

**WAT-G-045**

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**EASR Guidance:**

**Water activities related to geothermal energy**

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# Purpose and scope

This document provides information and guidance for anyone undertaking water activities associated with geothermal energy systems which requires an authorisation under The Environmental Authorisations (Scotland) Regulations (EASR).

This guidance does not cover any other permissions that may be required for example from the Coal Authority, Planning Authority or NatureScot[[1]](#footnote-2).

Guidance on the extraction of thermal energy from surface water is available in EASR guidance on water source heat pumps.

# Types of geothermal systems

Geothermal energy is broadly defined as energy from the interior of the earth used for heating or cooling.

Many schemes that involve the extraction of heat from the ground involve drilling a borehole(s). Most of these boreholes are to depths of less than 200m. Some involve drilling deep boreholes. A deep borehole is one that has a depth greater than 200m. Other schemes don’t require borehole construction and instead involve laying pipework at depths of a few metres.

Some systems do not involve abstractions or discharges to the water environment. These are termed ‘closed loop groundwater geothermal systems.’ They work by circulating a fluid around a closed system with one part of the circuit in groundwater and one part connected to a heat pump in the building(s) to be heated or cooled. The fluid in the system uses groundwater as a heat source or a heat sink.

Other systems involve abstracting groundwater, which is used as a heat source or sink in a heat pump, and then the water is returned to the water environment. These are termed ‘open loop geothermal systems’.

# Risks to the water environment from geothermal systems

Geothermal energy schemes can involve the following key activities:

* Construction and operation of a borehole or boreholes.
* Abstraction of groundwater.
* Subsequent return of the abstracted groundwater to the water environment.

## 3.1 Borehole construction and operation

Borehole construction can pose a risk to the water environment by:

* The introduction into groundwater of drilling fluids or other potentially polluting construction materials.
* Connecting groundwaters with differing water qualities.
* Creating a pathway to allow deep poor-quality groundwater, or any methane present within the strata, to reach surface receptors such as rivers or water supplies.
* The creation of a pathway to allow surface pollutants to enter groundwater; and
* The loss of groundwater via uncontrolled artesian flow.

## 3.2 The abstraction of groundwater

The abstraction of groundwater can pose a risk to the water environment and other water users by:

* Reducing flow to surface waters and other surface ecosystems.
* Causing the intrusion of saltwater or other poor quality water into the aquifer.
* Reducing the amount of water available for other water users.

## 3.3 The discharge of abstracted groundwater

The discharge of the abstracted groundwater can pose a risk to the water environment by the introduction of pollutants to the water environment either by their addition or by discharging the abstracted water into groundwater or surface ecosystems with a differing natural water quality.

# What authorisation is needed

Depending on the type of geothermal energy scheme you may need authorisation under The Environmental Authorisation (Scotland) Regulations (EASR) for the:

* Construction and operation of a borehole or boreholes.
* Abstraction of groundwater.
* Subsequent return of the abstracted groundwater to the water environment.

If you are removing and managing radioactive scales and precipitates from equipment associated with boreholes then you may encounter naturally occurring radioactive material (NORM). Guidance on whether you can manage NORM in accordance with a general binding rule, or whether you will need to apply for authorisation to do so, can be found in [SEPA’s Authorisation guide for radioactive substances activities.](https://www.sepa.org.uk/regulations/radioactive-substances/)

## 4.1 Closed loop systems

There is no abstraction or discharge of groundwater. The only water activity that is taking place is the construction of the borehole. This would normally be covered by water GBR 3, as the borehole is not intended for abstraction. If the borehole is greater than or equal to 200m deep then you need to apply for a permit for the construction and operation of the borehole.

## 4.2 Open Loop systems

Most groundwater abstractions and the subsequent return of groundwater for the purpose of geothermal energy extraction is covered by water GBR 17. Water GBR 17 covers “The abstraction and subsequent return of groundwater for the purposes of extracting geothermal energy from the abstracted water or for the purpose of transferring heat to geological formations as part of a cooling system”.

There are a number of rules in GBR 17 including:

* That the volume of water abstracted and not returned does not exceed 10m3 per day. For example, an abstraction of 200m3/d can be authorised under this GBR provided 190m3/d is returned.
* There should be a means of demonstrating that the volume of water abstracted and not returned does not exceed 103m/day.
* The abstracted water must be returned to same geological formation or mine working from which it was abstracted. We recommend you have a map to show the location of the abstraction and discharge. If you want to discharge the water to a different geological formation from which it was abstracted or discharge to a surface water you need to apply for an abstraction registration or permit and a discharge permit. If you want to discharge to the sewer you need to apply for an abstraction registration or permit. No EASR authorisation would be required for the discharge.
* That no substances should be added or allowed to enter the abstracted water by for example, addition of chemicals from a cooling process. If abstractions from mine workings take place you should take measures to prevent the oxidation of the water prior to its re-injection.
* Pipe work and other equipment should be maintained so there is no leakage or water.

If the abstraction and discharge is covered by water GBR 17 then the borehole construction is normally covered by water GBR 3. Water GBR 3 applies to the construction, extension or operation of any well, borehole or other works by which water may be abstracted, if such works are, amongst other things, intended for the purpose of undertaking activity 17. EASR Guidance: Borehole construction and decommissioning best practice provides some useful information.

There are a number of rules in water GBR 3 including:

* That the borehole is are less than or equal to 200m deep. If the borehole is greater than or equal to 200m in depth then you need to apply for a permit for the construction and operation of the borehole.

# Lithium extraction

Geothermal brines have the potential to be a possible source of lithium. The higher temperature groundwater results in increased lithium concentrations due to enhanced leaching from rocks. If lithium extraction is undertaken together with geothermal energy production, then the regulatory approach for the borehole construction, abstraction and discharge would be the same as that for geothermal. If you are removing and managing scales and precipitates from equipment associated with boreholes then you may encounter naturally occurring radioactive material (NORM). Guidance on whether you can manage NORM in accordance with a general binding rule, or whether you will need to apply for authorisation to do so, can be found in SEPA’s [Authorisation guide for radioactive substances activities](https://scottishepa.sharepoint.com/sites/IntegratedAuthorisationFramework/Shared%20Documents/WS06_Water_Activities/Guidance%20docs/Water%20Resources/%3A%20Radioactive%20substances%20%7C%20Scottish%20Environment%20Protection%20Agency%20%28SEPA%29). Depending on the method of lithium extraction an EASR industrial activities permit may also be required.

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SEPA reserves the right to depart from this guidance and take appropriate action as it considers necessary or appropriate. Operators are responsible for ensuring that they are compliant with the law. If necessary, independent legal / specialist advice should be sought.

1. For example, on a geological SSSIs where the interest features may be damaged by the installation, and activities associated with, the installation of a borehole. [↑](#footnote-ref-2)