

REPORT

Phase 4 - Woodsmith Mine Noise and Vibration Management Plan

Woodsmith Mine Phase 4 - NVMP

Client: Sirius Minerals PLC

Reference: 40-RHD-WS-70-EN-PL-0017 REV 0

Revision: 01/Final

Date: 25 May 2017

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Document Sign-Off

This document forms the Noise and Vibration Management Plan (NVMP) to address construction works associated with the Phase 4 Works at Woodsmith Mine. The NVMP was produced to address the requirements of Planning Condition NYMNPA-18.

The contractor hereby commits to comply with all noise and vibration management approaches and procedures detailed herein,

.....
(Contractor) (Date)

The remainder of this document contains technical information to support the NVMP and address the requirements of the Planning Condition. The document may be revised and updated as the project progresses.

1 Introduction

1.1 Purpose of this report

- 1.1.1 In 2014 a planning application (reference NYM/2014/0676/MEIA) was submitted to North York Moors National Park Authority (NYMNPAA) for permission to develop a polyhalite mine and underground Mineral Transport System (MTS). Planning consent was subsequently granted in 2015 subject to conditions.
- 1.1.2 This document has been prepared on behalf of Sirius Minerals plc (Sirius Minerals) and details the requirements with respect to noise and vibration management for the Phase 4 (see Paragraph 1.1.4 below) Works at Woodsmith Mine (formerly known as ‘Dove’s Nest Farm’). This document is required to partially satisfy the requirements of condition 18 of the NYMNPAA planning permission NYM/2014/0676/MEIA. It has been prepared in accordance with current good practice. This planning condition states that:

Table 1-1 Condition NYMNPAA 18 Noise and Vibration Management Plan

NYMNPAA 18	Compliance with Condition NYMNPAA-18
Prior to the commencement of the development at Dove’s Nest Farm or Lady Cross Plantation, a Noise and Vibration Management Plan (NVMP) for the control, mitigation and monitoring of noise and vibration for both construction and operational phases at the two sites shall be submitted to and approved in writing by the MPA in consultation with the SBC EHO. The scheme shall set out the following:	This document addresses Phase 4 Works at Woodsmith Mine. Works at Lady Cross Plantation are deferred and are therefore not addressed in this Plan.
Noise-sensitive receptors for which predictions shall be made and at which the noise and vibration limits shall apply and which shall include recreational receptors.	Section 4.1
Predicted noise levels at the noise-sensitive receptors from noise and vibration generated at the DNF and LCP sites for the key construction phases during the forthcoming year including any periods in which the higher daytime limit of 70 dB L_{Aeq} shall apply (permitted 56 days for temporary works to create noise-reducing bunds and/or barriers as per Conditions 16 and 18).	Section 4.2 and 4.3.
The best practicable means which will be used to control noise and vibration levels on site including such measures proposed in the Environmental Statement and Supplementary Environmental Information. Such measures shall include, but are not limited to: the use of the quietest available plant, equipment and techniques; the regular maintenance and inspection of such plant and equipment; the use of cladding, attenuators and barriers to reduce noise levels from noisy plant and operations; the specification of appropriate reversing alarms to minimise annoyance; and, measures to reduce vibration and air overpressure during blasting.	Section 6
Details of the noise and vibration monitoring system to be installed around the DNF and LCP sites to continuously log noise levels during construction and operation. The system shall include at least six noise monitors installed around the boundary of the Dove’s Nest site and at least four monitors at key residential receptors near the Dove’s Nest site and at least four noise monitors around the Lady Cross Plantation Site and at least three monitors at key residential receptors near the Lady Cross Plantation site.	Section 5
The precise number and location of noise monitors shall be set out in the NVMP. The developer shall use reasonable endeavours to obtain access to	Section 5 and Figure B.1

NYMNP 18	Compliance with Condition NYMNP 18
the residential receptor properties for the installation of noise monitors and only if access cannot be obtained the number or location of noise monitors may be reduced. The MPA and the SBC EHO and/or their advisers shall be granted access to inspect the noise and vibration data whenever required, records of the data should be kept for a reasonable period and these records should be accessible by the public.	
Details of the procedure to be followed in the event that the noise predictions detailed in the NVMP or the noise limits detailed in conditions 16 to 19 are exceeded. Such procedures shall require the investigation of the reasons for the breach of the limits and the cessation of the activity causing the breach until such a time as additional mitigation can be provided.	Section 6
Details of how the residents will be informed and consulted about the site operations and progress, particularly in regard to blasting and especially noisy operations including details of complaints logging and management procedures and a 24-hour telephone incident hotline. Details of the procedure for investigating complaints and informing complainants of the results of such investigations and of any actions resulting from them.	Section 6
The NVMP shall be adhered to at all times unless agreed previously in writing by the MPA.	A document sign off section has been included within this report requiring the Contractor to commit to compliance with the NVMP
The NVMP shall be updated and agreed whenever appropriate to reflect changes in the programme during construction and operation and at intervals not less than 6 months after the initial start on site and thereafter annually.	Comment to this effect included within Section 1

1.1.3 This NVMP details only the works required for the Phase 4 Works at Woodsmith Mine. It does not include any activities at Lady Cross Plantation as these works have been deferred. The NYMNP 18 has confirmed that it supports this approach.

1.1.4 The Phase 4 Works comprise the following:

- Operation of the concrete batch plant;
- Installation, commissioning and operation of the bentonite plant and associated temporary structures;
- Installation of concrete guide walls (excavate to -3.5m and concrete wall down to -1.5m to -1.75m);
- Mobilisation to site of diaphragm walling equipment (cutters, cranes, workshops etc.);
- Diaphragm wall construction to -60m below ground level at the Production, Service and Mineral Transport System shafts; and
- Limited continuation of earthworks to create an area for future storage of spoil.

1.1.5 The following activities from the Phase 3 Scope of Works are assumed to be running concurrently with the Phase 4 Works:

- Construction of temporary and permanent soil mounds, including the basal liner for a future storage facility in the northeast corner of the site for non-hazardous non-inert spoil and three topsoil, subsoil and inert material storage bunds in the southwestern area of the site, as shown on drawings 40-ARI-WS-71-CI-DR-1053 and 40-ARI-WS-71-CI-DR-1055, with earthworks volumes presented in 40-ARI-WS-71-CI-DR-1054;

- Construction of surface water drainage, a temporary surface water attenuation pond and temporary wetland in the southern area and two permanent attenuation ponds and two wetland areas in the north eastern area, as shown on Drawing 40-ARI-WS-71-CI-DR-1050;
- Construction of a spring and groundwater drainage layer in the north eastern area, discharging into a wetland area, as shown in drawing 40-ARI-WS-71-CI-DR-1080;
- Construction of the drilling platform and temporary saline lagoon area for the groundwater reinjection well as shown in drawing 40-ARI-WS-71-CI-DR-1057; and
- Establishment of construction welfare and security facilities - complete with hook-up of power, communications & water supplies and new waste water collection facilities as shown on drawing 40-ARI-WS-71-CI-DR-1050.

Planning Conditions

- 1.1.6 In addition to Condition NYMNPA 18, two further conditions relating to noise limits are relevant to this NVMP.
- 1.1.7 Conditions NYMNPA 20 and 21 relating to noise limits at the Woodsmith Mine (WS) site are reproduced below:

“Condition NYMNPA 20:

Day-time (07.00 hrs to 19.00 hrs) noise levels $L_{Aeq\ 1hr}$ from mine construction at the Dove’s Nest site, excluding blasting operations, shall not exceed 55 dB $L_{Aeq\ 1hr}$ and for short-term, construction activities solely relating to the demolition of existing buildings and erection of new structures excluding earth mound and bunds shall not exceed 65dB $L_{Aeq\ 1hr}$. An upper limit of 70 dB $L_{Aeq\ 1hr}$ for the purposes of temporary noisy operations to provide noise-reducing earth bunds and / or barriers may be permitted for up to 56 days in any calendar year provided such temporary operations are specified and agreed in the NVMP described in Condition 14 (sic¹). Each calendar day when the higher temporary noise level is exceeded shall be counted as one day. Noise levels shall be measured in accordance with BS 4142: 2014 and the limits apply at the curtilage boundary of residential properties and at the following recreational receptors: Falling Foss tea room, Lound House Camp / Caravan site, Sneaton Foss Lane Caravan site and at any location on the Wainwright Coast to Coast walk footpath as illustrated in drawing number PB1110-P2-7-002 which is Figure 7.2 of Part 2 of the York Potash Project Mine, MTS and MHF Environmental Statement dated September 2014.”

“Condition NYMNPA 21:

Evening (19.00 hrs to 22.00 hrs) and night-time (22.00 to 07.00 hrs) noise levels $L_{Aeq\ 1hr}$ from mine construction at the Dove’s Nest site, excluding blasting operations, shall not exceed 42 dB $L_{Aeq\ 1hr}$. Noise levels shall be measured in accordance with BS 4142: 2014 and the limits apply at the curtilage boundary of residential properties and at the following recreational receptors: Lound House Camp / Caravan site and Sneaton Caravan site.”

¹ The NVMP is required by Condition 18

- 1.1.8 This NVMP will be submitted to the NYMNPA for approval before the commencement of the Phase 4 Works. The approved version of this NVMP will then be implemented and adopted by the Contractor.
- 1.1.9 Updates to this plan will be prepared and submitted to the NYMNPA for approval in advance of subsequent construction phases and following any design or method change.
- 1.1.10 In reference to this document, the term ‘construction’ includes all physical and related engineering and construction activities associated with the Phase 4 Works, as described in paragraphs 1.1.4 and 1.1.5.

2 Guidance

2.1 Legislation and British Standards

2.1.1 As a minimum the Contractor will adhere to the following legislation and standards:

- Environmental Protection Act 1990;
- The Control of Pollution Act 1974 (COPA);
- BS 7445:2003 – Description and measurement of environmental noise; and
- BS 5228:2009+A1:2014 – Code of Practice for noise and vibration control on construction and open sites.

2.2 Construction Noise Limits

2.2.1 The Phase 4 Works will be undertaken during daytime hours only with the exception of the diaphragm walling process and the dewatering process.

2.2.2 Based on the conditions (NYMNPA 20 and 21) described in Section 1.1.7, the standard construction noise limits for activities to be carried out in Phase 4 were agreed as:

- 55dB $L_{Aeq,1hr}$ for daytime (07:00 – 19:00);
- 65dB $L_{Aeq,1hr}$ for the demolition of buildings and erection of new structures;
- Up to 70dB $L_{Aeq,1hr}$ for temporary noisy operations to provide noise-reducing earth bunds and / or barriers; and
- 42dB $L_{Aeq,1hr}$ for evening and night-time (19:00 – 07:00).

2.3 Construction Method

2.3.1 There is one Principal Contractor for the Phase 4 Works: Associated Mining Construction Inc. (AMC UK). There are two Principal Contractors for the concurrent Phase 3 Works: AMC UK and North Midland Construction Ltd (NMC Ltd) (‘the Contractors’). They have both provided details of the construction masterplan, number and type of plant items to be used and location/duration of construction activities within the site.

- 2.3.2 The Contractors' Method Statements (document references 40-AMC-WS-72-SW-RA-0002, 40-AMC-WS-10-SW-RA-0004, 40-AMC-WS-10-SW-RA-0006, 40-NMC-WS-70-CI-RA-0001 and 40-AMC-WS-72-SW-RA-0001) and supporting information, details the proposed construction methodology. Predictions of noise levels based upon these details were undertaken and assessed within this NVMP.
- 2.3.3 These method statements specifically relate to Works during Phase 4 and the concurrent works for Phase 3 and provide details of the locations of equipment to be used.
- 2.3.4 Appendix C details the plant items used within the model, their sound power level and location on site.

3 Predicted Construction Noise and Vibration Levels

3.1 Baseline Receptor Locations

- 3.1.1 The Environmental Statement (ES) which accompanied the planning application included (Part 2, Chapter 8, Noise and Vibration) an assessment of construction noise at the following nearby residential locations:
- Parkdown Bungalow, approximately 180m from the nearest site boundary;
 - Thornhill, approximately 467m from the nearest site boundary;
 - Moor House Farm, approximately 445m from the nearest site boundary;
 - Moorside Farm, approximately 489m from the nearest site boundary; and
 - Soulsgrave Farm, approximately 400m from the nearest site boundary.
- 3.1.2 For the purposes of this NVMP the receptors detailed above are the receptors named in Conditions 20 and 21, at which the noise limits in Conditions 20 and 21 apply, and for which predictions of construction noise were undertaken.
- 3.1.3 The following recreational receptors, also detailed within Conditions 20 and 21, were included within the construction noise calculations:
- Wainwright Coast to Coast walk footpath, approximately 500m from the nearest site boundary;
 - Lound House Farm Camp / Caravan site, approximately 750m from the nearest site boundary;
 - Falling Foss tea room, approximately 1250m from the nearest site boundary; and
 - Sneaton Foss Lane Caravan site, approximately 400m from the nearest site boundary.

3.2 Predicted Noise Levels

- 3.2.1 The COPA and BS 5228 define a set of Best Practice working methods and mitigation measures, referred to as Best Practicable Means (BPM). BPM, as detailed in Section 6 of this NVMP, will be adopted.
- 3.2.2 Tables C.1 to C.6 in Appendix C outline the results of the construction noise assessment predictions for the Phase 4 Works.

- 3.2.3 The noise modelling was undertaken to provide conservative predictions of noise levels according to site activities running concurrently throughout the Phase.
- 3.2.4 Noise levels due to construction activities in the Phase 4 Works were not predicted to exceed the agreed construction noise limits at any of the identified noise-sensitive receptors during the daytime, evening or night-time.

3.3 Vibration

- 3.3.1 Ground borne vibration assessments can be drawn from the empirical methods detailed in BS5228-2:2009+A1:2014; in the Transport and Road Research Laboratory Research Report (TRRL) 246: Traffic induced vibrations in buildings²; and within the Transport Research Laboratory (TRL) Report 429 (2000): Ground borne vibration caused by mechanical construction works³.
- 3.3.2 A series of calculations, in accordance with the empirical methods referred to above, were carried out based on typical construction activities, applying reasonable worst-case assumptions, in order to determine set-back distances at which critical vibration levels may occur. These were presented in the ES.
- 3.3.3 Table C.7, Appendix C lists the minimum set-back distances at which vibration levels of reportable significance are predicted to occur for typical construction activities that may take place on the site. A 66.6% certainty factor (i.e. an additional tolerance factor) was included in the relevant calculation methods in order to provide a conservative approach.
- 3.3.4 All identified sensitive receptors are at least 180m from the nearest site boundary, indicating that the only potential source of perceptible vibration at a sensitive receptor would be HGV movements.
- 3.3.5 The main haul route through the mine site is shown on Drawing 40-ARI-WS-71-CI-DR-1050, Woodsmith Mine Site Construction Phase 4 General Arrangement. The minimum distance between the primary haul route and any of the surrounding receptors is over 400m.
- 3.3.6 Ground-borne vibration levels will be significantly lower than 0.3mm/s at all nearby sensitive receptors, i.e. below levels which are considered to be 'just about perceptible in residential environments'⁴.

² Watts, GR (1990). Traffic induced vibrations in building. Department for Transport, Transport and Road Research Laboratory Research Report (TRRL), Research Report 246.

³ Hillier. DM and Crabb GI, (2000). Ground borne vibrations caused by mechanised construction works. Highways Agency, Transport Research Laboratory, TRL report 429.

⁴ Planning Policy Guidance Note 24 (PPG24, 1994), Department for Communities and Local Government

4 Noise and Vibration Monitoring Programme

4.1 Vibration Monitoring

4.1.1 As detailed within Section 3.3 of this NVMP, construction activities during Phase 4 will not give rise to significant levels of vibration at nearby sensitive receptors. Vibration monitoring is therefore not proposed during this phase. This approach has been agreed with the Scarborough Borough Council (SBC)⁵ Environmental Health Officer (EHO) and the NYMNPA⁶.

4.2 Noise Monitoring

4.2.1 Condition NYMNPA 18 specifies that continuous noise monitoring is undertaken during construction and operation at four key residential receptor locations near the Woodsmith mine site and at least six boundary locations around the Woodsmith mine site. The four key residential receptor monitoring locations are:

- NM1 – Parkdown Bungalow;
- NM2 – Thornhill;
- NM3 – Moorhouse Farm/Moorside Farm; and
- NM4 – Soulsgrave Farm.

4.2.2 During consultation with the property owners at each of these locations, it was advised that the occupier of Soulsgrave Farm had not agreed to the installation of monitoring equipment at their property. Therefore an additional monitoring location within the site boundary between the main shaft sinking area and the boundary monitoring location nearest to Soulsgrave Farm has been included.

4.2.3 The seven boundary and on-site monitoring locations will be at points in line with the four key residential receptor locations and the additional recreational receptors identified in the condition. These locations are summarised below:

- BML1 – Site boundary at closest point to Parkdown Bungalow;
- BML2 – Site boundary at closest point to Thornhill;
- BML3 – Site boundary at closest point to Moorhouse Farm/Moorside Farm;
- BML4 – Site boundary at closest point to Soulsgrave Farm/Wainwright Coast to Coast Walk;
- BML5 – Site boundary at closest point to Lound House Farm Camp / Caravan Site;
- BML6 – Site boundary at closest point to Sneaton Foss Caravan Site / Falling Foss tea room; and
- BML7 – Between BML4 and the main shaft sinking area.

4.2.4 The residential and boundary noise monitoring locations are presented in Appendix B, Figure B1.

⁵ Meeting held on 1st December 2016 with Graham Middleton and Julie Pierson (SBC) and meeting held on 17th March 2016 with Graham Middleton, minutes CRM-0293_H3_AF_SBC meeting 2016 03 17

⁶ Meeting held on 27th April 2016 with Mark Hill, Rona Charles and Chris France of NYMNPA

- 4.2.5 The redline boundary shown on Figure B1 is the land ownership boundary. The boundary monitoring equipment is located in proximity to the perimeter fence, in appropriate free-field conditions (see below).
- 4.2.6 Continuous noise monitoring is being undertaken at each location, having commenced on 4 April 2017. The noise measurements are conducted in accordance with the guidance contained in BS 7445:2003 parts 1 and 2.
- 4.2.7 The sound level meters are fully calibrated, traceable to United Kingdom Accreditation Service (UKAS) standards and satisfy the requirements of BS EN 61672-1: 2013⁷ for a 'Class 1' Sound Level Meter (SLM).
- 4.2.8 The SLMs record L_{Aeq} , L_{Amax} , L_{A90} , and L_{A10} data with a 'fast' time constant and A-weighting. Appendix A presents descriptions of these terms.
- 4.2.9 The noise measurements are being conducted in accordance with BS 7445 with the SLM microphone mounted on a tripod or secured mounting pole at 1.5m above ground level and 3.5m away from any reflecting surface other than the ground. The instruments were calibrated before the survey using a portable field calibrator, and will be at monthly intervals during the monitoring period, and before and after any battery change. No deviation in the calibration level has been noted at the time of release of this report. Any future deviations in the calibration level will be noted and reported within the summary reports.
- 4.2.10 The SLMs operate using a system of real time alerting which allows remote monitoring of noise levels and indication of noise levels approaching and/or breaching the limits. Alerts are managed by the Contractors who, following an investigation as to the cause of any alert (assisted by live audio observations provided by the monitoring equipment located at the boundary), will report the alert to SBC and the NYMNPA as necessary. To date, no such reportable alerts have been recorded.
- 4.2.11 The SLMs are inspected during each field calibration and maintenance visit and any faults will be identified and rectified during the visits. Should faults require off-site repair a replacement SLM will be installed during the repair period.
- 4.2.12 Monitoring of weather conditions including wind speed and direction, rainfall, temperature and humidity is being carried out simultaneously at the Woodsmith mine site.
- 4.2.13 Reports will be provided monthly to SBC and NYMNPA. The report will contain details of the type and system of sound level meters used and a summary of the measured noise data at each location with corresponding weather data and survey notes. The full dataset will be presented in an appendix to the report in tabular and graphical format.

⁷ British Standards Institution (2013). BS EN 61672-1:2013 Electroacoustics. Sound level meters. Specifications. BSI, London

5 Mitigation and Procedures

5.1 Purpose of this Section

5.1.1 This section outlines measures to be taken by the Contractors to limit, and manage the impact of, noise. This section also outlines the Best Practicable Means and specific mitigation actions to be adopted.

5.2 Best Practice Measures

5.2.1 The COPA and BS 5228:2009+A1:2014 define a set of Best Practice working methods and mitigation measures, referred to as Best Practicable Means (BPM). The following measures will be adopted:

- Weekly construction meetings will take place to discuss the minimisation of noise emanating from the site, the potential for noise reduction for any upcoming activities and to identify any potential concurrent activities which may lead to noise levels requiring the upper limit of 70 dB $L_{Aeq,1hr}$. Occasions requiring these upper limits will be reported to the NYMNP and SBC prior to the activities occurring and will be included within the regular communication to residents detailed within **Section 5.4**;
- locating temporary plant so that it is screened from receptors by on-site structures, such as site cabins;
- where practicable, not undertaking noisy activities concurrently in close proximity to residential receptors;
- using modern, quiet equipment and ensuring such equipment is properly maintained (see **Section 5.2.8** below) and operated by trained staff (see **Section 5.2.10** below);
- applying enclosures to particularly noisy equipment where possible – during Phase 4 the following items of plant requiring enclosures/screens have been identified;
 - Batch plant and bentonite plant generators
- ensuring that mobile plant is well maintained such that loose body fittings or exhausts do not rattle or vibrate;
- ensuring plant machinery is turned off when not in use;
- undertaking daily, pre-start inspections of plant and machinery;
- providing local residents with 24-hour contact details for a site representative in the event that disturbance due to noise from the construction works is perceived, this number to be displayed at the site entrances (see **Section 5.4.7**); and
- informing local residents about the construction works, including the timing and duration of any particularly noisy elements (see **Section 5.4.8**).

Management Structure and Responsibilities

5.2.2 While overall responsibility for compliance with environmental and approvals requirements will remain with Sirius Minerals, all Contractors working on site are accountable for undertaking the construction activities in line with the requirements of this NVMP.

5.2.3 The organograms in Figure 5.1 (reproduced from Section 2.0 of the CEMP for Phase 4 and Phase 3) show the lines of responsibility for environmental management during the Phase 4 Works and the concurrent Phase 3 Works.

Figure 5-1 Structure of the Environmental Team (Phase 4 Works)

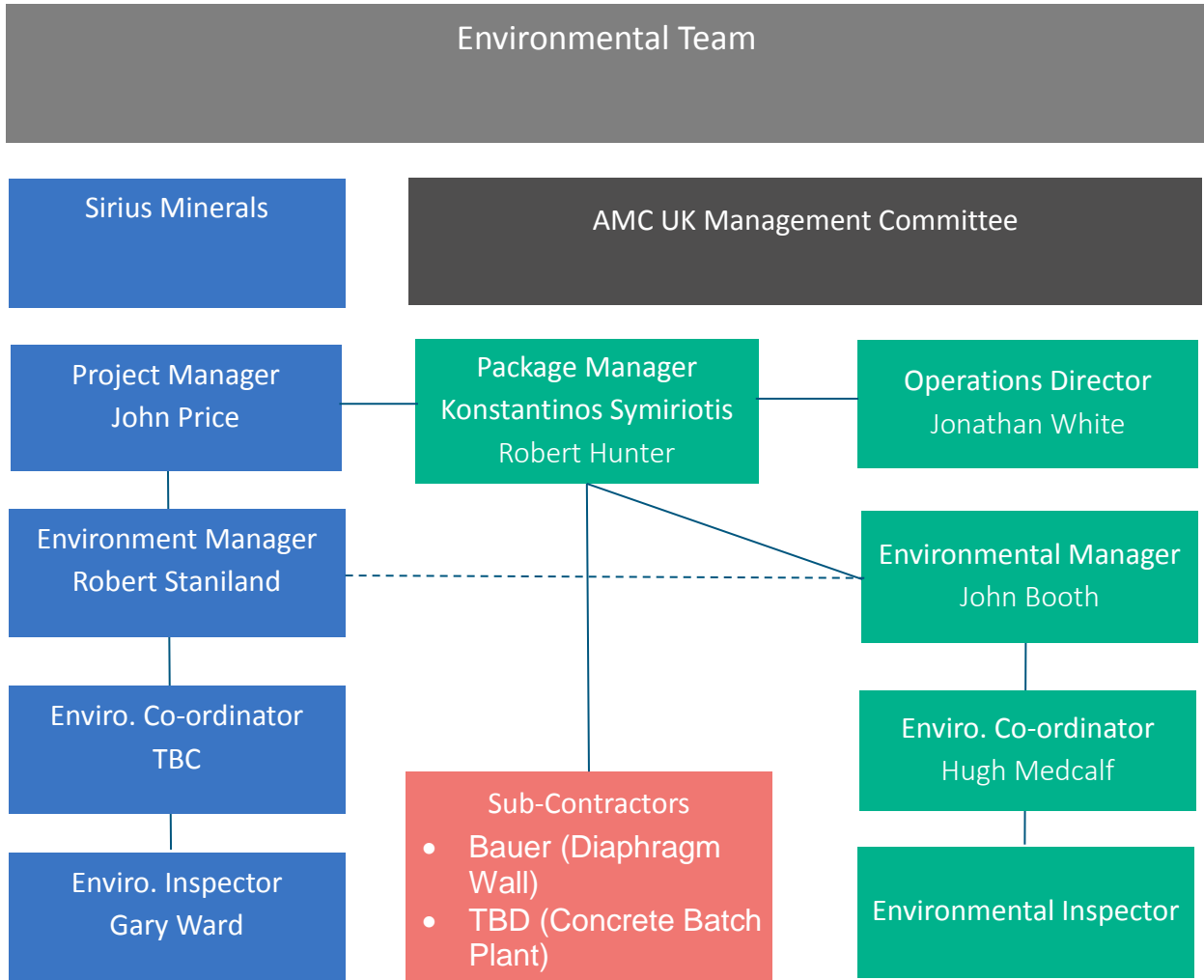
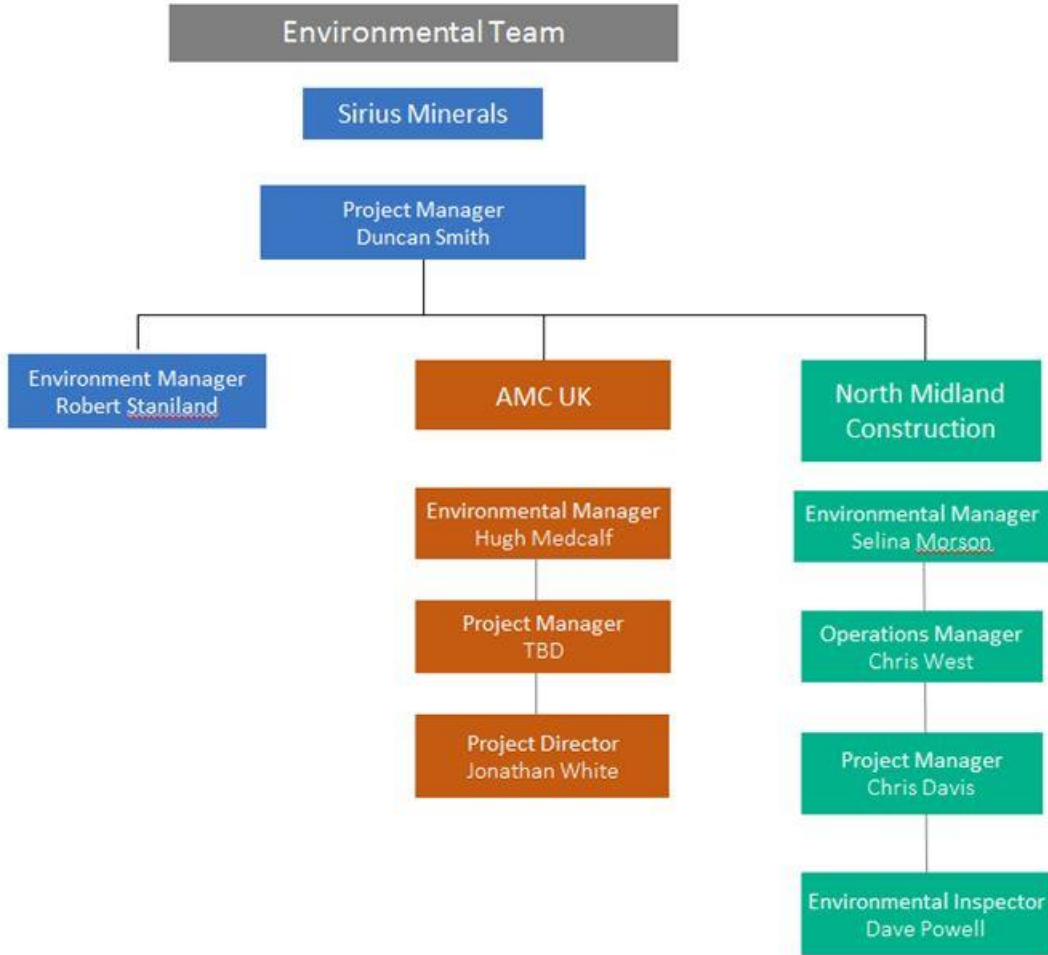


Figure 5-2 Structure of the Environmental Team (Phase 3 concurrent Works)



- 5.2.4 The Environmental Manager/Project Manager (or deputy) for each Contractor will be on site during working hours and will be responsible for robust implementation of noise management and mitigation measures.
- 5.2.5 The Operations Director/Project Manager (or deputy) for each Contractor is responsible for implementation of the appropriate Environmental Policy and the Construction Environmental Management Plan (CEMP) through:
- compliance with contractual requirements regarding environmental matters;
 - adherence to the NVMP and associated control measures;
 - designated responsibility for environmental control during the works;
 - regular meetings with project team members to review environmental matters;
 - regular reporting to the employer on environmental matters;
 - ensuring adequate resources are made available.
 - managing and advising on environmental matters affecting the Project with the assistance of the Employer's Environment Manager, the Contractor's Environmental Manager and Environmental Inspector;
 - reporting to the Employer's Environment Manager on implementation of the NVMP;
 - carrying out regular internal audits and procedure review on environmental matters;
 - reviewing and mitigating all environmental impacts identified in submitted method statements;
 - recording and maintaining all environmental matters/incidents in accordance with reporting procedures; and
 - ensuring all team members work in accordance with the NVMP.
- 5.2.6 The Operations Director/Environmental Manager/Project Manager for the two contractors, and their appointed subcontractors, engaged for the Phase 4 Works will, with the Employer's Environment Manager acting as coordinator, liaise to ensure regular review of environmental matters and appropriate assignment of responsibilities for Contractors' specific site activities.

Maintenance

- 5.2.7 Maintenance of plant will be carried out routinely and in accordance with the manufacturers' guidance.
- 5.2.8 A daily safety inspection of all plant and equipment will be undertaken to ensure that, as a minimum:
- all plant is in a good state of repair and fully functional;
 - any plant found to be requiring interim maintenance has been identified and taken out of use;
 - acoustic enclosures fitted to plant are in a good state of repair;
 - doors and covers remain closed during operation (self-closing doors/covers are recommended); and
 - any repairs are being undertaken by a fully qualified maintenance engineer.

Training

- 5.2.9 The site induction programme and site rules will include good working practice instructions for site staff, managers, visitors and contractors to help minimise noise whilst working on the site.

5.2.10 Good working practice guidelines/instructions will include, but not be limited to, the following points:

- avoid unnecessary revving of engines;
- plant used intermittently will be shut-down between operational periods, where possible;
- avoid reversing wherever possible;
- contractors to be advised that reversing alarms on mobile equipment must be specified as low/white noise where safety requirements allow;
- report any defective equipment/plant as soon as possible so that corrective maintenance can be undertaken; and
- handle material in a manner that minimises noise.

5.3 Specific Mitigation

Bunds

5.3.1 The temporary storage bunds in the southwest of the site will be constructed by first pushing the top soil to the outer perimeter of the bund to form a temporary bund. This will provide screening between the residential receptor and the continuing formation of the main bunds.

5.3.2 As the internal structure of the bund is built up in sections, the outer topsoil bund will be 'pulled' back over the bund for final restoration. This procedure will be repeated with sub-soils forming the temporary bunds, until the full bund is completed with top-soil claimed from other areas of the site, loose-laid over the bund area.

5.3.3 This process ensures that the majority of the more noisy plant associated with constructing the bunds, i.e. the bulldozers and compactors, benefit from some degree of visual and acoustic screening. Only the initial deposits and final restoration works which do not require compaction will take place on the top and outer faces of the bunds.

5.3.4 Where dumper trucks move from the main haul routes, across earth bunds and up to the position in which they deposit spoil loads, they will do so without driving directly over a bund at more than a 1:10 slope angle. Where bund sides are steeper than this, movements shall either navigate around bund edges or the bunds will be formed to include a 'cutting' through which dumper trucks can pass at an appropriate incline.

5.3.5 The bunds/temporary storage areas to the northeast of the platform are currently shown as having a wide gap between them to allow vehicle access/egress off the platform. This gap is to be closed by extension of the north-eastern bund leaving a smaller gap for vehicle access. The bund is to be at its maximum permitted height of 7m above ground level along its length prior to the commencement of diaphragm walling activities.

Activity timing, barriers, screens and enclosures

5.3.6 At Parkdown Bungalow the predicted noise level is, on occasion, close to the agreed limit during daytime activities. The predictions assumed a conservative case whereby the construction of the basal liner for the temporary storage area, creation of bunds and excavation of the attenuation ponds in the north east of the site were undertaken concurrently.

- 5.3.7 As a precautionary approach these works will be considered to require the application of the upper limit of 70 dB $L_{Aeq,1hr}$ detailed within Condition NYMNPA 20 for those periods when works to create earth bunds are undertaken concurrently with construction of the basal liner for the temporary storage area and excavation of the attenuation ponds. Such activities are to be carried out during daytime hours only. However these works will not be undertaken together unless absolutely necessary to maintain the construction programme but not to extend the duration of the Works.
- 5.3.8 Evening and night-time diaphragm walling activities will be restricted to the use of either one diaphragm wall cutter on the Service Shaft or two diaphragm wall cutters on the Production Shaft (the MC96, lower noise model) with associated bentonite plant equipment. No concreting, batch plant or crane operations will be carried out during evening or night-time.
- 5.3.9 The batch plant and bentonite plant generators will be enclosed/screened using temporary or semi-permanent acoustic screens.
- 5.3.10 The Contractor has confirmed diaphragm walling rigs will be treated with additional soundproofing and/or operate under reduced power in order to provide a reduction in the source noise.
- 5.3.11 Fixed, close boarded 3m high timber screens will be installed along the western flank of the Site boundary as shown on drawing 40-ARI-WS-71-CI-DR-1056.
- 5.3.12 Where applicable, any enclosures, temporary screens or barriers (including, for example, the use of straw bales) will possess adequate insulation such that sound energy does not readily pass through them.

5.4 Communications

Procedure for complaints or breach of limits

- 5.4.1 If the noise limits are exceeded as a result of the works, or a complaint is received from a local resident, an investigation will be instigated by the Operations Manager/Project Manager for the two appointed Contractors as soon as possible, consistent with safe operational practices and, as a minimum, within one working day, to identify the cause of the non-compliance or complaint.
- 5.4.2 Such an investigation may involve the identification and cessation of the activity or activities considered to be the cause of the non-compliance/complaint (where operationally safe to do so) and/or the investigation of mitigation measures to reduce the noise emission levels from the activity or activities. For example, the replacement of noisy plant with quieter alternatives and/or the use of temporary screens.
- 5.4.3 Any recommended deviation from agreed working practices will be identified immediately and conformance to the working practice reinstated.
- 5.4.4 A complaints response system will be maintained for the site enabling any complaints regarding noise to be reported and appropriate action taken.

5.4.5 The complainant will receive acknowledgement of their complaint from the Contractor Operations Manager/Project Manager within 24 hours of receipt of the complaint. An update as to the progress of the investigation and details of any remedial actions proposed or taken will be provided to the complainant by the Contractor/Project Manager every five working days until the resolution of the complaint.

Public relations

5.4.6 Good public relations with local residents in nearby noise-sensitive receptors will be maintained.

5.4.7 A Community and Stakeholder Engagement Plan is provided in Appendix 4 to the **Phase 3 CEMP** (40-RHD-WS-70-EN-PL-0014), which remains valid for Phase 4 Works, and details actions to be taken by Sirius Minerals plc and the Contractors. The main actions specified within this Plan are summarised below:

Table 5-1 CSEF Actions

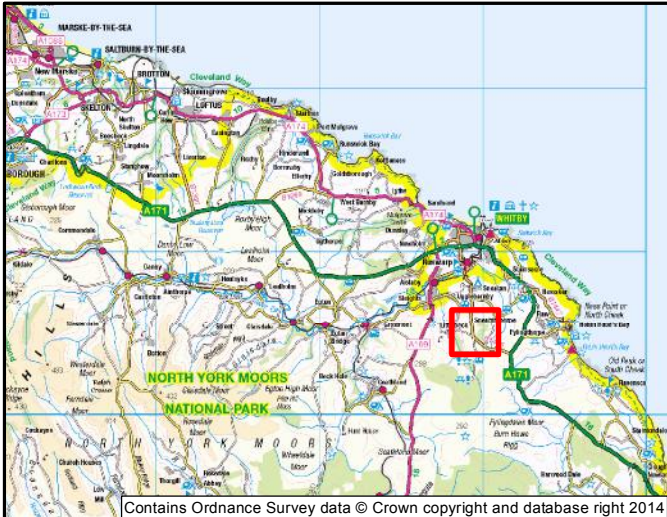
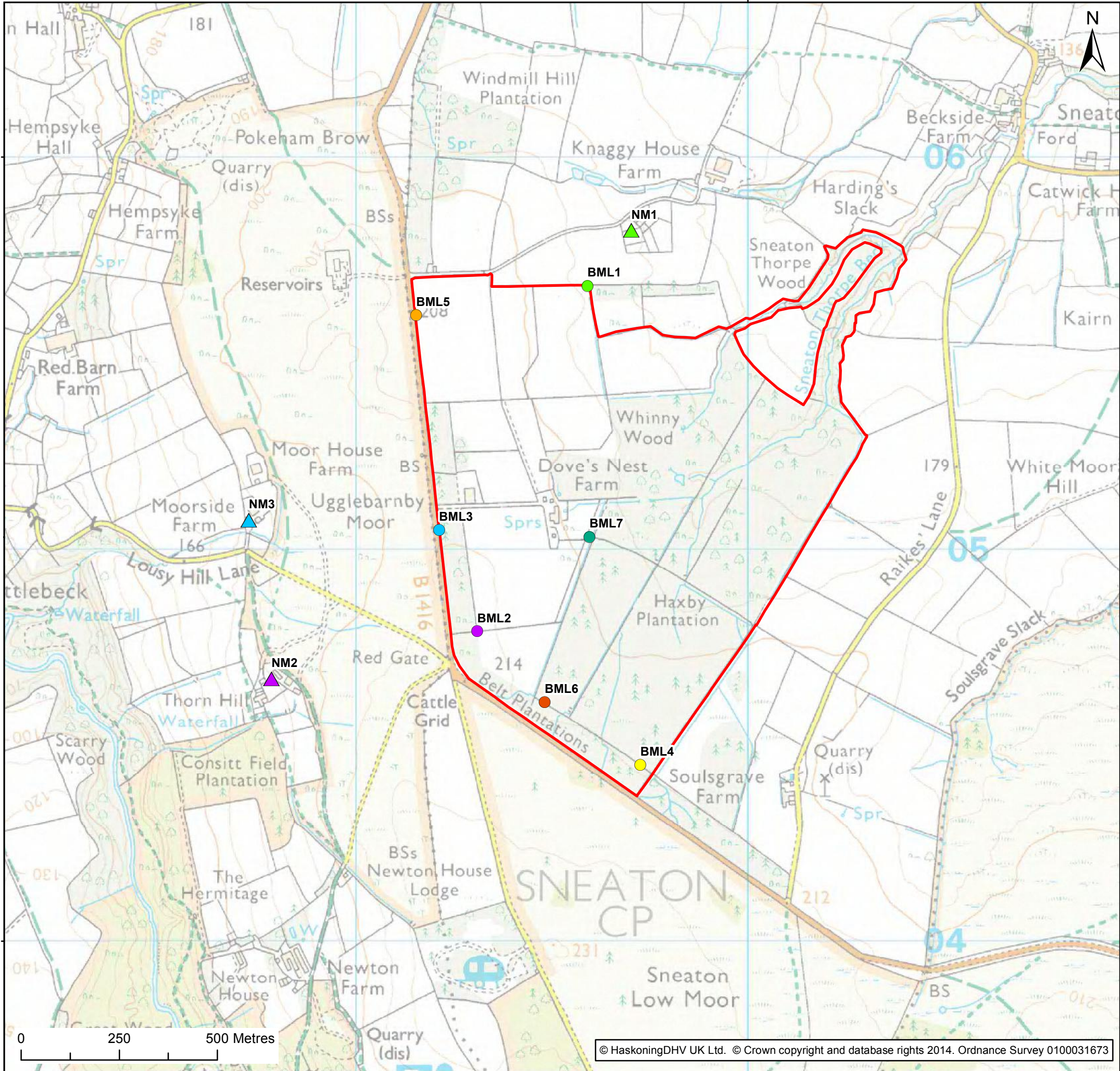
	Pre-briefing activities	Ongoing management
Sirius Minerals plc	<ul style="list-style-type: none"> Establish Liaison Group Forum and Traffic Management Liaison Group Project update newsletter Media, website update, social media Briefings with site neighbours, landowners, community representatives and other key stakeholders as identified Produce leaflet detailing upcoming construction activities Send letters to stakeholders likely to be immediately affected Hold public open days / exhibitions 	<ul style="list-style-type: none"> Chair Liaison Group Forum and Traffic Management Liaison Group Manage 24-hour community helpline and Attend parish and town council meetings quarterly Regular updates to site neighbours, landowners, community representatives and interest groups Media, website update, social media Manage complaints procedure
Construction contractors	<ul style="list-style-type: none"> Install information board and signage at construction sites / transport routes Provide information to Sirius Minerals to be used in leaflets, letters, web content, etc., as required Attend public open days/exhibitions and meetings with stakeholders as required 	<ul style="list-style-type: none"> Attend liaison groups, parish council and other meetings as required Provide information to support on-going community and stakeholder relations Participate in media events as required Adherence to complaints procedure, media protocol and crisis response procedure

5.4.8 A display board (i.e. a site information board) will be erected at the entrance to the Woodsmith Mine site to keep local residents and stakeholders informed of the Works and their schedule. The site information board will identify key personnel, contact addresses and telephone numbers, as well as showing visually the progress of Works. These signs will be erected two weeks before the commencement of Phase 4 and will remain in situ until all of the Phase 4 Works are completed.

Appendix A Acoustic Terminology

Term	Definition
Noise sensitive receptors	People, property or designated sites for nature conservation that may be at risk from exposure to noise and vibration that could potentially arise as a result of the proposed development/project
Noise and Vibration study area	The area assessed for noise and vibration impacts during this assessment
Baseline scenario	Scenarios with the proposed development/project not in operation
Decibel (dB)	A unit of noise level derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure level the reference quantity is 20 μ Pa, the threshold of normal hearing is 0dB, and 140dB is the threshold of pain. A change of 1dB is only perceptible under controlled conditions. Under normal conditions a change in noise level of 3dB(A) is the smallest perceptible change.
dB(A)	Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise level in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).
$L_{Aeq,T}$	The equivalent continuous sound level – the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (T). $L_{Aeq,T}$ is used to describe many types of noise and can be measured directly with an integrating sound level meter.
$L_{A10,T}$	The A weighted noise level exceeded for 10% of the specified measurement period (T). L_{A10} is the index generally adopted to assess traffic noise
$L_{A90,T}$	The A weighted noise level exceeded for 90% of the specified measurement period (T). In BS 4142:2014 it is used to define the 'background' noise level.
L_{Amax}	The maximum A-weighted sound pressure level recorded during a measurement.
PPV	Instantaneous maximum velocity reached by a vibrating element as it oscillates about its rest position.
'A' weighting	A frequency weighting to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Fast time constant	Sound level meters have two conventional time weightings, F = Fast and S = Slow with time constants of 125 ms and 1000 ms respectively. Fast time constant relates to the response time of the meter which allows rapid variations in noise level to be registered.

Appendix B Figures



- Legend:
- Land Ownership Boundary
 - Receptor Monitoring Locations**
 - ▲ NM1 - Parkdown Bungalow
 - ▲ NM2 - Thornhill
 - ▲ NM3 - Moorside Farm
 - Site Boundary Monitoring Locations**
 - BML1 - Parkdown Bungalow
 - BML2 - Thornhill
 - BML3 - Moorside Farm
 - BML4 - Soulsgrave Farm/Wainwright Coast to Coast Walk
 - BML5 - Lound House
 - BML6 - Sneaton Foss/Falling Foss
 - BML7 - Between shaft sinking area and BML4

Client:	Project:
Sirius Minerals plc	Sirius North Yorkshire Polyhalite Project

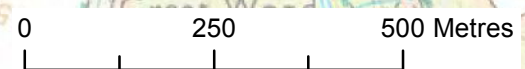
Title: Proposed Residential Receptor and Boundary Noise Monitoring Locations

Appendix: B	Figure: B.1	Drawing No: 40-RHD-WS-70-EN-PL-0016-D001
Rev: A	Date: 23/05/2017	Drawn: GC
	Checked: AB	Size: A3
		Scale: 1:10,000

Co-ordinate system: British National Grid

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Appendix C Predicted Construction and Demolition Noise and Vibration Levels

The predicted noise levels detailed within the Tables below are considered to represent the most conservative scenario and are based on all Works being undertaken concurrently during Phase 4.

Table C.1 Calculated noise levels – Phase 4 Installation of Bentonite Plant (and concurrent Phase 3 Works) Daytime

Receptor Location	Daytime (07:00–19:00)	
	Limit $L_{Aeq,1hr}$ dB	Maximum $L_{Aeq,1hr}$ dB
Parkdown Bungalow	55	52.4
Moor House Farm	55	48.4
Moorside Farm	55	47.0
Thornhill	55	47.1
Soulsgrave	55	47.2
Wainwright Coast to Coast Path	55	45.2
Sneaton Foss Caravan Park	55	47.3
Falling Foss Tearooms	55	26.0
Lound House Caravan Park	55	41.4

Table C.2 Calculated Noise Levels Phase 4 Installation of Bentonite Plant (and concurrent Phase 3 Works) Evening and Night-time

Receptor Location	Evening and Night-time (19:00–07:00)	
	Limit $L_{Aeq,1hr}$ dB	Maximum $L_{Aeq,1hr}$ dB
Parkdown Bungalow	42	35.5

Receptor Location	Evening and Night-time (19:00–07:00)	
	Limit $L_{Aeq,1hr}$ dB	Maximum $L_{Aeq,1hr}$ dB
Moor House Farm	42	32.3
Moorside Farm	42	30.2
Thornhill	42	31.7
Soulsgrave	42	30.8
Wainwright Coast to Coast Path	42	29.1
Sneaton Foss Caravan Park	42	30.5
Falling Foss Tearooms	42	11.8
Lound House Caravan Park	42	29.4

Table C.3 Calculated noise levels – Phase 4 Service Shaft Diaphragm Walling (and concurrent Phase 3 Works) Daytime

Receptor Location	Daytime (07:00–19:00)	
	Limit $L_{Aeq,1hr}$ dB	Maximum $L_{Aeq,1hr}$ dB
Parkdown Bungalow	55	52.8
Moor House Farm	55	50.1
Moorside Farm	55	48.4
Thornhill	55	48.4
Soulsgrave	55	48.5
Wainwright Coast to Coast Path	55	46.5

Receptor Location	Daytime (07:00–19:00)	
	Limit $L_{Aeq,1hr}$ dB	Maximum $L_{Aeq,1hr}$ dB
Sneaton Foss Caravan Park	55	48.5
Falling Foss Tearooms	55	27.8
Lound House Caravan Park	55	42.9

Table C.4 Calculated Noise Levels Phase 4 Service Shaft Diaphragm Walling (and concurrent Phase 3 Works) Evening and Night-time

Receptor Location	Evening and Night-time (19:00–07:00)	
	Limit $L_{Aeq,1hr}$ dB	Maximum $L_{Aeq,1hr}$ dB
Parkdown Bungalow	42	39.6
Moor House Farm	42	39.4
Moorside Farm	42	37.3
Thornhill	42	38.3
Soulsgrave	42	37.1
Wainwright Coast to Coast Path	42	35.2
Sneaton Foss Caravan Park	42	36.6
Falling Foss Tearooms	42	18.6
Lound House Caravan Park	42	34.6

Table C.5 Calculated noise levels – Phase 4 Production and MTS Shaft Diaphragm Walling (and concurrent Phase 3 Works) Daytime

Receptor Location	Daytime (07:00–19:00)	
	Limit $L_{Aeq,1hr}$ dB	Maximum $L_{Aeq,1hr}$ dB
Parkdown Bungalow	55	52.6
Moor House Farm	55	49.1
Moorside Farm	55	47.7
Thornhill	55	47.8
Soulsgrave	55	48.3
Wainwright Coast to Coast Path	55	46.3
Sneaton Foss Caravan Park	55	48.2
Falling Foss Tearooms	55	27.5
Lound House Caravan Park	55	43.5

Table C.6 Calculated Noise Levels Phase 4 Production and MTS Shaft Diaphragm Walling (and concurrent Phase 3 Works) Evening and Night-time

Receptor Location	Evening and Night-time (19:00–07:00)	
	Limit $L_{Aeq,1hr}$ dB	Maximum $L_{Aeq,1hr}$ dB
Parkdown Bungalow	42	40.5
Moor House Farm	42	40.4
Moorside Farm	42	38.4
Thornhill	42	39.6

Receptor Location	Evening and Night-time (19:00–07:00)	
	Limit $L_{Aeq,1hr}$ dB	Maximum $L_{Aeq,1hr}$ dB
Soulsgrave	42	38.7
Wainwright Coast to Coast Path	42	37.0
Sneaton Foss Caravan Park	42	37.5
Falling Foss Tearooms	42	20.0
Lound House Caravan Park	42	36.6

Modelling Assumptions

The following equipment and associated sound power levels were used within the CadnaA noise models:

General site equipment

2x Excavators 20T - 103dB(A) CAT 320 or similar
 13 x Excavators 30T - 103dB(A) CAT 320 or similar
 2 x Dozers D6 - 109dB(A)
 2 x Wheeled dumpers 9T - 109dB(A)
 6 x Wheeled dumpers 30T Volvo A30D or similar - 109dB(A)
 4 x Tractors - 107dB(A)
 2 x bowsers 6000 litre towable – effectively silent as not motorised (will be towed)
 3 x Single-drum Rollers 30T - 108dB(A)
 Delivery lorries 20T / 28T - 108dB(A) up to 10 per hour during daytime hours only
 Production shaft drill rig, 109dB(A) source measured on site, 100% ontime day and night (under separate permission to Phase 4 works, included as will run concurrently with installation of bentonite plant and diaphragm walling on the service shaft)

Plant foundations construction equipment

Mobile elevated working platforms – 3no (95dB(A) source BS5228 C4.57) 50% ontime
 73t Mobile Crane, 2no, 104dB(A) 100% ontime
 Front end loader (CAT 966M), 109dB(A) source Manufacturer, 100% ontime
 Telescopic boom lift (JLG 600S), 104dB(A) source Manufacturer, 100% ontime
 8m³ Concrete trucks discharging, 106dB(A) source BS5228, 25% ontime
 Excavator (CAT 316F L), 102dB(A) source Manufacturer, 100% ontime
 Telehandler (CAT TL1255C, no noise data therefore assumed as telescopic boom lift above) on time 100%

Dewatering

1no flush circulation pump (Selwood H80 Super Silent), 96dB(A), 100% ontime daytime
 1no flush suction pump (Selwood S150 Super Silent), 92dB(A), 100% ontime
 Compressor, 97dB(A), source Manufacturer, 100% ontime daytime
 2no. generators (see Generators section below)

Diaphragm Walling

1no MC128 Diaphragm Walling Rig, 117dB(A) (reduced to 115dB(A) through reduced power operation/soundproofing), 100% ontime daytime
 2no MC96 Diaphragm Walling Rigs, 115dB(A) (reduced to 113dB(A) through reduced power operation/soundproofing), 100% ontime daytime, 1no rig 100% ontime day, evening and night (on Service Shaft followed by Production Shaft)
 Crawler crane, 2no 90t Kobelco CKE900G or similar, 110dB(A)
 Crawler crane, 2no 160t Liebherr LR1160 or similar, 105dB(A)
 Mobile crane, 110t Liebherr LTM 1100 or similar, 110dB(A)

Guide wall installation

360 Degree Excavator (CAT 320) 103dB(A) 100% ontime, daytime
 Petrol / Electrical Powered Poker 110dB(A) 25% ontime
 110V Stihl Saw 115dB(A) 12% ontime
 110V Drill 115dB(A) 25% ontime
 Petrol Disc Cutter 115dB(A) 12% ontime
 Plate Compactor 110dB(A) 25% ontime

Generators

12no 50kVA, Platform area – 90.2dB(A) assumed as Hyundai DHY22KSE or similar, source Manufacturer, daytime only, 20% on time
 1no 10kVA, Security Facilities (gate) – 97dB(A) source xxx 100% ontime, daytime only
 1no 20kVA, Security Facilities (cabin) – 93dB(A) source xxx 100% ontime day, evening and night
 1no 20kVA, Wheel washer – 93dB(A), daytime only 20% on time
 1no 50kVA, Water supply pumps – 90.2dB(A) assumed as Hyundai DHY22KSE or similar, source Manufacturer, daytime, evening and night, 70% on time
 1no 350kVA, Batch plant welfare – 95dB(A) calculated from SPL of 72dB@7m Inmesol II-385, source Manufacturer, , 100% on time daytime only
 3no 1MVA, Batch/bentonite plant generator, Frerk, 103.3dB(A) calculated from SPL of 85dB@1m and 80dB@7m

Mobile equipment was modelled as a moving point line source with speeds of between 5 and 20kph. Stationery plant was modelled as a point source.

Noise propagation was calculated using the BS5228:2009+A1:2014 methodology.

Table C.7 Predicted Distances at which Specific Vibration Levels Occur

Activity	Set-back Distance at which Vibration Level (PPV) occurs			
	0.3 mm/s	1.0 mm/s	10 mm/s	15 mm/s
Vibratory Compaction (Start-up)	166m*	65m	9m	6m
Vibratory Compaction (Steady State)	102m	44m	8m	6m
Vibratory Piling (Start-up)	154m*	56m	8m	6m
Vibratory Piling (Steady State)	75m	32m	6m	5m
Tunnelling	137m*	54m	9m*	7m*
HGV Movement on uneven Haul Route	277m	60m	3m	2m

Note These predicted distances are outside the limitations of the calculations and are therefore provided for information only.*



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