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Flood Risk Assessment
Horn Crag Quarry
A.D. Calvert Architectural Stone Supplies Ltd.

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Waste
Environment

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Chapter 5: Flood Risk Assessment

5.1. General

- 5.1.1. This Flood Risk Assessment (FRA) assesses the potential risk of flooding as a result of a proposed dimension stone quarry at Horn Crag Quarry ('The Site'). The proposals involve the stripping of top-soil and sub-soils at The Site before extraction of dimension stone block, followed by a biodiversity focused restoration of The Site.
- 5.1.2. This FRA will assess the level of risk of flooding at The Site from any source, and whether the proposals will increase flood risk elsewhere.

5.2. Site Description

- 5.2.1. Horn Crag Quarry is located approximately 1.9km to the northeast of the centre of Silsden, at grid ref: SE 05303 47994 (See drawing ref: *232/5 - 1*). The Site would occupy an area of some 5.9ha. The Site is a former quarry and unworked areas are currently used as agricultural land. The Site is abutted to the north and east by agriculture, to the south by agriculture and Fishbeck Lane and to the west by stables and an equestrian centre.
- 5.2.2. The Site's existing topography (shown on Drawing ref: *E454-001 and E454-002*) is a 'ridge', orientated north-south, reaching a maximum elevation of 261m AOD. This ridge extends to the north and south of The Site. The elevation of The Site falls way from the ridge to the east (256m AOD) and to the west (232m AOD). The historic extraction area has been worked into the ridge. The base of the historic quarry face is at 241m AOD and the top of the face is at 248m AOD. The pre-existing quarry void is in the western half of The Site. At present, the eastern half of The Site drains towards the east and the western half drains towards the west. The localised 'watershed' is located, approximately, along the ridge down the centre of The Site, orientated north-south.
- 5.2.3. There are no surface water courses within The Site, however, there are two springs in the west of The Site; shown on Drawing ref: *3080/HIA-04*. The more northerly spring directly feeds into a chamber, which supplies a residential

property as a drinking water source to the south of The Site (see Chapter 8). The more southerly spring is directed out of a pipe and leads to an area of muddy ground, but there is no overland flow of water.

- 5.2.4. The underlying geology is the Middleton Grit Unit of the Silsden Formation, "*Fine to very coarse-grained pebbly feldspathic sandstone, interbedded with grey siltstone and mudstone and subordinate marine black shales, thin coals and seatearths*"¹. The parent unit is the Millstone Grit Group. Groundwater depth information was recorded during the exploratory drilling carried out at The Site. The depth of the water table varies throughout The Site; it is higher in the north east of The Site and lower in the south west. Groundwater has been interpreted to, generally, flow towards the south west.
- 5.2.5. The Environment Agency classifies The Site (at 1:75,000 scale) as being within / upon a '*Secondary A Aquifer*'. This is defined as "*permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers*".
- 5.2.6. The Site is completely within Flood Risk Zone 1 (lowest risk).

5.3. Development Proposals

- 5.3.1. The proposed development is a small-scale dimension stone quarry. Extraction would be preceded by stripping of the top-soil and sub-soils (to be retained for use in restoration). Overburden and interburden would be retained on site for use in restoration.
- 5.3.2. It is proposed to start extraction in the southwest corner of The Site and migrate the quarry face towards the southeast corner, before extracting northwards as shown on drawing ref: 232/5 - 3. The proposals include a 'Rolling Restoration' scheme. This would be implemented in phases, carried out in conjunction with extraction.

¹ BGS Geology of Britain Viewer

- 5.3.3. Paragraph 066 of the Flood Risk and Coastal Change guidance² states that mineral extraction is classed as a 'less vulnerable' development.
- 5.3.4. The development has a proposed end-date of 22nd February 2043, by which time The Site would be restored. The lifetime of the proposed development has been taken into account within this FRA, and it is emphasised here that the development (and indeed all mineral extraction) is a temporary development.

5.4. Risk Assessment

- 5.4.1. The Site is entirely within Flood Zone 1 and is not within an area with critical drainage problems as notified by the Environment Agency. However, as The Site's surface is over 1ha, an FRA is required.
- 5.4.2. The Government publishes maps³ showing the long-term flood risk from a number of sources. Long term flood risk of the area is 'very low' for all available sources shown (rivers and the sea, reservoirs, and surface water). 'Very low' flood risk means that "*the chance of flooding is less than 0.1% [each year]*".
- 5.4.3. Bradford's Strategic Flood Risk Assessment⁴ (SFRA) was published in 2019 and assesses "*the distribution of flood risk sources*" throughout the Region, taking into account the effects of climate change on flood risk. Localised, 'Detailed Interactive GeoPDF Maps' have been produced to show the strategic flood risk for the whole County. The Site is shown on Map 4, which shows that The Site is not within Flood Risk Zone 2 and 3 and, therefore, has low risk of flooding. There is no further information specific to The Site or the proposals within the SFRA.
- 5.4.4. Additionally, the SFRA states "*a high proportion of Bradford District is categorised as very little or no risk of flooding from groundwater*". The proposed development would maintain a 1m standoff from the water table, therefore, the operations would not change the groundwater regime at The Site.

² <https://www.gov.uk/guidance/flood-risk-and-coastal-change#Table-2-Flood-Risk-Vulnerability-Classification>

³ <https://flood-warning-information.service.gov.uk/long-term-flood-risk/>

⁴ [https://www.bradford.gov.uk/planning-and-building-control/planning-policy/evidence-base/?Folder=Environment\2019%20Level%20Strategic%20Flood%20Risk%20Assessment%20\(SFRA\)\Appendix+B](https://www.bradford.gov.uk/planning-and-building-control/planning-policy/evidence-base/?Folder=Environment\2019%20Level%20Strategic%20Flood%20Risk%20Assessment%20(SFRA)\Appendix+B)

Consequently, the risk from groundwater flooding at The Site would not be increased by the proposals. As such, it is considered that there would be low to negligible risk of groundwater flooding at The Site.

- 5.4.5. As previously described in paragraph 5.2.2 of this FRA, the 'localised' water shed runs approximately north-south through the centre of The Site. Surface water on the east of The Site drains towards the east and south-east. Surface water on the west of The Site drains towards the west. The existing quarry void is in the west of The Site, there is a deep excavation in the centre of the quarry void (shown on Drawing ref: *E454-001 and E454-002*), hereafter referred to as the 'historic sump'. The Site has been visited in all weather conditions, and the historic sump in the centre of the base of the quarry has always been dry, however, it could theoretically provide some attenuation capacity should it be needed.
- 5.4.6. There will be no net increase in surface water volume entering the permission boundary as a result of the operation. However, there will be a nominal change in the direction of surface water flow; with an increased fraction entering the quarry void as opposed to running off The Sites eastern boundary. Whilst exposed gritstone can increase the rate of surface water run-off compared to vegetated ground, the scale of The Site, as well as the consideration that some of The Site already features exposed bedrock, means that any increases would be negligible and not increase the flood risk to any significant degree. The total catchment area and total volume of surface water run-off, however, would not change to any significant degree as a result of the proposed development. Therefore, it is considered that, whilst there would be negligible change to the drainage regime at The Site, the risk of flooding would not increase to any unacceptable degree.
- 5.4.7. Surface water would be managed by maintaining and migrating a sump throughout the lifetime of The Site. The sump would act as a collection point for surface water in which it could be temporarily stored whilst it naturally percolates into the gritstone underlying The Site. The historic sump has never been observed to have any water in it and so it is not expected that the migrating sump would retain a significant amount of water, and may indeed not hold any standing

water during operations. The sump would migrate as necessary, alongside extraction so that it would always be the lowest point within the extraction area.

5.4.8. Extreme precipitation or storm events could occur during the lifetime of The Site. However, it is considered that the sump would have a capacity more than sufficient to accommodate any surface water flow from a 1 in 100-year storm event. As stated, during the lifetime of operations, the sump may not hold any standing water, but is proposed as a 'worst case scenario'.

5.5. Summary

5.5.1. Currently surface water flows towards both the east and west, however, the proposed extraction and restoration would cause a very minor increase in surface water to flow towards the west within The Site. However, the increase in volume and flow rate would be negligible and would have an equally negligible impact upon flood risk.

5.5.2. As a result, there is considered to be negligible risk of flooding due to surface water at, or away from, The Site as a result of the proposed development. The risk of flooding from groundwater is, equally, not considered to be increased as a result of the proposals.

5.5.3. Surface water management would primarily consist of a migrating sump forming the deepest point within the extraction area.

5.5.4. It is concluded, through the above considerations, that the risk of flooding at, or away from, The Site as a result of the proposed development would not increase and is **very low**.