CREW CENTRE OF EXPERTISE FOR WATERS

Understanding problems associated with small-scale Private Sewage Systems (PSS) from regulators' perspectives

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Executive Summary

Question

What are the problems associated with small-scale Private Sewage Systems (PSS) from regulators' perspectives?

Background

Private sewage systems (PSS) refer to systems that are not connected to the mains sewer. According to estimates by the Scottish Environment Protection Agency (SEPA) the majority of PSS in Scotland serve domestic properties. SEPA is aware that problems in PSS design, siting, management and maintenance may lead to problems such as nuisance and diffuse pollution. A detailed account of the different types of PSS-related problems from the perspective of the householder, neighbours, local communities and regulatory authorities, i.e., SEPA and the local authorities, will help to inform bespoke actions. This work focuses on PSS serving up to nine properties, i.e., up to 50 population equivalent (p.e.), and regulators' perspectives.

Method

The project team reviewed the modelled evidence (as of 2017) on PSS locations and property addresses and estimated total PSS numbers, PSS density per hectare and distance of modelled PSS locations from coastline and watercourses. Qualitative evidence on PSS problems, regulatory weaknesses, and barriers to improvements from regulators' perspectives was collected through three workshops. Attendees from SEPA and local authorities shared their experiences and perspectives, which are summarised in this report. The evidence collected in these workshops may be further analysed in a future project on solutions to PSS problems.

Key Findings

1. Review of modelled PSS locations

- There are 168,635 unique modelled PSS locations in Scotland serving 172,805 properties.
- Over 99% of the modelled PSS locations refer to one property in a rural area.
- Density of PSS locations and properties per hectare (100m x 100m grids) is generally low, with approximately 50% of grids occupied by one PSS-served property and 95% of grids occupied by up to nine PSS-served properties.
- Modelled PSS locations associated with less than nine properties were found in rural areas.
- Modelled PSS locations associated with more than nine properties were found at the outskirts of urban areas or at caravan sites.
- A small proportion of PSS are located within 200m from the coastline in designated bathing and shellfish waters, implying a potential risk to the environment.
- It is possible to ground-truth modelled PSS locations using up-to-date Google Maps.
- The modelled PSS location database must be updated at frequent intervals to catch up with urban sprawl, new housing developments and changes in the sewerage network.

2. Summary of workshop discussion

The qualitative evidence collected through three workshops revolved around four themes: availability and reliability of PSS-related information; implementation and interpretations of different types of regulations; regulatory action taken; and PSS-related problems and their causes.

a. Availability and reliability of PSS-related information

- There is a lack of information on PSS treatment type, discharge point, desludging frequency, sharing of management/ownership, population equivalent and age of the system.

b. Implementation and interpretation of the regulations

- The current regulatory framework for new and existing PSS is multifaceted. It grants the responsibility for PSS management to householders. It involves different duties for local authorities and SEPA but also requires their collaboration and engagement with other Scottish agencies, including Scottish Water.
- The regulatory authorities (SEPA and local authorities) are clear with their duties. However, regulators' experiences from inspections following complaints suggest that householders may be unaware of the different aspects of the PSS-related regulatory framework and/or the consequences of not complying with the regulations for the environment, themselves, or public health.

c. Type of regulatory action taken

- The local authorities address PSS-related complaints about statutory nuisance, handle planning applications in consultation with SEPA and Scottish Water, enforce Building Standards that refer to new

PSS, assess Building Warrant applications that include PSS, and undertake inspections to check compliance of PSS with Building Regulations.

- SEPA regulate and authorise discharges from PSS, provide guidance on PSS management, undertake inspections in response to reports or complaints about environmental incidents including water pollution, and provide advice to planning authorities to ensure protection of the environment. Response to complaints or incidents is determined by the severity of the problem and availability of resources.
- Local authorities agree that a mix of interventions, highlighted as opportunities for improvements (see below), is needed to collect the necessary information and ensure compliance with regulations. With regard to resource needs, these were mainly related to regulatory staff time, SEPA and local authority budget and a broader pool of experts to assess PSS along the planning and property sale process.

d. PSS-related problems and their causes

- There is a broad acceptance that problems related to small-scale PSS include: poor management and maintenance, historic (i.e., built before current regulations) systems, misconnections, unsuitable (size and type) soakaways and faulty piping. These problems usually come to regulators' attention following complaints by those affected (mainly neighbours and visitors in an area).
- A variety of causes were highlighted including PSS owners' being unaware of PSS existence; management/maintenance responsibilities and the regulations; lack of regulatory problem-detection mechanism; and lack of consequences for PSS users who fail to comply with the regulations.

Opportunities for improvement include

1. More collaboration between local authorities and SEPA staff and better data collection.
2. Improving maintenance and upgrade by owners by, for example, inspections by the regulator, a septic tank MOT system or an approach like they have at one water board (Waterschap Rivierenland; Helwig et al. 2022) in the Netherlands.
3. More comprehensive information on PSS in the Landlord's register and the Home Report.
4. A project or workshop to explore this further.

3. Lessons learned for SEPA

SEPA assessed the key findings of this report and added the following concluding remarks:

1. Not all small-scale sewage discharges are currently authorised by SEPA under the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended) (CAR). For existing unauthorised discharges this is to happen at the point of house sale and the number authorised rises every year. Because SEPA do not yet have data on the location of all PSS they have to, in part, rely on modelling the location of PSS based on the distance of properties to main sewer.
2. It can be hard to determine the impact that discharges from PSS are having on the water environment because their impact is often either very localised or diffuse in nature. This is not helped by the fact the data on the exact location of the sewage discharges and the nature of the discharge (e.g., to soakaway or surface water) and treatment type is not available for all properties.
3. Along with time spent processing CAR applications to discharge sewage effluent from PSS, complaints involving PSS take a lot of SEPA's time. In addition, some complaints are difficult to resolve and can re-occur.
4. The legislative and enforcement responsibility for PSS rests between a number of bodies including local authority planners, building control staff and Environmental Health Officers as well and SEPA. This can at times be complex.
5. There are thousands of PSS, and SEPA and local authority do not have the resources to inspect them. Because they are deemed low risk, SEPA normally only inspects registration level sewage discharges if a complaint is received.
6. If the correct PSS is not installed or if not maintained, upgraded or installed correctly it can cause nuisance and pollution issues. In a lot of areas problems with PSS will not become obvious, for example discharges to groundwater.
7. Some owners do not have adequate treatment in place for the location of the discharge, they have not installed the system properly or appropriately maintained or upgraded their system. This can result in problems that can be very costly to fix. Because the environmental impact can be small (but often serious for the community) and costly to fix, it can make taking enforcement action for SEPA difficult. A member of SEPA staff commented that they have had feedback from the companies that install and sell PSS that less than 50% of new Package Treatment Plants (PTPs) have a maintenance contract taken out when

the plant is installed. These companies also mention that PSS are often incorrectly designed and installed.

8. For shared systems it can be hard to get agreement from all of those involved to pay for any major costs to maintain or upgrade a system.
9. Often there is limited site assessment of private sewage drainage solutions at local develop plan or planning stage. Later ground conditions can be found to be unsuitable for a soakaway.
10. There are many less adequate sites being proposed for development where the discharge is to very small burns/ditches. Authorisation is on the basis that best available techniques are in place and high-level treatment systems that eventually are not maintained and go wrong or are replaced by lower lever systems at installation.
11. SEPA would like to further consider wider issues related to PPS such as transitioning to a more circular approach, considering the impact of climate change and chemicals of emerging concern.

1.0 Introduction

Private sewage systems (PSS) refer to systems that are not connected to the mains sewer. According to estimates by the Scottish Environment Protection Agency (SEPA) the majority of PSS in Scotland serve domestic properties but include some bigger systems serving caravan parks, hotels and other business premises (SEPA 2019a).

SEPA is aware that poor PSS design, installation, management and maintenance may lead to problems such as nuisance and diffuse pollution. However, a detailed account of these problems is needed from the perspective of the householder, neighbours, local communities, industry, and the regulatory authorities, i.e., SEPA and the local authorities (LAs). This will assist all parties involved to understand the context of the different types of PSS-related problems and inform options to improve the situation.

The aim of this project is to:

(**i**) Understand the number of PSS, their locations and density across Scotland; and

(**ii**) report qualitative evidence (i.e., observations and experiences) on the factors underlying PSS-related problems, regulatory weaknesses and barriers to PSS improvements from regulators' perspectives.

The work is focused on small-scale PSS, here defined as those systems serving up to nine properties. Modelled PSS locations (last updated in 2017) were provided by SEPA and served to estimate numbers of PSS locations and addresses (properties) per location, density (PSS locations or PSS-served properties per hectare[1] grids) and distance of these grids from surface waters. Qualitative evidence was collected during three workshops held within a period of two months (November 2021 to January 2022) and attended by SEPA and LA officers responsible for the implementation of different PSS-related regulatory aspects. This included PSS authorisations, planning, inspections, granting building warrants and enforcement.

The report includes the following chapters:

- Chapter 2 reviews modelled PSS numbers, locations, density and proximity to surface waters across Scotland.
- Chapter 3 summarises the qualitative evidence.

Further details on the methodology can be found in APPENDIX I. The questionnaires used for structuring the workshops are annexed in APPENDIX II.

[1] Grids of 100m x 100m

2.The number of PSS in Scotland and their location and density

SEPA authorise discharges of treated sewage to the water environment. However, since the introduction of the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended), (CAR) (SEPA, 2022), PSS that are not currently authorised were normally picked up and authorised at the point of house sale. To date SEPA is aware that not all household discharges are currently authorised, meaning that SEPA does not have a complete record of all small-scale sewage discharges. To try to understand the numbers and location of these PSS a modelled dataset on distance of properties from the main sewer was used.

This section presents the results of the PSS location data analysis (see APPENDIX I.1). It outlines any weakness in using the dataset along with a consideration of the location and density of the systems.

2.1. How many small-scale PSS are estimated to occur and how many properties do they serve?

There are 168,635 unique modelled PSS locations in Scotland serving 172,805 properties. If PSS locations in transboundary river catchments are included, to account for all potential influences on Scotland's freshwater environment, there are 177,122 PSS location in Scotland's catchments (see APPENDIX I.1). This estimate assumes that each modelled PSS location refers to a PSS system. Further analysis suggests that 98.6% of PSS serve one property, be it domestic or otherwise (Table 1).

Table 1. Analysis of PSS modelled locations in relation to number of properties and authorisation options for SEPA and PSS users. Authorisation options per p.e. category are based on CAR.

No. of properties	Population equivalent (p.e.)	No. of PSS locations	%	Level of SEPA Authorisation
1	≤ 5	174,255	98.551	Registration for new and existing PSS
2 - ≤3	≤ 15	2,411	1.275	Registration for new and existing PSS
4 - ≤9	≤ 50	383	0.145	Registration for existing PSS CAR Licence for new PSS
10 - ≤20	>50 - ≤100	62	0.025	CAR Licence for new and existing PSS
>20 -	>100	11	0.004	CAR Licence for new and existing PSS

It must be noted that this analysis does not provide information on:

- The type of properties (domestic, commercial or industrial) served by each PSS location, therefore the p.e. equivalent may be different.
- The PSS management, size and type (i.e., septic tank, package treatment, drainage field).
- The sharing pattern of each PSS between different properties.

2.2 What is the distribution of PSS locations and properties served by small-scale PSS?

The density was assessed by looking at the number of properties and PSS locations within a 1-hectare grid. The analysis of modelled PSS locations and properties per location shows that the distribution of PSS is uneven (Table 2). The greatest number of properties served by PSS is estimated to occur in rural LAs such as Aberdeenshire and the Highlands. A lower proportion of properties served by PSS is estimated to occur within urban LAs such as Dundee City, Glasgow City and Inverclyde.

It must be noted that the PSS-served properties are sparsely distributed with half of the grid squares containing one property and one location. This information is broken down by LA in Figure 1.

The estimated distribution of PSS-served properties were compared against Google maps (September 2021) as a way of ground truthing. This examination confirmed the modelled PSS locations and the number of properties per location estimated from address data and suggested that the majority of modelled locations of PSS serving up to nine properties were found in rural areas (Figure 2a and b). However, crosschecking was inconclusive for properties located within urban areas, a category that contained single and multiple properties per PSS location and grid. The presence of modelled PSS locations within urban areas can be explained by three possible situations.

1. The presence of Victorian PSS-served properties, which were originally located out with the current urban fabric and away from the mains; this can explain the presence of single PSS-served properties within cities.

Table 2. Number of PSS locations and PSS-served properties per location		
LA properties	**Total number of locations**	**Total properties**
Aberdeen City	916	934
Aberdeenshire	26,865	27,068
Angus	8,286	8,305
Argyll & Bute	12,554	12,554
Clackmannanshire	504	518
Dumfries & Galloway	13,949	13,956
Dundee City	67	69
East Ayrshire	2,285	2,817
East Dunbartonshire	447	476
East Lothian	2,984	3,076
East Renfrewshire	777	778
Edinburgh, City of	603	659
Eilean Siar	3,933	3,933
Falkirk	1,198	1,275
Fife	5,491	5,562
Glasgow City	66	70
Highland	28,311	29,769
Inverclyde	292	307
Midlothian	1,062	1,093
Moray	8,242	8,359
North Ayrshire	3,621	3,738
North Lanarkshire	1,130	1,161
Orkney Islands	5,256	5,312
Perth & Kinross	11,474	11,524
Renfrewshire	833	870
Scottish Borders	10,526	10,724
Shetland Islands	2,807	2,838
South Ayrshire	2,940	3,065
South Lanarkshire	5,610	6,247
Stirling	3,583	3,622
West Dunbartonshire	395	405
West Lothian	1,628	1,721

2. The locations of properties in recently developed areas; the majority of grid squares with PSS serving more than nine properties were in recent housing developments (Figure 2c and d). It is possible that some of these developments maybe connected to the Scottish Water sewer and that the dataset of the location of the main sewer used to model the location of the PSS properties has not kept pace with real time (SEPA, pers.com., March 2022).

3. A high density of properties per grid, usually above 20, was observed in caravan parks that are licensesd or sharing a PSS.

Making a distinction between PSS location and PSS-served properties per location helped to provide a more realistic estimate of PSS density (as PSS locations per ha). As shown in the example of Figure 2e, grids that seem to have very high PSS density (e.g.,61 PSS per ha) contained one PSS location shared by 61 different properties in the same building.

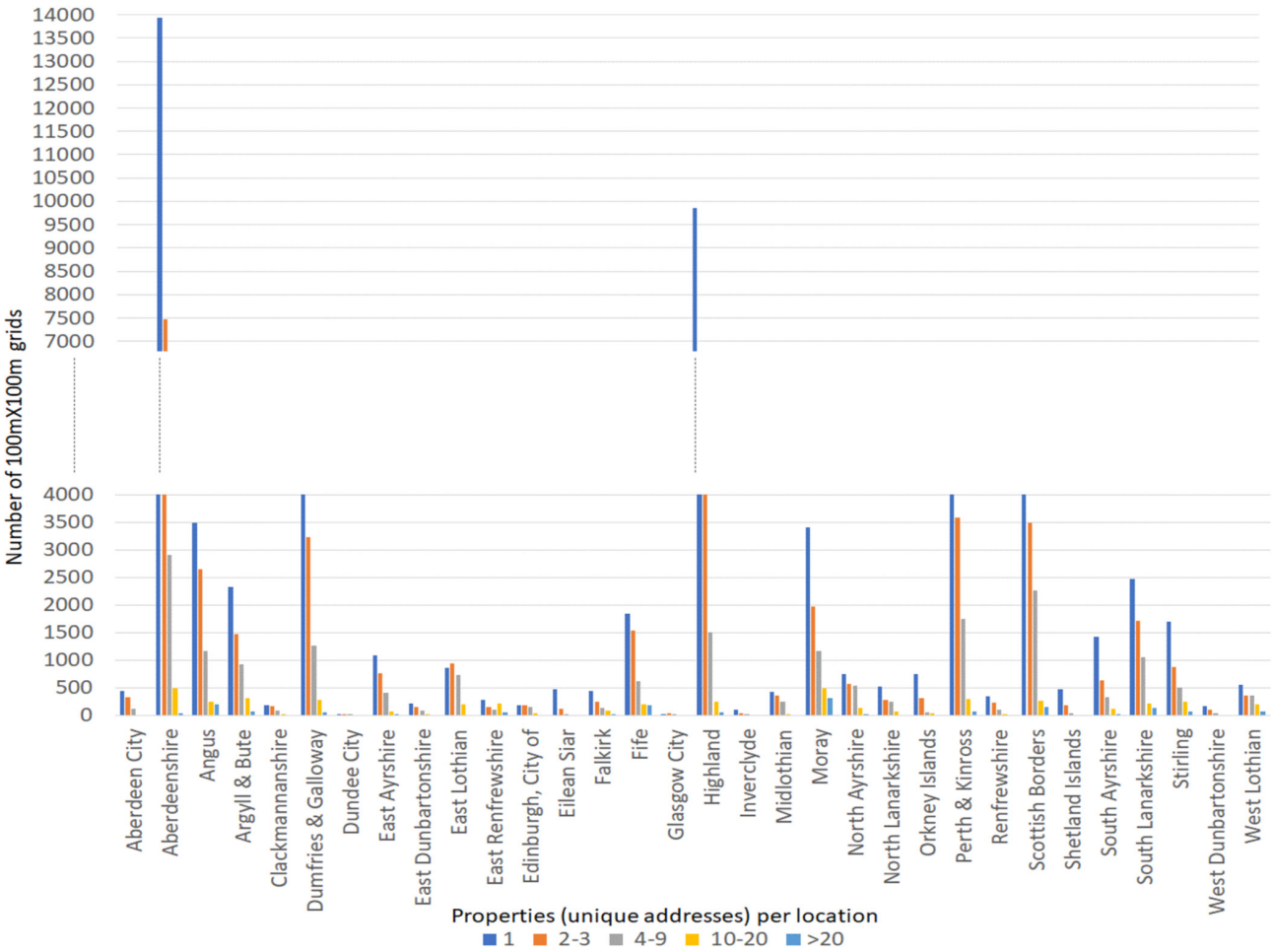

Figure 1. Estimated number of properties per ha in each LA based on modelled property addresses per PSS location. Data source: SEPA.

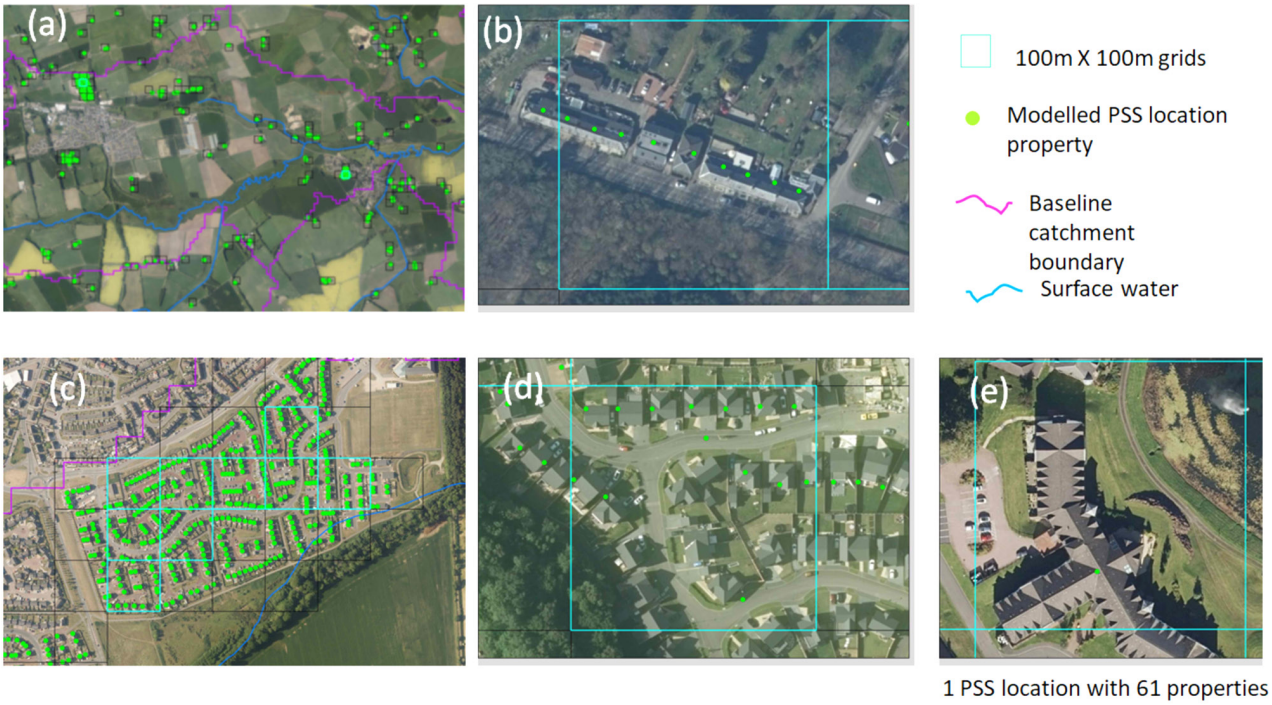

Figure 2. Examples of desk-based ground-truthing of modelled PSS location. Source of data: SEPA and Google Maps (September 2021).

3.0 Workshop discussion

The subsequent sections summarise the evidence collected in the three workshops held to gather SEPA and LA officers' observations and experiences in relation to the implementation of PSS-related regulations. Each workshop involved a roundtable discussion structured around a questionnaire. The questions were developed to identify knowledge gaps and improve the understanding of diverse evidence on PSS in Scotland.

The questions focused on three main issues:

(i) problems leading to complaints addressed to SEPA and LAs, which were discussed in Workshop 1 (see APPENDIX II.1).

(ii) regulatory weaknesses, which were discussed in Workshop 2 (see APPENDIX II.2).

(iii) barriers to improving PSS-related problems and potential regulatory weaknesses, which were discussed in Workshop 3 (see APPENDIX II.3).

Four themes appeared repeatedly during the three workshops:

1. Availability and reliability of PSS-related information.
2. Implementation and interpretations of different types of regulations.
3. Regulatory action.
4. PSS-related problems and their causes.

The attendees also suggested opportunities for improvements.

The observations and experiences of SEPA and LA officers who attended the three workshops for each of these themes and a list of opportunities for improvements that emerged during the discussion are summarised below.

3.1 Availability and reliability of PSS-related information

This is an issue mainly for both regulatory authorities. There are five sources of PSS-related information about the state, location and specifications.

- Complaints to SEPA related to PSS-related discharges to the environment.
- Complaints to LAs related to PSS-related discharges to the environment.
- Inspections from SEPA and LA officers following complaints.
- Regulatory and investigative monitoring.
- Modelling of locations that are not adjacent to the mains network.
- PSS authorisations (such as CAR registration and licensing) by SEPA.
- Information submitted to building control when requesting a building warrant, especially for discharges to an infiltration system.

3.1.1 Complaints-Inspections

Complaints addressed to SEPA and/or LAs are a key source of information about PSS-related problems, in terms of their causes, type of problem or perceived risk (i.e., on the environment or public health) and location.

It is difficult to estimate the total number of complaints submitted to SEPA and LAs across Scotland, as the type of complaints may vary by region and department. Further, as a member of SEPA staff said, quite often people will complain to SEPA and the LA at the same time.

Argyll and Bute Council attendees stressed that complaints reflect complainants' perceived priorities, for example a direct impact on personal, family or pet health and well-being, such as problems related to direct discharge of PSS effluent to easily accessible beaches used by the general public. SEPA officers reported cases where the issues were related to disputes between neighbours sharing either a PSS or other parts of a property. However, there was a consensus that complaints reflect a real PSS technical or management problem with potential public health or environmental consequences. A list of complaints submitted to SEPA and LAs and the PSS problems identified during inspections are summarised in Table 3.

Table 3. Problems identified in complaints to SEPA and LAs and problems identified during follow-up inspections		
Complaints to SEPA	**Complaints to LAs**	**Problems identified during inspections**
• Sewage fungus in a burn • Burn looks polluted • Neighbour disputes • No desludging: "they don't know they have a septic tank" • Inappropriately constructed e.g., built septic tank without putting in a soakaway • Issues with buying and selling properties • No septic tank/soakaway: direct discharge onto the beach • Odour/ponding sewage	• Direct discharge to waterbody/ beach (coastal) • Defects (e.g., old/pipes, leaking septic tanks) • Corroded pipes discharging onto the beach • Complaints about public health risk to children playing on the beach	• Lack of maintenance • No desludging • No/infrequent servicing of a Package Treatment Plant • Package Treatment Plant is not switched on and functioning, if it requires a power supply and has aeration system or a bio disk with rotating disks • Historic discharges – undersized tank, old brick built, could be too small, could be non-conforming with modern design

SEPA and LA officers alike mentioned that the interpretation of a problem from the general public is nuanced. Reporting to the regulatory authorities may not be a matter of severity, but rather, the visibility of the problem. There is, however, a problem behind a complaint, suggesting that complaints are a reliable source of information for regulatory authorities. An Environment Health Officer (EHO) from Argyll and Bute Council mentioned:

"When the complaints come in, they are usually justified as we discover when we go out. Sometimes there is a discharge to an area with no public access, so it is difficult to argue that it is a nuisance."

3.1.2 Monitoring and modelling

SEPA officers commented on the role of regulatory monitoring under the Water Environment and Water Services (Scotland) Act 2003 (which transposes the EU Water Framework Directive 2000/60/EC to Scots law) to detect PSS-related pressures and enhance the visibility of PSS problems.

SEPA monitor primarily where they have statutory obligations. For example, samples at bathing waters are analysed for bacteria, specifically the faecal indicator organisms (FIOs) Escherichia coli and Intestinal Enterococci. SEPA use microbial source tracking to identify the source as human, ruminant, dog or gull. Bathing waters with a poor or a risky classification, have improvement plans which summarise evidence why the bathing water is poor and actions to improve water quality. SEPA does not routinely undertake FIO monitoring out with designated bathing and shellfish waters.

A member of SEPA staff noted that it can be hard to determine the impact that discharges from PSS are having on the water environment because their impact is often either very localised or diffused in nature. This uncertainty is compounded by the fact the data on the exact location of the sewage discharges and the nature of the discharge (e.g., to soakaway or surface water) and treatment type is not available for all properties.

Another CREW report to SEPA developed a probabilistic risk model of soluble reactive phosphorus (P) discharges from PSS and tested the effect of PSS management scenarios on P load at the catchment scale (Glendell et al., 2021). The applicability of the model to predict PSS-related problems and support P source-apportionment is heavily influenced by uncertainties in the modelled PSS locations, which may lead to misleading estimates of PSS density and distance from watercourses and therefore is a risk to the environment, as shown in Section 2.1.

The attendees also mentioned that an additional source of information for PSS may come from sanitary survey reports developed on behalf of Food Standard Scotland. These reports describe locations of PSS on the shoreline in the immediate vicinity of Shellfish Production Areas. However, an earlier CREW report on "Developing Scotland's shellfish water monitoring programme" (Akoumianaki et al., 2018) revealed that the information on PSS locations reported in the sanitary surveys is not recorded in a database. Therefore, this information is difficult to extract, besides being relatively old and limited to the shoreline.

The importance of the availability of information on PSS discharges for ensuring safe shellfish growing waters was highlighted by both SEPA and LA officers. A member of SEPA staff mentioned:

"When applications from shellfish growers and Food Standard Scotland to get a shellfish water production area classified come in, SEPA are consulted. We would let them know if there are any discharges in the area and of any concerns we have about any pollution sources."

An EHO from Argyll and Bute Council added:

"Part of it is pushed back onto the applicant[2], asking them to show what they have done to show what is in the area. As is often the case with any planning, the applicant has to demonstrate that they have looked at the risks, identified the risks, what risks have been considered and ruled out, either as a minimal or non-existent risk."

3.1.3 CAR authorisations

SEPA's database of registered and licensed PSS is incomplete because properties that were not authorised when CAR came in were expected to be registered when the house was sold. A SEPA officer explained *"There are still tens of thousands of discharges unregistered in this country."* This database of authorised discharges differs from the complaints database. This implies that it is difficult to link complaints with CAR authorisation.

A member of SEPA staff laid down the issues emerging from an incomplete database of authorised PSS when there are complaints.

If a non-compliant PSS was causing a problem and it was unregistered, SEPA would then require the owner to have that PSS registered. When septic tank licensing was brought in (2006), it was the intention that all properties would be registered within c.25 years. This was on the assumption that most properties are likely to change hands at least once within 25 years. There is a legal requirement that a property cannot change hands unless the PSS associated with it has been registered.

In relation to registering existing sewage systems a member of SEPA staff observed:

"We used to collect a lot of information when people applied for registrations but now, to simplify things, SEPA only asks for the address that the treatment system serves. For these existing discharges we don't require details of the discharge."

[2] i.e., Shellfish grower

3.2 Implementation and interpretation of regulations

The legislative and enforcement responsibility for PSS rests between a number of bodies including LA planners, building control staff and EHO as well as SEPA.

3.2.1 Statutory nuisance

LAs address the problem of a PSS-related statutory nuisance through the provisions of Part 9 of the Public Health etc. (Scotland) Act 2008 (in force since 26th January 2009) and are responsible for the implementation of the procedural guidance on existing Statutory Nuisance provisions within the Environmental Protection Act 1990. Under the 1990 Act only certain matters may constitute a statutory nuisance (see section 79 of the 1990 Act). In each case, the matter must either be a nuisance in its own right or be prejudicial to health in order to be a statutory nuisance. Part III of the 1990 Act, which contains the main provisions on statutory nuisance, enables LAs and individuals to take action to secure the abatement of a statutory nuisance. LAs have a duty to inspect their areas to detect whether a nuisance exists or is likely to occur or recur. An LA must also take such steps as are reasonably practicable to investigate any complaint of statutory nuisance from a person living in its area. Where the LA is satisfied that a statutory nuisance exists, or is likely to occur or recur, it must serve an abatement notice on the person responsible.

The EHOs from Argyll and Bute Council mentioned:

"One of our bigger issues is whether it should be SEPA or ourselves that deal with the complaint. Our primary role here is public health. From a statutory nuisance perspective, there is other nuanced legislation we can dip into for defective drainage and sewage issues. Looking at the problem from a public health perspective, rather than an environmental pollution one, we consider if there is a problem, where is it, who is likely affected. If it is in the middle of nowhere and has a low likelihood of human health risk, then we would refer it to SEPA and if it is of public health relevance then I am always happy to deal with it because there is that element of risk there."

Another EHO from Argyll and Bute commented on the clarity in the provisions of the existing legislation on statutory nuisance:

"Prescriptive legislation is good to an extent. It can miss the nuances which is why the nuisance legislation brought in during the 19th century is so 'wide reaching'. Different sewage jobs that fall into the same bracket under statutory nuisance can be manifestly different in the way they work, who it affects, how it affects, and the severity of the issue. The problem with prescriptive

legislation for that type of thing is that you run the risk of issues falling out with the legislation (the 'tick boxes') meaning we can't touch them (deal with them) which is not useful. Although the legislation is very nuanced, it is very case law-led in terms of what is and what is not a statutory nuisance. This gives the officer a lot of leeway in what actions they can take because it is not prescriptive. We get regular complaints from complainants who are not happy with the outcome. Being held to account is a day-to-day part of the job. We're there to serve the public. We are accountable for our decisions."

However, the EHO officers have experienced cases where the general public fails to accept that the statutory nuisance is a problem that needs resolving. An EHO officer from Argyll and Bute mentioned an example with

"a guy we caught and took to court. The sewage was streaming on to the beach where the kids were playing, and he was still arguing 'but there wasn't an issue' These are the types of things. Even in front of a Sheriff, they will still argue black is white."

And another EHO from Argyll and Bute Council added:

"You need to make whatever the problem is something that the society accepts is in fact a problem and that change needs to be made. Until you have a buy-in by those that are using septic tanks or are not maintaining them, you are going to have an uphill struggle. Because you are never going to be able to resource regulation enough."

3.2.2 Authorising sewage discharges to the water environment

Under CAR, SEPA has the responsibility for the protection of the water environment from sewage discharges. Under CAR, private sewage systems must be authorised by SEPA (Box 1).

CAR are used to regulate sewage discharges and any impact they might have. Individual private sewage discharges are not normally expected to have a measurable environmental impact unless, for example, the dilution is very low, or it impacts on a nearby water supply. The biggest issue in terms of impacts on the water environment with respect to private sewage systems is the proliferation of them and their combined effect. Longer term, SEPA would like to further consider wider issues related to PSS such as transitioning to a more circular approach, considering the impact of climate change and chemicals with emerging concern.

Complaints about private systems often turn out to be nuisance issue such smell or ponding sewage. In some instances, the complaint is sparked by a neighbourhood dispute.

Box 1. Sewage systems authorisations by SEPA under CAR (as amended)

Registration is required in sewage systems (including discharge to soakaways) that:

- have been in use for more than two years and with ≤50 population equivalent(a), i.e., serving nine or fewer properties, and/or
- have been in use for less than two years and with ≤15 population equivalent, i.e., serving three or fewer properties.

Licensing applies to sewage systems that:

- have been in use for more than two years, with >50 population equivalent and/or
- have been in use for less than two years, with >15 population equivalent.

(a) For domestic housing, a minimum of five population equivalent (p.e.) is used for any house with up to and including three bedrooms. For houses with more than three bedrooms, a further 1 p.e. is added for each additional bedroom.

Source: SEPA 2022.

Another member of SEPA staff added:

"The situation is categorised and prioritised using judgement."

A member of SEPA staff also observed that there are good systems in place now to authorise sewage discharges to water bodies depending on their size:

"So, you authorise a system that fits in the environment, big river less treatment, smaller burn more treatment is generally the rule of thumb."

The SEPA staff member went on to say

"I think we're seeing much more in the way of marginal sites being developed now. We have very small burns/ ditches being considered for discharge, and sites on poorly drained ground." They added that these are often authorised on the basis that the sites have best available techniques (BAT) in place and high-level treatment systems. However, these may not be well maintained and can stop working effectively.

3.2.3 SEPA guidance on PSS management

SEPA has issued guidance on sewage discharges to surface water (SEPA 2019b) and to land and groundwater (SEPA 2019c). SEPA operates a general presumption against the direct discharge of sewage effluent (from less than 50 p.e./9 properties) to surface waters. The preferred environmental option is for discharge to land where the ground conditions are suitable, i.e., where the soil percolation value is 15 – 100 sec/mm. Direct discharges

to Shellfish Waters and Bathing Waters are to be avoided. Sewage registrations (up to three new properties) are considered relatively low risk. Further, the NetRegs, a partnership between the Northern Ireland Environment Agency in Northern Ireland and SEPA has a dedicated webpage on PSS, their management, sharing, and maintenance to benefit the environment, with links to legislative websites.

3.2.4 SEPA compliance monitoring

A member of SEPA staff also said *"authorising discharges from PSS is just the first step. If owners don't then install the system properly or appropriately maintain or upgrade their system, then it will eventually cause problems and that can be very costly to fix. This is often when SEPA gets called in. Because the environmental impact can be small (but often serious for the community) and costly to fix it can make taking enforcement action difficult."*

SEPA can only suggest potential interventions to reduce the risk to the environment providing generic advice on septic tank managment and maintenance but not specific instructions on what users must do. A member of SEPA staff mentioned:

"It is important to distinguish between a septic tank that is failing, i.e., it is no longer complying with its registration conditions, (and others). We can take action to say (to the owner) that 'you must comply with your registration conditions', so that the septic tank is brought back into compliance. It is slightly easier to get an owner to get a septic tank that fails to comply with the regulations (e.g., a CAR registration of licence breach) back into compliance, than to use basic CAR legislation as a route for enforcement saying, 'you must stop causing a pollution incident'. For example, the registration might say 'your septic tank must be designed to provide the following chemical conditions in the effluent and be sized appropriately for this size of house', so we could use that as an enforcement route."

There is some PSS mismanagement and lack of maintenance leading to pressure on the water environment and causing nuisance issues. There are thousands of PSS and SEPA do not have the capacity to check their compliance with the regulations and environmental guidance[3]. A member of SEPA staff observed that, because SEPA do not normally inspect small sewage discharges, a lack of PSS maintenance can go on for decades without being detected by the regulator. In a lot of areas the problems will not become obvious, or the problem is there but nobody wants to spend the money to fix it. Also, for shared systems it can be hard to get agreement from all of those involved to pay for fixing it.

Another member of SEPA staff explained that having an appropriately working system

"is often about a lot more than just emptying", adding *"it will often be about replacing the septic tank with, for example, a package plant, or completely reworking the drainage to take out the roof water from a septic tank. This can cost a lot of money, not just a few hundred but thousands of pounds. Often people struggle to fund this or have other priorities for their spending."*

3.2.5 Planning regulations

In most cases there is very limited consideration as to the PSS design when planning permission is being sought to build or extend a property. In a very few limited areas in Scotland, for example in the Loch Leven catchment where action to reduce the phosphorous is required, developers may need to improve the discharge from existing neighbouring houses to allow their own to proceed.

SEPA and Scottish Water are consultees in the planning process and normally SEPA will issue standard advice. SEPA local offices will not normally handle a planning permission for a single or up to five house development. A member of SEPA staff mentioned that if an applicant is required to install a treatment plant to provide a certain level of treatment, and they agree, then SEPA will not object on those grounds, and it goes through the planning process. Another point raised was the question of who reviews the site investigation results, whether it is SEPA or building control. Previous discussions between SEPA and building control colleagues at various councils identified that there was a lack of clarity as to who's remit this falls under.

SEPA's water permitting service often receives applications referring to plots of land where location and soil conditions are not ideal from a sewage disposal point of view. A member of SEPA staff reported that, if soil conditions are not suitable for a soakaway such that discharge to land is inappropriate and there are no sizable water courses anywhere nearby, SEPA often requires the installation of a high specification plant because the discharge will be into a small water course. There can be constraints on sewage discharge in some places which it would be helpful to know about before an applicant spends a lot of money buying a plot of land and then finds a sewage solution is problematic.

The discussion in the second workshop suggested that identifying the right areas for development is plan-led. A senior planning officer from SEPA explained that the planners identify housing demand and identify the areas through the Local Development Plan (LDP). Developers at that stage can make bids for the sites that they

[3]PSS users' and owners' perspectives on the clarity of the regulations on PSS is outwith the scope of this report.

want to develop. As part of that, there is the strategic environmental assessment that assesses all environmental impacts on the different areas. The developers can have their 'preferred sites', their 'non-preferred sites', and "everybody has the opportunity at that stage to say 'we don't support allocation for a particular reason'."

However, a member of SEPA staff noted that the suitability of ground conditions are not always known at LDP stage so it is hard to know at this stage if a discharge to soakaway will be feasible.

Scottish Water involvement in the planning process was also discussed. For example, Scottish Water during the planning process can highlight the reason they can or cannot invest in connections of old or new developments. A member of SEPA staff clarified that it is the smaller developments that are less likely to get connected to a public sewer. There are also 'windfall sites', which can come in at any stage and which tend to be the smaller developments.

3.2.6 Building regulations

The building warrant process in Scotland is a pre-emptive system that seeks to ensure that buildings are designed and constructed to the minimum standards (at the very least) as set out in the building regulations (APPENDIX II.5) and the Building (Scotland) Act 2003. It is important to know the difference between planning permission and building regulations. Building regulations set the standards for the design and construction of a building, ensuring the health and safety of people. Whereas planning permission takes into consideration the impact of developments on the general environment (see above). An overview of the Building Standards enforcement role is given in Box 2.

Box 2. PSS and Building Standards' enforcement role

Building Standards cover dangerous defects in buildings and assets. They assess effects to health,safety and wellbeing of people in or around the building. In most cases a soak-away will not present a danger. If a lorry delivering a load of slabs reverses over a septic tank lid and breaks it, then Building Standards would potentially issue a defective building notice and enforce it so the damage is repaired. There is other legislation that is better placed to deal with the issue. If the issue is due to flooding it is unlikely that the Building (Scotland) Act (2003) can be used as a mechanism for dealing with the issue.

Source: Buildings Standards Perth and Kinross Council.

To assess if the standards can be met, Building Standards assess information regarding the percolation rate where the effluent is to be discharged to an infiltration system.

For example, the team leader of Building Standards from Perth and Kinross Council mentioned:

"We would certainly check a percolation report but, again, we are just assessing the information put on that report. If any of the information is not correct, we are not out on site witnessing the percolation tests being carried out, but we would certainly verify a report if we were there. If there was a particularly complex scenario and the risk was quite high, maybe some sort of innovative system that covered a lot of houses, we might appoint a specialist consultant to help us assess that. In terms of our limitations, we have a knowledge of all things but I would not confess to being an expert in PSS or anything like that so if there was something high risk we might seek external expertise but a lot of the time something that high risk is likely to require a licence from SEPA so the mechanism we might use is to request a copy of that licence before approving a building warrant application."

This limitation was also pointed out by a member of SEPA staff:

"For registrations SEPA asks for the percolation values but does not normally look at the detail of the percolation report or other things covered by the building standard technical guidance."

Building Standards have an awareness of CAR regulations but potentially a closer engagement with SEPA would be beneficial (see Opportunities, section 3.5).

The discussion on building regulations revealed that the Building Standards register provides no information on the methods of wastewater discharge from a building, whether it is a single household treatment system, whether it is nine houses, whether it is a mass system or going into the public sewer. It may be useful to consider including information on how wastewater is treated within any new buildings, in the publicly available Building Standards register.

The discussion also highlighted the lack of specific coverage of PSS-related issues in terms of certifications. For example, there are certification schemes under the Building (Scotland) Act (2003) for design and installation but none of them actually cover PSS. There is certification of structures and for energy design and for electrics.

The question was raised whether issuing a building warrant for a property requiring a CAR registration requires consultation between Building Standards and SEPA on environmental evidence. The response from the team leader of the Buildings Standards form Perth and Kinross Council was:

"Certainly, if there is a requirement that a SEPA licence is required we would always ask for it in the first instance during our assessment of the warrant application."

3.2.7 Procedure following approval of application for a building warrant in PSS-served properties

Buildings Standards issue a construction compliance notification plan (CCNP) following approval of a warrant. A CCNP is a summary of the key stages of a building project that need to be inspected by the Council's Building Standards. The number of key inspection stages in a CCNP depends on the complexity of the project. However, as mentioned by the team leader of Building Standards from Perth and Kinross Council, a CCNP is not statutory, and there is no full statutory inspection:

"It is a guide for us to carry out a 'reasonable enquiry', which is how we can tell something has been built as per the approved drawings. A PSS system of any sort would be noted on the CCNP. We would expect to be notified and go out to see that. That is not to say we go out and see every single one, for a number of reasons. Sometimes we are not told about it and because it is not mandatory, we struggle to get people to expose things to the inspectorate. We have a lot of work going on and we have a limited team capacity so we can't see everything. When carrying out inspection what we look for, with septic tanks or a plan of any sort, is: is it installed where the drawing says it should be; is it the correct size of tank that is shown; is there access for inspection, for maintenance; is it going into a soakaway; is the soakaway the correct size, the right materials, is it discharging into a water course; are there the correct requirements at the discharge such as one-way valves? That is the level of inspection we are doing on these things. We are not doing anything scientific such as testing of discharge or the ground after the PSS has had some use. We just do a visual inspection, checking if the site construction meets the plans that were approved during the application process."

Small developments, e.g., up to nine properties, tend to have a higher level of compliance than larger developments, which are usually connected to the mains but not always.

The attendee from Building Standards (Perth and Kinross Council) commented:

"This is potentially because it is an individual investing a lot of their own money on their own home and they have spent the money to get the right professionals onboard. The biggest issue is where you have these four or five house developments done by a smaller developer looking to maximise the return on the investment. The person whose pocket the money is coming out of may be involved in the day-to-day management of the development, so we do occasionally find issues. It could be the soakaway is a bit smaller than the plans specify, or it is moved into an unsuitable location, maybe too close to neighbouring buildings. I would say that is the highest risk area. If we get a building warrant for a replacement system, if it is like-for-like replacement it doesn't need a warrant, so we are not told about that, but if someone is changing the method of wastewater discharge like changing from septic tank to bio-disk, that is low risk because they are investing in resolving an issue, actively trying to make it work."

For small discharges SEPA does not normally check if the system installed matches the design standard in the SEPA authorisation. A member of SEPA staff noted that they are trusting that the applicant installs the system in line with their authorisation. If complaints are received, for example with respect to inappropriate construction of a soakaway, this can be very hard to verify because it would involve potentially digging up the system. SEPA also have trouble with people not maintaining their treatment system, which can mean the PSS does not work as expected.

The attendee from Building Standards from Perth and Kinross clarified:

"Every council is slightly different. In Perth and Kinross we have a team of inspectors, a team of assistant surveyors and a team of surveyors who are checking the plans, so if a package plant is specified on the approved drawing, and that is not what is on site, then that would certainly be raised. We do include that as something we would inspect in our CCNPs. We would then ask for an amendment to the warrant and they would have to go through the process again to prove that the PSS they have installed is suitable, fit for purpose, for the number of houses it is serving. We would expect that information to be on the drawings – specifying a make and model of the tank – and before approving the warrant we would ask for evidence that the system will achieve that, (is fit for purpose), a British Board of Agrement (BBA) certificate for example, or manufacturer's literature confirming it is tested to meet that standard. If there was a requirement for it to meet a set value, we would check that. If the surveyor in the office determines that, for example, it is a Klargester plant, a different type of plant that has been installed but it is equivalent to what has been specified then we might not have to ask for an amendment for that."

3.2.8 Selling a property

SEPA and LA attendees alike identified limitations in the procedures related to selling or renting a PSS-served property. For example, the Home Report provides limited reporting of PSS specifications and frequency of maintenance. The Home Report could be improved and instead of extraction of binary information (Yes/No), it could extract information on dates and frequency of PSS maintenance or upgrades.

Further, private landlords in Scotland are legally required to apply for registration with their LA. However, the registration procedures do not involve any information regarding the landlord's obligation to comply with PSS-related regulations and management or maintenance guidance. An EHO from Argyll and Bute Council suggested:

"There are other things that are specifically asked about in the registration process, but they don't ask about septic tanks or anything like that, so maybe that is something you would like to link up a bit more with the Scottish Government and the national registration scheme that is by LAs as well. But again, it's part of a wider remit and it would depend on what breaches have occurred. Landlord registration isn't there necessarily to pursue it, it would be who has the regulatory powers to deal with problems with the septic tank, and have they been breached? If it has created a statutory nuisance, for example, has the landlord dealt with that?"

3.3 Type of regulatory action

The attendees clearly described what they do and are clear with the barriers to taking action.

An EHO from Argyll and Bute stated that the response time to complaints of statutory nuisance is within one working week to make an initial assessment. Emergency response is within 24 hours. The complainant is called back to determine the severity of the situation.

Likewise, SEPA described a quick response to complaints:

- Initiating a first response (usually within 24 hours), which involves making a judgement call and categorising the event (Box 3).
- Calling the complainant.
- Calling the homeowner.
- Checking maps for sensitive water bodies or anything nearby.

Box 3. SEPA PSS-related environmental risk categories

SEPA carries out 'dynamic risk assessments' using a pollution risk categorisation system. An environmental protection officer gave a detailed description of this system:

Category 1: When the event impacts 1km of river and/or causes a major fish kill.

Category 2: When the event also must have a significant/major environmental impact.

Category 3: When events cause breaching of Environmental Quality Standards (EQS) and have a measurable environmental impact but is not desperately serious.

Category 4: Any event less than Category 3 including a no pollution event.

Some SEPA staff said that sometimes the reason for the complaint is neighbour disputes rather than an environmental issue. A member of SEPA staff mentioned:

"Sometimes when we go out and investigate a complaint, we find out there is no evidence of breaching CAR regulations and there is no need to take the case any further. We have had various cases where the complaint is due to the relationship between them and their neighbour."

3.4 PSS-related technical and management problems

The attendees identified a list of problems, technical and management-related, and their causes (Table 4).

The problems mentioned in complaints or identified in inspections are very similar to problems reported online in regulatory webpages (CAS, NetREGS) and PSS supplier sites. The consensus was that information on fixing and preventing these problems is available and seems to be easy to access and comprehend.

It is unclear what the causes of these problems are, but the attendees suggested multiple interrelated causes.

A SEPA officer pointed to historical legacy issues. Some problems are caused by historic systems not being built to modern standards, for example having undersized tanks and small soakaways. The owners of such PSS may not know that they have to upgrade their systems. The upgrades can be expensive. If the system is shared this can add extra complications if not all property owners agree to the upgrade. These difficulties are significant barriers to getting upgrades undertaken.

An EHO from Argyll and Bute Council gave an example of "ignorance" (as a result of both lack of knowledge of not being on the mains and lack of understanding of private sewage management):

"When people buy a property on a private supply, they are told there is a septic tank but not what type of septic tank it is or what type of maintenance is required so they see PSS as 'just a hole in the ground'. The council does briefings (workshops) on different types of building maintenance, but no one turns up to them. They only spend money on something if they have to. They will let the problem – with the septic tank – go on until someone else complains about it instead of fixing it to make it work as it should."

A member of SEPA staff commented on the issue of false perceptions of responsibility regarding SEPA discharge authorisations:

"It is not uncommon to hear that the house holder, the person responsible for maintaining the system, will say 'I have an authorisation from SEPA, so when

Figure 4: PSS related problems and their causes identified by the workshop attendees

Problems	Causes
• Poor management and maintenance: o De-sludging not carried out o No/infrequent servicing of a package treatment plant (PTP) o Making sure PTP is switched on and functioning if it requires a power supply and aeration system or a bio disc with rotating discs • PSS installed in the past (historic discharges) non-conforming with modern design standards (e.g., undersized tank and old brick built) • Misconnections (which were common in the past and are expensive to rectify), including either a rainwater outlet that is incorrectly connected to the septic tank, or household wastewater that is directly discharging to surface waters • Soakaways being under-sized due to assessments for size suitability not being done prior to construction • (Little evidence) Systems installed but not adhering to authorised specifications, e.g., an under-sized soakaway • Outfalls not reaching the water environment (coastal or rivers) due to broken pipes, or low water flows in rivers during drought conditions • Reedbeds: poor maintenance, lack of alternative treatment during winter frost	• Lack of knowledge of sewage management (treatment, maintenance, consequences)/Lack of knowledge on sources of reliable information for PSS • False perceptions of responsibility • Lack of interest or ability to look after the system, maintenance being more demanding for high-tech PSS in new developments/houses • Developers putting in inappropriate or hard to maintain systems. Any problems are handed on to the house buyer/ owner • Shared responsibility/ownership issues. Requires everyone to agree or the whole thing falls apart in terms of maintenance and organisation/arrangements • Lack of upgrading old/out-of-date systems • Lack of CAR compliance inspections: SEPA do not inspect any PSS under 200 p.e. routinely • Hard to detect some problems, especially if a discharge is to a soakaway and cannot be easily seen • It is expensive to upgrade a system and maintenance also involves a cost • Governance framework

are you (SEPA) coming to empty my septic tank, or repair my outfall?'. This is a wrong perception where the responsibility lies. The authorisation requires the property owners to maintain the system in good order, it is not SEPA's responsibility."

PSS-related complaints may also be submitted to Building Standards, as the attendee from Perth and Kinross Council mentioned:

"We do sometimes get complaints about septic tanks and discharge into water courses. The majority of these we pass on to our environmental health team or direct the complainant to SEPA. A lot of the complaints are about older buildings, possibly the septic tank pre-dates building regulations and it has been up graded over time which has not required consent."

The attendees were also concerned about the role of developers and other intermediaries between regulatory authorities and the owners of PSS-served properties. The owner quite often has no idea of 'what is in the ground' (how the sewage/drainage system is built and functions).

A SEPA officer mentioned:

" The house developer designs the system and builds the development so the house owner, coming later, does not know much, if anything, about the system, for example where it is or how it works. They might not have the knowledge or time to look after the system. Even though the system is more high-tech it does not mean they will be maintained any better. Many homeowners don't get their systems desludged regularly. A package treatment system is more complicated and requires more maintenance so maintaining them is even more difficult."

With regards to shared PSS ownership, the two EHOs from the Argyll and Bute Council observed:

"Any shared and common responsibility is inadequately covered in most of the house sales processes that go on. People are not really interested; the solicitors are not too keen on pointing out responsibilities. Any shared and common responsibility is not documented, not laid down in these situations. It is a problem 'across the board', in water supplies, common shared areas as well."

And,

"You find one person is proactive but as soon as that owner sells up, management and maintenance of the shared system falls apart in terms of even understanding what is needed, let alone organising the maintenance of the system."

Dr Karin Helwig (Glasgow Caledonian University) who also attended the workshops conveyed examples on the governance of PSS from an ongoing review of governance and management of PSS internationally for a CREW project[4]:

"We have come across different ways the responsibilities are distributed between the local authority and environment agencies, i.e., the environmental regulator and the Water Boards. For example, in the Netherlands the water boards are responsible for treating wastewater and keeping the surface waters in good condition. The local authorities are responsible for providing sewage services. There is a handover point. In remote areas it is slightly different, and the local authority might ask for an exemption, so it is no longer responsible but then it becomes a problem for the Water Board because the responsibility passes to the Water Board. In different parts of the Netherlands there are differences about who does what. In one case the Water Board decided to take over the management of all the PSS because they posed too much of a threat to the surface water quality. They felt they could manage the risks better that way. The householders have automated monitoring systems on their PSS. The householder just calls the Water Board if the sensors turn on a red light. It is as simple as that. Someone comes out and deals with it. We may need to explore that further by interviewing the people involved there (i.e., in the Netherlands). Similar things happen in Belgium too."

A member of SEPA staff commented that they have had feedback from the companies that install and sell PSS that less than 50% of new PTPs have a maintenance contract taken out when the plant is installed. These companies also mention that PSS are often incorrectly designed and installed.

3.5 Opportunities

The discussion highlighted opportunities for improvements. These opportunities involve, in relation to PSS, more collaboration between LAs and SEPA staff around data collection and sharing and during the authorisation process. It also suggested ensuring sufficient data was collected on type of treatment, point of discharge, frequency of desludging, sharing of management/ownership, population equivalent and age of the system. Thoughts included using the Improvement Service or building standards register.

In addition, it would be useful to consider ways to improve maintenance and upgrade by owners for example, inspections by the regulator, a septic tank MOT system or an approach like they have at one water board (Waterschap Rivierenland; Helwig et al. 2022) in the Netherlands.

[4]Helwig et al., 2022.

Another opportunity is to include more comprehensive information in the Landlord's register and the Home Report as well as including a performance-based rating of the PSS in the Home Report.

It was also recommended by a member of SEPA staff to have a further project or workshop to explore these and other ways of making improvements further.

4.0 Lessons learned for SEPA

SEPA assessed the key findings of this report and added the following concluding remarks:

1. Not all small-scale sewage discharges are currently authorised by SEPA under CAR. For existing unauthorised discharges this is to happen at the point of house sale and the number authorised rises every year. Because SEPA do not yet have data on the location of all PSS they have to, in part, rely on modelling the location of PSS based on the distance of properties to main sewer.
2. It can be hard to determine the impact that discharges from PSS are having on the water environment because their impact is often either very localised or diffuse in nature. This is not helped by the fact the data on the exact location of the sewage discharges and the nature of the discharge (e.g., to soakaway or surface water) and treatment type is not available for all properties.
3. Along with time spent processing CAR applications to discharge sewage effluent from PSS, complaints involving PSS take a lot of SEPA's time. In addition, some complaints are difficult to resolve and can re-occur.
4. The legislative and enforcement responsibility for PSS rests between a number of bodies including LA planners, building control staff and EHOs as well and SEPA. This can at times be complex.
5. There are thousands of PSS and SEPA and LA do not have the resources to inspect them. Because they are deemed low risk, SEPA normally only inspects registration level sewage discharges if a complaint is received.
6. If the correct PSS is not installed or if not maintained, upgraded or installed correctly it can cause nuisance and pollution issues. In a lot of areas problems with PSS will not become obvious, for example discharges to groundwater.
7. Some owners do not have adequate treatment in place for the location of the discharge, they have

not installed the system properly or appropriately maintained or upgraded their system. This can result in problems that can be very costly to fix. Because the environmental impact can be small (but often serious for the community) and costly to fix, it can make taking enforcement action for SEPA difficult. A member of SEPA staff commented that they have had feedback from the companies that install and sell PSS that less than 50% of new PTPs have a maintenance contract taken out when the plant is installed. These companies also mention that PSS are often incorrectly designed and installed.

8. For shared systems it can be hard to get agreement from all of those involved to pay for any major costs to maintain or upgrade a system.

9. Often there is limited site assessment of private sewage drainage solutions at local develop plan or planning stage. Later ground conditions can be found to be unsuitable for a soakaway.

10. There are many less adequate sites being proposed for development where the discharge is to very small burns/ditches. Authorisation is on the basis that BAT are in place and are not maintained and go wrong or are replaced by lower lever systems at installation.

11. SEPA would like to further consider wider issues related to PPS such as transitioning to a more circular approach, considering the impact of climate change and chemicals of emerging concern.

5.0 Concluding remarks

The qualitative evidence collected through three workshops revolved around four themes: availability and reliability of PSS-related information; implementation and interpretations of different types of regulations; regulatory action taken; and PSS-related problems and their causes.

a. Availability and reliability of PSS-related information

- There is a lack of information on PSS treatment type, discharge point, desludging frequency, sharing of management/ownership, population equivalent and age of the system.

b. Implementation and interpretation of the regulations

- The current regulatory framework for new and existing PSS is multifaceted. It grants the responsibility for PSS management to householders. It involves different duties for LAs and SEPA but also requires their collaboration and engagement with other Scottish agencies, including Scottish Water.
- The regulatory authorities (SEPA and LAs) are clear with their duties. However, regulators' experiences from inspections following complaints suggest that householders may be unaware of the different aspects of the PSS-related regulatory framework and/or the consequences of not complying with the regulations for the environment, themselves, or public health.

c. Type of regulatory action taken

- The LAs address PSS-related complaints about statutory nuisance, handle planning applications in consultation with SEPA and Scottish Water, enforce Building Standards that refer to new PSS, assess Building Warrant applications that include PSS, and undertake inspections to check compliance of PSS with Building Regulations.
- SEPA regulate and authorise discharges from PSS, provide guidance on PSS management, undertake inspections in response to reports or complaints about environmental incidents including water pollution, and provide advice to planning authorities to ensure protection of the environment. Response to complaints or incidents is determined by the severity of the problem and availability of resources.
- Both LAs agree that a mix of interventions, highlighted as opportunities for improvements (see below), is needed to collect the necessary information and ensure compliance with regulations. As of resource needs, these were mainly related to regulatory staff time, SEPA and LA budget and a broader pool of experts to assess PSS along the planning and property sale process.

d. PSS-related problems and their causes

- There is a broad acceptance that problems related to small-scale PSS include: poor management and maintenance, historic (i.e., built before current regulations) systems, misconnections, unsuitable (size and type) soakaways, and faulty piping. These problems usually come to regulators' attention following complaints by those affected (mainly neighbours and visitors in an area).
- A variety of causes were highlighted, including PSS owners' lack of knowledge of PSS existence, management/maintenance responsibilities and the regulations; lack of regulatory problem-detection mechanism in addition to complaints and water quality routine monitoring; and lack of consequences for PSS users who fail to comply with the regulations.

Opportunities for improvement include:

1. More collaboration between LAs and SEPA staff and better data collection;
2. Improving maintenance and upgrade by owners by, for example, inspections by the regulator, a septic tank MOT system or an approach like they have at one water board (Waterschap Rivierenland; Helwig et al. 2022) in the Netherlands.
3. More comprehensive information on PSS in the Landlord's register and the Home Report.
4. A further project or workshop to explore this further.

6.0 References

Legislation

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