High Peak Borough Council

Code of Practice
Drilling of Boreholes in the Vicinity of Buxton Thermal Springs

1. General

1.1 Scope

This code of practice provides a source of advice on how to protect Buxton thermal springs from drilling activities that might affect the quality or flow from the thermal spring. It should be used whenever drilling activities are contemplated in Areas A or B shown on Figure 1.1. This restriction applies to any borehole drilled to a depth greater than 600 mm at any diameter and using any technique that is drilled for any purpose whatsoever including site investigation, investigating structures or for water supply.

1.2 Background

Thermal springs are rare in Britain. The Buxton thermal springs have been known to have been used since Roman times and have a long history of use as a mineral water and spa. They consist of a series of springs that discharge at up to 27.5 degrees C through Carboniferous Limestone in the vicinity of The Crescent in Buxton. The location of the springs suggests that the thermal water is capped beneath Namurian strata (shales and sandstones) that exist to the north of The Crescent, with the thermal water emerging at the ground surface at the feather edge of the Namurian strata. The water is unpolluted and has unique chemical properties that distinguish it from the non-thermal groundwater that is also present in the Carboniferous Limestone. It has been shown that the thermal springs originate from the percolation of rainfall into a network of micro-fractures in the Carboniferous Limestone to reach a depth greater than 900 m. The heated water then returns rapidly to the surface probably following faults in the limestone strata.

The thermal water is bottled as Buxton Water, one of the best known mineral water brands in UK. The Crescent buildings are being regenerated as a Spa Hotel using the thermal water for treatments, and are expected to lead to increased tourism and income generation for the town. Water quality or flow impacts to the Buxton Thermal Spring could be irreparable and cause significant economic damage to the town of Buxton.

Although the thermal water has a greater hydraulic head than the cold groundwater system through which it emerges, there is a delicate balance within the limestone aquifer and therefore a need to avoid changes in hydraulic pressure that could affect this balance or changes in loading on the thermal water that might cause breakthrough of thermal water through the feather edge of the Namurian strata. New pathways within the limestone, created by drilling, could present a potential risk to the system: a borehole into the Carboniferous Limestone in the vicinity of The Crescent could create interconnections within the non-thermal aquifer that could result in changes in groundwater flow, which could have a knock-on impact on the flows and heads in the thermal system that could have a serious detrimental effect by diverting thermal water flow away from these springs. Any abstraction from such a borehole would further increase this risk. The construction works associated with drilling also have the potential to cause contamination of the aquifer and possible turbidity with unknown implications for the thermal water system.

1.3 Who the code is aimed at

This Code of Practice is aimed at landowners and occupiers, drillers, and supervising personnel who are considering conducting drilling activities within Areas A and B shown on Figure 1.1. These Areas are within

500 m of known thermal water associated with the Buxton thermal springs and where the Namurian strata is estimated to be less than 100 m thick. Area A defines an area within 250 m of known thermal water, where Namurian strata is estimated to be less than 25 m thickness and ground level is below 300 m AOD. These criteria are used to indicate Areas where special care needs to be taken because of the possible risk that drilling activities may affect the Buxton thermal springs.

1.4 Further Information

This document should be read in conjunction with other codes of practice, health and safety guides and British Standards in relation to excavations, drilling, installation and decommissioning of these schemes. These include the *BS 5930:2015 (Code of practice for ground investigations)* and *Environment Agency (EA) Guidance on the design and installation of groundwater quality monitoring points (2006).*

Much of Areas A and B coincide with Environment Agency Groundwater Protection Area (SPZ1) and their guidance *EA Groundwater protection: Principles and practice (GP3) August 2013 Version 1.1* will also give background to the importance of aquifer protection in this area.

2. Fundamental Requirements

2.1 General

When drilling boreholes in sensitive areas a precautionary approach is required. Ideally, drilling activities would be minimised within Area B and avoided altogether within Area A. If drilling activities are to be completed in either Area, a **risk assessment** and **method statement** describing the approach to be taken should be prepared and discussed with High Peak Borough Council as the owners and abstraction licensees of the Buxton thermal springs, and also appropriate regulators. The approach that is recommended be taken in order to prepare this risk assessment and method statement is described below.

Contact details for High Peak Borough Council are: xxxx

In case of emergency: xxxxx

2.2 Legal Requirements to Protect Groundwater

High Peak Borough Council, Nestle and the owners of the Buxton Spa Hotel all have significant financial interests in the thermal source and legal liability for any disturbance or damage to the source may fall to the person(s) who cause such disturbance or damage particularly if such disturbance or damage is caused by failure to adhere to the advice in this Code of Practice.

It is a criminal offence to “cause or knowingly permit” groundwater to become polluted, with heavy penalties (£20,000 maximum fine in a magistrates court, or an unlimited fine and/or imprisonment on indictment).

If drilling for water abstraction purposes, a water abstraction licence is required from the EA where abstraction rates exceed 20 m^3/day.

2.3 Desk Study and Risk Assessment

The following steps should be carried out as a minimum:

1. Desk study to collate and understand background information.
2. Risk assessment to understand the risks to the thermal system from the proposed activities.
3. Method Statement that demonstrates that the activities can be conducted safely without detriment to the thermal spring, including appropriate actions if thermal water is encountered.

A desk study review is intended to identify the sensitivity of the proposed drilling location. It should consider the local geology/hydrogeology/hydrology conditions, particularly the depth to Carboniferous Limestone, proximity to known or expected thermal water, potential land contamination issues, proximity to water

features such as River Wye, septic tanks, services etc. The desk study review should also be used as the basis of preliminary discussions with stakeholders and other interested parties including regulators, conservation bodies, drillers and landowners.

If the proposed drilling location has the potential to be contaminated there is a risk that drilling or associated excavation could lead to pollution of groundwater and migration of contaminants. Where possible drilling through potentially contaminated materials should be avoided. If this is not possible a risk assessment and method statement should show how the risks posed by this contamination will be managed. Guidance on groundwater risk assessments can be found in the EA's *Horizontal Guidance Note H1 - Annex (j).* Consultation with the regulator is recommended.

If the drilling could result in contamination or disturbance of the groundwater regime and affect water quality in the Buxton thermal springs, the drilling method, borehole design and, if required, monitoring should provide adequate mitigation.

There is a particular danger that any drilling fluid used could easily enter the limestone and cause particles that have been deposited within the fracture system to be lifted into suspension thereby causing the thermal water to be contaminated. Such contamination could be carried into the bottling equipment or the treatment systems used in the Spa hotel.

The risk assessment should include consideration of:

- The likelihood of encountering thermal water
- The likelihood of introducing near surface contamination into the Carboniferous Limestone aquifer
- The likelihood of contaminating the Carboniferous Limestone by the drilling process, either by causing turbidity or by accidental contamination from the drilling equipment
- The likelihood that the cold groundwater system will be disturbed and affect the balance between the thermal and cold water groundwater systems

For any risk identified, the method statement should identify appropriate good practice for the drilling activity and appropriate mitigation measures for those occasions where a risk is realised.

3. Technical Requirements for inclusion in the Method Statement

3.1 Supervision

The works should be supervised at all times by an experienced drilling supervisor/foreman who has achieved full accreditation by the British Drilling Association. In addition, the site work should be under the overall supervision of a qualified hydrogeologist.

3.2 Inspection Pits/CAT Scans

All drilling locations should be CAT scanned in order to identify the location of services.

Inspection pits should normally be provided at the proposed drilling locations as good practice to confirm the absence of services. Inspection pits for this purpose are excavated to 1.2 m depth unless bedrock is encountered. All pit locations should be CAT scanned prior to excavation of the pit and again at the base of the pit. Excavated material shall be stored on thick polythene sheeting at the surface and replaced in the reverse order to that excavated. No trial pits or hand excavated pits are to be left open overnight. Should visual or olfactory evidence of contamination be identified there may be a requirement to relocate the borehole.

Groundwater encountered during the excavation of such pits should not be allowed to enter natural water bodies or drains or to seep onto unprotected ground and cause seepage to the water table. Groundwater shall not be allowed to spill outside the working area. Where contaminated groundwater is encountered disposal off site will be required.

3.3 Drilling Methodology

Drilling Method

If there are concerns regarding shallow contamination the method statement for the drilling works should ensure that the works minimise the risks of creating pathways for contaminants to migrate into the limestone aquifer and should assess the need for use of telescopic drilling.

Groundwater and arisings should not be allowed to enter natural water bodies or drains or to seep onto unprotected ground and cause seepage to the water table. Groundwater should not be allowed to spill outside the working area.

A sealed lockable stopcock cover, or other appropriate cover, should be used to prevent the ingress of surface water and to protect the top of the borehole tubing. The driller should avoid leaving any exploratory holes open overnight.

Groundwater Temperature/ Artesian Conditions

If groundwater is encountered in the borehole, the temperature of the water must be measured and recorded at regular intervals. High Peak Borough Council should be notified immediately of any occurrence of groundwater at or exceeding 15 degrees C.

If overflowing artesian water is struck High Peak Borough Council should be notified immediately.

In either case, the borehole could present a significant risk to the thermal spring and urgent action is likely to be required to backfill the borehole with a bentonite-cement grout mixed using chlorinated water, unless the borehole is specifically designed to monitor the occurrence of thermal water, and has been designed appropriately.

Drilling Equipment

The equipment used in the construction of boreholes shall not introduce contamination. The rig shall be checked for oil or fuel leakage before the fieldwork starts. The method statement should detail the measures to be taken to avoid contamination of the aquifer by the drilling process. This may include:

- The drilling rig, compressor and other equipment shall be supplied with drip trays and adsorbent matting to prevent loss of fuel or lubricant to the ground;
- The compressor shall be oil free and provision of oil lubricant to the drill shall be of an approved biodegradable vegetable composition;
- All downhole equipment shall be lubricated using the minimum amount of vegetable oil required.

Drilling Fluid

The only drilling fluid should be potable water. Minimum bit pressure should be applied to achieve circulation. No oils, greases or similar type lubricants should be used on boring or drilling tools or casing.

3.4 Cleaning Equipment

All equipment used in the construction of boreholes should be cleaned using mains potable quality water (or within Area A using non-perfumed sodium hydrochlorite or peracetic acid) at an agreed wash-down area on arrival and before leaving at site and prior to repositioning the equipment to begin the next hole. (It should be noted that domestic forms of disinfectant such as perfumed sodium hypochlorite or Jeyes Fluid are specifically banned.)

Steam cleaning or jet washing is the most suitable technique for removing debris and contaminants and should be used at locations where the discharge water will not pose an environmental risk.

3.5 Waste Collection and Disposal

All drilling locations should be protected by plastic sheeting. The method statement should describe the practical methods of containment of arisings at borehole and trial pit locations to protect water courses and surface ground conditions in the event contamination is encountered.

All waste materials should be disposed of in accordance with Environmental Law.

3.6 Fuel Storage and Plant Refuelling

All refuelling of plant shall incorporate methods to prevent spillage to ground or groundwater. Ideally plant shall be refuelled and stored outside Areas A and B when not in use. Off-site storage of petroleum products and other hazardous materials is particularly important for drilling sites in Area A. If on site refuelling is required it shall be undertaken on areas of hardstanding or over an impermeable surface, using a hand pump or similar approved. All fuel containers shall be of suitable material and shall incorporate suitable labelling. All fuels stored on site must be in a lockable, bunded facility.