaint ó éifeachtaí díobhálacha na radaíochta agus an truaillithe.

Is féidir obair na Gníomhaireachta a roinnt ina trí phríomhréimse:

Rialú: *Déanaimid córais éifeachtacha rialaithe agus comhlíonta comhshaoil a chur i bhfeidhm chun torthaí maithe comhshaoil a sholáthar agus chun díriú orthu siúd nach gcloíonn leis na córais sin.*

Eolas: *Soláthraímid sonraí, faisnéis agus measúnú comhshaoil atá ar ardchaighdeán, spriocdhírithe agus tráthúil chun bonn eolais a chur faoin gcinnteoireacht ar gach leibhéal.*

Tacaíocht: *Bímid ag saothrú i gcomhar le grúpaí eile chun tacú le comhshaol atá glan, táirgiúil agus cosanta go maith, agus le hiompar a chuirfidh le comhshaol inbhuanaithe.*

Ár bhFreagrachtaí

Ceadúnú
Déanaimid na gníomhaíochtaí seo a leanas a rialú ionas nach ndéanann siad dochar do shláinte an phobail ná don chomhshaol:
- saoráidí dramhaíola *(m.sh. láithreáin líonta talún, loisceoirí, stáisiúin aistrithe dramhaíola)*;
- gníomhaíochtaí tionsclaíocha ar scála mór *(m.sh. déantúsaíocht cógaisíochta, déantúsaíocht stroighne, stáisiúin chumhachta)*;
- an diantalmhaíocht *(m.sh. muca, éanlaith)*;
- úsáid shrianta agus scaoileadh rialaithe Orgánach Géinmhodhnaithe *(OGM)*;
- foinsí radaíochta ianúcháin *(m.sh. trealamh x-gha agus radaiteiripe, foinsí tionsclaíocha)*;
- áiseanna móra stórála peitril;
- scardadh dramhuisce;
- gníomhaíochtaí dumpála ar farraige.

Forfheidhmiú Náisiúnta i leith Cúrsaí Comhshaoil
- Clár náisiúnta iniúchtaí agus cigireachtaí a dhéanamh gach bliain ar shaoráidí a bhfuil ceadúnas ón nGníomhaireacht acu.
- Maoirseacht a dhéanamh ar fhreagrachtaí cosanta comhshaoil na n-údarás áitiúil.
- Caighdeán an uisce óil, arna sholáthar ag soláthraithe uisce phoiblí, a mhaoirsiú.
- Obair le húdaráis áitiúla agus le gníomhaireachtaí eile chun dul i ngleic le coireanna comhshaoil trí chomhordú a dhéanamh ar líonra forfheidhmiúcháin náisiúnta, trí dhíriú ar chiontóirí, agus trí mhaoirsiú a dhéanamh ar leasúchán.
- Cur i bhfeidhm rialachán ar nós na Rialachán um Dhramhthrealamh Leictreach agus Leictreonach (DTLL), um Shrian ar Shubstaintí Guaiseacha agus na Rialachán um rialú ar shubstaintí a ídíonn an ciseal ózóin.
- An dlí a chur orthu siúd a bhriseann dlí an chomhshaoil agus a dhéanann dochar don chomhshaol.

Bainistíocht Uisce
- Monatóireacht agus tuairisciú a dhéanamh ar cháilíocht aibhneacha, lochanna, uiscí idirchriosacha agus cósta na hÉireann, agus screamhuiscí; leibhéil uisce agus sruthanna aibhneacha a thomhas.
- Comhordú náisiúnta agus maoirsiú a dhéanamh ar an gCreat-Treoir Uisce.
- Monatóireacht agus tuairisciú a dhéanamh ar Cháilíocht an Uisce Snámha.

Monatóireacht, Anailís agus Tuairisciú ar an gComhshaol
- Monatóireacht a dhéanamh ar cháilíocht an aeir agus Treoir an AE maidir le hAer Glan don Eoraip (CAFÉ) a chur chun feidhme.
- Tuairisciú neamhspleách le cabhrú le cinnteoireacht an rialtais náisiúnta agus na n-údarás áitiúil *(m.sh. tuairisciú tréimhsiúil ar staid Chomhshaol na hÉireann agus Tuarascálacha ar Tháscairí)*.

Rialú Astaíochtaí na nGás Ceaptha Teasa in Éirinn
- Fardail agus réamh-mheastacháin na hÉireann maidir le gáis cheaptha teasa a ullmhú.
- An Treoir maidir le Trádáil Astaíochtaí a chur chun feidhme i gcomhair breis agus 100 de na táirgeoirí dé-ocsaíde carbóin is mó in Éirinn.

Taighde agus Forbairt Comhshaoil
- Taighde comhshaoil a chistiú chun brúnna a shainaithint, bonn eolais a chur faoi bheartais, agus réitigh a sholáthar i réimsí na haeráide, an uisce agus na hinbhuanaitheachta.

Measúnacht Straitéiseach Timpeallachta
- Measúnacht a dhéanamh ar thionchar pleananna agus clár beartaithe ar an gcomhshaol in Éirinn *(m.sh. mórphleananna forbartha)*.

Cosaint Raideolaíoch
- Monatóireacht a dhéanamh ar leibhéil radaíochta, measúnacht a dhéanamh ar nochtadh mhuintir na hÉireann don radaíocht ianúcháin.
- Cabhrú le pleananna náisiúnta a fhorbairt le haghaidh éigeandálaí ag eascairt as taismí núicléacha.
- Monatóireacht a dhéanamh ar fhorbairtí thar lear a bhaineann le saoráidí núicléacha agus leis an tsábháilteacht raideolaíochta.
- Sainseirbhísí cosanta ar an radaíocht a sholáthar, nó maoirsiú a dhéanamh ar sholáthar na seirbhísí sin.

Treoir, Faisnéis Inrochtana agus Oideachas
- Comhairle agus treoir a chur ar fáil d'earnáil na tionsclaíochta agus don phobal maidir le hábhair a bhaineann le caomhnú an chomhshaoil agus leis an gcosaint raideolaíoch.
- Faisnéis thráthúil ar an gcomhshaol ar a bhfuil fáil éasca a chur ar fáil chun rannpháirtíocht an phobail a spreagadh sa chinnteoireacht i ndáil leis an gcomhshaol *(m.sh. Timpeall an Tí, léarscáileanna radóin)*.
- Comhairle a chur ar fáil don Rialtas maidir le hábhair a bhaineann leis an tsábháilteacht raideolaíoch agus le cúrsaí práinnfhreagartha.
- Plean Náisiúnta Bainistíochta Dramhaíola Guaisí a fhorbairt chun dramhaíl ghuaiseach a chosc agus a bhainistiú.

Múscailt Feasachta agus Athrú Iompraíochta
- Feasacht chomhshaoil níos fearr a ghiniúint agus dul i bhfeidhm ar athrú iompraíochta dearfach trí thacú le gnóthais, le pobail agus le teaghlaigh a bheith níos éifeachtúla ar acmhainní.
- Tástáil le haghaidh radóin a chur chun cinn i dtithe agus in ionaid oibre, agus gníomhartha leasúcháin a spreagadh nuair is gá.

Bainistíocht agus struchtúr na Gníomhaireachta um Chaomhnú Comhshaoil
Tá an ghníomhaíocht á bainistiú ag Bord lánaimseartha, ar a bhfuil Ard-Stiúrthóir agus cúigear Stiúrthóirí. Déantar an obair ar fud cúig cinn d'Oifigí:
- An Oifig um Inmharthanacht Comhshaoil
- An Oifig Forfheidhmithe i leith cúrsaí Comhshaoil
- An Oifig um Fianaise is Measúnú
- Oifig um Chosaint Radaíochta agus Monatóireachta Comhshaoil
- An Oifig Cumarsáide agus Seirbhísí Corparáideacha

Tá Coiste Comhairleach ag an nGníomhaireacht le cabhrú léi. Tá dáréag comhaltaí air agus tagann siad le chéile go rialta le plé a dhéanamh ar ábhair imní agus le comhairle a chur ar an mBord.

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Deslugging Rates and Mechanisms for Domestic Wastewater Treatment System Sludges in Ireland

Authors: Laurence Gill, Joanne Mac Mahon, Jan Knappe, Salem Gharbia and Francesco Pilla

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Climate - Water - Sustainability
Identifying pressures • Informing policy • Developing solutions

Identifying Pressures

The domestic wastewater of approximately one-third of the population in Ireland (489,069 dwellings) is treated on site by domestic wastewater treatment systems (DWWTSs), of which approximately 90% are septic tanks. The recent introduction of the National Inspection Plan (under the Water Services (Amendment) Act, 2012) means that records now need to be kept to prove that tanks have been desludged at the recommended frequency. This study has identified major gaps in capacity for both the transport of DWWTS sludge and treatment of sludge at wastewater treatment facilities. Current levels of collection and treatment are between 10% and 18% of the expected load if all DWWTS were to be desludged every 3 to 5 years. This level of DWWTS sludge collection indicates that most septic tanks and packaged treatment systems in Ireland are rarely emptied and thus may pose both health and environmental risks. Particular areas of the country are likely to be under more pressure than others due to a current lack of facilities to receive and treat the sludge. These areas have been identified in western counties for the most part. Therefore, further analysis of wastewater treatment services in under-serviced areas is required.

Informing Policy

Field studies to measure the rate of sludge accumulation, as well as a comprehensive review of international research in sludge accumulation and desludging frequency, have identified that a desludging interval of 3 years is suitable for septic tank systems bigger than 3.5 m3. Annual desludging has been found to be too frequent and can negatively disrupt the biological processes that develop within septic tanks, resulting in less than optimal decomposition of solids. The maximum interval between desludging for any tank should not exceed 5 years to avoid possible contamination of effluent with solids. Rates of accumulation should be monitored annually for all tanks under 3.5 m3 and for older systems, which may be in a poor state of repair or undersized for current use, to determine bespoke appropriate desludging frequencies for these systems. Packaged treatment systems must be desludged at least annually and more frequently where recommended by the manufacturer. Current figures for collection of DWWTS sludge indicate that septic tanks and packaged treatment systems are for the most part neglected and incentives are needed to mobilise homeowners to desludge systems on a regular basis, not just when problems arise.

Developing Solutions

There is an urgent need to address the lack of understanding among homeowners of how their DWWTSs operate. This study has produced a set of guidelines for owners of septic tanks and packaged treatment systems to help to address this knowledge gap and encourage responsible operation and maintenance of DWWTSs. In addition, messaging in other key areas could help to motivate homeowners to change operation and maintenance habits. These include communicating (1) their legal responsibilities not to pollute; (2) the health and environmental benefits of correct operation and maintenance; and (3) the economic benefits of carrying out regular desludging rather than expensive repair works. In addition, local coordination of regular desludging through organisations such as the National Federation of Group Water Schemes could mobilise homeowners more effectively and result in more economic desludging costs. A pilot project is currently running with this organisation in this regard. In terms of the effects of increased sludge loads on existing infrastructure, engagement with private desludging contractors, private waste facilities with permits to handle DWWTS sludge, and Irish Water is essential to properly address the need for increased capacity in terms of both the transport and treatment of DWWTS sludge.

EPA Research: McCumiskey House,
Richiew, Clonskeagh, Dublin 14.

Phone: 01 268 0100
Twitter: @EPAResearchNews
Email: research@epa.ie

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