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Planning Partnership

APPENDIX 9

(Noise Impact Assessment - Acoustic Associates Sussex Ltd)

Chartered Building Consultancy

Acoustic Associates

Client:	**Matthews (Sussex) Limited**
Site Address:	**Knepp Castle Estate**
Description:	**Noise Impact Assessment of Revisions to Previous Scheme**

Providing Better Living, Working & Learning Environments

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Contents

Acoustic Associates

Tables and Figures

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Issue 1	18/05/2019	Original Issue
Issue 2	04/12/2019	Revisions to include proposed scheme

Noise Impact Assessment

Town and Country Planning (Environmental Impact Assessment) Regulations 2017

1 Introduction

This chapter of the Environmental Statement (ES) presents and assesses the potential noise impacts of the ongoing works at Knepp Castle Estate (KCE), to carry out continued re-profiling and landscaping enhancement works. Landscaping works have received historic approval by West Sussex County Council (WSCC/029/18/SP dated 4th October 2018 and consents prior to this) to construct bunds at the Eastern site boundary which run North to South reducing the intrusion of road traffic noise from the A24 onto the Knepp Castle Estate.

Whilst the majority of the site works have been completed, recent amendments to the permitted planning consent have been incorporated into the scheme which impact the site profiling, requiring additional works and additional inert materials to be imported to site. The additional features are as follows:

- An amphitheatre style landform at the Northern end of the site,
- A permanent vehicle access to serve occupants of the KCE and which will subsequently close two direct access points onto the A24,
- The creation of a new car park and public right of way are proposed

The above works will amend and complement the previously approved planning consent with an amended application which reads as follows:

"*Construction of landscape enhancement features using imported inert materials, together with the provision of public access and amenity; comprising revised landform and details to WSCC/029/18/SP"*

Under the revised proposal, there remains an additional 250,000m^3 of materials to be imported to complete the construction works, as well as the 28,000m^3 still to be imported under the extant consent.

Given the size of the development and the volume of materials being imported onto the site, the revisions to the approved planning consent, fall into Schedule 2 of the EIA Regulations.

Accordingly, this noise impact assessment assesses the impact to existing site residents (on and off site) of the above processes and the additional materials being imported onto the site.

2 Applicable National Standards and Legislation

Assessment methodology, and the prediction of impact will follow the principles detailed within the following international/national standards and guidance documents:

- ISO9613 (1996) Attenuation of sound during propagation outdoors
- BS7445 (2003) Description and measurement of environmental noise. Guide to quantities and procedures
- BS5228-1 (2009+A1:2014) : Code of practice for noise and vibration control on construction and open sites –Part 1: Noise
- BS8233 (2014) - Guidance on sound insulation and noise reduction for buildings
- World Health Organisation (WHO) Guidelines for Community Noise (1999)
- Minerals Policy Statement 2 (MPS2): Controlling and Mitigating the Environmental Effects of Minerals extractions in England (2005)
- IEMA Guidelines for Environmental Noise Impact Assessment (Nov 2014)
- Design Manual for Roads and Bridges (DMRB), LA111, (November 2010)

2.1 ISO 9613 (1996) Attenuation of sound during propagation outdoors

The international standard ISO 9613 'Attenuation of sound during propagation outdoors' provides a general method of calculation of environmental noise levels at a distance from a variety of sources. The method predicts the equivalent continuous A-weighted sound pressure level under meteorological conditions favourable to propagation from sources of known sound emission. The method consists of octave band algorithms (with nominal mid band frequencies from 63Hz to 8kHz) for calculating the attenuation of sound that originates from a group of point sources. The physical effect of geometrical divergence, atmospheric absorption, ground effect attenuation, reflection from surfaces, and screening by obstacles are allowed for. The method is applicable to most situations concerning road or rail traffic, industrial noise sources, construction activities and many other ground-based noise sources.

2.2 BS7445:2003 Description and measurement of environmental noise. Guide to quantities and procedures

BS 7445 defines the basic quantities to be used for the description of noise in community environments and describes basic procedures for the determination of these quantities.

The methods and procedures described in this British Standard are intended to be applicable to sounds from all sources, individually and in combination, which contribute to the total noise at a site. At the present stage of technology this requirement is best met by adopting the equivalent continuous A-weighted sound pressure level as a basic quantity.

2.3 BS 5228-1:2009+A1:2014 : Code of practice for noise and vibration control on construction and open sites –Part 1: Noise

BS 5228 provides recommendations for basic methods of noise control relating to construction sites, including sites where demolition, remediation, ground treatment or related civil engineering works are being carried out, and open sites, where work activities/operations generate significant noise levels, including industry-specific guidance. The legislative background to noise control is described and recommendations are given regarding procedures for the establishment of effective liaison between developers, site operators and local authorities. Part 1 of BS 5228 provides guidance concerning methods of predicting and measuring noise and assessing its impact on those exposed.

2.4 BS8233:2014 Sound Insulation and Noise Reduction for Buildings

Table 4 of BS8233:2014 provides guideline values for day and night time noise levels within living areas and bedrooms. This is reproduced in Table 1 below:

Table 4 **Indoor ambient noise levels for dwellings**

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hour}$	—
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	—
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

Table 1. Extract from Table 4.1 BS8233:2014

Annex G of BS8233:2014 states that if partially open windows were relied upon for background ventilation, the insulation of the building envelope would be reduced to approximately 15 dB.

Note 4 of Table 4 in BS 8233 also stipulates that isolated but regular events can be assessed in terms of $L_{Amax,F}$ values or the SEL (Sound Exposure Level) thereby taking account of the potential annoyance of discrete noisy events.

Paragraph 7.7.3.2 of BS8233:2014: Design criteria for external noise states:

"For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces but should not be prohibited.

Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate. Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity

space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation. In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55 dB $L_{Aeq,T}$ or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space".

2.5 World Health Organisation (WHO) Noise Criteria (1999)

The WHO have produced two documents which provide guidance relevant to this chapter, namely Guidelines for Community Noise (1999) & Night Noise Guidelines (2009).

The former, which in part is superseded by the latter, is still useful to refer to and tallies with the targets set out in BS8233.

Table 2 below sets out the target daytime values for Living rooms and Bedrooms for day and night time.

Room Type	**Target Maximum Internal Level - L_{Aeq} dB(A)**
Living rooms	35 (Daytime only)
Bedrooms	30 (Night)
Room Type	**Maximum Internal Level – L_{Amax} dB(A)**
Bedrooms	45 (not more than 10-15 times per Night)

Table 2. World Health Organisation Guidelines on Community Noise : 1999

The target internal noise level for bedrooms and living rooms during the day time for a reasonable standard is set to 35dB(A). When the internal noise levels exceed 35dB (A) speech intelligibility levels of the occupants will be reduced.

With regard to outdoor amenity areas WHO Guidelines for Community Noise states the following:

To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dB(A) on balconies, terraces and in outdoor living areas.

To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 50dB(A) on balconies, terraces and in outdoor living areas.

2.6 Minerals Policy Statement 2: Controlling and Mitigating the Environmental Effects of Minerals Extractions in England, 2005

Whilst there are methods available within the British Standards to predict construction site noise which seek to quantify the impact, there are more applicable documents which relate to short term noisy operations. Minerals Policy Statement or MPS2 specifically references activities such as soil stripping, the construction and removal of baffle mounds, soil storage mounds and spoil heaps and the construction of new permanent landforms. This is a more appropriate fit in terms of the

assessment methodologies as the operations are short term in the context of the landform being created rather than an active mineral working site.

The guidance suggests that up to 70dB(A) $L_{Aeq,1\ hour}$ may be permitted for periods up to 8 weeks in a year at noise sensitive properties where it is clear that the work will bring longer term environmental benefit to the site or its environs. The policy states also that where longer than 8 weeks in duration, a lower noise level should be applied.

Two further assessment metrics are presented with these being a level not to be exceeded of 10dB(A) above the existing background noise levels ($L_{A90(T)}$) and a higher absolute limit of 55dB $L_{Aeq,1\text{-}hour}$ free field at the property boundary.

Prior to considering any applicable noise levels, it is relevant and important to determine the likely impact with regards to the background noise levels.

2.7 Design Manual for Roads and Bridges (DMRB), VLA111, Revision 0, November 2019

When examining change and perceptions of change, DMRB, 2011 is useful in providing attributable figures for short term change, albeit with regards to road traffic noise.

3 Technical Assumptions and Method including criteria

3.1 Scoping Consultation

3.1.1 West Sussex County Council

A scoping report in relation to the proposed changes to the scheme was previously submitted to West Sussex County Council on 1st August 2019. The feedback received from West Sussex County Council (6th September 2019) required the following:

- The sensitive receptors for the site are to the remain the same as was previously assessed by Acoustic Associates Sussex Limited on 18th May 2018 (J2217)
- A cumulative impact assessment is required to consider both the construction traffic as well as proposed operational traffic using the new permanent vehicle route for Buck Barn Cottages.
- A cumulative impact assessment is required to consider both the construction traffic as well as proposed operational traffic using the new permanent vehicle route for Floodgates Farm
- The impact of the new car park to be considered.
- An assessment is required to consider the impact of reflected noise as a result of the amphitheatre style landform on the Buck Barn Cottages.

3.1.2 Horsham District Council

Horsham District Council were also approached to determine, for the purposes of EIA, whether any other developments are proposed in the immediate area in order that a cumulative approach of impact may be properly considered. The response received directed the viewer to an online GIS with various layers which may be expanded to determine potential future development. No significant areas of concern were noted.

3.2 Context

Knepp Castle Estate (KCE) is a privately-owned estate covering approximately 3500 acres. The estate includes a large portfolio of properties including cottages, stables, light industrial units and offices. The site also includes a large mill pond, wooded areas and the historic Knepp Castle monument, as well as Knepp Castle.

The application site has a current planning consent (WSCC/029/18/SP) which is in the process of being implemented and works have been ongoing since February 2014. It is estimated that the works are significantly underway with approximately two thirds completed with the Buck Barn area and Hill House Lawn almost complete and Floodgates landscape enhancement feature still to be undertaken. The additional works to site are proposed to take a further 2-3 years, taking the timescale beyond the current consented date for completion (30 April 2020).

KCE is situated to the South West of Buck Barn Crossroads in West Sussex. The site is bordered by two busy highways: to the North (A272) and the East (A24).

The site is delineated on its Southern and part of its Western border by the River Adur. The Western Boundary is formed by Pound Lane running in a North/South direction.

As described above, the application site is contained by natural features such as the highways on three of the four site boundaries and additionally the River Adur. The application site has minimal impact outside of the site and remains relatively enclosed providing a very tranquil parkland environment.

The application site area is shown outlined in red in Figure 1 below with the three principal areas of development/works annotated.

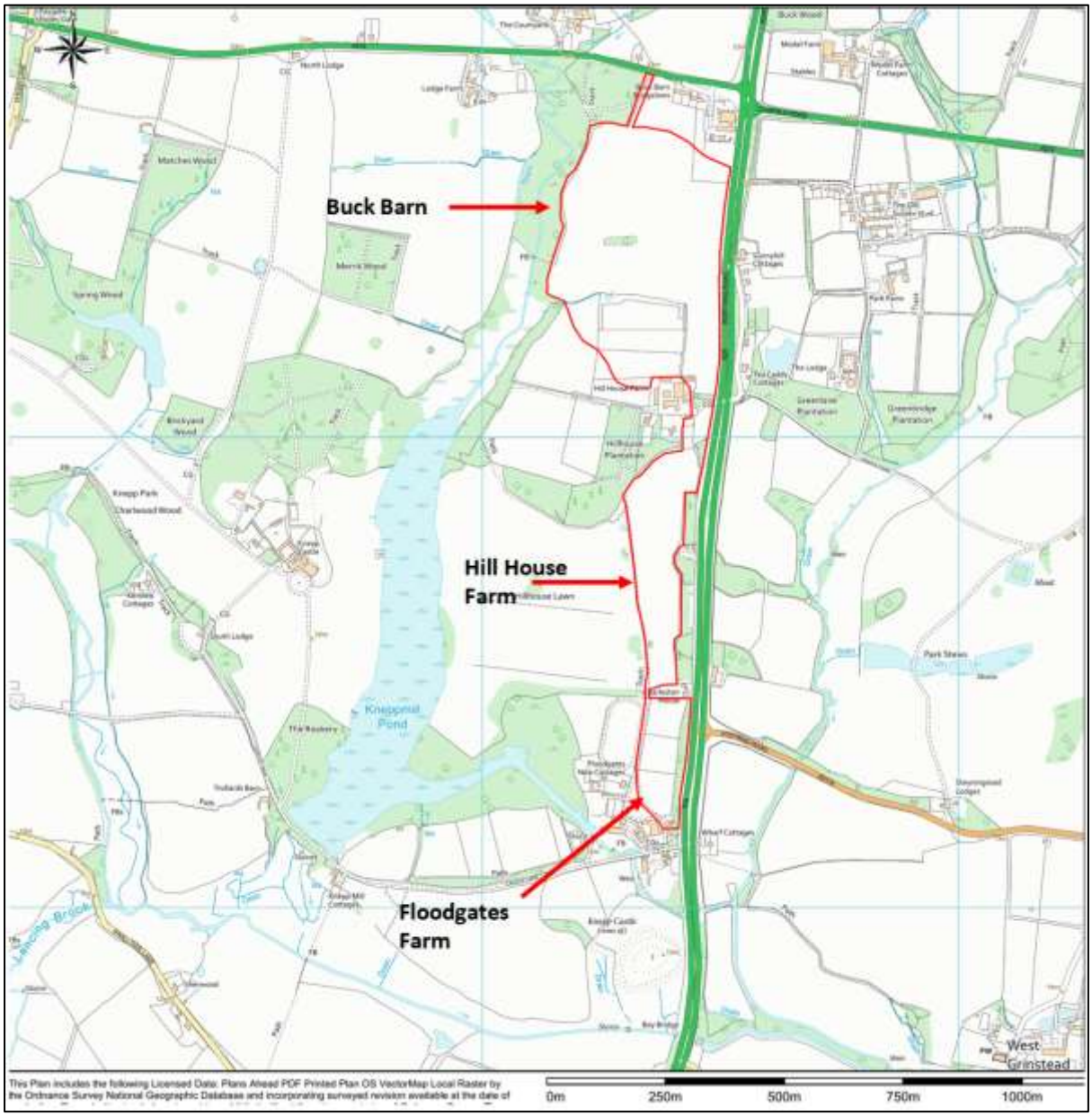


Figure 1. Application Area Outline

3.3 Works to be carried out

The works to be carried out will complement the already consented works and include the following:

- An amphitheatre and pond to the south of Buck Barn Cottages providing improved vistas and landscape bookends from Knepp Castle
- Additional tree planting on the Northern and Eastern slopes of the amphitheatre
- The temporary construction access (haul route) at the North of the site which links the estate with the A272 will be a become permanent route onto the KCE serving Hill House Farm as a private access road.
- A new vehicle access route will also run from the South of the site from Floodgates Farm to serve both Charleston House and BG Machinery.
- Acoustic fences are proposed between Hill House Farm and the A24 and additionally between the permanent access road and Charleston House.
- With the new vehicle access routes established, the two direct access routes for both Charleston House and BG Machinery onto the A24 will be closed off, providing both properties with significantly improved and safer highway access.
- The creation of a Public Right of Way (PROW) and a car parking area for approximately 12 spaces will be created to the North of Floodgates Farm.
- In carrying out the above works, an additional 250,000 m^3 of material will be required to be brought onto the site.
- It is anticipated that the additional works will take 2-3 years to complete going beyond the 30/4/2020 deadline.
- It is also noted that there still remains approximately 28,000m^3 still to complete the current landscape features from the extant planning consent. These are likely to be comprised of 21,000m^3 imported materials with 6000m^3 for Floodgates Farm, 10,000m^3 for Hill House Farm and 5000m^3 for Buck Barn area. The remaining 7000m^3 deficit will not to be imported but will be generated from the wetland habitat onsite.
- Whilst the bund shapes and footprints may change slightly for the revised application, the bund heights will not change.

3.4 Site Location

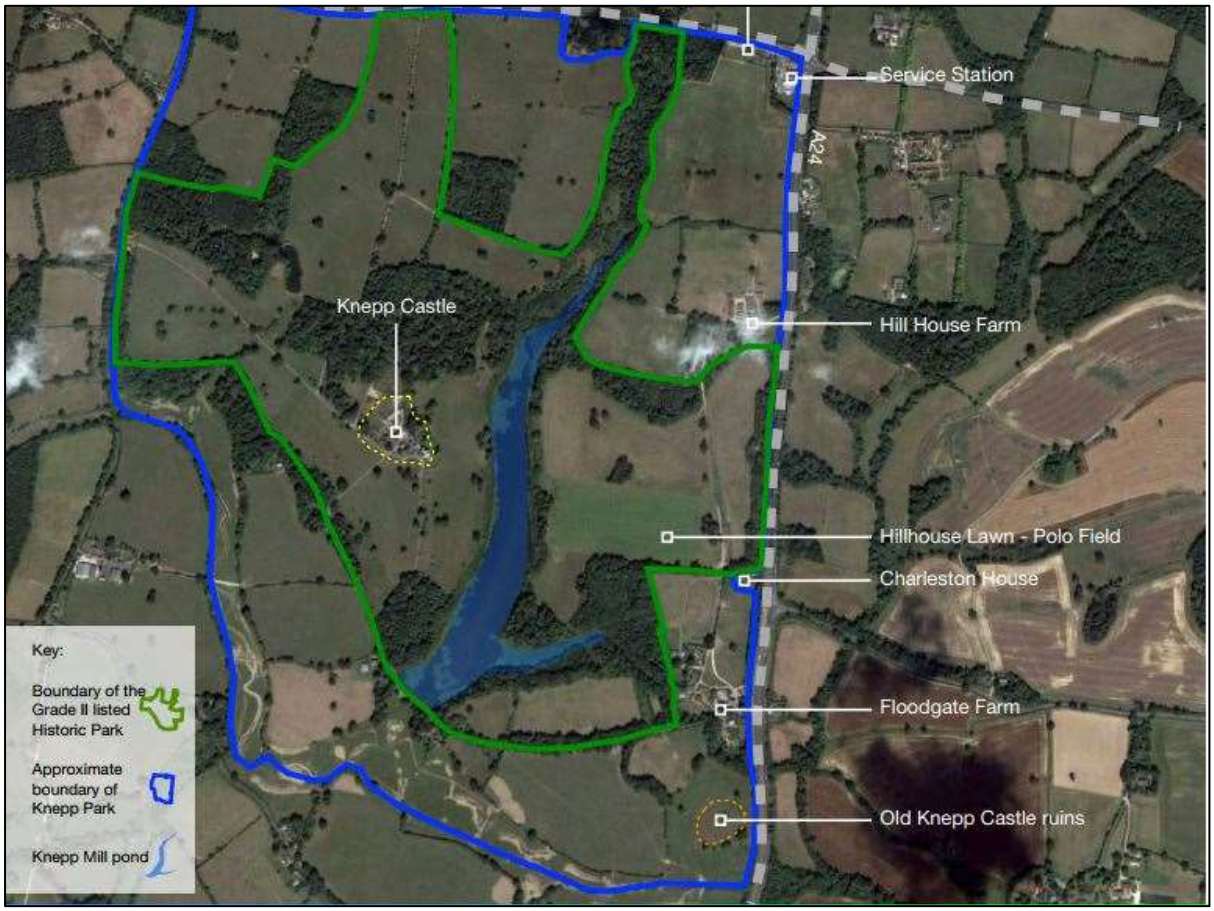


Figure 2. Aerial Site Location Plan showing locations of receptors.

Figure 2 above shows the approximate location of the estate in relation to its West Sussex surroundings and arterial highway network. Figure 3 below shows an aerial photo of the Knepp Castle Estate (KCE) which further illustrates the natural boundaries described in 3.2 above and emphasises the key work areas.

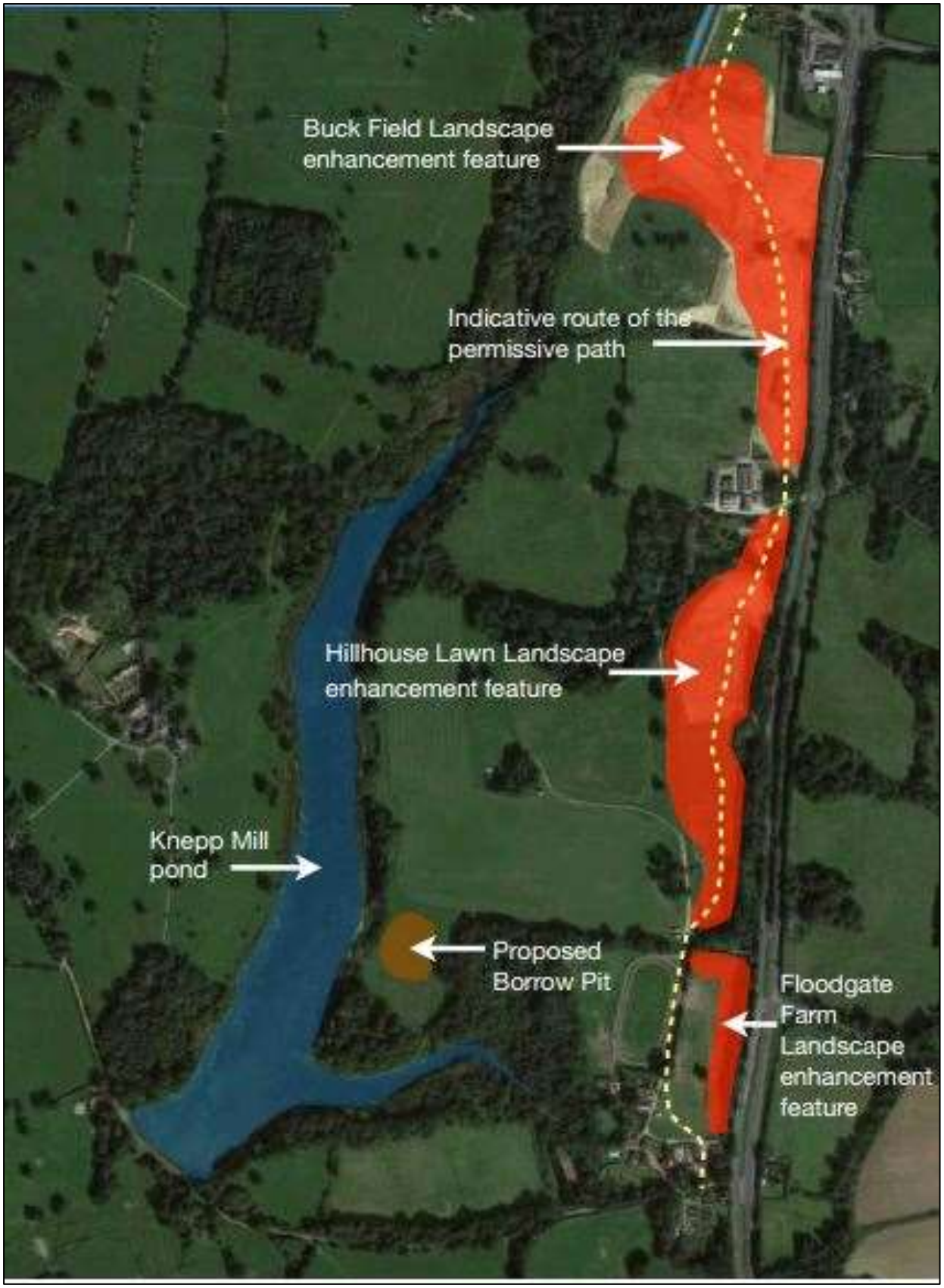


Figure 3. Aerial Image of Knepp Castle Estate with Key work areas shown (Historic Consent)

3.5 Nearest Residential Receptors

The locations and spread of the noise sensitive receptors may be seen below in Figure 4. As was detailed in the original scoping assessment, the selection of noise sensitive receptors built upon work already carried out by Vibrock Consulting when baseline noise data was measured in May 2007. To identify any changes in the local soundscape, the same locations were selected and measured, with the exception of Lodge Farm.

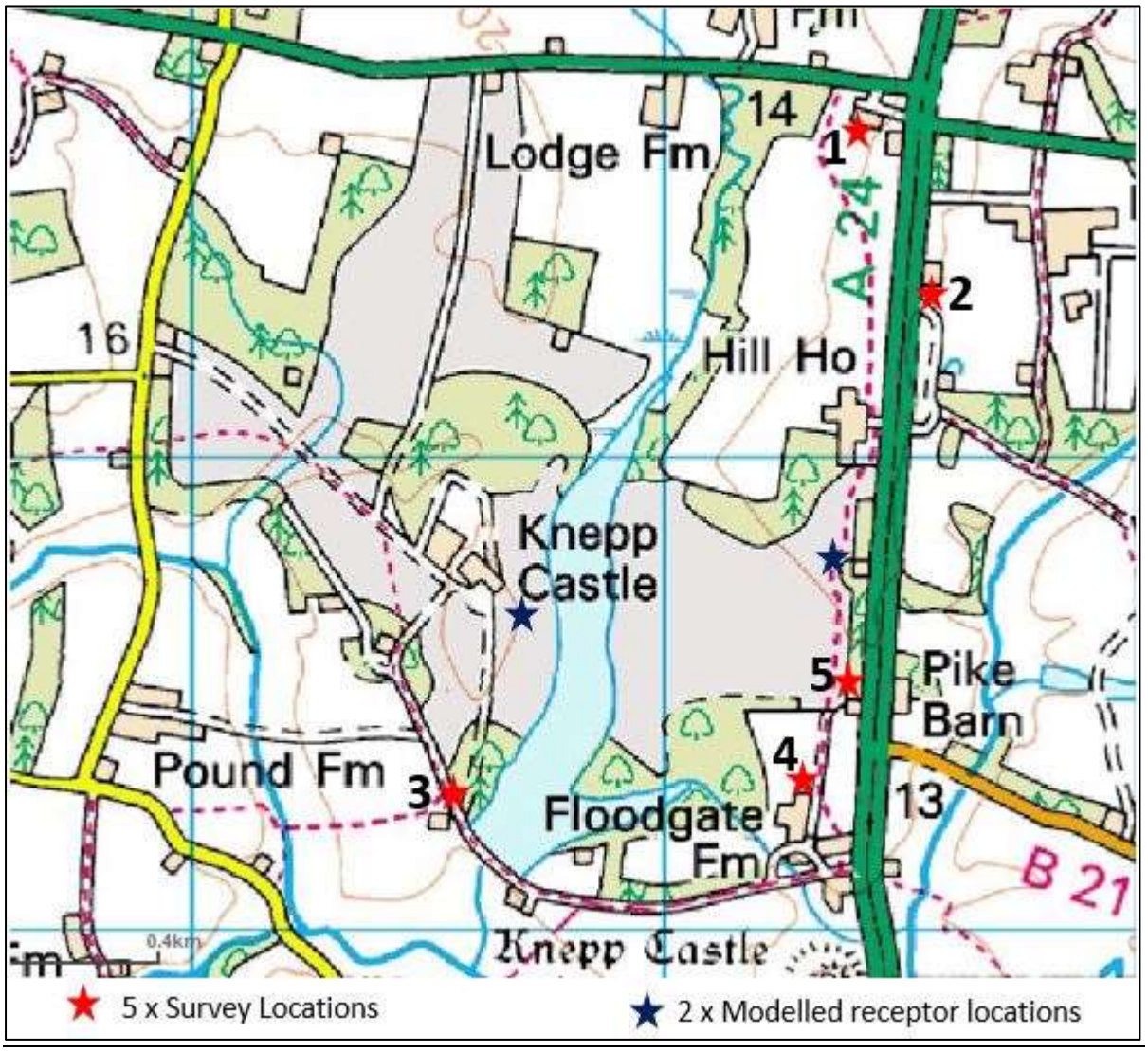


Figure 4. Survey Positions used, representing receptor locations

4 Baseline Acoustic Survey

Sound levels were measured to characterise the soundscape on Tuesday 5th December 2017. Historically, each of the 7 locations had been assessed using a 3-hour time period to identify the ambient sounds occurring at the 7 different residential receptors. As per the previously submitted scoping assessment, it was deemed appropriate and representative to repeat the 3-hour monitoring periods at the receptor locations. Lodge Farm was not assessed, predominantly due to its distance (347m from the haul route without any line of sight) from day to day site activities/operations, but also due to a lack of access on the day of monitoring.

4.1 Methodology

4.1.1 Locations

Sound levels were measured on Tuesday 5th December 2017 at 5 different locations as follows;

1. Rear of 3 Buck Barn Cottages
2. Adjacent 54 Sunnyhill Cottages
3. Trollards Barn
4. Floodgates Farm
5. Charleston House

The locations were assessed using both attended and unattended sound monitoring with three separate sound level meters deployed around the KCE. The use of three sound level meters collecting information simultaneously represented good time management whilst on site.

4.1.2 Meteorology

The date for monitoring was chosen due to it having a favourable weather forecast of low wind, dry and still conditions, ideal for environmental noise monitoring. Whilst on site, the conditions were as forecast and suitable for environmental monitoring in line with BS7445:2003. These ranged from 7-8°C, with a 4-5mph WSW wind and overcast cloud conditions.

4.2 Measurement Vs Prediction

It is important to note that whilst 7 locations were historically monitored over a two-day period, for the current data collection at KCE, 5 positions were monitored over a single day. With the exception of Lodge farm, this left BG Machinery without any site data being obtained. However, having plotted the information obtained from the survey positions in close proximity to the A24, it was noted that the location for BG machinery could be predicted using noise modelling software, IMMI (Wolfel, 2015). When assessed against the data collected in 2007, the BG machinery location was in fact consistent with historic measured data.

For completeness, IMMI noise modelling of the propagation effects of the A24 was used to predict the likely ambient noise levels at Knepp Castle for an estimation of noise levels.

4.2.1 Indices Collected

The L_{Aeq}, L_{A90} and L_{Amax} were collated for each measurement location to ensure both a thorough assessment of the site and additionally, to allow a comparison with the historic 2007 site data.

4.2.2 Instrumentation Used

The sound level meters were calibrated before and after commencing the noise measurements (@94dB with no drift). All measurements are considered to be free-field and apply Fast and A weighting filters. The measurement periods were set to three hours with a smaller resolution period.

Survey(s) carried out by	Scott Castle BSc (Hons) Env Health, MCIEH CEnvH PGDip Acoustics MIOA
Equipment Used	Norsonics -Type 1 Sound Level Meter (140)- Serial Number 1403397
Equipment Used	Norsonics -Type 1 Sound Level Meter (118)- Serial Number 31460
Equipment Used	Norsonics -Type 1 Sound Level Meter (118)- Serial Number 31769
Equipment Used	Castle Group Calibrator – Type 1 Calibrator. GA607 Serial Number 031042
Height	All measurements were recorded with the microphone at 1.5m above ground level.

4.3 Baseline Sound Survey

The data obtained from 5th December 2017 monitoring may be seen in Table 3 below

Location	Meter	Duration	Time	Grid Ref	$L_{Aeq,\ 3\ hour}$	$L_{A90,\ 3\ hour}$	L_{AMax}
Rear of 3 Buck Barn	NOR118(B)	3 hours	08:56-11:56	TQ1643/2271	51dB $L_{Aeq,3\ hour}$	48 dB $L_{A90,\ 3\ hour}$	69
Sunnyhill Cottage	NOR140	3 hours	09:24-12:24	TQ1655/2236	74 $L_{Aeq,3\ hour}$	58 dB $L_{A90,\ 3\ hour}$	98
Charleston House	NOR118(A)	3 hours	13:17-16:17	TQ1642/2149	58 $L_{Aeq,3\ hour}$	52 dB $L_{A90,\ 3\ hour}$	88
Trollards Barn	NOR118(B)	3 hours	12:50-15:50	TQ1559/2124	61 $L_{Aeq,3\ hour}$	37 dB $L_{A90,\ 3\ hour}$	85
North of Floodgates	NOR140	3 hours	13:00-16:00	TQ1634/2128	55 $L_{Aeq,3\ hour}$	51 dB $L_{A90,\ 3\ hour}$	

Table 3. Baseline Noise Data obtained on 5th Dec 2017

4.3.1 Subjective Assessment/s

Rear of 3 Buck Barn Cottages

Buck Barn Cottages are separated into two semi-detached buildings which separate the KCE from the A272 to the North. A 3-4 metre linear earth bunds is located to the West of the Buck Barn Cottages providing protection from the haul route where HGV's access the estate. The rear of the semi-detached Cottages has line of sight to the current haul route. The dominant noise source at the rear of the Cottages is the passing or queuing traffic on the A272/A24 cross roads, located to the North East. Photographs of the measurement position may be seen in Appendix A.

An excavator and HGV tipping were seen immediately due South of the monitoring position although occurring at some significant elevation (approximately 28m). This was at the approximate area of the seating location (166m in distance).

Sunnyhill Cottage

The measurement position was located 6m East from the Southbound 60 mph dual carriageway located on the grass verge between 54 Sunnyhill Cottages and 1 Waterloo Cottages.

The dominant noise source was that of passing road traffic at speed. It was also noted that larger vehicles (i.e. HGV's) made a particularly noticeably double thud as they drove over a metallic telecommunications manhole cover on the closest carriageway to the properties.

Subjectively, from the monitoring position, the KCE could be seen and a 360 excavator was seen to be operating and HGV's arriving throughout the duration of the survey period. The plant was visible through a deciduous tree screen. Only once during the measurement period with a significant lull in passing traffic, was any construction site noise noted and was insignificant. Photographs of the measurement position may be seen in Appendix A.

Charleston Cottage

The dominant noise source was the road traffic noise of the A24 located to the Eastern boundary. There were no other noise sources apparent. To the West of the monitoring position wild deer were seen in the distance.

Trollards Barn

Trollards Barn was selected as the residential location likely to be impacted for historic dredging activities of the Knepp Mill Pond and was located to the South West. The location was relatively quiet with only passing vehicles heading up to Knepp Castle or East to Floodgates/A24 exit. Aside from passing vehicles, only horses and dog walkers were noted.

Approximately 180 metres South East, a number of individuals were seen to be engaged in netting activities in the Knepp Mill Pond, although this was not visible or heard from Trollards Barn measurement location.

North of Floodgates

A monitoring position was chosen to represent the northern most property of the Floodgates complex. Whilst present, road traffic noise was again audible from the A24 as well as vehicle workshop noise and specifically, an angle grinder heard in the distance. Passing vehicles visiting the stables and offices were also noted in the immediate area.

The microphone was also impacted by vehicles travelling North on the estate, and one such tractor pass was witnessed within the measurements/dataset.

4.4 Comparison with 2007 Vibrock data

It is relevant to review the historic site noise data to see how the location soundscapes may have changed. Table 4 below shows the data comparison. Only two of the sites appear to bear different results, with the $L_{A90/}$ L_{Aeq} showing very similar results. The differences were noted as being Sunnyhill Cottages and Trollards Barn with the remaining 3 sites having similar noise results.

Only one site could not be compared like for like, which was the monitoring position North of Floodgates Farm. Due to concern over batteries, the 3- hour monitoring period was comprised of one-hour monitoring periods. It is not appropriate to logarithmically average an L_{A90} or an L_{Amax} indices. They may however be arithmetically averaged.

It is good practice to be able to ensure repeatability in measurement data and for this reason, GPS readings, photographs and sketch maps were taken of the locations. However, it was unclear from the 2007 monitoring data, exactly where the original measurements had been taken. Figure 4 below shows that from the scale of the map, the precise locations remain unclear.

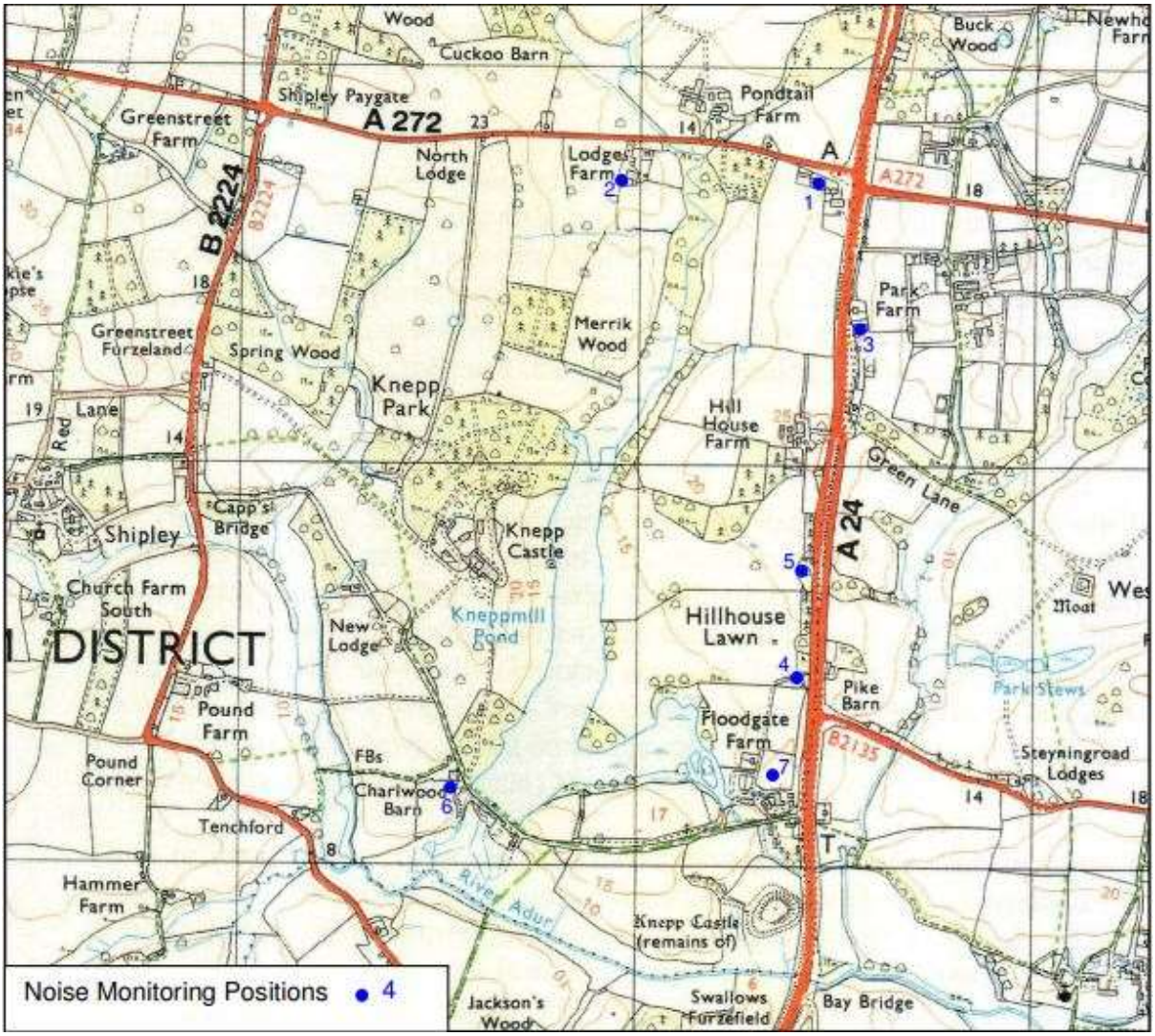


Figure 5. Extract from 2007 Vibrock Monitoring report showing measurement locations.

Location	$L_{Aeq,\ 3\ hour}$	Comparison to 2007 data	$L_{A90,\ 3\ hour}$	Comparison to 2007 data	L_{AFMax}
Rear of 3 Buck Barn	51 dB $L_{Aeq,3\ hour}$	+1	48 dB $L_{A90,\ 3\ hour}$	+2	69
Sunnyhill Cottage	74 dB $L_{Aeq,3\ hour}$	+10	58 dB $L_{A90,\ 3\ hour}$	+3	98
Charleston House	58 dB $L_{Aeq,3\ hour}$	0	52 dB $L_{A90,\ 3\ hour}$	+1	88
Trollards Barn	61 dB $L_{Aeq,3\ hour}$	+10	37 dB $L_{A90,\ 3\ hour}$	0	85
North of Floodgates	55 dB $L_{Aeq,3\ hour}$	-3	51 dB $L_{A90,\ 3\ hour}$	+1	81

Table 4. Comparison of baseline noise data with Vibrock 2007 survey

4.4.1 Further Investigation into the differences between the Historic data and current measured data

- Trollards Barn

The initial monitoring was carried out from 13:45 to 16:45 hours, very similar to the monitoring conducted on 5th December 2017 from 12:50 hours to 15:50 hours. It is unclear why the L_{Aeq} data should be 10dB different, however it is noted that the L_{A90} results were exactly the same at 37dB $L_{A90, 3\ hour}$, which may indicate passing traffic and temporary spikes in the monitoring data.

- Sunnyside

The initial monitoring was undertaken from 13:00 to 16:00 hours on 22nd May 2007, whereas the site monitoring commenced on 5 December 2017 from 09:24 to 12:24. It is noted that there is a 10dB increase in the $L_{Aeq, 3\text{-}hour}$ result and a 3dB increase in the $L_{A90, 3\text{-}hour}$ result suggesting that the noise climate may have risen. This may be possible for a number of reasons.

It is possible that the traffic numbers may have increased in the 10 years since the last survey, speed limits increased, or even the traffic lights sequencing changed which might accommodate less lulls in the passing traffic, making traffic flow more efficient. There were no road works seen and the Buck Barn cross roads was seen to be operating effectively without any obvious delays. Without knowing the exact monitoring locations of the Vibrock measurements, it is difficult to draw meaningful comparisons with the historic data.

5 Use of Noise Modelling Software

Whilst only 5 of the previous 7 sites were examined on 5th December 2017, Lodge Farm was discounted on distance grounds and BG machinery was not examined due to time constraints and safety as it was dark at the time of decommissioning the sound level meters.

IMMI (Wolfel) noise modelling software was used to input the survey positions, and then to input a line source representing the A24 northbound and southbound carriageways. The sound power of the line source was adjusted until the data obtained at the survey position was matched. The noise model is then considered to be calibrated and additional receptor points may be added and the propagation software run to determine the likely sound levels received as a result of the road traffic (A24) noise.

Modelling was therefore carried out for BG Machinery, due to its close proximity to the A24. The IMMI noise model predicted a specific noise of 63dB L_{Aeq}.

It was not considered appropriate to run the noise model for Lodge farm as it is likely to be dominated by passing single lane road traffic on the A272 running East and West. Sufficient data and survey positions are not held to be able to calibrate the model with any confidence for the A272 traffic.

As stated above, the IMMI noise prediction software was also used to predict the likely ambient (L_{Aeq}) noise levels at Knepp Castle. It is suggested that with the validated line source of the A24 dual carriageway and not accounting for any barrier effects, the specific noise level is likely to be 47dB(A) L_{Aeq} at the Eastern façade.

A plot was also added into the noise model for Hill House Farm, with a suggested ambient noise level due to the A24 alone as being 65 dB L_{Aeq}.

Location	Modelled L_{Aeq}
Hill House Farm	65 dB L_{Aeq}
BG Machinery	63 dB L_{Aeq}
Knepp Castle	47 dB L_{Aeq}

Table 5. Summary of modelled receptor locations

5.1 Reliability of data

From the conditions seen at the time of the monitoring and the diligence taken to select appropriate weather conditions and representative monitoring locations, it is considered that the data collected on 5th December 2017 is an accurate reflection of site baseline activities. There is no reason why the 2017 collected data should have changed and accordingly may be relied upon for an assessment in 2019.

5.2 Summary

Noise measurements were undertaken around the KCE on 5th December 2017 to replicate the duration and selection of noise sensitive receptors undertaken by Vibrock in 2007. Whilst it was not possible to replicate exactly the 2007 monitoring locations, due to a lack of information on exactly where these were recorded, the data obtained is felt to be a robust reflection of the site and its soundscape.

Where measurements were not recorded, noise modelling software was utilised to plot receptors and obtain likely ambient noise readings which would reflect the continuous exposure to the daytime A24 road traffic noise.

6 Assessment of Predicted Effects

Whilst the Environmental Impact Assessment (EIA) process is applied to consider the impact of the remaining works on site, it is relevant to note that contextually, the impacts being examined relate only to short term construction activities. The completion of the wider KCE project and associated implementation of the final Southern bund at Floodgates will likely reduce the ingress of road traffic noise onto the KCE bringing an overall benefit to the site and the residents within it.

The effects of the ongoing construction will be considered, as well as the operational effects of the two new permanent access routes, the new car park and the effect of the amphitheatre landform on Buck Barn Cottages;

Such effects will be discussed further in section 8 in line with Regulation 18(3), Schedule 4 of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017.

DMRB (2019) is also useful in being able to quantify the effects of short-term change, albeit with regards to road traffic noise.

6.1 Works to be undertaken

The construction activities carried out on site involved with earthmoving, reprofiling and landscaping have been carried out on the site since February 2014 without any adverse impacts to residents to date. The additional works on site fall into the following areas:

- Impact of additional materials being brought onto site via the existing entrance at A272 and associated haul route use. As with current site operations, Matthew's HGV's already attend site and use a defined haul route, which has a speed limit of 5mph (8.05km/h).
- Impact of the single 360-degree excavator and crawling dozer to reprofile materials delivered to site at both the bund areas and the amphitheatre and surrounding area.
- Creation of the new car parking area and assessment of operational use. It is proposed that the 360-degree excavator and crawling dozer will be used to create the new car park.
- Operational impact of the two new permanent access routes serving properties inside the KCE.

6.2 Estimated timelines and % completed

The proposed additional work is likely to take an additional 2-3 years to complete with the works going beyond the April 2020 consented deadline and progressing into 2022-2023. It is relevant to note that by the time the new works commence, extant works such as the dredging of the mill pond and the creation of the wetland habitat will already be complete and accordingly, do not need to be considered as cumulative work streams.

Whilst there remains additional works, it is noted that this will not be a continuous process with large periods of dormant activity. The site activities are currently constrained by natural light, and this will continue to be the case, with winter daytime activities ceasing around 16:00 hours and this being extended during the summer months to a typical 18:00 hours finish.

It is understood that the majority of the 250,000m^3 of imported material will be deposited in and around the amphitheatre feature to the South of Buck Barn Cottages.

6.3 Assessment Methodology

To be able to determine the likely noise impact, a number of factors must be established. These are, the plant to be used, the distances to the nearest residential receptors and the current background noise levels. This allows the calculation and prediction of received noise levels. It will also be necessary to consider pathway conditions to the receptors, i.e. any localised barriers, bunds, woodland, soft ground attenuation etc to provide a more accurate prediction. The resulting predictions may then be compared with measured sound levels to provide an estimate of impact.

6.3.1 Plant Sound Levels

Mobile plant listed in Table 6 below is either in use or proposed to be used to deliver the works described in 6.1 above.

Type	Name/Model	Quantity Used on site	Sound Power Level L_{wA}
Heavy Goods Vehicle	Volvo FMX460	N/A	110 dB(A) L_w
360 Excavator	Doosan 300	1	104 dB(A) L_w
Crawling Dozer	Komatsu	1	108 dB(A) L_w

Table 6. Plant to be used on site and Sound Power Levels

6.3.2 Plant Uses

The Volvo HGV (FMX460) is used to import inert materials to site. As discussed, these access the site via the Haul Route access on the A272. The 360 excavator (Doosan) and the crawling Dozer (Komatsu) are used simultaneously to level and profile received materials at the bund locations.

To present a robust assessment, in construction calculations, the use of the 360-degree excavator and the crawling dozer have been assumed to be used simultaneously. The assessment also presents a worst case in that the plant works continuously for the daytime period, which in reality may not be the case.

6.3.3 Methodology being utilised

Noise Modelling and prediction software (IMMI) was used to predict the impact of the existing A24 North to South dual carriageway as well as the locations where plant will likely be operating. Where it is apparent that plant will be stationary, such as a 360-degree excavator, a point source has been used, however, where there are circumstances where moving vehicles are involved, a line source has been applied into the modelling software.

An example demonstrating the application of line sources would be the operational aspects of the new car park to the north of Floodgates and the two new permanent access roads inside the Knepp Castle Estate as these pass residential properties. A line source demonstrates a worst-case estimate, as in reality, the volume of traffic involved in the predictions is very low indeed and accordingly the sound source in question would represent more of a moving point source, which would attenuate sound at a higher rate. Notwithstanding this, the line sources have been applied as the noise modelling software is unable to implement moving point sources within its algorithms.

6.3.4 Assumptions made for Construction Activities (ie Landscape Enhancement Feature Works)

To enable calculations to be made, assumptions have been derived to inform the input criteria. These are as follows:

1. The speed limit on site haul route remains 5mph (8.05km/h). This is enforced by Matthews.

2. The construction and reprofiling of the landscape enhancement features will require the 360-degree excavator and the crawling dozer both operating simultaneously.

3. The HGV's bringing imported materials to site will carry $10m^3$ per load.

4. The working week has been identified as a 10-hour working day from Monday to Friday only.

5. The closest boundary to residential properties has been considered for static plant.

6. The process of land profiling is dynamic with the plant unlikely to remain in the same position for longer than one day and consequently, the sound sources move further away from the receptor locations.

7 Assessment of Noise Impact

Any assessment of noise impact or noise change must include a suitable reference to the context.

Whilst EIA and associated guidance (IEMA, Noise Impact Assessment) is focused towards an existing soundscape, a future end state and how the noise climate may have changed in terms of both absolute noise level and character, it needs to be interpreted with caution.

The works on the Knepp Castle Estate are short-term construction works and whilst the majority of the site is already landscaped, the remaining work is likely to be carried out in phases and is not continuous. The overall end state, whilst introducing a permanent access road for estate residents does not introduce any new noise sources and is likely to improve the overall site tranquillity and soundscape for those residents within the Estate.

Construction site activities, although limited in their nature, need careful consideration of the appropriate assessment indices to apply. Whilst BS5228:2014 uses two principal methods (ABC and 5dB(A) change) to consider significance, the use of "*significance*" as a change indicator, albeit short term, this has a very limited application to both the construction of new roads and new railway lines. In view of this, it is appropriate to consider the metrics of noise change in terms of L_{Aeq} and additionally, the guidance offered by MPS2, which relates to the working of minerals sites, earth moving and profiling.

The MPS2 guidance works by considering the existing L_{A90} at the receptor locations and states that the predicted sound pressure level of the noise sensitive property does not exceed the measured background noise level by more than 10dB(A) during normal working hours (07:00-19:00 hours). Where this is not achievable without imposing unreasonable burdens on the site operators, total noise from operations should not exceed 55dB $L_{Aeq,\ 1\ hour}$ (free field).

In evaluating the noise impact, it is also relevant to consider the noise contributions which already exist at the site and predominantly, the impact of the fast flowing A24 as a linear noise source, running North to South at the Eastern site boundary.

Accordingly, change in noise levels (L_{Aeq}) and the MPS2 Guidance have been applied as relevant metrics for this particular noise assessment. Contextually, the results have also been compared to the likely site noise levels generated by the A24.

Specific noise levels have been predicted using the IMMI noise modelling software and plotted against the various work phases and the receptor locations most likely to be impacted. Where the L_{A90} has not been determined (i.e. the three modelled locations) for example Knepp Castle, the noise predictions have been assessed against the absolute levels in MPS2, i.e. 55dB $L_{Aeq,\ 1\ hour}$ freefield.

The workstreams for assessment have been identified in the order that West Sussex County Council have expressed. These are as follows:

- Cumulative Assessment of Buck Barn Cottages to include both continued construction and additionally the creation of the new permanent access road
- Cumulative Assessment of the Floodgates Farm residents to include both continued construction and additionally, the creation of the new permanent access road
- Operational impacts of the new car park area
- Assessment to consider reflected sound from the amphitheatre landform on Buck Barn Cottages.

7.1 Buck Barn Cottages and Floodgate Farm Residents – Impact of Construction Site Noise

Construction site noise has been assessed using a number of approaches. IMMI noise modelling software has considered the impact of stationary plant, entered as point sources such as the 360-degree excavator and the crawling dozer operating simultaneously.

Haul route calculations have also been performed to assess the impact of the proposed continued construction traffic, with particular relevance to the rear of the Buck Barn Cottages located to the North of the site. In order to present both the MPS2 prediction at the boundary as well as the likely existing noise levels from the A24, the reception positions have been moved from the building facades to the property boundary, and in most cases, closer to the sound source, to ensure a consistent approach with MPS2.

7.1.1 Stationary Sources (360 and Crawling Dozer)

As previously stated, whilst such plant has been assessed in a worst-case position, it is not likely to stay there, as the dynamic profile of earthmoving dictates that plant moves to where it is needed and typically, further away from the receptor locations.

Table 7 below shows the impact of the plant operating simultaneously on the nearest receptors.

Construction Noise Impact of Stationary Plant (360 + Crawling Dozer)				
Receptor Location	**Predicted $L_{Aeq,T}$**	**MPS2 +10**	**MPS2 - Upper Limit**	**Existing Sound Pressure Levels from A24- $L_{Aeq,\ 3\ hour}$**
Plant Located at 85m South of Buck Barn Rear Boundary				
1-2 Buck Barn Boundary	57.6	58	55	61.5
3-4 Buck Barn Boundary	58.7	58	55	61
Plant Located at Northern Tip of Floodgates Farm Bund				
Charleston House	72.1	62	55	61.1
1 Floodgates Farm	50.4	61	55	57.4
2 Floodgates Farm	50.8	61	55	57.4
Plant Located at Middle Section of Floodgates Farm Bund				
Charleston House	55.3	62	55	61.1
1 Floodgates Farm	53.1	61	55	57.7
2 Floodgates Farm	53.6	61	55	57.6
Plant Located at Southern Section of Floodgates Farm Bund				
Charleston facade	45.9	62	55	61.1
1 Floodgates Farm	60	61	55	57.7
2 Floodgates Farm	59.7	61	55	57.6
All Predicted Sound Pressure Levels are shown in dB(A)				

Table 7. Assessment of Stationary Construction Plant

The predictions marked in red text inside the cells relate to where the predicted sound pressure levels are above the MPS2 plus 10 category. The predicted sound pressure levels are specific to the simultaneous use of the 360-degree excavator and the crawling dozer combined.

Table 7 demonstrates that as the plant and reprofiling activities moves in a Southerly direction down the Floodgates bund, the impact on Charleston House diminishes, yet the impact on the Floodgates Farm increases. The construction process is not a permanent activity and will remain dynamic in terms of its day to day positioning. Of the 11 predictions made, 5 remain below the upper MPS2 limit of 55dB at the property boundary, whereas only 3 of the 11 predictions are above the existing measured soundscape.

A check of the modelling software can be performed by combining the sound power levels of the 360-degree excavator and the crawling dozer and using for the formula $Lp=L_{WA}-20\log(r)-8$.

The combined sound power level of the 360 excavator and the crawling dozer would be 109.5. $109.5-20\log(108)-8 = 60.8$ dB measured at the rear of 1-4 Buck Barn Cottages, only 2.1dB different from what the IMMI noise modelling software has predicted.

7.1.2 Haul Route Impact

With stationary plant assessed using the noise modelling software, the impact on the receptor locations may be quantified further by applying a calculation used in BS5228:2014 for *"mobile plant using a well-defined haul route"*. This is a calculation which uses distances (from façade) to the centre of haul routes, site speed limits and the likely number of vehicles passing in a single hour. This predicts a worst-case hour.

The calculation is as follows:

$L_{Aeq,\,T}$ = LWA - 33 + 10log(Q) - 10log(V) - 10log(d)
where:

LWA is the sound power level of the plant, in decibels (dB);
Q is the number of vehicles per hour;
V is the average vehicle speed, in kilometres per hour (km/h);
d is the distance of receiving position from the centre of haul road, in metres (m).

The assumptions applied are as follows

- As per table 6, the HGV sound power level for Matthew's vehicles are 110dB(A).
- Within the Motion Transport Planning document, it is noted that there could be up to 64 vehicle movements a day.
- Assuming a 10.5-hour day, this equates to 6 vehicles an hour

Table 8 below indicates the assessment of the vehicles importing materials onto the site with distances from the centre of the haul route to the residential façade.

A	B	C	D	E	F	G	H	I	J
Receptor Location	**Distance (m)**	**Speed Limit (Km/h)**	**Predicted $L_{Aeq,1\ hour}$**	**Loss for Barrier Effect**	**Revised Prediction ($L_{Aeq,1\ hour}$)**	**Measured L_{Aeq}**	**Predicted Vs Measured**	**MPS2+10**	**MPS2 Absolute**
Western edge of Buck Barn	54	8.05	58.4	5	53.4	51.0	2.4	58.0	55.0
Southern edge of Buck Barn	87	8.05	56.3	0	56.3	51.0	5.3	58.0	55.0
Western edge of Charleston Ho	70	8.05	57.3	5	52.3	58.0	-5.7	62.0	55

Table 8. Assessment of Residential Receptors using Haul Route Calculation Methodology

Column D within Table 8 is the predicted L_{Aeq} sound pressure level during a worst-case hour. Column E has applied a conservative 5dB barrier correction to the predicted sound level, with the revised prediction apparent in column F. The previously measured L_{Aeq} from Dec 2017 is shown in Column G and the difference in prediction versus measured is shown in column H.

Text within Table 8 marked in red indicates that the predicted sound pressure levels are above the existing measured soundscape. However, these worst case values for the hour period still fall below the MPS2 +10 values.

7.2 Buck Barn Cottages and Floodgate Farm Residents – Impact of Permanent Access Route

To address the concerns of West Sussex County Council over operational noise generated from the new permanent access road, an approach is proposed which combines both noise modelling and real time measurements of SEL recorded from passing vehicles.

As with other assessments made, there is a need to consider what assumptions have been made.

- The client has suggested a maximum of 100 trips a day, which will be considered as a full day (ie 07:00-23:00 hours).
- A 20mph speed limit as a private road is considered to be sufficient
- It will only be relevant to consider car passes on the permanent road, where these pass residential receptors.

To ensure that sufficient data was held, 15 car passes of random vehicles travelling in different directions were measured outside of the Acoustic Associates Sussex Offices which has low background noise conditions. The start and finish position for the recordings was measured at approximately 125m in length with the survey position tripod mounted (1.5m) at approximately 5m from the passing vehicles. It is relevant to note that the length of road used is subject to a 20mph speed limit and has at least one speed hump, making the speed relevant for such a private access road on KCE. The data was collected in free field conditions. The measured SEL was arithmetically averaged to determine 74.9dB as a representative value of the 15 car passes.

IMMI Noise modelling software may then be used to determine the impact of the operational aspect of vehicles using the permanent routes on the existing noise sensitive receptors. As with the assessment of the car parking scheme, the line source drawn in the model can then be calibrated and the modelling software run to determine the likely impact on the receptors.

As has been previously discussed, the line sources represent a worst case and conservative estimate.

The SEL calculation remains the same in that SEL can be determined for either 30 trips or 100 trips, by amending the later part of the equation.

74.9-10log(57600)+l0log(30) = 42.1 $dBL_{Aeq,\ 16\ hour}$ for 30 trips in a 16 hour daytime period.

74.9-10log(57600)+l0log(100)= 47.3 $dBL_{Aeq,\ 16\ hour}$ for 100 trips in a 16 hour daytime period.

Sensitive receptors to be considered for car passes have been considered as follows:

- 1-4 Buck Barn Cottages
- Sunnyhill
- Charleston House.
- Floodgates Farm (1 and 2)

Knepp Castle as a sensitive receptor has been discounted on grounds of both distance from the new road and the topography that the road will follow. Similarly, Hill House Farm and BG Machinery have also been discounted as residential receptors, as the Northern and Southern permanent roads are for traffic driving either to or from their site and they will be benefiting from the new access road.

As with the assessment of the operation of the new car parking site, the sound from the A24 has been discounted to ensure only the specific sound level from the car passes has been assessed.

All modelling has been carried out with the contours as built, so any reflection and/or barrier effects will be taken into account.

As stated above, to ensure a robust approach, trips for 30 vehicles a day and 100 trips a day have both been considered.

A 125-metre line source was used within the model with a calibration point plotted at a perpendicular position of 5metres to account for the distance at which the vehicle passes were measured. The line source was drawn at the area of the proposed new permanent routes closest to the existing residential receptors referred to above.

Table 9 below shows the results of the predicted operational impact of the vehicle passes on the new private access road serving both Hill House Farm and BG Machinery with vehicle trips of both 30 and 100 trips plotted respectively, as well as the measured sound levels from 5th December 2019 for context.

Location	Predicted Sound Pressure Level, $L_{Aeq, 16\ hour}$	Location	Predicted Sound Pressure Level, $L_{Aeq, 16\ hour}$	Existing Measured Sound Pressure Level from A24 $L_{Aeq, 3\ hour}$
30 Trips in a day		**100 Trips in a day**		
1 Buck Barn	20.8	1 Buck Barn	26	51 dB
2 Buck Barn	21.3	2 Buck Barn	26.5	51 dB
3 Buck Barn	21.2	3 Buck Barn	26.4	51 dB
4 Buck Barn	21.4	4 Buck Barn	26.6	51 dB
Sunny Hill	28.7	Sunny Hill	33.9	74 dB
Charleston House	24.5	Charleston House	29.6	58 dB
1 Floodgates	31.5	1 Floodgates	36.7	55 dB
2 Floodgates	32.2	2 Floodgates	37.4	55 dB
All Predicted Sound Pressure Levels are shown in dB(A)				

Table 9. Assessment of Vehicle Passes using Permanent KCE Access Road

Table 9 above does not evidence any impact from the vehicle passes using the two new permanent access routes on the receptors considered.

It is relevant to revisit the location of the Floodgate Farm residential receptors to determine if they are likely to be subject to both vehicles accessing the proposed new car park as well as vehicles travelling on the new permanent access route. Properties 1 and 2 Floodgates, annotated in red below, are approximately 90 metres from the turn into the newly proposed car parking area and are not likely to be impacted by both sets of vehicular traffic.

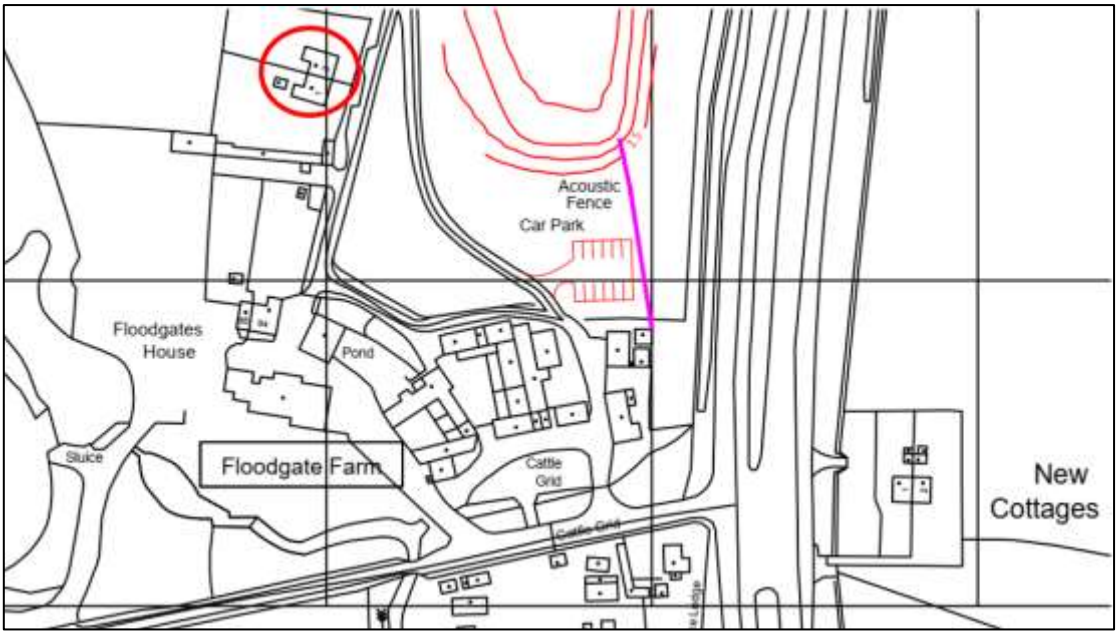


Figure 6. Floodgates Farm Complex (and new car parking area) with 1 and 2 Floodgates Highlighted

7.3 Operational Impacts of the New Car Parking Area

The operational impact of the proposed new car parking area has been considered. The new park will be located to the North of the Floodgates Farm complex, which are a collection of commercial workshops and farm style buildings. The location of the car park and its circa 12 spaces can be seen in Figure 7 below. The closest residential properties are likely to be numbers 1 and 2 Floodgate Farm, measured as approximately 90m from the Western element of the new car park location and are annotated in a red circle below.

It is relevant to state the assumptions made in considering the operational impact of the car park which are as follows:

- With circa 12 spaces, a maximum of 40 return trips a day will be made to and from the car park space.
- The route into the car park is from Castle Lane to the South, with vehicles driving in between the farm buildings and workshops and turning right into the new car parking area. The departure route is the reverse.
- It is assumed as a worst case, that the car park trips will be assessed over a 12-hour day, namely 07:00 to 19:00 hours. Reality dictates that in winter with shorter days, the use of the car park is likely to be less still. Running the calculation for 07:00-23:00 hours is not considered to be an appropriate reflection of the site use as the car park users will either be visitors to the Floodgates Farm buildings and/or users of the newly created public right of way.
- It is also assumed that the car park will not be used during the night time period. Therefore an assessment of L_{Amax} values for short term noise incidents such as car doors being slammed are not required for this particular assessment.

- The closest residents for assessment will be numbers 1 and 2 Floodgate Farm. Receptor positions have been placed in the noise modelling software at 1.5m to replicate ground floor windows.

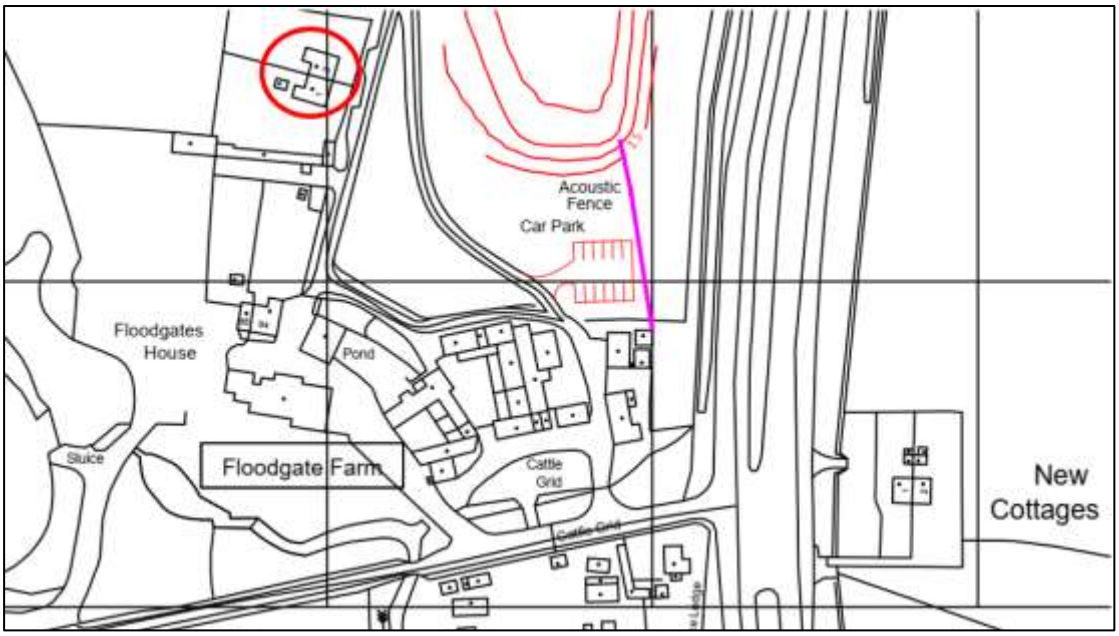


Figure 7. Floodgates Farm Complex (and new car parking area) with 1 and 2 Floodgates Highlighted

A noise modelling approach was used to determine the impact of the new car parking area. Distances were measured from Castle Lane, past the Floodgate Farm buildings to the turn off into the new car parking area, as approximately 75m, with a further distance of 25m into the North East corner of the car park.

To replicate the effect of a single vehicle arriving, the same distances were measured outside of Acoustic Associates Sussex offices with a vehicle approaching between 15-20mph and turning into a car park measuring the same area footprint as the proposed new car park. The office location was selected due to it having a low background soundscape.

A tripod mounted class 1 sound level meter (1.5m) in freefield conditions measured 4 separate car passes at 5m distance which then turned and manoeuvred into the furthest car parking space. The same diesel Audi A4 was used for each vehicle pass. The sound level meter was positioned at 5m from the car passing point. Four separate passes allowed an average SEL to be calculated of 75.2dB.

Within the noise modelling software, a line source was plotted in between the farm buildings and the required change in direction at the entrance to the new car parking area, with the line source continuing onto the furthest North East corner. A receptor/calibration position was plotted at 5m in distance from the line source, prior to the change of direction, to reflect the same conditions during which the measured vehicle passes were undertaken.

The SEL calculation (SEL-10log(T)+10log(N)) was run using 40 trips over a 12-hour period (43200 seconds). The calculation is shown as follows:

75.2-10log(43200)+l0log(40) = 44.86, rounded to 44.9 dB $L_{Aeq,\ 12\ hour}$.

The line source drawn within the model is then calibrated by adjusting the sound power level of the new line source (road) until it met 44.9 dB, which was measured at 5m. It is

relevant to note that when determining the specific sound generated by car park trips, the A24 and the A272 sound sources have been switched off.

With the line source calibrated, the modelling software may then be run to determine the impact on the nearest residential receptors, specifically numbers 1 and 2 Floodgates. The noise modelling software has been run to accommodate the fact that with the bunding close to the A24 coming to a gradual and tapered decline to the North of Floodgates Farm, a 2m acoustic fence has been applied to the road side element of the car parking space, as demonstrated in Figure 7 above.

The resulting freefield sound pressure level is 22.8 dB $L_{Aeq,12\ hours}$ at Number 2 Floodgates and 23.1 dB $L_{Aeq,12\ hours}$ at Number 1 Floodgates. The predicted sound pressure levels are significantly below the sound levels measured just North of 1 and 2 Floodgates on 5th December 2017 of 55dB $L_{Aeq,\ 3\ hour}$.

The model output detailing the predicted noise contours is shown below in Figure 8 and attention is drawn to the brown and yellow areas as the line source transits past the farm buildings/commercial workshops, where the sound energy is reflected off of the buildings.

Figure 8. IMMI Noise Modelling Contours of Proposed Car Park Use

It is relevant to note that whilst the operational impact of the car park has been considered for a 12 hour period, the calculation can also be re-run to account for a three-hour time period, to allow a more consistent comparison between the 3-hour period which was measured on 5th December 2017 just North of Floodgates Farm.

The revised SEL calculation will be 75.2-10log(10800)+10log(40) = 50.9 dB $L_{Aeq,\ 3\ hour}$, an approximate 6dB increase on the previous calculation. Adding 6dB to the initial calculations would still suggest a result under 30dB $L_{Aeq,\ 3\ hour}$, some 25dB less than the 55 dB $L_{Aeq,3\ hour}$ which was previously measured on site.

Importantly, a line source represents a very conservative and worst-case scenario. In reality a line source is taken to represent traffic flow such as the A24 or the A272 above, not 3 cars an hour. A moving point source is likely to be more accurate and will attenuate sound energy better than a line source, however, the limitations of the noise modelling software prohibits moving point sources being included.

Notwithstanding the limitations of line sources, the operational impact of the new car park is considered to be minimal and masking noise from the A24 traffic noise will be the dominant sound source.

7.4 Consideration of Reflected Sound from Amphitheatre

To address the specific concern raised by West Sussex County Council over the potential for reflection effects of traffic noise of the A272 and A24 by the raised amphitheatre landform, noise modelling software was used to create two noise models for comparison. One model was created without any contours or raised landforms and one model was created with the proposed landform and contours built into the model showing up to 31AOD.

The IMMI noise modelling software was left with the A24 line source as still occurring and a new line source was added for the A272 to the North of the site. At the time of the initial sound survey on 5th December 2017, there was not a requirement to consider the sound levels generated from the A272. A modelling approach has therefore been used and the assumption made that the A272 will not be as busy as the A24, however for the purposes of a model, two sound power levels (L_{WA})were added to the line source of both 70dB(A) and 85.7dB(A).

A reception point was created at the rear position of numbers 1-4 Buck Barn Cottages with the position generated at 1.5 metres to account for a standard ground floor rear living room window as a worst case. The models were then run with the two different sound powers for the A272 to determine, what if, any, difference the raised amphitheatre would make on the local soundscape for the closest residents. The rationale for using an artificially higher sound level was to ensure that there was sufficient sound energy in the model to ensure that it reached the landform and was reflected accordingly.

In terms of perspective, it is relevant to note that from the rear façade of 1-4 Buck Barn Cottages to the highest point of the amphitheatre is approximately 340m in distance. It is noted that the North and Eastern side of the amphitheatre landform will have considerable planting as seen in Figure 9 below which will assist in preventing the landform being reflective. As a worst-case scenario, the planting was deliberately omitted from the two noise models generated, the models simply included the effect of both with and without contours.

From Figure 9 below, the amphitheatre is noted to be curved to provide visual vistas from Knepp Castle to the South West without any intervening landforms.

Figure 9. Proposed Landform of the Amphitheatre

The results of the noise modelling are seen in Table 10 below. The predicted sound pressure levels are not entirely relevant, it is the fact that these do not change with the contours introduced into the model and with greater sound energy from the road which remains the relevant principle.

Assessment of Impact of Raised Landforms on the Rear of 1-4 Buck Barn Bungalows			
With Contours		Without Contours	
A272 modelled with 70dB L_{WA}			
4 Buck Barn	54.7	4 Buck Barn	54.7
3 Buck Barn	54.3	3 Buck Barn	54.3
2 Buck Barn	56.6	2 Buck Barn	56.7
1 Buck Barn	57.5	1 Buck Barn	57.5
A272 modelled with 85.7dB L_{WA}			
4 Buck Barn	55.3	4 Buck Barn	55.3
3 Buck Barn	55	3 Buck Barn	55.2
2 Buck Barn	57.2	2 Buck Barn	57.2
1 Buck Barn	58	1 Buck Barn	58

Table 10. IMMI Noise Modelling Predictions for Buck Barn Cottages with and without Amphitheatre

As can be seen from Table 10 above, the raised landforms, modelled without planting effects and assuming hard ground as the model default position do not create any differences in the predicted sound pressure levels at the receptor locations located at 1-4 Buck Barn Cottages.

8 Analysis of Impact

The assessment has summarised the impacts from the scoping comments from West Sussex County Council on the receptor locations in Table 11 below showing the greatest impact at the top and identifying when the impact is likely to occur. The receptor and/or the phases of work assessed with the least impact is at the bottom of the table.

Receptor Location	Phase of Work	Predicted Sound Level ($L_{Aeq,T}$)	Predictions vs Measured Sound Levels	MPS2+10 Criterion	MPS2 Absolute Criterion
Charleston House	Stationary Plant-North of Floodgates Bund	72	10.9	62	55
3-4 Buck Barn Cottages	Stationary Plant-Amphitheatre	58.7	7.7	58	55
1-4 Buck Barn Cottages	HGV Deliveries to Site	56.3	5.3	58	55
1-4 Buck Barn Cottages	Operational Effects of Landform and Reflection	No Change			
1-2 Floodgates	Permanent Access Road	37.4	-17.6	Not Applicable	Not Applicable
4 Buck Barn Cottages	Permanent Access Road	26	-25	Not Applicable	Not Applicable
Charleston House	Permanent Access Road	29.6	-28.4	Not Applicable	Not Applicable
1-2 Floodgates	Assessment of New Car Park	23	-32	Not Applicable	Not Applicable
SunnyHill	Permanent Access Road	33.9	-40.1	Not Applicable	Not Applicable

Table 11. Impact Assessment rated from High to Low

The greatest impact is seen at Charleston House with a predicted 10.9 dB rise in sound pressure levels over those previously measured, with the noisy work being the 360-degree excavator and the crawling dozer which are deliberately located in close proximity to the receptor. It is likely that the duration of the works would be limited, since as the profiling of the bund develops, the mobile plant will move further South. The already-laid bund, as well as enhanced distance, will both then serve to attenuate sound levels from this 'start' value.

The next greatest impact is with the same plant (ie 360 and crawling dozer) located to the rear of 1-4 Buck Barn Cottages with direct line of sight and a 7.7 dB rise in sound pressure levels over those previously measured. Again, the duration is likely to be limited and it is probable that the closer work on the Northern side of the amphitheatre has already been carried out, to provide a natural barrier or bowl to work behind on the Southern elevation of the amphitheatre. Notwithstanding this, the model was plotted to present a worst-case scenario.

The next impact is described as the arrival of the HGVs past the rear of 1-4 Buck Barn Cottages with a 5.3dB rise in sound pressure levels.

The assessments to determine reflections as well as operational uses of the car park and the permanent access roads are shown not to present any concerns.

8.1 Discussion

It is apparent that different receptors are likely to be impacted at different times during the forthcoming works. The three principal impacts are seen below in Table 12 showing both the change in ambient noise levels and the use of the MPS2 metrics with both a raised background target and the application of an absolute noise level. The receptors are placed in descending order with the greatest impact at the top of the table.

Receptor Location	Phase of Work	Predicted Sound Level ($L_{Aeq,T}$)	Predictions vs Measured Sound Levels	MPS2+10 Criterion	MPS2 Absolute Criterion
Charleston House	Stationary Plant-North of Floodgates Bund	72	10.9	10 dB above	17 dB above
3-4 Buck Barn Cottages	Stationary Plant-Amphitheatre	58.7	7.7	0.7 dB above	2.7dB above
1-4 Buck Barn Cottages	HGV Deliveries to Site	56.3	5.3	1.7 dB below	1.3 dB above

Table 12. Assessment of Impact

8.1.1 Charleston House – Northern End of Floodgates Bund Construction

As stated above, Charleston House is deemed to have the highest impact with a prediction of 72dB L_{Aeq}, which is generated by the close proximity of the 360-degree excavator and the crawling dozer, operating simultaneously at the Northern end of the Floodgates Bund. The area was previously measured as being 58dB $L_{Aeq,\ 3\ hour}$ and the predicted sound level is 10dB more than the MPS2 plus 10dB criteria and 17dB above the fixed criteria of 55dB L_{Aeq}, free field.

MPS2 also states that the sound levels at the boundary should not be more than 70dB for periods of up to 8 weeks. It is arguable that once the initial element of the bund has been constructed at the Northern end with the mobile plant moving south, that the bund is likely to operate as a landform or barrier which impacts on line of sight and additionally, how sound propagates to the receptor location concerned.

The impact is likely to be short term relating to construction only without any longer-term operational impact or effects.

8.1.2 3-4 Buck Barn Cottages – Stationary Plant within 5 metres of Haul Route

From Table 12 it is apparent that 3-4 Buck Barn is also likely to be impacted by the stationary mobile plant located in close proximity (within 5m) of the established haul route. The impact is only 0.7dB above the MPS2 plus 10 criteria and 2.7 above the absolute and fixed 55dB L_{Aeq} criteria. However, it is noted, as with Charleston House that the plant is not likely to remain in a fixed position and will move further away from the receptor location. It is also likely that the works in close proximity to the haul route may already be complete, and that further working will occur behind the amphitheatre to the south, using the land massing as an effective barrier.

The impact is likely to be short term relating to construction only without any longer-term operational impact or effects.

8.1.3 3-4 Buck Barn Cottages – Haul Route Assessment.

Aside from stationary plant, Table 12 details that there is likely to be a minor impact in Heavy Goods Vehicles passing along the haul route to the South of Buck Barn Cottages. The impact is predicted to be 1.7dB below the MPS2+10 criteria but 1.3dB above the MPS2 fixed 55dB L_{Aeq}, criteria. The predictions made are as a result of using haul route calculations based on a worst case of 64 vehicle movements a day, which have been calculated as 6 per hour.

When considering BS5228:2014 methodology for establishing impacts, two principal methods are applied, the ABC method and the 5dB change method. The ABC method considers predicted sound levels above 65dB $L_{Aeq,12\ hour}$ as being significant, whereas the 5dB change method adds the predicted sound pressure level to the measured ambient sound level prior to construction, to determine if a 5dB change occurs. When the measured existing (pre-construction sound level of 51dB $L_{Aeq,3\ hour}$) is added to the predicted sound pressure level (56.3 dB L_{Aeq} at boundary), the combined sound power level is 57.6 dB L_{Aeq}, which is more than a 5dB change in the pre-construction sound levels. Using BS5228:2014 to consider the change in soundscape, using the ABC method it is considered to be acceptable and below 65dB $L_{Aeq,\ 12\ hour}$, yet using the 5dB(A) change methods, it is above the criterion stated. Notwithstanding this, the calculated vehicle passes are still significantly below criterion stated in BS5228:2014 for considering eligibility for noise insulation (75dB $L_{Aeq,\ 10\ hour}$).

Due to the volume of materials still to be imported to site and likely to pass the rear of numbers 1-4 Buck Barn Cottages until 2022-2023, the impact whilst protracted, still remains related to construction site movements and is short term in origin, ceasing in 2023.

When considering noise change it is relevant to consider how noise is perceived and what noise levels might actually mean. Figure 10 below from Bruel and Kjaer, 2001 shows that the smallest change we can hear is likely to be about 3dB.

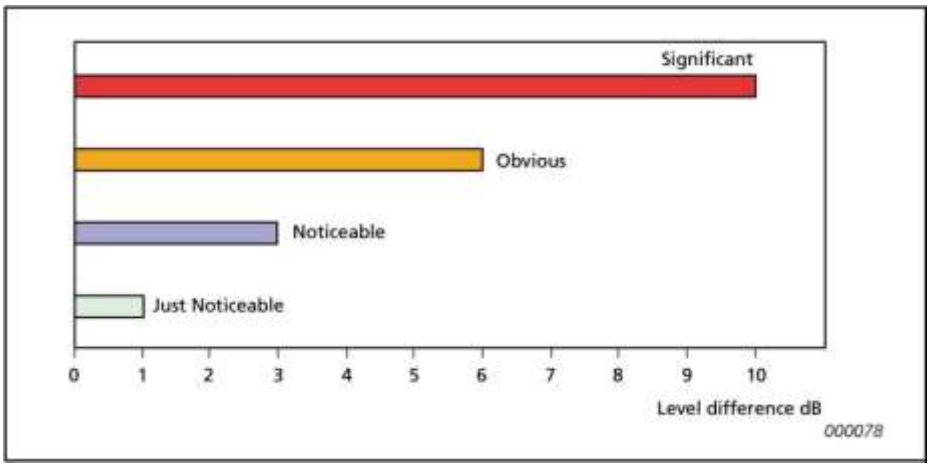


Figure 10. Extract from Bruel and Kjaer, 2001

BS4142:2014-A1:2019 also provides narrative on the subjective assessment of sound as follows; "*Response to sound can be subjective and is affected by many factors, both acoustic and non-acoustic. The significance of its impact, for example, can depend on such factors as the margin by which a sound exceeds the background sound level, its absolute level, time of day and change in the acoustic environment, as well as local attitudes to the source of the sound and the character of the neighbourhood" (BS4142:2014*).

It is relevant that in examining impact and magnitude, the EIA tools and guidance available are typically more focused towards evaluating longer term change and do necessarily cater for the assessment of shorter-term impacts.

8.1.4 Character and duration of Noise Levels

As stated above, the impacts from the presence of the two items of stationary plant are considered to be shorter term on the receptor locations.

However, the impact of the more protracted HGV passes which are likely to be encountered over a longer timescale until the completion of the project, still remain short term construction impacts.

9 Assessment of the Impacts

Given the requirement to consider the noise impacts stated above in an EIA context and as per the original scoping report, the convention of significance is applied, albeit in a different context to BS5228:2014 as discussed above. The EIA process seeks to determine significant events or impacts.

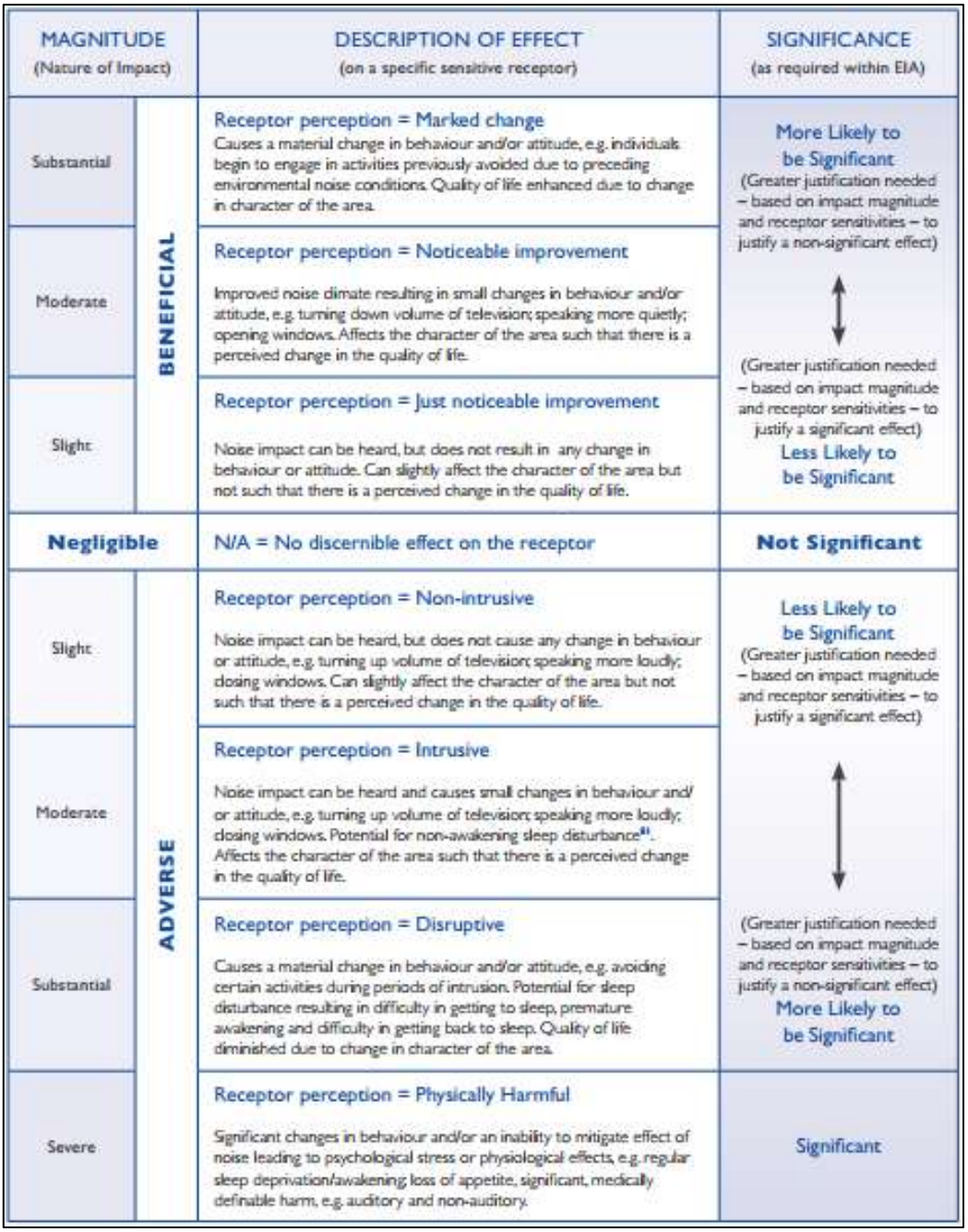
9.1 Consideration of residential receptors

In considering the impact on residential properties, it is relevant to determine aside from those impacted in the short-term construction stages, any properties that will be unlikely to benefit from the wider or overall scheme of landscaping and re-profiling works.

Whilst Charleston House has been identified in terms of a residential receptor for its proximity to the creation of the northern area of the Floodgate bund, it is relevant that Charleston House is outside of the estate boundary and will not benefit from the landscaping works. Similarly, the properties at 1-4 Buck Barn Cottages are also unlikely to benefit from the landscape enhancement features being proposed.

9.2 Effects

When considering the impact and significance, the application of the headings, **adverse**, **negligible** and **beneficial** are applied and are summarised easily in the following Figure 11 taken from IEMA, Guidelines for Environmental Noise Impact Assessment (2014):



MAGNITUDE (Nature of Impact)		DESCRIPTION OF EFFECT (on a specific sensitive receptor)	SIGNIFICANCE (as required within EIA)
Substantial	BENEFICIAL	Receptor perception = Marked change Causes a material change in behaviour and/or attitude, e.g. individuals begin to engage in activities previously avoided due to preceding environmental noise conditions. Quality of life enhanced due to change in character of the area.	More Likely to be Significant (Greater justification needed – based on impact magnitude and receptor sensitivities – to justify a non-significant effect)
Moderate	BENEFICIAL	Receptor perception = Noticeable improvement Improved noise climate resulting in small changes in behaviour and/or attitude, e.g. turning down volume of television; speaking more quietly; opening windows. Affects the character of the area such that there is a perceived change in the quality of life.	
Slight	BENEFICIAL	Receptor perception = Just noticeable improvement Noise impact can be heard, but does not result in any change in behaviour or attitude. Can slightly affect the character of the area but not such that there is a perceived change in the quality of life.	(Greater justification needed – based on impact magnitude and receptor sensitivities – to justify a significant effect) Less Likely to be Significant
Negligible		N/A = No discernible effect on the receptor	**Not Significant**
Slight	ADVERSE	Receptor perception = Non-intrusive Noise impact can be heard, but does not cause any change in behaviour or attitude, e.g. turning up volume of television; speaking more loudly; closing windows. Can slightly affect the character of the area but not such that there is a perceived change in the quality of life.	Less Likely to be Significant (Greater justification needed – based on impact magnitude and receptor sensitivities – to justify a significant effect)
Moderate	ADVERSE	Receptor perception = Intrusive Noise impact can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; closing windows. Potential for non-awakening sleep disturbance[81]. Affects the character of the area such that there is a perceived change in the quality of life.	
Substantial	ADVERSE	Receptor perception = Disruptive Causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in character of the area.	(Greater justification needed – based on impact magnitude and receptor sensitivities – to justify a non-significant effect) More Likely to be Significant
Severe	ADVERSE	Receptor perception = Physically Harmful Significant changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Significant

Figure 11. Effects Schematic taken from IEMA (2014)

Figure 11 refers primarily to the behaviour and quality of life of individuals in and around their homes. As per the convention of EIA principles, Figure 11 also incorporates that if either an adverse or beneficial impact are deemed likely, the further specific headings of substantial/major, moderate and minor categories are then included.

Figure 11 must not be considered in isolation and the following headings are also applicable to ensure that suitable context is applied to the assessment, given that this is a short-term construction project which seeks the continuation of landscaping and earthmoving. The further headings are:

9.2.1 Extent and Magnitude of the Impact

The proposed works are likely to be considered as permanent, albeit bringing an overall benefit to the wider Knepp Castle Estate. The considered impacts are only likely to arise from the short-term construction activities. Whilst the impacts relate to short term construction, it is however noted that the construction period (specifically, the importation of additional materials) is protracted over a number of years, concluding in 2023.

The creation of landscaping and re-profiling on the site has been carried out since approximately 2014. Approximately two thirds of the works have already been completed.

The operational effects of the proposed works have been assessed and are not likely to generate any concerns.

9.2.2 Duration of the Impact

The working day in terms of construction site hours at Knepp Castle Estate is governed by daylight and being able to carry out operations and activities safely. When daylight ceases, the construction works cease.

The site operators, Matthews, confirm that noisy working activities are only carried out between 08:00 to 18:00 hours at the latest for Monday to Friday with the occasional Saturday morning working (08:00-13:00 hours).

Matthews, the site contractors, have been operating at the site without any complaints since approximately February 2014.

The impact of the bund creation to the South of Charleston House is also considered to be temporary. The impacts are created by mobile plant predicted as operating close to the property boundary. This is unlikely to be permanent, as when the bund reaches the required profile, the plant will move further South and away from Charleston House with diminishing impact. The creation of the bund itself is also likely to act as a natural earth barrier to the plant operating by extending the path difference and reducing any line of sight to the receptor location.

The creation of the earth bund in close proximity to Floodgate Farm and its mixture of units is likely to impact different receptors as it travels South. Again, the impact is considered to be temporary and capable of being mitigated against.

The passing of HGV's to import soil to site is also considered to be a short-term construction impact, with the final landforms providing a more parkland style vista to the KCE. However, whilst still temporary, the overall duration for HGV passes is likely to continue for a number of years, having a more protracted impact. Mitigation Measures may therefore be considered to the impacted receptors at Buck Barn Cottages.

9.2.3 Nature of the Impact

In assessing the nature of the impact, it is relevant to consider that the landscaping and re-profiling works are limited to the daytime only, so are unlikely to have any sleep impacts for the residential receptors. It is also appropriate to revisit the fact that the activities being assessed are only construction and earthmoving events which have a definitive end state in 2023. As previously discussed, the project seeks to obtain greater protection from the road traffic noise generated from the A24 and provide greater tranquillity to the Estate which will benefit the majority of the residential receptors.

9.2.4 Does the Impact Occur in Isolation - Residual Effects and Cumulative Effects?

The work phases on the Knepp Castle Estate are each separate and will be carried out in isolation.

It is relevant and a requirement of EIA assessment to consider the impact of cumulative effects, i.e. where more than one development may be occurring in close proximity and the overall impact needs to be closely assessed.

The Knepp Castle Estate is relatively isolated, with the application areas being bordered by roads to the North (A272), the East (A24), the West (Pound Lane) and Swallows Lane to the South with the River Adur providing an additional natural boundary.

The site activities currently permitted by the local planning authority are merely improvements to the site which seek to improve the quality of life for those residents on the Eastern boundary who are likely to be adversely impacted by road traffic noise. The re-profiling of the site and the creation of two new permanent access roads are not likely to contribute any adverse characteristics to the site, merely an improvement in terms of quality of life, and improved parkland and vistas. The two new access roads are a big improvement in terms of highway safety from the arrangements currently in place.

To ensure cumulative impacts were fully considered, Horsham District Council were previously contacted to discern other major projects in close proximity. None were identified that would provide any cumulative effects for the current proposals.

9.2.5 Sensitivity of the receptors

The receptors are effectively Buck Barn Cottages and Charleston House, both of which are considered to be normal residential receptors and not high risk or unduly sensitive to noise. An example of a highly sensitive receptor might include hospitals, day-care, convalescing or housing for the elderly in close proximity to a demolition site.

9.3 Summary of main effects on Receptors

- **Charleston House**

Without any construction site activities happening, Charleston House due to the close proximity to the A24 will already experience relatively high levels of road traffic noise from the adjacent carriageways.

Whilst identified as a residential receptor likely to be impacted by only the creation of the bund, the works are temporary in nature, and are unlikely to be continuous and will diminish with distance from the mobile plant.

The operational noise impact of vehicles using the permanent access route has also been considered for Charleston House with the resulting impact as well below previously measured ambient sound levels.

- **1-4 Buck Barn Cottages**

Buck Barn Cottages have been assessed as being impacted by two particular work streams, with these being both the operation of stationary plant in close proximity to the rear haul route, and additionally, the use of the haul route to bring in an additional 250,000m^3 of imported materials to complete the parkland vistas. Both of which are temporary in nature, however, the haul route is likely to be more protracted over a number of years and is likely to warrant mitigation measures.

The operational noise impact of vehicles using the permanent access route has also been considered for 1-4 Buck Barn Cottages with the resulting impact as well below previously measured ambient sound levels.

9.4 General

EIA is concerned with assessing change in noise levels, typically in the longer term and as a result of introducing a new element, i.e. a new housing estate, a new business into an area or larger planning projects. Reporting the change in soundscape is ultimately to promote good judgement and inform decision makers.

It is however difficult to articulate short term noise change likely to be experienced for a limited period of time using EIA methodologies and tools. Whilst IEMA (2014) provides useful guidance on noise impact assessments and “effect descriptors”, these again relate to long term noise change and struggle to attribute short term noise change to effect descriptors. Appropriate British Standards and relevant guidance have been used to ensure quantification of any impacts and making the predictions as accurate as possible.

Where there remain operational effects such as the use of the two new permanent access routes as well the use of the new car park location, these have been demonstrated as not likely to contribute to the site soundscape.

DMRB (2011) also provides some guidance on short term change in noise levels, albeit related to road traffic noise and uses the metric of $L_{A10,18\ hours}$ as per Figure 12 below.

Short term magnitude	Short term noise change (dB $L_{A10,18hr}$ or L_{night})
Major	Greater than or equal to 5.0
Moderate	3.0 to 4.9
Minor	1.0 to 2.9
Negligible	less than 1.0

Figure 12. Table 3.54a extracted from DMRB,2019 (LA111)

Whilst the change in sound levels associated with Charleston House (10.9 dB(A)) as a short-term measure is deemed via DMRB to be a major change, it is relevant to consider that the sound is generated as a result of construction site plant operating in close proximity and is not a continuous noise source, which will diminish with distance and as the bund height is created. Similarly, the predicted increase in soundscape as a result of the haul routes also remains a temporary construction impact and is not continuous.

The overall Knepp Castle Estate project will provide greater tranquillity for the estate, and a likely reduction in noise levels for those living on the estate which will be beneficial, and as such less likely to be significant.

However, the process of achieving the landscaping and earthmoving as a result of construction site activities are likely to fall temporarily into a slight adverse effect, which is not likely to be significant. The use of focused mitigation measures and the application of Best Practicable Means (BPM) will also seek to restrict the overall impact of the remaining works to be carried out. Figure 13 below shows both the short term and overall impact of the works at KCE in context with the earlier effect's schematic seen in Figure 11.

There are no significant effects as a result of the continued works at the KCE.

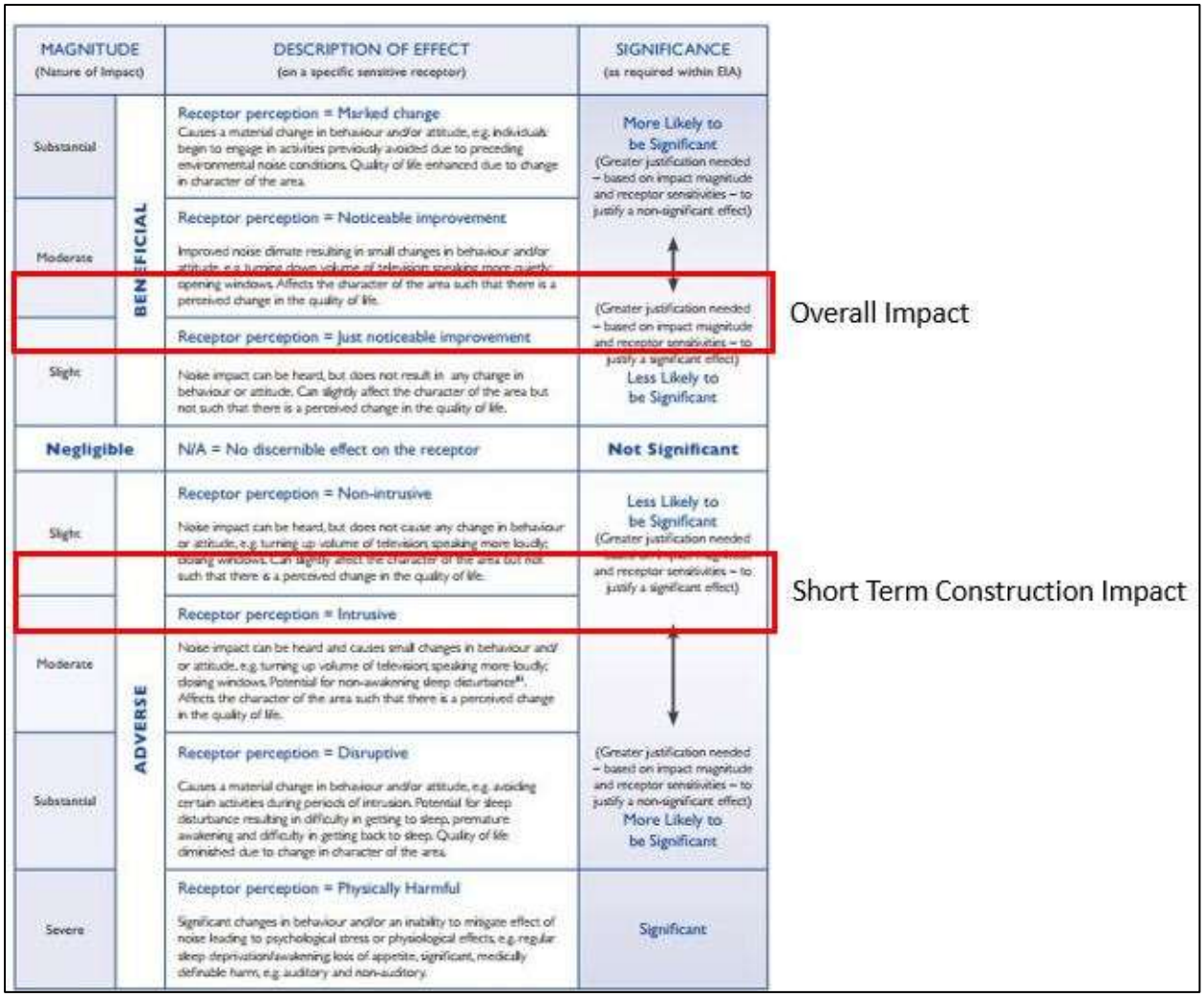


Figure 13. Likely Effects Table annotated to provide site context

10 Mitigation Measures

The noise impact assessment process identifies those receptors likely to be impacted as a result of specific activities and when. Accordingly, focused mitigation measures and resources may be implemented to reduce the impact on the residential receptors.

The following mitigation measures are relevant to the site and were presented in the original scoping report, although it is noted that the applicable works are now more directed towards the South East of the Knepp Castle Estate;

- Setting of constraints for “noisy” construction hours
- Limits on timings for delivery vehicles

- Use of “just in time” delivery methods, whereby the contractor’s delivery vehicles are timed to arrive at the site in a controlled manner ensuring a smooth flow and no queuing or bottlenecks of vehicles at site entrances or junctions.

- Haul routes should continue as close as possible to the point of final deposition of the materials.

- Selection of inherently quiet plant during the tendering and contracts process.

- No idling of plant and plant to be shut down when not in use

- Plant to be well maintained and inspected as well as being regularly serviced to ensure that all relevant fixtures and fittings remain in good working order

- Plant to contain any mufflers or silencers as appropriate to ensure that the noise limit and noise marking requirements prescribed by the Noise Emission in the Environment by Equipment For Use Outdoors Regulation 2001 implementing the EU directives 2001/14/EC

- Planning condition 15 of WSCC/073/15/SP already requires that vehicles attending and operating on the site only use a white noise or broadband reversing alarm signal as opposed to a single tone alarm.

- Where plant exhibits noisy characteristics or directional noise, consideration may be given to temporary acoustic fences or barriers in close proximity to the source

- Any plant to be located in such a position, or orientation that any directional noise is away from residential receptors

- Plant and any welfare facilities to be located well away from residents’ properties

- Construction plant will not be permanently located in one position.

- Toolbox talks will be delivered to site staff on the importance of noise and being courteous contractors.

- Residents to be kept appraised of project timescales and be provided with local contact details should they wish to make contact with the contractors.

- Vehicle speeds limits will be applied to all site haul roads

- The use of bunds, hoarding or barriers.

More focused interventions or mitigation measures might include the following:

- It is strongly recommended that the previous bund located to the South of 1-4 Buck Barn Bungalows is reinstated to provide a degree of protection to the residents. The bund should seek to match in height the existing bund which runs North to South at the Western end of Buck Barn Bungalows. The bund would provide a conservative 5dB loss in predicted sound levels, reducing the noise impact of the importation of soils to only marginally above the existing measured ambient noise levels (51 dB $L_{Aeq,\ 3\ hour}$) from the A24/A272.

- Regular examination of the haul route being used to ensure good surface conditions. The filling of potholes and uneven surfaces when identified will assist in reducing the clatter and rattle from passing vehicles.

- Regular examination and servicing of all mobile plant on site including an examination of any mufflers, silencers or measures intended to minimise noise emissions

- Information being provided to residents, farms and businesses in respect of phasing of works, what is likely to occur and when and importantly, for how long. This serves to manage expectations and will be of particular relevance to the Floodgate complex.

- No idling of mobile plant to be permitted. When plant is not in use, it should be switched off.

- Where imported soils are used solely for the Floodgates bund, it may be preferable to have the HGV's arrive via the Southern A24 access to the estate rather than the A272 Northern Access as this is more direct.

- When commencing work at the Floodgates Bund, consideration should be given to commencing works at the Northern end closest to Charleston House to ensure that the mobile plant moves away from the receptor rather than increasingly towards the property.

11 Conclusion and Summary

The process of Environmental Impact Assessment seeks to ensure that decision makers have all of the relevant information and that the impacts of any scheme are very carefully considered to determine who they might impact, when and to quantity the scale of the impact.

The methodologies and tools associated with the EIA process are typically applied to consider longer term change and more specifically, the change in soundscape. Whilst the EIA process has been applied, contextually, the works under consideration are an extension of works which have been taking place on the Knepp Castle Estate since February 2014.

The overall works are to implement bunds parallel to the A24 creating greater landscaping on the site, greater tranquillity and a more enclosed parkland or estate. The creation of an amphitheatre, a new car park and the operational effects of two new access routes have all been assessed.

To ensure a robust approach, the original noise measurements undertaken in December 2017 around the site have been used and the impact of the proposed works has been determined using noise modelling and prediction software as well as accepted haul route calculations in BS5228:2014.

In carrying out the remainder of the works to complete the site, there are likely to be time limited and temporary impacts to two groups of residential receptors, both outside of the Knepp Castle Estate. The use of good site management, as well as focused mitigation measures will ensure that where practicable, the noise impact on residential receptors is kept to a minimum.

Based on the assessment carried out, there are no significant impacts which cannot be mitigated against.

12 Appendix A- Photographs of Measurement Locations

Figure 14. Sound Level Meter located south of 3 Buck Barn Cottages

Figure 15. Sound Level Meter in between Sunnyhill and Waterloo Cottages to the East of the A24.

Figure 16. Sound Level Meter at Trollards Barn, South West of Knepp Mill Pond

Figure 17. Sound Level Meter located North of Floodgates Farm

Figure 18. Sound Level Meter to rear of Charleston House.