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# Hydrogeological Guidance to Apply for a Licence to Discharge Effluent to a Soakaway

# Purpose

This guidance applies to licence applications for the discharge to soakaway of treated sewage or other effluents. The guidance does not cover the discharge of water run-off.

This document sets out:

* The criteria that influence the hydrogeological suitability of a site for the discharge of effluent to soakaway; and
* The hydrogeological information that should be submitted in support of licence applications to discharge effluent to soakaway.

There are also requirements in relation to Building Standards regarding proximity to structures and property boundaries that should be considered.

# What makes a suitable site?

You should consider the following criteria in determining whether or not to select a site for the discharge of effluent to soakaway.

## 2.1 The water table must be below the base of the soakaway at all times of the year

You should take into account whether:

* The discharge may locally raise groundwater levels.
* Seasonal and other variations in groundwater levels
* The site is within a designated flood risk zone.
* Any influence of the tide on groundwater levels.
* Peat is present as this can imply high groundwater levels.

To help improve resilience to climate change, you should consider whether any of the above factors are likely to change over the expected operational lifespan of the discharge.

## 2.2 The ground allows the effluent to drain

You must not discharge to ground which doesn’t allow the effluent to drain as this can create boggy conditions or result in the effluent ponding. For example, discharges into ground where the percolation rate is greater than 140 secs/mm.

You must not use mound soakaways for discharges greater than 50 population equivalent.

## 2.3 The ground beneath the soakaway provides sufficient attenuation

Bedrock and high permeability strata (i.e. percolation rate < 15 secs/mm) do not normally provide sufficient attenuation and discharges to these strata are discouraged.

If the natural ground conditions above the water table do not offer sufficient attenuation, it may be feasible to locally modify the subsurface properties and/or to increase the sizing of the infiltration system to reduce the risks to groundwater and other sensitive receptors.

## 2.4 There are no preferential pathways

Features such as field drains, services, historic mine workings and disused wells or boreholes can act as preferential pathways for pollutants to reach receptors.

## 2.5 The soakaway is not on or near to a steep slope

Steep slopes can result in the effluent emerging as a spring downhill. This may result in nuisance or risks to public health.

Topography can also constrain whether the infiltration system can be gravity-fed or whether a pumped system will be required. Gravity-fed systems are preferable as they are more energy efficient and require less maintenance.

## 2.6 The discharge does not pose a significant risk to sensitive receptors

Sensitive receptors include:

* Water Supplies.
* Groundwater dependent terrestrial ecosystems (GWDTE).
* Surface waters.
* Bathing waters
* Shellfish waters

Discharges within 50m of an abstraction or GWDTE will only be acceptable if you can demonstrate there is no hydraulic connection.

The potential risks to any other nearby sensitive receptors identified by the water features survey must be assessed by detailed quantitative risk assessment (DQRA). See [Annex 3](#_Annex_3:_Detailed) for more details.

## 2.7 The discharge does not mobilise contaminants in any land that has existing contamination

Existing contamination may be present due to current or historical activities The discharge may increase the mobility or persistence of contaminants present above the water table by enhancing leaching or by changing the biogeochemical conditions. The presence of existing contamination in the subsurface may also adversely impact the natural processes that help attenuate contaminants present in the discharge.

If existing contamination is present you will normally need to carry out further desk study, ground investigation, monitoring, and risk assessment to assess these factors. This work may overlap with the works required in support of any planning permission for the development.

## 2.8 There is no adverse interaction with other existing discharges

The presence of other discharges in close proximity can affect the functioning of the infiltration system, both in relation to hydraulic factors and natural attenuation processes.

Infiltration-based sustainable drainage systems (SUDS) can locally affect the depth to the water table.

Discharges containing elevated concentrations of disinfectants or other biocides can adversely affect local microbial communities. This can adversely affect the natural attenuation processes in the subsurface.

Having multiple discharges to ground in close proximity can result in cumulative pressures and nutrient enrichment.

## 2.9 The soakaway will not be adversely affected by activities at the site

Likely current or future activities and land use on or near the soakaway must not adversely impact the performance of the soakaway nor prevent future inspection and maintenance. This includes considerations regarding landscaping and planting. For example, tree roots may affect subsurface pipework. In addition, particular care should be taken to avoid compaction or disturbance of the area over and around the soakaway.

# Information that must be submitted to support an application to discharge effluent to soakaway

The following information must be included in support of your application:

## 3.1 Location of the discharge

A 10-figure NGR of the discharge point must be provided. The soakaway must also be marked on an Ordnance Survey basemap (1:10,000 scale). A 10-figure NGR must be provided for the inlet to the infiltration system.

## 3.2 The raw effluent composition and flow rates

This should include any expected seasonal or other temporal variation.

For sewage discharges, reference can be made to the [British Water code of practice flows and loads.](https://www.britishwater.co.uk/page/Publications#wastewater%20treatment%20plant%20publications)

For other effluents an assessment of effluent composition and flow rates is required.

## 3.3 Details of the proposed discharge infrastructure

This must include:

* Detailed design drawings (plans and cross-sections) of the proposed soakaway and associated infrastructure including sizing and layout of infiltration pipework and their associated trenches, access points for future inspection and maintenance, and pumping arrangements, if required. Gravity-flow systems are preferable.
* The elevation of the discharge point(s) in metres above Ordnance Datum.
* The calculations used to determine the area of the infiltration trenches. The footprint of the entire soakaway may be considerably larger. The British Standard requires that the maximum trench length should be 30m for gravity-flow systems and there should be at least 1m of undisturbed soil between individual trenches.

The design of the soakaway and associated infrastructure should be in accordance with the requirements of the current Building Standards and BS6297:2007+A1:2008 Code of practice for the design and installation of drainage fields for use in wastewater treatment. The sizing and hydraulic design of the infiltration system must be based on the maximum proposed discharge flow rate.

## 3.4 Details of the effluent treatment system

This must include evidence of treatment efficiency and expected concentrations in the treated effluent. Acceptable evidence on treatment efficiency includes performance details published by the manufacturer for package treatment works, and/or monitoring evidence from analogue sites of a similar scale and setting.

## 3.5 Water features survey

Annex 1 provides information on how to carry this out and what it must include.

## 3.6 Factual and interpretative report of ground investigation and baseline conditions

This must include the findings of the intrusive ground investigation (GI) and groundwater monitoring. Annex 2 provides information of what this must contain.

## 3.7 Conceptual site model

This must include identification of potential pollutant linkages on a Source-Pathway-Receptor basis.

## 3.8 Risk assessment

High risk discharges require a detailed quantitative risk assessment (DQRA) to be carried out. For lower risk discharges this can be by simple assessment of the risks. [Annex 3](#_Annex_3:_Detailed) provides information on how to do this assessment.

### What is a high risk discharge?

High risk discharges include:

* sewage discharges from greater than 50p.e;
* discharge containing groundwater hazardous substances;
* discharges that have a sensitive receptor nearby; or
* discharges which require more than ten dilutions to meet the environmental standards.

# Annex 1: Water features survey requirements

A water features survey is required to identify sensitive receptors close to the discharge. It will inform the risk assessment.

The search distance should be measured from the external boundary of the soakaway. If the exact location, geometry and spatial extent of the soakaway is not known at the time of completing the water feature survey, you should increase the search area to avoid the need to repeat the survey.

The water features that should be identified are detailed in section A1.1 to A1.7.

The water feature survey report must include:

* An Ordnance Survey basemap (1:10,000 scale) with the location of all identified features plotted on it; and
* a report or database summarising the details of each feature identified including 10-figure NGRs. It should include photographs of key features where possible.

## A1.1 Surface waters (rivers, burns, lochs, transitional and coastal waters) springs and field drains

The minimum search distance is 250m.

You can identify these features by consulting the Ordnance Survey map and carrying out a walkover survey.

## A1.2 Field drains

The minimum search distance is 50m.

You can identify these features by consulting the Ordnance Survey map, carrying out a walkover survey and from landowner knowledge or records.

## A1.3 Abstractions

The minimum search distance is 500m.

You can identify these features by:

* contacting SEPA, who hold records of the locations of authorised abstractions suppling more than 10m3/day.
* Contacting the local authority who hold records of private water supplies (PWS). The local authority records may be the location of the property supplied, rather than the location of the source of the abstraction. Confirmation of the exact location and details of the source from the owner/operator is required as part of the walkover survey. In the absence of local authority records, in areas outside the Scottish Water potable supply network, you should consult with the owners of the properties as to the source of their supply.

The information you should supply as part of the water feature survey includes the:

* Location of the abstraction source (10-figure NGR)
* Type of abstraction (e.g. borehole, well, spring, surface water, etc)
* Abstraction source construction details including borehole log (if applicable), construction details, and photographs
* Use of abstraction (e.g. potable supply, irrigation, food processing, etc)
* Abstraction rate. if the abstraction is unmetered, then the abstraction rate may be estimated based on pump capacity and likely usage (e.g. number of people the abstraction is serving)
* Existing treatment arrangements (if any)
* Evidence of existing water quality (if available). The local authority may hold information on this for individual PWS.

## A1.4 Groundwater Dependent Terrestrial Ecosystems (GWDTE)

The minimum search distance is 250m.

To identify whether there are GWDTE you must:

1. Contact NatureScot who hold some information on GWDTEs, predominantly within designated sites (SSSIs, SPAs and SACs) and
2. Undertake a Phase 1 habitat survey following the guidance set out in ‘[SNIFFER (2009) WFD95 – A Functional Wetland Typology for Scotland’](https://www.sniffer.org.uk/snifferwfd95-fieldsurveymanual-v1-pdf).
3. If any potential GWTDE are identified within the search radius, a [National Vegetation Classification (NVC) survey should be provided](https://jncc.gov.uk/our-work/nvc/).
4. Once this has been done you should use the sections on:

* [NVC communities that are highly groundwater dependent](#_NVC_communities_that); and
* [NVC communities that are moderately groundwater dependent;](#_NVC_communities_that_1)

to identify if the NVC communities you have identified are likely to be dependent on groundwater. Wetlands containing these communities should be considered to be GWDTE unless further ecological and/or hydrogeological information can be provided to demonstrate this is not the case.

### NVC communities that are highly groundwater dependent.

M5, *Carex rostrata - Sphagnum squarrosum* mire

M6 *Carex echinata - Sphagnum recurvum* mire

M7, Carex curta - Sphagnum russowii mire

M8, Carex rostrata - Sphagnum warnstorfii mire

M9, Carex rostrata - Calliergon cuspidatum/C.giganteum mire

M10, Carex dioica - Pinguicula vulgaris mire

M11, *Carex demissa - Saxifraga aizoides* mire

M12, *Carex saxatilis* mire

M13, *Schoenus nigricans - Juncus subnodulosus* mire

M14, *Schoenus nigricans - Narthecium ossifragum*

M29, *Hypericum elodes - Potamogeton polygonifolius* soakway

M31, *Anthelia julacea - Sphagnum auriculatum* spring

M32, *Philonotis fontana - Saxifraga stellaris* spring

M33, *Pohlia wahlenbergii* var. *glacialis* spring

M34, *Carex demissa - Koenigia islandica* flush

M35, *Ranunculus omiophyllus - Montia fontana* rill

M36, Lowland springs and streambanks of shaded situations

M37, *Cratoneuron commutatum* springs

M38, *Cratoneuron commutatum* springs

S24 *Phragmites australis - Peucedanum palustre* tall-herb fen

W4, *Betula pubescens - Molinia caerulea* woodland

W7, Residual alluvial forests (*Alnus glutinoso-incanae*)

W20, *Salix lapponum – Luzula sylvatica* scrub

CG11, *Festuca ovina - Agrostis capillaris - Alchemilla alpina* grassland (when not on limestone)

CG12, *Festuca ovina – Alchemilla alpina – Silene acaulis* dwarf-herb community

U15, *Saxifraga aizoides – Alchemilla glabra*

U16, *Luzula sylvatica – Vaccinium myrtillus* tall herb community

U17, *Luzula sylvatica – Geum rivale* tall herb community

SD13, *Salix repens -Bryum pseudotriquetrum* dune-slack community

SD14, *Salix repens -Campylium stellatum* dune-slack community

SD15, *Salix repens-Calliergon cuspidatum* dune-slack community

SD16, *Salix repens - Holcus Lanatus* dune slack community

SD17, *Potentilla anserina-Carex nigra* dune-slack community

### NVC communities that are moderately groundwater dependent.

M15 \*, *Scirpus cespitosus - Erica tetralix* wet heath

M16, *Erica tetralix - Sphagnum compactum* wet heath

M21, *Narthecium ossifragum - Sphagnum papillosum* valley mire

M22, *Juncus subnodulosus - Cirsium palustre* fen meadow

M23, *Juncus effusus/acutiflorus - Galium palustre* rush-pasture

M24, *Molinia caeruleae - Cirsium dissectum fen meadow*

M26 \*, *Molinia caerulea - Crepis paludosa* mire

M27 \*, *Filipendula ulmaria - Angelica sylvestris* mire

M28 \*, *Iris Pseudacorus - Filipendula ulmaria* mire

M30 \*, *Hydrocotylo – Baldellion*

S2 \*, *Cladium mariscus* swamp and sedge beds

S3 \*, *Carex paniculata* sedge swamp

S7 \*, *Carex acutiformis* swamp

S11, *Carex vesicaria* swamp

S25 \*, *Phragmites australis - Eupatorium cannabinum* tall-herb fen

MG4 \*, *Alopecurus pratensis - Sanguisorba officinalis*

MG8 \*, *Cynosurus cristatus - Caltha palustris* lowland neutral grassland

MG9 \*, *Holcus lanatus - Deschampsia cespitosa* grassland

MG10 \*, *Holcus lanatus - Juncus effusus* rush-pasture

MG11 \*, Inland wet grassland, *Festuca rubra-Agrostis stolonifera-Potentilla anserina* grassland

W1 \*, *Salix cinerea - Galium palustre* woodland

W2 \*, *Salix cinerea - Betula pubescens - Phragmites australis* woodland

W3 \*, *Salix pentandra - Carex rostrata* woodland

W5 \*, *Alnus glutinosa - Carex paniculata* woodland

W6 \*, *Alnus glutinosa - Urtica dioica* woodland

CG10, *Festuca ovina – Agrostis capillaris – Thymus praecox* grassland (when not on limestone)

U6 \*, *Juncus squarrosus - Festuca ovina* grassland

## A1.5 Bathing and shellfish waters

The minimum search distance is 250m.

This includes designated bathing waters and shellfish water protected areas as well as classified shellfish harvesting areas.

* Bathing waters can be identified on the [map of bathing waters](https://map.environment.gov.scot/sewebmap/)
* Shellfish water protected areas can be identified on [Shellfish water protected areas | Scottish Environment Protection Agency (SEPA)](https://www.sepa.org.uk/environment/water/shellfish-water-protected-areas/)
* Classified shellfish harvesting areas can be identified on [Map Layers (NMPi) | marine.gov.scot](https://marine.gov.scot/maps/nmpi)

## A1.6 Phosphate sensitive catchments

The minimum search distance is 50m.

Phosphate sensitive catchments are:

* The Loch Leven catchment (Perth and Kinross) [Loch Leven planning guidance](https://www.pkc.gov.uk/media/46494/Loch-Leven-Protected-Area/pdf/LochLevenSG2020Final.pdf?m=637386980902670000)
* The Lunan Lochs catchments (Perth and Kinross) [Lunan Lochs planning guidance](https://www.pkc.gov.uk/media/46815/Lunan-Lochs-SAC/pdf/Lunan_Lochs_2020_Adopted.pdf?m=1607079691217)
* The Loch Flemington catchment (Highland)

## A1.7 Authorised discharges

The minimum search distance is 50m.

This data is available from SEPA via data request.

A further check can be undertaken by carrying out a walkover survey and from landowner knowledge or records.

# Annex 2: Report on ground investigation and baseline conditions

You need to provide a report on the ground investigation and baseline conditions. This is to inform the DQRA. To do this you should:

* Carry out a desk study. This will provide an initial indication of the hydrogeological setting and likely ground conditions. The desk study findings will help inform the subsequent ground investigation.
* Carry out an intrusive ground investigation (GI). This is to characterise the site-specific ground conditions. Prior to carrying out the GI you may wish to discuss your plans with SEPA.
* Carry out baseline monitoring as necessary.
* Report on your findings. This should include the factual details as well as an interpretation of the results.

## A2.1 Desk Study

The hydrogeological desk study should include:

* Ordnance survey mapping (current and historical)
* Aerial photography
* Published geological mapping
* British Geological Survey records, including records of any previous ground investigation in or near the site
* Landowner records
* Local authority records
* Coal Authority records (if applicable)
* Observations from any walkover survey (if applicable)

## A2.2 Ground Investigation

### GI required for all licence level discharges.

An intrusive ground investigation (GI) is required to characterise the site-specific ground conditions.

For very large discharges, the drainage field is likely to be of considerable spatial extent. Ground conditions may not be uniform over the entire area. This should be taken into account when planning the GI.

The GI must be planned and undertaken in accordance with BS5930:2015+A1:2020 Code of practice for ground investigations. If the desk study identified the potential presence of historical land contamination, then the GI should also be planned and undertaken in accordance with BS10175:2011+A2:2017 Investigation of potentially contaminated sites – code of practice.

Trial pits are required around the proposed drainage field to confirm the near-surface ground conditions. Trial pits on each side of the proposed drainage field at a minimum spacing of 25m are recommended. Additional trial pits may be necessary to characterise any spatial variation in ground conditions. The trial pits should be at least 1.2m deeper than the proposed invert level of the infiltration pipework.

Percolation testing in accordance with the methodology set out in the building regulations ([Building regulations - Building standards - gov.scot (www.gov.scot)](https://www.gov.scot/policies/building-standards/monitoring-improving-building-regulations/)) is required to establish the percolation value (Vp) within the area of the proposed soakaway. A minimum of 6 test pits evenly distributed across the soakaway area and at least 5m apart is required for soakaways up to 300m2 in area, with a further 2 test pits for every additional 100m2 of soakaway area. The percolation tests should be undertaken at the proposed depth of the infiltration pipework. As far as practicable, avoid undertaking the percolation testing during extreme weather conditions such as drought, frost or storm events.

### Additional GI required for high-risk licence discharges

Where the discharge poses a [high risk](#_What_does_high) to groundwater at least three groundwater monitoring points are required: one upgradient and two downgradient.

Additional groundwater monitoring points will be required where:

* The discharge is very large.
* The discharge is underlain by complex hydrogeology.
* They are needed to assess the risk to any sensitive receptors.

The monitoring points may include purpose-built monitoring boreholes, springs, and/or co-opted third party wells if suitable.

The groundwater monitoring points must be sited and designed to allow triangulation of the groundwater flow direction and to facilitate long-term groundwater monitoring, including during operation of the system (if required). The depth of the monitoring points must be adequate to account for any seasonal or other temporal fluctuations in groundwater levels. The monitoring points must have adequate headworks to prevent accidental damage or ingress of surface run-off.

Obtaining soil and rock samples for geotechnical and chemical testing to aid the hydrogeological risk assessment is highly recommended. Relevant testing is likely to include particle size distribution analysis, moisture content, and organic matter content.

Additional chemical testing of soils, rock or water samples may be required if the desk study has identified the potential presence of historical land contamination.

Undertaking in situ variable head testing in the monitoring boreholes to aid characterisation of hydraulic properties such as hydraulic conductivity is highly recommended. This is in addition to, not instead of, the percolation testing requirements.

The following information is required for all exploratory holes:

* Borehole logs, including the geology and installation details,
* the NGR of the borehole
* The elevations of the borehole-specific monitoring datum (usually top of borehole casing) relative to Ordnance Datum.

## A2.3 Baseline Monitoring

Baseline monitoring is required for [high-risk](#_What_does_high) discharges.

At least 12 months of groundwater level monitoring at a frequency of at least monthly are required plus at least quarterly groundwater quality monitoring.

Water levels should be measured to at least 10mm accuracy and the data provided in both metres below ground level and metres above Ordnance Datum. Flow rates should be monitored at springs. The use of dataloggers to allow more frequent monitoring is highly recommended to better characterise how groundwater levels respond to weather events. Comparison of groundwater level data with nearby rainfall records is recommended.

Appropriate measurement and sampling methods should be selected to ensure the data collected is representative and to avoid cross-contamination between monitoring points.

The recommended water quality monitoring suite for sewage discharges includes:

* pH, electrical conductivity, dissolved oxygen, redox, temperature (these parameters preferably measured in the field)
* Chloride, alkalinity, sulphate
* Sodium, potassium, calcium, magnesium
* Ammoniacal nitrogen, nitrate, nitrite, orthophosphate
* Total suspended solids
* Dissolved organic carbon

The recommended water quality monitoring suite for other effluents depend on the effluent composition, the hydrogeological setting, or if historical land contamination is suspected.

Baseline monitoring at nearby sensitive receptors (if identified during the water features survey) is also highly recommended. The appropriate scope of baseline monitoring will depend on the nature of the receptor.

Pre-application discussion with SEPA prior to commencing baseline monitoring is recommended.

## A2.4 Reporting

Both factual and interpretative reporting is required for the desk study, GI and baseline monitoring. The report should include exploratory holes logs, water monitoring records, and field testing results and laboratory certificates for all soil and water testing.

Supplementing the interpretation with appropriate plans, cross-sections and photographs is highly recommended. The report must include a site plan showing the locations of groundwater monitoring points, groundwater levels contours and flow direction(s).

All assumptions in the interpretation of the factual data should be justified.

The interpretative reporting of the GI may be combined with the development of the Conceptual Site Model if preferred.

# Annex 3: Detailed Quantitative Risk Assessment

Where the conceptual site model has identified potential pollutant linkages where pathways link the discharge and the receptors, then further detailed quantitative risk assessment (DQRA) is required to assess the potential risks to the water environment.

## A3.1 What parameters should be modelled?

For sewage discharges, the key parameters to be modelled in the DQRA are ammoniacal nitrogen and nitrate. In addition, phosphate should be modelled when assessing risks to GWDTE, freshwater lochs or in phosphate-sensitive catchments. Phosphate should also be considered when assessing to the risk to watercourses from discharges greater than 200 population equivalent.

For other effluents, the parameters requiring modelling will depend on the expected composition of the effluents. Pre-application discussions with SEPA are recommended.

If there are sensitive receptors nearby (e.g. abstractions for human consumption, etc), then the DQRA for the discharge of the treated effluent should be based on the maximum predicted loading rate. If only the risk to future groundwater resources is being assessed, the DQRA for the discharge of the treated effluent may be based on average annual loadings.

## A3.2 What should the DQRA include?

The DQRA should include an assessment of the:

* the location of the groundwater table and whether there will be a direct discharge to groundwater
* risks to future groundwater resources
* risks to receptors via a groundwater pathway if these are identified by the water features survey and conceptual site model including:
  + abstractions
  + GWDTEs
  + surface waters
  + bathing waters
  + shellfish waters
* whether the discharge will mobilise any existing land contamination or if any contamination will affect the mobility or persistence of pollutants in the effluent.
* whether any discussed wells or boreholes, field drains, services or mines have the potential to act as preferential pathways between the discharge and receptors.
* the cumulative impact of the discharge when considered with other discharges or pollutants affecting groundwater in the area.

WAT-PS-10 provides further guidance on assessing risks to groundwater and the related water environment. The DQRA modelling approach, input parameters and all assumptions must be justified.

## A3.3 How should the modelling be undertaken?

You can use [The H1 annex J5 infiltration worksheet](https://www.gov.uk/government/publications/h1-annex-j5-infiltration-worksheet) when undertaking the DQRA. You may also use alternative modelling approaches if they are appropriately justified.

If you would like this document in an accessible format, such as large print, audio recording or braille, please contact SEPA by emailing [equalities@sepa.org.uk](mailto:equalities@sepa.org.uk)