Appendix 5 to Item C2

Request for approval of details pursuant to conditions 4, 7, 8, 12, 17 and 27 of planning permission TM/88/1002 at Blaise Farm Quarry, Blaise Quarry Road, Kings Hill, West Malling, Kent ME19 4PN – TM/88/1002/RVARA (KCC/TM/0121/2020)

Appendix 5:

- **Appendix 5:** Proposed “Schedule of Blasting” (dated June 2020).

Compliance with Condition 17
of
Planning Permission TM/88/1002

Schedule of Blasting

Blaise Farm Quarry, Offham, Kings Hill, West Malling, Kent, ME19 4PN

June 2020

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1. INTRODUCTION

1.1 This document follows a review of the "Scheme of Blasting" for Blaise Farm Quarry prepared by Vibrock Limited and approved by Kent County Council (KCC) in 2002[1]. Updates have been made to take account of current legislation, policies, British Standards and good practice guidance. The vibration prediction levels have been revised in relation to the next phase of working and restoration and are set out in Table 1 of this document. The vibration prediction level locations are shown on Drawing GAL-062-BM01.

2. PLANNING CONDITIONS RELATING TO BLASTING

2.1 Blaise Farm Quarry operates under planning permission reference TM/88/1002 dated 28th 1994 (as amended by TM/98/460). Attached to the permission are two conditions relating to blasting.

Condition 17

2.2 Prior to any blasting operations being carried out a schedule of blasting shall be submitted to and approved by the County Planning Authority, the scheme shall include measures for minimising nuisance/danger from ground vibrations, air over-pressure, noise, fly rock and dust; and thereafter implemented as approved unless otherwise approved in writing by the County Planning Authority.

Condition 18

2.3 No blasting shall take place except between the hours of 0900-0930 Monday to Saturday, 1200-1400 Monday to Friday and 12-1300 on Saturday; no explosive charge weight per delay of any one blast in excess of 10kg weight shall be used and there shall be no secondary blasting; unless otherwise approved in writing by the County Planning Authority."

2.4 Details for a 'Scheme of Blasting'[2] to comply with Condition 17 were approved in October 2002 (Application Reference (Ref) TM/88/1002/R17 & R18) together with a 'Blast Monitoring Scheme'. This permission was also subject to conditions which defined ground vibration limits for Phase 1 Operations and notification procedures prior to blasting.

2.5 KCC approved minor amendments to the "Blast Monitoring Scheme" in 2004. These related to the shortening of timeframes within which monitoring results would be made available and any complaints dealt with, as well as the introduction of procedures for independent monitoring.

3. EFFECTS OF BLASTING

3.1 When an explosive detonates within a borehole stress waves are generated causing very localised distortion and cracking. Outside of this immediate vicinity, however, permanent deformation does not occur. Instead. the rapidly decaying stress waves cause the ground to exhibit elastic properties whereby the rock particles are returned to their original position following the passage of the stress waves.

3.2 Such vibration is always generated even by the most designed and executed of blasts and will radiate away from the blast site attenuating as distance increases.With experience and knowledge of the factors which influence ground vibration, such as blast type and design, site geology and

[1] Blaise Farm Quarry - Compliance with Planning Conditions to Permit Blasting for Hanson Aggregates, 28 March 2002
[2] Vibrock Report dated 28 March 2002

receiving structure, the magnitude and significance of these waves can be accurately predicted at any location.

3.3 Vibration is also generated within the atmosphere where the term air overpressure is used to encompass both its audible and sub-audible frequency components. Again, experience and knowledge of blast type and design enables prediction of levels and an assessment of their significance. In this instance, predictions can be made less certain by the fact that air overpressure levels may be significantly influenced by atmospheric conditions. Hence the most effective method of control is its minimisation at source.

3,4 It is important to realise that for any given blast it is very much in the operator's interest to always reduce vibration, both ground and airborne to the minimum possible in that this substantially increases the efficiency and hence economy of lasting operations.

4. SCHEDULE OF BLASTING

Legal Requirements

4.1 Legislation which may apply to quarries in addition to the Quarries Regulations 1999 (2013 version) includes, but may not be limited to:-

a) Explosives Act 1875
b) Control of Explosives Regulations 1991
c) The Manufacture and Storage of Explosives Regulations 2005
d) Packaging of Explosives for Carriage Regulations 1991
e) Carriage of dangerous Goods by Road Regulations 1996
f) Transport of dangerous Goods (Safety Advisor) Regulations 1999
g) FEEM EU Directive 2014/28/EU

4.2 Compliance at all times with the requirements of Quarries Regulations 1999 (2013 version) regulation 25, and specifically: -

a) Regulation 25 (1)(b) - appoint one or more competent individuals as Explosive Supervisor
b) Regulation 25 (1)(c) - ensure that at no time there is more than one person acting as Explosive Supervisor
c) Regulation 25 (2)(b) - produce an adequate written specification for each blast
d) Regulation 25 (2)(c) - give a copy of the above specification to the quarry Manager

e) Regulation 25 (3)(a) - all operations involving explosives are carried out by an authorised competent person
f) Regulation 25 (4)(a) - safety equipment and facilities are provided
g) Regulation 25 (4)(b) - any vehicle used in shotfiring operations is clearly marked
h) Regulation 25 (5) - all shotfiring operations are carried out in accordance with the shotfiring rules and the relevant blasting specification.

Shot Firing Rules

4.3 See Appendix 1 of this document – *Gallagher Aggregates Shot Firing Rules and Procedures*

Miss-Fire Procedure

4.4 See Appendix 1 of this document – *Gallagher Aggregates Shot Firing Rules and Procedures*

Blast Specification

4.5 See Appendix 1 of this document – *Gallagher Aggregates Shot Firing Rules and Procedures*

Good Practice Measures

4.6 The following good practice measures will minimise ground vibrations, air over pressures, noise, flyrock and dust:-

1. Ensure that the blast area is accurately surveyed and recorded according to the Quarries Regulations 1999 (2013 version).
2. Ensure that the correct design relationship exists between burden, spacing and hole diameter.
3. When bench blasting choose the correct burden with due regard to the local geological conditions and the face survey information.
4. Drill accurately in order to maintain the intended blast pattern.
5. Keep sub drilling to the minimum required
6. Ensure there is an adequate dust collection system for each drill rig.
7. Accurately survey and record each completed borehole as required by the Quarries Regulations 1999 (2013 version)
8. Make maximum use of existing free faces
9. If necessary, revise the blast design following an inspection of the survey data and face condition
10. Ensure that the maximum amount of explosive on any one delay interval (the MIC) is optimised by considering reducing the instantaneous charge by in-hole delay techniques, reducing the bench height, reducing the borehole diameter or a combination of these factors.
11. Ensure that the optimum blast ratio is maintained in any changes of blast design
12. Ensure that the detonator delay sequence optimises the internal (dynamic) free faces developed during the detonation sequence, particularly in multiple row blasting and in corners.
13. Where practicable ensure that the direction of detonation is away from the nearest vibration sensitive location.
14. Have a due regard for any local weaknesses in the strata, including back break from any previous shot, clay joints, and fissured ground.
15. If loading explosives through fissured or broken ground, or through cavities of any kind, consider using pre-packaged explosive and/or check the rate of rise if explosive continually during loading.
16. Whenever possible the use of unconfined charges should be avoided, also consider prohibiting surface lines of detonating cord and secondary blasting.
17. All surface detonators and explosive should be adequately covered with suitable material
18. Stemming material should be of sufficient quality and quantity to confine adequately all explosive upon detonation. A course stemming material such as angular chippings should be considered for use. Drill fines should not be used for stemming collars of holes.
19. Consider the effects of top or bottom initiation in the blasting sequence.
20. Misfire procedures should have due regard for under-burdened charges.
21. If air overpressure levels are a problem, give consideration to a reduction in the face area to be blasted.
22. Blast at regular times.
23. Regularly monitor the ground and airborne vibration generated by blasting events so the information can be employed in any necessary modification of future blast designs.
24. Maintain good public relations with those who live and work near to the blasting site.
25. Always attempt to minimise the resulting environmental effects of blasting operations and recognise that the fact that the perception of blasting events occurs at levels of vibration well

below those necessary for the possible onset of the most cosmetic of damage, but nonetheless at levels that can concern neighbours.

26. Be aware that relatively small changes in blast design can produce noticeable differences in environmental emissions and that it is very often in response to changes in these emissions rather than their absolute value that complaints may be made.

5. CONTROL OF VIBRATION LEVELS

Ground Vibration

5.1 The accepted method of predicting peak particle velocity for any given situation is to use a scaling approach utilising separation distances and instantaneous charge weights. This method allows the derivation of the site-specific relationship between ground vibration level and separation distance from a blast.

5.2 A scaled distance value for any location may be calculated as follows:-

Scaled Distance	SD	=	$DW^{-½}$ in $mkg^{-½}$
where	D	=	Separation distance (blast to receiver) in metres
	W	=	Maximum Instantaneous Charge (MIC) in kg i.e. maximum weight of explosive per delay interval in kg

5.3 For each measurement location the maximum peak particle velocity from either the longitudinal, vertical or transverse axis is plotted against its respective scaled distance value on logarithmic graph paper.

5.4 An empirical relationship derived by the USBM relates ground vibration to scaled distance as follows:

	PV	=	a (SD)b
where	PV	=	Maximum Peak Particle Velocity in mms^{-1}
	SD	=	Scaled Distance in $mkg^{-1/2}$
	a, b	=	Dimensionless Site Factors

5.5 The Site factors a and b allow for the influence of local geology upon vibration attenuation as well as geometrical spreading. The values of a and b are derived for a specific site from least squares regression analysis of the logarithmic plot of peak particle velocity against scaled distance which results in the mathematical best fit straight line where:

a: is the peak particle velocity intercept at unity scaled distance; and
b: is the slope of the regression line

5.6 In almost all cases, a certain amount of data scatter will be evident, and as such statistical confidence levels are also calculated and plotted.

5.7 The statistical method adopted in assessing the vibration data is that used by Lucole and Dowding. The data is presented in the form of a graph showing the attenuation of ground vibration with scaled distance and results from log - normal modelling of the velocity distribution at any given scaled distance. The best fit or mean (50%) line as well as the upper 95% confidence level are plotted.

5.8 The process for calculating the best fit line is the least squares analysis method. The upper 95% confidence level is found by multiplying the mean line value by 1.96 times 10 raised to the power

of the standard deviation of the data above the mean line. A log - normal distribution of vibration data will mean that the peak particle velocity at any scaled distance tends to group at lower values.

5.9 From the logarithmic plot of peak particle velocity against scaled distance, for any required vibration level it is possible to relate the maximum instantaneous charge and separation distance as follows:

Maximum Instantaneous Charge (MIC) = $(O/SD)^2$

Where D = Separation distance (blast to receiver) in metres
SD = Scaled Distance in $mkg^{-½}$ corresponding to the vibration level required

5.10 The scaled distance approach assumes that the blast design remains similar between those shots used to determine the scaling relationship between vibration level and separation distance and those which prediction is required. For prediction purposes, the scaling relationship will be most accurate when calculations are derived from similar charge weight and distance values.

5.11 The main factors in blast design that can affect the scaling relationship are the maximum instantaneous charge weight, blast ratio, free face reflection, delay interval, initiation direction and blast geometry associated with burden, spacing, stemming and sub drill.

5.12 Although the instantaneous explosive charge weight has perhaps the greatest effect upon vibration level, it cannot be considered alone and is connected to most aspects of blast design through the parameter of blast ratio.

5.13 The blast ratio is a measure of the amount of work expected per unit of explosive, measured for example in tonnes of rock per kilogramme of explosive detonated (tonnes/kg), and results from virtually all aspects of a blast design i.e. hole diameter, depth, burden, spacing, loading density and initiation technique.

5.14 The scaled distance approach is also strictly valid only for the specific geology in the direction monitored. This is evident when considering the main mechanisms which contribute to ground motion dissipation: -

i. Damping of ground vibrations, causing lower ground vibration frequencies with increasing distance.
ii. Discontinuities causing reflection, refraction and diffraction.
iii. Internal friction causing frequency dependent attenuation, which is greater for coarser grained rocks.
iv. Geometrical spreading.

5.15 In practice similar rates of vibration attenuation may occur in different directions, however, where necessary these factors should be routinely checked by monitoring, especially on sites where geology is known to alter.

Airborne Vibration

5.16 Airborne vibration waves can be considered as sound waves of a higher intensity and will, therefore, be transmitted through the atmosphere in a similar manner. Thus, meteorological conditions such as wind speed, wind direction, temperature, humidity and cloud cover and how these vary with altitude, can affect the level of the air overpressure value experienced at a distance from any blast.

5.17 If a blast is fired in a motionless atmosphere in which the temperature remains constant with altitude then the air overpressure intensity will decrease purely as a function of distance. In fact, each time the distance doubles the air overpressure level will decrease by 6dB, However, such conditions are

very rare and it is more likely that a combination of the factors mentioned above will increase the expected intensity in some areas and decrease it in others.

5.18 Given sufficient meteorological data it is possible to predict these increases or decreases. However, to be of use this data must be both site specific and of relevance to the proposed blasting time. In practice this is not possible because the data is obtained from meteorological stations at some distance from the blast site and necessarily at some time before the blast is to be detonated. The ever-changing British weather therefore causes such data to be rather limited in value and its use clearly counter-productive if it is not relevant to the blast site at the detonation time. In addition, it would not normally be safe practice to leave charged holes standing for an unknown period of time.

5.19 It is because of the variability of British weather that it is standard good practice to control air overpressure at source and hence minimise its magnitude at distance, even under relatively unfavourable conditions.

5.20 Such a procedure is recommended by the government in their National Planning Policy Framework[3] (NPPF) and accompanying Planning Practice Guidance (PPG) which requires any blast vibrations to be controlled, mitigated or removed at source but does not offer any specific guidance, either on assessment methodology or allowable limits. The now archived[4] Minerals Practice Guidance (MPG) 9 and14 did advise that ground vibration limits of between 6mm/s and 10mm/s at a 95% confidence level measured at a sensitive property, with a maximum of 12mm/s were considered acceptable. Up to date British Standards[5] provide relevant guidance which is in line with the vibration criteria within the former MPG 9 and 14.

5.21 Such control is achieved in a well-designed and executed blast in which all explosive material is adequately confined. Thus, particular attention must be given to accurate face profiling and the subsequent drilling and correct placement of explosive within any borehole, having due regard to any localised weaknesses in the strata including overbreak from a previous shot, clay joints and fissured ground.

5.22 Stemming material should be of sufficient quantity and quality to adequately confine the explosives, and care should be taken in deciding upon the optimum detonation technique for the specific site circumstances.

5.23 Although there will always be a significant variation in observed air overpressure levels at a particular site it is possible to predict a range of likely values given sufficient background information and/or experience. In this respect, past recordings may be analysed according to the cube root scaled distance approach to provide a useful indication of future levels.

6. CONTROL OF NOISE, DUST AND FLYROCK

Blast Induced Noise

6.1 Although there will always be a significant variation in observed air overpressure levels at a particular site it is possible to predict a range of likely values given sufficient background information

[3] Ministry of Housing, Communities and Local Government, February 2019
[4] In March 2014
[5] BS ISO 4866: 2010. Mechanical vibration and shock – Vibration of fixed structures – Guidelines for the measurement of vibrations and evaluation of their effects on structures. British Standards Institution.
2. BS 6472-2: 2008. Guide to evaluation of human exposure to vibration in buildings, Part 2: Blast-induced vibration. British Standards Institution.
3. BS 7385: 1993 Evaluation and measurement for vibration in buildings: Part 2. Guide to damage levels from groundborne vibration. British Standards Institution.
4. BS 5228-2: 2009 + A1:2014, Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration.

and/or experience. In this respect, past recordings may be analysed according to the cube root scaled distance approach to provide a useful indication of future levels.

6.2 With the elimination of denoting cord, the characteristic noise of a blast is no longer a sharp crack but rather a dull thump. This is partly due to the detonating sequence and partly due to natural energy dissipation and attenuation.

6.3 Peak levels from blasting are comparable to the sort of levels routinely generated by cars, etc., only in this case the noise would exist for less than a second and occur relatively infrequently. It is because of this very brief duration and its infrequent occurrence that blast noise is rarely measured in terms of dB(A) but rather looked at as part of the air overpressure generated and measured by the more meaningful parameter of dB.

6.4 It is our experience that residents become accustomed to such noise and that since the great majority of blast related complaints concern a fear of property damage, once it is clear that such noise is harmless then complaints are unlikely.

Dust

6.5 Dust from blasting activities can arise from two potential activities, namely the drilling of the boreholes and from their subsequent detonation.

6.6 Drill rigs have potential for the emission of significant quantities of dust if the waste air which is vented to atmosphere is not first filtered. Such dust suppression techniques are commonplace and hence the relatively high potential for dust emissions from this source is rarely if ever realised.

6.7 With regard to the dust caused by detonation, the explosion results in the formation of a rock pile, however dust is usually confined to the blast location and its immediate surroundings.

6.8 Mitigation measures can involve the bagging and removal from the blast zone of the drill returns. An adequate quantity and quality of stemming material is also of importance in order to prevent the explosives' rapidly expanding gases from ejecting such material from the blast holes and acting as a source of dust generation. This latter precaution will also reduce the potential air overpressure and noise generation associated with a blast event.

Flyrock

6.9 The most common causes of flyrock include**:**

a) Insufficient Burden - When there is insufficient burden or stemming on the column of explosive then the potential for flyrock exists, as the energy released from the explosive is likely to be greater than that required to solely fragment the rock mass in its immediate locality resulting in excess energy available to project rock debris beyond the danger zone.

b) Insufficient Training - The Quarries (Explosives) Regulations 1999[6] outline the training that should be given to both shotfirers and management. Since these Regulations came into force there has been a greater awareness of the need for proper training and this has been reflected in a reduction in the number of flyrock incidents. However, shotfirer and management error is still a significant problem and is present in the majority of incidents.

c) Inadequate Specification Factors - The above Regulations also list the factors to be considered when designing blasts and all should be taken into account.

d) Explosives in the Stemming Line - Explosives can be introduced into the stemming line either deliberately in an attempt to break hard top bands or accidentally usually as a result of employing

[6] Second Edition, 2013

bulk loading methods. In both cases any excess of energy from the rapidly expanding explosives' gases may result in debris projection.

e) Hole Deviation - This can be in the form of drilling at the wrong angle in any direction resulting in either reduced toe burden or toe charges in consecutive holes being too close together giving too high a concentration of explosives at one point.

f) Incorrect Delay Sequence - Care must be taken to ensure the correct delay sequence is used. Delay periods must be chosen such that under burdening of subsequent shot holes does not occur.

g) Unforeseen Geological Weakness - This is the most difficult effects to detect and counter and is probably the only cause of flyrock that is not the result of human error.

h) Weathered or Loose Rock in the Stemming Line - Extra care must always be taken when blasting operations take place in these conditions.

i) Cavity - It has to be recognised that in certain rock formations, such as some limestones, cavities may exist and are a potential problem since if inadvertently filled with explosive they can give rise to a local concentration of explosives that is too great with respect to the surrounding rock mass or burden. This can only be countered by careful checking of the explosive column length during loading to ensure the explosive is not filling a cavity. Cavities provide a greater source of danger when using bulk loading explosive systems due to the faster loading rate employed.

j) The likelihood of a flyrock occurrence can be minimised by ensuring blasts are carried out exactly to the design specification. The specification should take account of possible causes of flyrock. Should deviations to the specification occur then management must be informed and be aware of the potential hazard. Training of all personnel is essential to ensure these incidents are minimised.

7. VIBRATION PREDICTION LEVELS

7.1 Table 1 details the predicted vibration levels when blasting during the 4th five-year working and restoration scheme, employing an instantaneous explosive charge weight of 10 kg, again at the nearest possible distance of approach to the locations given.

7.2 The predicted maximum vibration levels given will only occur when using an instantaneous charge weight of 10 kg at the nearest possible distance of approach to the respective locations.

7.3 As such, the vast majority of blasting events will be significantly below the predicted maximum level.

Remains of Church of St Blaise

7.4 Considering the utilisation of instantaneous explosive charge weights of 10kg, blasting operations within Phases 3/4, the worst case predicted vibration levels from blasting operations is 3mm/s^{-1}.

7.5 Such a vibration level will have no effect upon the remains of the Church of St Blaise.

Blaise Farm

7.6 The worst-case vibration level is predicted to be 0.7 mm/s^{-1}. The predicted level is well within the recommended vibration criterion.

Properties to East

7.7 The effect of blasting operations on properties to the east is at the worst case predicted to be 0.2 mm/s^{-1}. It is well within the recommended vibration criterion and is unlikely to result in perception.

Properties to South East

7.8 The effect of blasting operations on properties to the south east are likely to result in a worst-case vibration level of 0.3 mm/s^{-1}. Such operations will be imperceptible. All predicted vibration levels are within 6mm/s^{-1} at a 95% confidence level.

Properties to North East

7.9 The effect of blasting operations on properties to the north east is predicted to generate a worst-case vibration level of 0.2mm/s^{-1}. The predicted level is well within the recommended vibration criterion of 6 mm/s^{-1} at a 95% confidence level.

8. VIBRATION IMPACT PROCEDURES AND MONITORING

8.1 The following procedures will minimise the vibration impact of blasting operations at Blaise Farm Quarry to nearby residents and structures.

Ground Vibration – Inhabited Property

8.2 A vibration limit of 6 mms^{-1} peak particle velocity is in line with successful current practice at numerous similar open pit workings within the United Kingdom. It is also in conformity with the relevant British Standard 6472-1, 2008. No individual blast will exceed 12 mms$^{-1.}$

Air Overpressure

8.3 It is impracticable to set a maximum air overpressure limit, with or without an appropriate percentile of exceedances being allowed because of the significant and unpredictable effect of variable weather conditions.

8.4 This point is clearly recognised by the Government in the NPPF and PPG which recommend that the operator employs methods to minimise air overpressure to the Mineral Planning Authority. They do not recommend an air overpressure limit.

8.5 With a sensible ground vibration limitation, the economics of safe and efficient blasting will automatically ensure that air overpressures are kept to reasonable levels.

8.6 In line with the current best accepted modern practice in the extraction industries safe and practical measures will continue to be adopted that ensure the minimisation of air overpressure generated by blasting at source, considering such factors as initiation technique.

Monitoring and Control

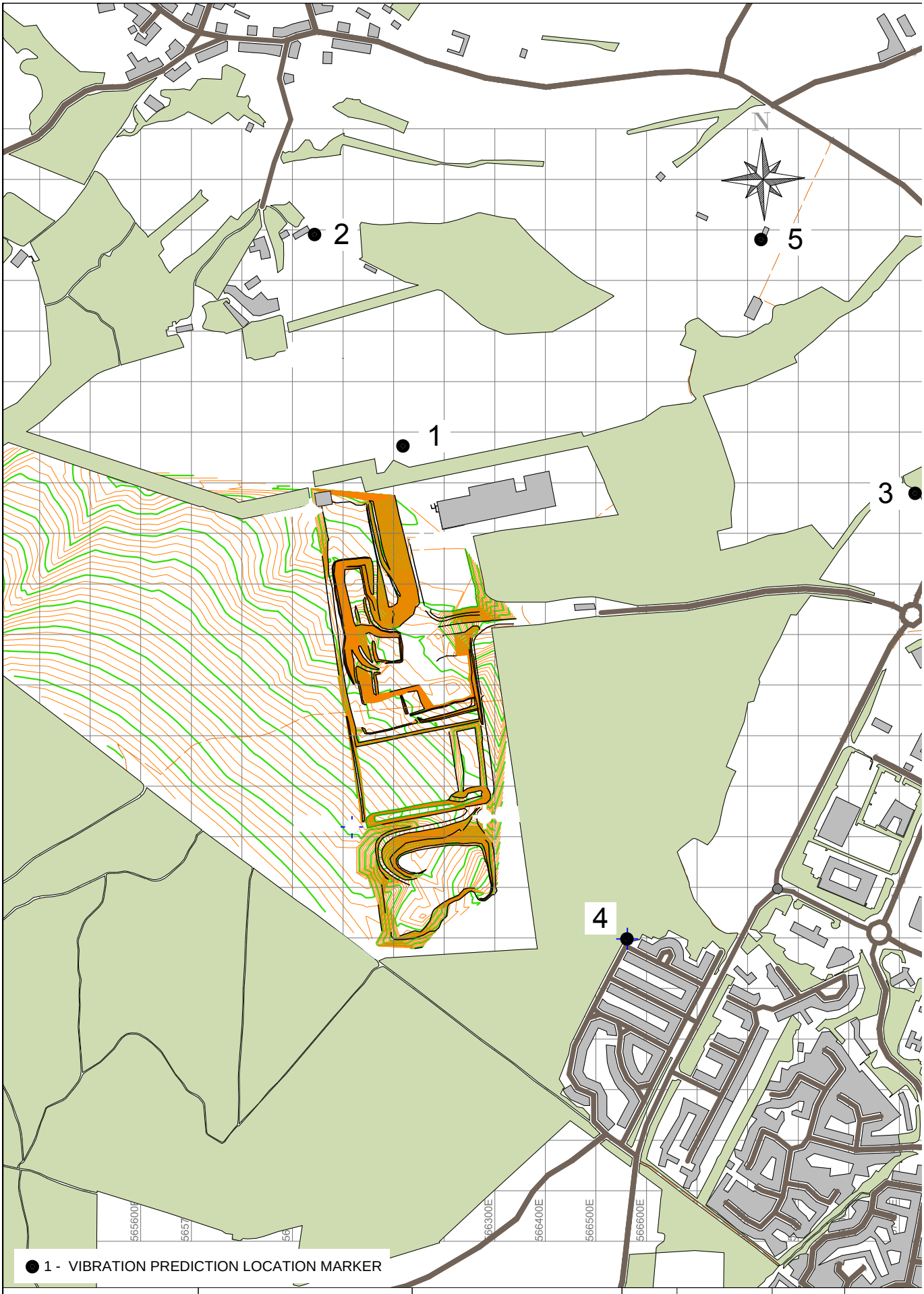
8.7 An updated *Blast Monitoring Scheme*[7] will sit alongside this *Schedule of Blasting*. Monitoring results will indicate whether or not there is compliance with the vibration criteria. The results will also be used to update the regression analysis and thus provide valuable input into the design of future blasts.

8.8 With the necessary control and best practice measures in place and the exercise of reasonable engineering control over quarry blasting, operations will continue to be within the vibration criteria.

[7] June 2020

VIBRATION PREDICTION LOCATIONS

DRAWING REFERENCE: GAL-062-BM01



● 1 - VIBRATION PREDICTION LOCATION MARKER

Gallagher

VIBRATION PREDICTION LOCATIONS

GALLAGHER AGGREGATES LTD
BLAISE FARM QUARRY
WEST MALLING

Drn by:-	Date:-	Scale:-	Sheet number:-
MJW	13th April 2018	1:10000 @ A4	1 of 1

Drawing number:- GAL-062-BM01

Revision:- /

TABLE 1

PREDICTED VIBRATION LEVELS

PHASE 4 OPERATIONS AT BLAISE FARM QUARRY

Considering a maximum instantaneous charge weight of 10 kg utilised in Phase 4 at the nearest distance of approach to the location considered, the predicted vibration levels are as shown in Table 1.

TABLE 1 - PREDICTED VIBRATION LEVELS

Location	**Vibration Level Maximum Peak Particle Velocity (mms·1)**	
	Mean	**Maximum**
1. Remains of Church of St. Blaise	1	3
2. Blaise Farm to North	0.3	0.7
3. Properties to East	0.1	0.2
4. Properties to South East	0.1	0.3
5. Properties to North East	>0.1	0.2

APPENDIX 1

SHOT FIRING RULES AND PROCEDURES

Managers Rules – Rule 11 – Use of Explosives

Aim:

These site-specific explosives rules are made to comply with **Part V of the Quarries Regulations 1999**. (2nd Edition) 2013. The rules will be read in conjunction with the following additional documents:

- QPTC Guidance on Misfires – located in the Health &Safety Document (H&SD)
- IEE Explosive Use, Drilling & Surveying – located in the H&SD
- Site Health & Safety Plan – located in the H&SD
- The Control of Explosives Regulations 1991. (Amendment's 2014)
- The Manufacture and Storage of Explosives Regulations 2014

Operator's Rules - Use of Explosives:

1 Explosives Storage

- Explosives may only be stored in compliance with the relevant explosives store license. They must always be kept in a locked explosives store or under the constant supervision of a suitable person.
- Ammonium nitrate should be stored in well-ventilated conditions at least 25m from other stored explosives and fuel oil, keeping the surrounding area clear of grass, spilled fuel oil and other organic material.
- At all times the explosives store keys must be kept either in the custody of the explosives supervisor, shotfirer or in a safe in the quarry manager's office.
- The explosives supervisor will authorise all movements of explosives to and from the place of use.

2 Custody of Explosives

- Explosives will be issued to authorised persons only, and must remain under the control of that person. A prohibited person under the Control of Explosives Regulations 1991 must not knowingly be appointed for this purpose.
- Detonator containers must have secure locks, be lined with shock-absorbing anti-static material, kept clean and be used only for detonators. Containers should be unlocked only while detonators are being inserted or removed and must be located in a secure place.
- Explosive delivery notes must be checked for quantities delivered against the amount ordered, and that such deliveries are not left unattended.

3 Transport of Explosives

- Transport of explosives to the blast site will be either, directly by road vehicle when delivered, or by vehicles or machines suitably identified, constructed and maintained to

comply with the 1999 Quarries Regulations. These vehicles, easily recognisable from a distance, will display a flashing light and be provided with enough, suitable fire extinguishers.

- Explosives shall be loaded in a safe manner so that they cannot fall out of the vehicle. In addition to explosives only essential shotfiring equipment may be carried on these vehicles.
- Explosives must be transported in the manufacturer's packaging or robust containers, only removing them immediately before use.
- Detonators will be carried in a separate lockable container and will be carried and kept in a position that does not expose it to risk of falling out the vehicle or being run over.
- The loading area on the vehicle must be kept clean and free from grit.
- A duly appointed competent person or a trainee under the close personal supervision of a shotfirer will carry out the transport operation.

4 Shotfiring Equipment

- All spark initiators must have been tested within the last 12 months and a record of that test available on site for at least 4 years.
- Tools used for piercing cartridges or in shotholes must be made of non-sparking material.

5 Explosives Supervisor

- The operator shall appoint one or more explosives supervisors. The appointment will include a written statement summarising his duties and authority. Only one such person can be in charge at any one time. Where there is more than one supervisor there must be good communication and co-ordination between them at hand-over and on maintenance issues.
- The explosives supervisor's principal responsibility is to take overall charge of the day-to-day work with explosives at the quarry. The appointed person must have sufficient practical and theoretical knowledge and experience for the work he is expected to do.
- The supervisor must be familiar with the shotfiring rules and the site as regards the safe use of explosives.

6 Drill/Blast Method Statement

Drilling

- The shotfirer/explosive supervisor shall instruct the driller on hole location, diameter, depth, inclination and azimuth. These details will be entered on the driller's report to serve as a reference for the intended drilling geometry to those concerned with it.

- The driller shall carry out the shotfirers/explosive supervisor instructions. He will record on the driller's log any variations from the intended hole locations and the position and extent of any voids, clay backs or zones of poorer quality/soft rock identified during the drilling operation. Where there is a need for a substantial departure from the instructions given the driller must refer the matter to the shotfirer or explosives supervisor.
- Ensure that adequate and effective fall prevention systems are used at all times when working within the 3-metre danger zone of a face edge.
- On completion of drilling, the driller's log will be submitted to the explosives supervisor to allow the blast specification to be produced and subsequent attachment to the blast report record.
- Carry out daily Safety checks on the drill rig and record these on the checklist.

Surveying

- Surveys will be carried out by an experienced operator using optical, laser, or other practical methods to permit burden measurements to be estimated to standards of accuracy required by the Quarries Regulations 1999 and its associated Codes of Practice.
- To enable complete and accurate face surveys to be carried out, the face must be cleared of all loose blasted material in the intended blast area.
- The surveyor will submit the completed survey to the shotfirer or the explosives supervisor.
- Any features within the face (such as broken ground, cavities, slips etc.) must be individually surveyed thus providing additional coverage in these potentially vulnerable areas.
- If the blast has a 'free' end this must also be surveyed.
- All holes must be physically examined by the use of a hand held inclinometer; where the inclinometer has not been used the reason shall be outlined on the specification along with what measures have been employed to survey the hole.

Design

- The specification, prepared by the shotfirer or explosives supervisor for presentation to the explosives supervisor will take into account the prevailing face conditions, experience gained from previous blasts and information from the driller's log. For each hole the specification will include details from the face and hole surveys, profiles, the intended loading patterns, initiation method, detonator position and blast sequence. The burden for each shot hole will determine the amount, type and placement of explosives to be used, so that the blast can be carried out safely.

- Account will have been taken of any constraints due to factors such as ground vibration or air blast over-pressure and the MIC designed accordingly. Blaise is not permitted above 10kg.
- The explosives supervisor's approval of such a specification authorises the theoretical plans for the blast design. The blast site location plan will delineate the danger zone; show sentry positions and location of the shotfiring station.
- Where detonators are used in the hole minimise the risk of misfires by using 2 detonators in each explosive deck. Cover shock-tube surface detonators with 200mm of 10mm chippings and check the integrity of connections immediately before firing, marking as double checked using tape and/or spray paint.
- Information on any special precautions that are required to contain rock within the danger zone must be highlighted after discussion with the quarry manager.
- The plan showing hole locations must be accurate, enabling these positions to be determined precisely in the event of a misfire.
- The design should ensure that faces are left in good condition after firing and take into account any unusual circumstances, which are present or likely to arise.
- A copy of the specification will be given to any person upon whom it imposes duties.

Charging

- Only those who have been explicitly appointed or are authorised in accordance with the rules are allowed to handle explosives in a quarry.
- The shotfirer shall charge the blast according to the blasting specification and in compliance with the explosives rules. If it is not possible to conform to the specification or the danger zone appears to be different from that shown, the operation should be suspended until its author or other designated person amends it. Such changes must be recorded on the blast specification sheet.
- The shotfirer must always be present during the charging operation, never leaving detonators, explosives and charged holes unattended.
- Check the rise of explosives in the holes continually during loading.
- Endeavour to have only one explosives container open at any one time.
- No person shall forcibly remove any detonator lead, safety fuse or other system for initiating shots from a shot hole after the shot hole has been charged and primed.
- The shotfirer will ensure that there is no naked flame within 10 metres of any explosives or detonators.
- Mixing of ANFO must take place at the hole. Hand mixing tools and equipment must be made of wood, plastic or aluminium and contain no ferrous components.
- Surplus explosives must be removed from the blast area before firing, not left unattended and returned to the store as soon as possible.
- Make checks to ensure that no explosives remain in discarded containers.

Firing

- Gallagher Aggregates currently uses a system of Nonel initiation that does not require circuit testing.
- Sentries shall be positioned to control the danger zone, previously identified, and will have full knowledge of the blasting and siren procedure.
- No sentry will leave his post until instructed to do so and must ensure that no person enters or attempts to enter the danger zone prior to the blast taking place.
- The shotfiring system or circuit must be checked to ensure that it has been connected correctly; a second independent check of all surface connectors shall be undertaken before they are covered
- The shotfirer will only fire a shot from a safe location that is determined by the blast supervisor.
- When using a spark initiator to initiate the surface lead line, a small length shall be cut from the end and test fired to establish that both the shock tube exploder and lead line are satisfactory.
- No person shall fire a shot unless (1) he is an explosive supervisor, shotfirer or a trainee shotfirer working under the close personal supervision of a shotfirer and (2) other than by means of a suitable exploder.

7 Shotfiring Rules

Appointments

- All appointments and authorisations must be made in writing.
- A written statement summarising the duties and authority of the appointee will accompany these appointments. Contractors will provide curricula vitae for all staff involved in blasting.
- Training will continue until the necessary competence has been acquired and demonstrated. Trainees may only operate under the close personal supervision of a fully trained and experienced shotfirer.
- The storekeeper's duties will include:
  - The security and safe storage of explosives, including detonators;
  - the custody of keys;
  - keeping records of the issue and receipt of explosives including those deliveries made direct to the blast site;
  - immediately reporting any loss or theft of explosives to a designated person; keeping the store clean and tidy, attending to repairs when needed, providing and maintaining statutory notices;
  - keeping stocks within the maximum permitted quantity;
  - confirming the issue of explosives to properly appointed persons only;

- complying with the explosives supervisor's system of authorisation for the movement of explosives.
- A physical stock check of the explosives store once per week shall be undertaken and recorded in the store record book.

- The manager will appoint explosive supervisors, shotfirers, trainee shotfirers, sentries, and store keepers.

Explosives Supervisor

- The explosives supervisor has a specific duty to check that site conditions are in line with the blast specification before work with explosives.
- It is the explosives supervisor's responsibility to check that the equipment provided is suitable and safe. If he considers it not to be so it should be taken out of use.

Blasting Times

- The normal times for blasting will be between 10.00 a.m. and 3.00 p.m. on Monday to Friday. Only in cases of emergency and with the manager's permission can blasting take place outside these times.
- There must be sufficient visibility to allow the complete blasting operation to be carried out safely. Advice will be sought from the explosives supervisor and site manager should conditions change during charging that would affect visibility.

Danger Zone

- The extent of the danger zone for each shot will be determined by an assessment of the under noted variable factors:
  - prevailing face condition
  - past experience in the behaviour of similar blast patterns and blast ratios
  - knowledge of the local rock formation
  - information revealed during drilling of the shot holes with a generous allowance for possible unforeseen circumstances.

- Close liaison with the Quarry manager, Quarry Supervisor, explosives supervisor and/or the shotfirer will be required to ensure that the danger zone is cleared of all personnel prior to blasting. On the day of the blast, notices are posted relating to firing and everyone must remove themselves to a place of safety some 15 minutes before firing.

- A sketch plan showing the danger zone on the occasion of each and every blast will be included with the blast report. Where the danger zone is fixed, for example in the Westerly Development a generic plan would suffice.

Warning systems

- The following system will be adopted:

1 x 30 second siren blast - 5 minutes prior to blasting.

2 x 15 second siren blasts – immediately prior to blasting.

3 X 5 second siren blasts shall signal the 'All-Clear'

Sentries

- The shotfirer will ensure that sentries are posted at the designated locations marked on the danger zone plan.
- The quarry manager will appoint sentries in writing. The appointment will summarise their duties.

Notification

- Selected residents are notified in relation to blasting activities, dependent upon location and blast measuring equipment is deployed at local residencies from time to time.
- County, Borough and Parish councils are informed of all blasts; these arrangements are dealt with by the blast supervisor.

Post blast Inspection

- The shotfirer will inspect the blast site to check for misfires and the state of the face for overhangs and loose boulders once any vapour has dissipated and there is no movement in the rock pile or face. He will ensure that all precautions are taken during this exercise.
- Only when he has satisfied himself that it is safe should the all clear be sounded and normal working resumed.
- It may be necessary on occasions to inspect the sides and faces of adjacent working areas that may have been affected by the blast.

Unfired Shot Holes

- Where, at the end of a working day as the result of a machine breakdown at the face or other causes, there remain charged and unfired shot holes the manager must ensure

that these holes are not left unattended and he must inform the local police of the situation.

- If the shotfirer is required to leave the charging area he should be sure that:
  - all charging ceases
  - no detonators, explosives or charged holes are left unattended
  - all detonators are locked in their containers to which the shotfirer holds the key

Misfires

- There must always be a competent person available to ensure that any misfire is dealt with safely. This will normally be the explosives supervisor.
- In the event of a misfire the manager shall inform the operator and ensure that the under noted action is taken.

Safeguards

- No person shall enter the danger area until a period of 5 minutes has elapsed since the misfire.
- After the waiting period only the manager, explosives supervisor, shotfirer, trainee shotfirer or a person authorised by the manager shall enter the danger area to determine the cause of and deal with the misfire.

Procedures.

- Where the misfire is total, the traffic and pedestrians block shall remain in effect until the circuit has been examined, the fault corrected, the dangers zone rechecked, the blast detonated, and the all-clear sounded.
- Where the misfire is partial, again the traffic and pedestrian block shall remain in effect. The shotfirer will inform the quarry manager and/or the explosives supervisor of the occurrence and together they will examine the circumstances of the misfire.
- Thereafter the under noted procedures will be carried out under the direct supervision of the manager or the explosives supervisor and/or the shotfirer:

  - by hand, remove any loose explosives that are not in any way caught by loose rock
  - remove by hand, with the necessary personnel and with extreme care, any stones that would allow further safe removal of explosives
  - if necessary, deluge with water under pressure to wash away any non-gelatinous explosives and to render harmless
  - if explosives still remain then cautious machine digging may proceed until the danger is removed or until it can't be reduced further by this means. In this event

the affected area should be isolated and identified by a system of barriers, warning flags and notices until the explosives can be dislodged by blasting relieving holes and the search procedures already outlined carried out again.

Investigation.

- All misfires must be investigated to determine the cause and to enable action to be taken to avoid any recurrence.
- Keep a suitable record of the misfire event by endorsing the relevant blast specification.
- The manager shall inform the HSE of the occurrence by telephone as soon as practicable and confirm on Form 2508. A copy will be kept in the H & S file.

Monitoring.

- The explosives supervisor and manager will use spot checks to confirm that those involved in the operation understand the requirements of the rules and are complying with them.
- Independent audits of the blasting operations will be carried out at intervals not greater than 12 months. The findings of the audits will be the subject of a separate report prepared by the person in charge of the audit.

8 Review

- Following monitoring, the rules shall be periodically examined to ensure (1) that they are practical and workable and (2) if necessary to introduce changes to accommodate altering circumstances.

9 Record Keeping

9.1 Records of appointments of explosives supervisors, shotfirers and trainee shotfirers shall be kept at a suitable place for at least 3 years following the end of each individual's employment at the quarry.

9.2 Blast specifications and reports of misfires shall be kept for at least 3 years from the date on which it was made.

9.3 Retain exploder repair records for 4 years.

9.4 A copy of the written statement of duties of all persons appointed at the quarry under Part V of the Quarries Regulations 1999 shall be kept at a suitable place for at least 12 months after the date on which the appointment ceased to have effect.

Managers Rules – Rule 11 – Use of Explosives

Signed: **Site Manager**_____

Date_____

Signed: **Recipient**_____

Date_____

(On signing the recipient acknowledges receipt and understanding of any duties imposed by these rules)