hafrenwater
environmental water management

HORN CRAG QUARRY

HYDROGEOLOGICAL ASSESSMENT

Report Reference: 3080/HIA
Final
January 2021

Report prepared for:

MPG Ltd
The Rowan Suite
Oakdene House
Cottingley Business Park
BINGLEY
West Yorkshire
BD16 1PE

Barkers Chambers • Barker Street • Shrewsbury • United Kingdom • SY1 1SB
T: 01743 355770 • *F*: 01743 357771 • *E*: info@hafrenwater.com

GENERAL NOTES

Title of report: Hydrogeological Assessment

Site: Horn Crag Quarry

Report ref: 3080/HIA

Date: January 2021

Version	Date	Issued to
Draft version D1	14/01/21	MPG Ltd
Final	20/01/21	MPG Ltd

Author: Lawrence Brown BSc MSc FGS CGeol

Reviewer: Chris Leake BSc MSc FGS

CONTENTS

TABLES

DRAWINGS

1 INTRODUCTION

1.1 Background

Horn Crag Quarry is located 7.2 km southeast of Skipton and 1.7 km northeast of Silsden, West Yorkshire (*Drawing 3080/HIA/01*). The quarry, which was last worked some 30 years ago, is located on an outcrop of Carboniferous sandstone.

A D Calvert Architectural Stone Supplies Ltd (Calverts) proposes to re-commence operations for the purpose of extracting dimension stone. A private water supply exists adjacent to the quarry which utilises a catchpit to collect water discharging from the sandstone. The proposed extraction area lies within the presumed groundwater catchment for the water supply.

Hafren Water has been commissioned by The Mineral Planning Group Ltd (MPG) on behalf of Calverts to provide an assessment of the local water environment and potential risks from the proposed operation to the water supply. If necessary, mitigation measures are to be proposed.

1.2 Scope of work

This report provides:

- Details of the local geology and hydrogeology
- Conceptual site model
- Potential impacts on the private water supply
- Mitigation measures, if required

1.3 Landform

The quarry is located on an extensive area of elevated land, at an altitude of between 250 and 270 metres Above Ordnance Datum (mAOD). A steep escarpment exists to the west of the site and the ground level decreases westwards towards a small watercourse. Ground levels rise steadily to the southeast, reaching a maximum elevation of 384 mAOD, 2.2 km from the quarry.

2 HYDROLOGY

2.1 Surface water features

The only significant watercourse near the site is a small stream, Fish Beck, flowing southwards, 150 m west of the quarry (*Drawing 3080/HIA/02*). The stream is culverted beneath Fishbeck Farm and after re-emerging flows westwards before discharging into Silsden Reservoir.

2.2 Wells and springs

No wells or springs are present within 500 m of the quarry, according to current Ordnance Survey (OS) mapping. However, historical OS maps indicate their presence and these are shown on *Drawing 3080/HIA/02*. One spring has been identified within the quarry, located close to the access track. The spring is at an elevation of approximately 232 mAOD and located at the western edge of the mapped outcrop of the sandstone.

A spring collection chamber is located on the western edge of the sandstone outcrop, immediately west of the quarry. Water is piped from the collection chamber to Fishbeck Farm. The collection chamber is reported to be at an elevation of 228.3 mAOD. Two chambers are present. The first contains a collector pipe that receives water from the historical mineral waste tip on the quarry's western boundary. The water passes to a second chamber where it is filtered before being piped to the properties at Fish Beck.

3 GEOLOGY AND HYDROGEOLOGY

3.1 Geology

The quarry is located in an area underlain by the Carboniferous Millstone Grit Group (MGG), which comprises fine to coarse-grained feldspathic sandstones, interbedded with grey siltstones and mudstones. There are also subordinate marine mudstones, claystones, coals and seatearths. The distribution of these units is illustrated on *Drawing 3080/HIA/03*.

The strata in the vicinity of the quarry lie within the Silsden Formation, a subdivision of the MGG.

The geological map (*Drawing 3080/HIA/03*) records a number of named sandstone units, specifically the Nesfield Sandstone (NS), which crops out to the west of the quarry, the Middleton Grit (Mn), which is worked at the quarry, and Brocka Bank Grit (BB), which crops out to the east of the quarry. A cross-section reproduced from the 1:50,000-scale geological map for Bradford (Sheet 69) illustrates the relationship between the units.

The BGS map records dips to the ESE of between 6 and 9 degrees and that the area is heavily faulted.

Five boreholes were drilled in 2019 to assess the site and summary information from these are provided in *Table 3080/HIA/T1*. A sixth borehole ('Old') is also present, for which no geological information has been presented.

3080/HIA/T1: Borehole data							
ID		BH1	BH2	BH3	BH4	BH5	OLD
Easting		405252	405369	405350	405415	405350	405344
Northing		447993	447902	448073	448057	448073	447980
Ground level	(mAOD)	242.25	250.5	255.5	254	259.75	256.9
Depth	(mbgl)	14.4	21.53	30.03	18.00	15.00	
Base SST	(mbgl)	12.19	20.04	>30.03	16.2	12.7	
	(mAOD)	230.06	230.46	<225.47	237.8	247.05	
Top mudstone	(mbgl)	13.57	20.04	-	16.2	-	
	(mAOD)	228.68	230.46	-	237.8	-	
Water level		Water level at completion(July 2019)					26/10/20
Depth	(mbgl)	12.30	11.10	10.60	8.60	11.60	18.0
Elevation	(mAOD)	229.95	239.4	244.9	245.4	248.15	238.9

The sandstone is described as fine to coarse-grained and heavily fractured in places. Several siltstone bands occur within the sequence. In boreholes BH1 and BH4 a siltstone horizon is

apparent between the base of the sandstone and an underlying dark grey to black mudstone. In BH5 the base of the sandstone is more gradational into the underlying siltstone.

3.2 Hydrogeology

The Millstone Grit Group as a whole is classified by the Environment Agency as a Secondary 'A' aquifer. The sandstones are well-cemented and groundwater flow is considered to occur predominantly through fractures, with little interaction with the matrix.

There are no details available on the hydraulic parameters of the specific sandstone units at the quarry.

Groundwater levels were measured in the boreholes completed in July 2019 and are reported in *Table 3080/HIA/T1*. It is understood that the water levels were allowed to recover after borehole completion and therefore are likely to be representative of a true rest water level. Measurements in the Old borehole were made in October 2020 and in January 2021 and water levels of 18.0 and 18.01 metres below ground level (mbgl) were recorded.

Groundwater levels are not always within the sandstone unit and in BH1 it lies within the underlying siltstone. Despite the difference in lithology in which the groundwater level was measured, it is considered reasonable to assume that the levels represent a continuous groundwater level due to the extensive fracturing reported in both the sandstone and siltstone.

Groundwater contours are shown on *Drawing 3080/HIA/04* and indicate groundwater flow to the west, towards the spring collection chamber. There is an apparent steepening of the groundwater gradient between BH3 and the Old borehole. However, the measurement in the Old borehole was made 15 months after the 2019 boreholes were completed and so may not be directly comparable with the 2019 measurements. The reason for the relatively flat gradient between BH3 and BH4 in comparison with elsewhere is not immediately apparent, but could reflect some local change in the fracture pattern. Measurements from the Old borehole suggests that there is little movement in groundwater level.

The groundwater within the sandstone and siltstone is considered to be perched on the underlying mudstone unit. Groundwater flow is in a westerly direction and would appear to drain into the mineral spoil heaps present to the west of the site. No spring discharges from the sandstone have been recorded on current or historic Ordnance Survey maps. However, one spring has been recorded during site surveys, located in the southwest corner, possibly associated with some of the faults mapped by the BGS.

4 PROPOSED DEVELOPMENT

The proposed quarry extension will extend the former extraction area eastwards. The base of extraction is proposed to be to within 1 m of groundwater level, so as not to disturb the existing groundwater flow pattern and impact on the private water supply.

Processing of materials will be limited to crushing and screening of unsuitable overburden material and will only be undertaken as and when necessary and not as a continuous process.

5 RISK ASSESSMENT

The proposed re-opened quarry and extension area, will be located within the catchment of the private water supply located to the west of the site. The works have the potential to impact upon this water supply in terms of water volume and quality. These are discussed below.

5.1 Water volume

All mineral extraction will be undertaken above the watertable. Consequently, impacts to the existing groundwater flow regime or groundwater levels are not predicted. There is consequently not considered to be any potential for impact upon the volume of water received at the spring collector water supply and mitigation measures are not proposed.

Data on groundwater levels is limited to measurements made in the summer of 2019 and the scale of natural seasonal variation is unknown. Higher winter water levels are possible.

The 'Old' monitoring borehole is still open and could be used to monitor groundwater levels on a regular basis[1]. Monitoring will establish natural groundwater variability and provide information to suitably control the elevation of the base of the working area.

5.2 Water quality

The operation of plant associated with future working of the quarry has the attendant potential to impact upon water quality. The safeguarding of water quality is recognised by the Applicant as being of paramount importance to the effective operation of the quarry. The potential sources of pollution and their means of mitigation are discussed below.

5.2.1 Potential contaminants

Chemical and fuels

The principal materials that are likely to be utilised and stored on-site, which have potential to enter the external water environment, are diesel and hydraulic oil. These fluids occur both within mobile plant and also in storage facilities (eg fuel tanks etc).

Suspended solids

Mineral extraction is likely to generate fines which may be mobilised by rainfall-derived surface water. The operation of mobile plant, such as used for screening and crushing, can exacerbate their generation and movement.

[1] Groundwater level monitoring data is shown in Appendix A of this application

5.2.2 Pollution prevention measures

Chemical and fuels

Storage of potentially contaminating materials should ideally be kept off the sandstone, possibly in the southwest corner of the site where the ground is underlain by mudstone. All potentially contaminating materials will be stored in accordance with best practice. Fuel storage will be bunded and refuelling of plant undertaken where feasible on hardstanding. No refuelling of mobile plant should be undertaken within the mineral extraction area.

In the unlikely event of a pollution incident occurring absorbent materials within spill kits would be deployed to contain the incident. The resultant contaminated material would be disposed of at a suitable facility. Site personnel will be trained in the correct usage of spill kits.

Suspended solids

This will be managed by both prevention and management. Any sources of dust/silt, such as crushing and screening, will be minimised and located in areas distant from the spring collector. Surface water management measures, including the construction of low berms to channel water away from areas of high mobile plant movement, and wedge pits, will be incorporated into site housekeeping measures. These will serve to reduce the mobilisation and transport of fines.

After the completion of mineral extraction all sources of contamination will be removed from the site, hence the long-term, residual risk to the water environment is considered to be insignificantly small.

6 SUMMARY AND CONCLUSIONS

6.1 An assessment has been undertaken of the water environment in the vicinity of Horn Crag Quarry, using site-specific data and a variety of other sources.

6.2 The principal source of concern with regard to water issues is the presence of a spring collector located immediately to the west of the site, which is used as a domestic water supply. Concern has been expressed by residents regarding the potential of the proposed quarry re-opening to impact upon the continued viability of the water supply.

6.3 Groundwater level records and geological data from on-site boreholes have been used to develop an understanding of the conceptual hydrogeology of the quarry and its environs.

6.4 Based upon consideration of recorded groundwater levels and the geology it considered that the sandstone and siltstone strata beneath the site act as a single, interconnected aquifer, with generally poor aquifer properties and in which fracture flow predominates.

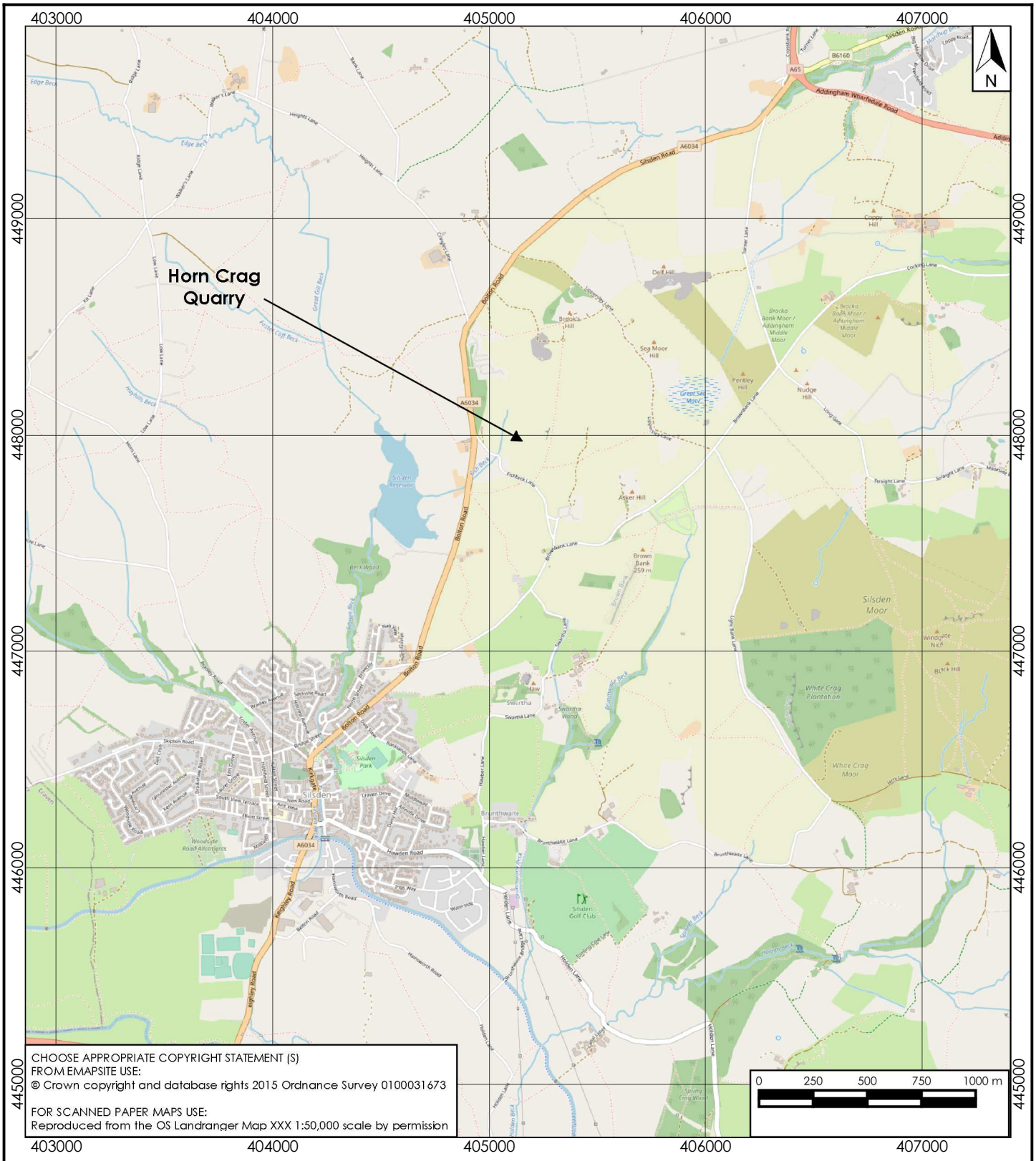
6.5 The proposed development has the potential to impact upon the extant water environment in terms of water volume and water quality. These were assessed using site-specific data and comparison with other sites in similar settings.

6.6 All mineral extraction will be undertaken above the watertable. Consequently, impacts to the existing groundwater flow regime or groundwater levels are not predicted. An existing borehole will be used to provide information on seasonal water level variation to provide better control on the base of the quarry extension.

6.7 Impacts upon water quality may potentially occur due to the accidental release of contaminants, or the generation and subsequent mobilisation of fines. Both of these can be mitigated effectively by identifying a suitable location for any storage tanks, limiting the area allocated for refuelling and by the adoption of best practice methods and good site housekeeping measures.

6.8 It is concluded that the proposed works will not impact adversely upon the wider water environment and the continued viability of the spring collector water supply located to the west of the site.

DRAWINGS



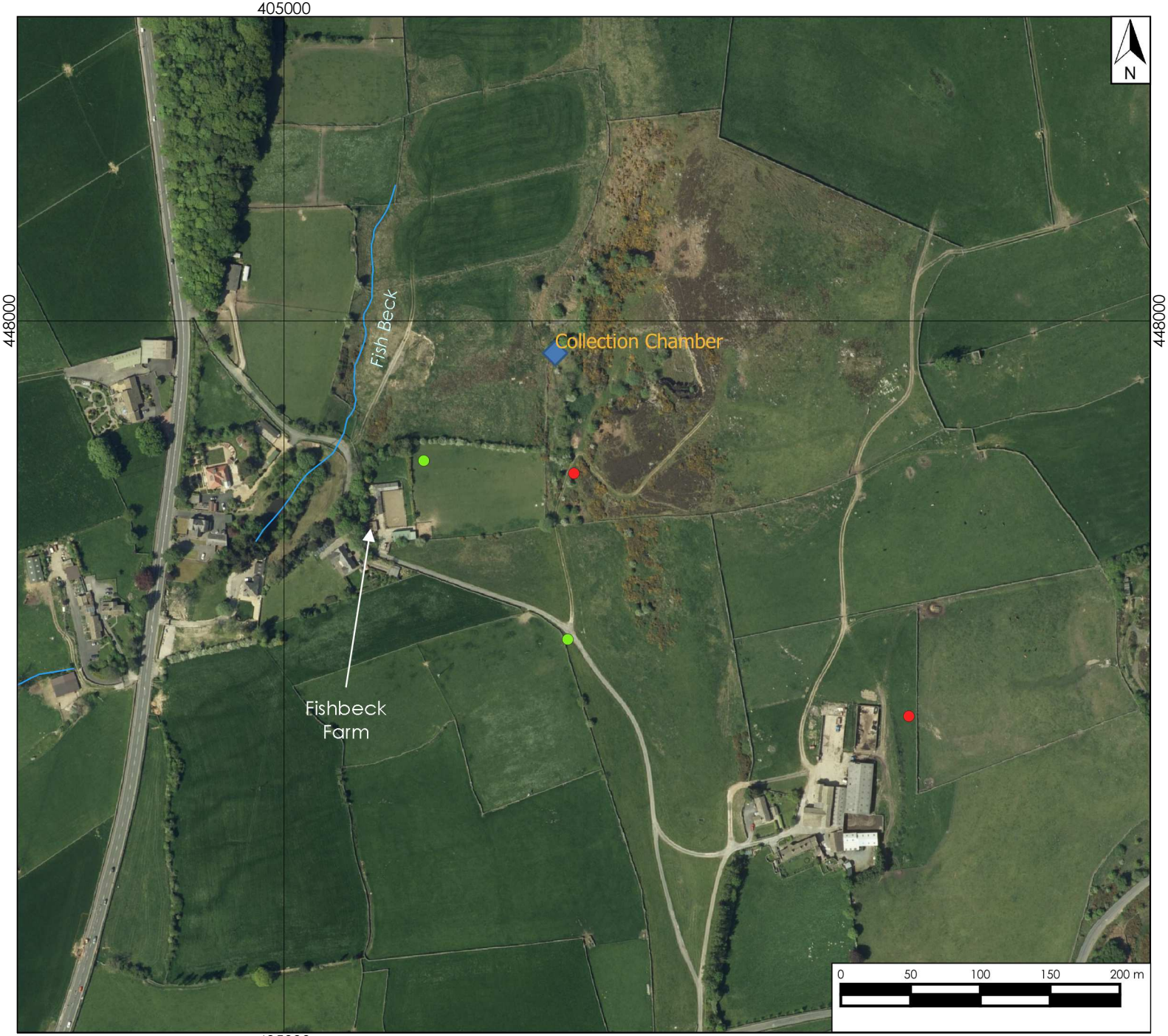
Legend

Scale correct at A4

hafrenwater
environmental water management

Barkers Chambers • Barker Street • Shrewsbury • Shropshire • SY1 1SB
www.hafrenwater.com • Tel. 01743 355 770

Client	Mineral Planning Group Ltd.
Title	Location
Project	Horn Crag Quarry
Drawing	3080/HIA/01
Version	1
Date	Jan-21
Scale	1:25000



Legend

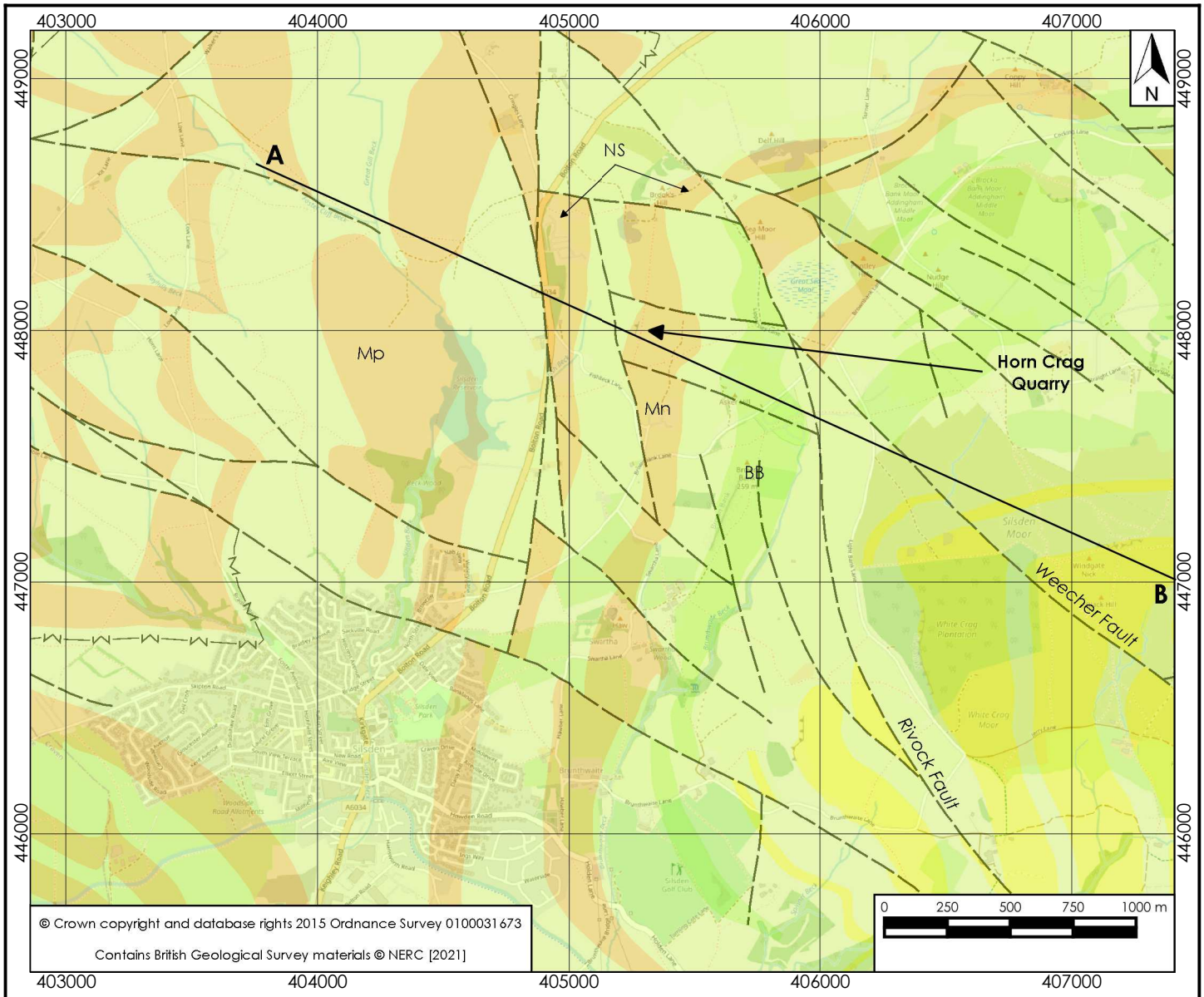
Springs

- Issue
- Spring
- Well

Scale correct at A4

Client	Mineral Planning Group Ltd.
Title	Water features
Project	Horn Crag Quarry
Drawing	3080/HIA/02
Version	1
Date	Jan-21
Scale	1:4000

hafrenwater
environmental water management
Barkers Chambers • Barker Street • Shrewsbury • Shropshire • SY1 1SB
www.hafrenwater.com • Tel. 01743 355 770

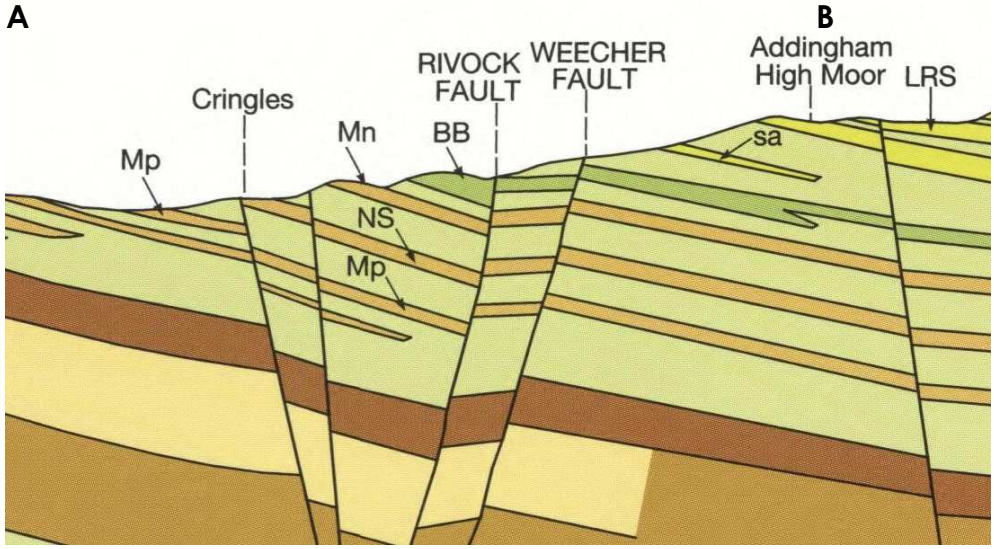


Note: the geology has been displayed for illustrative purposes and boundaries may not be accurate at the scale displayed.

Legend

Geological key

- sandstone
- sandstone (eg BB)
- sandstone (eg. NS & Mp)
- mudstone, shale

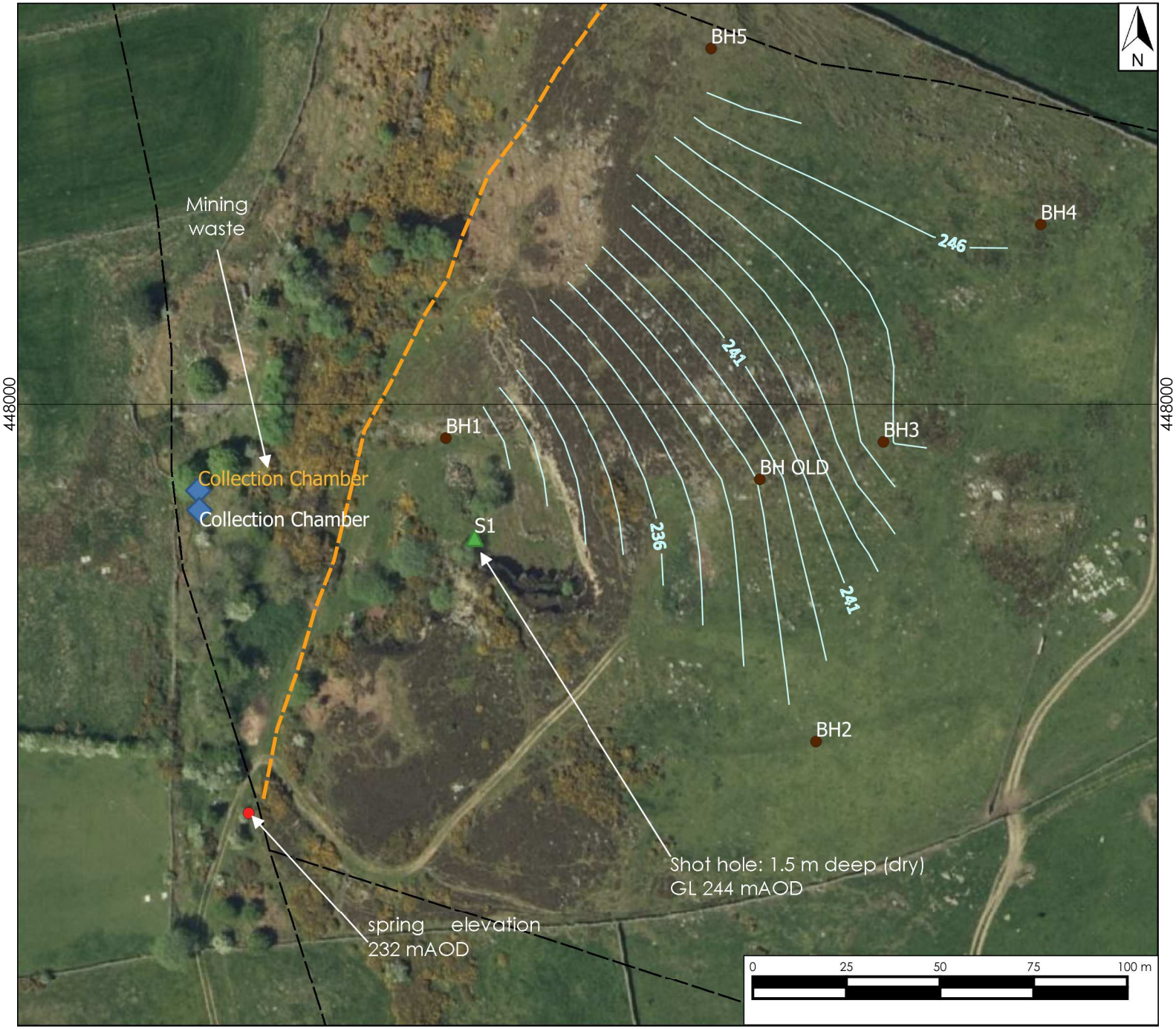


Section line reproduced from 1:50,000-scale geological map, Sheet 69, Bradford

Scale correct at A4

hafrenwater
environmental water management
Barkers Chambers • Barker Street • Shrewsbury • Shropshire • SY1 1SB
www.hafrenwater.com • Tel. 01743 355 770

Client	Mineral Planning Group Ltd.
Title	Geology
Project	Horn Crag Quarry
Drawing	3080/HIA/03
Version	1
Date	Jan-21
Scale	1:25000



Legend

GWL

Boreholes

Borehole

Shot hole

Borehole Locations copy

PWS

Springs

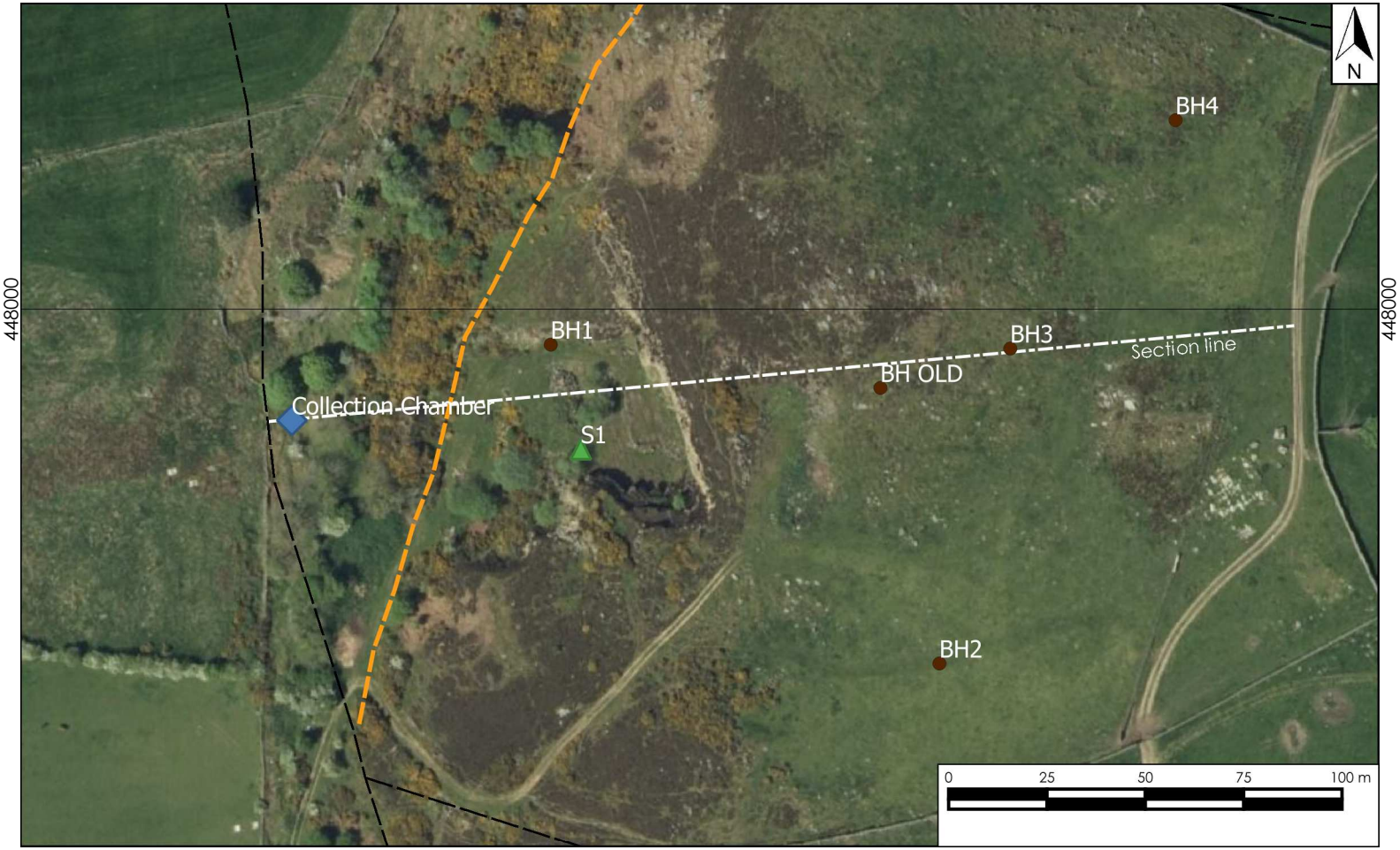
Spring

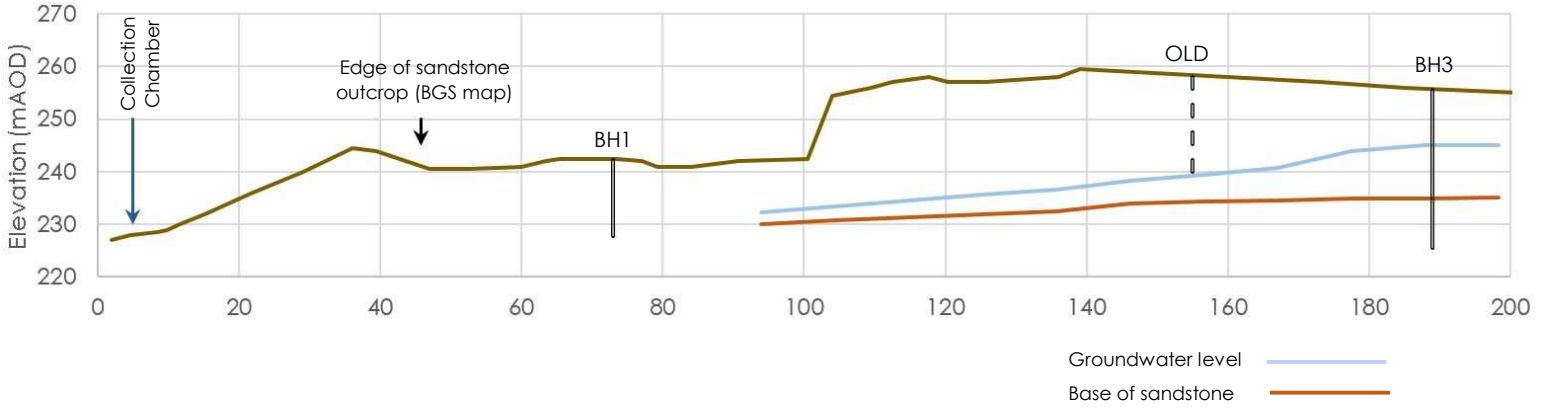
Outcrop of base of sandstone (BGS mapping)

Scale correct at A4

Client	Mineral Planning Group Ltd.
Title	Groundwater level
Project	Horn Crag Quarry
Drawing	3080/HIA/04
Version	1
Date	Jan-21
Scale	1:1500

hafrenwater
environmental water management
Barkers Chambers • Barker Street • Shrewsbury • Shropshire • SY1 1SB
www.hafrenwater.com • Tel. 01743 355 770





Legend

Boreholes

- Borehole
- Shot hole

Borehole Locations copy

- PWS

Springs

- Spring
- Outcrop of base of sandstone (BGS mapping)

Scale correct at A4

Client	Mineral Planning Group Ltd.
Title	Cross section
Project	Horn Crag Quarry
Drawing	3080/HIA/05
Version	1
Date	Jan-21
Scale	1:1700

hafrenwater
environmental water management
Barkers Chambers • Barker Street • Shrewsbury • Shropshire • SY1 1SB
www.hafrenwater.com • Tel. 01743 355 770