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 the effects of drilling activities that might affect the quality or flow of groundwater emerging from the springs. It should be used whenever drilling activities are contemplated in either the Core Protection Area or the Extended Protection Area shown on Figure 1. This restriction applies to any borehole drilled to a depth greater than 600 mm at any diameter, using any technique and drilled for any purpose whatsoever including but not limited to site investigation, investigating structures or for water supply.

A separate Code of Practice is available from High Peak Borough Council that describes the recommended approach for shallow excavations within the Core Protection Area. Shallow excavations have the potential to influence Buxton Thermal Springs most significantly when in close proximity. Therefore, the Code of Practice for shallow excavations applies only to the Core Protection Area.

1.2 Background

Thermal springs are rare in Britain. The Buxton Thermal Springs 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 temperatures up to 27.5 degrees Celsius 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, “Millstone Grit”) 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 thermal water is unpolluted and has unique chemical properties that distinguish it from the non-thermal groundwater. The thermal springs are understood to 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 to the surface, probably following faults in the limestone strata.

The thermal water is bottled as Buxton Water, which is one of the best known Natural Mineral Water brands in UK. The Crescent buildings have been regenerated as a Spa Hotel, which also uses the thermal water, in this case for bathing and spa treatments.

Although the thermal water has a greater hydraulic head than the cold groundwater system, there is a delicate balance between the cold and thermal groundwater systems and the precise route of the waters though the limestone is not entirely known. There is therefore a need to avoid disturbing established flow pathways within the limestone in and around the Crescent. Excavations, borehole drilling and piling have the potential to disturb groundwater flow pathways. The construction works associated with creating an excavation or borehole also have the potential to cause contamination of the groundwater, reducing groundwater quality and affecting their unique chemical characteristics.

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 The Core Protection Area or the Extended Protection Area shown on Figure 1. There is a risk that such activities within the areas identified may affect Buxton Thermal Springs.

1.4 How were the protection areas defined?

The protections area were defined by considering the pathways for thermal groundwater emerging at Buxton Thermal Springs and the hydrogeological factors that affect the vulnerability of those pathways.

The Extended Protection Area is defined by being within 500 m of known thermal groundwater associated with Buxton Thermal Springs and where the Namurian strata are estimated to be less than 100 m thick. The northern and eastern limit of the Extended Protection Area follows the boundary of the Environment Agency's Confined Inner Source Protection Zone (SPZ1c) for Buxton Thermal Springs.

The Core Protection Area corresponds to the area where the Namurian strata are expected to be less than 50 m thick, the ground level is below 300 m AOD and the location is within 250 m of known thermal groundwater associated with Buxton Thermal Springs. The northern limit of the Core Protection Area follows the boundary of the Environment Agency's Inner Source Protection Zone (SPZ1) for Buxton Thermal Springs.

1.5 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)*.

High Peak Borough Council's Code of Practice *Excavations in the Vicinity of Buxton Thermal Springs* provides information, guidance and a list of requirements for managing potential effects from shallow excavations on Buxton Thermal Springs.

The Core and Extended Protection Areas are wholly within the Inner Groundwater Source Protection Zone (SPZ1) for Buxton Thermal Springs. The Environment Agency uses Source Protection Zones as an initial screening tool to identify areas in which some activities or developments have the potential to adversely affect groundwater intended for human consumption. Environment Agency position statements relevant to potentially polluting activities and development within SPZ1 can be found in *The Environment Agency's approach to groundwater protection*[1]. Source Protection Zones are not statutory designations and the Environment Agency may not be required to permit the excavation works being proposed. However, the Environment Agency's position statements provide an indication of activities that pose a risk to groundwater and means of mitigating those risks.

2. Fundamental Requirements

2.1 General

When drilling boreholes in sensitive areas, such as near to Buxton Thermal Springs, a precautionary approach is required. Ideally, borehole drilling activities would be avoided altogether within the Core Protection Area and minimised within The Extended Protection Area. However, if borehole 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 recommended approach to preparing the risk assessment and method statement is described below.

[1] February 2018 Version 1.2

No intrusive works should be completed until High Peak Borough Council has received a copy of the programme or works, including proposed starting date, and has approved the risk assessment and method statement provided.

In case of emergency: telephone the Council on 01298 28400

2.2 Legal Requirements to Protect Groundwater

Under the Environmental Permitting (England and Wales) Regulations 2016 (as amended) it is a criminal offence to "cause or knowingly permit" groundwater to become polluted. Penalties include fines, imprisonment or both.

If drilling for water abstraction purposes, a water abstraction licence is required from the Environment Agency where abstraction rates exceed 20 m^3/day. Registration with the local authority is required for any water abstraction used for private water supply under The Private Water Supplies (England) Regulations 2016 and The Private Water Supplies (England) (Amendment) Regulations 2018, whether licensed or not.

As well as legal requirements not to pollute groundwaters, civil liability may also follow where mineral waters are adversely affected by the activities of a third party which could be substantial, particularly if guidance set out in this Code of Practice is not followed. Developers should seek their own advice in this regard and take out appropriate insurance for works they may wish to carry out in advance.

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 Buxton Thermal Springs from the proposed activities.
3. Method statement that demonstrates that the activities can be conducted safely without detriment to the Buxton Thermal Springs, including appropriate actions if thermal groundwater is encountered.
4. Identify any requirements for regulatory consents, permits or notifications and requirements for notifications to/discussion with local stakeholders.

The desk study, risk assessment and method statement must be completed or directly supervised by someone qualified in hydrogeology or geoenvironmental engineering and having experience of completing hydrogeological desk studies and groundwater risk assessments.

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.

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 groundwater system will be disturbed and affect the balance between the thermal and cold groundwater systems

For all risks identified, the method statement should identify appropriate good practice for the activity and appropriate mitigation measures reduce residual risks to Buxton Thermal Springs during and following the

works to acceptable levels. The method statement must show that the drilling method selected provides adequate mitigation for those risks and that there is sufficient monitoring to confirm the efficacy of the measures identified.

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.

If the proposed drilling location has the potential to be contaminated there is a risk that the borehole could lead to pollution of groundwater and migration of contaminants to Buxton Thermal Springs. Where possible, drilling through potentially contaminated materials within the Core or Extended Protection Areas should be avoided. Where this is not possible, it is expected that work on potentially contaminated sites will follow the Environment Agency's guide on managing risk from land contamination[2]. The process set out in this guide includes a risk assessment, which must consider Buxton Thermal Springs as one of the receptors. Construction works are also likely to be preceded by investigatory work conducted according to BS 10175:2011+A2:2017 *Investigation of potentially contaminated sites – Code of practice*. At potentially contaminated sites, separate method statements should be prepared for investigatory works (excavations and drilling) as well as for subsequent construction.

3. Technical Requirements for inclusion in the Method Statement

3.1 Supervision

The drilling works should be supervised at all times by an experienced drilling supervisor/foreman who should hold a Blue Lead Driller Audit Card issued by the British Drilling Association. In addition, all intrusive work should be under the overall supervision of a qualified hydrogeologist.

3.2 Materials

Prior to any drilling, a supply of bentonite pellets and bentonite powder sufficient to seal any incursions of thermal groundwater (15 degrees Celsius or greater) into the borehole should be provided on site. The supply must be sufficient to seal the borehole and should be calculated in advance and presented in the method statement.

3.3 Inspection Pits

Inspection pits are commonly dug at a proposed borehole location after scanning with a Cable Avoidance Tool and signal generator to confirm the absence of buried services before starting mechanical drilling. Such pits are usually hand dug or dug using vacuum extraction to a depth of around 1.2 m below ground surface.

Guidance and requirements provided in the parallel Code of Practice *Excavations in the Vicinity of Buxton Thermal Springs* should be consulted when preparing the part of the method statement concerned with digging inspection pits. Specific actions may be required during the digging of inspection pits in the Core Protection Area. Additional requirements for all inspection pits are as follows:

- Excavated material shall be stored on thick polythene sheeting at the surface and replaced in the reverse order to that excavated.
- No inspection pits are to be left open overnight.

[2] https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm

- Should visual or olfactory evidence of contamination be identified in the inspection pit, the borehole should be relocated unless the method statement specifically includes measures for protecting groundwater from surface contamination during drilling.
- Groundwater encountered during the excavation of inspection pits should not be allowed to enter natural water bodies or drains or to flow 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 of waste water off-site will be required (Section 3.6).
- In the unlikely event that groundwater encountered in the inspection pit has a temperature exceeding 15 degrees Celsius or rises to ground surface and overflows continually (flowing artesian conditions), the inspection pit must be sealed immediately using bentonite cement grout. No borehole drilling should occur at this location. High Peak Borough Council should be informed.

3.4 Drilling Methodology

Drilling Method

The drilling method selected by the developer should be suitable for the intended purpose of the boreholes, whilst minimising the risk to Buxton Thermal Springs. The risk assessment and method statement should describe how the risks associated with the selected method will be mitigated and explain how the selected method minimises risks in comparison to other suitable methods that could be employed safely at the site.

If ground contamination is identified as a hazard to Buxton Thermal Springs, the method statement for the drilling works should ensure that the risk is minimised. For example, it may be possible to mitigate the risk that contaminants migrate into the limestone aquifer from the surface using telescoping drilling methods.

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 cover should be used to prevent the ingress of surface water and to protect the top of the borehole tubing. The driller should not leave any boreholes open overnight – a temporary cap must be installed to prevent ingress of surface water, escape of groundwater (if groundwater naturally rises to ground surface in the borehole and overflows) and to secure the site.

Groundwater Temperature and Flowing Artesian Conditions

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

If groundwater is encountered during drilling and that water subsequently rises to ground surface, resulting in an overflowing of water from the borehole (flowing artesian conditions) High Peak Borough Council should be notified immediately. Drilling should be stopped and the overflow of water should be contained as soon as practicable by temporarily capping the borehole or otherwise preventing overflow (using bentonite for example).

Monitoring records should be made available to High Peak Borough Council for inspection at the time of notification.

In either case, the borehole could present an immediate risk to the Buxton Thermal Springs and urgent action is likely to be required. The organisation responsible for drilling must present a course of action to High Peak Borough Council based upon information provided in the risk assessment and method statement for the works. If High Peak Borough Council is not assured that the work can continue without posing risk to Buxton Thermal Springs, the borehole is to be sealed and backfilled.

If the works includes boreholes to monitor the occurrence of thermal water, the design for these boreholes and the drilling procedure to be used must be set out clearly in the method statement.

Drilling Equipment

The equipment used in the construction of boreholes shall not introduce contamination and must be cleaned before arrival at the work site (see Cleaning Equipment below). The rig and all supporting equipment such as generators and compressors shall be checked and confirmed free of oil or fuel leakage before the work at the site starts. The method statement should detail the measures to be taken to avoid contamination of the aquifer by the drilling process. Recommended minimum measures 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;
- Air compressors (if used) shall be oil-free / have oil scrubbers installed
- Oil lubricant provided to the drill shall be of a biodegradable vegetable composition designed for the purpose of drill lubrication;
- Downhole equipment shall be lubricated using the minimum amount of biodegradable oil required.

Drilling Fluid

Drilling methods that do not introduce drilling fluid are preferred over those requiring pressurised or pumped fluids that could introduce contamination. However, it is recognised that fluids will be necessary and justifiable for some types of drilling. In those cases, the only drilling fluids acceptable for use are potable water or air. No drilling fluid additives or muds (including bentonite) should be used during drilling. Minimum bit pressure should be applied to achieve circulation. No oils, greases or similar type lubricants should be used on boring or drilling tools unless of a biodegradable vegetable composition.

Borehole Casing and Backfill material

If casing is used, casing sections should be joined without the use of adhesive. No oil, grease or other lubricant should be used when joining sections of casing.

Aggregate used for backfilling the annular space around the casing or for filter pack must be washed with potable water, clean and free from contamination of any kind. Materials used to backfill boreholes or to fill the annular space must be installed in a sequence that prevents upward or downward flow between different groundwater systems. The uppermost part of all backfilled boreholes must be filled with bentonite cement grout to prevent ingress of runoff or contamination from the surface. Similarly, the uppermost part of the annular space in boreholes with casing should be backfilled with bentonite cement grout and the headworks profiled to prevent ingress of liquids into the ground around the casing.

Measures to ensure that bentonite cement grout does not contaminate the groundwater system during backfilling must be identified in the method statements.

Water used to prepare grout should be of potable quality.

Cleaning Equipment

All equipment used in the drilling and construction of boreholes in the Extended Protection Area should be cleaned using potable quality water on arrival at site, before leaving site and prior to repositioning the equipment to begin the next hole. Within the Core Protection Area, equipment should be disinfected after being cleaned. Disinfectants used must be safe to use in potable water applications[3], for example chlorine, hypochlorite or peracetic acid solution. It should be noted that domestic forms of disinfectant such as perfumed sodium hypochlorite or Jeyes Fluid are specifically banned.

[3] Water UK, 2017. Principles of Water Supply Hygiene, final version 1 October 2015 (updated 1 March 2017)

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. The wash-down area and method of cleaning should be identified in the method statement.

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 and water at borehole and trial pit locations to protect groundwater, surface water courses and ground conditions in the event contamination is encountered.

The method statement should describe how materials from the excavation will be collected, assessed for potentially contaminated material (if relevant) and disposed of in an appropriate manner.

Where there is risk of encountering contaminated materials, arisings are to be collected in suitable containers and transferred to an appropriately licensed waste disposal facility. Containers used for containment of waste arisings must be covered and in sound condition.

Fuel Storage and Plant Refuelling

All refuelling of plant shall incorporate methods to prevent spillage to ground or groundwater. Off-site re-fuelling and storage of petroleum products and other hazardous materials is recommended. 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 method that minimises the risk of spillages. All fuel containers shall be of suitable material and labelled. All fuels stored on site must be in a lockable facility or container that is bunded to at least 110% of stored fuel capacity.

405000 405500 406000 406500

374000 373500 373000 372500

Key

Surface Water/ River Network

Core Protection Area (applies to shallow excavations and borehole drilling)

Extended Protection Area (applies to borehole drilling only)

0 100 200 300 m

1:6,000

Scale at A3:

High Peak Borough Council

Code of Practice: Excavations in the Vicinity of Buxton Thermal Springs

Figure 1.1

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