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ROCK COMMON QUARRY

The Hollow, Washington RH20 3DA

PLANNING AND ENVIRONMENTAL STATEMENT
VOLUME 2
PART 2

ENVIRONMENTAL REPORTS AND IMPACT ASSESSMENTS

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APPENDIX C

Ecological Impact Assessment

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Ecological Impact Assessment

Rock Common Quarry

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Report Summary

1. Dudman Rock Common Ltd instructed the Ecology Co-op to undertake an Ecological Impact Assessment of a proposed variation from the approved restoration scheme at Rock Common Quarry. An Environmental Impact Assessment (EIA) scoping assessment prepared by Terrestria Ltd in 2019 identified the need for a suite of baseline ecological surveys at the site to inform the design and impact assessments for a proposed new restoration scheme involving the importation of inert classified engineering material over an eight year period, to create a restored landform suitable for low-key recreation activities and to enhance biodiversity.

2. Baseline ecological surveys were undertaken by The Ecology Co-op between April and October 2020. This document presents the findings of these surveys and an Ecological Impact Assessment (EcIA) in accordance with CIEEM Guidelines to inform the EIA process.

3. The application area comprises three separate areas totalling 33.64 hectares. This comprises (1) the existing main quarry pit, a working sand quarry, (2) the existing sand processing yard and (3) the area of the proposed new material reception area. The quarry has been active since the 1920s, supporting highly dynamic habitats dominated by bare sandy ground, ephemeral vegetation, and exposed sand cliffs. In less disturbed areas, there is developing scattered scrub, secondary woodland, and several waterbodies. The site lies within a rural farming landscape with the South Downs National Park boundary some 50m to the south (at the closest point) and the village of Washington some 350m to the south-west.

4. The surveys revealed a breeding bird assemblage largely comprising common and widespread species but also including the notable species peregrine falcon and a breeding colony of sand martin, presence of common dormice and reptiles, a rich and diverse terrestrial invertebrate assemblage including a range of solitary bees and wasps associated with sandy ground, and an active badger sett. The invasive non-native species New Zealand pigmyweed and false acacia were recorded on the site together with marsh frog.

5. A range of mitigation measures specific to the proposed restoration scheme are outlined in this document that provide assurances of how protected and notable species or habitats will be either protected through the establishment phase of the restoration scheme, or appropriate replacement habitats or features would be created to produce either positive impacts for biodiversity, or ensure any negative effects are minimised.

6. To ensure that the establishment phase of the proposed restoration scheme and future management of the site is carried out successfully, a Construction Environmental Management Plan (CEMP) and Landscape and Ecology Management Plan (LEMP) can be conditioned to planning permission and secured by West Sussex Council through reserved matters.

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1 INTRODUCTION

1.1 Background

Rock Common Quarry is located to the south of a small unclassified road known as "The Hollow" near the village of Washington, West Sussex within the district of Horsham. The central grid reference for the site is TQ12571360 and the postcode for the site is RH20 3DA. The A283 (Shoreham to Milford) passes close to the southern boundary, and the A24 (Worthing to Dorking Road) passes close to the western boundary. Figure 1 below illustrates the location of the quarry and the landform within it.

The processing plant lies to the north of The Hollow, served by a conveyor that passes through a culvert from the quarry pit under the road. On the east and north side of the quarry there are three former landfill sites known as The Windmill, The Rock and The Rough that have historically been infilled with municipal waste. These have now been closed and reinstated, although subject to ongoing monitoring of gas, leachate and groundwater emissions. Honeybridge Stream flows north around the western boundary of the quarry pit and groundwater is pumped continually from the quarry (dewatering) and discharged into the stream.

The sand quarry has been active since the 1920s and has been subject to a number of planning permissions since the 1950s. It is now working under a permission granted in 2004 under the provisions of the Environment Act 1995 requiring a review of old mining permissions. Under this existing permission, the restoration scheme (hereafter referred to as the 'approved restoration scheme') is to create a single large, deep body of water within the final excavated quarry void together with grading and landscaping of the margins "to be managed for amenity and nature conservation use" (see Figure 2). This would result in an estimated maximum water depth of 30m (40m AOD). The lake would be created by cessation of the existing dewatering pumps during the quarry operation, and allowing natural groundwater levels to recover.

However, the creation of a waterbody of this magnitude is not now acceptable for several reasons. Firstly, the large deep waterbody with steep underwater slopes represents a significant safety hazard. Secondly, there are complex issues with the permitted restoration plan related to the potential interaction of ground water with the adjacent landfill site (see the separate Hydrogeological Report). Finally, the applicant has sought to establish a restoration proposal that would provide greater value for biodiversity and future amenity use of the site.

The proposed solution is to submit a new application to permit the infilling of the quarry pit with suitable imported inert classified materials in order to create a dry restored landform above the natural groundwater level (hereafter referred to as the 'proposed (landform) restoration scheme'. The restored site will be landscaped with areas of shallow water sealed from the groundwater, suitable for low-key recreation activity and habitats created to encourage biodiversity (See Figure 3).

It should be noted that the existing permission for the extraction of sand expires on 31st December 2020. The proposed application will therefore also seek to include continued extraction of the remaining sand reserves and continued use of the existing processing plant operations.

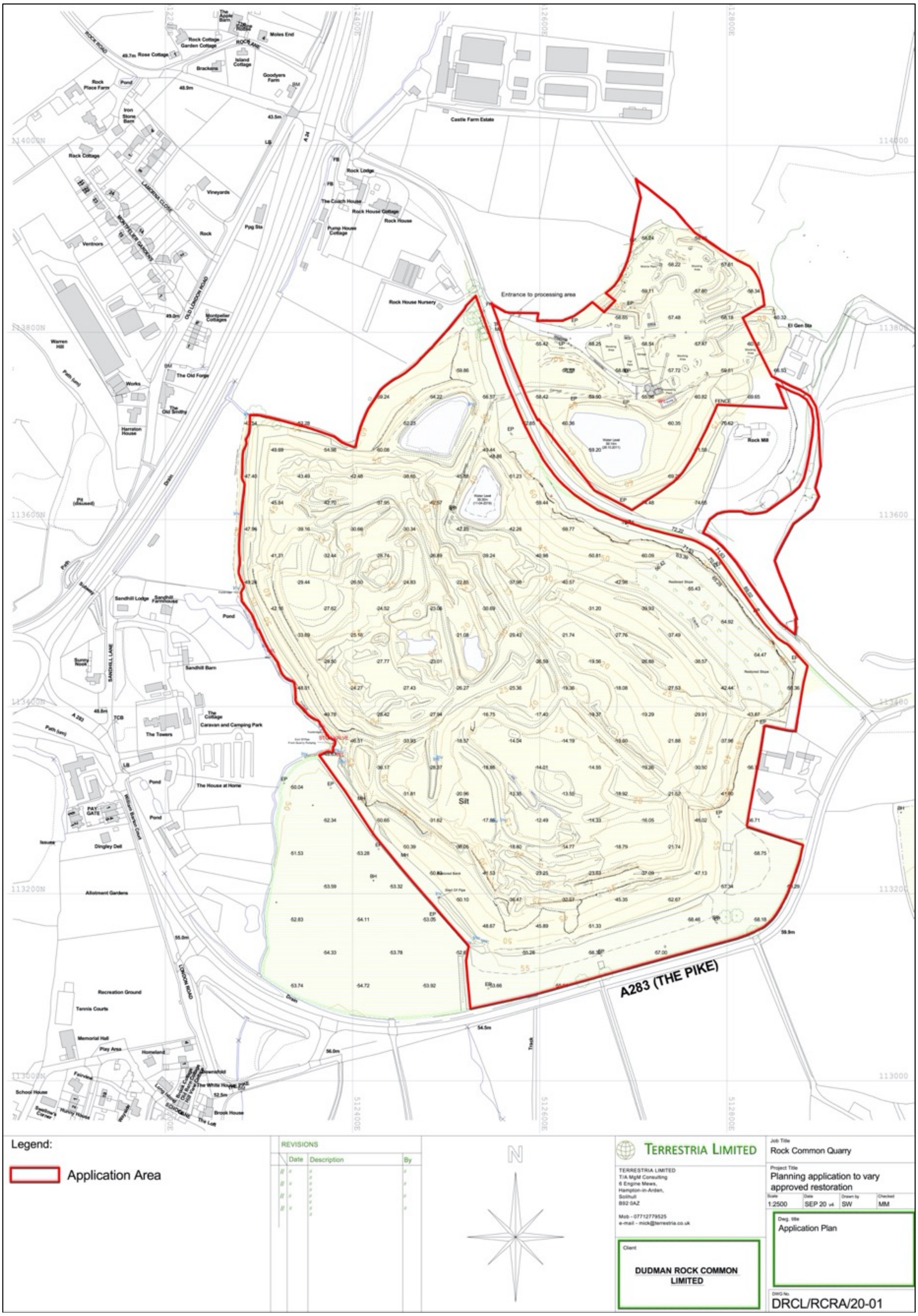

Figure 1. The location of the site, with the site boundary outlined in red. Image produced courtesy of Terrestria Limited.

Figure 2. Layout of the Approved Restoration Scheme. Image reproduced from Concept Restoration Plan, Tarmac Ltd Dated January 2004.

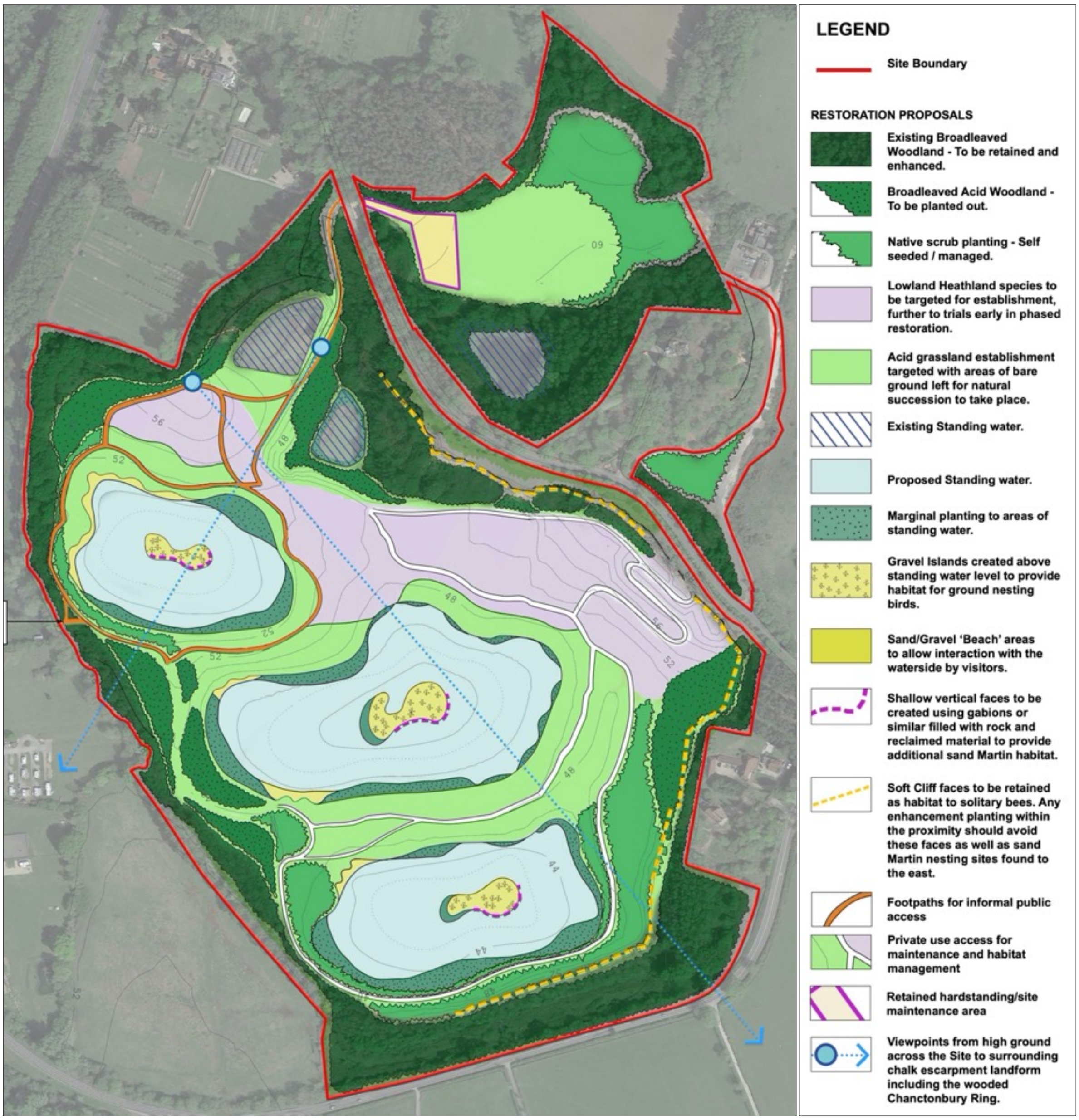

Figure 3. Layout of the Proposed Restoration Scheme. Image reproduced from Rock Common Quarry Landscape Masterplan Strategy, with permission from Lizard Landscape Design and Ecology, Reference LLD1955-LAN-DWG-001, Rev. 03, dated 22nd December 2020.

1.2 Purpose of this Report

The Town and Country (Environmental Impact Assessment) Regulations 2017 (as amended) requires that an Environmental Impact Assessment (EIA) must be undertaken for quarries that exceed 25 Hectares in surface area. As such, a screening opinion has been sought by the quarry operator Dudman Rock Common Ltd. from West Sussex County Council. The Environmental Impact Assessment Scoping Report[1] submitted in support of this request includes an Extended Phase 1 Habitat Survey Report[2]. The following surveys were recommended to inform the EIA:

[1] Terrestria Ltd. (2019) Environmental Impact Scoping Report, Rock Common Quarry, prepared on behalf of Dudman Rock Common Ltd.
[2] Your Environment (2015) Extended Phase 1 Habitat Survey – Rock Common Quarry, The Hollow, Nr Washington, West Sussex RH20 3DA.

- Breeding bird surveys (walked transects)
- Bat activity surveys (walked transects and static detectors)
- Bat emergence (buildings as appropriate)
- Badger walkover survey (presence/likely absence of setts)
- Dormouse survey (presence/likely absence)
- Common reptile survey (presence/likely absence)
- Great crested newt (presence absence in suitable ponds within 500m).
  Vegetation/habitats survey

These surveys were undertaken by the Ecology Co-op between April and October 2020, supplemented by a botanical survey and assessment of terrestrial invertebrates. The purpose of this document is to:

1. Present the findings of these surveys (the existing ‘baseline ecological information’);
2. Identify and evaluate the most ecologically important features present on the existing active quarry site and processing area, and within the zone of influence of the restoration schemes;
3. Describe the likely effects of both restoration options, by determining the significance of impacts upon existing ecologically important features and forming a comparison between the likely impacts of the approved restoration (lake) *versus* the proposed landform restoration (infilling);
4. Set out the proposed impact avoidance, mitigation, compensation measures that will be undertaken to reduce these impacts to an acceptable level;
5. Outline the habitat creation and enhancement measures that will be put into place during the proposed landform restoration. These seek to ensure that the proposed development contributes to both local and national biodiversity objectives as well as protect and enhance the existing ecological features wherever possible.
6. Finally, to provide an objective comparison of the overall ecological effects of each restoration option in terms of negative and positive residual impact and net biodiversity loss or gain.

This report is intended to be submitted as part of the planning application for the new restoration scheme and allow West Sussex County Council make an informed determination.

The surveys and report were carried out and produced at the request of Dudman Rock Common Ltd. and supervised by Paul Whitby BSc, full member of the Chartered Institute of Ecology and Environmental Management (CIEEM) and Charted Ecologist (CEcol).

1.3 Policy and Legislation

Legal protection applying to relevant bird, mammal, herpetofauna and invertebrate species and current nature conservation planning policy is outlined in Appendix 1 of this report.

Where possible, this report provides information on how the development proposal will be designed to meet the requirements of both the National Planning Policy Framework (NPPF) and local planning policy. Details of the NPPF and relevant local planning policy is provided in Appendix 1.

2 SURVEY METHODOLOGY

The following sections describe the methods used in the desk study and protected species/habitat survey(s) to establish the baseline ecological condition of the site. All survey methods are in accordance with current best practice guidance for the respective species/taxonomic group and any limitations encountered during the survey are explained in Section 2.13.

This document is written in accordance with the CIEEM Guidelines for Ecological Impact Assessment[3] and CIEEM Guidelines for Ecological Report Writing[4] Details of the ecological assessment methods are provided within Section 2.12 below.

2.1 Phase 1 Habitat Survey

An updated site walkover survey was undertaken on 16th April 2020 to identify and record any changes in habitats since the completion of the Phase 1 Habitat Survey in 2015[1], during which the habitats contained within the site were described and evaluated in accordance with standard Phase 1 Habitat Survey methodology[5].

2.2 Detailed Botanical Assessment

As an extension to the Phase 1 Habitat Survey, a detailed botanical survey was undertaken on 22nd May 2020 to provide a more detailed assessment of the ephemeral habitats on site and identify any rare or invasive species. The walkover survey was undertaken by Paul Whitby, assisted by Kate Lewis and Briony Hill. Botanical observations were also noted during all other ecological survey visits throughout 2020.

2.3 Badgers

Badgers tend to live in family groups with clearly defined territories with the main sett, used throughout the year, as a focal point. The territory often also contains a number of ‘annex’, ‘subsidiary’ and outlier setts that are used intermittently. Badgers can exist in a variety of habitats, but a mixed farmland landscape containing pasture and arable land, studded with woodland, scrub and hedgerows support the highest population density.

Evidence of badger activity was initially recorded during the initial Phase 1 habitat in 2015. No general walkover surveys for badgers were undertaken in 2020, but any signs of badger activity (e.g. setts, footprints, foraging marks) encountered during other survey visits were reported.

All known badger setts identified in 2015 were subject to on-going monitoring to determine the type of sett and current occupation by badgers.

[3] CIEEM (2018) *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine*. Chartered Institute of Ecology and Environmental Management, Winchester.
[4] CIEEM (2017) *Guidelines for Ecological Report Writing, 2nd edition.* Chartered Institute of Ecology and Environmental Management, Winchester.
[5] JNCC (2010) *Handbook for Phase 1 habitat survey: A technique for environmental audit.* Joint Nature Conservation Committee, Peterborough.

2.4 Bats

There are 18 species of bat resident in the UK, each with their own specific habitat requirements. Bats can use a wide range of features for roosting purposes including loft spaces, cavity walls, loose tiles, mortice joints and cracks/gaps in a variety of built structures. They can also be found in trees with holes, splits, cracks, cavities, ivy and loose bark. Bats are generally active at night and utilise a wide range of habitats for foraging and commuting between roost sites, hibernation sites and foraging habitats. Linear features such as hedgerows, woodland edges, even fences can be important for navigation between roosting and foraging habitats.

2.4.1 Natural Roost Features – Trees

Mature and semi-mature trees and groups of trees contained within the site were generally assessed for their suitability to support roosting bats. Features of interest include woodpecker holes, loose bark, cracks and splits in limbs, hollows and cavities.

Further surveys to assess individual trees including ground based visual inspection and climbing inspections are recommended as appropriate.

2.4.2 Emergence/Re-entry Surveys

The initial Phase 1 assessment[2] identified two buildings within the site with low potential to support roosting bats, both of which are within the processing plant to the north of The Hollow: '*TN2 supported pan-tiles which were not fully sealed with mortar and TN4 had damaged barge boards on the northern side which could provide suitable crevices for low numbers of roosting bats. The remaining buildings on the site had negligible potential to support roosting bats owing to lack of roosting opportunities and sub-optimal thermal conditions*.'[2] A repeat assessment of the buildings, carried out by The Ecology Co-op in April 2020 confirmed that the findings of the initial phase 1 still hold true.

In accordance with survey findings and best practice guidance, two emergence/re-entry surveys were recommended for TN4, whilst one survey was recommended for TN2. These surveys were undertaken in 2020 on the 5th May and 17th June. The surveys were carried out in accordance with the best practice methodology set out by the Bat Conservation Trust[6].

The surveys focused on all features identified during the initial assessment as potential roosting sites or access points for bats, with surveyors positioned according to Figure 4. From these locations, surveyors could see all features potentially suitable for roosting bats that were identified during the initial bat scoping survey. Surveyors were positioned to start surveillance at approximately 30 minutes before sunset and continued until at least one and a half hours after sunset and up to 2 hours depending on the level of activity.

The surveyors recorded any bat activity on or around the potential roosting entry/exit features. All surveys were undertaken during weather conditions suitable for bat activity and at ambient temperatures above 10°C. The surveyors recorded bat activity using 'Echo Meter Touch' bat detectors

[6] Collins, J.(ed.) (2016) *Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn).* The Bat Conservation Trust, London.

featuring auto-identification of bat species and automatically triggered recording for later review.

Figure 4. The locations of surveyors (red dot) and the night vision camera (blue dot) during the emergence surveys 5th May (TN4 only) and 17th June (TN2 & TN4).

2.4.3 Bat Activity Surveys – Walked Transects

Bat activity surveys followed best practice guidelines[6]. Three activity surveys were completed in 2020, in which pre-determined transect routes were followed by five surveyors (Figure 5), focussing on all linear features within the site boundary (tree-lines, woodland edge and hedgerows). The transect routes were walked at a slow pace during the period from sunset to two hours after sunset by a team of surveyors. Each transect comprised three stopping points, evenly spread across the route, at which surveyors stopped for a total of five minutes.

All surveys were undertaken during weather conditions suitable for bat activity and at ambient temperatures above 10°C. The surveyors recorded bat activity using 'Echo Meter Touch' bat detectors featuring auto-identification of bat species and automatically triggered recording for later review. The locations of all bat 'registrations' was recorded onto a field map during the survey to correspond with all sound recordings. The surveys were led by Natural England Level 2 class bat licence holder Paul Whitby.

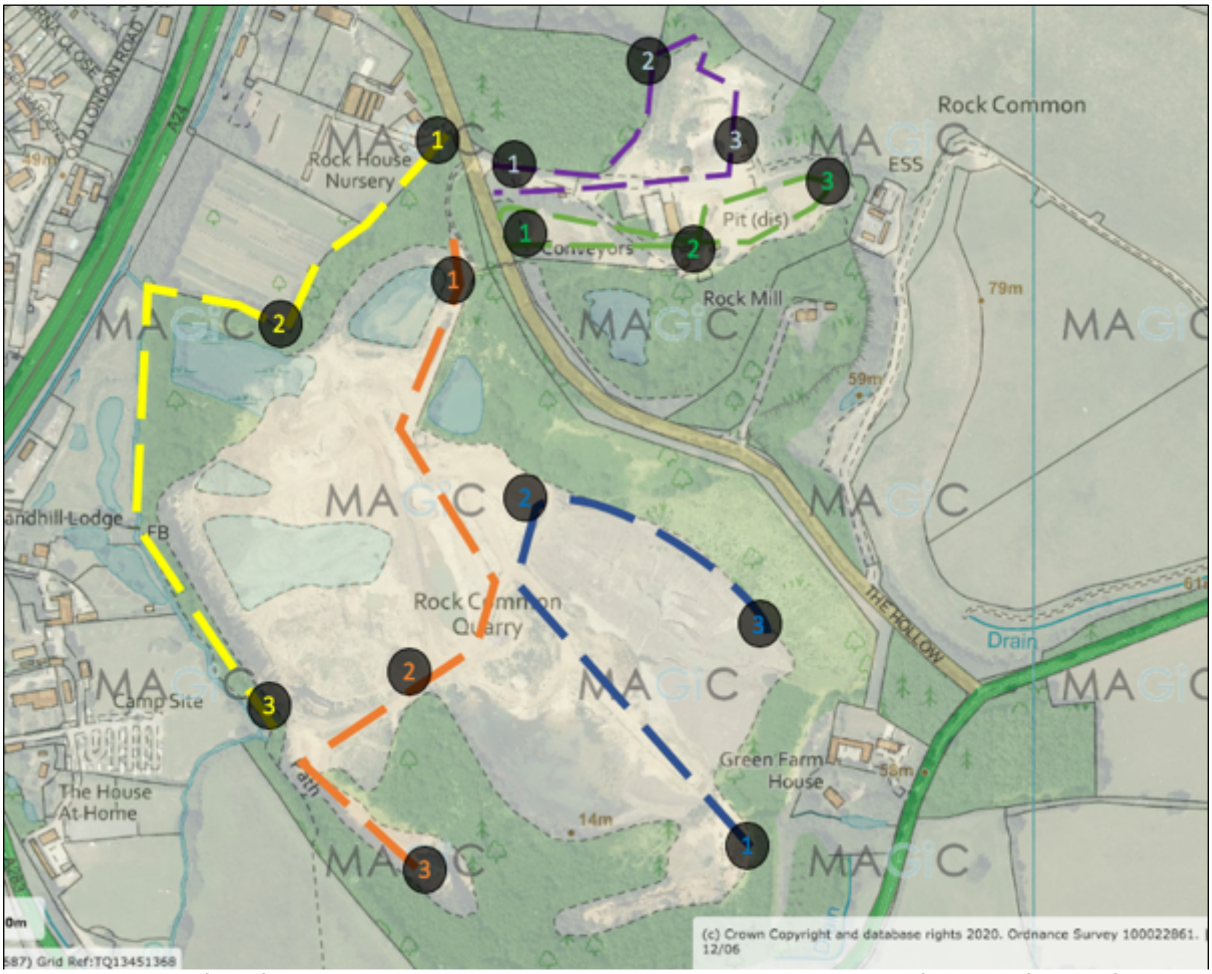

Figure 5. A map of the five transects walked during the bat activity surveys at Rock Common Quarry. Stopping points are marked by numbers. Image produced courtesy of Magic maps (http://www.magic.gov.uk/, contains public sector information licensed under the Open Government Licence v3.0).

2.4.4 Bat Activity Surveys – Automated Static Bat Detecting

Six Elekon Batlogger A+ static bat detectors were deployed on three occasions across the site (Figure 6), on 23rd April, 9th July and 3rd of September. The static detectors were left in the field for five days; the expected maximum lifetime of the battery. Static bat detectors comprise a passive recording device with real-time full-spectrum calls that can be viewed in detail once downloaded on analysis software, allowing accurate identification of most bat calls to species level (or genus level in the case of *Myotis* and *Plecotus* spp.).

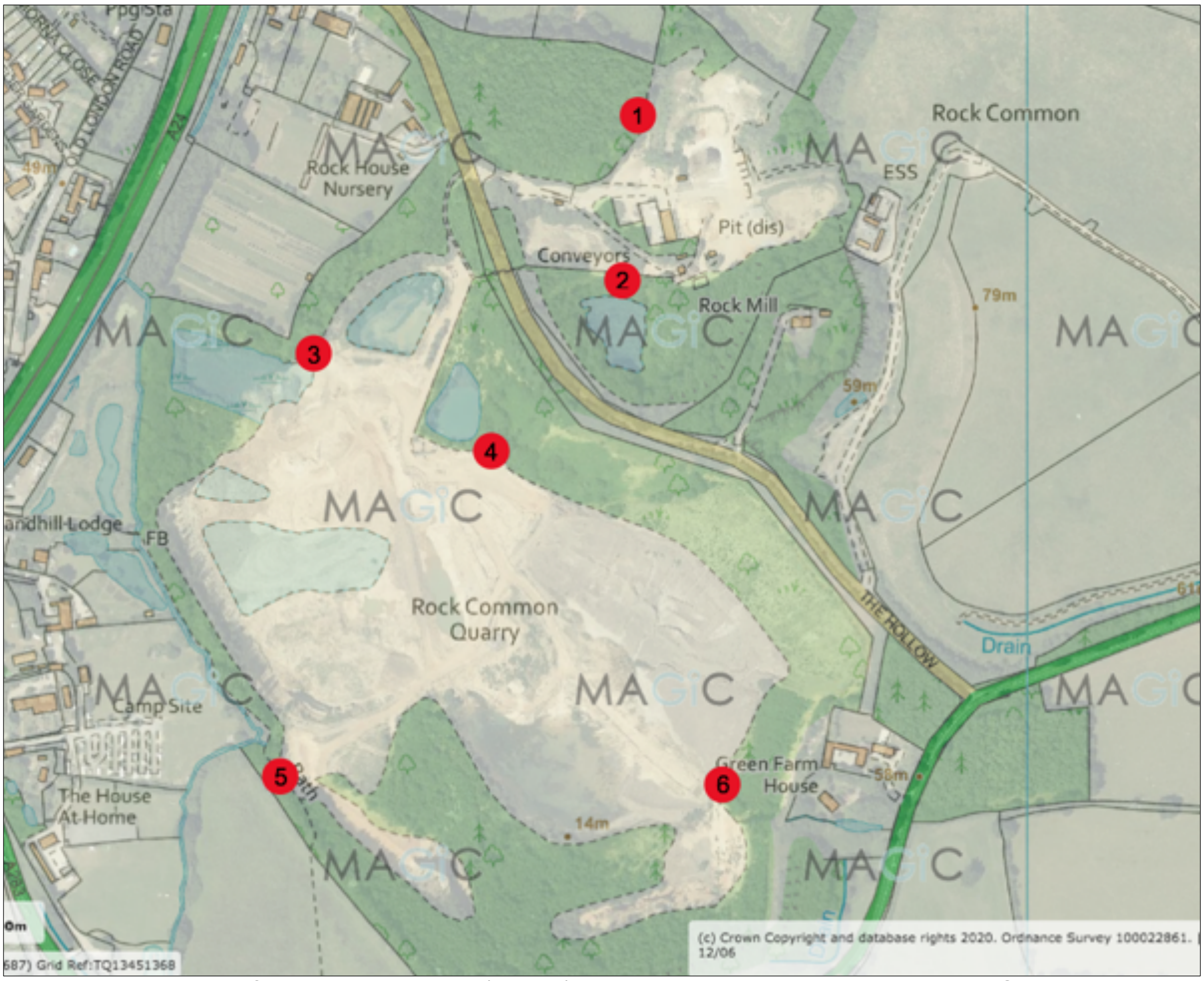

Figure 6. The location of six static bat loggers (red dot) deployed on 23rd April, 9th July and 3rd September. Image produced courtesy of Magic maps (http://www.magic.gov.uk/, contains public sector information licensed under the Open Government Licence v3.0).

The walked transect and static bat detector ('bat logger') survey methods complement each other with the transect surveys providing information on foraging and commuting patterns, and distribution across the site, and automated static detector surveys giving more prolonged coverage through consecutive nights, thus increasing the likelihood of detecting scarce species.

2.5 Breeding Birds

The method used for the breeding bird survey was adapted from the Breeding Bird Survey (BBS) methodology, designed by the British Trust for Ornithology (BTO)[7] as an accessible means of monitoring British bird population trends over the UK using volunteers and frequently adapted for EcIA. The original methodology requires two visits per season to be carried out over many seasons, allowing data sets to be built up. The number of visits has been increased to four for this survey to provide a more representative 'snapshot' of the bird assemblages present at the site during one survey season. The surveys visits were completed on the 17th April, 27th April, 22nd May and 5th June.

[7] https://www.bto.org/about-birds/birdtrends/2018/methods/breeding-bird-survey

A pre-determined transect focusing upon all the scrub, woodland and cliff faces within the site, was walked slowly on each visit. During this the observer recorded all birds encountered. As recommended in the BTO guidelines, all bird survey visits were carried out between 6am and 11am and were only undertaken during favourable weather conditions for bird activity, with periods of persistent or heavy rain, high winds or fog avoided. The transect route was walked at a constant slow pace by a competent bird observer, recording all birds detected either by sight or calls/song. The transect route was split into numbered sections and birds were counted within each of these sections. Notes regarding the behaviour of birds identified were made, to determine their breeding status. Birds were said to be ‘confirmed as breeding’ if they were observed carrying nesting material, food or faecal pellets; or nests, eggs, or recently fledged young were discovered. Birds were recorded as ‘likely breeding’ if observed singing or displaying, repeatedly visiting the same locations and showing agitated or distraction behaviour. Each bird ‘registration’ was recorded on a field map of the survey site using standard BTO Common Birds Census (CBC) notation, which includes behaviours and flight movements.

An additional survey visit was made at dusk to search for nightjars on 17th June 2020. Surveyors were also requested to report any nocturnal bird observations during the bat activity surveys.

In the UK, the conservation status of birds is recorded by the Royal Society for the Protection of Birds (RSPB) under a traffic-light system, with birds that regularly occur in the UK recorded as ‘green’, birds with an unfavourable conservation status recorded as ‘amber’ and birds that are globally threatened or showing severe decline in the UK as ‘red’[8].

[8] Eaton, M., Aebischer, N., Brown, A., Hearn, R., Lock, L., Musgrove, A., Noble, D., Stroud, D.,and Gregory, R. (2015) Birds of Conservation Concern 4: the population status of birds in the UK, Channel Islands and Isle of Man. British Birds 108. December 2015. 708–746

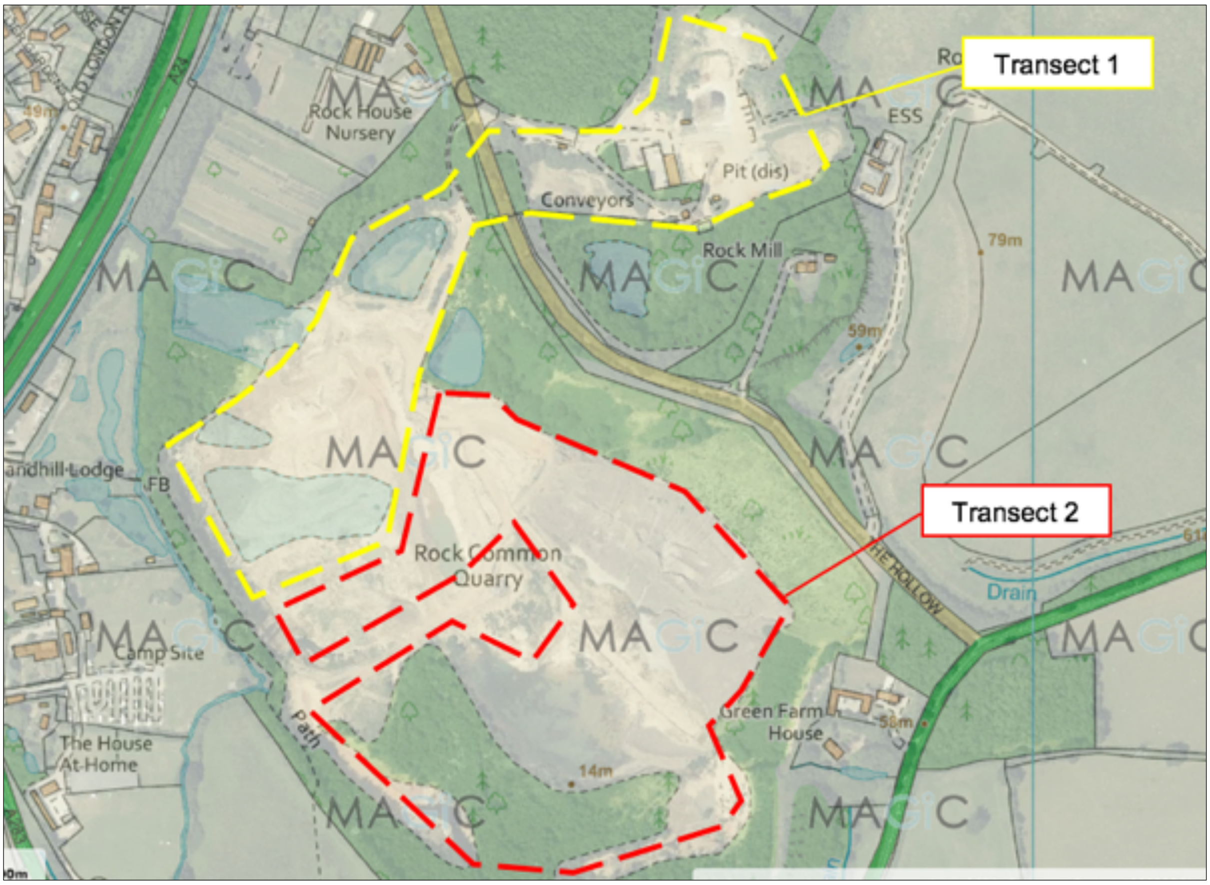

Figure 7. Walked breeding bird transects by two surveyors on 17th April, 27th April, 22nd May and 5th June. Image produced courtesy of Magic maps (http://www.magic.gov.uk/, contains public sector information licensed under the Open Government Licence v3.0).

2.6 Common Dormouse

Common dormice are typically associated with broadleaved woodland habitat, hedgerows and scrub. They tend to occur at low density and good habitat connectivity is important. Common dormice need a constant supply of food throughout the active season over a large home range. A diversity of tree and shrub species will provide a range of fruit, nuts and insects. They hibernate during the winter typically at ground level amongst leaf litter and mosses protected by coppice stools, tree stumps or piles of brash wood.

2.6.1 Nest Tube/Box Survey

Dormouse surveys are undertaken by attaching purpose built 'nest tubes' on trees and shrubs in suitable habitat such as woodland, scrub and hedgerows. Nest tubes are used by dormice as places of shelter and they will often construct their nests within them during their periods of activity (typically between April and November). In accordance with current best practice guidelines[9], 59 nest tubes were deployed approximately 20 m apart in woodland and hedgerows on 23[rd] April and left *in situ* for the survey season (see Figure 8). Surveys commenced 1 month after the nest-tubes were potisioned and checked on a monthly basis for presence of animals and evidence of dormice (distinctively woven nests)

[9] Bright, B., Morris, P., Mitchell-Jones, A.J. and Mitchell-Jones, T (1997) *The Dormouse Conservation Handbook*. English Nature.

from 19th May to 16th October 2020. Since the likelihood of use by dormice varies through the year, an index of probability score is used to determine confidence in a particular survey (see Table 1 below) comprising checks over several months. A minimum score of 21 is normally accepted to establish 'likely absence' in the event that no signs of dormice are found during the survey. Surveys were undertaken under the supervision of licenced surveyor Paul Whitby.

Table 1. Search effort score for each month that dormouse tubes are out on the site and subject to checks for occupation.

Month of check	Index of probability
April	1
May	4
June	2
July	2
August	5
September	7
October	2
November	2

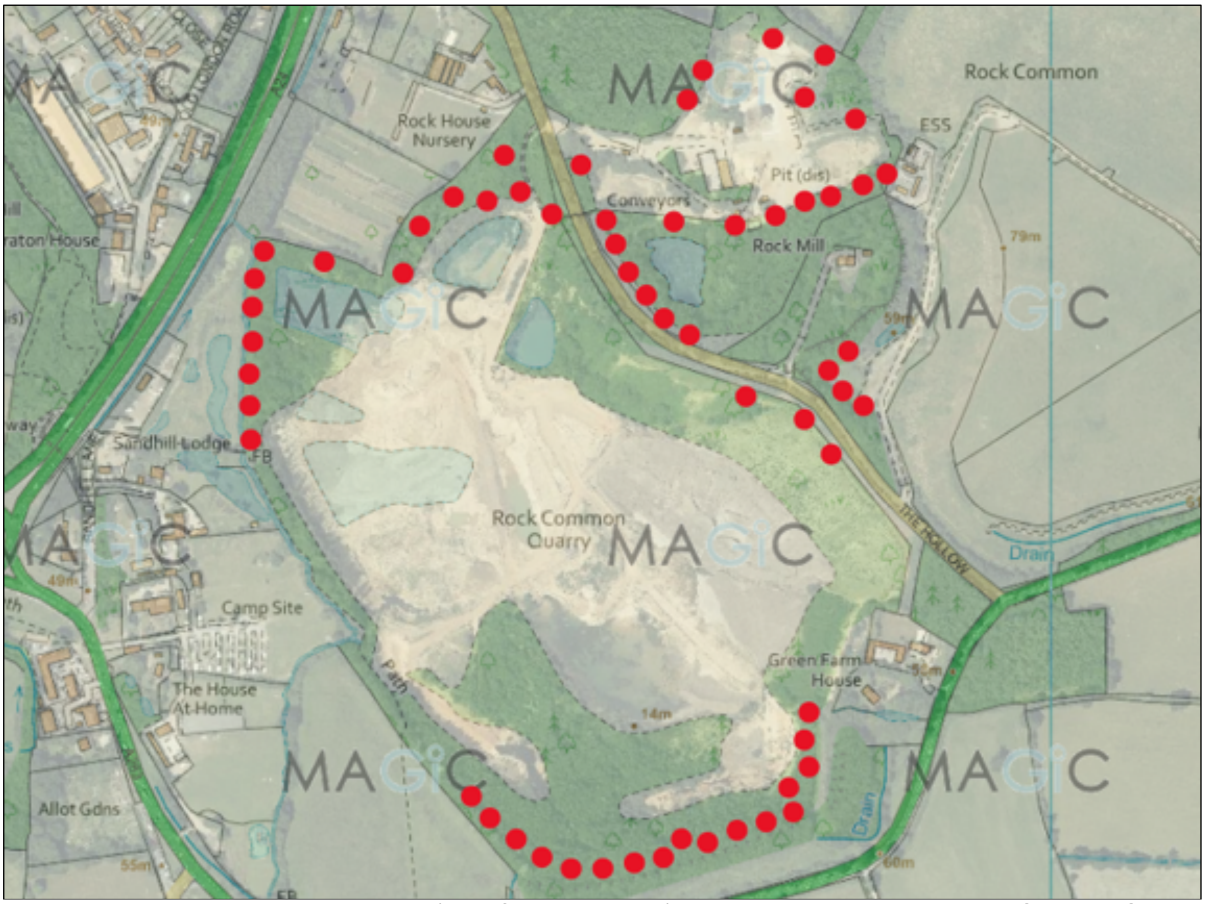

Figure 8. Dormouse nest tube locations (identified as red dots) across suitable habitat at Rock Common Quarry. Image produced courtesy of Magic maps (http://www.magic.gov.uk/, contains public sector information licensed under the Open Government Licence v3.0).

2.7 Great crested newts

Great crested newts require ponds for breeding that meet a series of habitat criteria including good quality water, aquatic plants and an absence of predatory fish. The ponds must have good connectivity to semi-natural terrestrial habitats that provide their invertebrate food sources and suitable safe places to rest and hibernate outside the breeding season. Great crested newts tend to occur more frequently in areas of high pond density across the landscape in 'metapopulations' where habitat occupancy ebbs and flows according to changes in conditions.

The HSI assessment was updated on the 16th April and environmental DNA (eDNA) samples were taken from all ponds that were assessed as average or above suitability and the samples sent for eDNA analysis. All ponds contained within the quarry site and up to a distance of 250m from the site boundary were subject to assessment, where accessible. Ponds that were separated from the site by a significant barriers to movement, inhibiting great crested newt travel, were excluded.

2.8 Reptiles

The common lizard *Zootoca vivipara*, slow-worm *Anguis fragilis* grass snake *Natrix helvetica* and adder *Vipera berus* are widespread species that can be found in many semi-natural habitats, such as rough grassland, scrub, heathland and open woodland where there is good vegetation cover, an abundance of invertebrate, amphibian or small mammal prey and areas of open ground for basking.

Standard reptile presence/likely absence surveys involve setting out artificial refugia (reptile 'mats' or 'tins') in potentially suitable habitat. Reptile mats are pieces of roofing bitumen felt or carpet and reptile tins are pieces of corrugated metal sheet, approximately 0.5 m x 0.5 m in size, which absorb heat from the sun more rapidly than the surrounding vegetation and provide cover and basking places attractive to reptiles. These are then checked for presence of animals under suitable weather conditions. They are placed in areas of potentially suitable habitat at an approximate density of 10 per ha, or 20m apart along linear features. There are no up-to-date best practice guidelines for reptile surveys, but a minimum of seven survey visits under suitable weather conditions is generally considered to be adequate when determining their presence/likely absence, and 15–20 visits are used to calculate a 'peak count' for population size class assessment.

A presence/absence survey was completed in 2020. During this a total of 58 refugia sheets/tins were used in this survey (see Figure 9). The mats were left *in situ* for a minimum of one week to 'bed in' and allow reptiles to locate them before the first check. The mats were checked at least seven times over the period 7th May to 29th September 2020 and all observations of reptiles were recorded, together with the weather conditions, temperature and time of day.

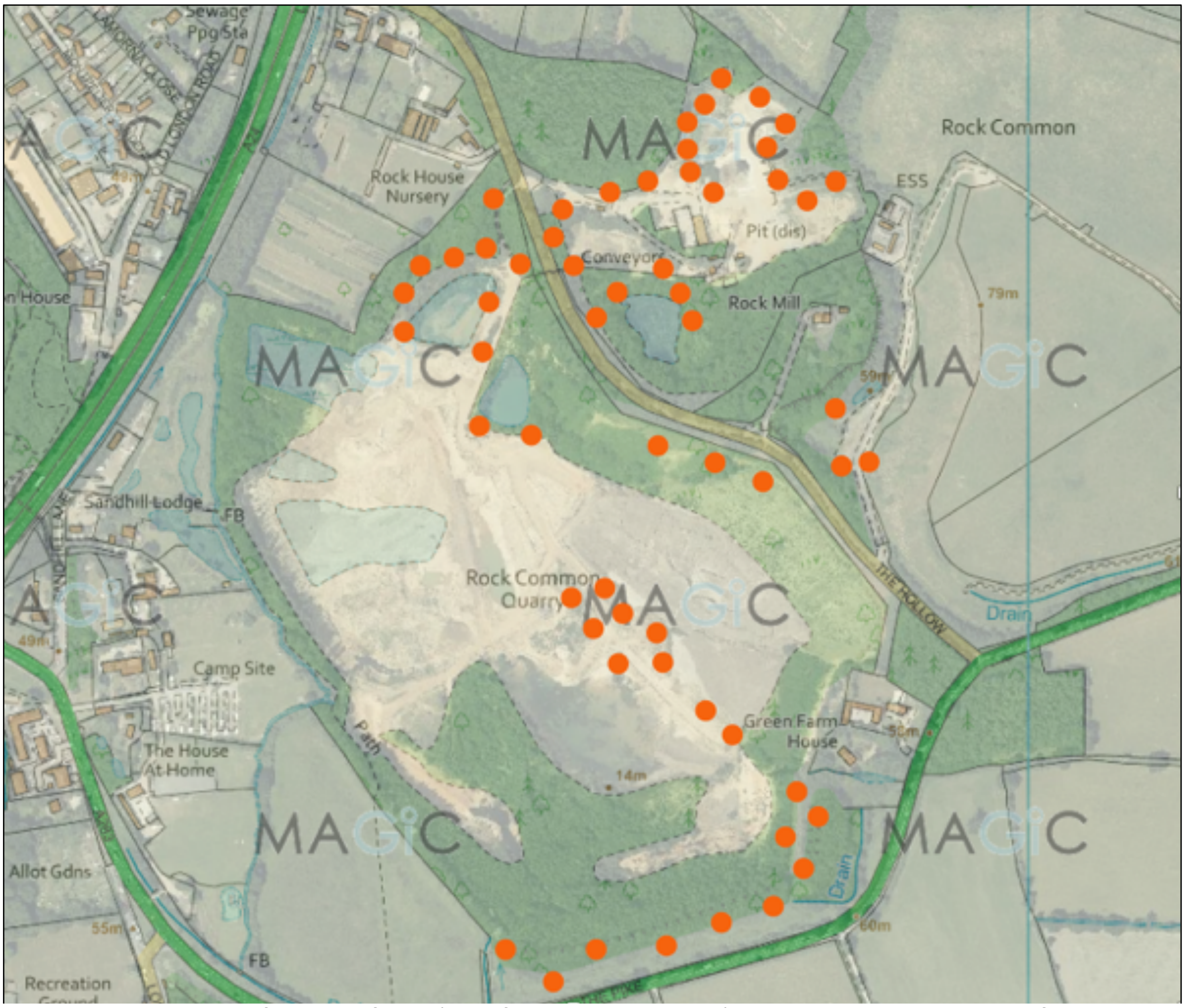

Figure 9. The location of reptile refuges (identified with yellow stars). Image produced courtesy of Magic maps (http://www.magic.gov.uk/, contains public sector information licensed under the Open Government Licence v3.0).

2.9 Terrestrial Invertebrates

2.9.1 Fieldwork

Three principal survey visits were made to Rock Common Quarry on 22nd April, 5th June and 15th July 2020. During each survey visit, a variety of active collecting methods were employed, included sweep-netting through vegetation, beating shrubs and trees where available, hand searching the ground and vegetation, underneath logs and debris, and direct observations of bees and other flying insects.

A XL Safari moth trap with a 20W Actinic Bulb was set up on the 17th June, 15th July and 14th September 2020, the catch was examined the following morning and macro-moths along with other positively phototaxic insects, were identified. For additional coverage, surveyors were asked to photograph/collect any potentially interesting invertebrate specimens when encountered during other survey visits.

Specimens that could not be identified immediately in the field were retained in pots or a pooter and returned for storage in the deep freeze for later sorting and identification. Specimens were initially sorted into orders/families and then identified to species level where possible using an assortment of field guides and specialist keys, with the aid of a binocular microscope.

2.10 Other notable species

The site's habitats were broadly assessed for their potential to support species of principal importance for nature conservation (Section 41 NERC Act 2006) and other notable species. This includes mammals such as harvest mouse *Micromys minutus*, hedgehog *Erinaceus europaeus*, brown hare *Lepus europaeus*, and many bird and terrestrial invertebrate species.

2.11 Invasive non-native species

No specific surveys for invasive non-native species (INNS) were undertaken. However, the presence of any invasive non-native species encountered during other fieldwork, was recorded.

2.12 Impact assessment methodology and mitigation

The assessment of ecological impacts and mitigation recommendations in this report follow CIEEM Guidelines for Ecological Impact Assessment (EcIA)[3]. This involves evaluating the importance of an 'ecological feature' (habitat, vegetation community, population of a single species or assemblages of species) in terms of nature conservation priority, followed by the application of the 'Mitigation hierarchy'.

2.12.1 Importance of ecological features

A level of importance was assigned to all existing ecological features, through consideration of the rarity and distribution of a habitat or species, the population size, ecological function, and trends (declining/expanding), together with any designations, legal status, or conservation policies. CIEEM recommend that the importance of an ecological feature, in terms of nature conservation priority, should be considered within a defined geographical context (for definitions used by The Ecology Co-op, see Appendix 2):

- International and European
- National
- Regional
- County
- Local or parish
- Site/negligible

Where protected species are present and there is the potential for a breach of the legislation as a result of the development proposals, those species are considered as 'important' features and included in the EcIA. However, the level of importance assigned to the affected population of a protected species will vary depending on contextual information about the population size, distribution, abundance and trends across the range of geographical scales.

Similarly, irreplaceable habitats such as ancient broadleaved woodland are considered as 'important features' and included in the EcIA. The level of importance will vary depending on the size of the habitat parcel, its distribution and abundance at different geographical scales.

Features that are considered to be important at site level only, or are of negligible importance, (such as paved ground or amenity grassland) are excluded from this EcIA and it should be reasonable to assume that if a feature is not mentioned, it is not ecologically important.

2.12.2 Significance of impacts and effects

In accordance with EcIA (CIEEM 2018)[3], a significant effect is defined as “an effect that either supports or undermines biodiversity conservation objectives for important ecological features”. Conservation objectives may be specific (e.g. for a designated site) or broad (e.g. national/local nature conservation policy). The effects may be described as significant at a range of geographic scales as defined above.

The impacts are identified and described in relation to the following characteristics:

- *Adverse or positive* – does the impact result in the loss or gain in biodiversity/quality of the environment?
- *Extent, magnitude* – the spatial area over which the impact may occur, the area of habitat lost, or the number of individuals/populations affected.
- *Timing* – in relation to the life cycle of the ecological feature (e.g. nesting bird season)
- *Duration, frequency* – is the impact temporary or permanent, frequently repeated or a one-off event?
- *Reversibility* – is the impact temporary or permanent? Would the ecological feature recover after the impact?
- *Cumulative impacts* – in combination with other plans/projects

This report has only sought to describe in detail the impacts that are likely to be significant. Impacts that are either unlikely to occur, or if they did occur are unlikely to have a significant effect have been discounted or ‘scoped out’ at an earlier stage. Effects on the conservation status of ecological features are only assessed in detail if they have a high enough value (local or above) and impacts upon them may be a material consideration in decision-making in terms of legislation and planning policy. Impacts on features below local value are categorised as of neutral significance and are not considered further. However, where it has not been possible to robustly conclude that there is no significant effects (due to insufficient survey data or scientific research for example), then the precautionary principle will be applied and a significant effect is assumed.

2.12.3 The ‘Mitigation Hierarchy’

The assessment of the significance of an impact is made initially in the absence of mitigation. This is followed by a sequential process of determining the most appropriate way to remove or minimise significant impacts and effects. The preferred option is to avoid impacts in the first place, for example by redesigning the scheme to retain an important area of habitat, or timing works sensitively. Mitigation measures such as translocation or displacement of populations is only applied as a last resort where significant impacts and effects are unavoidable.

When residual significant adverse impacts and effects remain after all practicable measures to avoid and/or minimise these have been applied, compensation measures are required. Compensation measures include habitat creation in alternative locations that offset unavoidable habitat loss.

Finally, enhancements are proposed that do not relate to a specific impact and effect but provide net gains in biodiversity – taking advantage of opportunities in the design and operation of the development. These measures are intended to ensure that the proposed development contribute towards national and local biodiversity objectives.

2.13 Constraints/limitations to surveys

Surveys record any flora or fauna that is present at the time of the survey visits. It is therefore possible that some species may not have been present during the survey but may be evident at other times of the year and may appear or disappear from the site if habitat conditions change. For this reason, the surveys are considered valid for up to eighteen months for badgers and bats, two years for reptiles and three years for great crested newts and dormice. If the habitat conditions change significantly in the intervening period, then it is recommended that the surveys be updated.

The terrestrial invertebrate survey was limited to three separate site visits, which reduced the seasonal coverage from April to early July (with one moth trapping session in September). This means that a proportion of the invertebrate fauna present at the site would not have been sampled due to their flight/active periods taking place at other times of year. However, the main purpose of this terrestrial invertebrate survey was to gain some understanding of the overall importance of the site for its invertebrate assemblage, and therefore it is the diversity and scarcity of the species recorded that is important, rather than obtaining a comprehensive inventory of all the species present.

Presence of peregrine falcon in the quarry pit meant that surveyors needed to be cautious about disturbance so as not to jeopardise any breeding attempt. Since the birds tended to settle on the south-eastern sand cliff and trees above, this area was avoided during the breeding season for this species. This meant that survey coverage was limited in some cases to ensure compliance with the strict legal protection afforded to this species.

Some parts of the quarry were difficult to access and/or posed a health and safety risk. For this reason, the distribution of dormouse nest tunes, reptile survey sheets and bat loggers was slightly restricted to ensure the safety of surveyors whilst deploying, collecting and monitoring equipment.

Accurate identification of some species is dependent on the availability of reference material and some invertebrate groups are more difficult than others; for example, specialist knowledge is required to identify smaller genera of aculeate hymenoptera. Where there is any uncertainty in the identification, this is stated clearly.

ECOLOGICAL BASELINE

2.14 Designated sites

There are two designated sites within 2km of Rock Common Quarry. The closest of these is the South Downs National Park, the boundary of which lies (at the closest point) 50m to the south of the quarry site and follows the A 283 main road. Chanctonbury Hill Site of Special Scientific Interest lies within the National Park and is just under 1km to the south-east of the quarry (Table 2). There are three Local Wildlife Sites (non-statutory designation) within 2km of the quarry, two of which are also located within the National Park to the south and south-west. There is also a notable road verge along The Hollow, north-east of the main quarry.

Magic Maps classifies the habitat contained within Rock Common Quarry as predominantly ‘Good Quality Semi-improved grassland’, with areas of ‘Deciduous Woodland’ around the margins. Surprisingly only small areas around the processing plant and lagoons are classified as ‘Open Mosaic Habitat on Previously Developed Land’ and it seems likely that these classifications are now significantly out of date – the semi-improved grassland is now largely replaced by open mosaic habitat as a result of ongoing permitted quarrying operations. All these habitats, excluding some parts of woodland, are classified as Priority Habitats for conservation under Section 41 of the NERC Act. An area of coniferous woodland to the north-west of the site is identified as ‘Network Enhancement Zone 1’ (Land connecting existing patches of primary and associated habitats which is likely to be suitable for creation of the primary habitat[10]). The land to the north and east of the quarry (former landfill) is identified as ‘Network Expansion Zone’ (land with potential for expanding, linking/joining habitat networks across the landscape, i.e. conditions such as soils are potentially suitable for habitat creation’[10]).

There are no granted EPS licenses for mitigation projects within 1km of the site boundary. The closest EPS licence to the site concerns the destruction of a whiskered bat *Myotis mystacinus*, Daubenton’s bat *Myotis daubentonii*, and Natterer’s bat *Myotis nattereri* resting place, dated 27/03/13 – 30/06/13, 2.6km west.

Table 2. Designated sites within 2km of Rock Common Quarry

Site name	Designation	Features listed on citation	Proximity
South Downs	National Park	The area’s designation as a National Park recognises that it is a landscape of national importance. Habitats present, include ancient woodland, river valleys, chalk grassland, heathland, meadows and farmland. The park supports a number of threatened and nationally scarce species, including round-headed rampion *Phyteuma orbiculare*, otter *Lutra lutra* and barbastelle bat *Barbastella barbastellus.*	Adjacent to the southern boundary of the quarry pit
Chanctonbury Hill	Site of Special Scientific	Steep chalk escarpment with a nationally uncommon woodland type as well as chalk grassland with areas of	0.9km to the south-east

[10] Natural England (2020) National Habitat Network Maps, User Guidance v.2.

	Interest (SSSI)	scrub. The site supports a range of butterflies associated with chalk grassland as well as records for over sixty species of breeding bird such as meadow pipit *Anthus pratensis* corn bunting *Emberiza calandra* and nightingale *Luscinia megarhynchos.*	
Washington Chalk Quarry (ref. H34)	Local Wildlife Site (LWS)	Chalk downland and disused chalk pits with natural regeneration supporting a species-rich calcareous grassland and scrub mosaic.	1.1km to the south
Sullington Hill (Ref. H35)	LWS	Chalk downland with species-rich calcareous grassland on north to north-east facing escarpment slopes.	1.9km to the south-west
Heath Common	LWS	This site has moderately rich remnants of wet and dry heath, several ponds and some relics of ancient base-rich woodland rich in lichens and ferns.	1.9km north-west

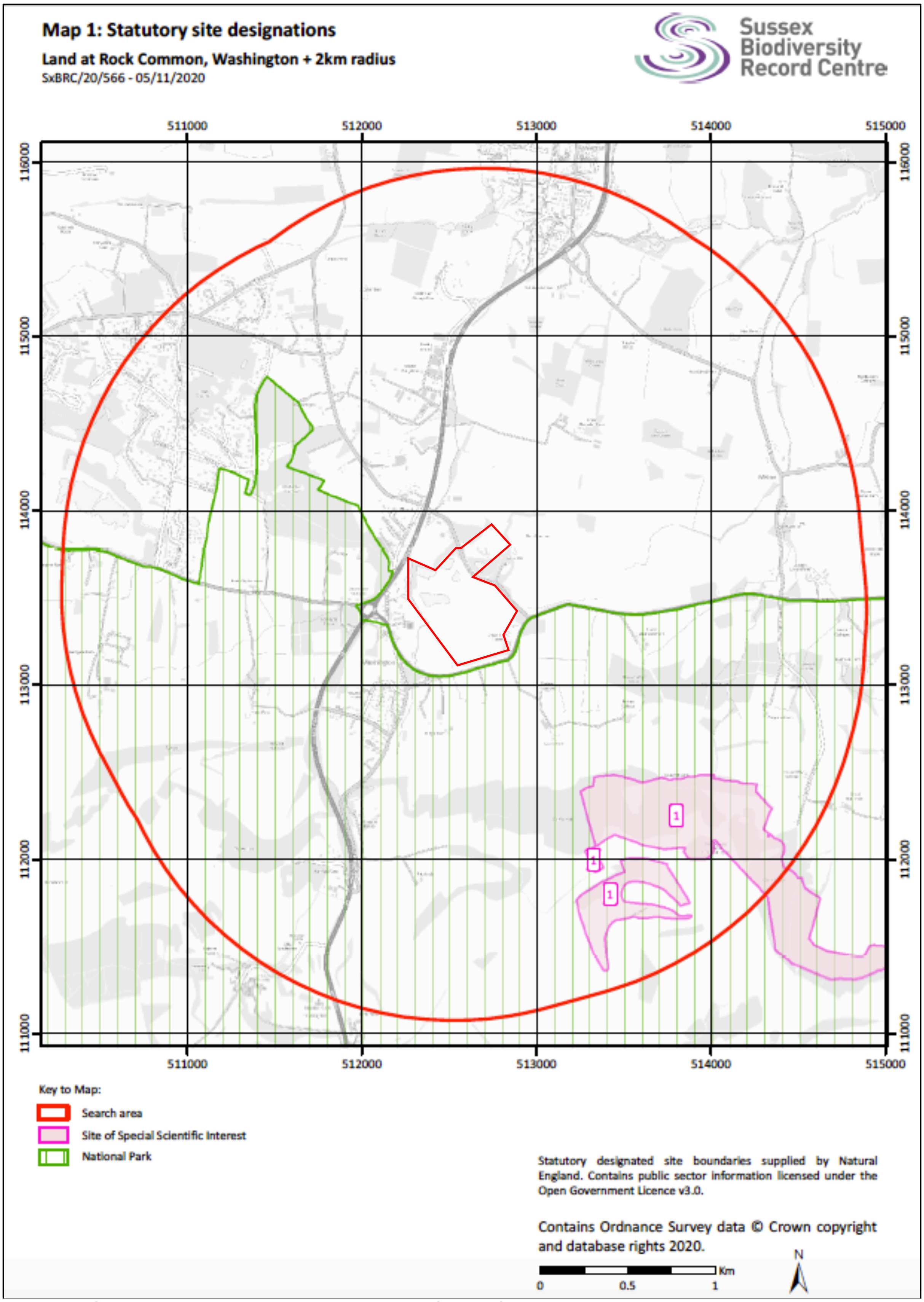

Figure 10. Statutory designated sites within a radius of 2 km of the application site. The approximate site boundary is outlined in red. Image produced courtesy of Sussex Biodiversity Records Centre.

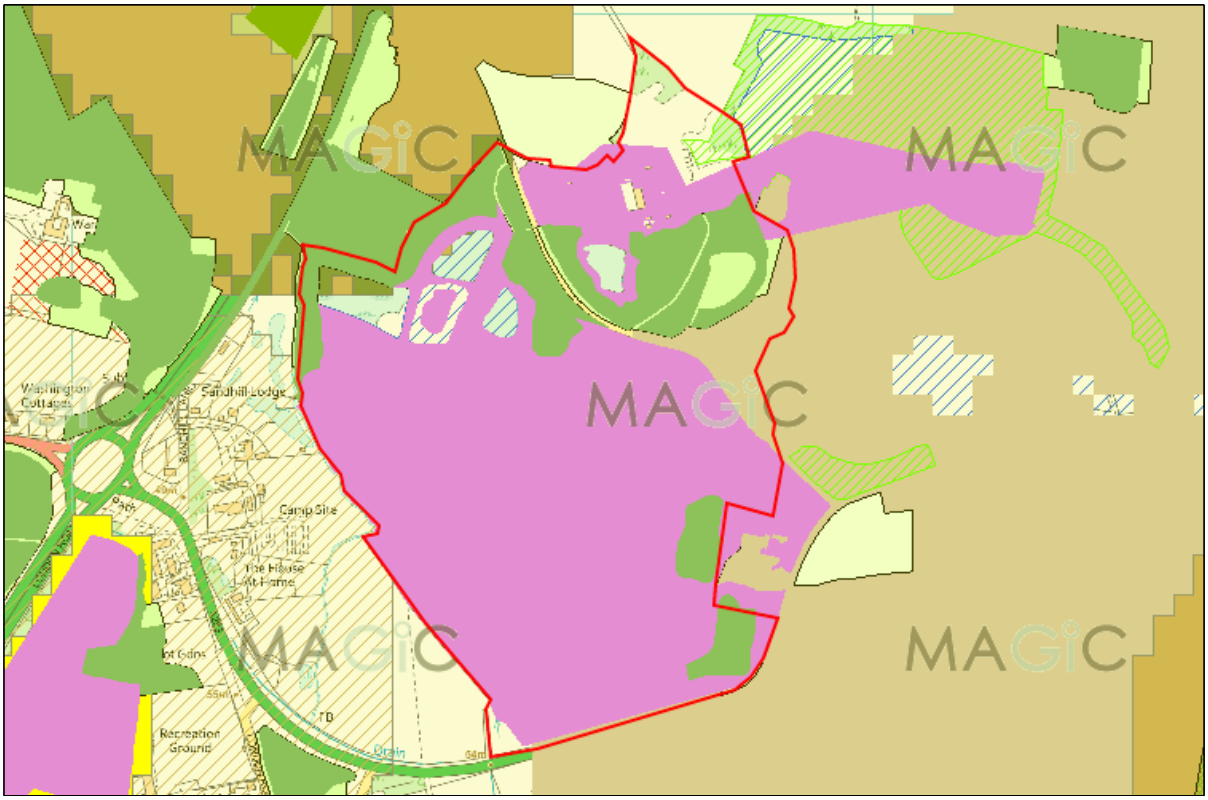

Figure 11. Habitats identified for their importance for nature conservation within and immediately surrounding the site. The approximate site boundary is outlined in red. Key**:** Priority Habitat Good Quality Semi-improved grassland (solid purple), listed Ancient Woodland (vertical green hatch), replanted Ancient Woodland (horizontal brown hatch), Priority Habitat Deciduous Woodland (mid-green), Broadleaved Woodland (light green), Open Mosaic Habitat on Previously Developed Land (blue hash), Network Expansion Zone (light brown), Network Enhancement Zone 1 (dark brown). Image produced courtesy of Magic maps (http://www.magic.gov.uk/, contains public sector information licensed under the Open Government Licence v3.0).

2.15 Habitats

The quarry pit is an active site dominated by bare sand and short annual vegetation. It has changed since the Phase 1 habitat survey as a result of ongoing sand extraction; ponds 24, 25 and 27 no longer exist, being infilled with material unsuitable for export. This area is now colonised with stands of soft rush *Juncus effusus* and hard rush *J. inflexus*. Some of the willow scrub on the southern part of the quarry floor and deciduous woodland bordering the site has been cleared to facilitate extraction on the south-western face of the quarry and scrub cover has expanded around the lagoon (Pond 28).

The original Phase 1 map described an area of new tree planting with natural gorse regeneration on the north-east side of the quarry (TN43). This area has been formed of clay material that has been used to stabilise the sand cliffs. By 2020 this planting has largely failed to establish and the area remains bare ground with sparse colonisation by small annual plants and some regenerating gorse at the top of the slope. During the five years since the original Phase 1 survey, dense scrub and tree saplings have colonised the open habitats around the sand processing area in the northern part of the site.

The Phase 1 Habitat Map for the site and key to the standard mapping symbols used is presented in Figure 12. Table 3 provides a detailed description of each habitat type listed on the site. Photographs of important areas of habitat are presented below.

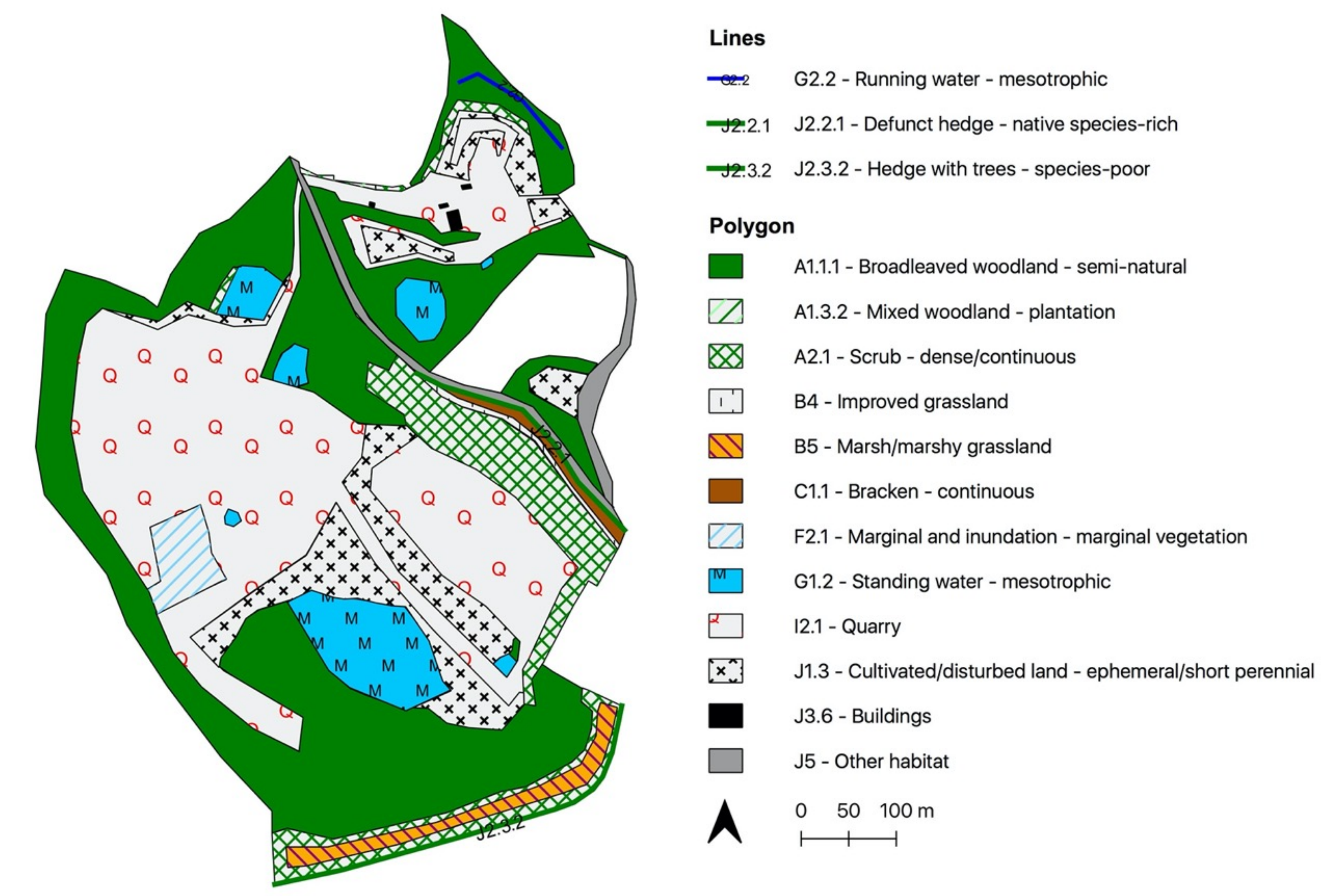

Figure 12. Phase 1 map of Rock Common Quarry as at March-April 2020. Image prepared by The Ecology Co-op.

Table 3. The Phase 1 habitats contained within Rock Common Quarry

Habitat type	JNCC code	Target note including species composition	Ecological Importance
Processing side, north of The Hollow			
Broadleaved woodland – semi-natural	A1.1.1	The woodland south of the entrance to the site and surrounding the pond comprises oak *Quercus robur*, sycamore *Acer pseudoplatanus* and silver birch *Betula pendula*. East of the pond and further north the woodland is a mixture of plantation sycamore and secondary woodland developing from colonisation by willow *Salix* sp., silver birch, elder *Sambucus nigra*, alder *Alnus glutinosa*, oak, *Buddleia davidii*, hazel *Corylus avellana*, hawthorn *Crataegus monogyna*, with occasional ash *Fraxinus excelsior*, horse chestnut *Aesculus hippocastanum*, holly *Ilex aqufolium*, cherry *Prunus* sp., and scots pine *Pinus sylvestris*. The ground flora is scattered, dense in places and bare in others, comprising wood sage *Teucrium scorodonia*, bluebells *Hyacinthoides non-scripta*, honeysuckle *Lonicera periclymenum*, pendulous sedge *Carex pendula*, bramble *Rubus fruticosus* agg., common nettle *Urtica dioica*, small nettle *Urtica urens*, lords and ladies *Arum maculatum*, moshatel *Adoxa moschatellina*, hedge garlic *Alliaria petiolata*, harts tongue fern *Asplenium scolopendrium*, dead wood and ferns. The woodland within the south-east corner of this part of the site is of recent origin and comprises willow, sycamore, oak, buddleia, elder, silver birch and gorse *Ulex europaeus*, with an understory of bramble. Ground flora comprises nettle, honeysuckle, lords and ladies, bluebell, hedge garlic, primrose *Primula vulgaris*, bracken *Pteridium aquilinum* and green alkanet *Pentaglottis sempervirens*.	District
Mixed woodland – plantation	A1.3.2	An area north-west of the processing plant, bordered to the north by plantation woodland outside the site, comprises planted mature scots pine and beech *Fagus sylvatica*, with yew *Taxus baccata* and a sparse understory of bramble and bracken.	Site
A2.1 – Scrub – dense/continuous	A2.1	Scrub comprising bramble, gorse and buddleia (*B. davidii* and *Buddleia* sp.), evening primrose *Oenothera biennis*, white bryony *Bryonia alba*, foxglove *Digitalis purpurea*, common figwort *Scrophularia nodosa*, comfrey *Symphytum officinale* and perforate st john's-wort *Hypericum perforatum*	Site
Standing water – mesotrophic	G1.2	There are two ponds on this side of the site. See section 2.20 below.	Local
Quarry	I2.1	The majority of the active quarry comprises bare sand. There is a limited amount of vegetation (<5%) comprising soft rush *Juncus effusus,* hard rush *Juncus inflexus*, common centaury *Centaurium erythraea,* evening primrose, staghorn sumac *Rhus typhina* and virginia creeper *Parthenocissus quinquefolia*.	Negligible
Cultivated/disturbed land –	J1.3	In less disturbed areas, ephemeral vegetation has established, comprising gorse, bramble, bracken, buddleia, silver birch	Local

ephemeral/short perennial		saplings, willow saplings, hard rush, evening primrose, early forget-me-not *Myosotis ramosissima*, common storksbill *Erodium cicutarium*, teasel *Dipsacus fullonum*, ragwort *Jacobaea vulgaris*, creeping thistle *Cirsium arvense*, common nettle, Canadian fleabane *Erigeron canadensis*, lesser burdock *Arctium minus*, horsetail *Equisetum arvense*, silverweed *Argentina anserina*, white campion *Silene latifolia*, common restharrow *Ononis repens*, creeping cinquefoil *Potentilla reptans*, field speedwell *Veronica persica*, bugloss *Lycopsis arvensis*, annual beard-grass *Polypogon monspeliensis*, creeping buttercup *Ranunculus repens*, field madder *Sherardia arvensis*, weld *Reseda luteola*, common poppy *Papaver rhoeas*, common centaury, common fleabane *Pulicaria dysenterica and* oxeye daisy *Leucanthemum vulgare*. South-east of the processing plant there is an area of ephemeral vegetation comprising, common fleabane, pendulous sedge, yellow loostrife *Lysimachia vulgaris*, field speedwell, bramble, creeping cinquefoil, hard rush, creeping thistle, bird's-foot trefoil *Lotus corniculatus*, scarlet pimpernel *Anagallis arvensis*, teasel and selfheal *Prunella vulgaris*.	
Main quarry, south of The Hollow			
Broadleaved woodland – semi-natural	A1.1.1	The mature woodland around the ridge of the quarry pit extending to the north, east and west comprises oak, sweet chestnut *Castanea sativa*, silver birch, alder, lime *Tilia* sp., sycamore, rowan *Sorbus aucuparia*, maple *Acer campestre*, elm *Ulmus* sp., beech, hazel, with dogwood *Cornus sanguinea*, *Malus* sp and false acacia *Robinia pseudoacacia*. Further south the woodland becomes plantation, dominated by cherry *Prunus* sp., silver birch, alder and pine *Pinus* sp. The ground flora is dense in places, comprising bluebell, bracken, bramble, lords-and-ladies, hedge garlic, honeysuckle, ground ivy *Glechoma hederacea*, primrose, lesser celandine *Ficaria verna*, snowdrop *Galanthus* sp., and ferns. There is an area of secondary woodland and scrub developing in the quarry floor, bordering the pond that is dominated by young willow *Salix* sp., and alder.	District
A2.1 – Scrub – dense/continuous	A2.1	Dense gorse scrub borders the northern most pond. The gorse scrub to the north-east of the site has become dense and well established, with scattered silver birch, willow and bracken. Dense bramble scrub surrounds the marshy grassland to the south.	Site
Improved grassland	B4	Very short, rabbit grazed grass strip.	Negligible
Marsh/marshy grassland	B5	There is a strip of marshy grassland at the foot of the southern cliff. This is rabbit grazed and bordered by recently colonised scrub, comprising hard and soft rush, agrimony *Agrimonia eupatoria*, common fleabane, mint M*entha* sp., teasel, tufted hair grass *Deschampsia cespitosa*, ground ivy, lesser celandine, bugle *Ajuga reptans*, enchanters nightshade *Circaea*	Local

		lutetiana, common spotted orchid *Dactylorhiza fuchsii*, red bartsia *Odontites vernus*, creeping thistle, selfheal, spear thistle *Cirsium vulgare*, st john's-wort, willowherb *Epilobium* sp. and broad-leaved dock *Rumex obtusifolius*.	
Bracken – continuous	C1.1	Dense bracken, with scattered bramble, borders the improved grassland to the north-east of the site.	Site
Marginal and inundation – marginal vegetation	F2.1	Where ponds 24 and 25 were located and the area is now infilled, the damper hollows have developed marshy vegetation and small seasonal pools, with soft rush, New Zealand pigmyweed *Crassula helmsii*, many-stalked spike-rush *Eleocharis multicaulis* and scentless mayweed *Tripleurospermum inodorum*.	Site
Standing water – mesotrophic	G1.2	There are six ponds contained within the site boundaries, ranging from established ponds with marginal scrub, a settlement lagoon and small ephemeral waterbodies formed as part of the quarrying operations. Further descriptions and assesments for their suitability for supporting great crested newts are presented in Section 2.20 and Appendix 4.	Local
Quarry	I2.1	Disturbed bare ground consisting largely of bare sand, spoil heaps and compacted trackways used by machinery.	Negligible
Cultivated/disturbed land – ephemeral/short perennial	J1.3	In less disturbed areas of the quarry floor, ephemeral vegetation has established on the thin sandy soils. Species recorded include coltsfoot *Tussilago farfara*, horsetail, hard rush, buddleia (*B. davidii* and *Buddleia* sp.), common fleabane, common centaury, celery-leaved buttercup *Ranunculus sceleratus*, yellow-wort *Blackstonia perfoliata*, annual beard-grass, red goosefoot *Oxybasis rubra*, Canadian goldenrod *Solidago canadensis*, canadian fleabane, groundsel *Senecio vulgaris*, foxglove, cudweed *Gnaphalium* sp., black medic *Medicago lupulina*, greater bird's-foot trefoil *Lotus pedunculatus*, lesser trefoil *Trifolium dubium*, scarlet pimpernel, hare's-foot clover *Trifolium arvense*, vipers bugloss *Echium vulgare*, creeping thistle, oxeye daisy, perforate st john's-wort, ragwort, teasel, redshank *Persicaria maculosa*, *Melilotus* sp., and hairy willowherb *Epilobium hirsutum.*	Site
Defunct hedge – native species-rich	J2.2.1	A hedgerow forms the north-east boundary of the main quarry, comprising elm, hawthorn, blackthorn *Prunus spinosa*, hazel, rowan and privet *Ligustrum vulgare*.	Local
Hedge with trees – species-poor	J2.3.2	The hedgerow bordering the A283 to the south is unmanaged in places, comprising hawthorn and willow with occasional mature oak trees.	Local
Exposed sand cliff	I1.1.1	The quarry pit is bordered on all sides by near vertical unstable sand cliff faces, created at some point through quarrying activity. Some are established features with areas of fairly stable consolidated sand, interspersed with weathered/slumped patches, and support patches of vegetation and solitary bee and wasp colonies; others are recently formed through sand extraction at the face. These features are important breeding sites for sand martin and peregrine falcon (see below).	District

Photograph 1. An overview of the quarry pit, from the south-east ridge, looking west.

Photograph 2. An overview of the quarry pit, from the north boundary looking south.

Photograph 3. A view of the established semi-natural woodland on northern perimeter of the main quarry pit.

Photograph 4a & b. A view of the wet grassland to the south of the main quarry in March (left) and July (right).

Photograph 5. A view of the area south-east of the processing site (north of The Hollow).

Photograph 6a & b. A view at the centre of the processing side of the quarry (left) and the conveyor belt which runs adjacent to the woodland to the south-west (right).

2.16 Badgers

2.16.1 Survey results

The four-entranced badger sett, found in woodland during the original Phase 1 survey to the east of the processing site (TN13) appears to still be active and there are mammal runs throughout the surrounding woodland. The other sett, TN49 was not re-found; access was restricted to this area and dense bramble scrub has grown up since the original survey. However, there was evidence of continued badger activity;

footprint trails were found in soft damp sand on the quarry floor on several occasions.

2.16.2 Pre-existing records

Records of badgers are not provided by Sussex Biodiversity Records Centre (SxBRC), due to the sensitive nature of this information.

2.16.3 Interpretation

Badger populations have been rising for several decades and they are now a common and widespread species across most of the UK countryside. Badgers are therefore not currently considered to be of great conservation concern within the UK, although the UK supports a significant proportion of the global population.

The presence of badgers and their setts at the quarry represents a very small proportion of the total UK population. Consequently, the site is not considered to be of importance to badgers beyond **site** level.

2.17 Bats

2.17.1 Built Structures – Emergence Surveys

The dates, times, weather conditions, temperatures and personnel for each survey visit is presented in Table 4 below.

Table 4. Details of surveys undertaken, timings weather conditions and personnel.

Date	Buildings surveyed	Survey start time/end time	Temp. degrees centigrade, weather conditions throughout survey	Surveyors
05/05/20	TN4	Start time: 20:48 Sunset: 21:18 Finish time: 22:48	Max/Min temp: 11-8°C. 30% cloud cover and light breeze	Xenia Snowman Jess Burkitt
17/06/20	TN2, TN4	Start time: 20:48 Sunset: 21:18 Finish time: 22:48	Max/Min temp: 15-13°C. 100% cloud cover and light air	Sophie Bradfield Hamish Muirden

The following descriptions summarise bat activity and emergences from the building for each survey visit.

- TN4: 5th May 2020

  No emergences from the building. General bat activity was very low, with only three passes by a noctule *Nyctalus noctula* recorded; at 21:06, 21:13 and 21:18.

- TN4: 17th June 2020

  No emergences from the building. More general bat activity was recorded during this survey visit, with occasional passes by common pipistrelle *Pipistrellus pipistrellus*, soprano pipistrelle *Pipistrellus pygmaeus*, noctule, *Myotis* sp. and brown long-eared *Plecotus autitus* bats, with a mixture of foraging and commuting activity.

- TN2: 17th June 2020
  No bats emerged from building 2. General activity was as recorded above.

2.17.2 Bat activity surveys – walked transects

The dates, times, weather conditions and personnel for each survey visit are presented in Table 5 below. The results of all three surveys are represented in Figure 13, Figure 14 and Figure 15.

The 'hot spots' for bat activity were fairly consistent across all three surveys and, as to be expected, were located along woodland boundaries, with the north-west boundary of the main quarry and the woodland boundaries of the processing plant supporting the most activity. Bat activity was very limited in the main quarry and along the eastern boundary.

A range of common species were recorded during the activity surveys, including common pipistrelle, soprano pipistrelle, brown long-eared, noctule, myotis and serotine *Eptesicus serotinus*. There was no evidence of rare or scarce bat species.

Table 5. Walked transect metadata: dates, times, temperature, weather conditions.

Date	Survey start/end time	Temperature (^{0}c) & weather conditions	Surveyors
22/04/20	20:09-22:09 Sunset – 20:09	Max/Min temp.: 14/12 0% cloud cover, 0mph wind	Paul Whitby Sam Lunn Kate Lewis Charlie Gardiner Sophie Bradfield
15/07/20	21:10-23:10 Sunset – 21:10	Max/Min temp.: 17/16 100% cloud cover, 0-5mph wind	Paul Whitby Dan Bennett Jess Burkitt Kate Lewis Sophie Bradfield
14/09/20	19:17 – 21:17	Max/Min temp.: 24/18 0% cloud cover, 0mph wind	Paul Whitby Sam Lunn Jess Burkitt Kate Lewis Sophie Bradfield

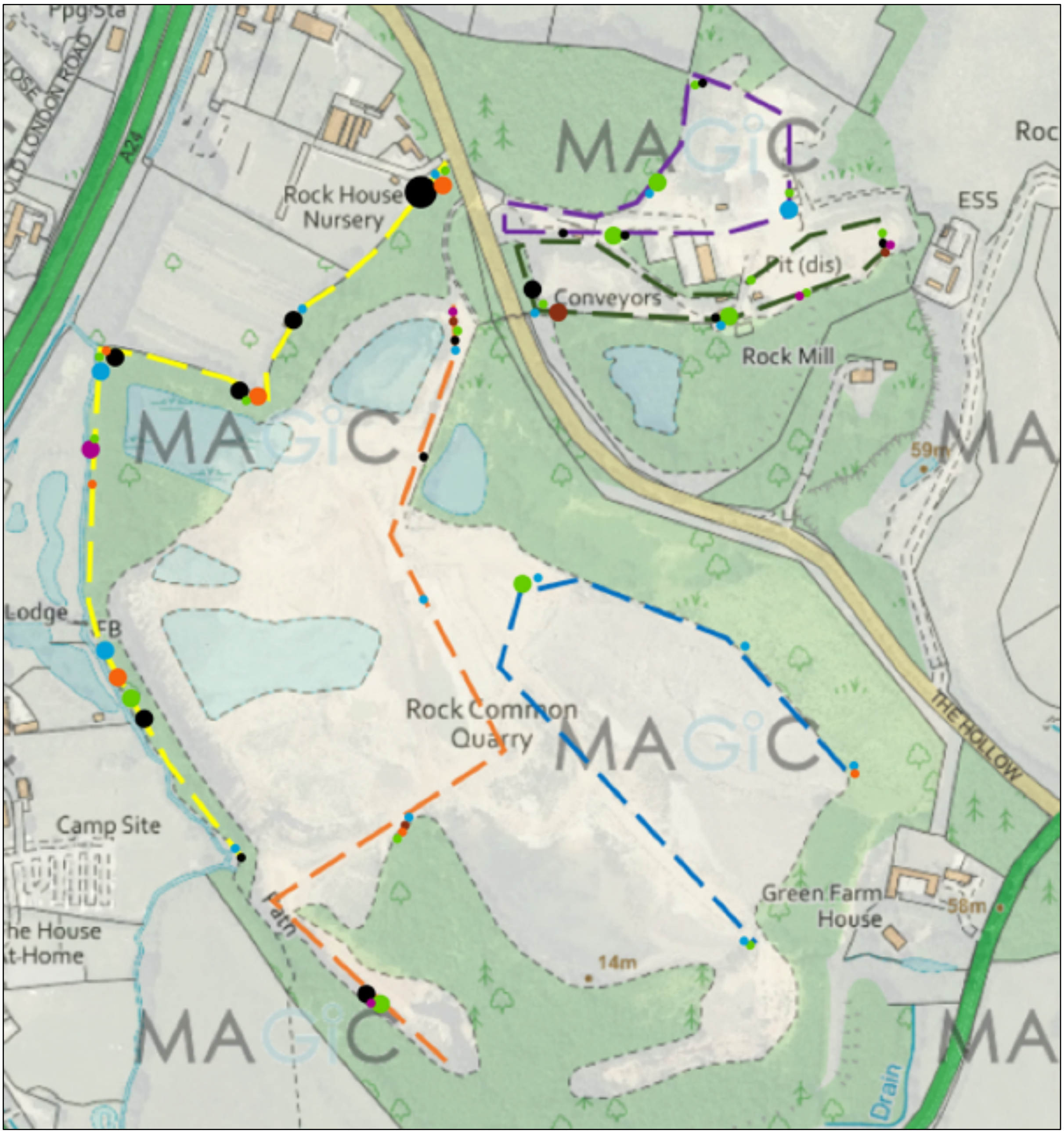

Figure 13. Approximate distribution of bats detected during each walked transects survey on 22nd April 2020. Coloured dots represent bat activity. Black = common pipistrelle, blue = soprano pipistrelle, brown = brown long-eared bat, purple = Myotis spp., orange = serotine bat and green = noctule bat. The size of the dot indicates the intensity of activity: Small dot = 1-3 passes; medium dot = 4-9 passes; large dot = >10 passes.

Figure 14. Approximate distribution of bats detected during each walked transects survey on 15th June 2020. Coloured dots represent bat activity. Black = common pipistrelle, blue = soprano pipistrelle, brown = brown long-eared bat, purple = Myotis spp., orange = serotine bat and green = noctule bat. The size of the dot indicates the intensity of activity: Small dot = 1-3 passes; medium dot = 4-9 passes; large dot = >10 passes.

Figure 15. Approximate distribution of bats detected during each walked transects survey on 14th September 2020. Coloured dots represent bat activity. Black = common pipistrelle, blue = soprano pipistrelle, brown = brown long-eared bat, purple = Myotis spp., orange = serotine bat and green = noctule bat. The size of the dot indicates the intensity of activity: Small dot = 1-3 passes; medium dot = 4-9 passes; large dot = >10 passes.

2.17.3 Bat activity surveys – automated static bat detecting

The results of the automated static bat detector surveys are summarised in Table 6.

The number of species recorded is similar to that of the activity surveys, with the addition of a few barbastelle and Nathusius' pipistrelle passes. Common pipistrelle and soprano pipistrelle were recorded the most frequently, with a large number of passes by serotine and noctule also recorded on occasion. Logger 5, situated on the west boundary of the main quarry, recorded the most activity whilst logger 3, on the northern boundary of the main quarry consistently recorded the least.

Table 6. Total number of passes recorded by each static detector across 5 nights. Grey shading highlights the most frequently recorded species for each deployment for ease of interpretation.

Logger	Date	Common pipistrelle	Soprano pipistrelle	Nathusius pipistrelle	Brown long-eared	*Myotis* sp.	Serotine	Noctule	Barbastelle
1	April 2020	**54**	3	1	1	11	10	29	-
	July 2020	**27**	22	-	-	1	-	-	-
	Sept 2020	**63**	18	-	1	38	-	10	3
2	April 2020	35	9	2	1	16	**51**	42	-
	July 2020	**47**	23	-	-	7	-	11	-
	Sept 2020	**76**	53	-	14	9	1	14	13
3	April 2020	**8**	7	-	1	-	6	2	
	July 2020	**26**	14	1	5	4	3	16	1
	Sept 2020	**9**	5	-	-	-	-	-	-
4	April 2020	**39**	11	1	2	1	18	35	1
	July 2020	25	**40**	-	2	3	9	11	-
	Sept 2020	3	**50**	-	-	2	-	4	-
5	April 2020	68	35	1	-	7	4	**119**	-
	July 2020	**199**	51	-	5	7	4	39	2
	Sept 2020	**297**	130	-	6	21	5	28	5
6	April 2020	32	46	-	2	1	2	**79**	-
	July 2020	51	**56**	1	8	7	-	13	1
	Sept 2020	1	9	-	-	1	1	**23**	4

2.17.4 Pre-existing records

The SxBRC provided 103 bat records in the search area comprising 8 identified species, which are detailed in Table 7 below.

Table 7. Bat records returned within a 2km radius of the site**.**

Species	No. of records
Natterer's bat *Myotis nattereri*	32
Common pipistrelle *Pipistrellus pipistrellus*	24
Brown long-eared *Plecotus auritus*	17
Daubenton's *Myotis daubentonii*	16
Plecotus species	10
Serotine *Eptesicus serotinus*	10
Unidentified bat species	8
Soprano pipistrelle *Pipistrellus pygmaeus*	7
Whickered/Brandt's *Myotis mystacinus/brandtii*	6
Pipistrellus species	4
Barbastelle *Barbastella barbastellus*	3
Noctule *Nyctalus noctula*	3
Lesser noctule *Nyctalus leisleri*	1
Nathusius' pipistrelle *Pipistrellus nathusii*	1

2.17.5 Interpretation

The buildings have limited potential for roosting bats due to their size, composition materials/thermal properties, and no evidence of roosting bats was found. These buildings are therefore highly unlikely to support roosting bats, though there is some potential for future roost establishment.

The main active quarry areas have limited value to foraging bats due to the lack of vegetation and are unproductive in terms of nocturnal insect biomass. This includes the waterbodies that often support large numbers of foraging soprano pipistrelle and Daubenton's bat on other sites. However, the woodland, scrub bordering the site and ponds it contains are of higher value for foraging bats. Table 8 presents the recognised conservation status and local distribution of bat species recorded on site.

Table 8. Conservation status and distribution of bats recorded on site[11]

Species	Conservation Status England	Distribution in England
Barbastelle	**Vulnerable**	Southern and central England
Serotine	**Vulnerable**	South and south east of England
Nathusius' pipistrelle	**Near threatened**	Widespread (but rare)
Common pipistrelle	Least concern	Widespread
Soprano pipistrelle	Least concern	Widespread
Brown long-eared	Least concern	Widespread
Noctule	Least concern	Widespread

*It is not possible to identify the species of Myotis without droppings for DNA analysis

[11] The Mammal Society (2020): https://www.mammal.org.uk/science-research/red-list/

Based on the available information, the habitats contained within the site are likely to be used by the barbastelle and serotine intermittently as part of a wider foraging resource, centred on a known roost site 750m from the site in the case of barbastelle (Table 7). But as these species are both classed as 'vulnerable', the suitable woodland and scrub habitats around the site are considered to be important to foraging/commuting bats at up to **district level**.

2.18 Breeding birds

2.18.1 Survey results

In total, 41 species of bird were recorded during the surveys. Of these, four species are 'red' listed under the Birds of Conservation Concern (BoCC) and three are 'amber' listed. The following species recorded during the survey are also listed under Sch. 1 of the Wildlife and Countryside Act, 1981 (as amended): peregrine falcon and red kite. An incidental sighting of a kingfisher, also a Sch. 1 bird, was recorded during a site visit on 23rd April 2020 and a common sandpiper *Actitis hypoleucos* (amber listed) on 15th July 2020.

Table 9 presents the dates, times and survey conditions recorded for each visit. Table 10 presents the bird survey results for all four visits. The table is divided into red, amber and green lists from the BoCC categories.

Table 9. Weather conditions recorded during breeding bird surveys at Rock Common Quarry

Date	Survey time	Weather notes	Surveyor
17/04/20	07:00-8:30	9°c, still air, 50% cloud cover	Paul Whitby Owen Crawshaw
27/04/20	07:00-08:15	5°c, still air, 80% cloud cover	Paul Whitby Owen Crawshaw
22/05/20	07:00-08:15	15°c, light breeze, 100% cloud cover	Paul Whitby Owen Crawshaw
05/06/20	07:10-08:30	12°c, light breeze, 80% cloud cover	Paul Whitby Dan Bennett

Table 10. Breeding bird survey summary list. The transect number is in brackets.

RESULTS **Species**	**17/04 (1)**	**27/04 (1)**	**22/05 (1)**	**05/06 (1)**	**17/04 (2)**	**27/04 (2)**	**22/05 (2)**	**05/06 (2)**	**Breeding status**
Herring gull *Larus argentatus*					5	6	2		Non-breeding
Linnet *Linaria cannabina*					6		2	5	Likely
Mistle thrush *Turdus viscivorus*	1								Possible
Song thrush *Turdus philomelos*	1	1		1			1	2	Likely
Dunnock *Prunella modularis*		2	3		1	1			Likely
Stock dove *Columba oenas*					4				Possible
Swallow *Hirudo rustica*							1		Non-breeding
Blackbird	4	2	4	1	3	2	2		Likely

RESULTS **Species**	**17/04 (1)**	**27/04 (1)**	**22/05 (1)**	**05/06 (1)**	**17/04 (2)**	**27/04 (2)**	**22/05 (2)**	**05/06 (2)**	**Breeding status**
Turdus merula									
Blackcap *Sylvia atricapilla*	1	1	1	1			1	1	Likely
Blue tit *Cyanistes caeruleus*	4	4	6	4	1	1	3	3	Likely
Buzzard *Buteo buteo*					1	1	1	1	Possible
Canada goose *Branta canadensis*	6				7	6	3	11	Confirmed
Carrion crow *Corvus corone*					2	2	2	1	Possible
Chaffinch *Fringilla coelebs*					1				Possible
Chiffchaff *Phylloscopus collybita*	4	2	3	4	4	2		3	Likely
Coot *Fulica atra*	1		1	2	2	1	2	1	Confirmed
Feral pigeon *Columba livia domestica*								1	Possible
Goldcrest *Regulus regulus*	2	1	2	1					Possible
Goldfinch *Carduelis carduelis*		2		4	1		1		Possible
Great spotted woodp. *Dendrocopos major*			1	2	1	1			Possible
Great tit *Parus major*	3	5	3	3	1	2	1		Likely
Green woodpecker *Picus viridis*					2				Possible
Grey heron *Ardea cinerea*						1			Non-breeding
Grey wagtail *Motacilla cinerea*		1		1	2	2			Confirmed
Jay *Garrulus glandarius*		1							Possible
Kestrel *Falco tinnunculus*	1				1		1		Possible
Long-tailed tit *Aegithalos caudatus*				1			1	1	Possible
Magpie *Pica pica*					1	1	1		Possible
Mallard *Anas platyrhynchos*	1	2			5	1		1	Possible
Moorhen *Gallinula chloropus*		1	2		1	2		1	Possible
Nuthatch *Sitta europaea*			1						Possible
Peregrine* *Falco peregrinus*					1	2	1	2	Possible**
Pheasant *Phasianus colchicus*	1					1			Possible
Reed warbler *Acrocephalus scirpaceus*	1		1	1					Possible

RESULTS Species	17/04 (1)	27/04 (1)	22/05 (1)	05/06 (1)	17/04 (2)	27/04 (2)	22/05 (2)	05/06 (2)	Breeding status
Red kite* *Milvus milvus*							1		Non-breeding
Robin *Erithacus rubecula*	9	9	6	1	1	1		2	Likely
Sand martin *Riparia riparia*					20	10	9	1	Confirmed
Treecreeper *Certhia familiaris*	1								Possible
Tufted duck *Aythya fuligula*								1	Non-breeding
Wood pigeon *Columba palumbus*					5	4	9	2	Likely
Wren *Troglodytes troglodytes*	1	7	3	5	4	1	1	2	Likely

* Sch 1 Birds, for which it is an offence to intentionally or recklessly disturb at, on or near an 'active' nest

**Breeding not confirmed in 2020, however it has in previous years; there was some concern that birds were put off from breeding by disturbance (see limitations section), the likely cause was identified as unauthorised use of a drone by a third party, as noted by surveyors on several occasions.

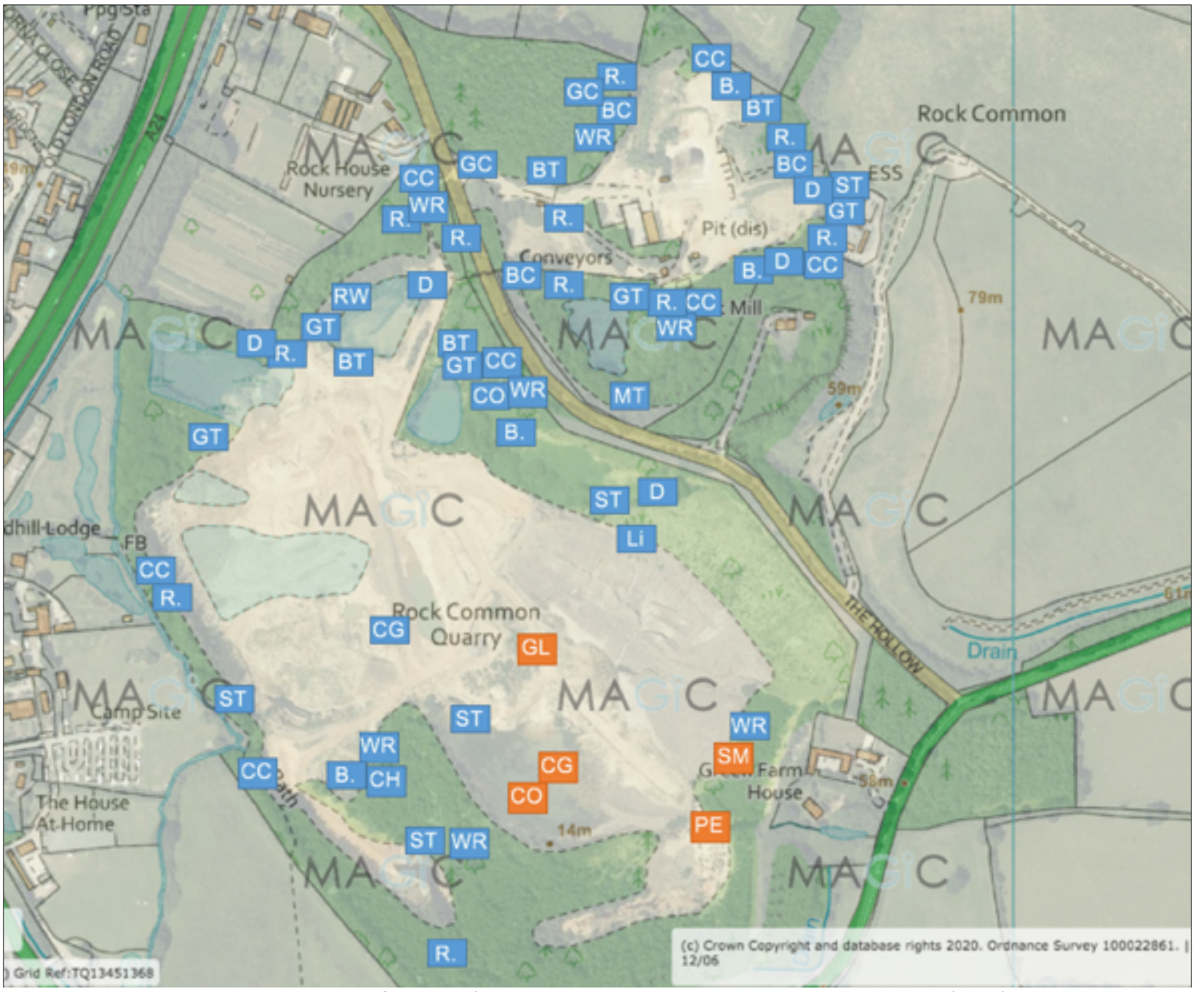

Figure 16. Approximate locations of singing/calling birds which could indicate a territory (blue) and nesting birds (orange) across the breeding bird surveys. Key: B=blackbird, BC=blackcap, BT=blue tit, CC=chiffchaff, CG=Canada goose, CH=chaffinch, CO=coot, D=dunnock, GC=goldcrest, GL=grey wagtail, GT=great tit, Li=Linnet, PE=peregrine, R=robin, RW=reed warbler, SM=sand martin, ST=song thrush and WR=wren.

2.18.2 Pre-existing records

SxBRC provided 152 records of bird species including 32 Priority Species (S41 NERC Act 2006), 29 WCA Schedule 1 and 30 BoCC Red list species within a 2km radius of the site.

These records include a wide range of species typical of several habitat types that occur within the search area including sand pits (e.g. little ringed plover *Charadrius dubius* and peregrine falcon *Falco peregrinus*), heathland (e.g. Dartford warbler *Sylvia undata*, woodlark *Lullula arborea* and crossbill *Loxia curvirostra*), woodland (e.g. firecrest *Regulus ignicapilla*, lesser spotted woodpecker *Dendrocopos minor*, wood warbler *Phylloscopus sibilatrix*, willow tit *Poecile montana* and hawfinch *Coccothraustes coccothraustes*, goshawk *Accipiter gentilis*), wetlands (e.g. bittern *Botaurus stellaris*, kingfisher *Alcedo atthis*) and farmland (e.g. barn owl *Tyto alba*, hen harrier *Circus cyaneus*, red kite *Milvus milvus*, stone-curlew *Burhinus oedicnemus*, hobby *Falco subbuteo*, quail *Coturnix coturnix*, tree sparrow *Passer montanus*, corn bunting *Emberiza calandra*, grey partridge *Perdix perdix*, turtle dove *Streptopelia turtur* and lapwing *Vanellus vanellus*.

2.18.3 Interpretation

The breeding bird surveys identified two notable bird species supported by the exposed, tall sand cliffs around the east and north-east part of the quarry pit. These are peregrine falcon and a breeding colony of sand martins. The wetland features support a small number of common waterfowl and wetland birds such as reed warbler. Most of the breeding birds recorded comprised passerines that are associated with fringing semi-natural woodland and scrub and the quarry pit itself supported very few birds.

Peregrine falcons are recovering from serious population declines in the 1970s – 1990s and are now fairly widespread, taking advantage of urban high-rise buildings as well as taking up former territories in more natural settings. In Sussex, peregrines are relatively widespread and there are breeding records scattered across the county (See Figure 17). Sand martin breeding colonies are much more common in the north-west of England, throughout Scotland and Ireland and pass through the south-east region on migration in large numbers in spring and autumn. However, breeding colonies are scarce in the south-east region making this small colony more ecologically important. Figure 18 shows the distribution of all breeding records in the last 20 years for East and West Sussex. Of the recent records (2010 to present), there are approximately 18 clusters of records (sites). Most of these are distributed along the foot of the South Downs escarpment including Rock Common Quarry. The only exception is a small cluster of records on the Pett levels grazing marsh.

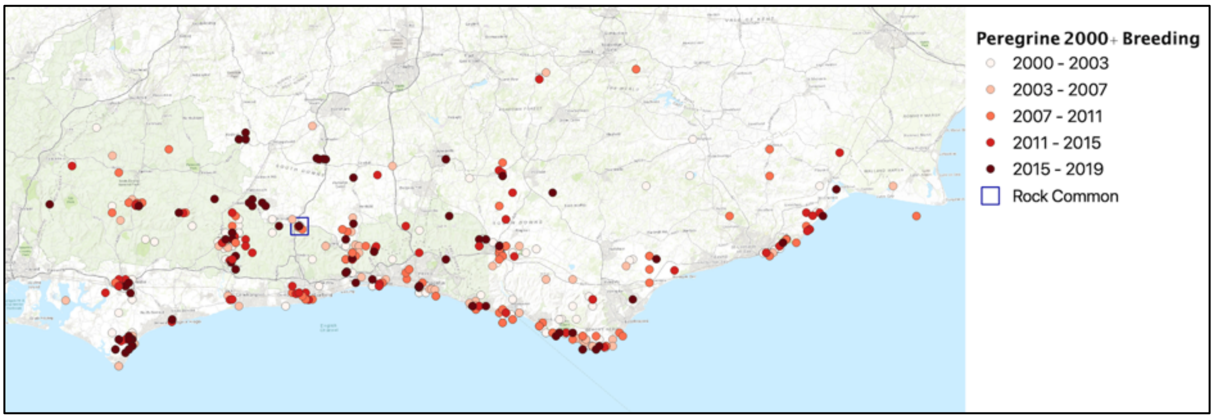

Figure 17. A map showing breeding records for peregrines in East and West Sussex, prepared by the Ecology Co-op based on data provided by the SxBRC from the last twenty years 2000 – 2020. The approximate location of Rock Common Quarry is highlighted.

Figure 18. A map showing breeding records for sand martin in East and West Sussex, prepared by the Ecology Co-op based on data provided by the SxBRC from the last twenty years 2000 – 2020. The approximate location of Rock Common Quarry is highlighted.

The remaining species are all common and widespread throughout the UK. The red-listed species recorded were either non-breeding birds 'passing through' the site, and for which the habitats contained on the site are not considered important. The exception to this is linnet, which probably breeds in the scrub and gorse that has established in places inside the pit (e.g. around the de-watering pump), and probably uses the ephemeral vegetation as a source of food (annual plant seeds).

Based on these findings, the breeding bird assemblage supported by Rock Common Quarry is considered to be important for the conservation of birds at **district Level**, due to the presence of a pair of breeding peregrine falcons, a Sch. 1 species, a small colony of breeding sand martins, which are scarce in the south-east, and 'likely' breeding linnets, red listed as birds of conservation concern.

2.19 Dormice

2.19.1 Nest-tube survey

Two dormouse nests were found during the August check, one towards the northern boundary and one along the southern boundary (See figure 19). The nests were found within scrub and woodland that are ecologically well connected to similar habitats across the site and dormice should therefore be assumed to be present within all suitable scrub and woodland habitat surrounding the site.

However, the woodland habitat that has developed on the quarry floor is of recent origin, is seasonally inundated and is composed predominantly of willow and alder. It lacks the fruit and nut bearing species that are typically required by dormice and large vertical sand cliffs separate it from much of the surrounding woodland, although there are a few canopy connections in the south-east corner of the quarry. For these combined reasons, this area is therefore considered to be sub-optimal for dormice. It was not included in the survey due to access and safety concerns.

The detailed findings are presented in Appendix 3.

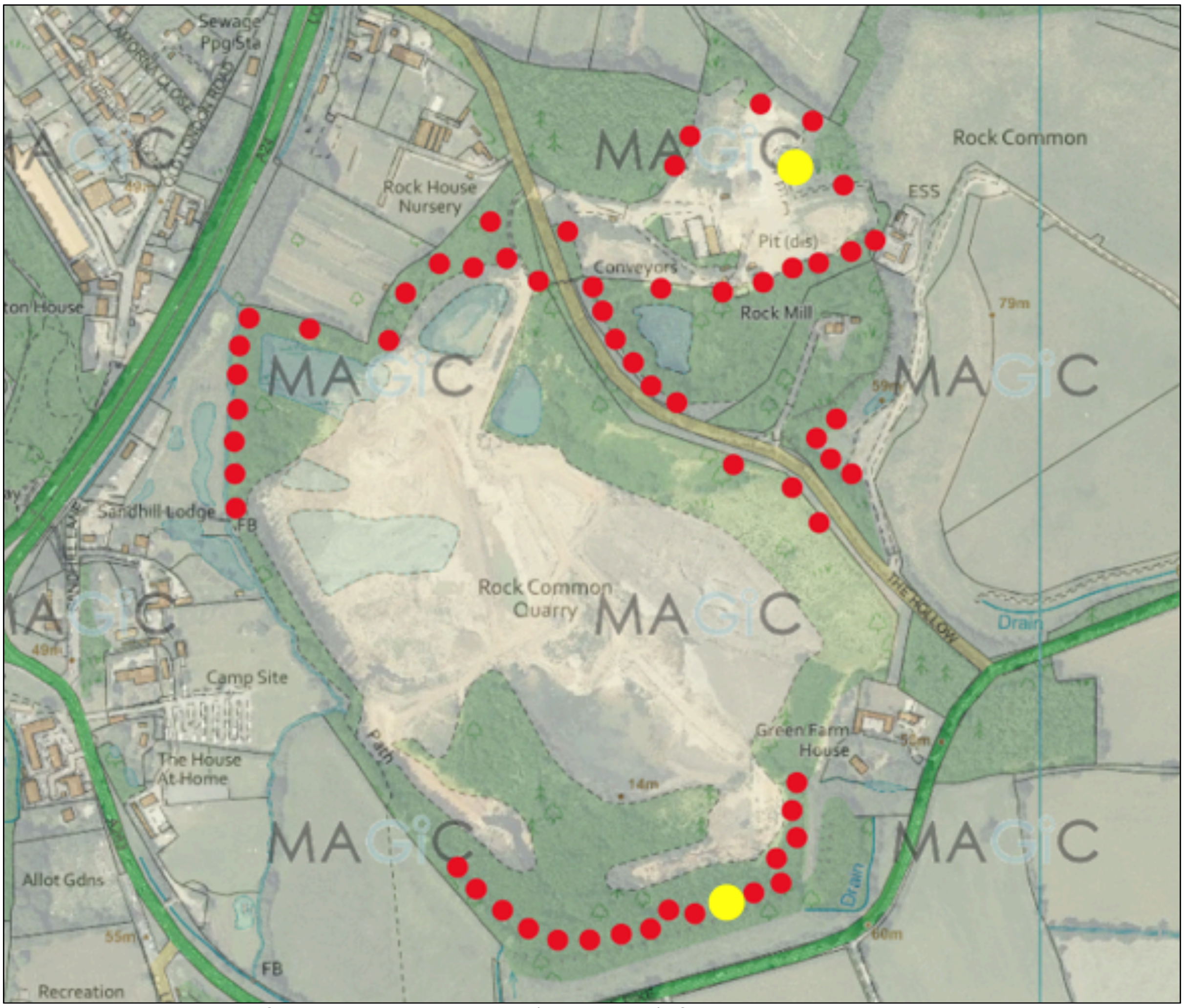

Figure 19. The location of the two dormouse nests (yellow dots), found during the August survey.

2.19.2 Pre-existing records

SxBRC returned one record for dormice within the search area, 1.4 km north-east, dated 18/05/17.

2.19.3 Interpretation

The surveys indicate that dormice are present within the site. Dormice are a conservation priority species in the UK and a European protected species; however, they are relatively common and widespread in south-east England, with West Sussex containing a high density of mixed broadleaved woodland compared to the national average. Given that the population at Rock Common probably represents a small proportion of the local population of this species, the site as a whole is considered to be important to dormice at up to a **local level**. The sub-optimal habitat contained within the quarry pit is not important beyond site level.

2.20 Great crested newts

2.20.1 Habitat suitability, eDNA testing and field survey results

The original phase 1 survey dated 2015 identified seven ponds within the boundaries of Rock Common Quarry and six beyond the boundary but within 250m of the quarry site and therefore within the zone of influence. To maintain ease of reference, the target note numbers used in the 2015 report are retained for the purpose of this report for consistency.

Of these, four ponds within the quarry were considered potentially suitable for great crested newts (TN19, 22, 23, and 24) and three were considered suboptimal as they were either newly created or disturbed, and therefore lacked suitable vegetation and had poor water quality (TN25, 27 and 28). Of the ponds beyond the boundary of the quarry, four were considered suitable for great crested newts (TN 30, 31, 34 and 42). Further assessments for all these ponds was recommended.

By 2020, three ponds on the quarry floor had been infilled as part of the ongoing quarry operations, leaving three established ponds (TN19, 23 and 28), and one used as a settlement lagoon (TN22). Water samples were taken for eDNA analysis in these three established ponds, but not from the settlement lagoon for safety reasons as it was not accessible.

Of the ponds outside the quarry boundaries, four ponds are situated on the other side of the Honeybridge Stream and steep sand cliffs (TN30, 31, 34 and 35), which are assumed to act as a significant barrier to dispersal. These ponds were therefore discounted from further surveys. Access to survey the remaining pond (TN42), which is situated in a private residential garden, was not possible due to COVID-19 restrictions and the National Lockdown.

A further three ponds were identified by the Ecology Co-op, for the purpose of continuity, labelled TN54, 55 and 56. Pond 54 was dry whilst ponds 55 and 56 were assessed as ‘below average’ following an HSI assessment (Appendix 4).

Full details of the HSI assessments and the eDNA results are presented in Appendix 4. A summary of the assessments for each pond is presented in Table 11.

Figure 20. Location of ponds contained on the site and up to a distance of 250m from the boundary. Those that are shaded grey no longer exist. The three ponds outlined in red were taken forward for eDNA analysis.

Table 11. An overview of the three ponds a Rock Common Quarry which were surveyed using eDNA techniques.

Ref.	NGR	Description	HSI value	Interpretation	Survey effort
19	TQ 33168 26230	A large pond with approximately 25% macrophyte cover and a large quantity of tadpoles present.	0.816	Excellent	eDNA sampling was completed in April 2020 with negative results for great crested newts. No further action taken.
23	TQ 33445 25903	A large pond with minimal macrophyte cover and frequently inundated with water from the quarry, used for cleaning the extracted sand.	0.736	Average	eDNA sampling was completed in April 2020 with negative results for great crested newts. No further action taken.
28	TQ 33793 26019	A heavily silted lagoon, frequented by waterfowl.	0.816	Excellent	eDNA sampling was completed in April 2020 with negative results for great crested newts. No further action taken.

2.20.2 Pre-existing records

SxBRC provided 33 records for great crested newts within the search area, the nearest of which was 200m to the north-west of the site, dated May 2020. Common toad *Bufo bufo,* palmate newt *Lissotriton helveticus* and smooth newt *Lissotriton vulgaris* were recorded on the site in 2006 and there are multiple common frog *Rana temporaria* records for the surrounding area.

2.20.3 Interpretation

While great crested newts were recently reported from a site close to the boundary of Rock Common Quarry, the eDNA sampling did not reveal any evidence that they are present in the quarry itself. Based on these results, it is reasonable to assume that that great crested newts are absent from the quarry and the site is considered to be of **negligible** importance to great crested newts. They are therefore not considered further in this assessment.

2.21 Reptiles

2.21.1 Survey results

The survey findings, dates and conditions are presented in Table 13.

The survey confirmed presence of a small population of grass snakes and slow worms at the site. Most of these were found in the processing side of the site, close to scrub and Pond 19. Grass snakes were also consistently found within the marshy grassland along the southern boundary of the main quarry. The site was split into three sections for ease of interpreting the results (see Figure 21).

In addition to the formal survey results, a common lizard was recorded within the processing section of the quarry in October 2020 (see Figure 21 for the location). This would indicate that there is also a small population of common lizard at the site.

Table 12. Reptile survey dates, times and weather conditions

Date	Start time	Air temp. °C	Refugia temp. °C	Weather conditions (cloud cover = cc)
07/05/20	08:45	Start: 15ºc Fin: 16ºc	Start: 30ºc Fin: 44ºc	5%cc, still air
13/05/20	14:00	Start: 12ºc Fin: 16ºc	Start: 23ºc Fin: 44ºc	50%cc, light breeze
29/06/20	08:15	Start: 15ºc Fin: 17ºc	Start: 38ºc Fin: 29ºc	50%cc, breezy
20/07/20	08:40	Start: 14ºc Fin: 18ºc	Start: 44ºc Fin: 55ºc	5%cc, light breeze, wet ground
27/08/20	09:00	Start: 16 Fin: 16	Start: 24 Fin: 24	80%cc, humid, light breeze, recent rain
17/09/20	08:40	Start: 15 Fin: 18	Start: 18 Fin: 33	0%cc, light breeze
29/09/20	14:30	Start: 18 Fin: 18	Start: 30 Fin: 30	40% cc, light breeze

Table 13. Reptile survey results for Rock Common.

Date	Slow worm	Grass snake	Common Lizard
07/05/20	Area 1; 1 Female	Area 1 1 subadult,	
13/05/20	Area 1; 1 Male, 1 female; Area 2:	Area 1; 1 subadult and 1 adult; Area 2; 1 sub adult, and one juvenile Area 3; 1 adult, 1 juvenile	
29/06/20	Area 1; 1 sub adult and 1 juvenile	Area 1: 1 adult, 1 subadult and 1 juvenile	
20/07/20		Area 1: 2 juvenile) Area 3: 1 adult	
27/08/20	Area 1: 1 female,	Area 2: 1 adult, 1 subadult and 1 juvenile Area 3: 1 juvenile	
17/09/20	Area 1: 1 juvenile		
29/09/20	Area 1; 1 female, 1 juvenile	Area 1; 2 adult, 1 juvenile	Area 1: 1 adult

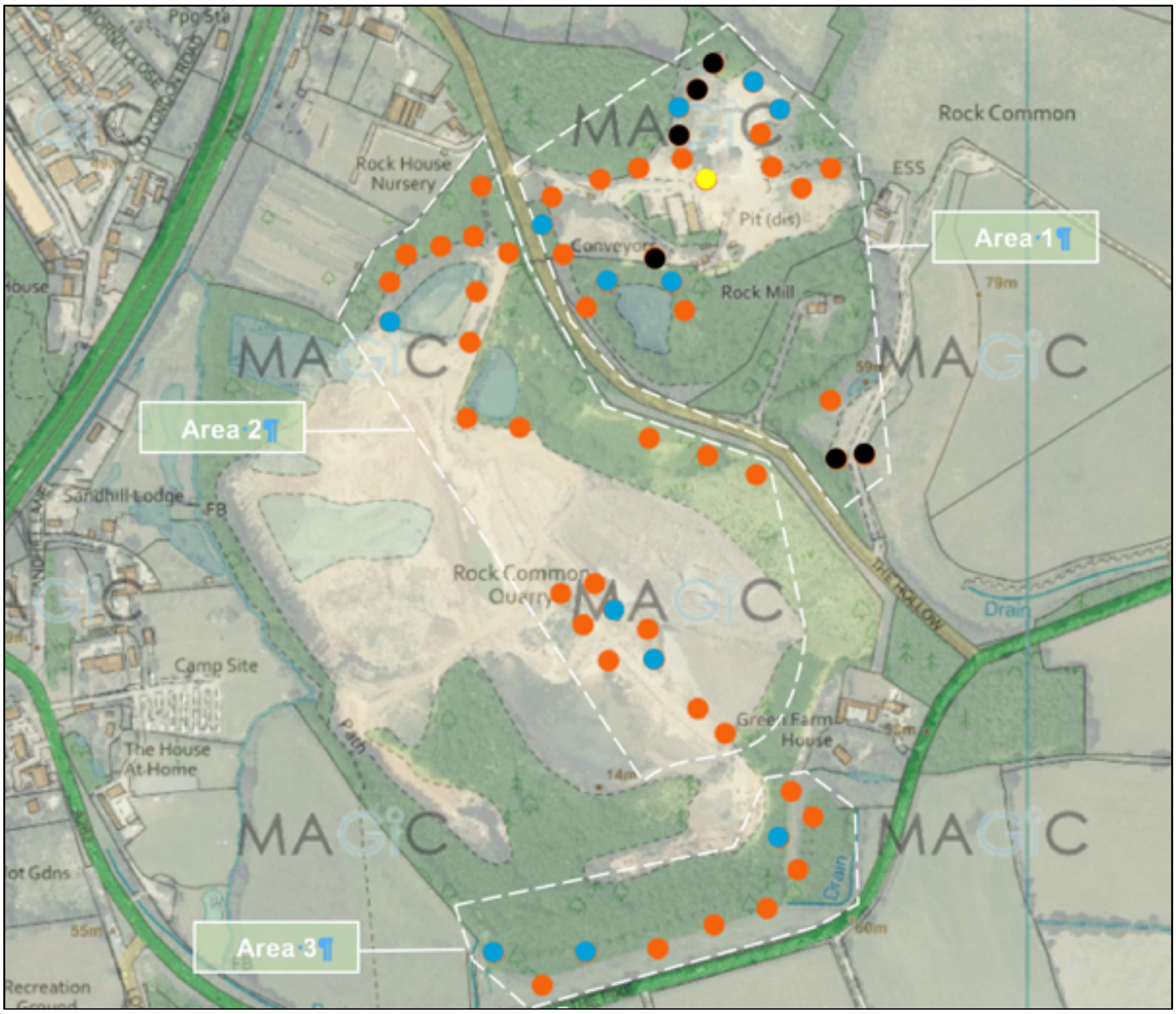

Figure 21. The location of reptiles recorded at Rock Common Quarry. Key: blue dot = grass snake, black dot = slow worm, yellow dot = common lizard, orange dot = no records.

2.21.2 Pre-existing records

SxBRC provided 139 records for reptiles within a 2km radius of the site. This included 34 records for slow worm, 67 records for grass snake, 22 records for adder and 16 records for common lizard. The majority of these records are located in Sandgate Park, which is approximately 1.8 km north-west of Rock Common Quarry, but the data includes records for grass snake within Rock Common Quarry, dated 2006.

2.21.3 Interpretation

The survey revealed a healthy population of grass snakes, including juveniles and adults in the quarry pit, and relatively small numbers of slow worm. Grass snakes are highly nomadic animals and probably use the site as part of a wider foraging resource. A single common lizard was also recorded at the site, within the processing yard. All three species were found in more established habitats around the site, where there is sufficient vegetation cover to offer refuge in an otherwise highly disturbed environment. Grass snakes were present in both the main quarry and processing yard, associated with the waterbodies and bordering scrub/woodland. The presence of marsh frog may be important as a source of prey and explain the concentration of numbers. Slow worms and common lizards are restricted to the more established grassland and scrub habitats around the processing yard.

The grass snake, slow worm and common lizard are common and widespread species in south-east England and likely to be present in most areas of suitable habitat across this region. Based on the available information, the quarry site is important to conservation at the **local level**.

2.22 Terrestrial Invertebrates

2.22.1 Survey results

A combined list over 130 species were identified from the quarry pit during the terrestrial invertebrate sampling and moth trapping, including three priority species (S41 NERC Act 2006), two nationally scarce/notable B species, and nine locally distributed species. A further 11 species are typically associated with sandy districts and/or open heathland habitats. A full list of species identified from the site is presented in Appendix 5.

2.22.2 Pre-existing records

SxBRC provided numerous records for invertebrates within a 2 km radius of Rock Common Quarry, including 36 Priority Species (S41 NERC Act 2006). The list includes stag beetle *Lucanus cervus*, nine species of butterfly and 24 moth species. Butterflies and, to a lesser extent moths, are among the most frequently recorded invertebrate groups and other groups are likely to be less well represented. The butterfly species are generally associated with quality semi-natural habitats contained within the South Downs. The moth records originate from relatively few locations and probably correspond to moth trapping enthusiasts – the priority moths reported have suffered significant declines in the numbers caught in moth traps but generally remain common and widespread species.

2.22.3 Interpretation

The terrestrial invertebrate surveys have revealed that the quarry pit supports a rich assemblage of solitary bees and wasps, and other species that are associated with well drained sandy habitats, together with more common and widespread species that occur in woodland, scrub and wetland habitats.

The bare sand cliffs on the north to eastern sides of the quarry pit, i.e. where they are south facing, are probably the most important feature and supports nesting aggregations of several thousand individual nests of the Early Colletes *Colletes cunicularius*. Rock Common Quarry provides all the 'partial habitat' required by this solitary bee, which forages for nectar and pollen on willow catkins (Salix spp.) and nests in sand cliffs. The areas of ephemeral vegetation that has developed in less disturbed parts of the sand quarry also support diverse assemblages of solitary bees and wasps that nest in consolidated sand. including the pantaloon bee *Dasypoda hirtipes* and bee wolf *Philanthus triangulum*, mining bees *Andrena* spp. and their various kleptoparasites *Nomada* spp. ('nomad cuckoo bees'). The on-going quarrying activity has actually created and maintained a supply of these ephemeral habitats as some areas are worked and then left undisturbed for several years creating a patchwork of ephemeral habitats at different stages in natural succession, which maintains metapopulations across the entire quarry.

The priority species small heath butterfly *Coenonympha pamphilus*, sallow moth *Xanthia icteritia* and

Rustic *Hoplodrina alsines* remain relatively widespread but have been added to the priority list due to concern of a decline in their numbers. The jumping spider *Sibianor aurocinctus* stands out as important as a nationally scarce species, together with a small solitary wasp *Pemphredon morio*, which is classified as nationally scarce (Nb).

Based on the available information, notwithstanding the survey limitations, the overall terrestrial invertebrate assemblage is likely to be important at least at **district level**.

2.23 Other notable species

2.23.1 Pre-existing records

SxBRC provided 12 records for hedgehog, 37 records for stag beetle and 1 record for water vole within the search area. The water vole record was located approximately 60m west of the site boundary on the Honeywell Stream, dated 29/03/19.

2.23.2 Interpretation

European hedgehog is a species of principal importance for nature conservation under Section 41 of the NERC Act (2006) (S41) that has suffered dramatic population declines in recent years. Water voles receive legal protection under the Wildlife and Countryside Act 1981 as amended. Both species are unlikely to occur within the Rock Common quarry site as the habitat it contains is generally unsuitable.

2.24 Invasive non-native species

Virginia creeper *Parthenocissus quinquefolia,* false acacia *Robinia pseudoacacia* and New Zealand pygmyweed *Crassula helmsii* were recorded on site, all of which are Schedule 9 invasive species. Several other non-native species that are also recognized as invasive were recorded. These included butterfly bush *Buddleia davidii*., staghorn sumac *Rhus typhina* and Canadian fleabane *Erigeron canadensis*.

Marsh frogs were recorded within the main quarry in Pond TN56. Marsh frogs are listed on Schedule 9, making it illegal to release or allow their spread into the wild.

2.24.1 Pre-existing records

SxBRC provided records of 36 invasive species within the search area, including New Zealand pigmyweed, Virginia creeper, false acacia, parrot's feather *Myriophyllum aquaticum*, variegated yellow archangel *Lamiastrum galeobdolon subsp. argentatum*, Japanese knotweed *Fallopia japonica*, harlequin ladybird *Harmonia axyridis*, horse chestnut leaf-miner *ameraria ohridella*, edible frog *Pelophylax esculentus*, Egyptian goose *Alopochen aegyptiaca*, American mink *Neovison vison* and grey squirrel *Sciurus carolinensis*.

2.24.2 Interpretation

Invasive non-native species often represent a current threat to native flora and fauna. This is because they often outcompete native species for resources, such as food and light, resulting in a reduction in biodiversity.

It is an offence to plant or otherwise causes to grow in the wild any plant which is included in Part II of Schedule 9. The marsh frog is known to be a vector of chytridiomycosis, which can be a threat to native amphibians, and there is a risk that they will migrate other ponds within the surrounding area.

3 IMPACT ASSESSMENT

In this section, the predicted impacts and effects of the proposed scheme are described for each important ecological feature in turn. This is based on the best available information, both on the baseline ecological condition and on the method of construction, timescale and other development/planning constraints known at the time. The significance of the impact on nature conservation is recorded in accordance with CIEEM guidance and the degree of uncertainty relating to the occurrence and severity of an impact is discussed.

This assessment is based on the information contained in the Environmental Impact Assessment Scoping Report[12]. It also draws upon information on the scheme and local area provided in the Landscape and Visual Impact Assessment[13] and addresses the points raised in the Screening Opinion Letter[14].

It is intended that a planning application will be submitted to West Sussex County Council as the mineral planning authority for the proposed (landform) restoration scheme:

"*The continued winning, working and processing of sand from the existing Rock Common Quarry, the importation of inert classified engineering and restoration material, the stockpiling and treating of the imported material, the placement of the imported material within the quarry void and the restoration and landscaping of the quarry"*

This is required because the existing permission (dated 2004) time-expires on 31st December 2020 and the approved restoration scheme is problematic and subject to review. The proposed sand extraction is straight forward and involves an extension of time for continued operation of the quarry using the existing infrastructure to remove the remaining reserves to the limits specified in the 2004 permission. As such, these ongoing operations have resulted in the existing habitats contained at the quarry site, and therefore forms the baseline ecological conditions. The continuation of sand extraction is not therefore considered further in this EcIA.

The approved restoration scheme results in the creation of a large and very deep waterbody with steep slopes, with some landscaping for ecological restoration, and for establishing recreation use at the site. This is now unacceptable because it represents a significant safety hazard and presents a complexity of ground water issues in relation to the adjacent landfill sites. Furthermore, as this permission was granted in 2004, the final resultant habitat types established by this approach would not meet today's standards in terms of biodiversity conservation and enhancement, ecological networks and ecosystem services.

The proposed landform restoration addresses these issues by importing classified inert material to infill the quarry pit to a level above the natural recovered ground water, replacing the deep-water lake with

[12] Terrestria Ltd (July 2019) Environmental Impact Assessment Scoping Report; Rock Common Quarry, The Hollow, Washington, West Sussex. Prepared on behalf of Dudman (Rock Common) Ltd. for submission to West Sussex County Council to inform an EIA screening opinion request.
13 Lizard Landscape and Ecology (September 2020) Landscape and Visual Assessment; Rock Common Quarry, The Hollow, Washington, West Sussex. Prepared on behalf of Dudman (Rock Common) Ltd.
14 West Sussex Council (November 2020) Environmental Impact Assessment Screening Opinion.

a platform on which to recreate/restore semi-natural habitats and ultimately open the site for low-key recreational use to complement the South Downs National Park that lies to the south.

The extraction of the remaining sand reserves is not expected to take more than a few years, but the proposed landform restoration scheme involves importation of almost 3 million cubic metres of inert material over a period of several years as part of a phased process (see Figure 18). The material will be brought by road into a new processing area on the former Windmill Landfill site, before being conveyed under The Hollow via an existing (reinstated) tunnel into the quarry pit and placed within the quarry void.

Activities that will occur during the proposed restoration scheme that could give rise to significant ecological impacts include:

Construction:

- Destruction of all existing habitats contained in the quarry including woodland of recent origin, permanent, semi-permanent and ephemeral waterbodies, annual short perennial vegetation and bare sand. Infilling the quarry pit will also result in the loss of exposed sand cliffs.
- Direct harm to flora and fauna (mortality)
- Widespread disturbance from operating machinery, human activity within the quarry pit that could potentially affect breeding birds and other protected species.
- Increased air pollution, dust and artificial light spill affecting existing quarry habitats and surrounding areas.
- Disruption of hydrology; groundwater and watercourses

Post construction/Operation:

- Permanent loss and/or damage to important ecological habitats and local species extinction/displacement.
- increased recreational use of adjacent habitats leading to soil compaction, human/dog disturbance, littering, and physical damage to restored habitats.
- Positive impacts through landform restoration, habitat creation and biodiversity enhancement of the former quarry site.

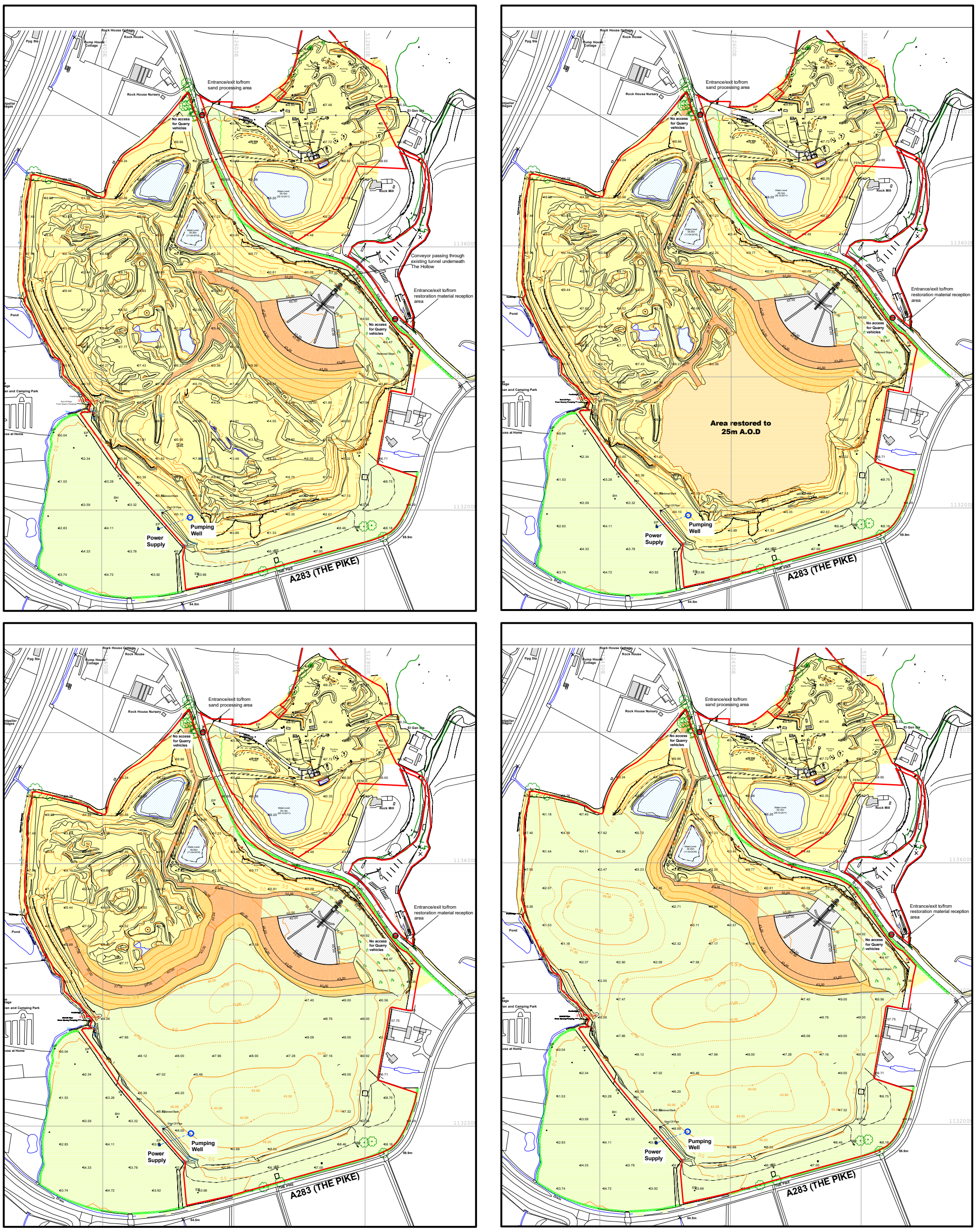

Figure 22. Proposed restoration scheme - indicative plans showing phased infilling, with the final landform levels established at the southern end of the site first, followed by the northern portion of the site. The images above are a sample of the eight phases proposed to establish the new landform within the quarry. Figure produced courtesy of Terrestria Limited.

Both the approved and proposed restoration schemes result in similar impacts in broad terms; the existing habitats contained within the quarry are lost directly, either by flooding to form a large lake, or through destruction by infilling. However, there are key differences in the way in which this occurs and how this effects the existing flora and fauna, and also in the long-term legacy of each scheme in terms of future biodiversity value of the resultant habitats.

The following sections of this EcIA consider the differences between the impacts of the proposed restoration scheme and the approved restoration scheme for each receptor in turn. This approach has been chosen to present an objective comparison between the two restoration schemes and consider their merits and limitations in creating the best value for biodiversity following the cessation of sand extraction.

Global Warming and Ecological Resilience

Often the scope of an Environmental Impact Assessment is applied without consideration of some of the long-term influences that may be experienced as a result of climate change. Whilst it is difficult to predict the exact path that global warming will take, the best available modelling by climate scientists suggests that extreme and volatile weather patterns are more likely in Britain, resulting both in longer periods of drought in the summer and very wet winter conditions. This is in addition to general warming, which combined with these weather pattern changes has the potential to have a significant impact upon British wildlife.

It is beyond the scope of this assessment to specifically design features into the restoration scheme that might result in increased tolerance of these weather patterns, however it is widely accepted that biodiversity will play a key role in tackling the impacts of climate change. This is because more diverse habitat and species communities are expected to have an increased tolerance and an ability to adapt to change, thus helping with the process of natural adaptation. It can therefore be relatively confidently concluded that the scheme proposal that results in the greatest uplift in biodiversity value will also be the most future-proofed scheme against the effects of future climate change.

3.1 Designated sites

3.1.1 Approved Restoration Scheme Potential Impacts

Rock Common Quarry lies within the Impact Risk Zone for Chanctonbury Hill SSSI, which requires consultation with Natural England for "*planning applications for quarries including new proposals, review of existing permissions, extensions or variations to conditions*"

However, this statutory designated and the three local wildlife sites lies sufficiently far away from Rock Common Quarry that no impacts will occur as a result of the cessation of dewatering and landscaping as part of the permitted restoration scheme.

The South Downs National Park is located close to the southern boundary of the quarry. The habitats that lie between the quarry and the ecologically important ancient woodland on the South Downs escarpment comprise mixed improved grassland pasture. This improved pasture forms a buffer between the quarry site and more sensitive habitats contained in the park and therefore no impacts are predicted to occur.

The approved restoration will however result in the direct loss of habitats identified on Magic as predominantly 'semi-improved grassland' with areas of 'open mosaic on previously developed land'. These are now classified as priority for conservation under Section 41 of the NERC Act. However, the most up to date Phase 1 surveys have revealed that the quarry habitats are predominantly open bare ground (active quarry), ephemeral/short perennial vegetation, mesotrophic standing water, marginal inundation, dense continuous scrub and broadleaved woodland (of recent origin). Most of the quarry site can more accurately be described as open mosaic on previously developed land, which is still a priority habitat. These habitats would be replaced with another priority habitat – standing water, as part of the approved restoration but this would result in a large, deep water lake of limited biodiversity value than the existing habitats.

3.1.2 Proposed Restoration Scheme Potential Impacts

As for the approved restoration, Chanctonbury Hill SSSI lies sufficiently far away from Rock Common Quarry that no direct impacts will occur. However, in contrast with the approved scheme, the proposed scheme could lead to increased diffuse air pollution from vehicles travelling to and from the quarry during the infilling operations, which could potentially affect the SSSI indirectly. This is beyond the scope of this EcIA but the designated site is located more than 1km from Rock Common Quarry, is approximately 1km south of the potential haul routes and is not downwind from prevailing winds from either, so there is very unlikely to be a measurable impact for nitrogen deposition and windborne dust above background levels.

The National Park does not lie downwind from prevailing winds and is therefore unlikely to receive air pollution and windborne dust from the proposed restoration scheme, although there are likely to be landscape character impacts. These are considered in detail in the Landscape and Visual Assessment (LVIA) for the proposed scheme.

The proposed restoration scheme has potential to impact on part of the designated roadside verge on the eastern side of The Hollow through increased heavy vehicle movements.

Both restoration schemes will result in the loss of priority habitat contained within the quarry site. However, in the case of the proposed scheme, in the long term these will be replaced through landscaping and creation of new habitats. Ultimately these habitats which are likely to have much higher biodiversity value than the existing site and a large deep-water lake that would be formed under the existing permission.

3.1.3 Impact Significance and Comparison

The approved restoration and proposed restoration will result in **negligible** impacts on the statutory designated sites.

The approved restoration will result in the permanent destruction of 'open mosaic on previously developed land', classified as priority habitat and replacement with a large deep-water lake of lower biodiversity value The proposed restoration will result in the replacement of existing classified priority habitats with habitats of potentially higher ecological value (see Section 3.2 below).

3.2 Priority habitats

3.2.1 Approved Restoration Scheme Potential Impacts

All habitats contained within the quarry pit will ultimately be destroyed as a result of both restoration schemes. While the bulk of the quarry pit and processing area is classified as 'good quality semi-improved grassland' on Magic Maps, it is clear that it should be updated to 'Open Mosaic Habitat on Previously Developed Land' in places where disturbance is infrequent and annual/short perennial vegetation has colonized. Both of these habitats are classified as priority habitats for conservation under S41 of the NERC Act 2006.

Both schemes will also result in the destruction of scrub and woodland of recent origin, and a variety of waterbodies contained within the quarry pit, together with the near-vertical sand cliff faces. While these latter habitats are not recognized as priority for conservation, the cliff faces are ecologically important for providing nesting habitat for sand martins, peregrine falcons and solitary bees and wasps (see below).

In the case of the approved restoration, these habitats are replaced with a large, deep-water lake covering approximately 14 hectares. The remaining fringes are landscaped to create a shelf or berm around the lake. This process is likely to take place as a single event once landscaping is completed and the de-watering pumps are switched off, leading to displacement and local extinctions of the existing flora and fauna present on the site.

The current dewatering pumps discharge into the adjacent Honeywell Stream, and augment the base flow of this watercourse with clean fresh water. The impacts of the approved scheme on groundwater flow are outside the scope of this document and are assumed to be dealt with in the original application for that scheme. However, there are potential ecological impacts arising from cessation of this augmentation that should be taken into account – for example, further downstream there is a locally important salmonid fishery (wild brown trout and sea trout). In the absence of detailed information, it is unclear whether removing the augmentation flow from Rock Common Quarry would have a significant effect on this fishery.

3.2.2 Proposed Restoration Scheme Potential Impacts

As for the approved scheme, the proposed restoration scheme will also result in the direct loss of the existing habitats contained within the quarry pit. However, in contrast with the approved scheme, this will occur in incremental phases as indicated on Figure 19 over several years. During this process, natural colonization of annual/short perennial is likely to naturally occur in the short term, and new high value habitats including the new wetlands are created on restored parts of the site before the scheme is complete. These processes allow the continuity of suitable habitat for the existing flora and fauna (especially terrestrial invertebrate assemblages) present at the site so that, in contrast with the approved restoration, they are not displaced by new habitats in a single event.

The area around the pond and settlement lagoon in the north-west part of the quarry are retained as waterbodies throughout the life of the proposed scheme, providing additional habitat continuity.

The mature woodland on the original landform, fringing the quarry pit and existing sand processing area will be retained. Ponds 22, 23, will remain intact as part of the proposed scheme, whereas these would be lost in the approved scheme. The proposed scheme includes a new inert material processing area which occupies an additional area of land that contains ephemeral/short perennial bordered by semi-natural broadleaved woodland. A proportion of this habitat area will therefore be lost. Ponds 54 and 55 also lie close to this area and are at risk of pollution or sediment run-off.

There is potential for temporary indirect impacts on semi-natural broadleaved woodland and semi-improved grassland bordering the quarry pit during the infilling phase (as substantial earthmoving works could lead to air pollution, release of dust, noise disturbance and artificial light spill), and in the absence of mitigation, a risk of pollution and release of fine silt into watercourses.

The proposed scheme includes continuation of de-watering of the site and augmentation of the Honeywell Stream will be maintained so that no significant impacts on downstream aquatic habitats will occur. It is proposed that there will be a reduced pumping rate of 2000m^3/day (from an existing mean average rate of approximately 4000 m^3/day) of water to augment the flow in the Honeybridge Stream. This new pumping rate would be released steadily throughout the day and therefore provide a more even flow than that which is currently in place. This is contrary to the proposed cessation of pumping, as per the approved restoration plan, and recognises the significant contribution currently made to flows in the Honeybridge Stream from Rock Common Quarry. Further detail for these proposals can be found in the EIA Chapter produced by H2O Geo on geological and hydrological impacts.

3.2.3 Impact Significance and Comparison

Direct loss of habitats resulting from the proposed restoration scheme will be broadly similar to the approved scheme. There are differences including the retention of existing ponds in the north-western part of the quarry, and the addition of land to accommodate the new inert material processing area. However, these differences are minor and on balance, the existing habitat loss of both restoration schemes is considered to be significant at the **district level**. However, the staged approach to the proposed scheme allows some habitat continuity throughout the restoration process, and the final restoration provides an opportunity for creating new habitat of high biodiversity value that compensates for the habitat loss. These represent significant advantages for biodiversity conservation over the approved scheme.

3.3 Badgers

3.3.1 Approved Restoration Scheme Potential Impacts

There are potentially two active main setts contained within the boundaries of the site. The first, confirmed as still active in 2020, is located in woodland to the east of the processing yard. This is some distance away from both restoration schemes and will not be directly impacted.

The second, which was not re-found during surveys in 2020, is located on the eastern side of the quarry pit and if it remains active, it would be inundated by the rising groundwater and lost as a result of the approved restoration scheme. Other setts may be established by badgers in the quarry pit in the intervening period between the ecological surveys and commencement of works. The habitats present in the pit are unlikely to be an important foraging resource for badgers, which prefer woodland and grassland pastures, but their presence indicated by footprints in the quarry floor does suggest that they pass through the site on a regular basis.

3.3.2 Proposed Restoration Scheme Potential Impacts

As for the approved scheme, there is potential for direct impacts on the sett located on the quarry floor if it remains active, as a result of earthmoving activity during the infilling phase.

3.3.3 Impact Significance and Comparison

The destruction of an active badger sett, in the absence of mitigation, would be significant in animal welfare terms, but since badgers are now common and widespread, the potential impact of both schemes on badgers is **negligible** in nature conservation terms.

However, it is important to consider badgers from a welfare perspective and to ensure compliance with legislation.

3.4 Bats

3.4.1 Approved Restoration scheme Potential Impacts

The approved restoration scheme does not impact upon any buildings that are known to currently support roosting bats. The buildings that were surveyed on the existing sand processing yard would ultimately be demolished and the area re-landscaped as part of the approved restoration scheme in the near future. Therefore, roosting bats are unlikely to be impacted by this scheme.

The current surveys have demonstrated that the existing habitats contained within the quarry pit are not important to foraging bats. Most of the foraging activity was recorded around the semi-natural woodland that borders the quarry and existing sand processing yard; the records of foraging by scarcer species (Barbastelle and Serotine) are intermittent and located in the fringing woodland habitats that will remain unaffected by both restoration schemes. The approved restoration scheme will replace the low value sand quarry with a large deep-water lake and retains the more important foraging habitats identified by the current surveys. The lake and its landscaped margins could potentially attract bats that specialise in gleaning the water surface to feed on emergent insects (i.e. Daubenton's bat) and Soprano pipistrelle, which is loosely associated with wetlands. However, this is unlikely to be a significant benefit to bats as a steeply sloping, deep, open waterbody has very limited invertebrate productivity compared to shallow, warmer and well vegetated wetlands.

The approved scheme will not lead to increased artificial lighting which results in disturbance to bats.

3.4.2 Proposed Restoration Scheme Potential Impacts

The proposed scheme also does not impact on any buildings that are known to support roosting bats. However, the two buildings on the processing yard that have features with potential to support roosting bats will remain in use during the extraction of the remaining sand reserves. Beyond that, it is likely that they will be demolished and replaced by a parking area. Their condition with respect to bats may change in that time and further surveys will be necessary to determine their importance to bats at the time immediately before their demolition.

The proposed restoration will eventually lead to the same degree of habitat loss in the quarry pit as the approved restoration scheme. The fringing woodland around the quarry pit will be retained and therefore the impacts on bats will be similar. However, the proposed scheme retains two of the existing waterbodies on the north-west side and replaces the lost habitats with a landscaped mosaic of terrestrial and shallow-water wetland features that are potentially significantly more valuable to foraging bats than the existing habitat and a large deep-water lake. Furthermore, the infilling process will take place in incremental phases over several years giving time for foraging bats to adapt to the changes and take advantage of the new habitats.

The existing processing yard will continue to operate unmodified until all the remaining sand reserves have been extracted. Therefore, no additional impacts on foraging bats are expected to occur here from the approved scheme. However, indirect disturbance impacts are possible as a result of the proposed new inert material reception area (e.g. habitat degradation, artificial light spill, disturbance).

The distribution of the bat species of higher conservation concern, barbastelle and serotine bat, is associated with the fringing woodland habitat on the original landform above the quarry to the north and west. These areas are retained as part of the restoration scheme and these species therefore will remain largely unaffected.

The quarry site presently has minimal artificial lighting, though a motion-sensor floodlight operates next to the water pump within the quarry and there is localised flood lighting of the sand processing yard. The continuation of sand extraction within the quarry beyond 2020 means this background impact would continue. However, in the longer term, all artificial light sources would be removed and the impact of the existing lighting would no longer be present, representing a positive impact on foraging bats.

3.4.3 Impact Significance and Comparison

Both schemes lead to a similar degree of loss of habitat contained within the existing quarry site. The surveys demonstrate that these habitats are of low value to foraging bats and their direct loss to either scheme is not considered to be significant beyond **site level**. However, the proposed restoration scheme differs from the approved scheme as the establishment of a mosaic of habitats on the restored landform will potentially have much higher value to a range of foraging bat species when compared to the approved scheme, which would replace the existing quarry with a large deep-water lake. The proposed scheme therefore is likely to result in a **positive impact at a site level** in the long term.

3.5 Breeding birds

3.5.1 Approved Restoration Scheme Potential Impacts

As previously indicated, the approved restoration scheme will result in the direct loss of all habitats contained within the quarry, this includes the vertical cliff faces used by the breeding pair of peregrine falcons, and the breeding colony of sand martins. This is because the creation of a large deep-water lake necessitates some landform works to stabilise the cliffs and lake margins; earthworks are required to regrade the quarry margins to prevent collapse/slumping/erosion around the lake margins. The original vertical cliffs will therefore be replaced by a gradient and flat berm with access for recreation. This scheme retains the top part of the original cliff face along the north-eastern corner of the quarry, where the majority of the cliff face has already been stabilised by infill material. This area is not suitable for breeding peregrines and would be sub-optimal for sand martin nesting burrows as it lacks sufficient height to prevent predators and therefore these important species are likely to be permanently lost from the site.

The inundation of the quarry floor will remove existing wetland features, woodland and scrub and will displace the existing bird assemblage supported by the quarry pit. This assemblage comprises common and widespread species of minor importance to conservation and is replaced with a large deep-water lake which has potential to attract a different suite of waterbirds (for example diving ducks, cormorants and grebes).

The fringing woodland and scrub habitats will remain intact and most of the breeding bird assemblage it supports will continue to survive unaffected.

3.5.2 Proposed Restoration Scheme Potential Impacts

The proposed restoration scheme has a similar impact on the existing breeding bird assemblage – the infilling of the main quarry pit, and with that the ultimate loss of the tall exposed sand cliffs used by the peregrine falcon and sand martin colony for a breeding site. The scheme will also result in the loss of all other habitats contained within the quarry pit, including the waterbodies and gorse/scrub used by breeding linnets.

The infilling process is expected to take several years to complete in incremental phases, with the southern area containing the wetland features being infilled first. The proposed infilling is expected to result in significant increases in the level of activity (both human and earthmoving machinery) which could lead to increased levels of disturbance to nesting peregrines in this area, although not all of the quarry will be active at any one time. The infilling of the wetland features on the quarry floor will remove foraging habitat for sand martins (and possibly peregrine), which together with the increased disturbance and ultimate loss of the vertical cliff faces, may render the site permanently unsuitable for breeding. All wetland birds will be displaced by these activities too.

Under the proposed scheme, the ponds on the north-west corner of the quarry will be retained, and all fringing woodland around the quarry will remain intact. The phased approach to infilling allows some of the existing ephemeral vegetation habitats to be retained while the other part of the quarry is infilled. This will then be subject to infilling operations while the new habitats are established on the newly formed ground; this will provide some continuity of habitat suitable for some of the existing breeding bird assemblage such as linnets.

3.5.3 Impact Significance and Comparison

The most significant impact of both schemes is the permanent loss of suitable breeding sites for peregrine falcon and sand martin, which is considered to be significant at the **District level**. Both schemes also result in the permanent loss of wetlands, scrub and ephemeral vegetation contained within the quarry which is not considered to be significant to bird conservation beyond local level.

The most significant difference between the two schemes is the final habitats that are left on completion of the restoration works. For birds, this means a contrast in the breeding, and wintering bird assemblages that the final habitats will support, both from each other and from the existing habitat. There are likely to be some gains and some losses with both options, and a degree of uncertainty. However, with the proposed scheme, there is more opportunity to create new habitat that is characteristic of the region that could benefit more species of conservation concern (e.g. red-listed species present on the existing quarry, i.e. linnet, and heathland specialists that are present locally i.e. nightjar, Dartford warbler).

3.6 Common dormice

3.6.1 Approved Restoration Scheme Potential Impacts

Two confirmed dormouse nests were found in woodland around Rock Common Quarry; one is located in the east of the existing sand processing yard, the other in mature woodland above the main quarry pit to the south. Since common dormice tend to have large home ranges, it is reasonable to assume that they are present in all fringing semi-natural woodland upon the original landform around the quarry pit and processing yard will be retained as part of both restoration schemes. These habitats will be retained intact and therefore no direct impacts on dormice are expected.

However, the woodland contained within the quarry pit will be lost through inundation and earthworks. This habitat is sub-optimal for dormice as it lacks nut and fruit bearing species and is seasonally inundated with water and therefore unlikely to support hibernation. The risk of direct impacts on dormice as a consequence of the approved scheme is considered very low, although their presence cannot be completely discounted as there are some canopy connections.

As for bats, there is also potential for indirect impacts on dormice, through dust deposition and habitat degradation of the fringing woodland during earthworks, disturbance from artificial light spill and increased recreation use on completion of the restoration.

3.6.2 Proposed Restoration Scheme

The impact of the proposed restoration scheme upon dormice is the same as for the approved scheme, with the direct loss of the same area of sub-optimal habitats that are unlikely to be of any significant value to the local population and potential for degradation and disturbance of bordering woodland. However, the key difference is that the final restoration will potentially result in new suitable dormouse habitat that is directly connected to the existing population and therefore allow an expansion of their range locally.

3.6.3 Impact Significance and Comparison

The permanent loss of an area of sub-optimal woodland as a result of both schemes represents a very small proportion of the available habitat in the region and is not considered to be significant beyond **site level**. However, there remains a very small risk that dormice may be displaced by inundation under the approved scheme, or directly harmed if present in the woodland during vegetation clearance or earthworks under the proposed scheme. This shall easily be accounted for by introducing precautionary mitigation measures.

In the long term, the proposed scheme has advantages over the approved scheme because the final landscaped site will potentially provide a net gain in suitable dormouse habitat through shrub and tree planting, resulting in a **positive impact at local level** that outweighs the loss of original sub-optimal habitat.

3.7 Reptiles

3.7.1 Approved Restoration Scheme

Grass snakes, slow worm and common lizard are relatively common and widespread in south-east England, and the loss of suitable habitats contained in the quarry pit that supports grass snakes represents a very small proportion of that available to the wider population. Grass snakes are likely to be displaced from the quarry, and provided they are not hibernating at the time will be able to move away as the water levels rise. However, grass snakes may be directly harmed during vegetation clearance and earthworks to reprofile the lake margins in the absence of mitigation. Slow worms and common lizard are unlikely to be impacted by the approved restoration scheme as they are not present in the quarry pit, being recorded from the bordering habitats around the existing sand processing yard.

Following completion of the approved restoration, a large deep-water lake would be unsuitable habitat for common reptiles although there is potential for better quality habitat to develop around the margins of the lake than that which currently exists. However, the extent of this habitat will be smaller and therefore the scheme will result in a net loss in suitable reptile habitat.

3.7.2 Proposed Restoration Scheme

The on-going quarrying activity at the site already poses a small risk of mortality and injury to grass snakes, which are known to occur within the quarry pit. This risk is significantly increased where localised areas of less disturbed habitats, such as vegetation fringing waterbodies, scrub and semi-improved grassland, known to support common reptiles are cleared for infilling operations. Clearance of existing habitats and infilling operations also represent loss of habitat for common reptiles, although this is unlikely to occur in one event, and the lost habitat will eventually be replaced by landscaping towards the end of the restoration.

In practice, the distribution of grass snakes across the quarry site is likely to continue to be dynamic during the infilling phase, as it is now, with animals moving to avoid areas of high disturbance and take advantage of newly established ephemeral habitats and restored areas. Grass snakes are highly mobile and will try to take evasive action if disturbed. However, they are at greater risk of harm during colder weather and during the winter hibernation period when they are immobile. In the absence of mitigation, mortality could be significant at these times.

The surveys revealed that slow worms and common lizard are restricted to the periphery of the processing yard, which will remain unchanged during the restoration process. Slow worms are recorded from the proposed new yard receiving and processing infill material and are therefore at risk from direct harm during the initial establishment of the facility. The slow worms and common lizard present around the existing sand processing yard will remain unaffected as this area will not change until sand extraction is complete, after which the site will be converted into a carpark area. At which time, slow worms may potentially be harmed during construction of the carpark area.

3.7.3 Impact Significance and Comparison

Overall, based on the extent and quality of habitat lost, the existing population size and common status of the species involved, the negative impact of both schemes on common reptiles is not considered to be significant beyond **local level**. However, as for other species, the proposed scheme has advantages over the approved scheme for common reptile species because the final landscaped site will potentially provide a net gain in suitable habitat through the establishment of a mosaic of heathland, acid grassland, wetlands and scrub/woodland. This outweighs the initial loss of habitat and is likely to represent a **positive impact at local level** in the long term.

3.8 Terrestrial Invertebrates

3.8.1 Approved Restoration Scheme Potential Impacts

As previously indicated, the ephemeral vegetation, bare sandy ground and exposed sand cliffs that are contained within the quarry pit and support important solitary bee and wasp aggregations will ultimately be lost as a result of the approved restoration. The existing secondary woodland and range of waterbodies and wetland habitats on the quarry floor that also contribute to the invertebrate diversity will also be lost. A small remnant of the cliff top would retained along the north-eastern corner of the quarry site.

The majority of habitats would be replaced by a large deep-water lake with limited value to terrestrial invertebrates. The areas to the north-west of the lake would be relandscaped together with the lake margins. It is not clear what habitat types will be created in these areas as part of the approved restoration and their value to terrestrial invertebrates but what is clear is that there would be a net loss in the area of terrestrial habitat.

The approved restoration is likely to take place as a single event, representing a break in the temporal continuity of suitable habitats for the existing terrestrial invertebrate assemblages. As a consequence, local extinctions of a proportion of the existing species will occur and there is uncertainty whether they will be able to recolonise the new habitats created, both because the replacement habitats may not be suitable, and there may not be populations nearby to act as a source of colonists for the scarcer and/or less mobile species.

3.8.2 Proposed Restoration Scheme Potential Impacts

The proposed restoration results in a very similar loss of existing habitats contained within the quarry, although in contrast to the approved restoration, some short ephemeral vegetation, sand banks and two waterbodies are retained in the north-west part of the quarry pit.

This habitat loss will not occur all at once as the infilling process will occur in incremental steps as indicated on Figure 22, while other parts of the quarry are left undisturbed. This allows for some habitat continuity throughout the infilling operation with natural regeneration of ephemeral vegetation and recolonsiation by terrestrial invertebrates, including nesting solitary bees to continue to nest and complete their life cycle in one part of the site or another.

However, the suitability of these intermediate habitats for those specialist invertebrates that require sandy substrates is uncertain and depends on the type of material that is imported. It is likely that habitat quality for terrestrial invertebrates will deteriorate over time, as the quarry is infilled, and sandy substrates are replaced with fill material. The level of activity and disturbance may be more intense than current operations, leaving less space and time for these ephemeral habitats to develop and insects to complete their life cycles.

Ultimately the proposed scheme will result in a mosaic of terrestrial and wetland habitats with potential to support a diverse invertebrate assemblage. The value of these habitats will depend on the vegetation types that develop, which is influenced by the soil type (determined by the imported material type) and management regime.

In the absence of mitigation, these processes could still potentially result in the gradual loss of sand specialist species from the site and replacement with more common and widespread species; i.e. leading to local extinctions of invertebrate species as for the approved restoration scheme.

3.8.3 Impact Significance and Comparison

The initial loss of the priority habitat 'open mosaic on previously developed land' to the approved restoration scheme represents a significant impact on terrestrial invertebrates at **district level**. The proposed restoration has distinct advantages both in terms of habitat continuity and retention of a proportion of suitable habitats throughout the infilling works, but also in legacy terms as the final restored site has potential (with mitigation and targeted habitat creation/enhancement) to be designed to conserve terrestrial invertebrate assemblages into the future. The approved restoration will result in a net loss in the area of suitable habitat for the existing terrestrial invertebrate populations in the short term, and the marginal habitats created by this scheme are unlikely to be suitable for maintaining populations of the existing assemblage.

3.9 Other notable species

3.9.1 Potential Impacts (Both Schemes)

Both the approved restoration and the proposed restoration schemes are unlikely to result in negative impacts on other notable species that have been recorded in the local area (hedgehogs, stag beetles and water voles).

3.9.2 Impact Significance and Comparison

As previously indicated, a key difference between the two restoration schemes is that the proposed restoration has potential to recreate habitats for the benefit of a wide range of species, whereas the approved restoration has limited scope for this as the bulk of the site would become open water.

The proposed scheme also retains the dewatering pumping and therefore maintains the current condition of the Honeywell Stream.

3.10 Invasive non-native species

3.10.1 Approved Restoration Scheme Potential Impacts

The existing quarry pit contains a small infestation of New Zealand Pigmyweed in the ephemeral ponds and other warty bodies. The inundation of the quarry pit to form a large lake could potentially result in the proliferation of this species around the margins of the lake, which would prevent the establishment of native flora and fauna.

3.10.2 Proposed Restoration Scheme Potential Impacts

Since the proposed infilling operations will destroy the existing wetland habitats, it is possible that these infestations will be removed during the proposed restoration scheme. However, this is not certain in the absence of mitigation, as new temporary pools may be created during operations, and fragments of the plant may persist and be carried inadvertently into them.

The false acacia or black locust tree is present in the fringing mature woodland around the quarry site, most notably on both sides of The Hollow. Unlike New Zealand pygmyweed, this species is not currently on Sch. 9 of the Wildlife and Countryside Act (1981) as amended[15], but has potential to be invasive, especially with the onset of climate change (it is already recognised as an invasive species in France, California, Australia and South Africa). Left to its own devices, there is potential for this species to be spread and colonise other areas of Rock Common Quarry including the newly placed fill material. There is also potential for propagules of this species to be carried and spread to other sites by vehicles during the infilling process - seeds may be inadvertently picked up in lorry tyre treads as they pass to and from the new processing yard along The Hollow.

The importation of large quantities of fill material always carries a risk of bringing invasive non-native species such as Japanese knotweed, giant hogweed and Himalayan balsam into the quarry site and processing yards. Finally, there is a small risk that invasive non-native plants could be introduced to the final scheme through inappropriate soft landscape planting.

3.10.3 Significance of impacts

Invasive non-native species have potential to cause significant ecological harm. If New Zealand Pygmyweed is allowed to become established in the large deep-water lake, or any other waterbodies at Rock Common Quarry, it would reduce the ecological value of the site substantially and could be source of propagules for dispersal to other sites.

The proposed scheme includes creation of shallow water bodies that could still potentially be colonised by New Zealand Pygmyweed in the absence of mitigation, although the risk of this occurring is much smaller. Conversely there is a higher risk of introducing other INNS with imported material with the proposed scheme in the absence of mitigation. Depending on the species involved this has potential to significantly reduce the ecological value of the final landscaped site.

Since there is a high degree of uncertainty in the behaviour of INNS, it is not possible to place a level of significance on this aspect for each scheme.

4 MITIGATION PROPOSALS

The restoration schemes (both the approved and the proposed schemes) can be broadly viewed as mitigation and compensation for the impacts of long-term quarrying at Rock Common Quarry and the

[15] https://www.legislation.gov.uk/ukpga/1981/69/schedule/9: accessed on 24 October 2020.

loss of the habitat that once existed on the original landform of the site. Whilst the Impact Assessment described in this EcIA has considered separately the effects that would result from the implementation of both of these restoration proposals, this section considers only the proposed new restoration scheme and sets out the measures to avoid, mitigate and compensate for the impacts identified. No comparison is therefore made between any detailed mitigation proposals that would be appropriate for each respective scheme, within this section.

4.1 Designated sites

As no significant risks have been identified that might impact designated sites, no mitigation measures specific to their protection is proposed.

4.2 Priority habitats

4.2.1 Impact avoidance

Destruction of existing habitats contained in the quarry are unavoidable. The proposed scheme is intended to infill the quarry void to create a new landform above the water table. However, the upper parts of the exposed sand cliffs will be retained in places, together with ponds TN22 and TN23 and their surroundings.

The existing mature woodland fringing the quarry pit will also be retained throughout and eventually merge with the restored landform, assisted by the soft landscape planting scheme.

4.2.2 Mitigation measures

The restoration scheme includes soft landscaping and habitat creation designed to maximise biodiversity and reflect the landscape character and ecosystem types of the surrounding area to blend in the former quarry site. The soft landscape design will include creation of new shallow waterbodies, heathland and acid grassland areas, together with scrub and woodland planting to bolster the existing fringing woodland on the original landform.

It is anticipated that the ‘inert classified engineering fill material’ will not be suitable for recreating heathland and acid grassland habitats, so it is proposed that a quantity of the existing sandy substrate will be retained and stockpiled within the quarry pit, to be used to top-dress the final fill level with an appropriate depth of suitable sand substrate for establishing the target vegetation types. Initially, a series of small experimental plots will be used to determine the most successful methods for establishing the target vegetation types.

The phased approach to the restoration scheme means that it is possible to establish these habitats incrementally across the site, as the infilling of each area is completed, resulting in a series of habitats at various stages in ecological succession. Moving into the final phases, habitat management will be introduced to ensure the continuity of early succession habitats with a high proportion of bare sand and ephemeral vegetation to maintain existing specialist invertebrate assemblages.

Construction safeguards will be strictly implemented throughout the infilling process to ensure pollution of watercourses or groundwater does not occur, and to minimise air pollution and release of dust. These measures can be appropriately secured through the preparation of a Construction Environmental Management Plan (CEMP) that is approved by West Sussex Council through reserved matters.

4.2.3 Residual impacts

Through the creation of new waterbodies, heathland and acid grassland and soft landscape planting (trees and shrubs) the scheme is expected to result in a net gain in biodiversity for future generations and therefore the residual impact on priority habitats will be **positive at a local level**.

4.3 Badgers

4.3.1 Impact avoidance

Continued monitoring and vigilance with respect to badgers and their setts is required throughout the 'construction phase' of the scheme. Where possible the scheme will be designed to avoid direct impacts on badger setts by ensuring a minimum 30m exclusion zone for all earthworks, machinery and personnel, if this is possible without compromising the objectives of the scheme.

4.3.2 Mitigation measures

If direct impacts to occupied badger setts cannot be avoided, a licence will be required from Natural England that permits 'interference with a sett for the purpose of development'. It is a condition of the licence that adequate mitigation measures are put in place to prevent harm to badgers, and licences can only be issued for sett closures between July and November inclusive. In this case, mitigation is likely to involve permanent exclusion of badgers, followed by controlled destruction of the sett. If the sett is classified as a 'main sett', it may be a requirement that an artificial sett is constructed in advance of the sett closure to provide badgers with a suitable alternative.

As standard practice, construction site safeguarding measures are recommended during the construction period to prevent harm to badgers. All deep, steep sided excavations (e.g. trenches) should be kept covered at night, or a means of escape provided (ramp or ladder) to prevent entrapment of badgers, and all hazardous waste, chemicals or food should be suitably contained to prevent access by badgers.

4.3.3 Residual impacts

The final restored site will contain potentially suitable habitat for badgers, both foraging and for establishing new setts so local badger populations can expand into the restored site. The residual impact is therefore positive with respect to badgers.

4.4 Bats

4.4.1 Impact avoidance

The severity of impacts arising from the proposed landform restoration infilling phase on foraging bats is low. Therefore, no specific impact avoidance or mitigation measures are deemed necessary apart from controlling artificial light spill (see below) where there is any future need to utilise artificial light during the restoration phase or continued quarrying activities.

Trees with potential for roosting bats will be retained if possible. Mitigation for bats, depending on the results of surveys, will either use precautionary felling techniques (‘soft-felling’) at an appropriate time of year, or, exceptionally, may require a European Protected Species (EPS) licence if bats are clearly using the feature on a regular basis, or could be present at the time of the works. In any case, it is important that detailed records are kept and trees are not felled before being thoroughly checked for bats.

4.4.2 Mitigation measures

It is important that the proposed scheme incorporates a ‘sensitive lighting plan’ developed as part of the detailed design, in accordance with guidelines set out by the Bat Conservation Trust (summarised in Appendix 6), should there be any need for artificial light to be used at the site for any reason.

4.4.3 Residual impacts

There are no significant residual impacts on bats. However, the establishment of woodland and scrub habitat on the final restored site represents a **positive impact** for foraging bats in the long term at a **local level**.

4.5 Breeding birds

4.5.1 Impact avoidance

The loss of the tall exposed vertical sand cliffs is unavoidable for both restoration schemes. Therefore the impacts on peregrines and sand martins cannot be avoided.

Some of the existing water bodies are retained where they are at a suitable elevation to be incorporated into the final layout but habitat losses on the quarry pit floor cannot be avoided and therefore the displacement of the existing breeding bird assemblage in the quarry cannot be avoided.

The standard approach will be used to avoid direct harm to nesting birds and ensure compliance with the Wildlife and Countryside Act (1981). This means that all shrub and tree clearance work shall be undertaken outside the nesting bird season, unless habitats are prior checked for active nests by a suitably qualified ecologist. It is especially important to ensure that any works with potential to disturb breeding peregrines are avoided as this would be a breach in legislation. Therefore, earthmoving works shall not commence between the months of April-July in the south and eastern third of the quarry to ensure that the breeding season for this species is avoided, unless it can be demonstrated that birds have not bred for another reason.

The proposed scheme phased approach will ensure that part of the quarry pit will remain undisturbed at any given time. With careful management, this may allow breeding birds to complete nesting during infilling operations in other parts of the site. The proposed phasing commences in the eastern part of the quarry, so initially the vertical cliffs on the southern side at the western end will remain undisturbed until this is complete, so that peregrines and sand martins will have alternative suitable nesting sites available. As the first phases are completed, artificial nesting habitat (see mitigation section below) for sand martins will be installed in the restored part of the quarry before progressing to the other parts of the quarry site.

4.5.2 Mitigation measures

The final restored site will contain habitats that will support a diverse breeding bird assemblage. The soft landscaping for the final restoration scheme includes the creation of wetland features designed to maximise biodiversity value including for birds. Features will be incorporated into these habitats such as shallow vegetated marginal swamp and unvegetated beaches to encourage wading birds and waterfowl, and areas of deeper permanent water to encourage piscivorous birds. The establishment of a mosaic of ephemeral vegetation, acid grassland and heathland, together with gorse scrub and broadleaved tree planting will potentially attract heathland specialist birds that are priority species for conservation (e.g., nightjar, Dartford warbler, woodlark).

Three artificial sand martin nesting sites will be created as part of the soft landscaping. This will be achieved by fixing hollow tubes[16] of the appropriate diameter and length into the sides of gabion baskets on the waterbody margins and rendering the face to form an artificial cliff with artificial nest burrows. Alternatively, more natural features will be formed by stockpiling a suitable blend of sandy earth material that is allowed to consolidate, and then cut away to form a vertical sand face. These shall be a minimum of 1.5m high and 5m long and contain a minimum of 15 artificial nest tubes. The construction of the artificial sand martin nest site will follow best practice guidance as set out by the RSPB[17].

4.5.3 Residual impacts

The loss of the sand cliffs used by nesting peregrines is unavoidable and cannot be mitigated for both the approved and proposed schemes, resulting in the permanent displacement of the breeding peregrine falcon pair. At this stage in the scheme design, it is assumed that the displaced peregrine pair will find alternative nesting sites elsewhere in the local landscape – for example at a nearby quarry site or an artificial structure.

However, apart from the peregrines, the habitat creation, soft landscaping and bespoke artificial sand martin nesting site compensates for the temporary displacement of the existing bird assemblage and will ultimately create improved habitats for nesting birds. The overall effect is likely to be **positive** for breeding birds at a **local level**.

4.6 Common dormouse

4.6.1 Impact avoidance

The loss of sub-optimal habitat contained in the quarry pit cannot be avoided for both the approved and proposed schemes. However, the fringing woodland on top of the ridge is retained and therefore impacts on known dormice habitat is avoided.

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[16] Bespoke artificial nest tubes are commercially available, for example see: https://www.nhbs.com/sand-martin-nest-box

17Best practice guidance on establishing artificial nest sites for Sand Martin can be found here: https://www.rspb.org.uk/our-work/conservation/conservation-and-sustainability/advice/conservation-land-management-advice/sand-martin-nest-sites/

4.6.2 Mitigation measures

The woodland that cannot be avoided is sub-optimal habitat and is unlikely to be important for dormice. There is therefore unlikely to be a requirement for an EPS licence with respect to this species. However, their presence cannot be completely discounted as they are recorded elsewhere on the site and this sub-optimal habitat is connected via the canopy to the woodland bordering the site that is known to support dormice. Therefore clearance works shall follow reasonable avoidance measures under an agreed method statement to ensure that an offence does not occur. This includes strict controls on timing of works and overseen by a suitably qualified ecologist. All works would have to stop in the unlikely event that a dormouse is found and the need for an EPS licence reviewed.

4.6.3 Residual impacts

The permanent loss of sub-optimal woodland and scrub on the quarry floor is a residual impact. However, this is compensated for by the establishment of woodland and scrub habitat on the final restored site. This will include a mix of fruit and nut bearing species suitable for dormouse and therefore provide additional habitat so that the local population can expand into the restored site. Ultimately the residual impact is **positive** in the long term at a **local level**.

4.7 Reptiles

4.7.1 Impact avoidance

As for other species, the loss of habitats in the quarry pit that support grass snakes is unavoidable. The loss of a proportion of the suitable habitat at the proposed new material processing site is likely to be unavoidable, although it can be minimised. The suitable reptile habitat fringing the existing sand processing site will not be affected during the proposed scheme and impacts can be avoided during the relandscaping of this site and the formation of a carpark.

4.7.2 Mitigation measures

The proposed infilling works of the quarry pit will take place in incremental phases, so that there will always be parts of the quarry that are left undisturbed. Where the ground is already disturbed and is predominantly bare sand, no mitigation for reptiles is necessary. However, areas where vegetation is more established (including fringing swamp, tall grass, scrub and woodland) will act as refuges for grass snakes. These habitats will be subject to ‘reasonable avoidance measures’ to prevent harm to reptiles:

Prior to earthworks in a given area, the vegetation shall be cut back using hand-held strimmers, hedgecutters and chainsaws during warm weather (taking into account the avoidance of breeding bird nests). By carefully removing vegetation cover in this way, it makes use of the grass snake’s highly mobile nature to encourage them to move away from the construction zone. This work will be undertaken sequentially so that temporary ‘safe refuge areas’ of habitat are always available for them to move into, away from earthworks and haul routes. This technique is preferable for grass snakes as they do not respond well to handling and translocation. Once the initial phases of restoration are complete and new habitats are established, this will provide permanent replacement habitat for grass snakes, and encourage other species to colonise from the boundaries.

If existing suitable habitats are unavoidable, the initial establishment of the new processing yard will require standard trapping and translocation of reptiles to prevent harm to individual slow worms. Animals must be released into a suitable receptor site.

4.7.3 Residual impacts

As for the above species and groups, the infilling of the quarry and loss of existing habitat for grass snake is compensated for by the creation of habitats designed to maximise biodiversity. The mosaic of heathland, acid grassland, woodland and scrub together with the wetland features will benefit grass snakes and other species in the longer term. Furthermore, the phased approach means that this habitat creation will be delivered at the same time as existing habitat is removed ensuring continuity of habitat for reptiles. The residual impact of the proposed scheme is therefore positive for reptiles in the long term and significant at local level.

4.8 Terrestrial invertebrates

4.8.1 Impact avoidance

The loss of a substantial proportion of habitats for terrestrial invertebrates including ephemeral vegetation on sandy ground, the wetland features, scrub and secondary woodland on the quarry floor cannot be avoided. However, the final restoration scheme is designed to incorporate the 'lip' at the top of the existing sand cliff on the north to eastern perimeters of the quarry pit. These are approximately 10m in height and with south facing aspects in parts of the site that already support substantial nesting colonies of solitary bees, and this feature will be retained throughout the scheme.

The local extinction of a proportion of the invertebrate assemblage may be avoided by careful mitigation that ensures continued supply of early succession habitats on sandy banks throughout the infilling phase, and into habitat maintenance of the final restored heathland and acid grassland habitats following completion of the scheme (see Mitigation below).

4.8.2 Mitigation measures

The phased approach to infilling operations means that works will take place in sequential steps across the quarry. As part of this process some areas will be subject to intensive activity while others will be left undisturbed for short periods to consolidate. Mitigation for the terrestrial invertebrates that depend on early succession habitats on sandy ground may be incorporated into this process relatively easily. For example, under the existing sand extraction operations, there are sandy embankments around haul routes on the existing site that have been left undisturbed over several seasons. This has allowed nesting aggregations of a variety of solitary bees and wasps to build up and complete their lifecycles. On other parts of the existing site, stockpiling of unwanted spoil has created a varied topography including temporary pools and left undisturbed allowing them to vegetate, creating a mosaic of habitats for solitary bees, wasps, and an assemblage of early succession beetles and aquatic invertebrates.

With careful planning, these features could be replicated with some purpose throughout the infilling phases to maintain a continuous supply of suitable early succession habitats for the existing invertebrate fauna. It is important that the existing substrates are used to form these features – areas of the site should be set aside for stockpiling sand material for the final habitat creation and soft landscaping phases. Some of this material could be used to form 'bee banks' along haul routes, as is already the case with current quarrying activities. Provided that at least some of this habitat is present and left undisturbed to allow insects to complete their lifecycle at all times, then populations are much more likely to persist and the risk of local extinctions is significantly reduced.

It is important that the retained earth cliff is protected throughout the life of the scheme. This includes refraining from stockpiling materials against it at any time, causing undermining or allowing scrub vegetation to grow up and shade out the exposed sand faces. Some controlled erosion and slumping is desirable as it maintains natural processes and exposes fresh sand faces for new nests.

The final restored landscape scheme is designed to incorporate the requirements of the existing terrestrial invertebrate assemblage and maximise diversity. The creation of heathland and acid grassland mosaics as previously indicated, is intended to match the local landscape and habitats, and will incorporate measures to maintain early succession communities with exposed bare sand suitable for solitary bee and wasp nesting aggregations, together with providing flower rich vegetation to provide a source of pollen and nectar in close proximity. Specifically, the planting scheme will include willow species around the wetland features; that is important as a source of pollen and nectar for the early colletes bee.

4.8.3 Residual impacts

The proposed scheme will result in much less severe impacts than the approved restoration scheme. The loss of existing early succession sandy habitats contained within the quarry are compensated for by the creation of new habitats, and the measures to ensure continuity of suitable habitat variety through the phased approach, together with the retention of the vertical sand cliff 'lip' throughout the scheme will help to maintain existing populations. On balance, the proposed scheme residual impacts are considered to be neutral for terrestrial invertebrates.

4.9 Invasive non-native species

4.9.1 Impact avoidance

Construction safeguards and good housekeeping at the inert materials processing site are essential to prevent inadvertent introduction and spread of new INNS into the quarry site. This includes documentation and physical checks of incoming material and vehicles to make sure that they are not carrying propagules (e.g. rhizome fragments of Japanese knotweed).

The prohibition of vehicle movements along The Hollow will reduce the risk of spreading seeds of false acacia into the quarry and beyond.

4.9.2 Mitigation measures

The initial phases of the proposed restoration will involve the infilling of the larger pond on the quarry floor. If this is done with controls to avoid cross transfer of New Zealand pigmyweed fragments, it could effectively eradicate this species from the quarry floor. All other temporary waterbodies that support this species across the quarry site should be treated in the same way. However, there remains a risk that the retained waterbodies will act as a source of further infestation throughout the scheme. Strict controls are therefore recommended including further monitoring and eradication of infestations with herbicides where they occur.

Consideration should also be given to the felling and removal of the false acacia trees bordering The Hollow to prevent the spread of this species into other areas.

4.9.3 Residual impacts

Provided that there is continued vigilance for invasive non-native species, the residual impact of the proposed scheme is negligible.

5 BIODIVERSITY ENHANCEMENTS

It is beyond the scope of this assessment to go through the finer detail of biodiversity enhancement opportunities with the proposal, above those already outlined. Details of specific enhancements can be appropriately secured through the production of a Landscape and Ecology Management Plan (LEMP) that is approved by West Sussex County Council.

The information provided within an LEMP can include detailed prescriptions for the creation and management of new habitats and features, such as the establishment of acid grassland and heathland habitat and the installation of suitable bat and bird boxes across the site.

6 CONCLUSIONS

A summary of the EcIA process is presented in Table14 below, which reflects the impacts summarised from section 3. It should be noted that these impacts are summarised in the absence of mitigation proposals for either the approved or proposed schemes, but does broadly indicate the likely effects upon all identified impact receptors.

Table 14. Impact summary comparison between the approved and proposed restoration schemes.

Ecological Receptor	Importance	Approved scheme impact	Proposed scheme impact	Likely effect of scheme change
Designated Sites	National	Likely neutral	Likely neutral	No change
Priority Habitats	District	Likely negative local impact	Likely positive district impact	Positive
Badgers	Site	Certain negative site impact	Likely neutral impact	Positive
Bats	Local	Likely negative local impact	Likely positive local impact	Positive
Breeding birds	Local/District	Likely negative local impact	Likely positive local impact	Positive
Common dormice	Site/Local	Possible negative local impact	Possible positive local impact	Positive
Reptiles	Local	Certain negative local impact	Likely positive local impact	Positive

Terrestrial invertebrates	District	Certain negative district impact	Likely neutral	Positive
Other notable Species	Unknown	Possible negative impact	Possible positive impact	Positive

APPENDIX 1 – LEGISLATION AND POLICY

Introduction

The following text is intended for general guidance only and does not constitute comprehensive professional legal advice. It provides a summary of the current legal protection afforded to wildlife in general and certain species. It includes current national planning policy relevant to nature conservation.

The 'Birds Directive', 'Habitats Directive' and 'Natura 2000 Sites'.

The Council Directive 79/409/EEC on the Conservation of Wild Birds ("the Birds Directive") sets a framework for the protection of wild birds. Under the directive, several provisions are made including the designation and protection of 'Special Protection Areas' (SPAs) – areas which support important bird populations, and the legal protection of rare or vulnerable species.

The Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the "Habitats Directive") directs member states of the EU to take measures to maintain favourable conservation status of important habitats and species. This requires the designation of a series of sites which contain important populations of species listed on Annex II of the directive. Together with 'Special Areas of Conservation' (SPAs), designated under the Birds Directive, SACs form a network across Europe of protected areas known as the 'Natura 2000'.

Annex IV lists species in need of more strict protection, these are known as "European Protected Species (EPS)". All bat species, common dormice *Muscardinus avellana*, otter *Lutra lutra* and great crested newts *Triturus cristatus* are examples of EPS that are regularly encountered during development projects.

The 'Habitats Regulations'

The Conservation of Habitats and Species Regulations 2010 (the Habitats Regulations") is the principle means of transposing the Habitats Directive and the Birds Directive, and updates the Conservation (Natural Habitats, &c.) Regulations 1994 ("the 1994 regulations") in England and Wales.

'Natura 2000' sites receive the highest level of protection under this regulation which requires that any activity within the zone of influence of these sites would be subject to a Habitats Regulations Assessment (HRA) by the competent authority (e.g. planning authority), leading to an Appropriate Assessment (AA) in cases where 'likely significant effects on the integrity of the site are identified.

For European Protected Species, Regulation 41 makes it a criminal offence to;

- Deliberately capture, injure or kill any such animal;
- Deliberately disturb wild animals of such species;
- Deliberately take or destroy their eggs (where relevant);
- Damage or destroy a *breeding or resting place* of such an animal;
- Possess, control, sell or exchange any live or dead animal or plant, of such species;
- Deliberately pick, collect, cut, uproot or destroy a wild plant of such species.

The Habitats Directive and Habitats Regulations provide for the derogation from these prohibitions for specific reasons provided certain conditions are met. An EPS licensing regime allows operations that would otherwise be unlawful acts to be carried out lawfully. Natural England is the licensing Authority and, in order to grant a license, ensures that three statutory conditions (sometimes referred to as the 'three derogation tests') are met:

- A licence can be granted for the purposes of "preserving public health or safety or for other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment" (Regulation 53 (2) (e).
- A licence can be granted if "there are no satisfactory alternatives" to the proposed action.
- A licence shall not be granted unless the action authorised will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range.

Wildlife and Countryside Act (1981) as amended.

The Wildlife and Countryside Act (1981)[18] remains one of the most important pieces of wildlife legislation in the UK. There are various schedules to the Act protecting birds (Schedule 1), other animals including insects (Schedule 5), plants (Schedule 8), and control of invasive non-native species (Schedule 9).

Under the Wildlife and Countryside Act (WCA) 1981, all wild birds (with the exception of those listed on Schedule 2), their eggs and nests are protected by law and it is an offence to:

- Take, damage or destroy the nest of any wild bird while it is in use or being built.
- Take or destroy the egg of any wild bird.
- Disturb any bird listed on Schedule 1, while it is nest building, or at a nest with eggs or young, or disturb the dependant young of any such bird.

Schedule 5 lists all non-avian animals receiving protection to a varied degree. At its strongest, the Act makes it an offence to intentionally kill, injure or take any wild animal listed on Schedule 5, and prohibits interference with places used for shelter or protection, or intentionally disturb animals while occupying such places. Examples of species with *full protection* include all EPS, common reptile species, water vole *Arvicola amphibius*, white-clawed crayfish *Austropotamobius pallipes* and Roman snail *Helix pomatia*. Other species are protected from sale, barter or exchange only, such as white letter hairstreak *Satyrium w-album*.

The Act makes it an offence to intentionally pick, uproot or destroy any plant or seed, and sell or possess any plant listed on Schedule 8. It is also an offence to intentionally uproot any wild plant not listed on Schedule 8 unless authorised [by the land owner]. Species on Schedules 5 and 8 are reviewed every 5 years when species can be added or removed.

Measures for the prevention of spreading non-native species which may be detrimental to native wildlife is included in the Act, which prohibits the release of animals or planting of plants into the wild of species listed on Schedule 9 (for example Japanese knotweed *Fallopia japonica*, Himalayan balsam *Impatiens glandifera*, New Zealand Pygmyweed *Crassula helmsii*).

The Wildlife and Countryside Act 1981 (as amended) also prohibits certain inhumane methods of traps and devices for the capture or killing of wild animals and certain additional methods such as fixed trap, poisoning with gas or smoke, or spot-lighting with vehicles for killing species listed on Schedule 6 of the Act (this includes all bat species, badger, otter, polecat, dormice, hedgehog and red squirrel).

Natural Environment and Rural Communities (NERC) Act (2006)

[18] Wildlife and Countryside Act (WCA) (1981). HMSO London.

The NERC Act (2006)[19] places a statutory duty under Section 40 on all public bodies, including planning authorities, to take, or promote the taking by others, steps to further the conservation of *habitats and species of principal importance for the conservation of biodiversity* in England (commonly referred to as the 'Biodiversity Duty'). This duty extends to all public bodies the biodiversity duty of Section 74 of the Countryside and Rights of Way (CROW) Act 2000, which placed a duty only on Government and Ministers. Section 41 lists the habitats and species of principle importance. This includes a wide range of species from mosses, vascular plants, invertebrates through to mammals and birds. It originates from the priority species listed under the UK Biodiversity Action Plan (UK BAP) with some omissions and additions.

Protection of Badgers Act (1992)

The Badger *Meles meles* is afforded specific legal protection in Britain under the Protection of Badgers Act (1992)[20], and Schedule 6 of the Wildlife and Countryside Act 1981 (as amended) (see above).

Under this legislation, it is a criminal offence to:

- intentionally kill, injure, take, possess, or cruelly ill-treat, a Badger, or to attempt to do so;
- interfere with a sett, by damaging or destroying it;
- to obstruct access to, or any entrance of, a Badger sett; or
- to disturb a Badger when it is occupying a sett.

A licence may be obtained from Natural England to permit certain prohibited actions for a number of defined reasons including interference of a sett for the purpose of development, provided that a certain number of conditions are met. Note that licenses are not normally granted for works affecting badgers between the end of November and the start of July.

National Planning Policy Framework

The National Planning Policy Framework (NPPF 2019)[21] sets out the Government's view on how planners should balance nature conservation with development and helps ensure that Government meets its biodiversity commitments regarding the operation of the planning system.

Paragraph 174b, which states that council policies should "promote the conservation, restoration and enhancement of priority habitats, ecological networks and the protection and recovery of priority species; and identify and pursue opportunities for securing measurable net gains for biodiversity". In accordance with the NPPF, it is important that developments should contribute to and enhance the natural and local environment by:

- Minimising impacts on existing biodiversity and habitats,
- Providing net gains in biodiversity and habitats, wherever possible,
- establishing coherent ecological networks that are more resilient to current and future

[19] Natural Environment and Rural Communities Act (2006). HMSO London.
[20] Protection of Badgers Act (1992). HMSO London.
[21] HM Government (2019). National Planning Policy Framework. Department for Communities and Local Government. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/779764/NPPF_Feb_2019_web.pdf.

pressures.

UK Post-2010 Biodiversity Framework

The UK Biodiversity Action Plan (UK BAP), published in 1994, was the UK's response to the commitments of the Rio Convention on Biological Diversity (1992). The UK BAP was replaced by the UK Post-2010 Biodiversity Framework. This framework covers the period 2011 to 2020 and forms the UK government's response to the new strategic plan of the United Nations Convention on Biodiversity (CBD) published in 2010. This promotes a focus on individual countries delivering target for protection for biodiversity through their own strategies.

The most recent biodiversity strategy for England, 'Biodiversity 2020: A strategy for England's wildlife and ecosystem services' was published by Defra (2011)[22], and a progress update was provided in July 2013 (Defra 2013)[23].

'Biodiversity 2020' builds on the Natural Environment White Paper for England – 'The Natural Choice', published on 7 June 2011, and sets out the strategic direction for biodiversity policy for the next decade.

Biodiversity 2020 deliberately avoids setting specific targets and actions for local areas because Government believes that local people and organisations are best placed to decide how to implement the strategy in the most appropriate way for their area or situation.

Birds of Conservation Concern (BoCC)

In 1996, the UK's leading non -governmental bird conservation organisations reviewed the conservation status of all bird species in the UK against a series of criteria relating to their population size, trends and relative importance to global conservation. The lists, known as the 'Red', 'Amber' and 'Green' lists (in order of decreasing concern) are used to inform key conservation policy and decisions. The lists are reviewed every 5 years and are a useful reference for determining the current importance of a particular site for birds. The most recent review was undertaken in 2015[24] (Eaton et al, 2015), which provides an up to date assessment of the conservation status of birds in the UK.

[22] Defra (2011) Biodiversity 2020: A strategy for England's wildlife and ecosystem services. Available at: https://www.gov.uk/government/publications/biodiversity-2020-a-strategy-for-england-s-wildlife-and-ecosystem-services.

[23] Defra (2013) Progress Update. Available at: https://www.gov.uk/government/publications/biodiversity-2020-simple-guide-and-progress-update-july-2013.

[24] Eaton, M., Aebischer, N., Brown, A., Hearn, R., Lock, L., Musgrove, A., Noble, D., Stroud, D.,and Gregory, R. (2015) Birds of Conservation Concern 4: the population status of birds in the UK, Channel Islands and Isle of Man. British Birds 108. December 2015. 708–746

APPENDIX 2 – IMPORTANCE OF ECOLOGICAL FEATURES

Table 1: Determining importance of an ecological feature

Level of importance	Criteria
International	Internationally designated site; Special Protected Area (SPA), Special Areas of Conservation (SAC), Ramsar, Biosphere Reserves; Regularly occurring population of internationally important species listed in Annex 1, 2 or 4 of the Habitats Directive and Annex 1 of the Birds Directive; A viable area of a habitat listed in Annex 1 of the Habitats Directive or area important for maintaining viability listed as in Annex 1 of the Habitats Directive; Areas outside designated sites that are important for supporting and maintaining the viability of the above designated habitats and/or species.
National	Nationally designated sites; Site of Special Scientific Interest (SSSI), National Nature Reserve (NNR), Local Nature Reserves (LNR). A sufficiently large population of a species or area of habitat listed as a priority for nature conservation (S41 NERC Act) to make a significant contribution to the national conservation status (e.g. greater than 1% of the national total). A viable or regularly occurring population of a species that is nationally scarce, threatened or declining on a national scale. A habitat type that is nationally scarce, threatened or declining on a national scale.
Regional	A habitat type that is scarce, threatened or declining on a regional scale. A sufficiently large population of a species or area of habitat listed as a priority for nature conservation (S41 NERC Act) to make a significant contribution to the regional conservation status (e.g. greater than 1% of the national total).
County	Locally designated sites; Local Wildlife Sites (LWSs), Sites of Nature Conservation (SNCIs) and Site of Importance for Nature conservation (SINCs). A sufficiently large population of a species or area of habitat listed as a priority for nature conservation (S41 NERC Act) to make a significant contribution to the conservation status of the species at county level (e.g. greater than 10% of the county total). A viable or regularly occurring population of a species that is rare in the county, but may be common and widespread elsewhere, For example, a population at the edge of a species' range. A habitat type that is scarce in a county but may be more frequent elsewhere.
Local/parish	Habitats and species which are scarce in the local area but are sufficiently common and widespread elsewhere that they do not meet the above criteria.
Site / negligible	Habitats with little to no ecological value (e.g. amenity grassland and hardstanding)

APPENDIX 3 – COMMON DORMOUSE SURVEY RESULTS

Abbreviations: DM=dormouse; E=empty; CS=cherry stones; SS=sycamore seeds

Nest Tube	19th May	19th June	20th July	20th Aug	18th Sept	15th Oct
1	E	E	E	E	E	E
2	E	E	E	E	E	E
3	E	E	E	E	E	E
4	E	E	E	E	E	E
5	E	E	E	E	E	E
6	E	E	E	E	E	E
7	E	E	E	E	E	E
8	E	E	E	E	E	E
9	E	E	E	E	E	E
10	E	E	E	E	SS	SS
11	E	E	E	E	E	E
12	E	E	E	DM nest	Nest Disused	Nest Disused
13	E	E	E	E	E	E
14	E	E	E	E	E	E
15	E	E	E	E	E	E
16	E	E	E	E	E	E
17	E	E	E	E	E	E
18	E	E	E	E	E	E
19	E	E	E	E	E	E
20	E	E	E	E	E	E
21	E	E	E	E	E	E
22	E	E	E	E	E	E
23	E	E	E	E	E	E
24	E	E	E	E	E	E
25	E	E	E	E	E	E
26	E	E	E	E	E	E
27	E	E	E	E	E	E
28	E	E	E	E	E	E
29	E	E	E	E	E	E
30	E	E	E	E	E	E
31	E	E	E	E	E	E
32	E	E	E	E	E	E
33	E	E	E	E	E	E
34	E	E	E	E	E	E
35	E	E	E	E	E	E
36	E	E	E	E	E	E
37	E	E	E	E	E	E
38	E	E	E	E	E	E
39	E	E	E	E	E	E
40	E	E	E	E	E	E
41	E	E	CS	E	E	E
42	E	E	E	E	E	E
43	E	E	E	E	E	E
44	E	E	E	E	E	E

45	E	E	E	E	E	E
46	E	E	E	E	E	E
47	E	E	E	E	E	E
48	E	E	E	E	E	E
49	E	E	E	E	E	E
50	E	E	E	E	E	E
51	E	E	E	E	E	E
52	E	E	E	DM nest	Nest Disused	Nest Disused
53	E	E	E	E	E	E
54	E	E	E	E	E	E
55	E	E	E	E	E	E
56	E	E	E	E	E	E
57	E	E	E	E	E	E
58	E	E	E	E	E	E
59	E	E	E	E	E	E

Photograph 7. The dormouse nests found during the August survey; one towards the northern boundary of the site (left) and one along the southern boundary (right).

APPENDIX 4 – GREAT CRESTED NEWT SURVEY RESULTS

Table 1. HSI calculation for ponds assessed during the survey.

	Pond 19		**Pond 22**		**Pond 23**	
NGR	**TQ12661368**		**TQ12491370**		**TQ12531362**	
SI attribute	**SI value**	**Notes**	**SI value**	**Notes**	**SI value**	**Notes**
Location	1.00	A	1.00	A	1.00	A
Pond area	0.88	1500m^2	0.88	1500m^2	0.88	1500m^2
Pond drying	0.90	Never	0.90	Never	0.90	Never
Water quality	0.67	Moderate	0.33	Poor	0.33	Poor
Shade cover	1.00	25%	1.00	5%	1.00	5%
Water-fowl	0.67	Minor	0.67	Minor	0.67	Minor
Fish presence	0.70	Possible	0.70	Possible	0.70	Possible
No. ponds	1.00	>12	1.00	>12	1.00	>12
Terrestrial habitat	1.00	Good	0.67	Moderate	0.67	Moderate
Macrophytes	0.55	25%	0.60	30%	0.60	5%
H.S.I. value	**0.816**	**'Excellent'**	**0.7368**	**'Good'**	**0.7368**	**'Average'**
eDNA Result	**Negative for GCN**		**N/A**		**Negative for GCN**	
	Pond 28		**Pond 55**		**Pond 56**	
NGR	**TQ12601330**		**TQ12731372**		**TQ12731331**	
SI attribute	**SI value**		**Notes**		**SI value**	
Location	1.00	A	1.00	A	1.00	A
Pond area	0.80	3200m^2	0.05	50m^2	0.05	25m^2
Pond drying	0.90	Never	0.90	Never	0.50	Sometimes
Water quality	0.67	Moderate	0.33	Poor	0.33	Poor
Shade cover	1.00	10%	1.00	15%	1.00	0%
Water-fowl	0.67	Minor	0.67	Minor	1.00	Absent
Fish presence	0.70	Possible	0.70	Possible	1.00	Absent
No. ponds	1.00	>12	1.00	>12	1.00	>12
Terrestrial habitat	1.00	Good	1.00	Good	0.33	Poor
Macrophytes	0.70	40%	0.3	0%	0.55	25%
H.S.I. value	0.816	**'Excellent'**	**0.53**	**'Below average'**	**0.52**	**'Below average'**
eDNA Result	**Negative for GCN**		**N/A**		**N/A**	

RESULTS

Date sample received at Laboratory: 21/04/2020
Date Reported: 22/04/2020
Matters Affecting Results: None

Lab Sample No.	Site Name	O/S Reference	SIC	DC	IC	Result	Positive Replicates
0868	TN28, Rock Common Quarry	TQ12 6513 27	Pass	Pass	Pass	Negative	0
0869	TN23, Rock Common Quarry	TQ12 5413 62	Pass	Pass	Pass	Negative	0
0873	TN19, Rock Common Quarry	TQ12 6713 69	Pass	Pass	Pass	Negative	0

Figure 22. The eDNA results of ponds 19, 23 and 28, provided by SureScreen Scientifics.

Table 14. Updated photos of ponds 19, 22, 23, 28, 55 and 56, taken April 2020.

P19	P22
	
P23	P28
	
P55	P56
	

APPENDIX 5 – TERRESTRIAL INVERTEBRATES

Table 15. Terrestrial invertebrates identified at Rock Common Quarry across all surveys in 2020.

Latin name	English name/type	Typical habitat	Conservation status
Order EPHEMEROPTERA; family BAETIDAE (mayflies)			
Cloeon dipterum	Pond olive	Larvae found in main pond on quarry floor on 22^{nd} April	Common and widespread
Order ODONATA; family AESHNIDAE (hawker dragonflies)			
Anax imperator	Emperor dragonfly	Larvae found in main pond on quarry floor on 5^{th} June	Common and widespread
Order ODONATA; family LIBELLULIDAE (chaser and skimmer dragonflies)			
Libellula depressa	Broad-bodied chaser	Larvae found in temporary pools and wheel ruts in quarry pit; adults observed flying about on 5^{th} June	A variety of still water habitats; favours seasonal waterbodies; common and widespread
Order ODONATA; family COENAGRIIDAE (damselflies)			
Coenagrion pulchellum	Azure damselfly	Adults among marshy vegetation on quarry floor on 5^{th} June	Variety of habitats near water Common and widespread
Order DERMAPTERA; family Forficulidae (earwigs)			
Forficula auricularia	Common earwig	Found in dormouse tubes throughout season	Ubiquitous; common and widespread throughout
Order DICTYOPTERA; family BLATTELLIDAE (cockroaches)			
Ectobius lapponicus	Dusky cockroach	Beaten out of shrubs on quarry floor	Scrub, woodland on poor soils; Local, south-east England
Order ORTHOPTERA; family TETRICIDAE (groundhoppers)			
Tetrix subulata	Slender groundhopper	Near temporary pools and puddles in ephemeral vegetation on 22^{nd} April	Wetlands, woodland rides, on damp soils; Local, south-east England
Order ORTHOPTERA; family ACRIDIDAE (grasshoppers)			
Chorthippus brunneus	Common field grasshopper	Short grasslands, disturbed ground, brownfield sites, arable margins	Common and widespread
Order ORTHOPTERA; family PHANEROPTERIDAE (bush crickets)			
Leptophyes punctatissima	Speckled bush-cricket	In rank vegetation around main pond on quarry floor on	Hedgerows, verges, grasslands; common and

Latin name	**English name/type**	**Typical habitat**	**Conservation status**
		5th June	widespread in England
Order HETEROPTERA; family PENTATOMIDAE (shield bugs)			
Dolycoris baccarum	Hairy shield bug	In ephemeral vegetation on quarry floor on 5th June.	Hedgerows, scrub, tall ruderal vegetation; common and widespread in southern England
Order HEMIPTERA; family APHROPHORIDAE (froghopper bugs)			
Neophilaenus campestris	Striped spittlebug	In ephemeral vegetation on quarry floor on 5th June.	Dry grasslands, verges, heaths; develops on wide range of grasses; common and widespread throughout UK
Order COLEOPTERA; family CARABIDAE (ground beetles)			
Cicindela campestris	Green tiger beetle	Found throughout quarry floor on 22nd April	Local, heathlands and sand dunes
Elaphrus riparius	A ground beetle	Common on bare sand near large pond on quarry floor on 22nd April	On bare damp ground near water; common and widespread throughout UK.
Notiophilus biguttatus	A ground beetle	Found in small numbers on ground among ephemeral vegetation on 22nd April	Common and widespread throughout UK.
Amara aenea	A ground beetle	Under stones and debris on quarry floor on 22nd April	Various dry habitats, common and widespread throughout UK, often abundant.
Amara montevaga	A ground beetle	Under stones and debris on quarry floor on 22nd April	Open sandy or chalky soils with sparse vegetation; local in southern England, scarce.
Pterostichus madidus	A ground beetle	Under stones on quarry floor on 22nd April	Ubiquitous; common and widespread throughout.
Anisodactylus binotatus	A short-spur ground beetle	Among vegetation around seasonal ponds on 22nd April	Damp marshy habitats; common in east and west England.
Poecilus cupreus	A ground beetle	Under stones on quarry floor on 22nd April	Arable, waste ground, dry situations; common and widespread throughout UK
Harpalus affinis	A ground beetle	Under stones on quarry floor on 22nd April	Arable, waste ground, dry situations; common and widespread throughout UK

Latin name	**English name/type**	**Typical habitat**	**Conservation status**
Harpalus rubripes	A ground beetle	On quarry floor near haul routes on 22^{nd} April and 5^{th} June	Open, dry sandy habitats; widespread in England but local
Oxypselaphus obscurus	A ground beetle	On soil in damp woodland on quarry floor on 5^{th} June	Damp shady places, woodland and marshes; common and widespread in England
Bembidion tetracolom	A pin-palp beetle	On bare sand near large pond on quarry floor on 22^{nd} April	On bare damp ground near water; common and widespread throughout UK.
Bembidion illigeri	A pin-palp beetle	On bare sand near large pond on quarry floor on 22^{nd} April and 5^{th} June.	On bare damp ground near water; common and widespread throughout UK.
Order COLEOPTERA; family DYTISCIDAE (diving beetles)			
Agapus bipustulatus	A diving beetle	In temporary pools in spoil heaps and wheel ruts on quarry floor on 5^{th} June.	Trickles, backwaters, stagnant pools; common and widespread throughout UK
Order COLEOPTERA; family HELOPHORIDAE (aquatic beetles)			
Helophorus grandis	A water beetle	In temporary pools in spoil heaps and wheel ruts on quarry floor on 5^{th} June.	Vegetated backwaters, stagnant pools; common and widespread throughout UK
Order COLEOPTERA; family ENDOMYCHIDAE (ladybirds)			
Endomychus coccineus	False ladybird	In dormouse tube in surrounding deciduous woodland – photographed by Kate Lewis on 14 October	Common and widespread
Order COLEOPTERA; family COCCINELLIDAE (ladybirds)			
Coccinella septempunctata	Seven-spot ladybird	Found on gorse on 22^{nd} April	Ubiquitous; common and widespread
Harmonia axyridis	Harlequin ladybird	Found on shrubs on 5^{th} June	Ubiquitous; common and widespread; Sch 9 invasive non-native species
Order COLEOPTERA; family OEDEMERIDAE			
Oedemera nobilis	A false blister beetle	Found on flowers on quarry floor on 5^{th} June	Flower-rich grassland, hedgerows and dense vegetation; common and widespread in southern England

Latin name	**English name/type**	**Typical habitat**	**Conservation status**
Oedemera lurida	A false blister beetle	Found on flowers on quarry floor on 5th June	Flower-rich grassland, hedgerows and dense vegetation; common and widespread in southern England
Order COLEOPTERA; family CANTHARIDAE (soldier beetles)			
Rhagonycha fulva	Common red soldier beetle (swinger beetle)	Caught in light trap on 15th July	Ubiquitous; Flower-rich places especially on Umbellifers; common and widespread throughout
Order COLEOPTERA; family GEOTRUPIDAE (dung beetles)			
Typhaeus typhaeus	Minotaur beetle	Caught in light trap on 5th June	In or under herbivore dung (horse, cattle, rabbits) in sandy or chalky districts; Locally common in southern England.
Order COLEOPTERA; family SCARABAEIDAE (dung beetles, chafers beetles)			
Onthophagus coenobita	A small dung beetle	Caught in light trap on 5th June	In or under dung (horse, cattle, human and dog); Widespread in southern England.
Serica brunnea	Brown chafer	Caught in light trap on 5th June	Grasslands, well drained soils; widespread throughout UK but localized.
Order COLEOPTERA; family ELATERIDAE (click beetles)			
Agriotes lineatus	A small click beetle	Caught in light trap on 5th June	Grasslands and cultivated habitats – an agricultural pest; Common and widespread in England
Order DIPTERA; family SYRPHIDAE (hoverflies)			
Epistrophe elegans	A hoverfly	On bramble on 22nd April	Common and widespread throughout the UK
Eupeodes sp.	A hoverfly	Found on gorse on 22nd April	Grassland, hedgerows, gardens; Common and widespread throughout the UK
Eristalis arbustorum	A drone fly	on 22nd April	Ubiquitous; common and widespread throughout the UK

Latin name	English name/type	Typical habitat	Conservation status
Eristalis pertinax	A drone fly	on 22nd April	Ubiquitous; common and widespread throughout the UK
Eristalis tenax	A drone fly	on 22nd April	Ubiquitous; common and widespread throughout the UK
Order DIPTERA; family TIPULIDAE (craneflies)			
Tipula oleracea	A true cranefly	Caught in moth trap on 15th July	Grasslands; common and widespread throughout UK
Tipula lateralis	A true cranefly	Caught in moth trap on 15th July	Wetlands; common and widespread throughout UK
Nephratoma flaviscens	A tiger cranefly	Caught in moth trap on 15th July	Common and widespread in southern half of UK
Nephratoma quadrifaria	A tiger cranefly	Caught in moth trap on 15th July	Common and widespread in southern half of UK
Order HYMENOPTERA; family APIDAE subfamily ANDRENINAE			
Andrena scotica	Chocolate mining bee	On brambles, composites, legumes, nests in bare ground on S. facing slopes on 22nd April and 5th June.	Common and widespread in southern half of UK, local towards north.
Andrena trimmerana	Trimmer's mining bee	On gorse flowers, on 22nd April	Common and widespread in southern half of UK
Andrena flavipes	Yellow-legged mining bee	On brambles, composites, legumes, nests in bare ground on S. facing slopes on 22nd April and 5th June.	Various habitats; common and widespread in southern half of UK
Order HYMENOPTERA; family APIDAE subfamily ANTHOPHORINAE			
Nomada furcata	Painted nomad bee	Along foot of north-western cliff face on 22nd April	Common and widespread in southern half of UK where host species *A. flavipes* occurs
Nomada lathburiana	Lathbury's nomad bee	Along haul routes on ephemeral vegetation on 22nd April	Various habitats with host species *A. cinerea*; common and widespread in England
Nomada panzeri	Panzer's nomad bee	Sand bank around settlement lagoon on 22nd April	Woodland edge; widespread in England
Nomada sheppardana	Sheppard's nomad bee	Sand bank around settlement lagoon on 22nd April	Various habitats with host *Lasioglossum* spp. Local,

Latin name	English name/type	Typical habitat	Conservation status
			southern England to midlands
Anthophora bimaculata	Green-eyed flower bee	Nests in sand among ephemeral vegetation on quarry floor, on 5th June.	Sandy districts, heathlands sand pits. Locally common in southern England
Melecta albifrons	Common mourning bee	On imported spoil on NE side of quarry, bare ground on 22nd April	Widespread in south-east England
Order HYMENOPTERA; family APIDAE subfamily APINAE			
Bombus terrestris/lucorum	Buff-tailed and white-tailed bumblebee	On various flowers , ephemeral vegetation, shrubs and trees on quarry floor on 5th June	Flower rich grassland, hedgerows, gardens; common and widespread
Bombus vestalis	Vestal cuckoo bee	On various flowers , ephemeral vegetation, shrubs and trees on quarry floor on 5th June	Flower rich grassland, hedgerows, gardens; common and widespread
Bombus pascuorum	Common carder-bee	On various flowers , ephemeral vegetation, shrubs and trees on quarry floor on 5th June	Flower rich grassland, hedgerows, gardens; common and widespread
Bombus pratorum	Early bumblebee	On various flowers , ephemeral vegetation, shrubs and trees on quarry floor on 5th June	Flower rich grassland, hedgerows, gardens; common and widespread
Bombus hypnorum	Tree bumblebee	On various flowers , ephemeral vegetation, shrubs and trees on quarry floor on 5th June	Woodland edge, scrub, tall ruderal herbs, gardens; common and widespread
Apis mellifera	Honeybee	Males (drones) found on gorse flowers near settlement lagoon on 5th June	Flower rich grassland, hedgerows, gardens; common and widespread throughout UK
Order HYMENOPTERA; family APIDAE subfamily COLLETINAE			
Colletes cunicularius	Early colletes	Large nesting aggregations on upper south-facing sand cliffs on 22nd April	Local, west but with recent colonization in the south-east suspected from continental populations
Order HYMENOPTERA; family APIDAE subfamily HALICTINAE			

Latin name	**English name/type**	**Typical habitat**	**Conservation status**
Hylaeus hyalinatus	Hairy yellow-faced bee	Sand bank around settlement lagoon on 22nd April	Various habitats, nests in preformed burrows in sand, mortar in walls. Common in eastern counties, local elsewhere
Sphecodes gibbus	Dark-winged blood bee	Sand bank around settlement lagoon on 22nd April	Ubiquitous, widespread in southern England, but declining
Order HYMENOPTERA; family APIDAE subfamily MEGACHILINAE			
Megachile ligniseca	Wood-carving leafcutter bee	In ephemeral vegetation and at foot of SW facing cliffs on 5th June	Nests in rotting wood; common and widespread in England.
Megachile maritima	Coastal leafcutter bee	In ephemeral vegetation and at foot of SW facing cliffs on 5th June	Sandy districts around coasts, inland in south-east England. Local.
Coeloxys conoidea	Large sharp-tailed bee	On flowers and bare sand on quarry floor, on 5th June	Sandy districts around costs, where host species *M. maritima* is found; Local.
Order HYMENOPTERA; family APIDAE subfamily MELITTINAE			
Dasypoda hirpites	Pantaloon bee	On flowers and bare sand on quarry floor, found by Kate Lewis on 16th June	Sandy districts; widespread but local where there are suitable habitats from Dorset to Norfolk
Melitta leporina	Clover melitta	Ephemeral vegetation on 22nd April	Graslands, on sandy or calcareous soils; widespread but local in southern England
Order HYMENOPTERA; family APIDAE subfamily XYLOCOPINAE			
Ceratina cyanea	Little blue carpenter bee	On bare sand near cliffs and settlement lagoon on 5th June.	Scrub and brambles on well drained sites with warm microclimate – breeds in hollow bramble stems; restricted to Hampshire, Sussex, Essex, locally common.
Order HYMENOPTERA; family FORMICIDAE			
Formica fusca	A black ant	Various locations on quarry floor on 22nd April	Uncultivated ground, nests in open habitats; common and widespread
Lasius niger agg.	Black ant	Various locations on quarry	Nests in dry open ground

Latin name	**English name/type**	**Typical habitat**	**Conservation status**
		floor on 22nd April	including urban habitats; not usually woodland; common and widespread
Myrmica rubra	A red ant	Various locations on quarry floor, woodland edge on 22nd April	Damp grasslands, cultivated ground, open urban habitats including lawns, parks and gardens; common and widespread.
Order HYMENOPTERA; family CRABRONIDAE			
Pemphredon morio	A small solitary wasp	On quarry floor, bare sand on 5th June	A range of contrasting habitats. Nests in old wood including posts and house timbers, provisioned with aphids. Nationally scarce Nb
Philanthus triangulatum	Bee wolf	In bare sand slopes at the foot of cliffs on northern side of quarry	Sandy districts, heathland, sand pits and coastal habitats; locally common in south-east England from Dorset to East Anglia but increasing range northwards.
Cerceris rybensis	A solitary digger wasp	In bare sand slopes at the foot of cliffs on northern side of quarry	Sandy districts, heathland, sand pits and coastal habitats; locally common in south-east England from Dorset to East Anglia.
Order HYMENOPTERA; family VESPIDAE			
Vespula vulgaris	Common wasp	On flowers, and packed lunch (!) throughout season	Ubiquitous; common and widespread
Order LEPIDOPTERA; family GEOMETRIDAE			
Peribatodes rhomboidaria	Willow beauty	Caught in moth trap on 14th September	Trees, hedgerows; common and widespread in England, local in Scotland.
Chloroclysta truncate	Common marbled carpet	Caught in moth trap on 14th September	Ubiquitous; common and widespread throughout UK
Thera cupressata	Cypress carpet	Caught in moth trap on 17th June	On Leyland cypress; First found in West Sussex in 1984, now well established in southern England; local.
Hydriomena furcata	July highflyer	Caught in moth trap on 15th	Woodland edge, hedgerows;

Latin name	English name/type	Typical habitat	Conservation status
		July	widespread throughout UK
Pasiphila rectangulata	Green pug	Caught in moth trap on 15th July	Woodlands, gardens; widespread throughout UK
Biston betularia	Peppered moth	Caught in moth trap on 17th June	Woodland, scrub, hedgerows and gardens; common and widespread throughout UK
Opisthographis luteolata	Brimstone moth	Caught in moth trap on 17th June	Woodland, scrub, hedgerows and gardens; common and widespread throughout UK
Aplocera plagista	Treble-bar	Caught in moth trap on 15th July	Grasslands, scrub; common and widespread throughout UK
Idaea aversata	Riband wave	Caught in moth trap on 15th July	Ubiquitous; widespread throughout UK
Selidosema brunnearia	Bordered grey	Caught in moth trap on 15th July	Disjointed distribution with strong populations in the New Forest and Dorset, Surrey Heaths, Cumbria and the Hebrides, but very scarce elsewhere
Order LEPIDOPTERA; family SPHINGIDAE			
Deilephilia elpenor	Elephant hawkmoth	Caught in moth trap on 17th June	Ubiquitous; common and widespread throughout UK
Deilephila porcellus	Small elephant hawkmoth	Caught in moth trap on 17th June	Grasslands, locally distributed but widespread throughout UK
Order LEPIDOPTERA; family ARCTIIDAE			
Miltochrista miniate	Rosy footman	Caught in moth trap on 15th July	Woodland; common and widespread in southern England
Phragmatobia fuliginosa	Ruby tiger	Caught in moth trap on 15th July	Ubiquitous; widespread throughout UK
Order LEPIDOPTERA; family NOCTUIDAE			
Noctua pronuba	Large yellow underwing	Caught in moth trap on 15th July	Ubiquitous; widespread throughout UK

Latin name	English name/type	Typical habitat	Conservation status
Omphaloscelis lunosa	Lunar underwing	Caught in moth trap on 14th September	Grasslands; common and widespread in England, local in Scotland
Axylia putris	Flame	Caught in moth trap on 17th June	Ubiquitous; common and widespread throughout UK
Xestia xanthographa	Square-spot rustic	Caught in moth trap on 14th September	Ubiquitous; common and widespread throughout UK
Apamea monoglypha	Dark arches	Caught in moth trap on 17th June	Ubiquitous; common and widespread throughout UK
Mythimna impure	Smokey wainscot	Caught in moth trap on 17th June	Grasslands; common and widespread throughout UK
Mythimna albipunctata	White point	Caught in moth trap on 17th June	Grasslands, immigrant to south-east England
Mythimna pallens	Common wainscot	Caught in moth trap on 14th September	Ubiquitous; common and widespread throughout UK
Hoplodrina blanda	Rustic	Caught in moth trap on 15th July	Ubiquitous; common and widespread throughout UK, Priority species for research (S41)
Hoplodrina alsines	Uncertain	Caught in moth trap on 17th June	Ubiquitous; common and widespread throughout UK
Xanthia icteritia	Sallow	Caught in moth trap on 14th September	Ubiquitous; common and widespread throughout UK, Priority species for research (S41)
Caradrina Morpheus	Mottled rustic	Caught in moth trap on 15th July	Ubiquitous; common and widespread throughout UK
Diarsia mendica	Ingrailed clay	Caught in moth trap on 15th July	Woodlands; common and widespread throughout UK
Ochropleura plecta	Flame shoulder	Caught in moth trap on 17th June	Ubiquitous; common and widespread throughout UK
Euplexia lucipara	Small angle shades	Caught in moth trap on 17th June	Ubiquitous; common and widespread throughout UK
Agrotis clavis	Heart and club	Caught in moth trap on 17th June	Open dry habitats; common in southern England
Agrotis segetum	Turnip moth	Caught in moth trap on 14th September	Ubiquitous; common and widespread throughout UK

Latin name	English name/type	Typical habitat	Conservation status
Mesapamea secalis	Common rustic	Caught in moth trap on 15th July	Grassy places; widespread throughout UK
Order LEPIDOPTERA; family LYCAENIDAE			
Celestrina argiolus	Holly blue	In marginal habitats and woodland around the quarry, 22nd April.	Woodland, hedgerows, scrub, gardens, holly and ivy are foodplants; common and widespread
Coenonympha pamphilus	Small heath	Among ephemeral vegetation on quarry floor	Grasslands with fine leaved fescues; widespread but declining; S41 priority species
Vanessa atalanta	Red admiral	On buddleja bushes and scrub – regularly seen throughout quarry site	Farmland, gardens, breeds on nettle patches in full sun, ubiquitous as adults; common and widespread, breeding range expanding northwards
Order LEPIDOPTERA; family PIERIDAE			
Pieris brassicae	Large white	regularly seen throughout quarry site	Ubiquitous; common and widespread throughout.
Pieris rapae	Small white	regularly seen throughout quarry site	Ubiquitous; common and widespread throughout
Order LEPIDOPTERA; family CRAMBIDAE			
Chrysoteuchia culmella	A grass veneer	Caught in moth trap on 15th July	Ubiquitous; common and widespread throughout UK
Crambus pascuella	A grass veneer	Caught in moth trap on 15th July	Grasslands with sedges; common and widespread throughout UK
Agriphila straminella	A grass veneer	Caught in moth trap on 15th July	Dry grasslands and heaths with fine fescues; common and widespread throughout UK
Catoptria pinella	A grass veneer	Caught in moth trap on 15th July	Marshy grasslands, wet heathland, waste ground; common in eastern England.
Order LEPIDOPTERA; family PYRALIDAE			
Elophila nymphaeata	Brown china-mark	Caught in moth trap on 17th	Waterbodies among aquatic

Latin name	English name/type	Typical habitat	Conservation status
		June	plants; common and widespread throughout Uk
Ostrinia nubilalis	European corn-borer	Caught in moth trap on 17th June	Grasslands, food plant mugwort and mallow; locally distributed in south-east and East Anglia.
Phycitodes binaevella	A micro-moth	Caught in moth trap on 17th June	Grasslands on sandy soils, f.p. spear thistle; widespread throughout UK but never common
Order LEPIDOPTERA; family TORTRICIDAE			
Agapeta hamana	A micro-moth	Caught in moth trap on 15th July	Ubiquitous – wherever f.p. thistles grow; widespread throughout UK
Celypha rosaceana	A small pink moth	Caught in moth trap on 17th June	On willows, woodland, scrub and heathland on waterlogged soils; locally distributed in southern half of England.
Acleris forsskaleana	A micro-moth	Caught in moth trap on 17th June	Woodland, hedgerows, gardens, f.p. *Acer* spp.; Common in eastern England
Order LEPIDOPTERA; family YPONOMEUTIDAE			
Yponomeuta spp (possibly *malinellus*)	A small ermine moth – possibly Apple ermine	Caught in moth trap on 17th June	Orchards, hedgerows; locally distributed across UK.
Order MECOPTERA; family PANORPIDAE (Scorpion flies)			
Panorpa communis	Scorpion fly	In tall ruderals and damp woodland near main pond on quarry floor on 5th June	Woodland, scrub and tall herb; common and widespread throughout England
Order NEUROPTERA; family SIALIDAE (alderflies)			
Sialis lutaria	An alderfly	Wetlands, slow flowing rivers on 22nd April	Common and widespread throughout England
OTHER INVERTEBRATES			
Order ARANEA, family SALTICIDAE (Jumping Spiders)			
Sibianor aurocinctus	A small brassy	On bare sand near haul route	Nationally scarce

Latin name	English name/type	Typical habitat	Conservation status
	jumping spider	on 22nd April	
Heiophorus flavipes	A jumping spider	Among ephemeral vegetation on 22nd April	Common and widespread in southern England
Order ARANEA, family ARANIDAE (Orb Spiders)			
Mangora acalypha	Cricket bat spider	Among ephemeral vegetation on 22nd April	Open woodland, heathlands, widespread in southern England
Order ARANEA, family THERIDIIDAE (comb-footed spiders)			
Steadota nobilis/grossa	A false-widow	In dormouse tube in surrounding deciduous woodland; photographed by Kate Lewis on 14 October	Common and widespread in southern England, locally common further north.
Order ARANEA, family TETRAGNATHIDAE (Stretch spiders)			
Tetragnatha extensa	Stretch spider	In emergent vegetation around ponds on quarry floor on 22nd April	Common and widespread in southern England, locally common further north.
Order ARANEA, family LYCOSIDAE (Wolf Spiders)			
Arctosa leopardus	A small wolf spider	Among ephemeral vegetation in damp conditions on 22nd April	Fens and marshland; widespread in southern England

APPENDIX 6 – ARTIFICIAL LIGHTING AND WILDLIFE

Bright external lighting can have a detrimental impact upon foraging and commuting bat flight paths, but more importantly can also cause bats to remain in their roosts for longer. Artificial lighting can also cause significant impacts on other nocturnal species, most notably moths and other nocturnal insects. It can also result in disruption of the circadian rhythms of birds, reducing their fitness. Guidelines issued by the Bat Conservation Trust[25] should be considered while designing the lighting scheme. A simple process which should be followed where the impact on bats is being considered as part of a proposed lighting scheme. It contains techniques which can be used on all sites, whether a small domestic project or larger mixed-use, commercial or infrastructure development. This includes the following measures:

Avoid lighting on key habitats and features altogether
there is no legal duty requiring any place to be lit. British Standards and other policy documents allow for deviation from their own guidance where there are significant ecological/environmental reasons for doing so. It is acknowledged that in certain situations lighting is critical in maintaining safety, such as some industrial sites with 24-hour operation. However, in the public realm, while lighting can increase the perception of safety and security, measurable benefits can be subjective. Consequently, lighting design should be flexible and be able to fully consider the presence of protected species

Apply mitigation methods to reduce lighting to agreed limits in other sensitive locations – lighting design considerations

Where bat habitats and features are considered to be of lower importance or sensitivity to illumination, the need to provide lighting may outweigh the needs of bats. Consequently, a balance between a reduced lighting level appropriate to the ecological importance of each feature and species, and the lighting objectives for that area will need to be achieved. The following are techniques which have been successfully used on projects and are often used in combination for best results;

- Dark buffers, illuminance limits and zonation
- Sensitive site configuration, whereby the location, orientation and height of newly built structures and hard standing can have a considerable impact on light spill
- Consider the design of the light and fittings, whereby the spread of light is minimised ensuring that only the task area is lit. Flat cut-off lanterns or accessories should be used to shield or direct light to where it is required. Consider the height of lighting columns. It should be noted that a lower mounting height is not always better. A lower mounting height can create more light-spill or require more columns. Column height should be carefully considered to balance task and mitigation measures. Consider no lighting solutions where possible such as white lining, good signage, and LED cats' eyes. For example, light only high-risk stretches of roads, such as crossings and junctions, allowing headlights to provide any necessary illumination at other times.
- Screening, whereby light spill can be successfully screened through soft landscaping and the installation of walls, fences and bunding
- Glazing treatments, whereby glazing should be restricted or redesigned wherever the ecologist and lighting professional determine there is a likely significant effect upon key bat habitat and features.
- Creation of alternative valuable bat habitat on site, whereby additional or alternative bat

[25] Bat Conservation Trust and Institute for Lighting Professionals (2018) Guidance note 8. Bats and Artificial Lighting. https://www.theilp.org.uk/documents/guidance-note-8-bats-and-artificial-lighting/

flightpaths, commuting habitat or foraging habitat could result in appropriate compensation for any such habitat being lost to the development.

- Dimming and part-night lighting. Depending on the pattern of bat activity across the key features identified on site it may be appropriate for an element of on-site lighting to be controlled either diurnally, seasonally or according to human activity. A control management system can be used to dim (typically to 25% or less) or turn off groups of lights when not in use.

Demonstrate compliance with illuminance limits and buffers

- *Design and pre-planning phase*; It may be necessary to demonstrate that the proposed lighting will comply with any agreed light-limitation or screening measures set as a result of your ecologist's recommendations and evaluation. This is especially likely to be requested if planning permission is required.
- *Baseline and post-completion light monitoring surveys*; baseline, pre-development lighting surveys may be useful where existing on or off-site lighting is suspected to be acting on key habitats and features and so may prevent the agreed or modelled illuminance limits being achieved.
- *Post-construction/operational phase compliance-checking;* as a condition of planning, post-completion lighting surveys by a suitably qualified person should be undertaken and a report produced for the local planning authority to confirm compliance. Any form of non-compliance must be clearly reported, and remedial measures outlined. Ongoing monitoring may be necessary, especially for systems with automated lighting/dimming or physical screening solutions.

APPENDIX D

Noise Impact Assessment

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PREPARED: Monday, 16 November 2020

Rock Common Quarry, The Hollow

Noise Impact Assessment

CONTENTS

LIST OF ATTACHMENTS

Project Ref:	AS11730	**Title:**	Rock Common Quarry, The Hollow
Report Ref:	AS11730.200929.EIA	**Title:**	Environmental Noise Impact Assessment
Client Name:	Dudman (Rock Common) Limited		
Project Manager:	Daniel Saunders		
Report Author:	Ian MacArthur		

Clarke Saunders Acoustics
Winchester SO22 5BE

1.0 EXECUTIVE SUMMARY

1.1 Restoration of the Rock Mill Quarry will require importation of 2,700,000m^3 of inert restoration material over a period of between 8 to 10 years.

1.2 To inform the Environmental Impact Assessment (EIA), a noise impact assessment has been undertaken of the likely noise emissions from the additional plant operating within the site, and of changes to road traffic noise levels due to additional HGV movements associated with the importation of material.

1.3 Key current policy, legislation, guidance and standards have been followed in the assessments, combined with Local Authority consultation and consideration of extant planning permissions.

1.4 A baseline noise survey has been undertaken to determine current ambient and background conditions.

1.5 The worst case noise emissions from future site activity have been calculated at the most affected nearby residential receptors and shown to have no significant impact in EIA terms, The extant noise conditions within permissions for the Rock Common Quarry site are likely to be satisfied.

1.6 The worst-case traffic noise increases on local roads have been predicted, showing negligible impact which would not be significant in EIA terms. A cumulative scenario considering the nearby CEMEX quarry site also shows negligible impact.

2.0 INTRODUCTION

2.1 This report details an environmental noise impact assessment of the proposed application at Rock Common Quarry, The Hollow, Washington, West Sussex RH20 3DA (the 'Site').

2.2 The assessment is related to the proposed restoration of the quarry site by importing 2,700,000m^3 of restoration material over a period of between 8 to 10 years. The existing extraction and processing of sand at the site will continue.

2.3 Methods used to assess the current noise conditions at the Site have been described. Receptors that may be affected by noise due to the proposed restoration have been identified.

2.4 This report has been prepared by Clarke Saunders Acoustics (CSA). In accordance with Regulation 18(5) of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017, as amended.

2.5 CSA is a full member of the Association of Noise Consultants. The authors of this report are Corporate Members of the Institute of Acoustics.

3.0 POLICY, LEGISLATION, GUIDANCE AND STANDARDS

Control of Pollution Act 1974

3.1 The Control of Pollution Act 1974 (COPA 1974) gives the local authority power to serve a notice under Section 60 imposing requirements as to the way in which works are to be carried out. This could specify times of operation, maximum levels of noise which may be emitted and the type of plant which should or should not be used. This is a common way of enforcing reasonable levels of construction noise.

3.2 Alternatively, contractors may obtain prior consent under Section 61 of COPA 1974. Section 61 enables anyone who intends to carry out noisy works to apply to the local authority for consent in advance. In this way, under Section 61, local authorities and those responsible for construction work have an opportunity to identify potentially noisy activities and appropriate mitigation measures before work starts.

National Planning Policy Framework

3.3 In March 2012 the 'National Planning Policy Framework' (NPPF) was introduced as the current planning policy guidance within England. Paragraph 123 of the NPPF states:

'Planning policies and decisions should aim to:

- *avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
- *mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*
- *recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and*
- *identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.'*

Noise Policy Statement for England' (NPSE)

3.4 In terms of 'adverse effects' the NPPF refers to the 'Noise Policy Statement for England' (NPSE) (Defra, 2010), which defines three categories, as follows:

'NOEL – No Observed Effect Level
- *This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.*

LOAEL – Lowest Observed Adverse Effect Level
- *This is the level above which adverse effects on health and quality of life can be detected.*

SOAEL – Significant Observed Adverse Effect Level
- *This is the level above which significant adverse effects on health and quality of life occur.'*

3.5 However, whilst the above terms are provided in NPSE, paragraph 2.22 acknowledges that these terms require further research in order to establish what is meant in terms of 'adverse impact'.

> *'2.22 It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.'*

Planning Practice Guidance

3.6 The Planning Practice Guidance published in March 2014 is available for mineral sites[1]. In assessing the acceptable noise levels as a consequence of the development, reference should be made to the Planning Practice Guidance on assessing environmental impacts from mineral extraction, paragraph 021[2]:

> *'Mineral planning authorities should aim to establish a noise limit, through a planning condition, at the noise-sensitive property that does not exceed the background noise level ($L_{A90,1h}$) by more than 10dB(A) during normal working hours (0700-1900). Where it will be difficult not to exceed the background level by more than 10dB(A) without imposing unreasonable burdens on the mineral operator, the limit set should be as near that level as practicable. In any event, the total noise from the operations should not exceed 55dB(A) $L_{Aeq,\,1h}$ (free field). For operations during the evening (1900-2200) the noise limits should not exceed the background noise level ($L_{A90,1h}$) by more than 10dB(A) and should not exceed 55dB(A) $L_{Aeq,\,1h}$ (free field). For any operations during the period 22.00 – 07.00 noise limits should be set to reduce to a minimum any adverse impacts, without imposing unreasonable burdens on the mineral operator. In any event the noise limit should not exceed 42dB(A) $L_{Aeq,1h}$ (free field) at a noise sensitive property.*
>
> *Where the site noise has a significant tonal element, it may be appropriate to set specific limits to control this aspect. Peak or impulsive noise, which may include some reversing bleepers, may also require separate limits that are independent of background noise (e.g. L_{max} in specific octave or third-octave frequency bands – and that should not be allowed to occur regularly at night.)*
>
> *Care should be taken, however, to avoid any of these suggested values being implemented as fixed thresholds as specific circumstances may justify some small variation being allowed.'*

3.7 The Planning Practice Guidance also describes circumstances where higher noise limits can be considered for particularly noisy short-term activities that cannot meet the limits set for normal activities. Paragraph 22 states that:

> *"Increased temporary daytime noise limits of up to 70dB(A) $L_{Aeq\ 1h}$ (free field) for periods of up to eight weeks in a year at specified noise-sensitive properties should be considered to facilitate essential site preparation and restoration work and construction of baffle mounds where it is clear that this will bring longer-term environmental benefits to the site or its environs."*

[1] http://planningguidance.planningportal.gov.uk/blog/guidance/minerals/assessing-environmental-impacts-from-minerals-extraction/

[2] http://planningguidance.planningportal.gov.uk/blog/guidance/minerals/assessing-environmental-impacts-from-minerals-extraction/noise-emissions/

British Standard 5228-1:2009

3.8 Guidance on the prediction and assessment of noise from development sites is given in British Standard (BS) 5228-1:2009 "Code of Practice for noise and vibration control on construction and open sites – Part 1: Noise" (BS5228-1).

3.9 Construction noise can have disturbing effects on the surrounding neighbourhood. The effects are varied and are complicated further by the nature of the site works, which will be characterised by noise sources which will change location throughout the construction period. The duration of site operations is also an important consideration. Higher noise levels may be acceptable if it is known that the levels will occur for a limited period.

3.10 The standard provides a reference database of noise levels generated by a range of site equipment for calculation and assessment purposes, a simplified noise prediction process and guidance on acceptance thresholds which are related to ambient noise conditions during the relevant operational periods during day evening and night time.

Design Manual for Roads and Bridges

3.11 DMRB states that the impact arising from a change in road traffic noise level depends upon whether it occurs as a result of a gradual or sudden change in road traffic flow. Generally, it is found that a sudden change gives rise to a greater impact than a gradual change. The impact of a sudden change in road traffic noise levels is defined in terms of the percentage of people *"bothered very much or quite a lot"* by noise. Levels of significance can be interpreted from *the "estimation of traffic noise nuisance"* graphs in DMRB, which can be combined with effect descriptors and guidance within IEMA Guidelines for environmental noise impact assessment to determine impact magnitude and significance criteria.

Existing Permissions

3.12 The extant permission for the continued sand extraction process (ref WS/15/97) contains conditions 13. and 14. relating to noise emissions;

> *"13. No plant or machinery used in connection with the operations on the site shall be operated so as to cause a noise level measured at a position one metre in front of any occupied building on land adjacent to the site which exceeds 55dB LAeq,1hr during the authorised working hours at the site…"*
>
> *"14. …in the event of temporary works necessary for the operation or restoration of the site by reason of construction of baffle mounds, soil stripping, removal of soil storage mounds and the construction of the new permanent restoration landform the noise level criteria expressed in condition 13 may be exceeded subject to a maximum 70dB $L_{Aeq,1hr}$ as measured at the specified locations for up to eight weeks in any twelve month period, Prior to the commencement of any operations on the site that the operator considers are likely to invoke the measures authorised by this condition the operator shall give not less than seven days notice to the Mineral Planning Authority of his intention to carry out the works"*

4.0 CONSULTATION

4.1 In August 2020, CSA liaised with Environmental Health Officer, Mr Lee Money of Horsham District Council (HDC) to discuss the proposed noise survey methodology and assessment.

4.2 The consultation focussed on the proposed scope of the survey and assessment methodology and the identification of the noise sensitive receptors in relation to the site.

4.3 These discussions included the potential effect of the COVID-19 lockdown and subsequent easing of measures on traffic flows on the A24 and local roads.

4.4 The potential uncertainty within the traffic flow data as well as the potential cumulative impact regarding the HGV traffic involved in the restoration of the CEMEX quarry approaching the A283 from Shoreham were discussed with HDC, both in terms of the reliability of the future traffic flow predictions and the limited baseline dataset that was gathered by the traffic consultants.

4.5 The Scoping Opinion from West Sussex County Council, dated 1st July 2019 details in para 4.43, "*in order that a worst case scenario can be assessed, consideration of noise impacts should take into account the maximum number of HGV's travelling to/from the site, and the maximum amount of material being processed/infilled…*"

4.6 The Scoping Opinion also states that "*The noise impact should be assessed in accordance with BS5228:2009…*"

5.0 ASSESSMENT METHODOLOGY

5.1 ASSESSMENT METHODOLOGY

5.2 Significance of effects on noise sensitive receptors of high sensitivity (i.e. residential dwellings, schools, hospitals) will be assessed on the basis of Table 8.2. This assessment focusses on the nearest receptors to the site of high sensitivity. Other receptors of lower sensitivity (i.e. factories/commercial buildings) are further from the site and any noise effects would not be Significant.

Magnitude of Impact	Significance Effect
Slight	Negligible
Low	Minor
Medium	Moderate
High	Major

5.3 Where effects of moderate and major significance are identified, these are considered to be 'Significant'. Where effects of negligible and minor significance are identified these are considered to be 'Not Significant'.

Construction (Restoration) Noise

5.4 The "ABC Method" described in BS 5228-1 gives advice on the noise limits applicable at residential locations. The ABC method for determining significance criteria requires the ambient noise levels at existing sensitive receptors to be determined. The ambient noise levels at each existing receptor location are then rounded to the nearest 5dB(A) to determine the appropriate threshold value in accordance with the category value A, B or C, as detailed in Table 6.1. The noise level likely to be generated at the receptor during the construction phase, i.e. the ambient noise level plus construction noise, is then compared to the appropriate category value. If the noise level exceeds the threshold value for the appropriate category, a significant noise effect may be registered.

It should be noted that these threshold values are higher than mineral operational noise limits to reflect the temporary nature of the construction (restoration) works.

BS 5228-1 ABC Method Assessment Category and Threshold Value Period	**Threshold Value dB(A)**		
	Category A (note A)	**Category B** (note B)	**Category C** (note C)
Night time (2300 - 0700)	45	50	55
Evenings and weekends (note D)	55	60	65
Daytime (0700 - 1900) and Saturdays (0700 - 1300)	65	70	75

A. Category A: Threshold values to use when ambient noise levels (rounded to nearest 5dB(A) are less than this value
B. Category B: Threshold values to use when ambient noise levels (rounded to nearest 5dB(A) are the same as Category A values
C. Category B: Threshold values to use when ambient noise levels (rounded to nearest 5dB(A) are higher than Category A values
D. 1900 - 2300 weekdays, 1300 - 2300 Saturdays and 0700 - 2300 Sundays

NOTE 1 A significant effect has been deemed to occur if the total L_{Aeq} noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level.

NOTE 2 If the ambient noise level exceeds the threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total L_{Aeq} noise level for the period increases by more than 3 dB due to construction activity.

NOTE 3 Applied to residential receptors only.

5.5 The noise levels above represent façade noise levels 1m outside occupied rooms closest to the site boundary.

5.6 To assess the significance of the noise impact, the ABC method detailed above indicates a lower threshold of $L_{Aeq,12hour}$ 65dB as a daytime average at the nearest noise sensitive receptors which could be deemed an appropriate threshold below which significant effects are unlikely to occur.

5.7 The ambient daytime noise climate at the nearest receptors (<60dBL_{Aeq}) would mean they are within ABC 'Category A'. Category B and C would be applicable to areas where ambient noise levels are significantly higher. As such, the following categorisations are proposed to assess the magnitude of impact from construction (restoration) noise.

Magnitude of Impact	Construction Noise Level ($L_{Aeq,12hr}$), dB
Slight	<60
Low	60-65
Medium	66-70
High	>70

Traffic Noise

5.8 Potential changes in noise levels caused by increases in road traffic due to the development will be assessed using the classifications of magnitude of impact given in DMRB.

5.9 The magnitude of impact due to change in the short-term (immediately after opening) at noise sensitive receptors is shown in the following table:

Magnitude	Significance	Road Noise Level Change L_{A10} (Short Term)
No Change	Negligible	0 dB
Slight	Negligible	0.1 to 0.9 dB
Low	Minor	1 to 2.9 dB
Medium	Moderate	3 to 4.9 dB
High	Major	5+ dB

STUDY AREA

5.10 The site is situated on land currently known as Rock Common Quarry to the north-east of Washington village. It is bounded by the A24 to the north-west and the southern extent is in close proximity to The Pike (A283). The Hollow, a relatively quiet rural road, extends from the northern part of the study area along the eastern curtilage to the south-eastern corner of the quarry. It is mainly used by site traffic.

5.11 The potential noise impacts of the proposals have been considered for the following assessment scenarios;

- Scenario 1: Noise during the continuation of existing operations relating to sand extraction, and commencement of the restoration process;
- Scenario 2a: Noise towards the end of operations relating to sand extraction with the continuation of the restoration process (restoration noise sources nearest to SE of site);
- Scenario 2b: Noise towards the end of operations relating to sand extraction with the continuation of the restoration process (restoration noise sources nearest to the SW of site);

ASSESSED RECEPTORS

5.12 The noise sensitive receptors to be included in this assessment are those that will be most exposed to noise from increased traffic noise levels, plant and operations associated with the on-site activities relating to sand extraction and restoration of the excavated land/former quarry areas. As such, these receptors are typically those closest to the site boundary which are considered as the most affected from potential noise impacts, as well as sensitive receptors in close proximity to the local road network.

5.13 The nearest most affected noise sensitive receptors (residential dwellings) have been identified and are indicated in attached figure 11730/SP1.

Reference (noise sensitive receptor)	Description	Postcode
R1	The Bungalow Rock House & Rock House Nurseries, The Hollow, Washington	RH20 3DA
R2	Green Farm Barn & Green Farm House, The Pike, Washington	RH20 4AA
R3	Washington Towers / The Cottage, London Road, Washington	RH20 4AJ
R4	Sandhill Barn and Farm House, Sandhill Lane, Washington	RH20 4TD

5.14 Receptor R3 also encompasses the Washington Caravan and Camping Park.

6.0 BASELINE CONDITIONS

ENVIRONMENTAL NOISE SURVEYS

6.1 The dominant noise source in the area within and surrounding the Site is road traffic noise from the major roads (A24 and A283) with additional contributions in the immediate locality of the site from the current sand extraction operation of the Rock Common Quarry.

6.2 Travel and business restrictions due to the COVID-19 pandemic have resulted in a reduction in road traffic and general activity levels. As such, noise data measured since late March 2020 may be atypical.

6.3 Noise surveys have been conducted at representative locations around the Site, to determine the baseline conditions at the Site and surrounding noise sensitive receptors to inform the noise assessment.

6.4 Automated measurements of consecutive 5-minute L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} sound pressure levels were taken between 12:30 hours on Tuesday 1st September and 11:15 hours Monday 7th September 2020. Additional attended measurements were recorded on the start and end dates of the survey period. Figure 11730/SP1 shows the location of the automated and attended noise survey locations.

6.5 All measurements were made following procedures in BS7445:1991 (ISO1996-2:1987) *Description and measurement of environmental noise Part 2-Acquisition of data pertinent to land use*, and conducted in free-field locations at a height of approximately 1.5m above ground level. Procedures described in BS4142:2014 + A.1:2019 *Methods for rating and assessing industrial and commercial sound* were also followed, where appropriate, in measuring background sound levels.

6.6 Calibration of all sound level meters was verified before and after use. No significant calibration drift was detected in any of the measurement equipment.

- 2 no. Rion NL-32 sound level meter (LT1 / LT2)
- 1 no. Rion NL-52 sound level meter (LT3)
- 1 no. Norsonic 118 sound level meter (ST1/ ST2/ ST3/ ST4)
- 1 no. Norsonic sound level calibrator type 1251
- 1 no. Rion NC-74 sound level calibrator

6.7 All measurement equipment has current certified laboratory calibration to traceable national standards. Copies of equipment calibration certificates are available upon request.

6.8 The weather during the surveys was mainly dry with light winds, conditions suitable for environmental noise measurements.

CURRENT BASELINE

6.9 The results of the long-term noise surveys are summarised in the tables below, with time history plots provided attached figures 11730 THX. The average daytime and night-time noise levels, L_{Aeq} are shown, alongside the typical lowest L_{A90}, defined as the 10th percentile of the measured L_{A90} dataset, and typical L_{AFmax}, defined as the 90th percentile of the L_{Afmax} dataset.

Monitoring Position	Period	Average $L_{Aeq,T}$	Typical L_{A90}	Typical $L_{AF,max}$
LT1	07:00 – 23:00	$L_{Aeq,16hr}$ 52 dB	L_{A90} 42 dB	$L_{AF,max}$ 69 dB
	23:00 – 07:00	$L_{Aeq,8hr}$ 45 dB	L_{A90} 39 dB	$L_{AF,max}$ 62 dB
LT2	07:00 – 23:00	$L_{Aeq,16hr}$ 52 dB	L_{A90} 41 dB	$L_{AF,max}$ 66 dB
	23:00 – 07:00	$L_{Aeq,8hr}$ 46 dB	L_{A90} 27 dB	$L_{AF,max}$ 60 dB
LT3	07:00 – 23:00	$L_{Aeq,16hr}$ 52 dB	L_{A90} 38 dB	$L_{AF,max}$ 69 dB
	23:00 – 07:00	$L_{Aeq,8hr}$ 45 dB	L_{A90} 27 dB	$L_{AF,max}$ 61 dB

6.10 As is evident in the attached noise time-histories, levels monitored at position LT1, which overlooked the quarry site, were variable due to the sporadic nature of the ongoing quarry operation and nearby water pumps. Breaks in plant operations during the daytime and over the weekend, however, enabled the background L_{A90} level in the absence of operational activity to be determined. During periods of quarry activity, ambient levels measured at position LT1 were typically in the range 55-59dB$L_{Aeq,5mins}$.

6.11 Ambient noise levels measured at positions LT2 and LT3 were primarily determined by road traffic noise.

6.12 The supplementary short-term survey results are shown in the following table.

Monitoring Position	Period	Average $L_{Aeq,T}$
ST1	13:12 - 13:15	$L_{Aeq,T}$ 54 dB
ST2	14:00 - 13:15	$L_{Aeq,T}$ 68 dB
ST3	14:05 - 14:25	$L_{Aeq,T}$ 72 dB
ST4	14:37 - 15:00	$L_{Aeq,T}$ 79 dB

7.0 ASSESSMENT

OPERATIONAL NOISE ASSESSMENT

7.1 The operator has provided expected numbers and type of plant to be used throughout the continued extraction and restoration process. Noise levels emitted by the proposed mechanical plant have been based on those detailed in the noise database in BS 5228: Part 1: 2009: *'Code of practice for noise and vibration control on construction and open sites -* Part 1: Noise'.

7.2 As is typical with construction or quarry sites, the exact location and duration of activities within each phase will vary depending upon operational requirements. Where these uncertainties are present, pessimistic assumptions have been made to ensure a robust assessment of the proposed restoration. Actual noise levels at any given time are therefore likely to be lower than those predicted and the assessment is therefore likely to represent a worst case.

7.3 There are four distinct operating areas under assessment, with a simplified overview described as follows:

7.4 For the existing sand extraction, the sand is 'won' within the main quarry area through use of an excavator. The material is then transported via conveyor under the Hollow, into the sand processing area. Here it is screened, stockpiled, potentially mixed with aggregate or cement and loaded onto lorries for export.

7.5 The restoration process comprises a reception area north of the Hollow. Material is received and loaded into a feed hopper/screen. It is then transported via conveyor under the Hollow to a platform within the main quarry. A crusher is also located in the reception area.

7.6 Hours of operation are 0700 to 1800 Monday to Friday, 0700 to 1300 on Saturday. No operations are to be undertaken on Sundays or Public and Bank Holidays.

7.7 The plant associated with each operational area is summarised in the table below:

Reception Area	**No.**	**Noise Level at 10m** **(* denotes max pass by level)**
Wheeled Loader	2	82 dB(A)
Loading Feed Hopper	1	80 dB(A)
Screener	1	81 dB(A)
Crusher	1	82 dB(A)
Conveyor	1	76 dB(A)
Lorry Unloading	250/day	80 dB(A)

Restoration Area	**No.**	**Noise Level at 10m** **(* denotes max pass by level)**
Wheeled Loader (Platform)	1	82 dB(A)
Articulated Dump Trucks	2	87 dB(A)*
Dump Trucks Unloading	2	80 dB(A)
Dozers	2	81 dB(A)
Sheepsfoot Roller	1	80 dB(A)*

Sand Extraction	**No.**	**Noise Level at 10m** **(* denotes max pass by level)**
Long Reach Excavator	1	85 dB(A)
Conveyor	1	76 dB(A)

Sand Processing	**No.**	**Noise Level at 10m**
Wheeled Loaders	2	82 dB(A)
Feed Hopper	1	80 dB(A)
Screener	1	81 dB(A)
Conveyor	1	76 dB(A)
Loading Sand to Lorry	4/hour	82 dB(A)*

7.8 Calculations have been undertaken to determine the likely worst-case noise emissions, in terms of an $L_{eq,1hr}$, from the restoration operation in combination with the sand extraction operations.

7.9 Noise emissions into the surrounding area have been calculated using calculation protocols defined within ISO9613-2 *Acoustics -- Attenuation of sound during propagation outdoors -- Part 2: General method of calculation*, as implemented within CadnaA noise prediction software. Topography for the quarry and surrounding area has been incorporated into the model from Lidar digital terrain surveys and the project working drawings. Octave band noise source data from BS5228:1 for all sources summarised above has been included.

7.10 Scenario 1 includes for existing operations, with landform and restoration working area as per the Phase 1 restoration area (drawing DRCL/RCRA.WP-04).

7.11 Scenario 2a and 2b account for the same worst case plant scenarios, with the quarry infilled to final restoration height (drawing DRCL/RCRA.WP-12). Scenario 2a assumes a working area close to the site boundary nearest to receptor R2, with Scenario 2b assuming a working area near to the boundary nearest receptors R3 and R4.

7.12 Noise contour plots are shown in the attached figures 11730/NM1-NM3.

7.13 A summary of the overall predicted levels are shown below, representing a worst case hourly L_{Aeq} level.

7.14 It is noted that this represents a robust worst-case scenario, with all plant operating concurrently and consistently throughout the hour.

Receptor	Typical Lowest Daytime Background Level	Scenario 1 Operational $L_{eq,1hr}$	Scenario 2a Operational $L_{eq,1hr}$	Scenario 2b Operational $L_{eq,1hr}$
R1	L_{A90} 38 dB	46 dB(A)	46 dB(A)	46 dB(A)
R2	L_{A90} 38 dB	48 dB(A)	65 dB(A)	52 dB(A)
R3	L_{A90} 42 dB	45 dB(A)	46 dB(A)	56 dB(A)
R4	L_{A90} 42 dB	48 dB(A)	46 dB(A)	57 dB(A)

7.15 Assessment of Scenario 1 shows that worst noise emissions during initial restoration operations and continued sand extraction would represent a slight impact magnitude in relation to the BS5228 assessment methodology (see section 5.7). The highest predicted noise level, occurring during Scenario 2a, at receptor R2, would be assessed as a low impact magnitude. In all cases, with reference to para 5.3, these would be of 'negligible 'or 'minor' significance, and classified to be 'Not Significant' in EIA terms.

7.16 The calculated worst-case emissions show that restoration would comply with the extant permission (ref WS/15/97) normal operational (Condition 13.) limits of 55dB$L_{Aeq,1hr}$ for the majority of the restoration works. When at the closest approaches to the receptors during the final restoration phases, noise levels would be below the maximum Condition 14 limit of 70dB $L_{Aeq,1hr}$, and would not occur for more than eight weeks in any 12 month period.

TRAFFIC NOISE ASSESSMENT

7.17 Changes to existing road traffic noise levels have been predicted using the relevant traffic flow information

Road Traffic Data

7.18 Road traffic information has been provided by the transport consultants, [GTA Civils and Transport]. For the restoration process, the average daily movements into the site is estimated at 150 inbound trips (300 total 2-way). This would be comprised primarily of 20 tonne tipper trucks. A maximum has been identified of 500 total 2-way daily movements.

7.19 HGV traffic into the site would access only via the Hollow/A283 junction and not from the A24/Hollow Junction.

7.20 Baseline data for the A283 has been provided, based upon the West Sussex County Council 2019 Vehicle count reports. This details an 18-hour total 2-way flow on the A283 of 16252 vehicles, of which 16% are HGV's.

7.21 Baseline data for the A24 has been taken from the DfT online Road traffic statistics3. The 2019 manual count at data point 46283, which is situated north of the site, details 37941 total vehicles, of which 4% were HGV movements. When using an appropriate 18-hour conversion factor of 0.95%, this results in a baseline of 36044 total vehicles, 4%HGV.

7.22 In order to determine the distribution of Site traffic, the transport consultants have advised that for the A283/Hollow Junction assuming 80%/20% West/East split would be appropriate. At the A24/A283 Junction, a 50%/50% North/South split has been advised as being an appropriate assumption.

7.23 The existing permitted site uses, comprising the extraction and processing of sand has no limit on the number of vehicle movements for the purposes of exporting processed sand. The site also benefits from additional permissions involving vehicle movements relating to the importation of soils and peat, aggregates and cement. Access to, and egress from, this site is from the A24/Hollow Junction only. No changes are proposed or sought from these activities and as such, are not included within this assessment.

Road Traffic Noise Increase

7.24 Changes in road traffic noise levels (LA10) have been calculated using the methodology in Section 42.2 of Calculation of Road Traffic Noise (CRTN): 1988 [DoT – Welsh Office. HMSO], taking into account the change in total vehicle flow and percentage heavy vehicles.

7.25 The following has been based upon the worst-case assumption of 500 2-way vehicle movements per day.

Road Link	2019 Baseline All Traffic	2019 Baseline HGV	With Dev. All Traffic	With Dev. HGV	Calculated increase in $L_{A10,18hour}$
A283 (East of the Hollow)	16252	2649	16352	2749	0.2dB
A283 (East of the Hollow)	16252	2649	16652	3049	0.7dB
A24	36044	1550	36244	1750	0.5dB

[3] https://roadtraffic.dft.gov.uk/manualcountpoints/46283

7.26 With reference to the assessment method as detailed in para 5.9, a short term increase in road traffic noise between 0.1dB and 0.9dB $L_{A10,18hour}$ at the residential receptors influenced by road traffic noise on these roads would be a slight magnitude and represent a negligible impact. In EIA terms, this would be assessed as Not Significant.

8.0 MITIGATION

8.1 White noise reversing technology, for reversing and movement alarms, has been employed on the site since 2011. This will be continued through the restoration phase.

8.2 A noise management plan will be implemented at the site, detailing best practice noise control measures with regard to plant and operations, training of operatives and the logging and handling of complaints due to noise.

9.0 CUMULATIVE EFFECTS

9.1 The consultation Horsham District Council raised concern of cumulative traffic noise effects on the A283 due to the similar restoration of the CEMEX quarry site, which is situated approximately west of the A24 and accessed via the A283. The submitted transport statements and noise impact assessments for Planning Application *WSCC/044/18/SR* have been reviewed to ascertain any potential cumulative effects.

9.2 The noise assessment (ES Chapter 9) detailed a calculated increase of road traffic levels on the A283 of 0.2dB $L_{A10,18hour}$.

9.3 The transport assessment details in its table 7.2, that the CEMEX development flows on the A283, East of its site would comprise 134 two-way movement. There is no detail as to how this traffic would disperse when it reached the A24.

9.4 An absolute worst can be considered to investigate possible cumulative effects, where all CEMEX HGV's used the A283 to Steyning, with no dispersal on the A24.

9.5 If the CEMEX HGV's are added to the flows (as detailed in para 7.25 , above), the following assessment would apply:

Road Link	2019 Baseline All Traffic	2019 Baseline HGV	All Traffic Dev+CEMEX worst case	HGV's Dev.+CEMEX worst case	Calculated increase in $L_{A10,18hour}$
A283 (East of the Hollow)	16252	2649	16486	2883	0.4dB
A283 (East of the Hollow)	16252	2649	16786	3183	0.9dB
A24	36044	1550	36244	1750	0.5dB

9.6 The cumulative impact of both sites under this absolute worst-case scenario is therefore negligible and Not Significant.

10.0 CONCLUSIONS

10.1 Restoration of the Rock Mill Quarry will require importation of 2,700,000m^3 of inert restoration material over a period of between 8 to 10 years.

10.2 To inform the Environmental Impact Assessment (EIA), a noise impact assessment has been undertaken of the likely noise emissions from the additional plant operating within the site, and of changes to road traffic noise levels due to additional HGV movements associated with the importation of material.

10.3 Key current policy, legislation, guidance and standard documents have been followed in the assessments, combined with Local Authority consultation and consideration of extant planning permissions.

10.4 A baseline noise survey has been undertaken to determine current ambient and background conditions.

10.5 The worst case noise emissions from future site activity have been calculated at the most affected nearby residential receptors and shown to have no significant impact in EIA terms, The extant noise conditions within permissions for the Rock Common Quarry site are likely to be satisfied.

10.6 The worst-case traffic noise increase on local roads have been predicted, showing negligible impact which would not be significant in EIA terms. A cumulative scenario considering the nearby CEMEX quarry site also shows negligible impact.

Ian MacArthur MIOA

Clarke Saunders Associates

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– *Planning Practice Guidance. Guidance Noise. www.gov.uk. [Online] Ministry of Housing, Communities & Local Government. https://www.gov.uk/guidance/noise--2.*
– *BS 5228:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Noise. British Standards Institution. London : BSI, 2014. BS 5228:2019+A1:2014.*
– *Design Manual for Roads and Bridges. The Highways Agency, Transport Scotland, Welsh Government, The Department for Regional Development Northern Ireland. 2011, Vol. 11 Section 3 Part 7 Revision 1.*
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– *BS4142:2014 + A.1:2019 Methods for rating and assessing industrial and commercial sound. British Standards Institution. London : BSi, 2019. BS4142:2014 + A.1:2019.*
– *ProPG: Planning and Noise: Professional Practice Guidance on Planning & Noise – New Residential Development. Institute of Acoustics. s.l. : IoA, 2017.*
– *Calculation of Road Traffic Noise. Department of Transport. 1988.*
– *National Planning Policy Framework (NPPF). Department for Communities and Local Government. 2019.*
– *Noise Policy Statement for England (NPSE). DEFRA. 2010.*
– *Control of Pollution Act 1974. Her Majesty's Stationery Office. 1974.*
– *Guidelines for Community Noise. World Health Organisation. 1999.*

Figure AS11730/SP1

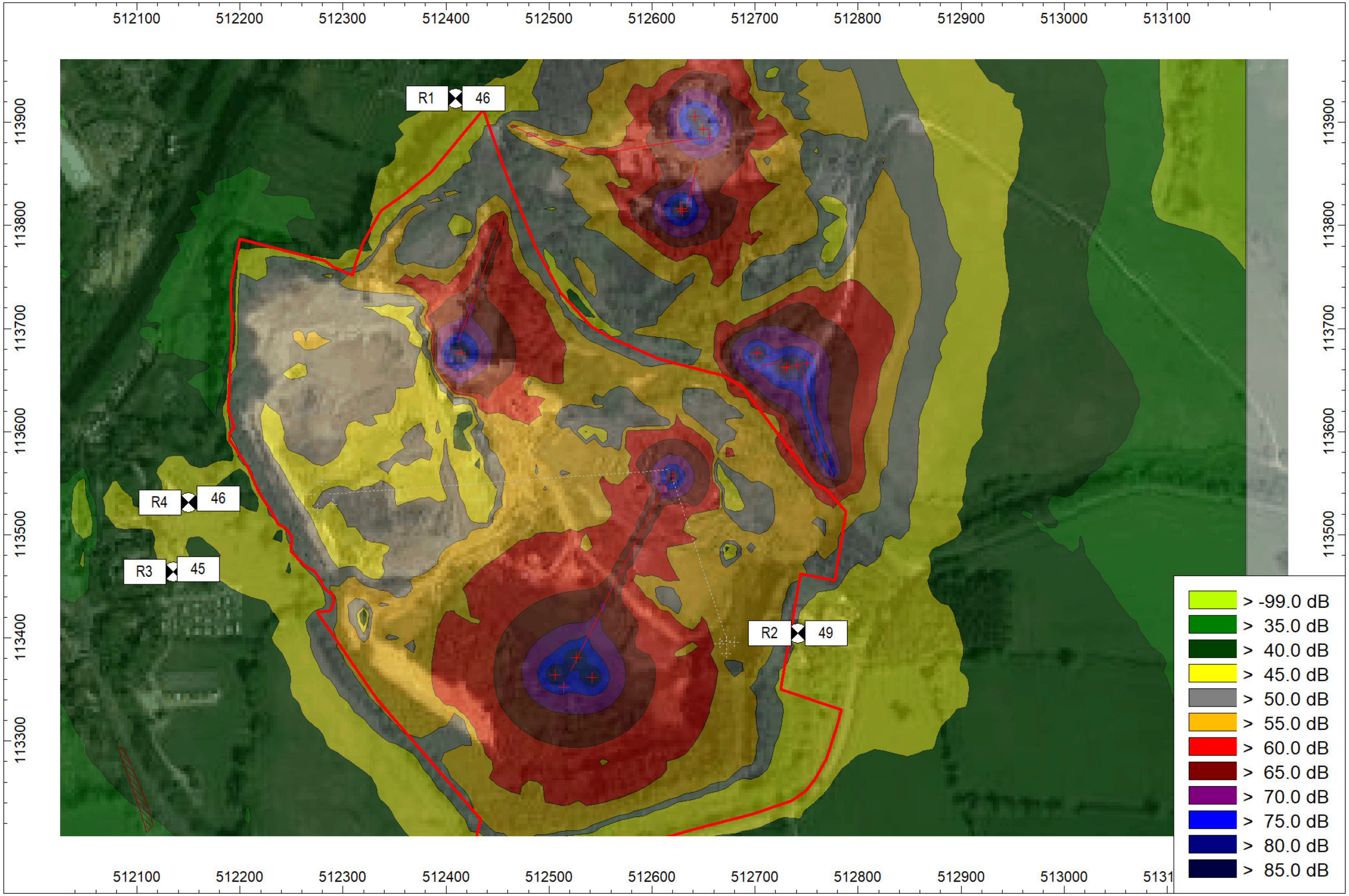


Figure 11730/NM1

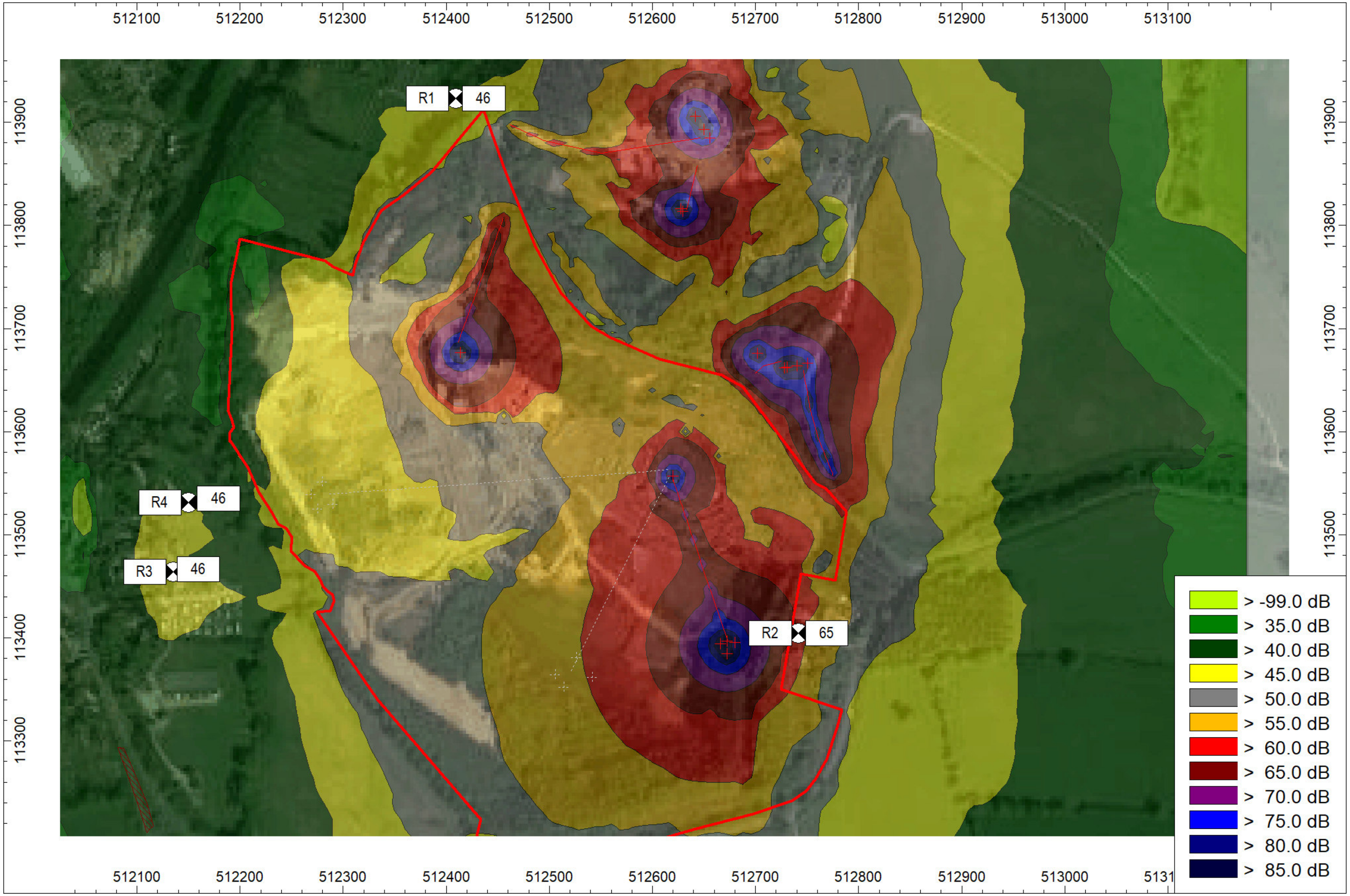
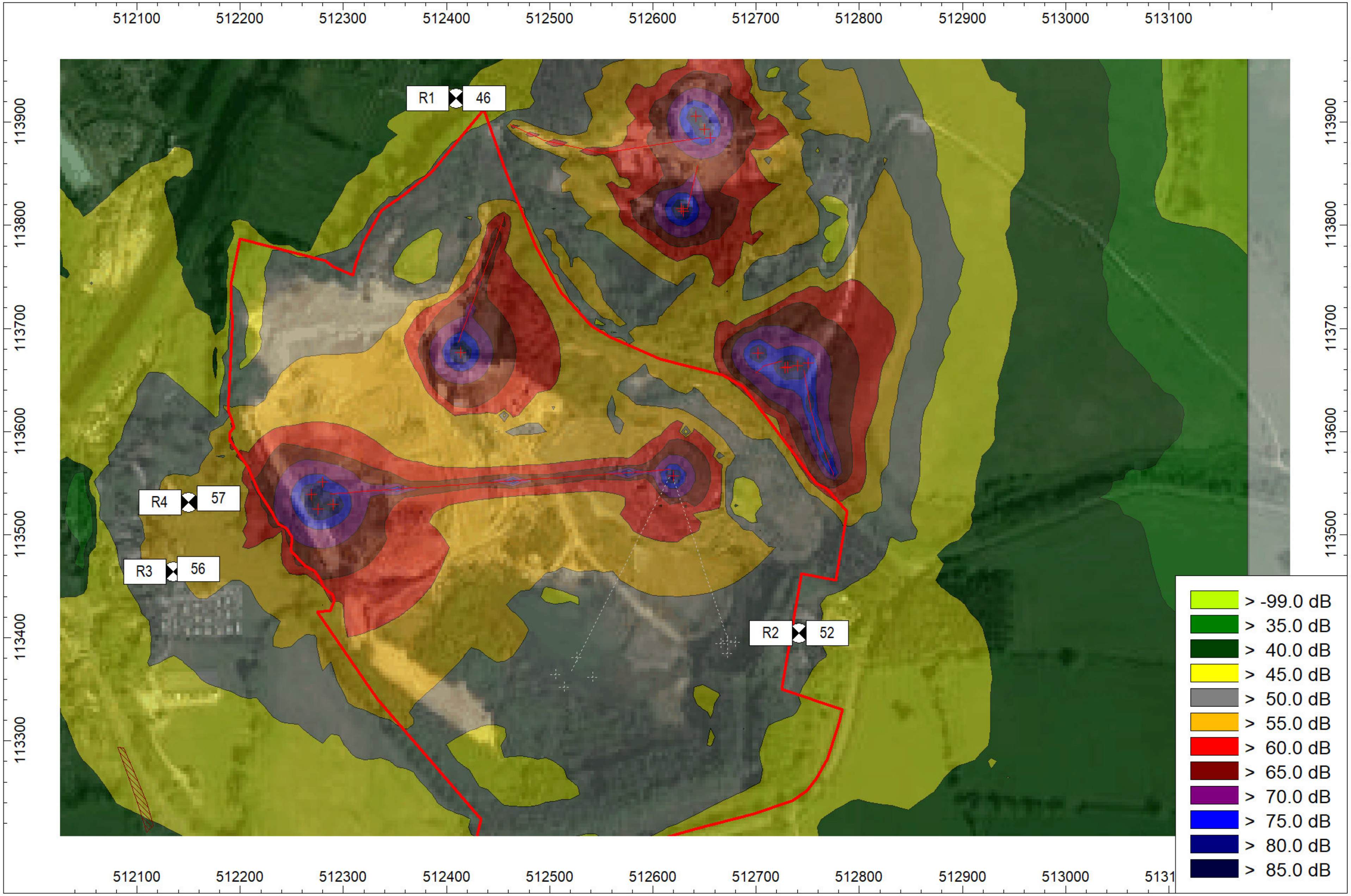


Figure 11730/NM2



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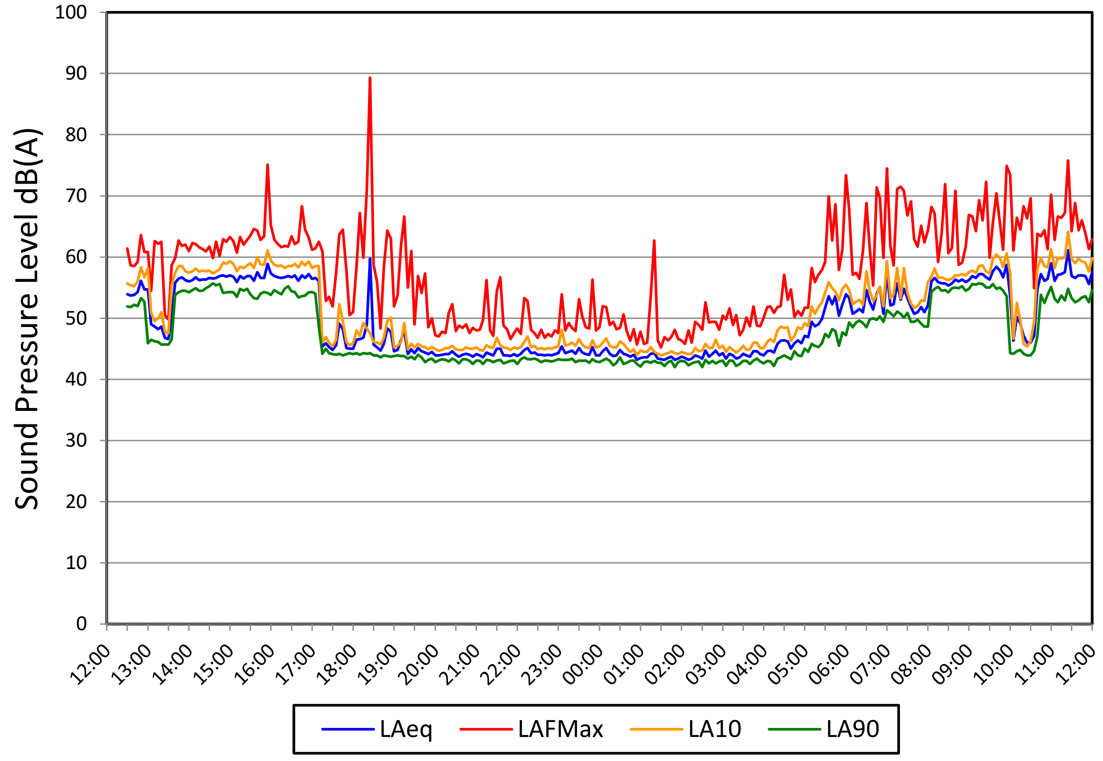
Rock Common Quarry, The Hollow

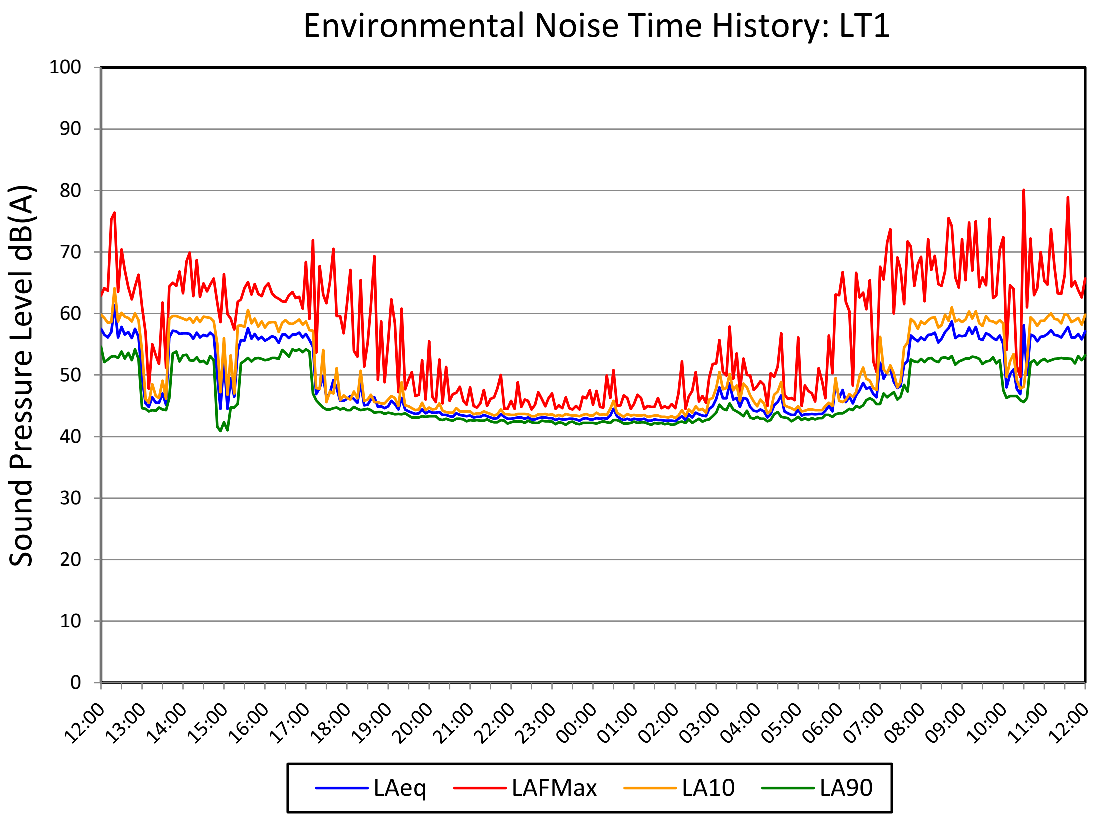
Environmental Noise Time History: LT1



Tuesday 01 September to Wednesday 02 September 2020

Figure AS11730/TH1

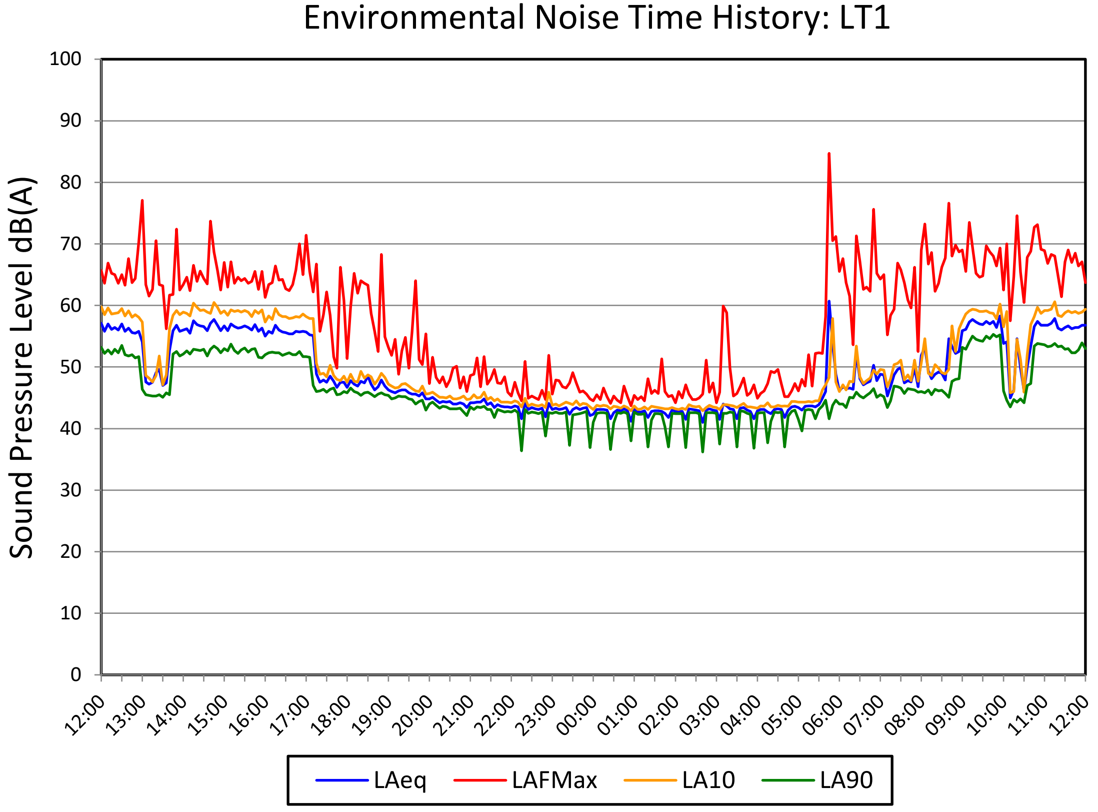
Rock Common Quarry, The Hollow



Wednesday 02 September to Thursday 03 September 2020

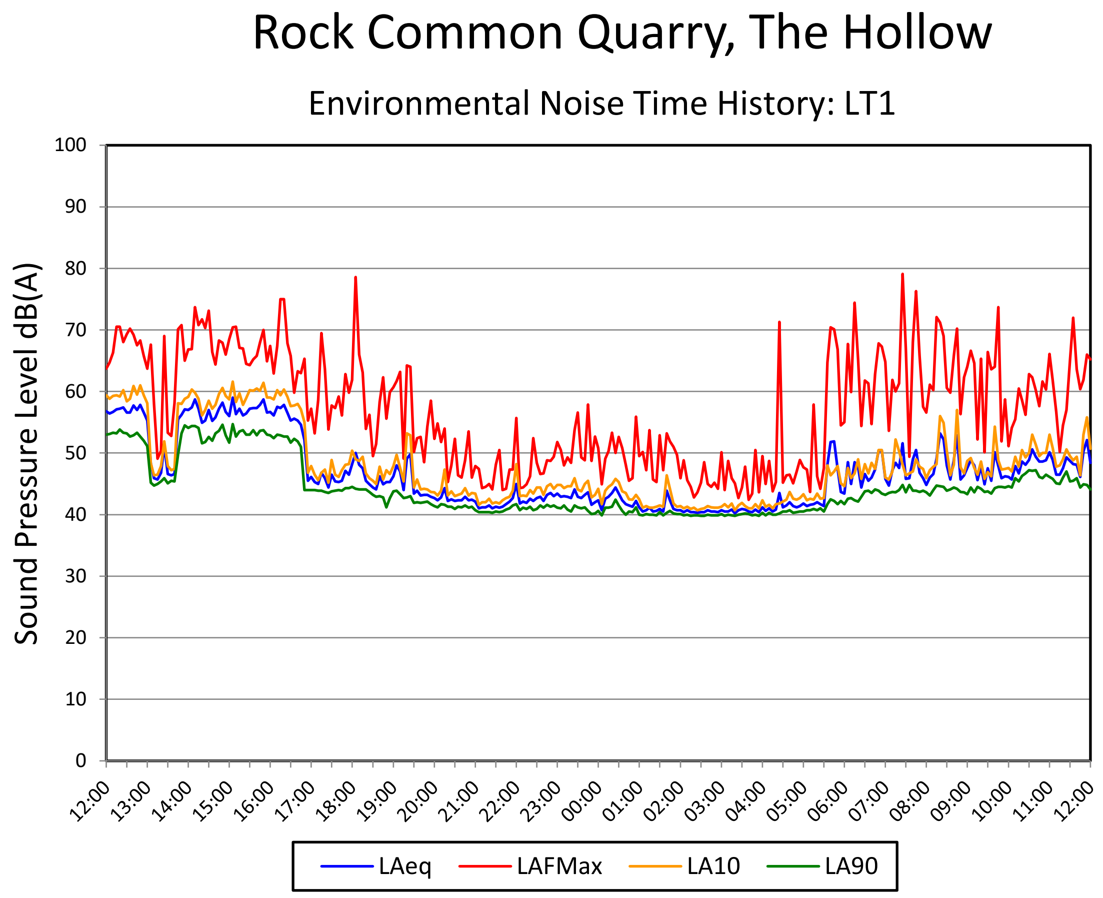
Figure AS11730/TH2

Rock Common Quarry, The Hollow



Thursday 03 September to Friday 04 September 2020

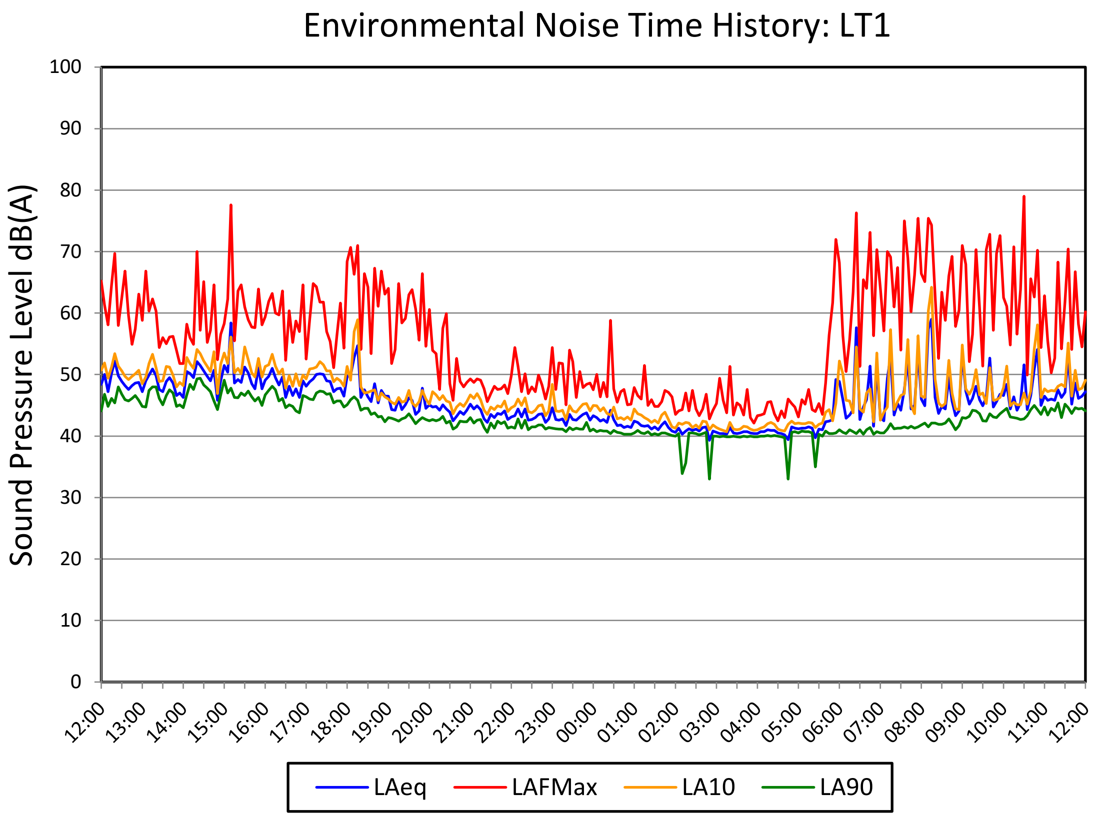
Figure AS11730/TH3



Friday 04 September to Saturday 05 September 2020

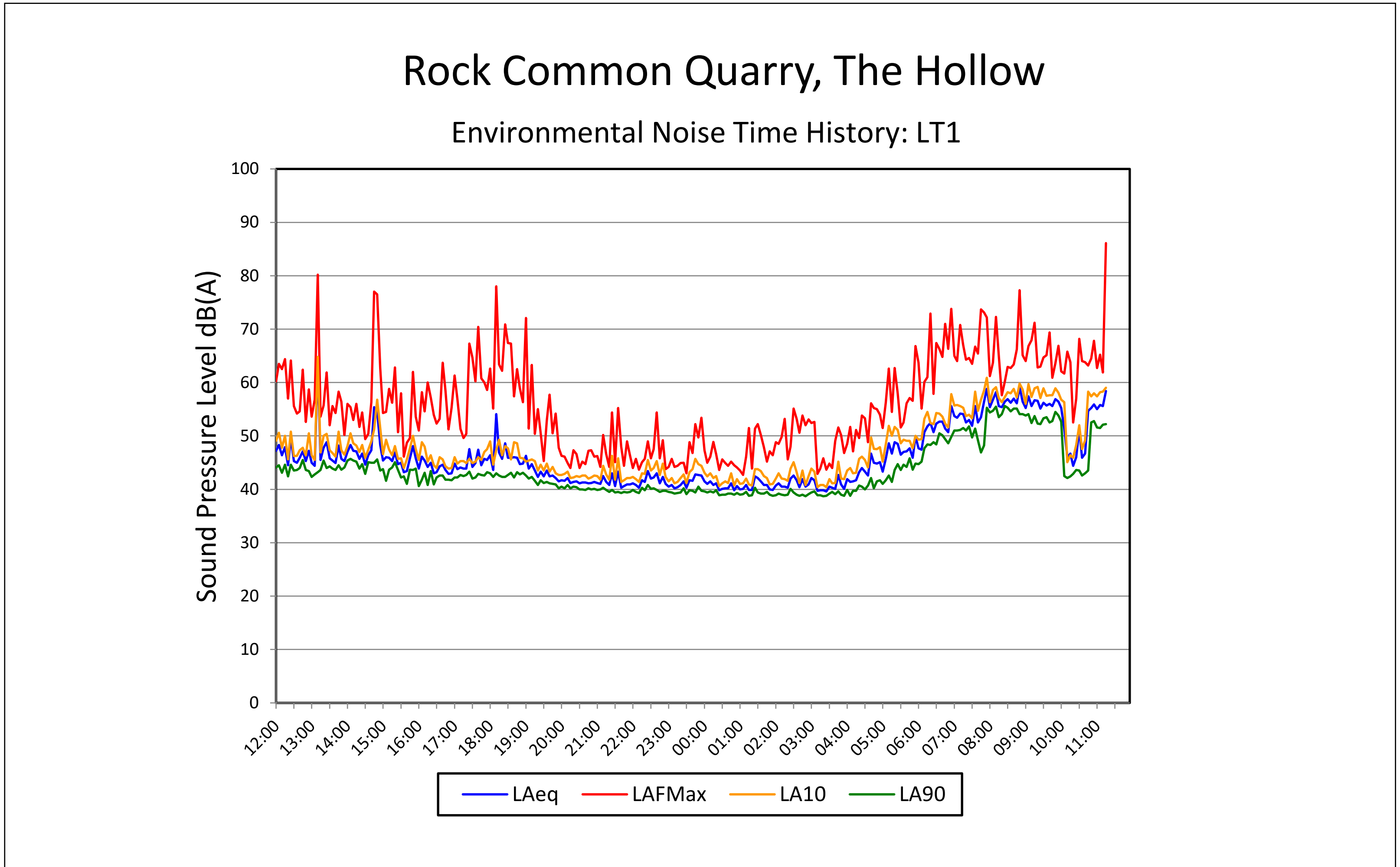
Figure AS11730/TH4

Rock Common Quarry, The Hollow



Saturday 05 September to Sunday 06 September 2020

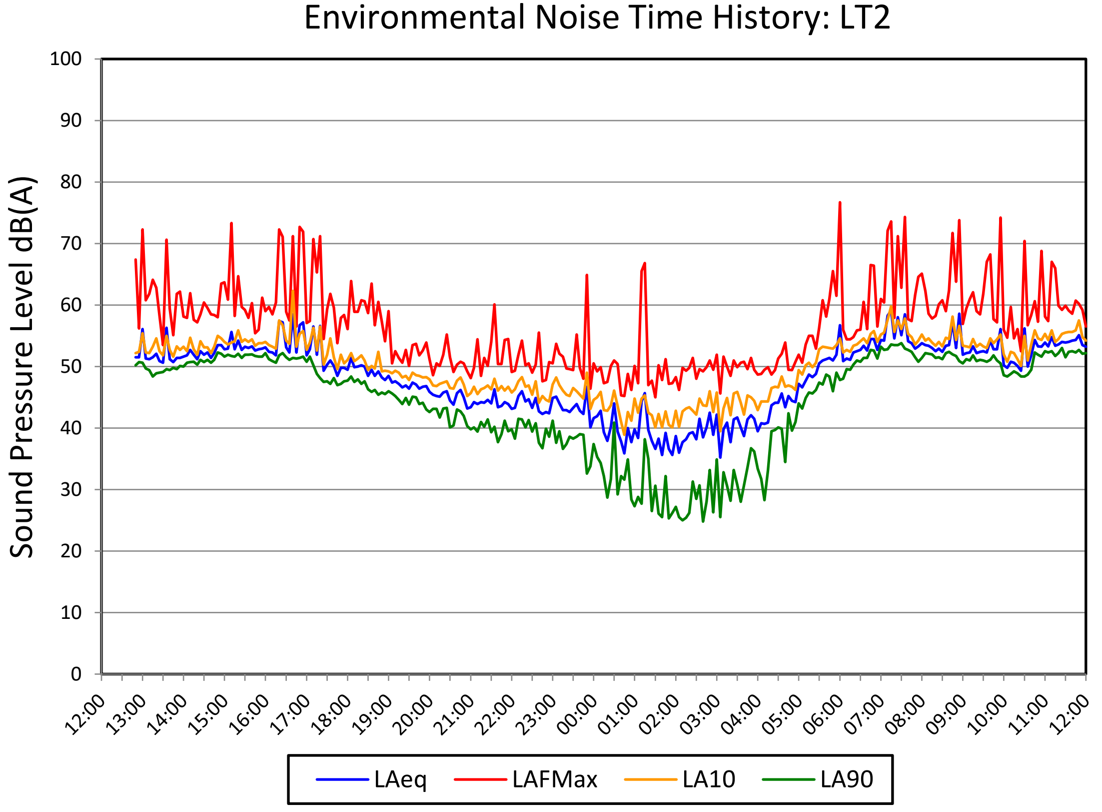
Figure AS11730/TH5



Sunday 06 September to Monday 07 September 2020

Figure AS11730/TH6

Rock Common Quarry, The Hollow

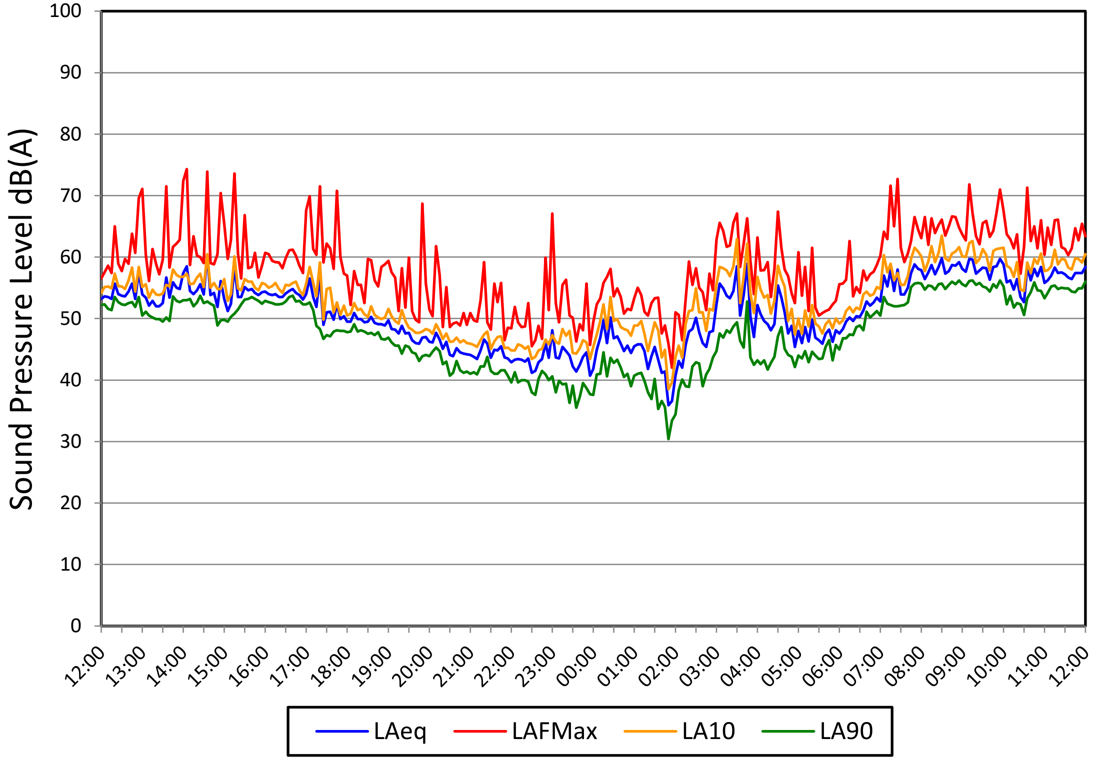


Tuesday 01 September to Wednesday 02 September 2020

Figure AS11730/TH7

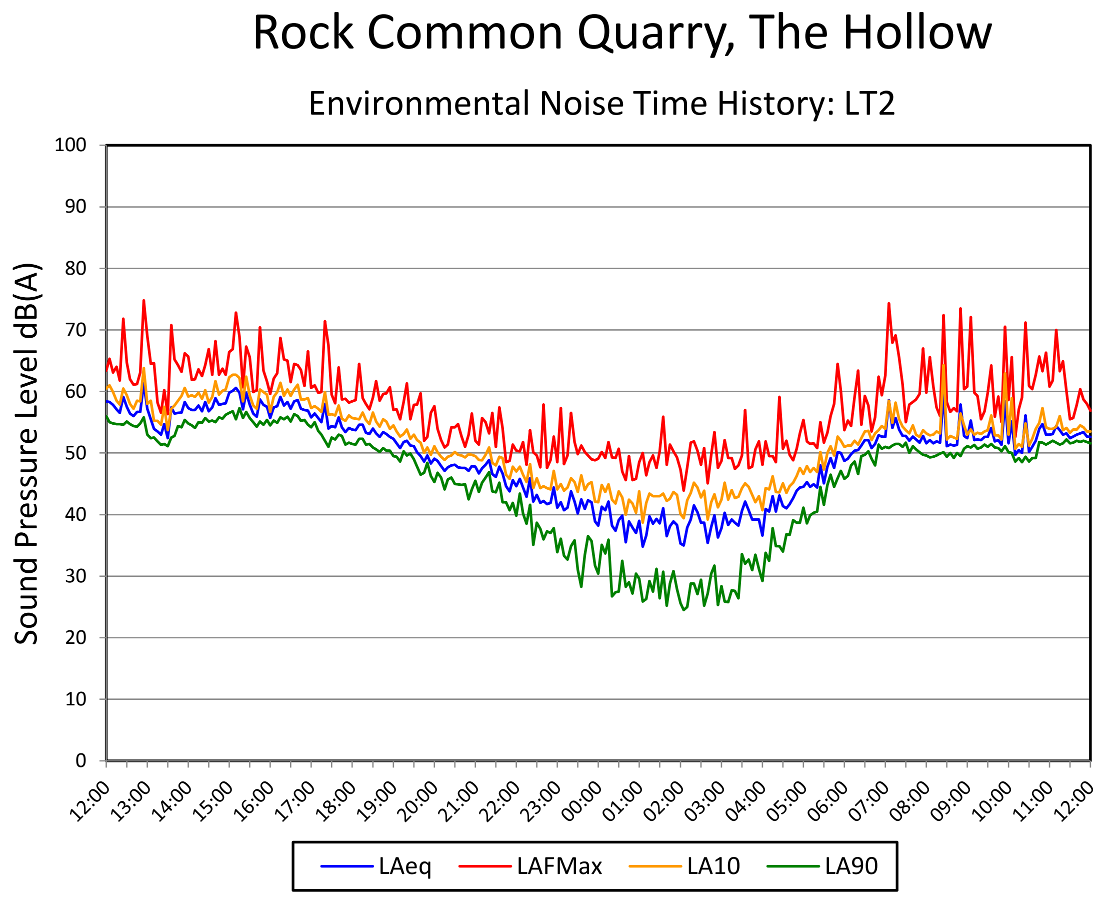
Rock Common Quarry, The Hollow

Environmental Noise Time History: LT2



Wednesday 02 September to Thursday 03 September 2020

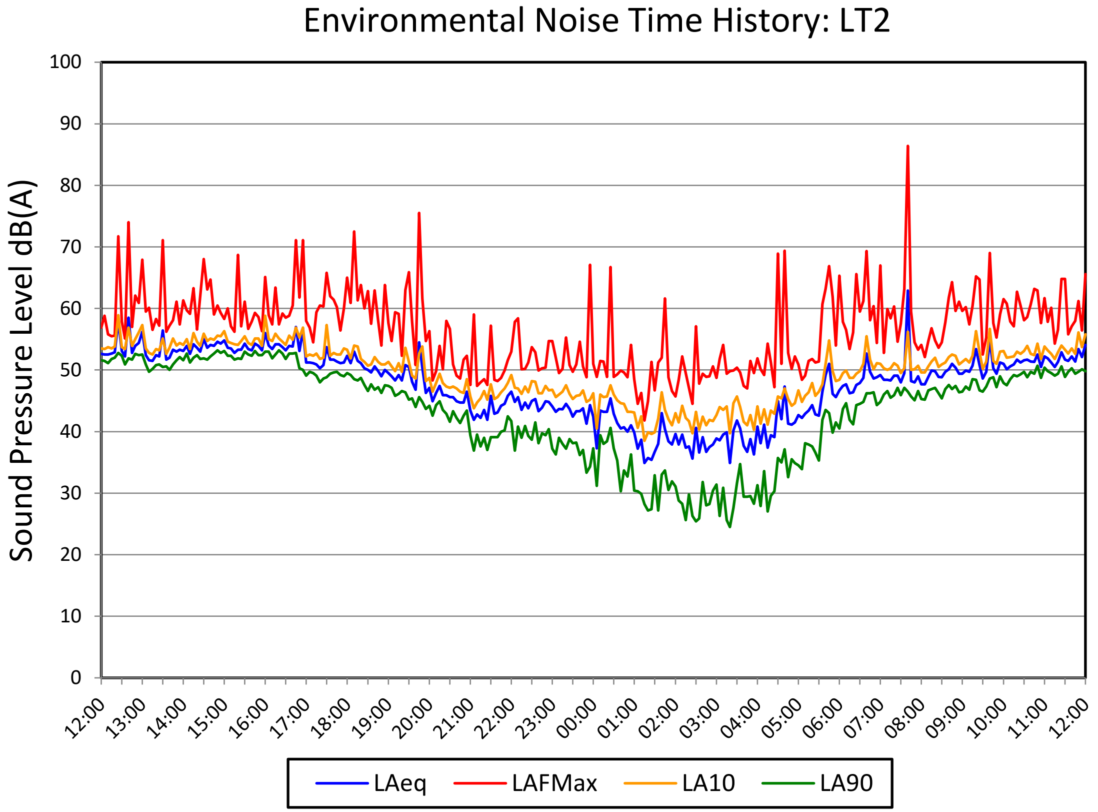
Figure AS11730/TH8



Thursday 03 September to Friday 04 September 2020

Figure AS11730/TH9

Rock Common Quarry, The Hollow

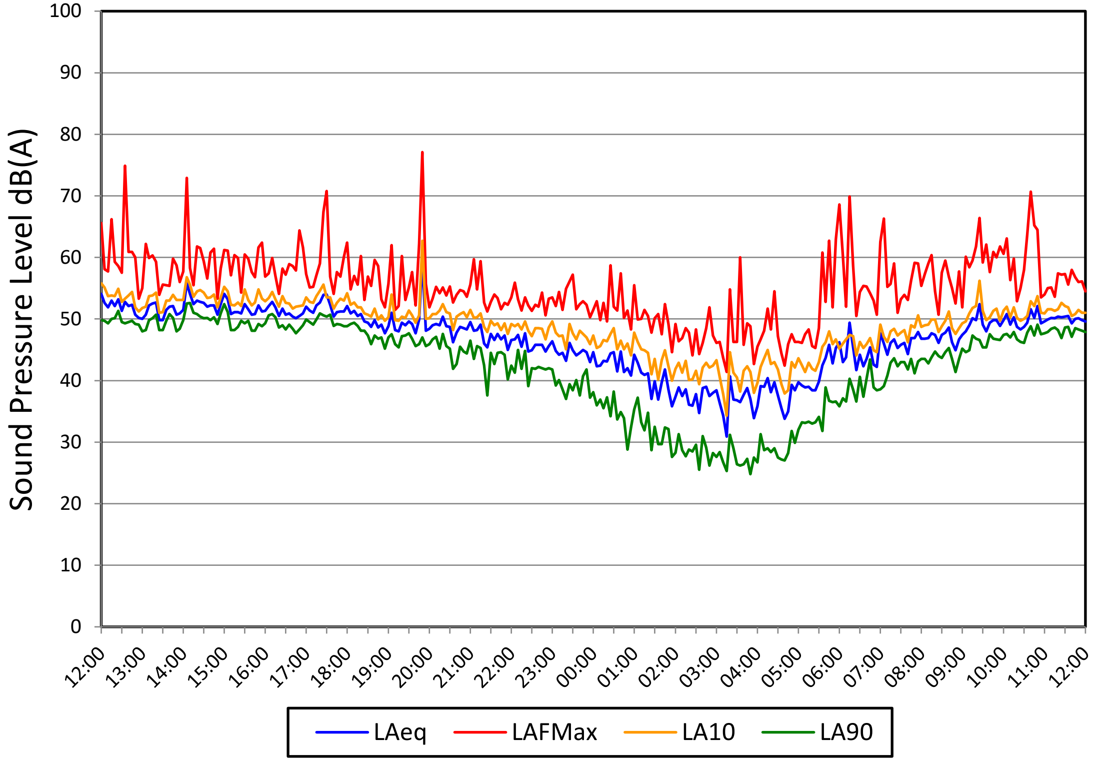


Friday 04 September to Saturday 05 September 2020

Figure AS11730/TH10

Rock Common Quarry, The Hollow

Environmental Noise Time History: LT2

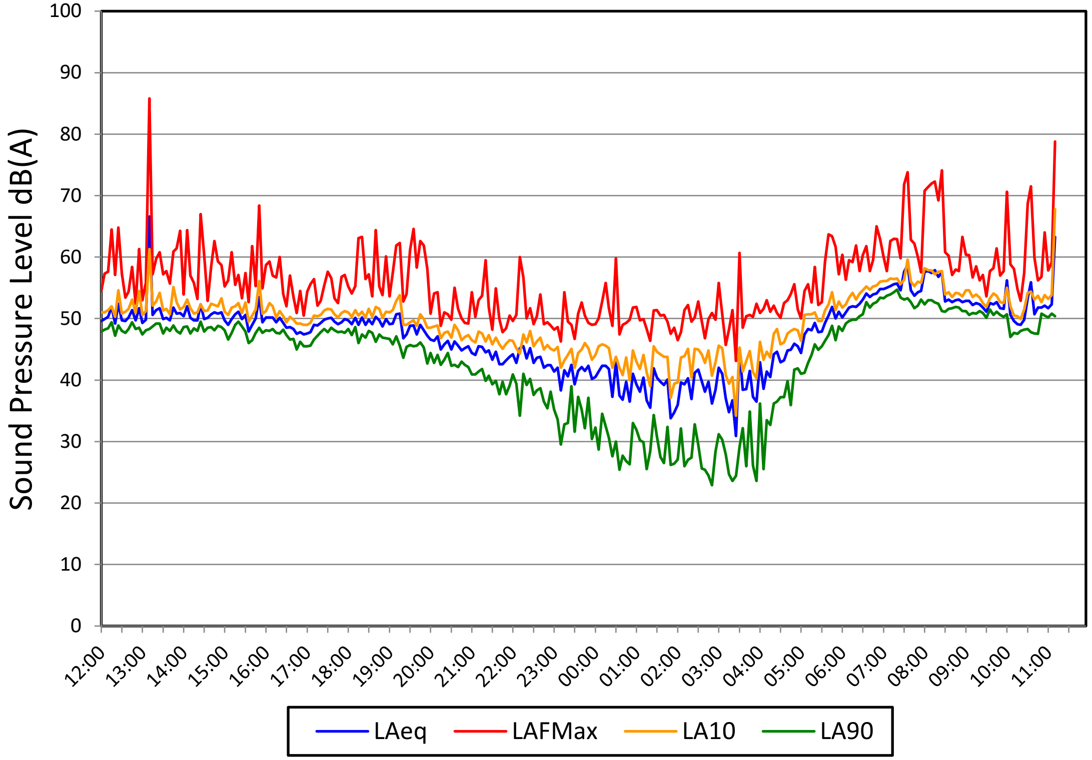


Saturday 05 September to Sunday 06 September 2020

Figure AS11730/TH11

Rock Common Quarry, The Hollow

Environmental Noise Time History: LT2

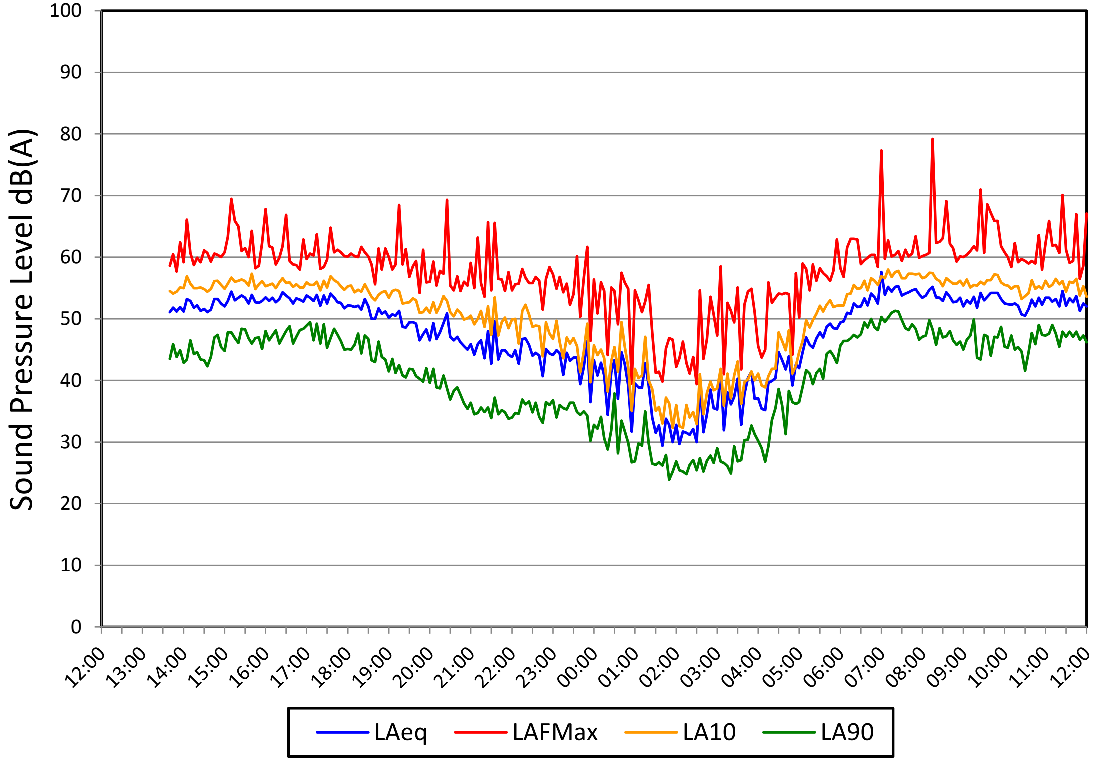


Sunday 06 September to Monday 07 September 2020

Figure AS11730/TH12

Rock Common Quarry, The Hollow

Environmental Noise Time History: LT3

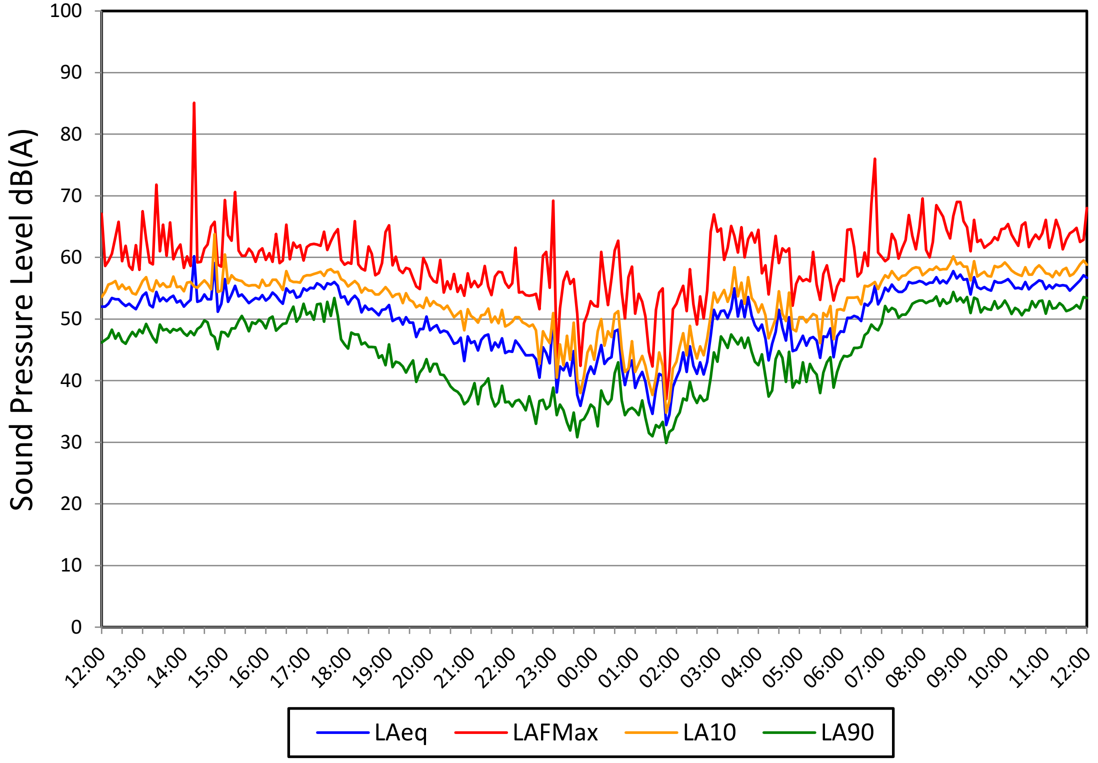


Tuesday 01 September to Wednesday 02 September 2020

Figure AS11730/TH13

Rock Common Quarry, The Hollow

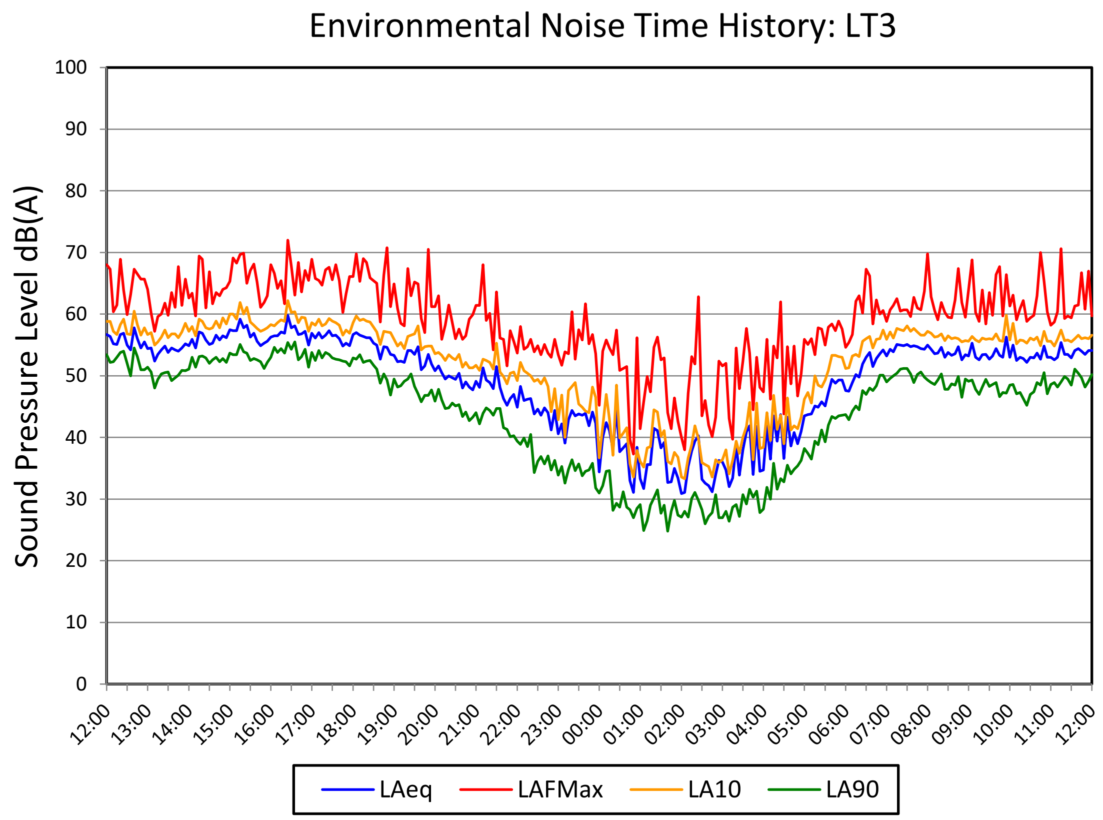
Environmental Noise Time History: LT3



Wednesday 02 September to Thursday 03 September 2020

Figure AS11730/TH14

Rock Common Quarry, The Hollow

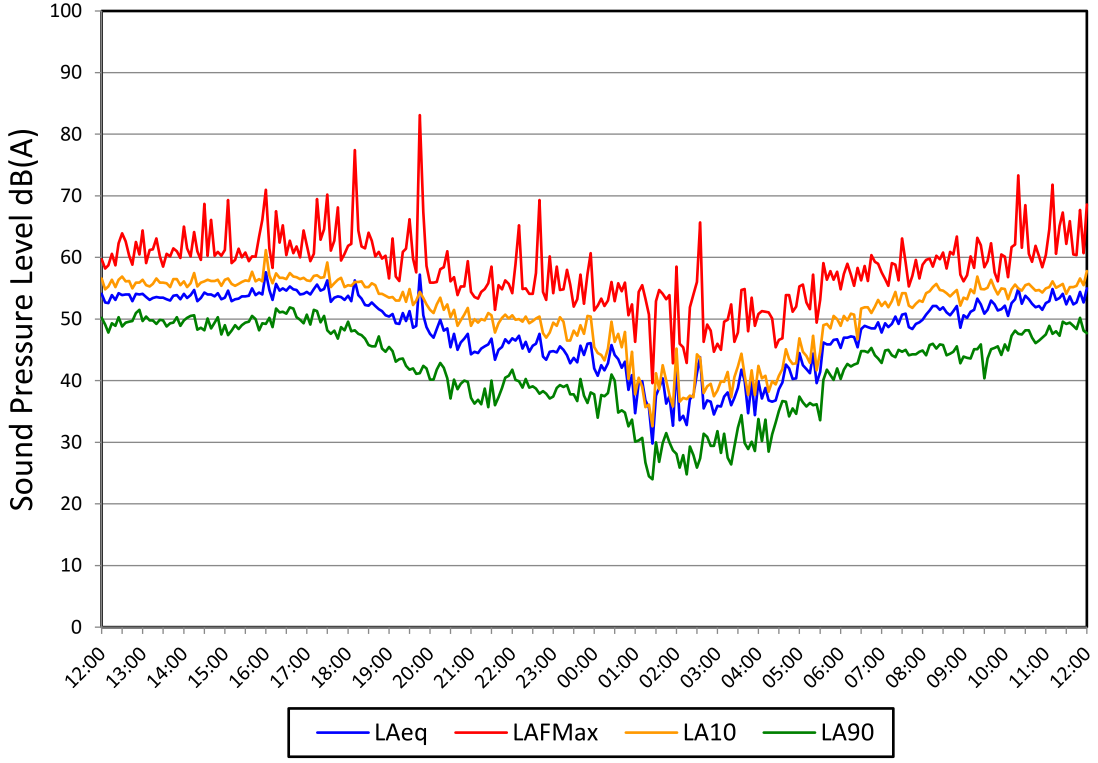


Thursday 03 September to Friday 04 September 2020

Figure AS11730/TH15

Rock Common Quarry, The Hollow

Environmental Noise Time History: LT3

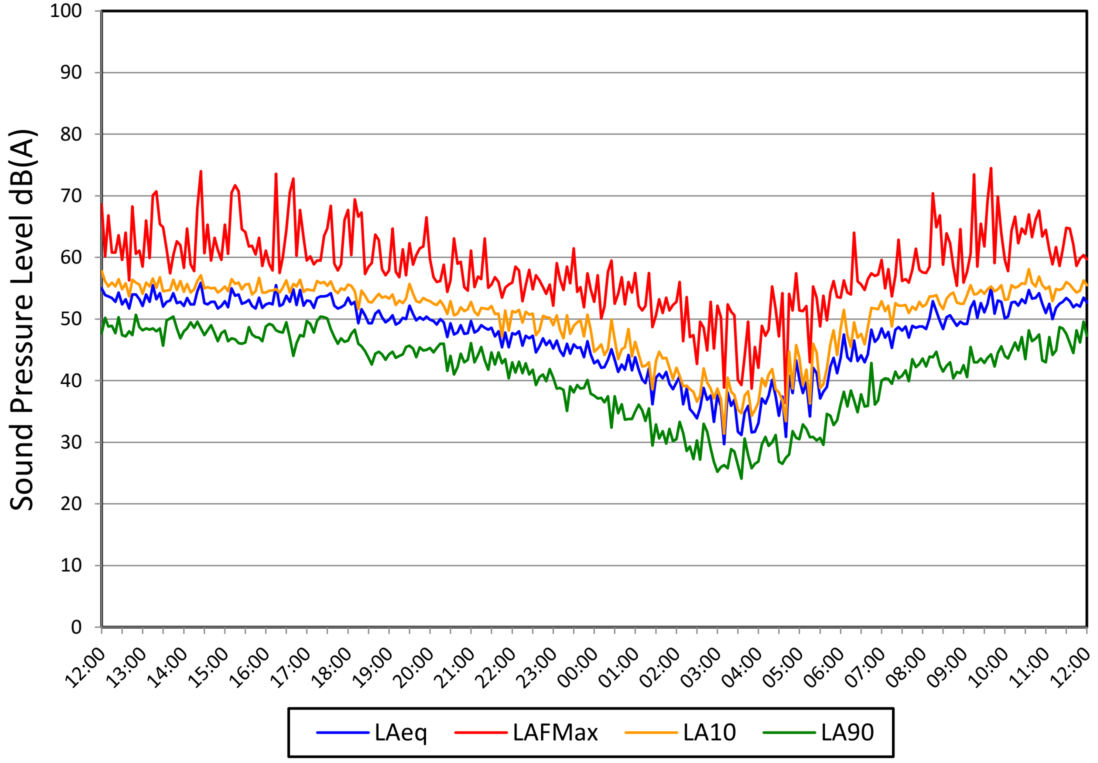


Friday 04 September to Saturday 05 September 2020

Figure AS11730/TH16

Rock Common Quarry, The Hollow

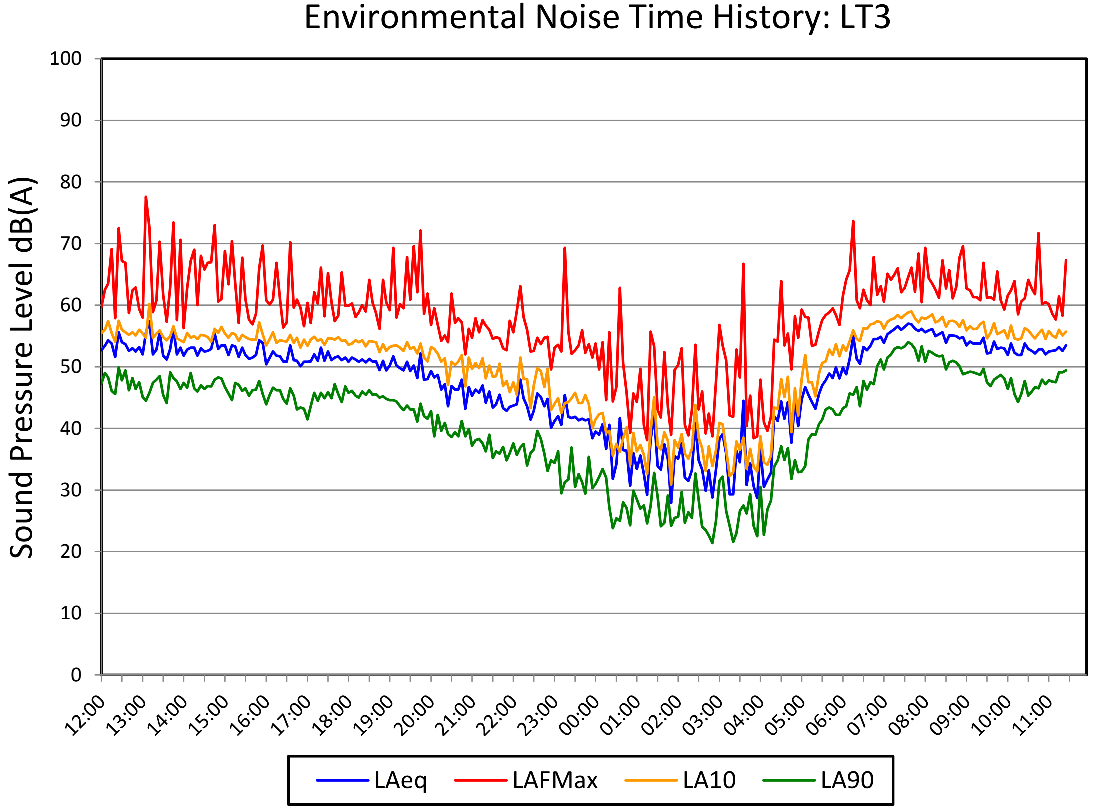
Environmental Noise Time History: LT3



Saturday 05 September to Sunday 06 September 2020

Figure AS11730/TH17

Rock Common Quarry, The Hollow



Sunday 06 September to Monday 07 September 2020

Figure AS11730/TH18

1.1 Acoustic Terminology

The human impact of sounds is dependent upon many complex interrelated factors such as 'loudness', its frequency (or pitch) and variation in level. In order to have some objective measure of the annoyance, scales have been derived to allow for these subjective factors.

Sound Vibrations propagating through a medium (air, water, etc.) that are detectable by the auditory system.

Noise Sound that is unwanted by or disturbing to the perceiver.

Frequency The rate per second of vibration constituting a wave, measured in Hertz (Hz), where 1Hz = 1 vibration cycle per second. The human hearing can generally detect sound having frequencies in the range 20Hz to 20kHz. Frequency corresponds to the perception of 'pitch', with low frequencies producing low 'notes' and higher frequencies producing high 'notes'.

dB(A): Human hearing is more susceptible to mid-frequency sounds than those at high and low frequencies. To take account of this in measurements and predictions, the 'A' weighting scale is used so that the level of sound corresponds roughly to the level as it is typically discerned by humans. The measured or calculated 'A' weighted sound level is designated as dB(A) or L_A.

L_{eq} : A notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (e.g. 8 hour, 1 hour, etc).

The concept of L_{eq} (equivalent continuous sound level) has primarily been used in assessing noise from industry, although its use is becoming more widespread in defining many other types of sounds, such as from amplified music and environmental sources such as aircraft and construction.

Because L_{eq} is effectively a summation of a number of events, it does not in itself limit the magnitude of any individual event, and this is frequently used in conjunction with an absolute sound limit.

L_{10} & L_{90} : Statistical L_n indices are used to describe the level and the degree of fluctuation of non-steady sound. The term refers to the level exceeded for n% of the time. Hence, L_{10} is the level exceeded for 10% of the time and as such can be regarded as a typical maximum level. Similarly, L_{90} is the typical minimum level and is often used to describe background noise.

It is common practice to use the L_{10} index to describe noise from traffic as, being a high average, it takes into account the increased annoyance that results from the non-steady nature of traffic flow.

L_{max} : The maximum sound pressure level recorded over a given period. L_{max} is sometimes used in assessing environmental noise, where occasional loud events occur which might not be adequately represented by a time-averaged L_{eq} value.

1.2 Octave Band Frequencies

In order to determine the way in which the energy of sound is distributed across the frequency range, the International Standards Organisation has agreed on "preferred" bands of frequency for sound measurement and analysis. The widest and most commonly used band for frequency measurement and analysis is the Octave Band. In these bands, the upper frequency limit is twice the lower frequency limit, with the band being described by its "centre frequency" which is the average (geometric mean) of the upper and lower limits, e.g. 250 Hz octave band extends from 176 Hz to 353 Hz. The most commonly used octave bands are:

Octave Band Centre Frequency Hz	63	125	250	500	1000	2000	4000	8000

1.3 Human Perception of Broadband Noise

Because of the logarithmic nature of the decibel scale, it should be borne in mind that sound levels in dB(A) do not have a simple linear relationship. For example, 100dB(A) sound level is not twice as loud as 50dB(A). It has been found experimentally that changes in the average level of fluctuating sound, such as from traffic, need to be of the order of 3dB before becoming definitely perceptible to the human ear. Data from other experiments have indicated that a change in sound level of 10dB is perceived by the average listener as a doubling or halving of loudness. Using this information, a guide to the subjective interpretation of changes in environmental sound level can be given.

INTERPRETATION

Change in Sound Level dB	Subjective Impression	Human Response
0 to 2	Imperceptible change in loudness	Marginal
3 to 5	Perceptible change in loudness	Noticeable
6 to 10	Up to a doubling or halving of loudness	Significant
11 to 15	More than a doubling or halving of loudness	Substantial
16 to 20	Up to a quadrupling or quartering of loudness	Substantial
21 or more	More than a quadrupling or quartering of loudness	Very Substantial

1.4 Earth Bunds and Barriers - Effective Screen Height

When considering the reduction in sound level of a source provided by a barrier, it is necessary to establish the "effective screen height". For example if a tall barrier exists between a sound source and a listener, with the barrier close to the listener, the listener will perceive the sound as being louder if he climbs up a ladder (and is closer to the top of the barrier) than if he were standing at ground level. Equally if he sat on the ground the sound would seem quieter than if he were standing. This is explained by the fact that the "effective screen height" is changing with the three cases above. In general, the greater the effective screen height, the greater the perceived reduction in sound level.

Similarly, the attenuation provided by a barrier will be greater where it is aligned close to either the source or the listener than where the barrier is midway between the two.

APPENDIX E

Air Quality Assessment and Dust Management Plan

southdowns
environmental consultants

DUDMAN (ROCK COMMON) LIMITED

ROCK COMMON QUARRY, THE HOLLOW, WASHINGTON, WEST SUSSEX

AIR QUALITY ASSESSMENT AND DUST MANAGEMENT PLAN

DECEMBER 2020

FINAL REPORT

2380W-SEC-00001-03

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DUDMAN (ROCK COMMON) LIMITED
ROCK COMMON QUARRY, THE HOLLOW, WASHINGTON, WEST SUSSEX
AIR QUALITY ASSESSMENT AND DUST MANAGEMENT PLAN
FINAL REPORT
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CONTENTS PAGE NO.

1. INTRODUCTION

1.1 Background

1.1.1 Southdowns Environmental Consultants Ltd (Southdowns) was commissioned by Dudman (Rock Common) Limited in September 2020 to produce an air quality assessment and dust management plan for the proposed restoration of Rock Common Quarry, within the administrative boundary of West Sussex County Council (WSCC).

1.1.2 This assessment has been prepared to determine the likely significance of air quality effects from the development of the site on existing and introduced receptors, to accompany a planning application by Dudman (Rock Common) Limited.

1.1.3 The purpose of the dust management plan is to prescribe appropriate measures to manage dust effects from the site. This is done through assessing the potential risk of adverse dust effects and identifying appropriate best-practice measures commensurate with the risk.

1.1.4 This document has been prepared in accordance with the principles and requirements of the Institute of Air Quality Management (IAQM) and EPUK's guidance for *'Land-use Planning & Development Control: Planning for Air Quality'* [1] and the IAQM's '*Guidance on the Assessment of Mineral Dust Impacts for Planning*' [2].

1.2 Report Structure

1.2.1 Details of the site and the proposed scheme are presented in the following section of this report. Relevant air quality policy and guidance are outlined in Section 3 and the assessment methodology is detailed in Section 4. The existing baseline conditions are presented in Section 5 and the mineral dust impacts are assessed in Sections 6. The detailed assessment of construction traffic is presented in Section 7 and mitigation options are raised in Section 8. The significance of residual dust effects is presented in Section 9 and the assessment is summarised in Section 10. Figures are presented separately in Appendix A. Model input assumptions are presented in Appendix B and model verification is presented in Appendix C. The Dust Management Plan is presented in Appendix D.

2. SITE DETAILS

2.1 Site Description

2.1.1 The development site is an active sand quarry set within rural surroundings, with residential and commercial units in the vicinity. The site is located approximately 0.35 km to the northeast of the village of Washington in West Sussex. The quarry is bounded by the A24 to the west, running north to south, and by the A283 to the south, running east to west. The site location is shown in Figure A1 of Appendix A. Fully restored former municipal landfills are located beyond The Hollow to the north-east of the site, known as The Windmill, The Rock and The Rough. A public footpath runs along the western site boundary.

2.1.2 The quarry comprises two parcels of land with a combined area of c. 327,100 m^2, separated by The Hollow running southeast to northwest. The larger parcel of land to the south contains the main sand quarry (c. 271,900 m^2), with the smaller area of land to the north of The Hollow used for processing and storage of materials (c. 55,200m^2).

2.1.3 The site is approximately 30m north of the Southdowns National Park at its closest point, separated by the A283, and approximately 900m northeast of the Chanctonbury Hill Site of Special Scientific Interest (SSSI).

2.1.4 The quarry has an extant planning permission (WS/15/97) for the extraction of sand and associated processing operations until 31 December 2020. This application to vary the currently approved restoration of the quarry will include provision to extend the period for sand extraction to enable the remaining sand reserves to be worked and processed.

2.2 Proposed Development

2.2.1 The proposed development involves the restoration of the quarry by importing inert material to raise the level of the quarry floor above that of the natural, groundwater level, altering the land use to a dry landform, with shallower areas of water to provide increased biodiversity and recreational opportunities.

2.2.2 Material will be brought to the site using The Hollow via the A283 to the south, where it will use the former Windmill Landfill access. Material will be deposited close to the conveyor tunnel which runs into the main quarry underneath The Hollow. This space constitutes the material reception area (c. 9,300m^2), which incorporates the small length of internal access road to the mineral processing area. Extracted sand export movements will remain travelling to and from the site via the north section of The Hollow which connects to the A24.

2.2.3 For the purpose of this assessment sand extraction is assumed to be completed by December 2023.

2.2.4 For the purpose of this assessment restoration operations are assumed to commence in April 2022 to be completed in April 2030 at the earliest.

2.3 Receptors

2.3.1 Locations where people or wildlife may be adversely affected by changes in air quality or dust soiling as a result of quarry operations are considered as relevant receptors for air quality. There will be no receptors introduced by the proposed development.

2.3.2 For dust soiling and disamenity, high-sensitivity receptors may include both residential and ecological receptors, whilst medium- to low-sensitivity receptors may include amenity areas and workplaces.

2.3.3 There are a number of residential receptors in the vicinity which could potentially be affected by changes in air quality arising from the development. Commercial and industrial premises in the area will also be sensitive to dust.

2.3.1 Washington Caravan and Camping Park is located immediately to the west of the quarry before the A283. Washington Towers, The House at Home and Sandhill Lodge are also located within c. 250 m of the site boundary. There are a number of residential properties to the northwest of the site beyond the A24, including along Old London Road, Montpellier Gardens and Lamorna Close. Two motor vehicle dealerships, Birchwood Kia Washington and Destination Triumph Washington, lie beyond the A283 to the west of site. Other commercial premises to the west and northwest of the development site include Moving Pictures Boudoir photography studio, Revive Therapy aromatherapy services, PAC Welding Ltd and Washington Coachworks Ltd vehicle repair shop.

2.3.2 Pump House Cottage and Rock House Cottage are located c. 100 m to the northwest of site, south of The Hollow. Rock Farm and The Rock Business Park which contains a number of industrial units including Premier GT motor vehicle dealership and LJS Aviation Ltd, is located c. 100 m and to the north of the development site. A plan showing the location of the development site in relation to sensitive receptors within 100 m is presented in Figure A2 of Appendix A.

2.3.3 There are two residential units to the south beyond the A283, including Tilleys Cottage, c. 165 m from the southern site boundary. Green Farm, a mixed-use site, comprising meeting rooms, spaces for corporate events and activities and a butchery, is located immediately at the southeast quarry boundary, south of The Hollow.

2.3.4 No ecological receptors have been identified within 400 m of the development site.

3. AIR QUALITY POLICY, GUIDANCE AND CRITERIA

3.1 Air Quality, Dust and Emissions

3.1.1 Atmospheric pollutants of general concern associated with the impacts of developments on human receptors are nitrogen dioxide (NO_2) and particulate matter (PM).

3.1.2 NO_2 is produced through the combustion of fossil fuels, used for transport and energy supply. Emissions of oxides of nitrogen (NO_x) from exhausts comprise nitric oxide (NO) and NO_2. NO undergoes oxidisation in the atmosphere to form NO_2. High concentrations of NO_2 can cause lung inflammation, shortness of breath and coughing, and reduced immunity to lung infections like bronchitis.

3.1.3 PM can result directly as emissions from local sources (primary), or further afield, often having originated as other pollutants and reformed in the atmosphere (secondary). Primary sources of particulates are of most relevance to this assessment and can include emissions from combustion processes and dust from construction activities. Exposure to high concentrations of particulate matter can cause respiratory and cardiovascular illness and even death. PM_{10} is defined as a mass fraction of airborne particulates with an aerodynamic diameter of 10 microns (µm) or less, whilst $PM_{2.5}$ is defined as a mass fraction of airborne particulates with an aerodynamic diameter of 2.5 microns or less. PM_{10} and $PM_{2.5}$ are respirable and can be drawn deep into the lungs and cause health problems. The fraction of dust that is larger than 10 µm is filtered by the nose and throat.

3.2 EU and National Air Quality Policy and Guidance

3.2.1 The EU Air Quality Directive (Directive 2008/50/EC) [3] came into force in June 2008, and was transposed into legislation in England, Wales, Scotland and Northern Ireland in the Air Quality Standards Regulations 2010 [4], since amended by the Air Quality Standards (Amendment) Regulations 2016 [5]. The Directive introduced legally-binding targets for national governments to reduce air pollution to levels at which no or minimal effects on human health are likely to occur. The obligation to meet the requirements of the Directive falls primarily upon the Secretary of State for the Environment in England, and appropriate Ministers in the Devolved Administrations, who are designated as the appropriate "competent authority". Although the UK has left the EU, EU legislation continues to apply during the transition period.

3.2.2 Defra's *Air Quality Plan for Nitrogen Dioxide (NO_2) in UK (2017)* [6] details the government's plan for reducing roadside NO_2 levels and achieving EU limit values. A supplement to the plan was published in October 2018.

3.2.3 The Air Quality (England) Regulations 2015 [7], define air quality 'objectives' for a number of key pollutants. The air quality objectives are set at a range of different levels and averaging times for different pollutants.

3.2.4 The NO_2 and PM objectives are summarised in Table 3.1 overleaf.

3.2.5 The annual mean (long-term) objective applies at locations where individuals might be expected to spend a large majority of their time, for example residential properties. In the case of the hourly mean (short-term), this applies at locations where people might reasonably be expected to spend at least an hour (such as outdoor spaces and leisure areas).

Pollutant	Air Quality Objectives		Date to be Achieved By
NO_2	40 µgm^{-3}	Annual mean	31 December 2005
	200 µgm^{-3} not to be exceeded more than 18 hours in a year	Hourly mean	31 December 2005
PM_{10}	50 µgm^{-3} not to be exceeded more than 35 times a year	24-hour mean	31 December 2004
	40 µgm^{-3}	Annual mean	31 December 2004
$PM_{2.5}$	25 µgm^{-3}	Annual mean	2020 (but not in UKAQS)
	15% reduction urban background	Annual mean	2010-2020

TABLE 3.1: SUMMARY OF UK AIR QUALITY OBJECTIVES FOR NO_2, PM_{10} AND $PM_{2.5}$ FOR PROTECTION OF HUMAN HEALTH

3.2.6 The Environment Act 1995 [8] introduced the requirement for local authority management of air quality. Part IV of the Act details the duties of local authorities in carrying out their local air quality management (LAQM) responsibilities. The duties include the requirement for review and assessment of air quality and production of regular Updating and Screening Assessments (USA) and Progress Reports.

3.2.7 The Act also requires the preparation of a national air quality strategy, setting health-based air quality objectives for specified pollutants. The current version is the Clean Air Strategy 2019 [9]. It sets out action that UK government will take to improve air quality, with a focus on $PM_{2.5}$, ammonia, NO_x and sulphur dioxide.

3.2.8 The Environmental Protection Act 1990 (EPA) [10] deals with statutory nuisance. Nuisance caused by dust is regulated by the statutory nuisance provisions under Part III and is defined in s.79(1)(d) as: "*Any dust, steam, smell or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance*".

3.2.9 Statutory nuisance is not intended to secure a high level of amenity but rather to act as a basic safeguard on emissions. The perpetrator of any alleged nuisance has a defence of best practicable means (BPM) which provides a basis for balancing the interests of the site and residents.

3.2.10 There are no UK standards or statutory guidance relating to deposited dust and nuisance, although a deposition rate of 200 mg/m^2/day is often used as a threshold for potentially significant nuisance effects.

3.2.11 The Clean Air Act 1993 (CAA) [11] details the legislative requirements for the heights of chimneys and flues where the burn rates exceed certain criteria. For appliances fuelled by gaseous matter the relevant criterion value is 366.4kW.

3.2.12 The National Planning Policy Framework (NPPF) was first published in 2012 and subsequently updated in July 2018 and February 2019 [12]. Paragraph 181 states: "*Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from* *individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan*."

3.2.13 The roles of the planning authority and pollution control authorities are defined in paragraph 183: "*The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities*."

3.2.14 In considering proposals for mineral extraction and as defined in paragraph 205, minerals planning authorities should:

"(b) ensure that there are no unacceptable adverse impacts on the natural and historic environment, human health or aviation safety, and take into account the cumulative effect of multiple impacts from individual sites and/or from a number of sites in a locality; and

(c) ensure that any unavoidable noise, dust and particle emissions and any blasting vibrations are controlled, mitigated or removed at source…".

3.2.15 The National Planning Practice Guidance (NPPG) [13] provides guiding principles on how planning can take into account of the impact of new development on air quality. It includes guidance on:

- air quality considerations for planning;
- plan-making and air quality;
- air quality and neighbourhood planning;
- available information;
- when air quality considerations could be relevant to development planning;
- specific issues when assessing air quality impacts;
- required detail for air quality assessments; and
- mitigating air quality impacts.

3.2.16 The guidance provides a flow chart detailing the process that should be followed in determining an application. It indicates that an application should proceed to decision with appropriate planning conditions or obligations if the proposed development, with mitigation in place, would not lead to an unacceptable risk from air pollution, prevent sustained compliance with EU limit values or fail to comply with the requirements of the Habitats Regulations [14].

3.2.17 The NPPG also states that for mineral operations: *"Where dust emissions are likely to arise, mineral operators are expected to prepare a dust assessment study, which should be* *undertaken by a competent person/organisation with acknowledged experience of undertaking this type of work".*

3.3 Local Air Quality Policy and Guidance

3.3.1 Under the Local Development Framework (LDF) strategy, local authorities are required to prepare an overarching Core Strategy document. Horsham District's Planning Framework was adopted in 2015 and covers the period up to 2031 [15]. The new Local Plan covering the period from 2019 to 2036 was submitted for consultation in March 2020 and aims to deliver the social, economic and environmental needs of Horsham District [16].

3.3.2 The new proposed Local Plan is due to supersede Horsham District's 2015 Local Plan upon final publication. Spatial Objectives 8 and 9 relating to air quality within the proposed Local Plan aim to:

"Identify and preserve the unique landscape character and the contribution that this makes to the setting of rural villages and towns and ensure that new development minimises the impact on the countryside"; and

"safeguard and enhance the environmental quality of the District, ensuring that development brings forward environmental net gains including biodiversity enhancements, and minimises the impact on environmental quality including air, soil, water quality and the risk of flooding".

3.3.3 Policy 26 – Air Quality, of the new proposed Local Plan, states:

"The Council recognises the importance of the management of air quality. Taking into account any relevant Planning Guidance Documents, proposals will be required to:

1. *Take account of The Air Quality and Emissions Mitigation Guidance for Sussex (2019), or any future updates. Major development proposals and proposals within an Air Quality Management Area (AQMA), or in relevant proximity to an AQMA, must be accompanied by an Air Quality Impact Assessment and an Emissions Mitigation Assessment;*

2. *Contribute to the implementation of local Air Quality Action Plans, and not conflict with the set objectives;*

3. *Minimise traffic generation and congestion through access to sustainable transport modes, maximising the provision for cycling and pedestrian facilities;*

4. *Encourage the use of cleaner transport fuels, including through the provision of electric car charging points;*

5. *Mitigate the impact on the amenities of users of the site and surrounding land to an appropriate level, where development creates or results in pollution including particulates, dust, smoke, pollutant gases or odour; and*

6. *Ensure that the cumulative impact of all relevant committed developments is appropriately assessed."*

3.3.4 Under the Local Air Quality Management regime introduced by the Environment Act 1995 and subsequent regulations, HDC is required to review and assess its air quality at regular intervals. As detailed in the 2020 Air Quality Annual Status Report (ASR) [17], there are currently two Air Quality Management Areas (AQMA) declared in in the district in the village of Cowfold (c. 12 km to the northeast) and the town centre of Storrington (c. 3.5 km to the west), in 2011 and 2010, respectively. Both declarations were made on the basis that the annual mean nitrogen dioxide (NO_2) concentrations would not meet the national air quality objective (AQO). Air Quality Action Plans (AQAP) were prepared for both.

3.3.5 The latest revision of the West Sussex County Council's (WSCC) AQAP: *'Breathing Better'* published in January 2020 [18] provides measures for improving air quality in the borough. This document contains proposed actions such as: increasing the uptake of low emission and electric vehicles and the introduction of electric vehicle charging points, identifying and implementing sustainable transport infrastructure and traffic management schemes, exploring behaviour change initiatives and engaging residents and businesses in activities that will benefit local air quality.

3.4 Non-Statutory Guidance

3.4.1 Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) have produced a document entitled: *Land-Use Planning & Development Control: Planning for Air Quality* [1] that provides guidance on how to ensure that air quality is properly accounted for in the development control process. This guidance provides advice on describing air quality impacts and assessing their significance.

3.4.2 This document advises: "*…arriving at a decision about a specific proposed development the local planning authority is required to achieve a balance between economic, social and environmental considerations."* The document also provides descriptors for magnitude of change, receptor sensitivity and the process for assessment of significance. This guidance is for developers, in the production of air quality assessments, and for reviewers.

3.4.3 The Institute of Air Quality Management (IAQM) has published specific *'Guidance on the Assessment of Mineral Dust Impacts for Planning'* [2] to provide guidance and good-practice approaches that can be used to assess the operational-phase dust impacts. This guidance supports the NPPG which provides only limited guidance on the mechanics of mineral dust assessments and indicative criteria for describing dust impacts from mineral developments. The impacts naturally depend on any incorporated mitigation and the emphasis in these guidelines is on classifying the risk of dust impacts from a site as a basis for the identification of mitigation that is commensurate with such risk.

3.4.4 Guidance on the likely risk of dust disamenity, human health effects and effects on the natural environment from dust produced during relevant mineral activities is provided in the guidelines. Recommended measures for controlling dust and emissions through site-specific mitigation and monitoring procedures are also presented in this IAQM document.

3.5 West Sussex County Council Scoping Opinion

3.5.1 A scoping opinion [19] has been provided by WSCC (issued November 2019) and forms the basis of the adopted assessment approach. Key IAQM and WSCC guidance outlined within the scoping opinion have each been followed and are explicitly referred to within this report.

4. ASSESSMENT METHODOLOGY

4.1 Assessment Approach

4.1.1 This air quality assessment has been produced using the information available and procedures as follows:

i. review and adoption of the WSCC scoping opinion [19] (issued November 2019);
ii. review of HDC's 2020 Annual Status Report [17] and Defra's background maps [20];
iii. consideration of the local environment to identify potentially sensitive receptors, that could be affected by changes in air quality as a result of the construction and operation of the proposed development;
iv. comparison of NO_2 and PM_{10} baseline data (following task 2) with UK air quality objectives;
v. qualitative assessment of the potential dust and air quality impacts of continued quarry extraction and quarry restoration operations and control measures considered necessary during these activities;
vi. review and use of available DfT traffic data [21] and traffic data from the appointed transport consultant, GTA Civils;
vii. dispersion modelling using the ADMS-Roads dispersion model to predict the likely concentrations of NO_X, NO_2 and PM_{10} at the development site and nearby sensitive receptors and the effects of the proposed development on air quality from the operation of development in terms of the traffic emissions, including model verification and adjustment in line with Defra TG16 guidance [22] and the use of Defra's latest NO_X:NO_2 calculator (version 8.1, August 2020) [23];
viii. comparison of the predicted NO_X, NO_2 and PM_{10} concentrations with the UK air quality objectives and the IAQM significance criteria [1]; and
ix. calculation of the estimated monetary value of damage caused by PM_{10} and NO_X from the proposed development in accordance with the *Air Quality and Emissions Mitigation Guidance for Sussex (2020)* [24].

4.2 Baseline Conditions

4.2.1 Baseline conditions at and around the development site have been considered using HDC's 2020 Annual Status Report for 2019, Defra's background maps and the latest local meteorological data from a representative site.

4.3 Mineral Dust and Emissions Screening

4.3.1 An assessment of dust and emissions is required as there are relevant human or ecological receptors within 400 m of dust generating activities.

4.3.2 The IAQM guidance uses PM_{10} as the health indicator of airborne particles, to be consistent with National Planning Practice Guidance for mineral sites, and states that mineral site impacts are more likely to be associated with coarser particulate matter rather than the fine $PM_{2.5}$ fraction. Therefore, this mineral dust assessment does not consider $PM_{2.5}$ further.

4.4 Mineral Dust Assessment

4.4.1 A qualitative assessment of the potential dust and air quality impacts from the continued sand extraction and proposed quarry restoration operations has been undertaken, to establish the risk, effects, significance and appropriate mitigation to prevent dust disamenity, human health and ecological impacts at local receptors.

4.4.2 This assessment follows the assessment procedure in the IAQM minerals guidance document [2], based on the Source-Pathway-Receptor (S-P-R) concept, which presents the hypothetical relationship between the source of the pollutant, the pathway by which exposure might occur and the receptor that could be affected.

Residual Source Emission Magnitude

4.4.3 The residual source emission magnitudes have been determined, taking into account the proposed dust control measures incorporated into the scheme, in line with Section 5 of the IAQM minerals guidance.

Receptors and Receptor Sensitivity

4.4.4 A representative selection of receptors have been used in the assessment up to 400 m from the dust generating activities.

4.4.5 The sensitivity of assessed representative receptors has been categorised based on the inherent properties of each receptor detailed in Information Boxes 3, 4 and 5 within the guidance.

Pathway Effectiveness

4.4.6 The percentage frequencies of dry windy data points have been calculated based on the meteorological data from the Shoreham site for the three latest years available: 2017, 2018 and 2019.

4.4.7 General thresholds have been applied to the dataset to represent windy and dry conditions. Wind speeds of greater than or equal to 5.0 ms^{-1} have been used to represent a conservative estimate of ‘moderate breezes’ and a precipitation rate of less than 0.2 mm per day represent periods of little to no rainfall, as per the IAQM minerals guidance. The percentage frequency of dry windy data points was calculated for twelve wind direction sectors.

4.4.8 The pathway effectiveness was calculated for each assessed receptor by combining the frequency of potentially dusty winds for each relevant wind direction sector with the distance between the receptor and the dust emission source, as per Tables A3-2 and A3-3 respectively, within the IAQM minerals guidance. The pathway effectiveness was classified based on Table A3-4 within the guidance.

4.4.9 For receptors within 30 m of the site boundary, as a conservative assumption, it has been assumed that they could be affected by wind from any direction, as suggested within the guidance.

Dust Impact Risk

4.4.10 The residual source emissions and the pathway effectiveness for each assessed receptor were combined to determine the dust impact risk, as per Table 2 within the IAQM minerals guidance.

Magnitude of Dust Effects

4.4.11 The overall effect from the dust deposition on the surrounding area has been determined taking into account the different magnitude of effects at different receptors and the number of receptors that experience these different effects, as per Table 3 within the IAQM minerals guidance.

4.5 Suspended Particulate Matter – Human Health Effects

4.5.1 The main potential effect from mineral sites is disamenity due to dust deposited on surfaces. However, effects on human health should be assessed if there are residential properties (or other sensitive uses) in close proximity to the emission sources by considering the likelihood of PM_{10} exceeding the AQOs.

4.5.2 As per the IAQM guidance, where the background PM_{10} concentration is below 17 μgm^{-3} there is little risk the process contribution (PC) could lead to exceedance of the annual mean PM_{10} objective.

4.6 Cumulative Effects

4.6.1 Where the mineral development is an extension of an existing site, is close to another mineral site or other dust generating sources, the cumulative effects may need to be considered, as per Section 2.2 of the IAQM minerals guidance.

4.7 Traffic Screening Criteria

4.7.1 The assessment follows the procedure as defined in the EPUK/IAQM guidance, using published information in the public domain.

4.7.2 The EPUK/IAQM guidance provides criteria for establishing whether a development will require an air quality assessment. The criteria are set out in a two-stage approach:

4.7.3 The criteria in Stage 1 are:

- 10 or more residential units or a site area of more than 0.5 ha; or
- more than 1,000 m^2 of floor space for all other uses or a site area greater than 1 ha.

4.7.4 This must be combined with either of the following:

- more than 10 parking spaces within the development; or
- the development has a centralised energy facility or combustion process.

4.7.5 Stage 1 criteria are designed to screen out smaller developments and developments where air quality impacts can be considered to have insignificant effects. As the proposed development site comprises a large site area and has the potential to lead to significant air quality impacts, the criteria in Stage 1 are considered to be met.

4.7.6 Following consideration of indicative Stage 2 criteria, the proposed development will cause a substantial change of heavy goods vehicle (HGV) flows of more than 100 annual average daily traffic (AADT) on local roads. Therefore, further assessment is required and detailed modelling was undertaken.

4.8 Traffic Dispersion Modelling

4.8.1 The ADMS-Roads gaussian dispersion model was used to predict NO_X, NO_2 and PM_{10} concentrations at nearby sensitive receptors for the following three scenarios:

- 2019, baseline and verification year;
- 2022, anticipated first year of operation without-development (Do Minimum – DM); and
- 2022, anticipated first year of operation with development (Do Something – DS).

4.8.2 The model set-up is presented in Appendix B.

4.8.3 For verification, major roads within 200m of the verification sites were modelled explicitly. For the scenarios, all roads where changes in two-way HGV traffic flows were 100 AADT or greater with the proposed development in place were modelled explicitly. In addition, all major road links within at least 200m of assessed receptors were modelled explicitly.

4.8.4 All other emission sources were accounted for through inclusion of background contributions from Defra maps [20].

4.8.5 Traffic flows for 2019 were taken from DfT data [21] and the transport consultant, GTA Civils. Speeds, where available, were provided by the transport consultant, taken from the WSCC traffic survey database, for roads near the dispersion site. In the absence of measured average speeds, speeds within the model were assumed and justified using the TG16 [22] document.

4.8.6 Baseline AADT growth factors of 1.0953 for LGVs and 1.0664 for HGVs have been applied to the 2022 scenarios. These were derived from the National Traffic Model (NMT) [25] for the South East region and the Trip End Model Presentation Programme (TEMPro) forecast data for Horsham District provided by the GTA Civils.

4.8.7 Road link emissions were calculated within ADMS-Roads, using the built-in EFT (version 10.1) emissions dataset and 'England (rural)' road type. Road widths were measured from online aerial maps.

4.8.8 A representative selection of locations sensitive to potential changes in pollutant concentrations were identified within 200m of the affected road network, in accordance with the guidance provided within the Design Manual for Roads and Bridges (DMRB) [26] on the likely limits of pollutant dispersion from road sources.

4.8.9 Meteorological data from Shoreham for 2019 were used in the model.

4.8.10 Key model input parameters are presented in Appendix B.

4.8.11 Results were predicted for a 2019 baseline, 2022 DM and 2022 DS scenarios. Receptor locations modelled include those that are representative of likely worst-case exposure to pollution from road traffic sources and of the greatest changes in pollution levels as a result of the proposed development.

4.8.12 NO_X contributions from major roads were predicted using the model. NO_2 concentrations were calculated using the derived verification adjustment factor, Defra background maps (base year 2018) and Defra's NO_X:NO_2 calculator (version 8.1).

4.8.13 PM_{10} contributions from major roads were predicted using the model and were calculated using the derived verification adjustment factor used for NO_2 concentrations and Defra background maps (base year 2018). The number of exceedances of 24-hour mean PM_{10} were calculated in line with Defra TG16 guidance using the following relationship:

No. 24-hour mean exceedances = -18.5 + 0.00145 × annual mean^3 + (206/annual mean).

4.8.14 Model verification for a base year of 2019 was undertaken in line with Defra guidance document TG16. This is included in Appendix C.

4.8.15 The significance of predicted air quality impacts was determined in accordance with EPUK/IAQM guidance [1].

4.9 Emissions Mitigation Assessment

4.9.1 In line with Sussex Air Quality Partnership's guidance [24], emissions were calculated using Defra's latest Emission Factor Toolkit (version 10.1) [27] for the trips to be generated by the proposed development, and the five-year 'exposure cost value' was calculated using Defra's latest Damage Costs Appraisal Toolkit [28].

4.10 New Receptors

4.10.1 The proposed development will not introduce new receptors.

5. BASELINE CONDITIONS

5.1 Local Air Quality

5.1.1 The site is located within the administrative boundary of HDC, which conducts air quality monitoring at various locations within the borough as part of its LAQM duties.

5.1.2 Two AQMAs were declared in the district in the village of Cowfold and town centre of Storrington, in 2011 and 2010 respectively, on the basis that the annual mean nitrogen dioxide (NO_2) concentrations would not meet the national air quality objective (AQO). The proposed development is not located within or adjacent to an AQMA.

5.1.3 It can be seen from the 2020 Annual Status Report that from 2015 to 2019, across the continuous and non-automatic monitoring stations within the district, there has been little change in NO_2 and PM_{10} concentrations.

5.2 Monitoring

5.2.1 The nearest NO_2 roadside continuous monitoring site, Storrington AURN, is located 3.3 km west of the development site on Manley's Hill (A283). This monitoring location is situated 4.6 m from the kerb of an A-road. The development site boundary is located approx. 30m away from the closest surrounding A-road, the A283; therefore the development site is likely to have lower NO_2 concentrations. There are no continuous NO_2 urban background monitoring sites within HDC.

5.2.2 It can be seen in Table 5.1 that the Storrington AURN roadside monitor remained well within the AQO for annual mean and hourly mean NO_2 between 2015 and 2019. Measured concentrations show an overall downward trend.

Description	X, Y	Distance from site (km)	Type	2015	2016	2017	2018	2019	AQO
HO4 - Storrington AURN	509083, 114198	3.3	Roadside	26.5 (0)	28.6 (0)	26.2 (0)	25.4 (0)	24.4 (0)	**40**

TABLE 5.1: CONTINUOUS MONITORING SITE MEASURED NO_2 CONCENTRATIONS (μgm^{-3})

Note: Exceedances of the annual mean NO_2 AQO are highlighted in **bold**.
Number of exceedances of the hourly mean NO_2 standard are presented in brackets

5.2.3 PM_{10} is also monitored at the continuous Storrington AURN roadside monitoring location detailed above. Table 5.2 shows that the measured annual mean PM_{10} concentration remained well within the annual and 24-hour mean AQOs at the monitoring location in all reported years.

Description	X, Y	Distance from site (km)	Type	2015	2016	2017	2018	2019	AQO
HO4 - Storrington AURN	509083, 114198	3.3	Roadside	18.6 (2)	18.0 (4)	18.2 (2)	19.6 (0)	19.3 (5)	**40**

TABLE 5.2: CONTINUOUS MONITORING MEASURED PM_{10} CONCENTRATIONS (μgm^{-3})

Note: Number of exceedances of the 24-hour mean PM_{10} standard are presented in brackets.

5.3 Diffusion Tube Sites

5.3.1 HDC also conducts NO_2 monitoring using passive diffusion tubes. The most representative long-term roadside diffusion tube site is located on the A283, 3.5 km west of the development site, Storrington 3, 1.2 m from the kerb. The only long-term urban background site, Storrington 17n, is located 3.7 km to the west of the site.

5.3.2 Both monitoring locations are situated much closer to the kerbside of nearby roads, whereas the development site boundary is located approximately 30m away from the closest surrounding A-road, the A283. Therefore the development site is likely to have lower NO_2 concentrations.

5.3.3 Monitoring data between 2015 and 2019 are presented in Table 5.3, showing that both the long-term roadside and urban background sites remained well within the annual mean AQO from 2015 to 2019.

Description	X, Y	Distance from site (km)	Type	NO_2 Annual Mean Concentration (μgm^{-3})					
				2015	2016	2017	2018	2019	AQO
Storrington 3	508935, 114297	3.5	Roadside	27.7	30.4	31.6	32.9	29.7	**40**
Storrington 17n	508677, 114149	3.7	Urban Background	11.8	14.8	12.9	13.3	11.2	**40**

TABLE 5.3: DIFFUSION TUBE MONITORING ANNUAL MEAN NO_2 CONCENTRATIONS

Notes: Exceedances of the annual mean NO_2 AQO are highlighted in **bold**.
Exceedances of the 60 μgm^{-3} NO_2 concentration are highlighted in **bold** and underlined.

5.4 Background Maps

5.4.1 Predicted background pollutant concentrations are available from the Defra website [19] for 1 km^2 grid squares across the UK. Concentrations of NO_2, NO_X and PM_{10} have been extracted for the grid square centred on 512500, 113500, which overlays the site, and are shown in Table 5.4 below. Modelled predictions of mean annual background concentrations are within the AQOs for NO_2 and PM_{10} in 2019 and 2022. Each pollutant is predicted to decline in future years.

Pollutant	2019 (μgm^{-3})	2022 (μgm^{-3})
NO_2	10.5	9.2
NO_X	13.8	12.0
PM_{10}	14.9	14.3

TABLE 5.4: PREDICTED BACKGROUND POLLUTANT CONCENTRATIONS (μgm^{-3})

5.5 Summary of Baseline Conditions

5.5.1 The development site is set within rural surroundings, with residential and commercial units to the south, west and north, and is bounded by the A24 to the west, running north to south, and to the south by the A283, running east to west.

5.5.2 Continuous monitoring data from the nearest roadside location show that annual mean roadside NO_2 concentrations remained well within the AQO for annual mean NO_2 between 2015 and 2019.

5.5.3 PM_{10} concentrations remained well within the annual AQO and met the 24-hour mean AQO at the roadside location and for all reported years.

5.5.4 There are no active continuous NO_2 or PM_{10} urban background monitoring sites within HDC.

5.5.5 Annual mean NO_2 concentrations recorded at the only long-term passive roadside and urban background diffusion tube monitoring locations remained within the AQO of 40 μgm^{-3} for mean annual NO_2 in all reported years. Both monitoring locations are situated much closer to the kerbside of nearby roads, whereas the development site boundary is located approx. 30m away from the closest surrounding A-road, the A283, therefore the development site is likely to have lower NO_2 concentrations.

5.5.6 Modelled Defra background annual mean pollutant concentrations predict that NO_2 and PM_{10} pollutants currently meet the AQO.

5.5.7 Defra guidance TG16 [22] states that when the annual mean NO_2 concentration at diffusion tube locations is less than 60 μgm^{-3}, the short term (one-hour) objective for NO_2, is unlikely to be exceeded. Annual mean NO_2 concentrations have been well below 60 μgm^{-3} in all reported years.

5.5.8 Overall, baseline data indicate that annual NO_2 and PM_{10} concentration objectives are currently being met at and around the development site and are expected to continue to do so.

6. MINERAL DUST ASSESSMENT

6.1 Meteorological Conditions

6.1.1 Meteorological data from Shoreham, the site with nearest and most representative meteorological data for the development site, show that the prevailing wind direction is from the southwest, typical of those across the UK. This will lead to dust usually being carried away from the majority of nearby sensitive receptors.

6.1.2 Shoreham meteorological data has a relatively high frequency of northerly winds, which may be specific to Shoreham and not to the development site. and has been considered with caution.

6.1.3 Windrose plots of Shoreham 2017, 2018 and 2019 meteorological data are presented in Figures A11, A12 and A13 of Appendix A, respectively.

6.2 Local Terrain Characteristics

6.2.1 The local terrain rises gently in a southwest to northeast direction from the village of Washington toward The Hollow and beyond. The main quarry void and the mineral processing area are surrounded by hedgerow/treeline of approximately 5 m at the thinnest part and 50 m at the thickest part. The proposed restoration material reception area is surrounded by trees to the north, west and southwest.

6.2.2 Restoration of the quarry void will begin at approx. 10 m above ordnance datum (AOD) at its shallowest point, the deepest point of permitted sand extraction. The restoration will continue in phases, with the shallowest parts of the quarry being filled first. The southern section of the quarry void will be restored to 35 m AOD, before restoration of the northern section begins to a depth of 45 m AOD, as shown in Figures A3 to A10 of Appendix A. As such, the majority of operations within the quarry void will occur below the local ground level of the surrounding site boundary.

6.3 Suspended Particulate Matter – Dust Disamenity Effects

<u>Residual Source Emission Magnitude</u>

6.3.1 The residual source emission magnitudes, determined in line with IAQM guidance and taking into account proposed dust control measures incorporated into the scheme, are shown below in Table 6.1. Incorporated measures are described in Table 6.1 below.

Activity	Residual Source Emission Magnitude	Description
Site Preparation / Restoration	Small	• Quarry void requires minimal preparation prior to the commencement of restoration works; • mineral processing area requires no preparation; • establishment of restoration material reception area (east land parcel) approx. 9,300 m^2 area; • reception area has existing surfaced access and areas of hardstanding; • <20,000 m^3 material moved; and • <5 no. heavy plant simultaneously active. <u>Incorporated Mitigation:</u> • Material storage bays will be surfaced with concrete to prevent damage and scraping.
Mineral Extraction	Small	<u>Extraction:</u> • Sand extraction working area of approx. 327,100 m^2 (comprising main quarry void approx. 271,900 m^2 and mineral processing area of approx. 55,200 m^2); • remaining extraction operations will take place below local ground level; • quantity of material moved is, for the purposes of this assessment, assumed to be approx. 40,000 tonnes per annum for a 3 year period until December 2023; • <6 no. heavy earth moving plant simultaneously active; • extracted material type: Folkstone sand formation (dry) with a medium potential for dust release based on grain size and capacity to hold moisture - sand is worked dry; and • extracted material is dug using excavators, transported to a hopper via dumpers which feed a conveyor which passes sand over a screen before transporting the sand underneath The Hollow to the mineral processing area. <u>Incorporated Mitigation:</u> • No blasting activities.

Material Restoration	Medium	Restoration: • Total quarry restoration working area of approx. 281,200 m^2 (comprising main quarry approx. 271,900 m^2 and restoration material reception area of approx. 9,300 m^2);I • majority of restoration operations will take place below local ground level starting from approx. 10m AOD building up to the projected restored height gradually (in a south to north direction based on the current quarry depths); • quantity of material moved approx. 345,000 m^3 per annum; • <8 no. heavy plant simultaneously active; and • restored material type: mixture of inert hardcore, soil and clay with a high to medium potential for dust release based on variable grain sizes and capacities to hold moisture. Incorporated Mitigation • Where quarry restoration operations occur within 30m of Green Farm and above 50 m AOD, solid screens shall be erected at the southeast site boundary around Green Farm, until such works are complete and the land surface is fully restored.
Materials Handling	Medium	Extraction: • <4 no. loading plant simultaneously active, operating within 50m of the site boundary within the quarry void on unpaved compacted surfaces; and • extracted material type: Folkstone sand formation (dry) with a medium potential for dust release based on general grain size and capacity to hold moisture - sand is worked dry. Restoration: • <5 no. loading plant simultaneously active, operating within 50m of the site boundary within quarry void on unpaved compacted surfaces; and • restored material type: mixture of inert hardcore, soil and clay with a high to medium potential for dust release based on variable grain sizes and capacities to hold moisture.
On-site Transportation	Medium	Extraction: • Use of a conveyor transporting extracted sand beneath The Hollow from the quarry void to the mineral processing area removing on-site HGV movements between the two locations; and • HGV movements within the quarry void will travel up to an approx. 200 m on unpaved surfaces. Restoration: • Use of a conveyor transporting inert materials beneath The Hollow from the restoration material reception area to the quarry void, removing on-site HGV movements between the two locations; • HGV movements within the quarry void will travel up to an approx. distance of 200 m on unpaved surfaces; and • the loading excavator will be largely stationary within the quarry void handling area and the roller and dozers will be making short movements spreading and compacting the fill material. Incorporated Mitigation: • Maximum speed limit of 10 mph for all HGVs; and • HGVs within the quarry void will travel on compacted surfaces.

Minerals Processing	Medium	Extraction: • 1 no. mobile screening plant; • processing approx. 40,000 tonnes per annum; • processing of Folkstone sand formation with a medium dust release potential; and • sand passed through a series of screens before being washed, sorted and dried. Restoration: • 1 no. fixed Powerscreen Aggregate Wash Modular Plant; • processing approx. 550,000 tonnes per annum; • processing of hardcore, soil and clay with a medium dust release potential based on variable grain sizes and capacities to hold moisture; and • inert material will be inspected for suitability in the restoration material reception area, screened and conveyed to the main quarry void, poured into stockpiles and be transported to the final point of infill by dumpers. Incorporated Mitigation: • Dry sand is placed into bins or stockpiles within the mineral processing area after being washed and sorted.
Stockpiles and Other Exposed Surfaces	Medium	Extraction: • 1 no. open area wet stockpile of surface area <25,000 m^2 ha and <10 m in height located under sand washing plant within mineral processing area located <50 m from the site boundary and approx. 100 m from the nearest sensitive receptors; and • daily transfer of material and approx. sand production of 40,000 tonnes per annum. Restoration: • Stockpile bays of surface area <25,000 m^2 and <6 m in height within restoration material reception area located approx. <50 m from site boundary and <50 m from nearby sensitive receptors); • stockpiles within the quarry void will be located <50 m from the site boundary and nearby sensitive receptors and <8 m in height upon exiting the conveyor before placement within the quarry void; • daily transfer of material and approx. restoration of 550,000 tonnes per annum; and • stockpiles will be transient, only existing for short durations at a time. Incorporated Mitigation: • Dry sand will be stored in elevated bins (150 tonne capacity) or stockpile bays of <3 m in height within mineral processing area; • stockpiles within the mineral processing area will be largely shielded from prevailing high wind speeds due to the area being located within an enclosed treeline; • stockpiles within the restoration material reception area will be damped down at the point of processing after following delivery and dampened down within the quarry void using mobile water bowsers with sprinkler systems; and • stockpiles within the restoration material reception area will be largely shielded from prevailing high wind speeds due to the area being bordered by trees to the north and west / southwest.

Off-site Transportation	Medium	Extraction: • Approx. 60 no. HGV peak two-way movements (30 no. inbound and 30 no. outbound) in any one day; and • HGVs will only be permitted to travel to and from the mineral processing area via the junction connecting The Hollow to the A24. Restoration: • Approx. 300 no. HGV peak two-way movements (150 no. inbound & 150 no. outbound) in any one day; • HGVs will only be permitted to travel to and from the restoration material reception area via former Windmill access road toward the junction connecting The Hollow to the A283. Incorporated Mitigation: • All on-site haul road surfaces used for mineral processing will have surfaces with low potential for dust release; • all on-site haul road surfaces used for restoration material will be paved (tarmac and concrete), with low potential for dust release; • approx. 160m of paved site access road before turning right onto The Hollow from the mineral processing area; and • approx. 100m of paved site access road before turning left onto The Hollow from the restoration material reception area; and • a wheel wash will be located approx. 50 m before the exit of the restoration material reception area before joining The Hollow.

TABLE 6.1: RESIDUAL SOURCE EMISSION CLASSIFICATION

Receptors

6.3.2 A list of the selected representative sensitive receptors can be found in Table 6.3.

Pathway Effectiveness

6.3.3 The percentage frequencies of dry windy data points are summarised in Table 6.2.

Wind Direction	Degrees (˚)	Frequency of Occurrence (%)
N	345 – 15	1.6
NNE	15 – 45	1.8
ENE	45 – 75	1.0
E	75 – 105	0.4
ESE	105 – 135	0.8
SSE	135 – 165	0.5
S	165 – 195	0.6
SSW	195 – 225	3.1
WSW	225 – 255	3.6
W	255 – 285	0.9
WNW	285 – 315	0.6
NNW	315 – 345	0.7

TABLE 6.2: FREQUENCY OF POTENTIALLY DUSTY WINDS

Summary of Magnitude of Dust Effects

6.3.4 The magnitude of the dust disamenity effects at each sensitive receptor around the development site is summarised in Table 6.3.

6.3.5 The magnitude of dust effects from dust deposition ranges from ‘Negligible’ to ‘Moderate Adverse’. The ‘Moderate Adverse’ dust effect at Green Farm is based largely on the proximity of the receptor to the closest point of quarry infill operations. This is a pessimistic judgement, since infill operations close to this location will generally be some metres below the level of the receptor, and since solid screens are proposed here.

6.3.6 The use of meteorological data other than Shoreham, with a higher frequency of northerly winds than other sites in Sussex, is not likely to change the assessment conclusions.

6.3.7 The overall effect is considered to be slight adverse and not significant, based on a consideration of the different magnitude of effects at individual representative receptors and the number of receptors that would experience these different effects. Incorporated mitigation is noted within Table 6.1 and is formalised within the Dust Management Plan presented in Appendix D. The mitigation measures incorporated into the scheme, in conjunction with good practice design and operation mitigation measures detailed in the Dust Management Plan, are considered appropriate with regard to minimising the overall effect of dust disamenity at nearby receptors and protecting residential amenity.

Ref	Receptor details and location	Location relative to nearest dust source	Residual Source Emissions	Direction and Frequency of Potentially-Dusty Winds	Pathway Effectiveness	Dust Impact Risk	Receptor Sensitivity	Magnitude of Dust Effect
01	Green Farm	<20 m southeast of site boundary, upwind of Material Restoration, Mineral Extraction and Off-site Transportation	Medium	All wind directions (15.8%)	Highly Effective	Medium Risk	High	Moderate Adverse Effect
02	Tilleys Cottage	Approx. 165 m south of site boundary, upwind of Material Restoration, Mineral Extraction and Off-site Transportation	Medium	N, NNE, NNW (4.1%)	Ineffective	Negligible Risk	High	Negligible Effect
03	Washington Village Memorial Hall	Approx. 390 m southwest of site boundary, upwind of Material Restoration and Mineral Extraction	Medium	NNE, ENE, E (3.2%)	Ineffective	Negligible Risk	Medium	Negligible Effect
04	Birchwood Kia & Destination Triumph Motor Dealerships	Approx. 260 m west of site boundary, upwind of Material Restoration and Mineral Extraction	Medium	NNE, ENE, E, ESE (4.0%)	Ineffective	Negligible Risk	High	Negligible Effect
05	Washington Caravan & Camping Park	Approx. >30 m west of site boundary, upwind of Material Restoration and Mineral Extraction	Medium	N, NNE. ENE, E, ESE, SSE (6.1%)	Moderately Effective	Low Risk	High	Slight Adverse Effect
06	Moving Pictures Boudoir Photography Studio	Approx. 80 m west of site boundary, upwind of Material Restoration and Mineral Extraction	Medium	NNE, ENE, E, ESE, SSE (4.5%)	Ineffective	Negligible Risk	Medium	Negligible Effect
07	Residential properties on Old London Road	Approx. 90 m northwest of site boundary, upwind of Material Restoration and Mineral Extraction	Medium	E, ESE, SSE, S (2.3%)	Ineffective	Negligible Risk	High	Negligible Effect
08	Rock House Cottage	Approx. 40 m northwest of site boundary, upwind of Material Restoration, Mineral Extraction and Off-site Transportation	Medium	E, ESE, SSE, S, SSW, WSW (9.0%)	Moderately Effective	Low Risk	High	Slight Adverse Effect

09	Pump House Cottage	Approx. 130 m northwest of site boundary, upwind of Material Restoration, Mineral Extraction and Off-site Transportation	Medium	E, ESE, SSE, S, SSW (5.4%)	Moderately Effective	Low Risk	High	Slight Adverse Effect
10	Rock Farm	Approx. 110 m north of site boundary, upwind of Material Restoration, Mineral Extraction and Off-site Transportation	Medium	E, ESE, SSE, S, SSW, WSW (9.0%)	Moderately Effective	Low Risk	Low	Negligible Effect
11	Premiere GT Motor Dealership	Approx. 250 m north of site boundary, upwind of material restoration, sand extraction, on-site transportation and mineral processing area	Medium	ESE, SSE, S, SSW (5.0%)	Ineffective	Negligible Risk	High	Negligible Effect
12	The Rock Business Park (inc. LJS Aviation Ltd, Pragma Group, etc.)	Approx. 130 m north of site boundary, upwind of Material Restoration, Mineral Extraction and Mineral Processing	Medium	ESE, SSE, S, SSW, WSW (8.6%)	Moderately Effective	Low Risk	Medium	Negligible Effect
13	Western Boundary Footpath	Approx. <10 m west the of site boundary, running south to north, upwind of Material Restoration and Mineral Extraction	Medium	All wind Directions (15.8%)	Highly Effective	Medium Risk	Low	Negligible Effect

TABLE 6.3: SUMMARY OF DUST DISAMENITY EFFECTS AT SPECIFIC RECEPTORS

6.4 Suspended Particulate Matter – Human Health Effects

6.4.1 The Defra background PM_{10} concentration around the development site is below the screening value of 17 μgm^{-3} for all reported years, as shown in Table 5.4. There is therefore a negligible risk of an exceedance of the PM_{10} objectives and the potential for PM_{10} emissions from the development to affect human health is predicted to be negligible and the effect is not significant.

6.5 Ecological Effects

6.5.1 There are no designated ecological receptors sensitive to dust deposition within 400m of the potential dust-generating activities. Furthermore, the dust impact on non-designated ecological receptors within the site boundary has been duly considered within the Ecological Impact Assessment. Therefore, the proposed development will have a negligible effect on ecological receptors.

6.6 Cumulative Effects

6.6.1 For the purposes of this assessment sand extraction operations are assumed to be completed in December 2023 while the quarry restoration operations are assumed to commence in April 2022. The impact of continued sand extraction operations and proposed quarry restoration operations have been considered cumulatively within this assessment.

6.6.2 Additional activities permitted within the processing area are listed below. The magnitude of these activities is not considered great enough to lead to additional dust deposition effects at nearby sensitive receptors:

- Ready-mixed concrete batching (Planning Ref DC/2319/06 (WS));
- Importation (and storage) of up to 10,000 tonnes per annum of aggregates for blending and re-sale (Planning Ref DC/2151/07 (WS)); and
- Importation of up to 5,000 tonnes per annum of soils and peat for blending to create a growing medium ("root zone" or "top dressing") (Planning Ref DC/554/05 (WS)).

6.6.3 The cumulative effect of the nearby Sandgate Quarry, located approximately 1.5 km west of the development site, has been assessed qualitatively by following simple distance-based criteria. It is considered that the risk of adverse dust effects from particle sizes most likely associated with mineral sites (PM_{10}) is negligible beyond 400 m and will decrease further with distance from the source due to dispersion. Therefore, the cumulative effects from deposited dust, including Sandgate Quarry, are considered to be slight adverse and not significant.

7. DETAILED ROAD TRAFFIC ASSESSMENT

7.1 Receptors

7.1.1 Modelled receptors are listed in Table 7.1 and presented in Figure A14.

Receptor ID	Receptor Name	Coordinates		Height (m)
		X	Y	
R1	Green Farm	512896	113344	1.5
R2	Property east of Tilleys Farm	512696	112903	1.5
R3	Tilleys Farm	512595	112921	1.5
R4	Property west of Washington Bostal	512341	112913	1.5
R5	Wayne Blake adjacent to The Pike (A283)	512249	112972	1.5
R6	No. 2 London Road	512227	113040	1.5
R7	Property south of William Barton Court	512145	113262	1.5
R8	William Barton Court	512151	113289	1.5
R9	Property on The Pike (A283) west of Washington Caravan & Camping Park	512199	113322	1.5
R10	Washington Caravan & Camping Park	512223	113332	1.5
R11	Washington Towers	512180	113382	1.5
R12	The Cottage	512220	113382	1.5
R13	Sandhill Barn	512208	113441	1.5
R14	Property north of Sandhill Barn	512194	113500	1.5
R15	Property west of Sandhill Lane	512126	113422	1.5
R16	Property north of Sandhill Lane	512148	113505	1.5
R17	Property on Manley's Hill (A283) west of A24 Roundabout	511972	113488	1.5
R18	Property on Old London Road east of A24	512198	113714	1.5

TABLE 7.1: MODELLED RECEPTORS

7.2 Modelling Inputs

7.2.1 The dispersion modelling inputs are shown in Appendix B.

7.3 Modelling Results

7.3.1 The long-term modelled annual mean NO_2 and PM_{10} concentrations for all scenarios are presented in Table 7.2 and Table 7.3 respectively. Percentage changes between the 2022 DN and 2022 DS scenario, relative to the AQO, were compared to the impact descriptor matrix in EPUK/IAQM guidance [1].

7.3.2 The modelled number of exceedances of the short-term daily mean PM_{10} AQO for all scenarios are presented in Table 7.4.

7.4 Predicted Annual Mean NO_2 (Long-term)

7.4.1 Table 7.2 indicates that, at all assessed receptors, modelled annual mean NO_2 concentrations are calculated to be within the annual objective of 40 µgm^{-3} for the development year DM and DS scenarios.

7.4.2 The percentage change in NO_2 from the proposed development ranges from 0.07% to 0.50% at the assessed receptors. Predicted impacts using IAQM/EPUK criteria are 'Negligible' at all receptors and effects are not significant.

7.4.3 As discussed in Appendix C, modelled concentrations may be over-predictions and are therefore likely to be pessimistic.

7.4.4 The Defra TG16 document states that, when the annual mean NO_2 concentrations are less than 60 µgm^{-3}, the short-term (one-hour) objective for NO_2, is unlikely to be exceeded.

Receptor ID	Annual Mean NO_2 concentrations (µgm^{-3})			Percentage Change in Concentration Relative to Air Quality Assessment Level (40 µgm^{-3})	Impact Descriptor
	2019 Baseline	2022 DM	2022 DS		
R1	18.8	15.9	16.0	0.28	Negligible
R2	11.7	10.1	10.2	0.08	Negligible
R3	12.5	10.8	10.8	0.07	Negligible
R4	13.8	11.8	11.9	0.10	Negligible
R5	17.6	14.9	14.9	0.13	Negligible
R6	19.3	16.3	16.3	0.17	Negligible
R7	27.1	22.7	22.8	0.33	Negligible
R8	32.7	27.2	27.4	0.40	Negligible
R9	26.7	22.3	22.5	0.33	Negligible
R10	23.3	19.6	19.7	0.25	Negligible
R11	28.0	23.4	23.5	0.32	Negligible
R12	23.7	19.9	19.9	0.23	Negligible
R13	25.9	21.6	21.7	0.20	Negligible
R14	30.6	25.5	25.6	0.20	Negligible
R15	37.6	31.2	31.4	0.50	Negligible
R16	41.8	34.7	34.8	0.27	Negligible
R17	27.1	22.6	22.6	0.20	Negligible
R18	28.6	23.9	23.9	0.10	Negligible

TABLE 7.2: PREDICTED ANNUAL MEAN NO_2 CONCENTRATIONS AT RECEPTORS

7.5 Predicted Annual Mean PM_{10} (Long-term)

7.5.1 Table 7.3 indicates that, at all assessed receptors, modelled annual mean PM_{10} concentrations are calculated to be well within the annual objective of 40 µgm^{-3} for all scenarios.

7.5.2 The percentage change in PM_{10} contribution from the proposed development ranges from 0.04% to 0.25% at the assessed receptors. Predicted impacts using IAQM/EPUK criteria are negligible at all receptors and effects are not significant.

Receptor ID	**Annual Mean PM_{10} concentrations (µgm^{-3})**			**Percentage Change in Concentration Relative to Air Quality Assessment Level (40 µgm^{-3})**	**Impact Descriptor**
	2019 Baseline	**2022 DM**	**2022 DS**		
R1	16.1	15.6	15.6	0.16	Negligible
R2	15.0	14.4	14.5	0.04	Negligible
R3	15.1	14.6	14.6	0.05	Negligible
R4	15.3	14.7	14.8	0.05	Negligible
R5	15.9	15.3	15.3	0.06	Negligible
R6	16.2	15.6	15.6	0.08	Negligible
R7	17.3	16.8	16.9	0.17	Negligible
R8	18.3	17.8	17.9	0.25	Negligible
R9	17.3	16.7	16.8	0.17	Negligible
R10	16.7	16.1	16.2	0.12	Negligible
R11	17.4	16.9	16.9	0.15	Negligible
R12	16.7	16.2	16.2	0.10	Negligible
R13	17.0	16.5	16.5	0.10	Negligible
R14	17.7	17.1	17.2	0.10	Negligible
R15	18.9	18.4	18.5	0.21	Negligible
R16	19.5	18.9	19.0	0.14	Negligible
R17	16.8	16.3	16.3	0.07	Negligible
R18	17.3	16.8	16.8	0.06	Negligible

TABLE 7.3: PREDICTED ANNUAL MEAN PM_{10} CONCENTRATIONS AT RECEPTORS

7.6 Predicted Daily Mean PM_{10} (Short-term)

7.6.1 Table 7.4 indicates that, at all modelled receptors, the number of exceedances of the 24-hour-mean PM_{10} standard are predicted to occur no more than three times a year for all modelled scenarios.

7.6.2 No changes in the number of days that the 24-hour standard is exceeded are predicted between the 2022 DS and 2022 DM scenarios. Therefore, impacts on 24-hour-mean PM_{10} will be negligible and the effect will be not significant.

Receptor ID	No. of 24-hour-Mean PM_{10} AQ Standard Exceedances		
	2019 Baseline	2022 DM	2022 DS
R1	0	0	0
R2	0	0	0
R3	0	0	0
R4	0	0	0
R5	0	0	0
R6	0	0	0
R7	1	1	1
R8	2	1	1
R9	1	1	1
R10	1	0	0
R11	1	1	1
R12	1	0	0
R13	1	0	0
R14	1	1	1
R15	2	2	2
R16	3	2	2
R17	1	0	0
R18	1	1	1

TABLE 7.4: PREDICTED NO. OF EXCEEDANCES OF 24-HOUR MEAN PM_{10} AQ STANDARD

7.7 Cumulative Effects

7.7.1 The assessment above accounts for other emissions sources in the area, through explicitly-modelled major roads and background contributions. The predictions above are therefore cumulative and cumulative effects from traffic emissions will be negligible and not significant.

8. MITIGATION AND CONTROL

8.1 Disamenity Dust Mitigation

8.1.1 All mineral sites will encompass a degree of dust mitigation as part of normal working practice. Basic good practice mitigation measures should apply to all mineral extraction sites.

8.1.2 The proposed development will lead to a slight adverse effect from dust overall, which is not significant. On this basis, no additional mitigation measures are considered necessary over and above those incorporated into the proposed scheme presented in Section 6.

8.1.3 Nevertheless, the added use of appropriate mitigation measures will ensure that risk to sensitive receptors is minimised. It is therefore recommended that, in addition to the incorporated mitigation measures, further basic good practice design and operational mitigation measures (taken from the IAQM guidance [2]) be adopted and formalised within a Dust Management Plan (DMP), as presented in Appendix D.

8.1.4 Monitoring proposals within the DMP could potentially be secured through a planning condition.

8.2 Emissions Mitigation Assessment

8.2.1 The five-year exposure damage cost of the development was found to be £14,938.

8.2.2 The five-year exposure cost represents the value to be used to implement mitigation measures in the development to aid in off-setting adverse air quality impacts. The calculation of the five-year air quality exposure cost for the development scenario is presented below in Table 8.1.

8.2.3 The monetary value of the incorporated mitigation will be in excess of the total five-year damage cost. Therefore, there is no requirement for further mitigation spending.

Sum of All Vehicles (Annual Emissions (kg/yr))			
Trip Rate for Development (vehicles per day)		236	
		NO_x	**PM_{10}**
Emissions (tonnes/annum)	2022	0.483507	0.049928
	2023	0.404456	0.048875
	2024	0.344942	0.048084
	2025	0.301134	0.047500
	2026	0.272170	0.047116
2017 IGCB Damage Cost Valuations (£/tonne)		3,166.00	30,697.00
Five-year Exposure Cost Value (£)		6,519.00	8,419.00
Five-year Exposure Cost Value NO_x + PM_{10} (£)		**14,938**	

TABLE 8.1: FIVE-YEAR EXPOSURE AIR QUALITY DAMAGE COST CALCULATION

9. RESIDUAL EFFECTS

9.1 Residual Dust Effects

9.1.1 With the identified dust mitigation in place, residual dust effects from the proposed development are considered to be not significant.

9.2 Residual Road Traffic Effects

9.2.1 No mitigation is required in respect of road traffic emissions. Residual effects from road traffic will be negligible and not significant for NO_2 and PM_{10}.

10. CONCLUSIONS

10.1.1 The baseline assessment indicates that NO_2 and PM_{10} AQOs are currently being met in the area around the development site and are expected to continue to be met.

10.1.2 The minerals dust assessment for dust deposition effects indicates that activities may have, at worst, ‘Negligible’ to ‘Moderate Adverse’ air quality effects at nearby sensitive receptors. The overall effect from dust deposition is considered slight adverse and not significant.

10.1.3 For human health effects, there is negligible risk that PM_{10} contribution from quarry restoration activities would lead to an exceedance of the annual mean PM_{10} objective and the potential for PM_{10} emissions from the development to affect human health is predicted to be negligible and the effect is not significant.

10.1.4 There are no recognised dust sensitive ecological receptors within 400 m of the dust-generating activities.

10.1.5 Detailed road traffic dispersion modelling has demonstrated that NO_2 and PM_{10} from traffic introduced by quarry restoration operations will result in negligible impacts on local air quality and the effects will therefore be not significant.

10.1.6 To ensure adverse dust impacts at local sensitive receptors are minimised and to further support planning proposals, good practice mitigation measures commensurate to the risk, relating to the design and operation of the proposed development, are proposed within a Dust Management Plan.

10.1.7 Mitigation incorporated into the proposal is expected to be in excess of the total five-year damage cost required for this development. No further mitigation is required in addition to that which is detailed in the DMP.

10.1.8 Residual dust effects from construction will be slight adverse and not significant overall. Residual effects from road traffic emissions will be negligible and not significant overall.

10.1.9 The proposed development does not conflict with relevant national, regional or local policy. On the basis of the assessment undertaken, air quality does not present a constraint to the development proposals.

11. REFERENCES

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APPENDIX A: FIGURES

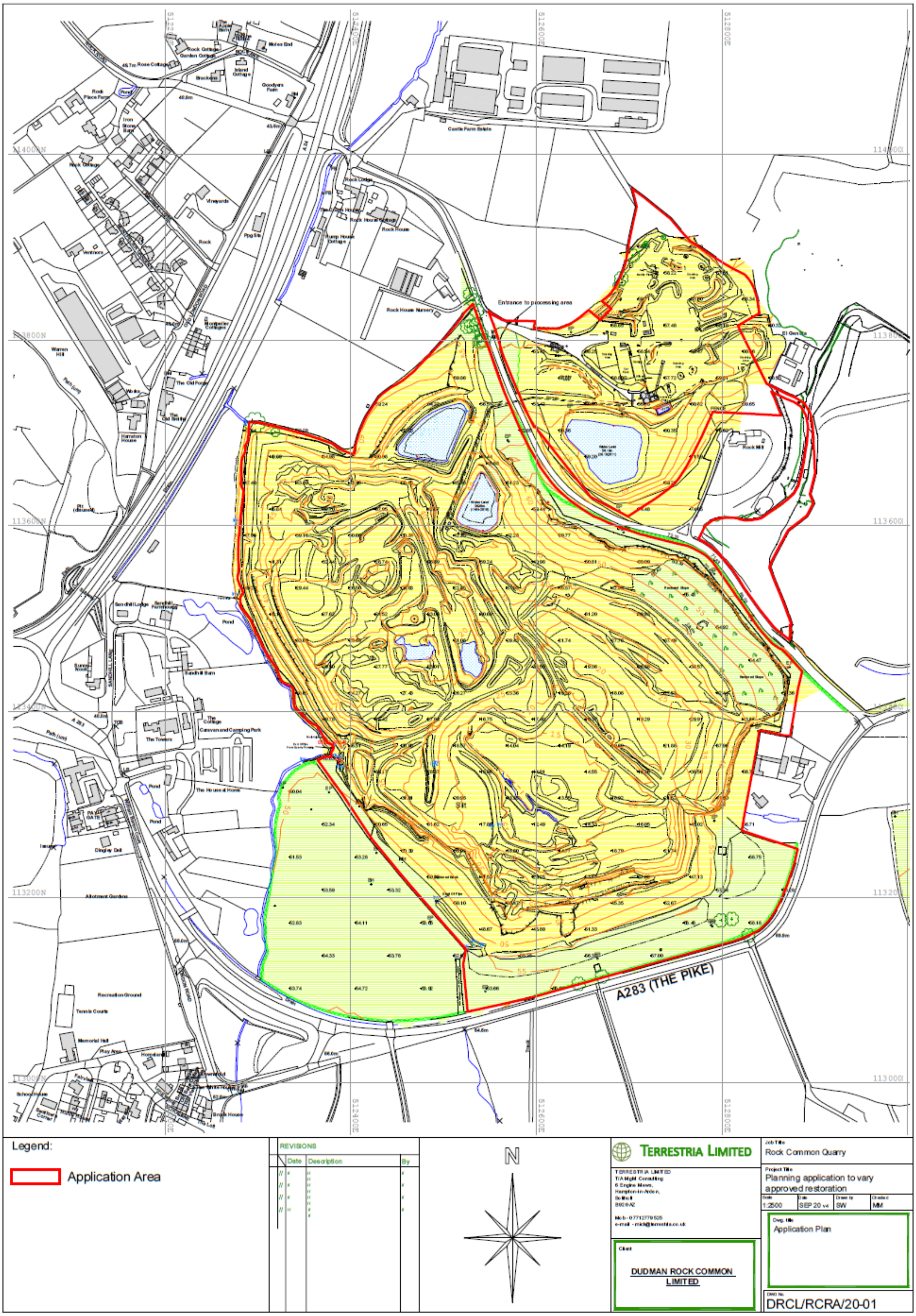


FIGURE A1: SITE LOCATION PLAN

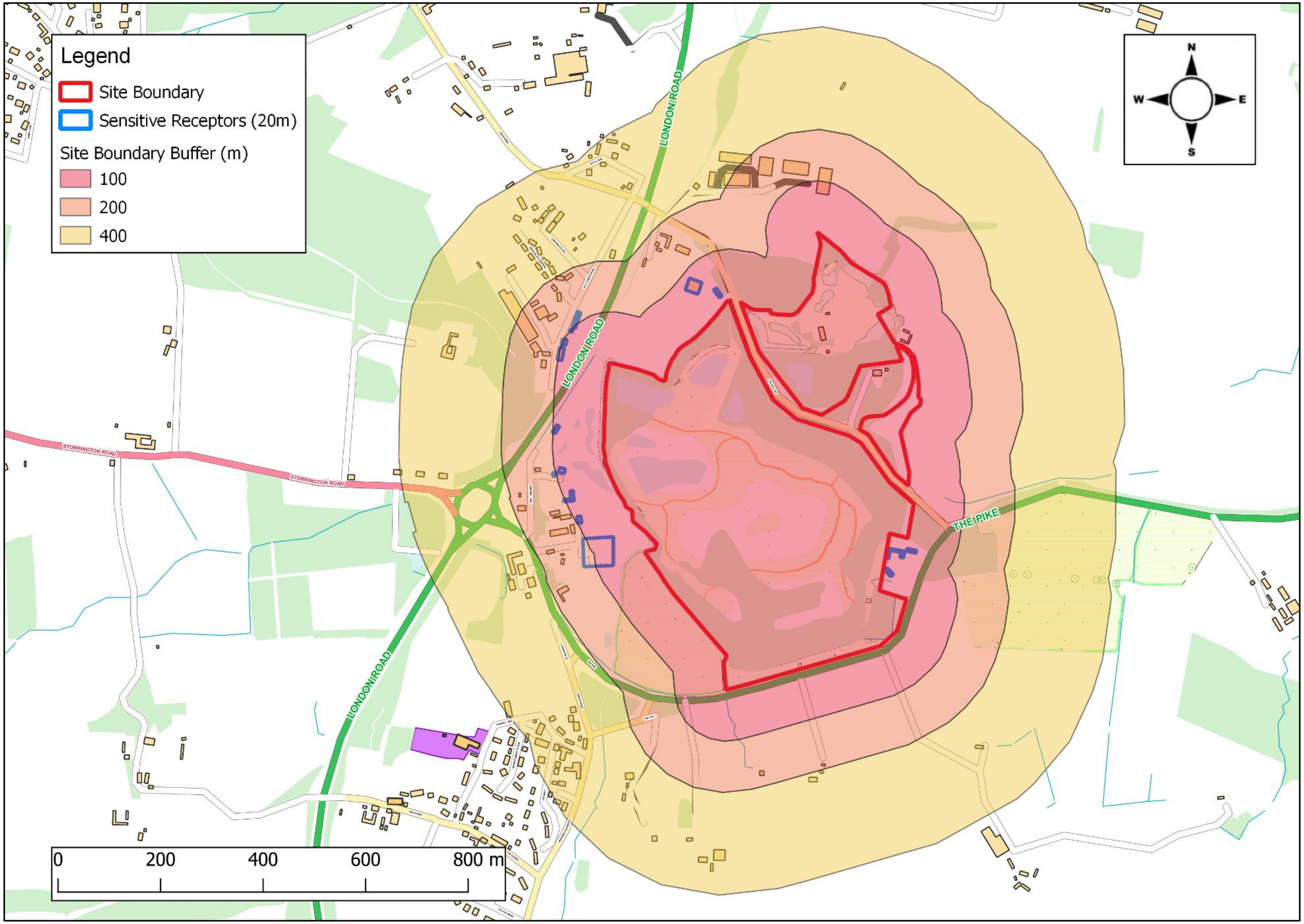


FIGURE A2: SITE LOCATION WITH DUST RISK BUFFER AND LOCAL SENSITIVE RECEPTORS WITHIN 100 M

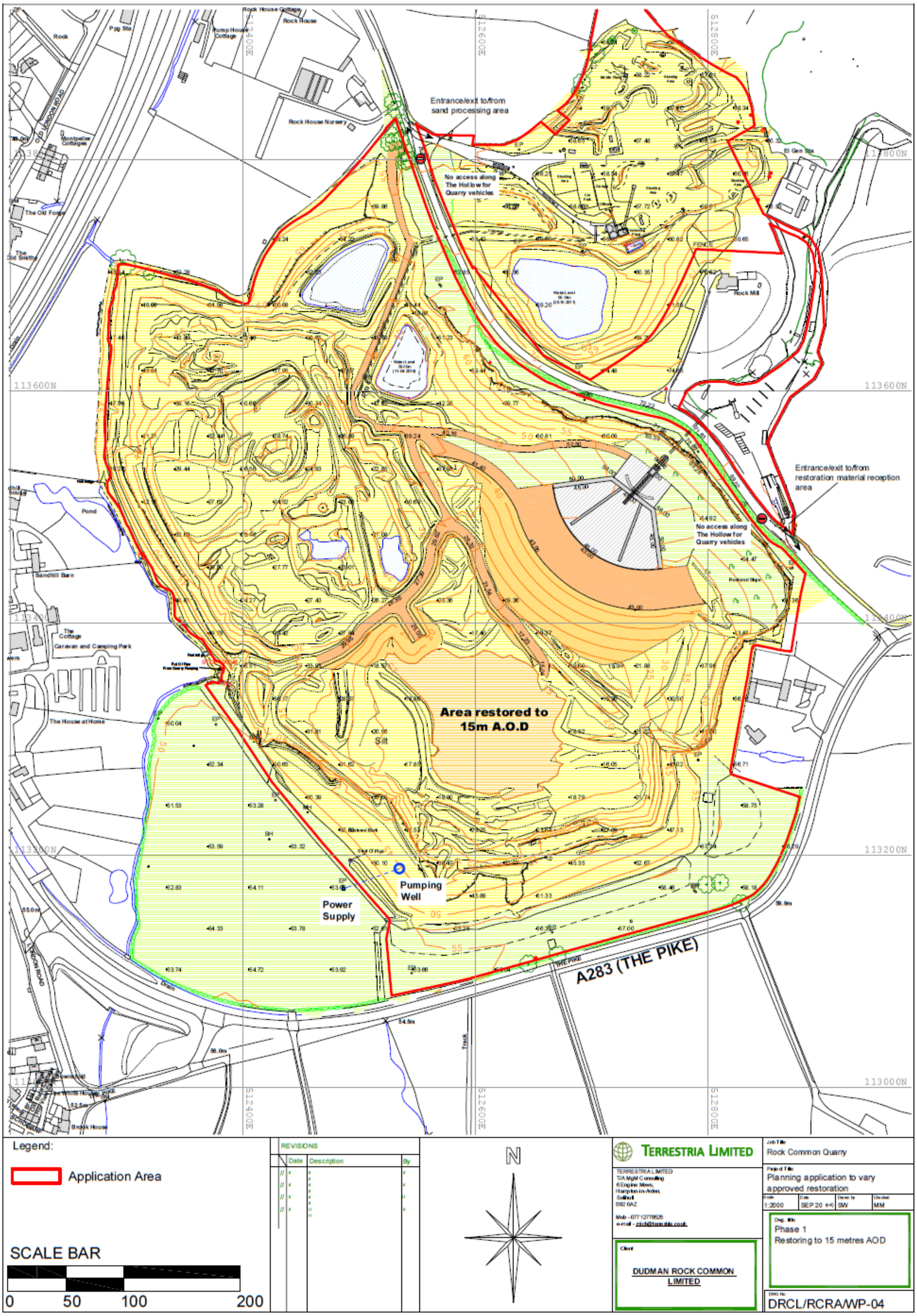


FIGURE A3: PHASE ONE RESTORATION PLAN TO 15M AOD

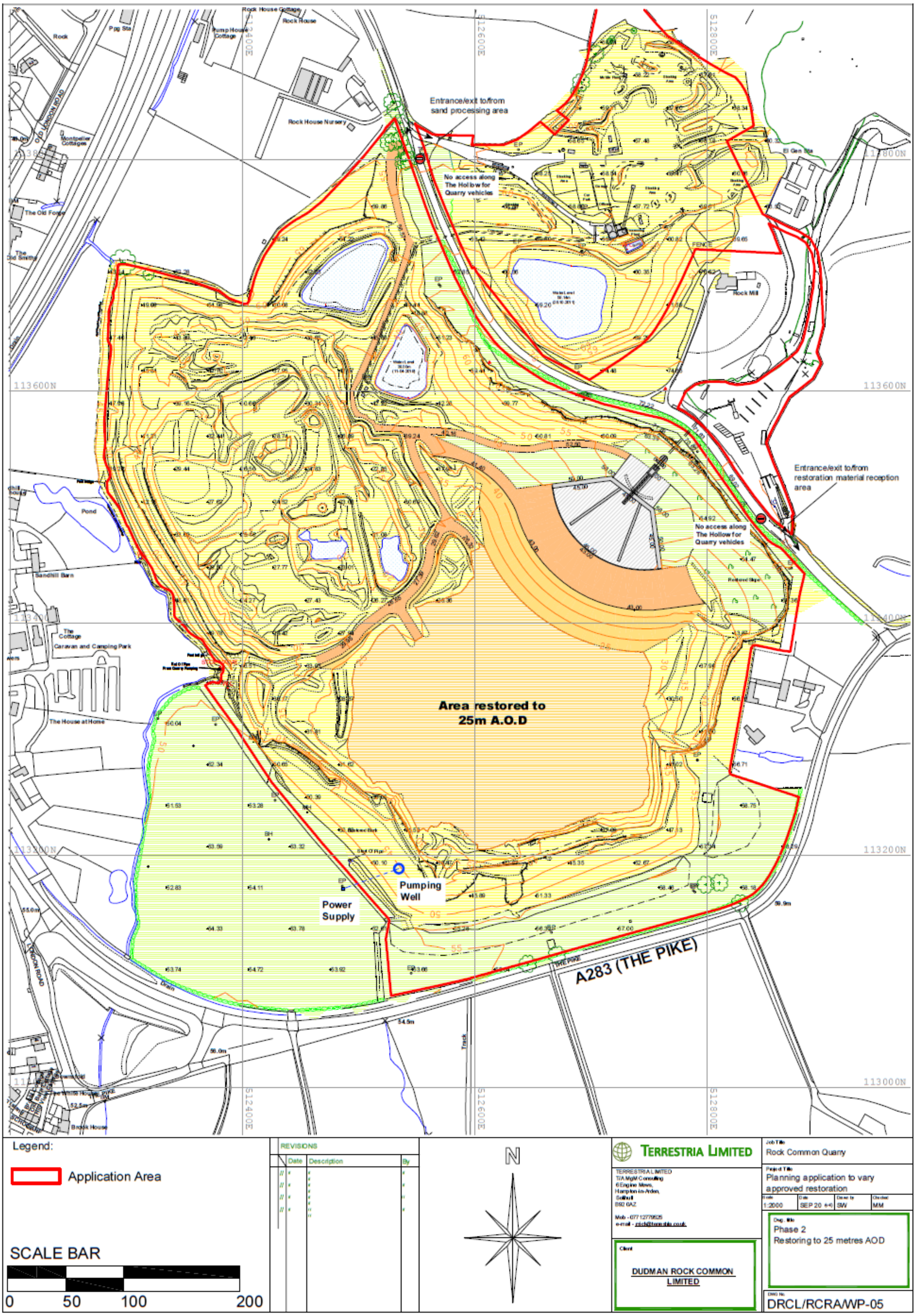


FIGURE A4: PHASE TWO RESTORATION PLAN TO 25M AOD

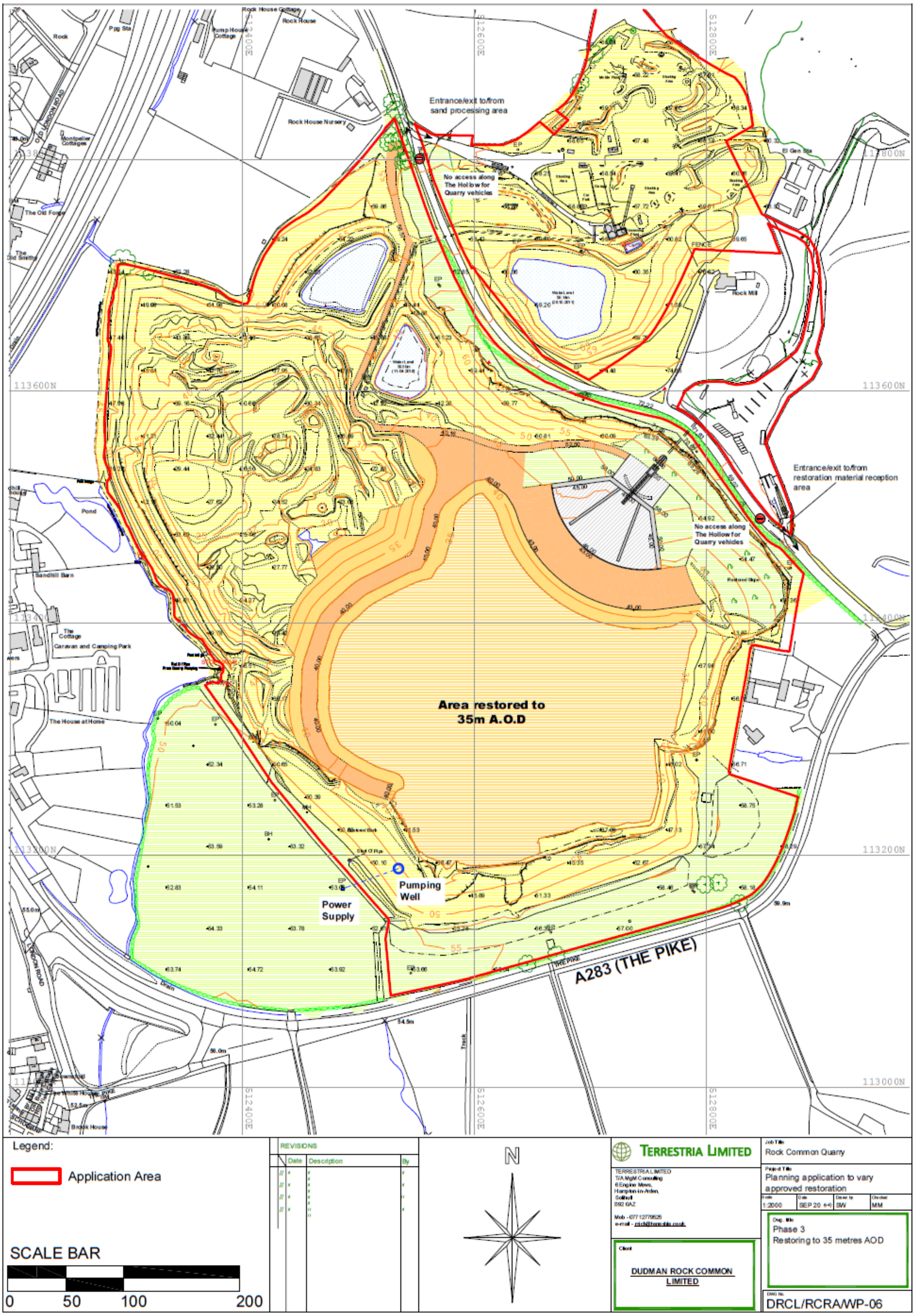


FIGURE A5: PHASE THREE RESTORATION PLAN TO 35M AOD

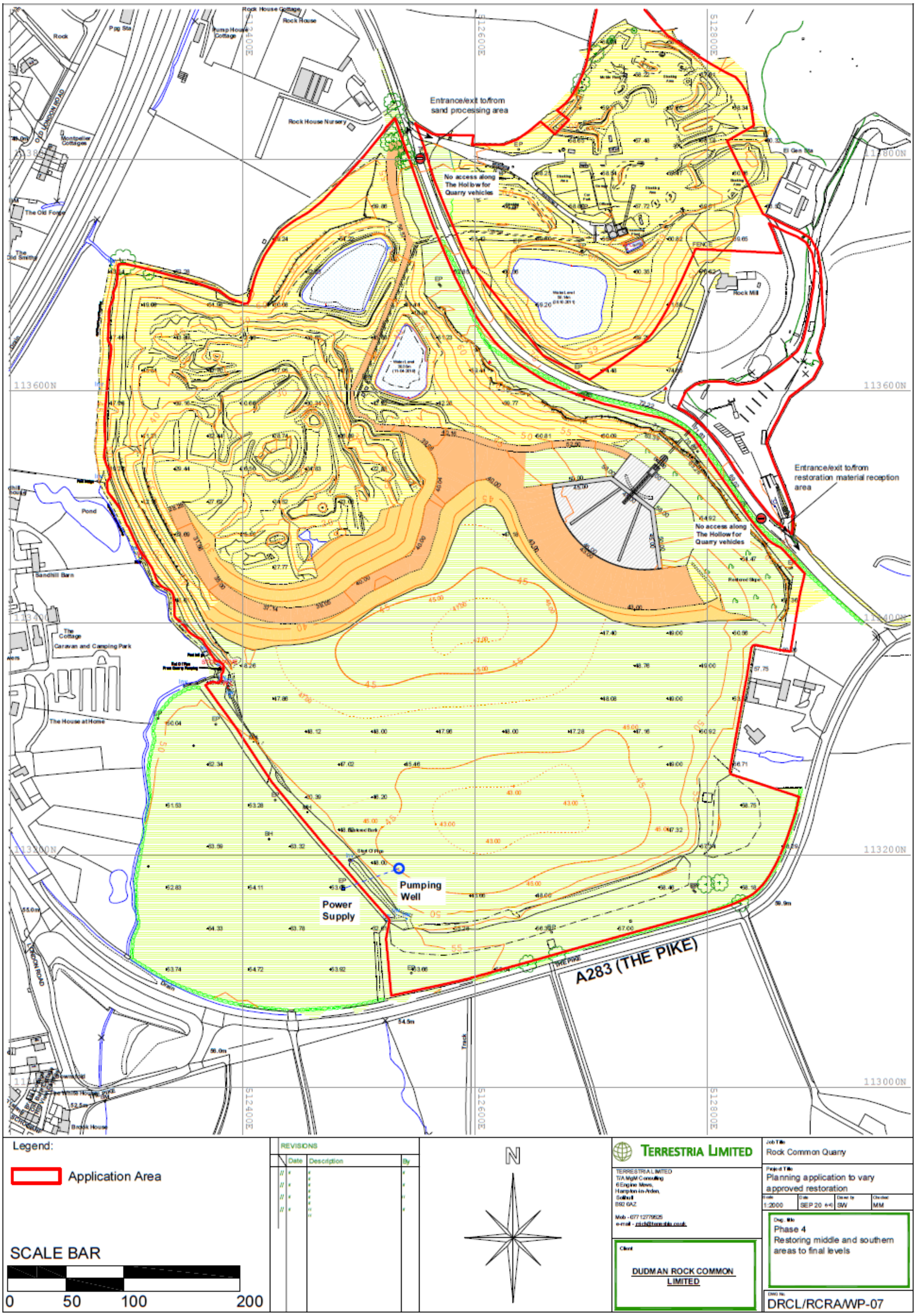
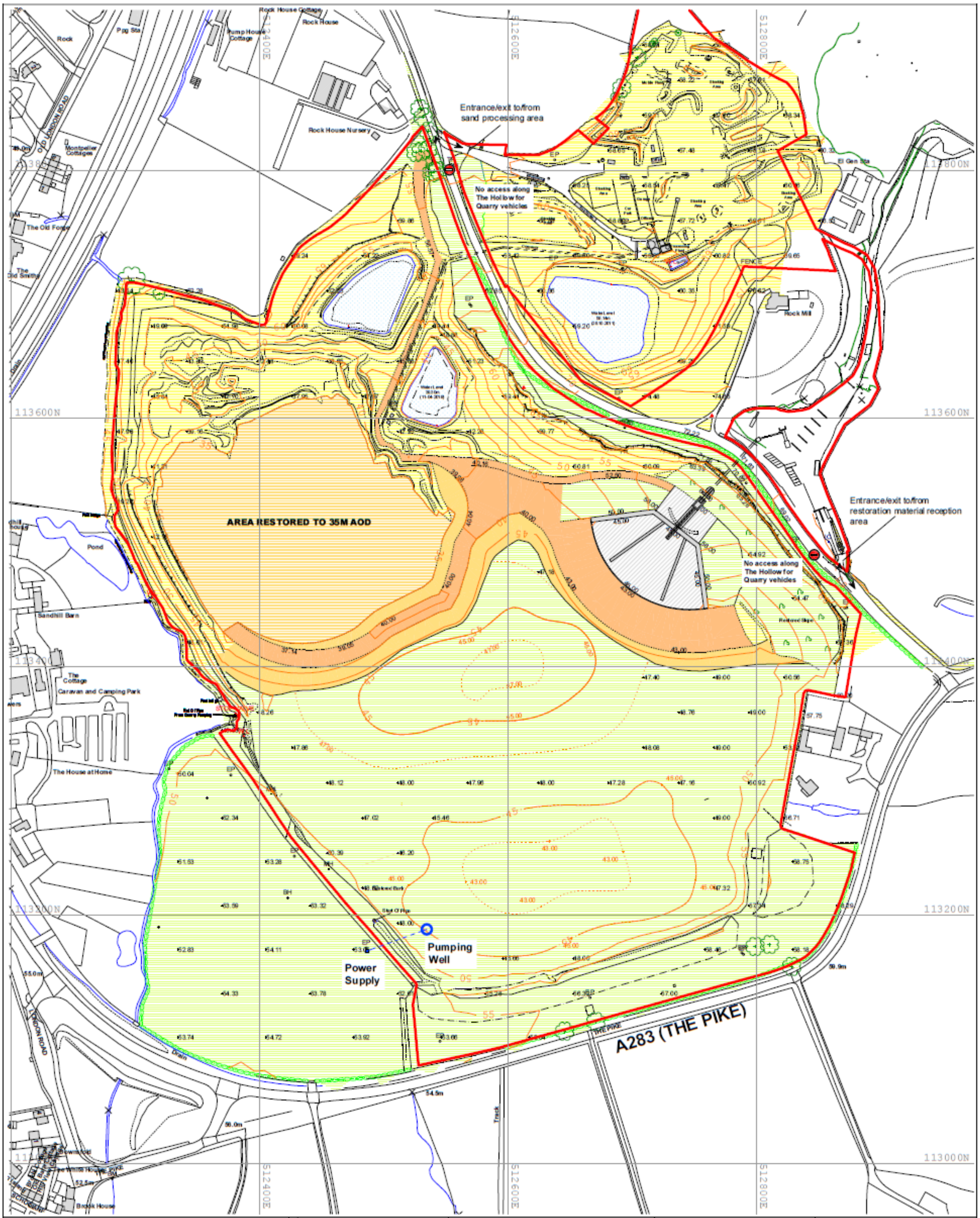


FIGURE A6: PHASE FOUR RESTORATION PLAN TO FINAL LEVELS



Legend:

Application Area

SCALE BAR

0 50 100 200

REVISIONS

Date	Description	By

TERRESTRIA LIMITED

TERRESTRIA LIMITED
T/A MgM Consulting
6 Engine Mews,
Hampton-in-Arden,
Solihull
B92 0AZ

Job Title: Rock Common Quarry

Project Title: Planning application to vary approved restoration

Scale	Date	Drawn by	Checked
1:2000	SEP 20	SW	MM

Client: DUDMAN ROCK COMMON LIMITED

Dwg. title: Phase 5 Restoring to 35m AOD

DWG No. DRCL/RCRA/WP-08

FIGURE A7: PHASE FIVE RESTORATION PLAN TO 35M AOD

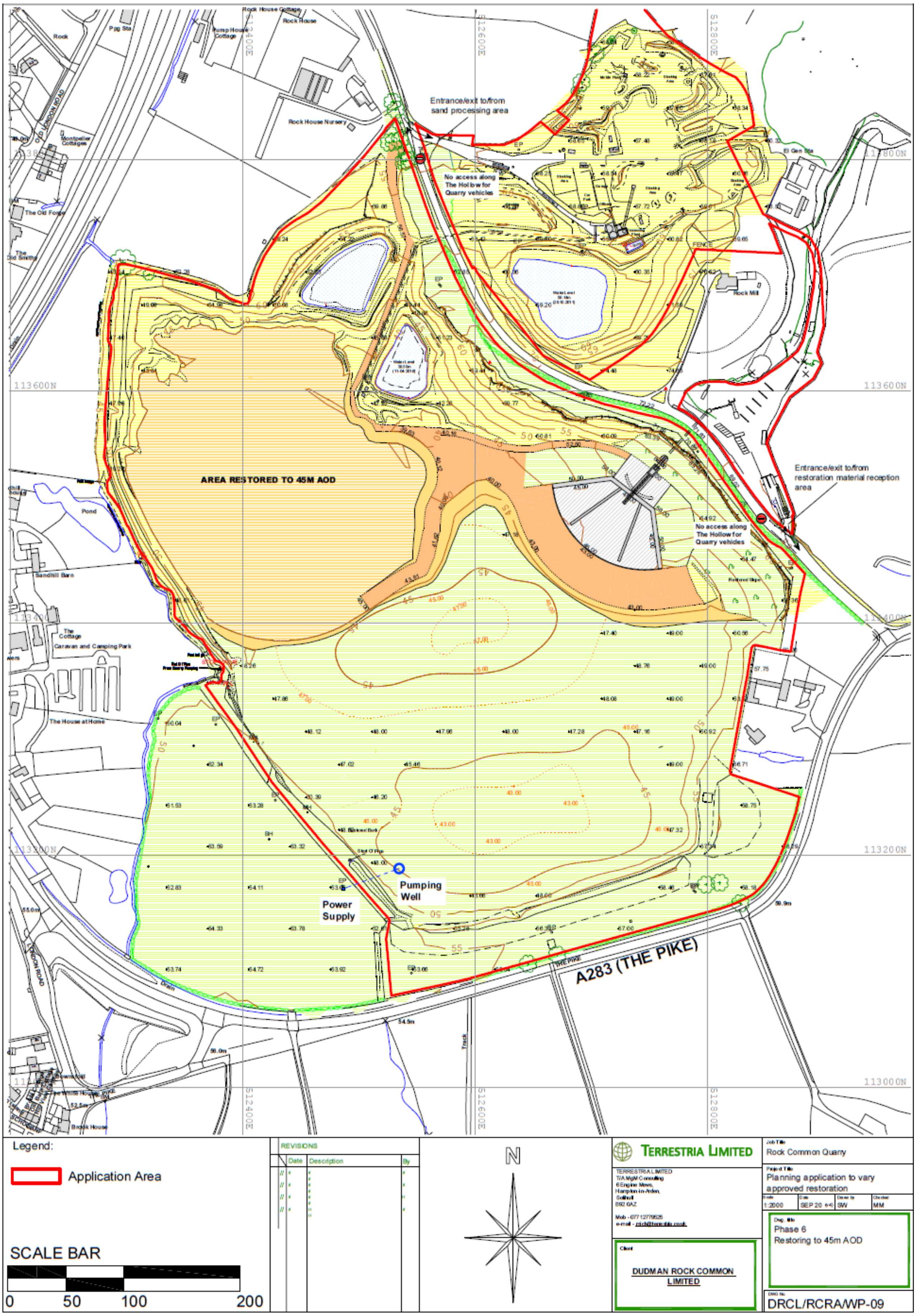


FIGURE A8: PHASE SIX RESTORATION PLAN TO 45M AOD

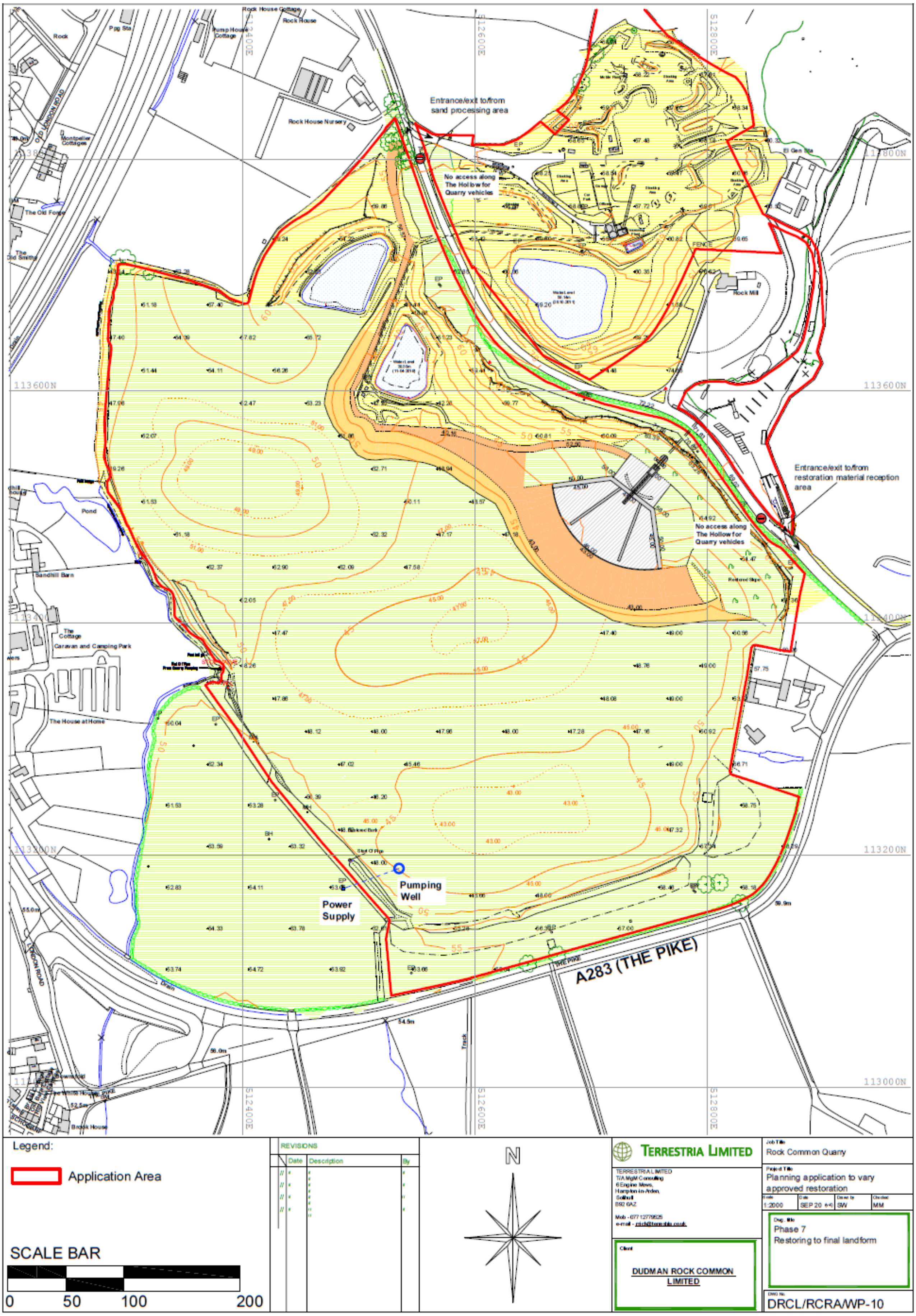


FIGURE A9: PHASE SEVEN RESTORATION PLAN

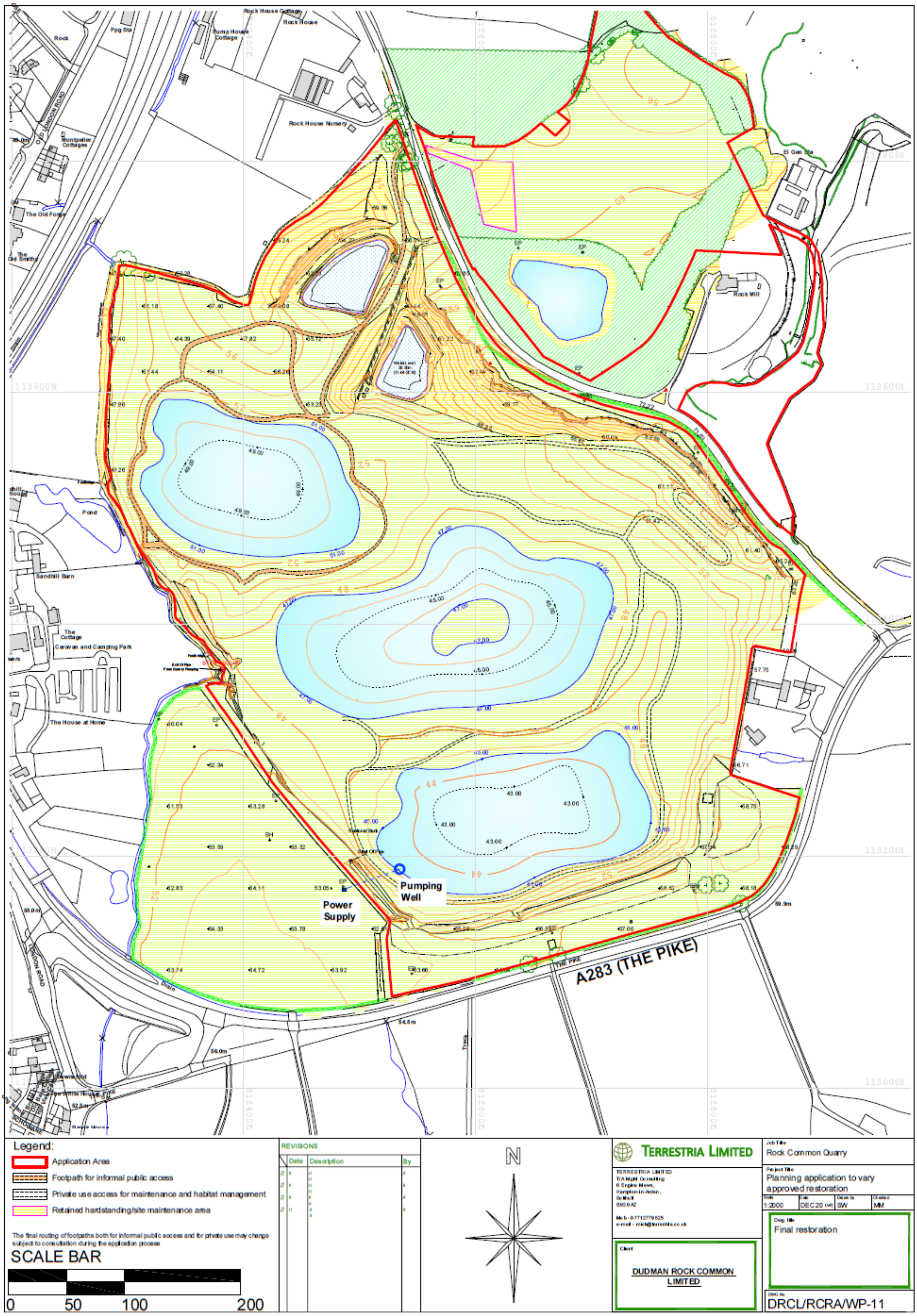


FIGURE A10: FINAL RESTORATION PLAN

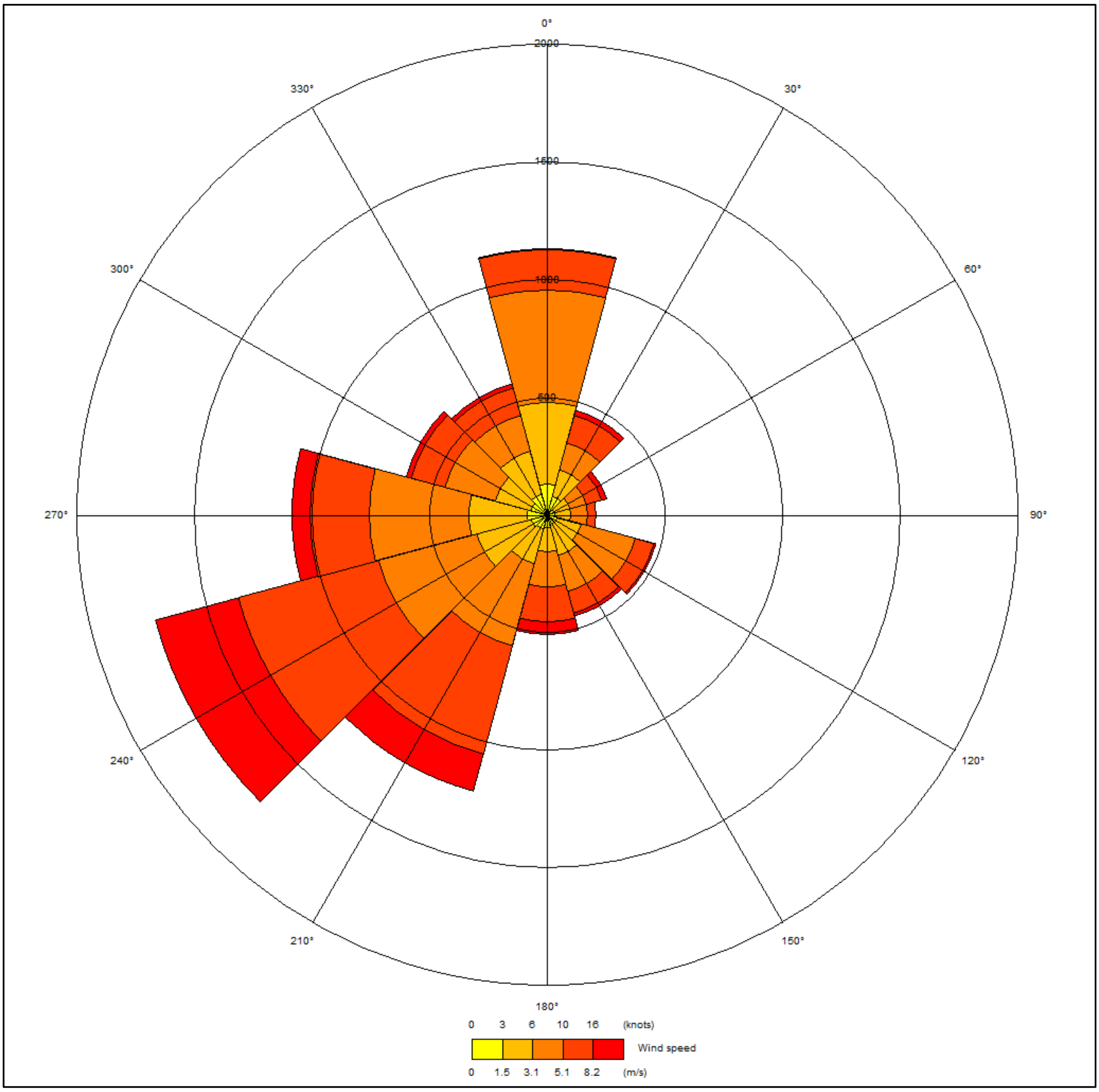


FIGURE A11: WIND-ROSE PLOT FOR SHOREHAM 2017

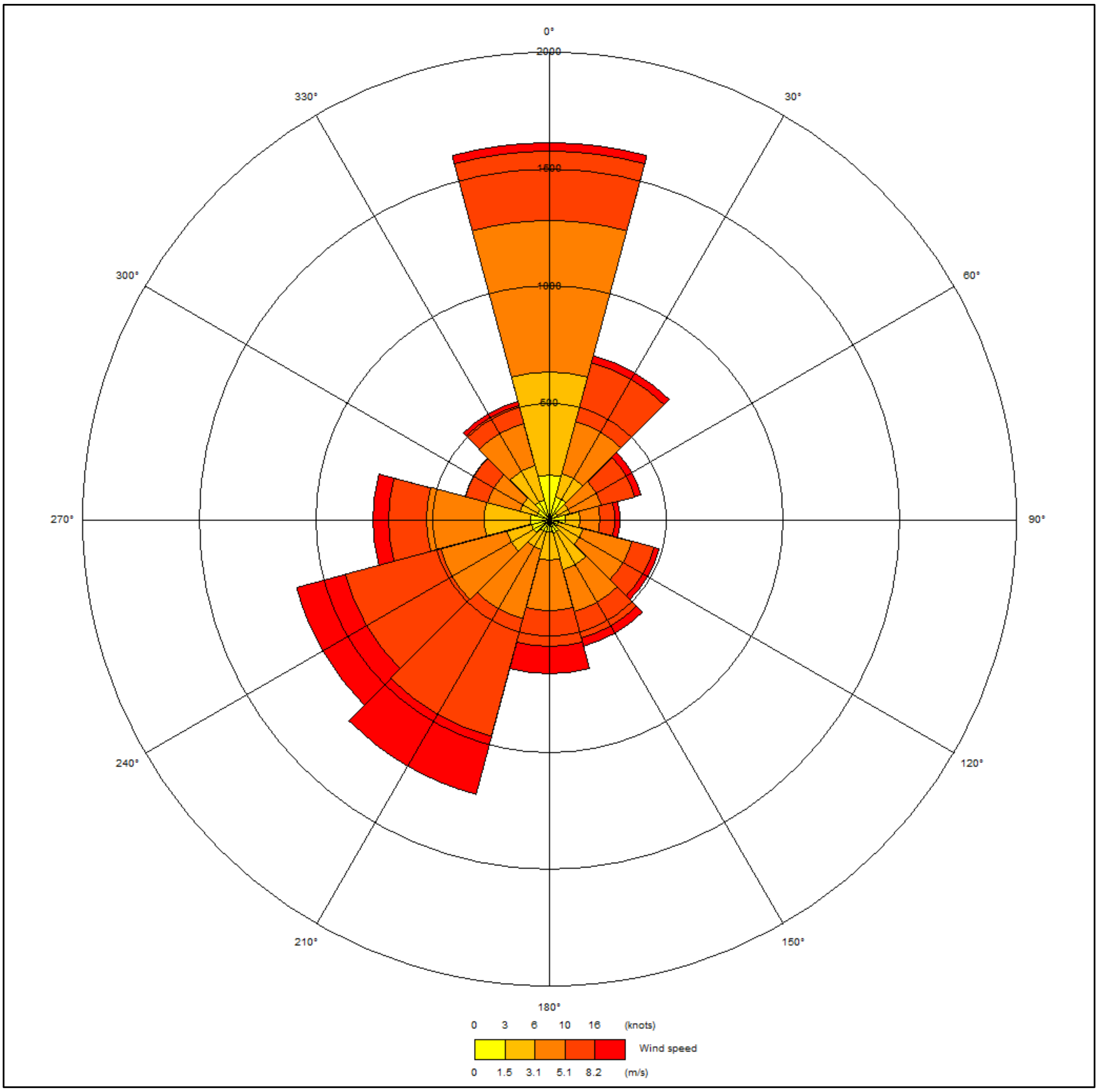


FIGURE A12: WIND-ROSE PLOT FOR SHOREHAM 2018

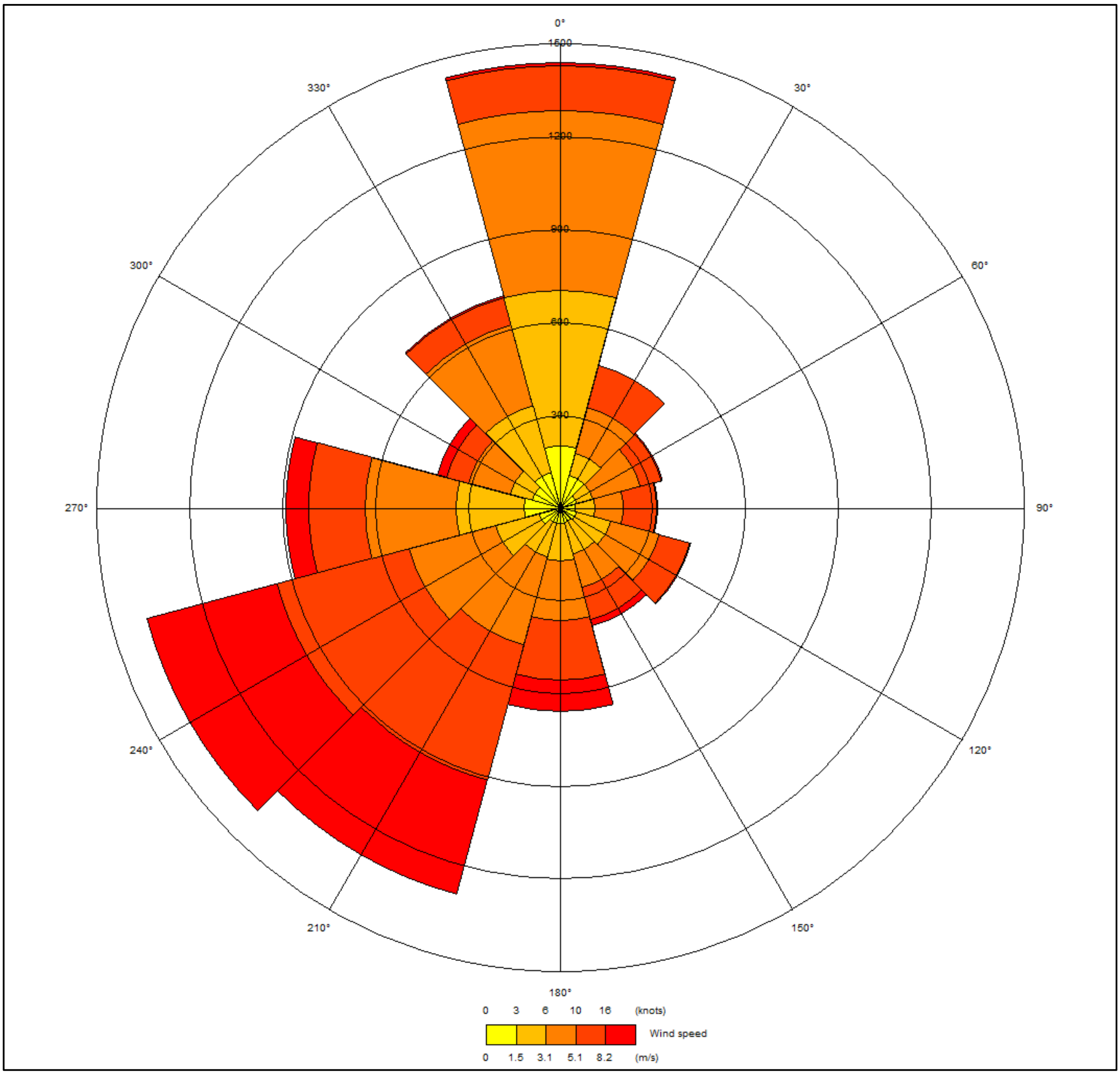


FIGURE A13: WIND-ROSE PLOT FOR SHOREHAM 2019

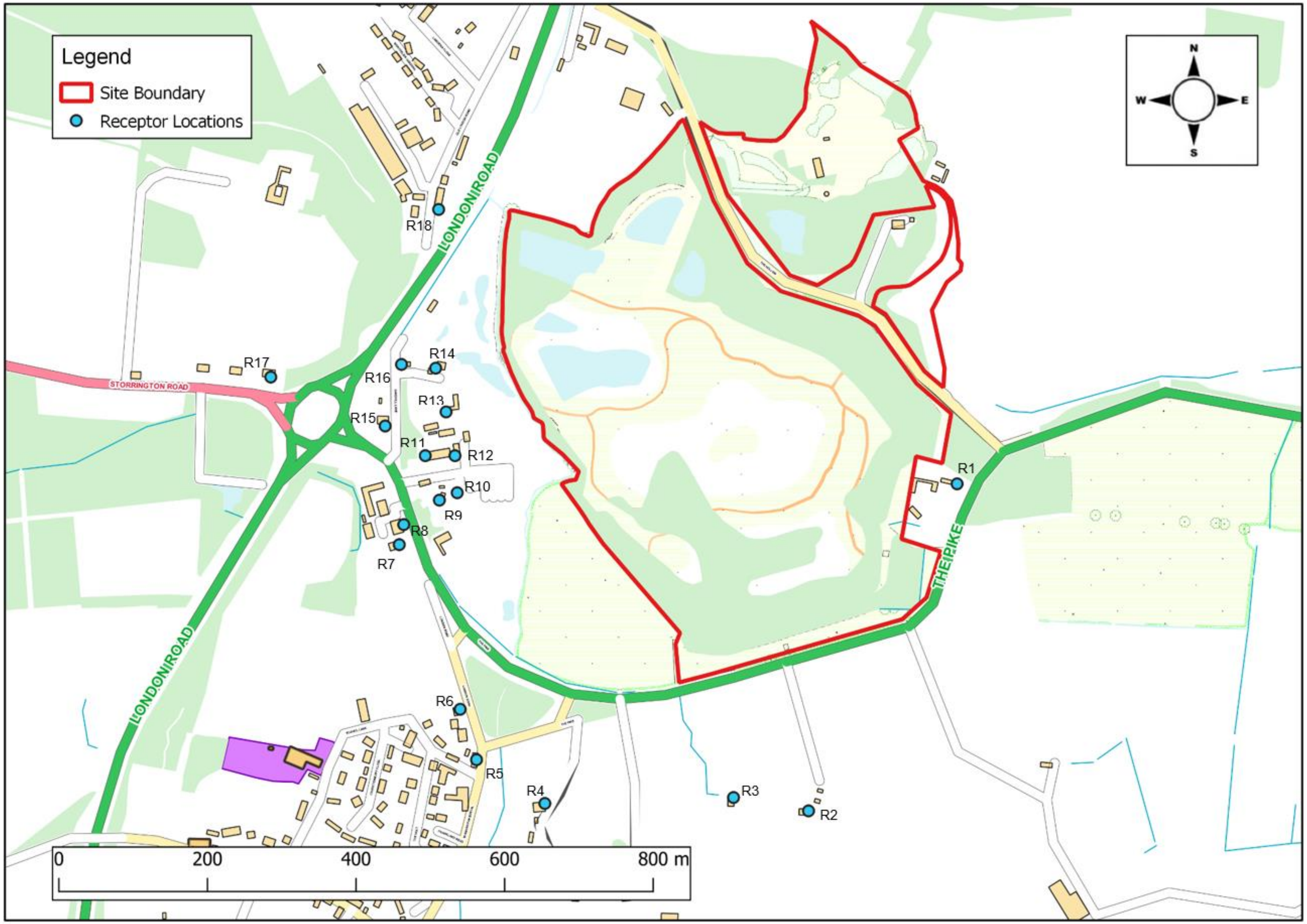


FIGURE A14: DETAILED ROAD TRAFFIC ASSESSMENT - MODELLED RECEPTORS

APPENDIX B: DISPERSION MODEL INPUT ASSUMPTIONS

Set-up

ADMS-Roads model parameters used in the assessment are shown in Table B1 below.

Parameter	Value
Surface roughness length at the development & verification dispersion site (m)	0.5
Surface roughness length at meteorological site (m)	0.0119
Minimum Monin-Obukhov length (m)	10
Latitude (degrees)	50.9
Surface Albedo (model default)	0.23
Minimum Monin-Obukhov length (m)	10
Priestley-Taylor parameter (model default)	1
Precipitation (same as met. site)	n/a
Emission Year (baseline year)	2019
Emission Year (development year)	2022
Road Type	England (rural)

TABLE B1: MODEL INPUT PARAMETERS

Road Sources

The following roads were modelled. Road widths were measured from aerial maps. This information is presented in Table B2.

DfT ID	Link Description	Modelled Road Elevation (m)	Modelled Road Width (m)	Canyon Height (m)
n/a	The Hollow after Site Access Point	0	5.4	0
6859	The Pike (A283) East of The Hollow	0	7.3	0
6859	The Pike (A283) West of The Hollow	0	7.3	0
6859	The Pike (A283) East of Roundabout Slip WB	0	6.5	0
6859	The Pike (A283) East of Roundabout Slip EB	0	6.5	0
6859	The Pike (A283) East of Roundabout Join	0	12	0
n/a	Road joining The Pike (A283) with Washington Bostal	0	7.4	0
n/a	Washington Bostal North	0	8.4	0
n/a	A24 Roundabout	0	10	0
46283	A24 North NB	0	8.1	0
46283	A24 North SB	0	8.1	0
46283	A24 North Roundabout Slip NB	0	8.1	0
46283	A24 North Roundabout Slip SB	0	8.1	0
26284	A24 South Roundabout Slip SB	0	8.1	0
26284	A24 South Roundabout Slip NB	0	8.1	0
26284	A24 South SB	0	8.1	0
26284	A24 South NB	0	8.1	0
n/a	The Hollow / The Pike (A283) Junction	0	5.4	0
26877	Manley's Hill (A283) West of Roundabout Slip EB	0	7.5	0
26877	Manley's Hill (A283) West of Roundabout Slip WB	0	7.5	0

26877	Manley's Hill (A283) West of Roundabout Join	0	13	0
26877	Manley's Hill (A283) West of Roundabout	0	6.5	0
810683	Washington Bostal South	0	8.4	0
n/a	The Hollow before Site Access Point	0	5.4	0

TABLE B2: MODELLED ROAD LINKS

Traffic Data

The Hollow, The Pike (A284), Washington Bostal, the connecting road between The Pike and Washington Bostal, the A24, Storrington Road (A283) and the Washington Roundabout road links within 200m of the development were modelled explicitly.

Other minor roads, including Sandhill Lane and School Lane were accounted for indirectly through background concentrations.

Road traffic data were taken from DfT traffic counts. Annual average daily traffic (AADT) flows for all vehicles and HGVs were derived from DfT data. Measured average speeds for the A24 and the A283 we provided by the transport consultant. In the absence of measured average speeds, average speeds from TG16 guidance were applied.

Traffic flows on Washington Bostal were assumed to split evenly between travelling north on London Road and east on The Pike.

The Washington roundabout was modelled as one road link, using average flows from all entry and exit points.

Traffic growth factors of 1.0953 for LGVs and 1.0664 for HGVs were derived from the National Traffic Model (NMT) for the South East region and the Trip End Model Presentation Programme (TEMPro) forecast data for Horsham District. The latter was provided by the transport consultant.

Roads modelled explicitly and their associated traffic data are presented in Table B3 overleaf.

Road name	Baseline 2019		DM 2022		DS 2022		Direction	Assumed speed (km/h)
	AADT vehicles	AADT HGVs	AADT vehicles	AADT HGVs	AADT vehicles	AADT HGVs		
The Hollow after Site Access Point	734	39	804	41	804	277	Two-way	64
The Pike (A283) East of The Hollow	15,753	610	17,255	651	17,255	698	Two-way	82
The Pike (A283) West of The Hollow	15,753	610	17,255	651	17,255	840	Two-way	82
The Pike (A283) East of Roundabout Slip	8,095	313	8,867	334	8,867	428	WB	40
The Pike (A283) East of Roundabout Slip	7,658	297	8,388	317	8,388	411	EB	50
The Pike (A283) East of Roundabout Join	15,753	610	17,255	651	17,255	840	Two-way	82
Road joining The Pike (A283) with Wash. Bos.	953	43	1,043	46	1,043	46	Two-way	64
Washington Bostal North	953	43	1,043	46	1,043	46	Two-way	48
A24 Roundabout	24,962	963	27,342	1026	27,342	1,215	Two-way	40
A24 North	18,443	813	20,201	867	20,201	914	NB	103
A24 North	17,882	803	19,587	856	19,587	904	SB	103
A24 North Roundabout Slip	18,443	813	20,201	867	20,201	914	NB	50
A24 North Roundabout Slip	17,882	803	19,587	856	19,587	904	SB	40
A24 South Roundabout Slip	17,780	556	19,475	593	19,475	640	SB	50
A24 South Roundabout Slip	14,802	543	16,213	579	16,213	626	NB	40
A24 South	17,780	556	19,475	593	19,475	640	SB	103
A24 South	14,802	543	16,213	579	16,213	626	NB	103
The Hollow / The Pike (A283) Junction	734	39	804	41	804	277	Two-way	54
Manley's Hill (A283) West of Roundabout Slip	9,145	266	10,017	284	10,017	284	EB	40
Manley's Hill (A283) West of Roundabout Slip	8,856	269	9,700	287	9,700	287	WB	50
Manley's Hill (A283) West of Roundabout Join	18,001	535	19,717	571	19,717	571	Two-way	83
Manley's Hill (A283) West of Roundabout	18,001	535	19,717	571	19,717	571	Two-way	83
Washington Bostal South	1,905	86	2,087	92	2,087	92	Two-way	48
The Hollow before Site Access Point	734	39	804	41	804	41	Two-way	64

TABLE B3: TRAFFIC DATA USED IN THE ASSESSMENT

APPENDIX C: MODEL VERIFICATION

NO_2 data were taken from HDC's 2020 Air Quality ASR for 2019. The Storrington 8/9/10 AURN continuous roadside site and the Storrington 14n roadside diffusion tube site were used. The x and y co-ordinates in the ASR did not match with verification sites located on recently updated online aerial maps. Therefore, co-ordinates were adjusted to represent accurate diffusion tube locations. Details are listed in Table C1 below.

Verification ID	X, Y Co-ordinates	Height Above Ground (m)	Distance to nearest Kerb (m)	Measured NO_2 2019 (ugm^{-3})
Storrington 8/9/10 AURN	509089, 114197	3.3	4.6	22.0
Storrington 14n Diffusion Tube	509298, 114146	2.6	0.9	33.4

TABLE C1: DIFFUSION TUBE DATA USED FOR MODEL VERIFICATION

The same model set-up as the baseline and development scenarios was used for the verification.

Relevant Defra backgrounds were used in the model verification.

<u>Traffic Data</u>

Manley's Hill (A283), School Hill (B2139) and the High Street (A283) road links within 200m of the verification sites were modelled explicitly.

Road traffic data were taken from DfT traffic counts. AADT flows for all vehicles and HGVs were derived from DfT data. In the absence of measured average speeds, average speeds were assumed within the model using TG16 guidance.

Roads modelled explicitly and their associated traffic data are presented in Table C2.

DfT ID	Road name	AADT vehicles	AADT HGVs	Direction	Assumed speed (km/h)
26877	Manley's Hill	18,536	535	Two-way	48
26877	Manley's Hill Roundabout Junction	18,536	535	Two-way	20
46890	High Street Roundabout Junction	19,748	397	Two-way	20
946465	School Hill	6970	84	Two-way	48
946465	School Hill Roundabout Junction	6970	84	Two-way	20

TABLE C2: TRAFFIC DATA USED IN THE ASSESSMENT

Modelled road contributions to NO_x were compared to monitored road contributions to NO_x. Monitored road NOx contributions were calculated with Defra's NO_x to NO_2 calculator. Initial verification results are shown in Table C3 below. This shows that the model under-estimates road NO_x contributions at the verification sites. This is commonly observed in model verification.

Meadowside, which passes within X m of the Storrington 8/9/10 site, was not modelled explicitly due to a lack of traffic data. Therefore, modelled road NO_X contributions at the Storrington 8/9/10 AURN verification site may be underpredicted. The adjustment factor may be greater because of this and lead to consequent over-predictions

Site ID	Background NO_2 (μgm^{-3})	Background NO_x (μgm^{-3})	Monitored total NO_2 (μgm^{-3})	Monitored road contribution NO_2 (μgm^{-3}) (total – background)	Monitored road contribution NO_X (μgm^{-3}) (total – background)	Modelled road contribution NO_X (μgm^{-3}) (excludes background)	Ratio of monitored road contribution NOx: modelled road contribution NOx
Storrington 8/9/10 AURN	8.9	11.6	22.0	13.1	24.6	8.6	2.8
Storrington 14n DT	8.9	11.6	33.4	24.5	48.4	14.0	3.4

TABLE C3: COMPARISON OF MONITORED AND MODELLED DATA

A NO_x adjustment factor of 3.284 was applied to all modelled road NO_x concentrations. The same factor was also applied to modelled road PM_{10} concentrations.

Defra's NO_x:NO_2 calculator was used to derive modelled NO_2 concentrations, using adjusted modelled road NO_x and background NO_2 concentrations. Modelled total NO_2 concentrations were compared against monitored total NO_2 and found to be within 10% at both sites. The results of further calculations undertaken are shown in Table C4 below.

Site ID	Monitored total NO_2 (μgm^{-3})	Monitored road contribution NO_X (μgm^{-3})	Adjusted modelled road contribution NOx (μgm^{-3})	Modelled Total NO_2 (μgm^{-3})	% Difference (modelled – monitored)
Storrington 8/9/10 AURN	22.0	24.6	28.3	23.9	9%
Storrington 14n DT	33.4	48.4	46.1	32.3	-3%

TABLE C4: COMPARISON OF ADJUSTED MODELLED NO_X AND NO_2

APPENDIX D: DUST MANAGEMENT PLAN

1. PROPOSED DUST MANAGEMENT PLAN

1.1 Dust Control Mitigation Measures

1.1.1 Dust mitigation is a dynamic process, involving the review and regulation of the mitigation applied as per the conditions on site.

1.1.2 Both design-stage and operational measures of dust management are complementary, and work together to reduce the potential for excessive levels of dust to be generated at the site. Design and operational mitigation measures taken from the IAQM guidance have been selected based on good practice principles and have been made specific to this site.

1.1.3 The scale and nature of dust mitigation measures detailed within this DMP are commensurate to the risk of dust impact from the site. This DMP combines good practice dust mitigation measures and measures already incorporated into the scheme.

1.1.4 Incorporated and proposed good practice measures are presented in the tables below.

Management Cat.	Description
Phasing of extraction activities	Activities will not be undertaken in dry and windy conditions when wind is blowing towards the sensitive receptors.
Design and location of dust-generating activities	The remaining sand extraction operations will take place below local ground level, to a depth of approx. 10m AOD. Restoration operations will work largely in a south to north direction and will not exceed local ground level at the site boundary and the treeline surrounding site will be maintained, thereby minimising dust egress from site. Stockpiles and exposed areas will be located at least 50 metres away from sensitive receptors where possible and unless restoration is occurring in the immediate area, and will not be located upwind from sensitive receptors in the south west or north west corners of site to prevent dust movement toward nearby sensitive receptors at Green Farm and Rock Cottage, respectively. Stockpiles within the mineral processing area and the restoration material reception area will be largely shielded from prevailing high wind speeds due to the former area being within an enclosed treeline and the latter area being bordered by trees to the north and west / southwest. This configuration will remain for the duration of the development. Dry sand will be placed into elevated bins (150 tonne capacity) bins or stockpiles within the mineral processing area after being washed and sorted. Material storage bays within the restoration material reception area will be surfaced with concrete to prevent damage and scraping.
Provision for dust mitigation measures	Areas close to nearby sensitive receptors at the site boundary perimeter left for long periods of time will be vegetated or covered to minimise dust release. Solid screens shall be erected at the southeast site boundary around Green Farm, where quarry restoration works occur above 50 m AOD and within 30m of Green Farm, to reduce dust egress from site toward Green Farm until such works are complete and the land surface is restored. If necessary, stockpiles of material in the restoration material reception area will be dampened down at the point of processing following delivery and dampened down within the quarry void using mobile water bowser sprinkler systems.

Equipment and vehicles	Conveyors will be used to transport extracted sand and inert materials to and from the quarry void from the respective mineral processing area and the restoration material reception areas removing on-site HGV movements between the two locations. HGV movements within the quarry void will be on compacted ground formed using rollers. The maximum speed limit on site will be 10 mph for all vehicles. All on-site haul road surfaces used to access the mineral processing area and th restoration material reception area will have surfaces with low potential for dust release; A wheelwash will be located approx. 50 m before the exit of the restoration material reception area. All HGVs will be required to pass through the wheelwash before joining The Hollow. The internal access road will be paved. A road sweeper will be deployed, when necessary, to clean the access road (and public highway, if necessary). HGVs delivering inert material and exporting extracted sand will be sheeted over during transportation and before leaving site to minimise escape of dust. A paved parking area and entrance to the restoration material reception area will be used for staff cars and visitors, separate from the HGV entrance.
Planting	Existing woodland/hedgerows along the site boundary perimeter will be retained.

TABLE D1: GOOD PRACTICE MITIGATION – DESIGN MEASURES

Management Category	Description
Management	The site will periodically be audited against the DMP. All dust and air quality complaints will be recorded along with the cause(s) identified. Appropriate measures will be taken to reduce emissions in a timely manner, and will be recorded as per this DMP.
Training	Training will be provided to the site personnel on dust mitigation. Training will cover 'emergency preparedness plans' to react quickly in case of any failure of the planned dust mitigation.
Monitoring	A visual monitoring scheme has been proposed (see below) commensurate with the risk of dust impact from the development site. Auditing of the management and monitoring regime will take place. The frequency of site inspections will increase when the dust risk increases during dry and windy conditions.
Communication	Regular communication with the community surrounding the site is proposed. Meetings with the community will be convened to detail the forthcoming work phases will take place. Information on the performance of the dust management and monitoring audits will be made available to the local community and regular accessible liaison arrangements will be made.
Planning of activities	Where practicable the handling of sand and inert material will not take place during periods of windy weather or during prolonged dry spells unless all agreed measures for dust control are implemented and carried out.
Vehicle movements	All site vehicles/traffic will adhere to the following: • avoid abrupt changes in direction; • regular clearing, grading, compacting and maintenance of haul routes within the quarry void; • HGVs within the quarry void will travel on compacted haul road surfaces; • site enforceable speed limit of 10 mph; • evenly loading vehicles to avoid spillages; • regular application of water via mobile water bowsers with sprinklers in dry conditions; • use paved roads where practicable; and • ensure mobile plant has upward directing exhausts and radiator fan shields, where possible. A wheelwash will be located approx. 50 m before the exit of the restoration material reception area. All HGVs will be required to pass through the wheelwash before leaving site and joining The Hollow. The internal access road to the restoration material reception areas will be paved.
Soil and overburden handling	Any site material stripping and overburden handling activities will be avoided during dry and windy conditions. Drop heights from excavator and dozer buckets to the dumper trucks and from the dumper trucks to the hopper feeding the conveyor will be minimised. During the restoration phase a vibratory compactor roller will be used to compact the material to reduce the potential for dust emission.

Mineral extraction (including drilling and blasting)	There will be no blasting or drilling activities on site.
Mineral processing (crushing and screening)	Extracted sand and inert restoration material will be screened in their respective processing/reception areas which are sheltered from prevailing winds by maintained and existing treelines, away from nearby sensitive receptors. When conditions require, the following measures should be adhered to: • inert material within the quarry void will be damped down prior to processing immediately following delivery; • the restoration material conveyor will be either partially or fully enclosed within housing to minimise dust egress; • screening plant will be used within its design capacity; and • good standards of all plant and equipment will be maintained.
Materials handling	Where visible dust emissions occur and where reasonably practical, transfer points and conveyor discharges will be enclosed. The following measures should be adhered to: • installations will be placed on even alignments with no abrupt changes in grade; • return belt cleaners, with arisings will be collected into a bin or cleaned up; • spillages will be minimised by maintaining structures; • transfer points and conveyor discharges will be enclosed where visible dust emissions occur; • fixed sprays will be established where dust release is observed frequently; • spillages will be cleared to minimise accumulations of loose dry material around the structures; • drop heights will be minimised at feed hoppers and discharges; • the duration of site activities will be controlled and restricted where practicable, particularly during dry windy conditions; • surfaces exposed for large periods will be stored under cover and protected from wind, where practicable; • materials will be frequently dampened using sprays; • hopper load systems will be designed to ensure a good match with truck size, and will be enclose fully on all sides; and • surfaces exposed for large periods will be vegetated where practicable with quick growing plants.

TABLE D2: GOOD PRACTICE MITIGATION – OPERATIONAL MEASURES

1.2 Monitoring: Visual Inspections

1.2.1 The scale and nature of dust mitigation measures detailed within this DMP are commensurate to the risk of dust impact from the development site. Measures have been selected based on good practice principles and have been made specific to this site.

1.2.2 Visual monitoring of dust is recommended throughout the work.

1.2.3 Daily visual inspections, both on- and off-site along haul routes onto the public highway, will be undertaken to ensure that the measures are effective at minimising off-site dust soiling. Surfaces which may display signs of dust soiling are buildings, cars, window sills, lamp posts and other street furniture. All inspection results will be recorded in site logs.

1.2.4 If significant visible dust soiling is observed along the haul route, the frequency of cleaning mitigation measures (such as wet brushing and road sweeping) will be increased to daily. If settled dust or dust plumes from the site are observed off-site, a check of site activities will be undertaken to determine the likely source, and whether dust emissions are still being produced on site. If this is found to be the case, dusty activities will be halted until corrective actions are be taken to prevent or minimise dust emissions. All observations will be recorded in site logs. Any photographic records taken will be kept, recorded and maintained alongside monitoring records.

1.2.5 If dust soiling is observed on a regular basis (three consecutive days), the cause of the soiling will be investigated. If the soiling is determined to be coming from the site, then mitigation measures will be reassessed and updated accordingly to prevent further exceedances.

1.2.6 The results of these inspections will be recorded in site logs and sent to the relevant local authority on request.

1.2.7 If a dust incident is noticed by site personnel during the soiling inspections of surrounding areas undertaken as part of the dust management plan and it is determined that the incident is attributable to the worksite and requires further controls (within industry best practice limits) these will be implemented by the contractor and a report will be produced for inclusion within site logs.

1.3 Roles and Responsibilities

1.3.1 It is recommended that appropriate resources be supplied to cover the dust mitigation requirements and to ensure that the requirements are communicated effectively and acted upon in an appropriate manner. Recommended key roles and responsibilities relating to air quality are detailed below.

1.3.2 The Site Manager should be confirmed prior to start of main site works.

Role	Responsibilities
Site Manager	Ensure that the mitigation and monitoring requirements laid out are carried out during works on site.
	Ensure that staff are aware of the mitigation and monitoring laid out and have access to this information. Regular training of staff should be implemented.
	Undertake and record dust inspections of the site as required.
	Ensure that site documentation (including method statements and risk assessments) includes dust mitigation.
	Act on complaints and dust alerts as required.
	Maintain up-to-date site logs of air quality events and complaints.
	Investigate the cause of air quality events and apply additional mitigation are required.
	Act as the key point of contact for queries and complaints regarding air quality emissions from site.
All Site Personnel	Carry out the works in line with requirements.
	Report observations of dust events or deviations from the requirements.
	Attend environmental management training.

TABLE D3: ROLES AND RESPONSIBILITIES

1.4 Incident and Complaints Procedure

1.4.1 The Site Manager will immediately investigate all dust complaints that are attributed to the worksite. All complaints received will be recorded in site complaint log, investigated and corrective actions implemented and feedback given to the complainant. If it is determined that the complaint is valid or the incident is attributed to the worksite, then further controls (within industry best practice limits) will be implemented and a report will be produced for inclusion in the complaint log.

1.4.2 Site staff will maintain a log of any complaints received, subsequent actions taken to investigate the complaint and any actions which have been put in place to rectify the situation (if found to be necessary). The incident and complaint reporting template overleaf will be used to record complaints, outcomes from visual inspections and actions taken.

1.4.3 A copy of the incident and complaint log will be made available to relevant local authority on request.

Site Exceedance, Dust Incident and Complaint Form					
Reference:		**Date:**		**Time:**	
Incident Type (select as appropriate):		DUST EVENT / COMPLAINT			
DUST					
Location:					
Visible Sign of Dust?		YES/NO			
Description of Incident/Complaint:					
Action Taken:					
Report Filed By:			**Date:**		

TABLE D4: SITE EXCEEDANCE, DUST INCIDENT AND COMPLAINT FORM

APPENDIX F

Transport Statement

Transport Statement

Dudman (Rock Common) Limited,

Rock Common Quarry,

The Hollow,

Washington,

West Sussex,

RH20 3DA

Client:	Dudman (Rock Common) Limited	Ref:	10684
		Date:	Oct 2020

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Schedule of Appendices

Issue	Issue date	Compiled	Checked	Authorised
Draft	2020-08-13	RF	ART	LNS
Draft	2020-09-21	ART	RIN	LNS
Draft	2020-09-30	ART	RIN	LNS
FINAL	2020-10-29	ART	LNS	LNS

Executive Summary

The existing Rock Common Quarry is located to the north of the village of Washington in West Sussex. The site lies to the north of the A283 and to the east of the A24, on either side of a minor public road called The Hollow.

This Transport Statement has been prepared to assess the impact of traffic associated with a proposal to restore the site by importing 2,700,000m^3 of engineering inert restoration material over a period of between 8 to 10 years.

Trips associated with the proposal will either be linked with the restoration or be related to the continued exportation of sand.

Trips associated with the continued extraction and processing of sand will be unchanged from the existing planning permissions covering usage of the site. Access to and from that part of the site area (mineral processing area) will continue to be via the A24/The Hollow junction as required by existing permissions.

Restoration material will be brought to the site by a combination of 20-tonne tippers and a variety of smaller delivery vehicles and offload at a new 'restoration material reception area' to be constructed on land forming part of the former Windmill Landfill site. Deliveries will only be made via the A283/The Hollow access and then use a re-opened existing access for the currently closed Windmill Landfill site which is located 125m to the northwest of the A283/The Hollow junction. Some maintenance work will be required to the Windmill Landfill access to make it suitable for deliveries however this is relatively minor and deliverable.

The sale of sand and the importation of restoration material will be separate operations. The existing export of sand will have access only from the A24/The Hollow access. The proposed importation of inert restoration material will only have access from the A283/The Hollow junction. There will be no conflict between the different usage as a result. Different traffic management plans will be in effect for each usage on site.

The total number of daily movements associated with the importation of the inert restoration material is likely to be 300 daily 2-way movements on average, up to 500 maximum. The number of movements from the associated sales of sand will remain unchanged from the currently permitted usage.

Junction modelling has demonstrated that adopting a worst case, stringent assessment approach, the A283/The Hollow junction would operate well within capacity, with appropriate visibility available in both directions.

This Transport Statement concludes that the development proposals are in accordance with local and national policy from a transport perspective and demonstrates no severe impact to key junctions as a result of the development proposals.

1 Introduction

1.1 This report has been prepared for Dudman (Rock Common) Limited in conjunction with the above development and no responsibility is accepted to any third party for all or part of this study in connection with this or any other development.

1.2 GTA Civils& Transport Ltd has been commissioned by Dudman (Rock Common) Limited to prepare a Transport Statement to investigate and advise on the impacts of the proposed development at Rock Common Quarry on the local and nearby strategic highway networks.

Policy Context

1.3 This Transport Statement has been written in accordance with the following guidance and policy documents:

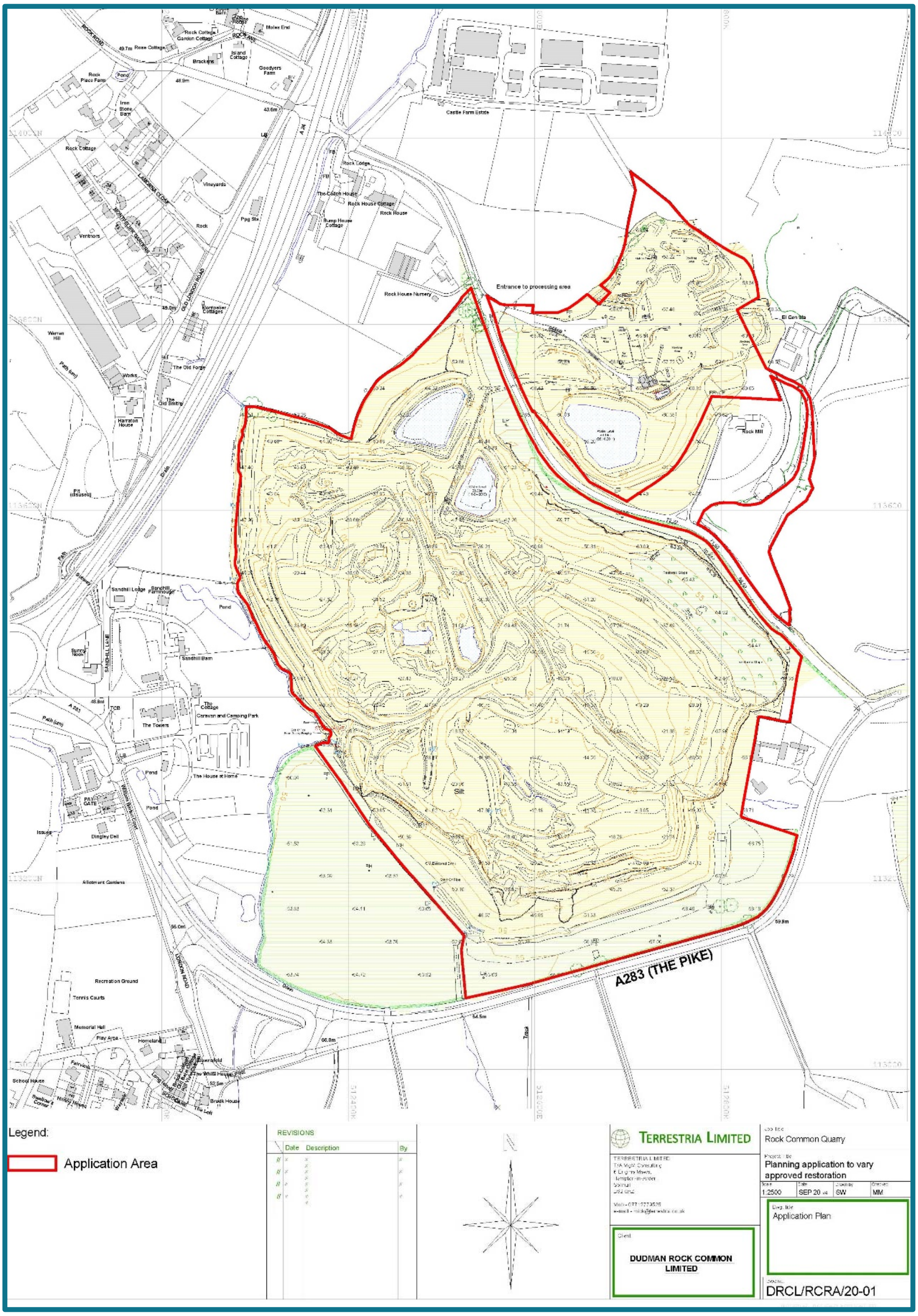
- 2018 National Planning Policy Framework (NPPF);
- 2014 National Planning Policy Guidance (NPPG);
- Manual for Streets 1 & 2 (2007);
- West Sussex County Council's Local Transport Plan;
- West Sussex Joint Minerals Local Plan July 2018;
- West Sussex Waste Local Plan April 2014;
- Horsham District Planning Framework 2015.

2 Site Details

Site Location

2.1 The site is Rock Common Quarry which is to the northeast of the village of Washington in West Sussex. The site is adjacent to a minor road (The Hollow) connecting the A24 and the A283. The site location and existing site layout with an approximate boundary outlined in red is shown in **Figure 2.1**.

Figure 2.1 Aerial View of Existing Sitewith Approximate Site Boundary in Red



Local and Strategic Highway Network

2.2 The A24 forms part of the strategic highway network within West Sussex, connecting Washington to Horsham and the M25 in the north, and Worthing in the South. The A24 also plays a vital role in connecting regional hubs and airports in the surrounding area, notably the A264 to Crawley and Gatwick Airport.

2.3 The A283 heads south east to connect the proposed development to the A27 at Shoreham-bypass via Steyning. The A27 also forms part of the strategic highway network within West Sussex, connecting the A24 to Brighton & Hove and Eastbourne in the east, and Chichester and Portsmouth in the west.

2.4 All parts of Rock Common Quarry are accessed via the Hollow which is a single carriageway road approximately 4.8m wide, connecting to the A24 in the northwest and the A283 in the southeast.

Existing Site Use and Access

2.5 The existing site use is the extraction and processing of sand. The existing Rock Common site is a building sand quarry that is coming towards the end of its life. Sand extraction is undertaken in the southwestern portion of the site and processing of extracted materials in the north-eastern portion of the site.

2.6 Access for the existing quarry usage is limited under planning permission to/from the A24 only. The current condition on application WS/15/97 stipulates that vehicles collecting sand or delivering equipment must access the site via the A24/The Hollow left-in-left-out junction, accessing the site via a short northern section of The Hollow.

2.7 HGVs associated with limited short period sand extraction will continue to use The Hollow/A24.

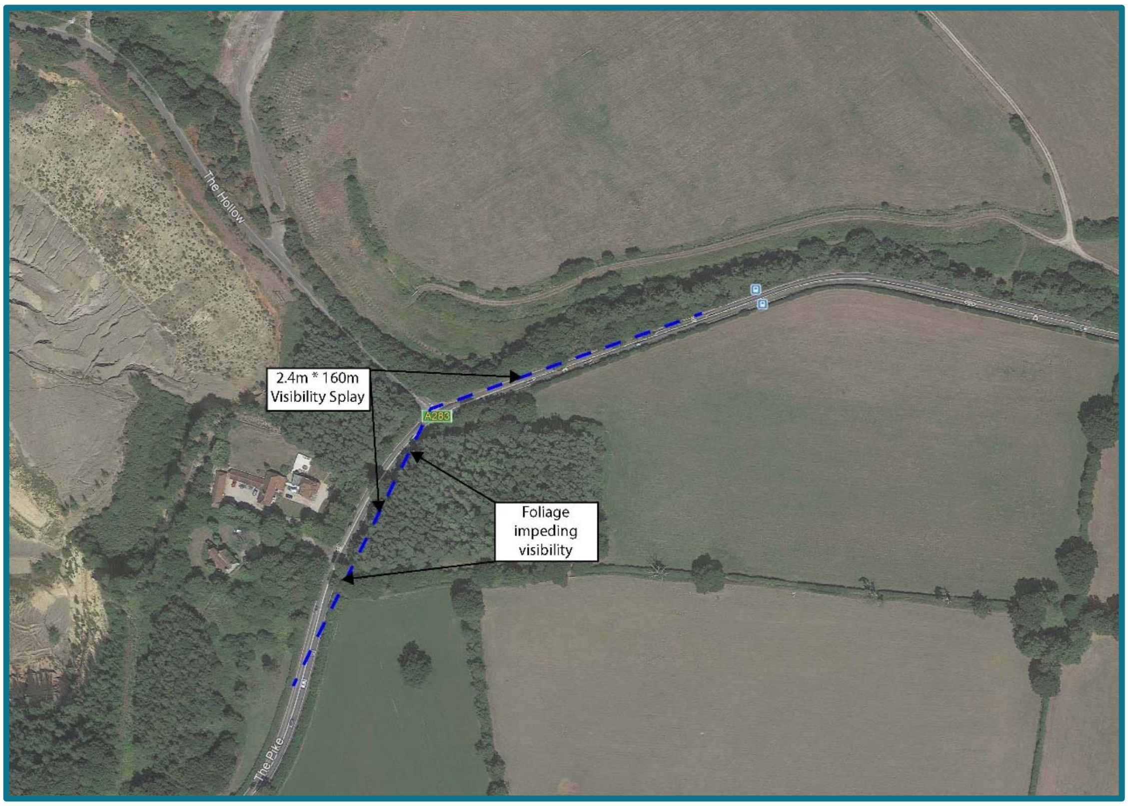
2.8 The proposed site access for the restoration will be via the former Windmill Landfill site access which will be accessed via the A283/The Hollow to the south and is dealt with in detail under Section 3 below.

A283-The Hollow junction

2.9 The A283/The Hollow junction is a simple priority T-junction. The A283 is subject to a 50mph speed limit in this location. The relevant DMRB standards for visibility based upon CD109 Table 2.10 (Mar 2020) are for 2.4m * 160m. The junction including visibility splays are shown below in **Figure 2.2**.

2.10 The visibility looking to the east is achievable to standards. The visibility looking to the west is currently impeded by overgrown foliage on the verge on the south-eastern side of the A283. This is considered to be within the highway boundary, and a highway boundary map has been requested to confirm this. An ATC vehicle speed survey should also be undertaken when conditions are such that WSCC are satisfied that speeds and volumes have returned to nearer 'normal'.

Figure 2.2: A283-The Hollow Junction



Accident Data

2.11 Accident records for the local highway network in the site vicinity were reviewed for the 5 years 2015-2019, using Crashmaps.co.uk. There have been only four recorded accidents over the 5-year period in a 750m radius of the A283/The Hollow junction, all on the A283. More detail is provided below in **Figure 2.3** and **Table 2.1** below. There have been no recorded accidents on The Hollow over the past 5 years.

Figure 2.3: Crash Accident Data

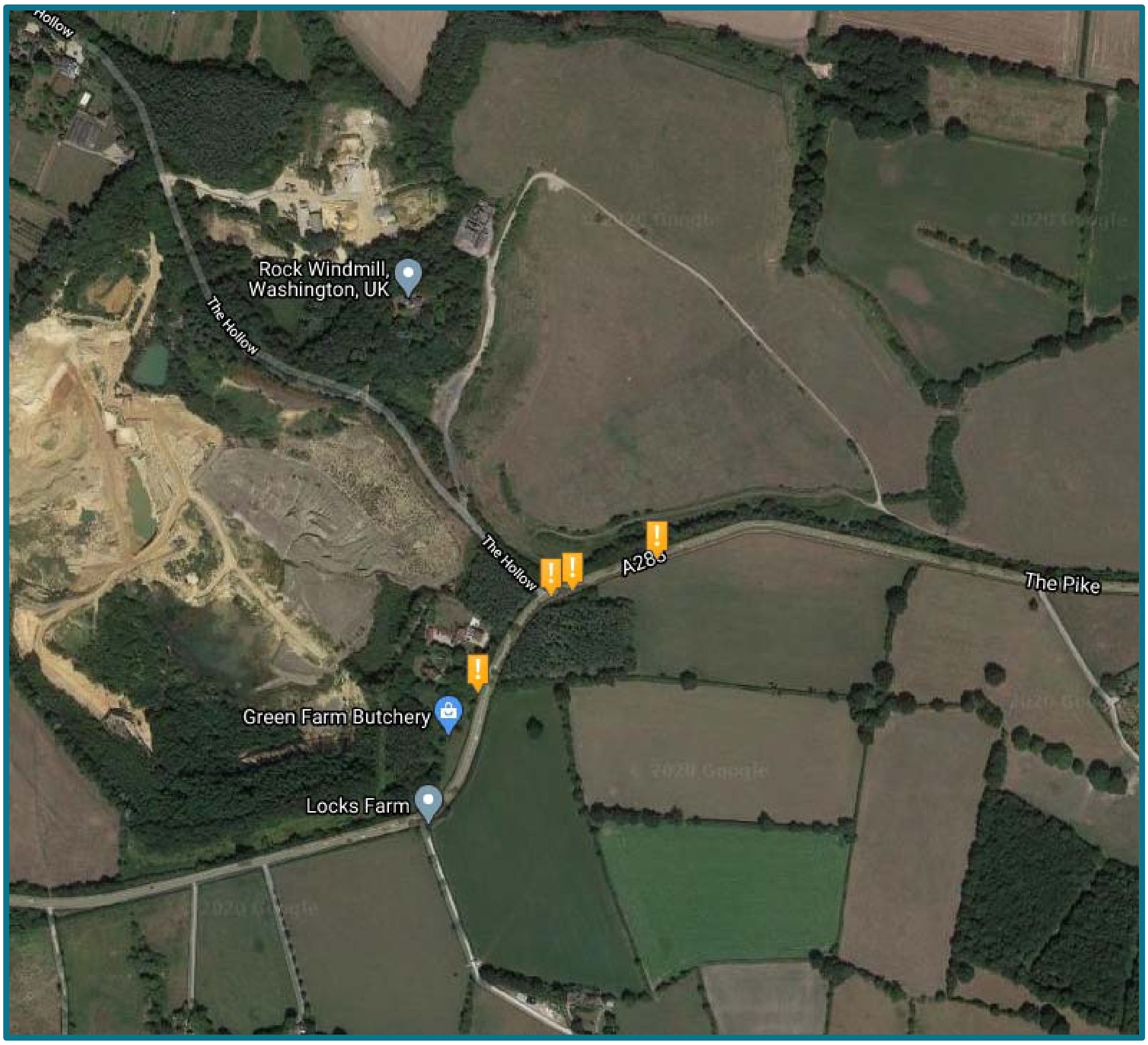


Table 2.1 Recorded Traffic Incidents (2015)

Date	Severity	Location	No. of Vehicles Involved	No. Casualties Involved
24/08/2015	Slight	The Pike (A283)	2	1
01/12/2015	Slight	The Pike (A283)	1	1
30/04/2017	Slight	The Pike (A283)	1	1
24/06/2017	Slight	The Pike (A283)	1	1

2.12 Crashmaps report data is detailed below in **Table 2.2** regarding the incident detailed on Petworth Road. More information is detailed in **Appendix A**.

Table 2.2 Crashmaps Report Data

Date	Incident Details
24/08/2015	Conditions fine but wet or damp road surface. Not at or within 20 metres of junction one car hit another from behind.
01/12/2015	Conditions fine but wet or damp road surface. Not at or within 20 metres of junction and hit the kerb.
30/04/2017	Conditions fine but wet or damp road surface. At a T-junction and hit a fence.
24/06/2017	Conditions fine and dry. At a T-junction and hit a wall.

2.13 Although there were four recorded accidents categorised as 'slight', there is no suggestion that the existing junction layout posses any safety issues. Two of the recorded accidents are greater than 20m from the junction and the other two suggest driver error as the cause of the accident.

3 Proposed development

Proposed Site Use

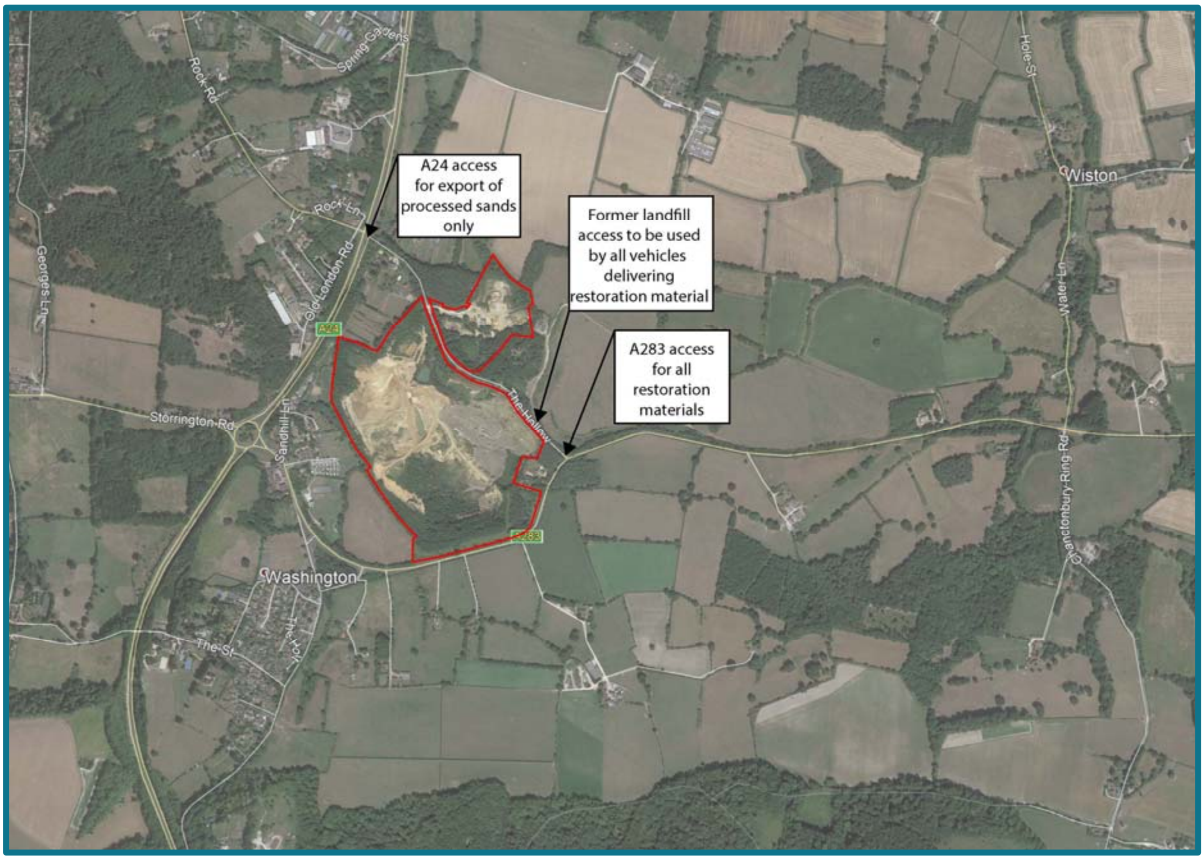
3.1 The proposals are for the importation of inert restoration materials to vary the approved restoration of the quarry. The proposals are for the importation of approximately 2,7000,000m^3 of restoration material with landscaping. The proposed plan is over several full phases, full details including phased working drawings are included with Volume 1 of the Environmental Statement that will accompany this submission.

Proposed Access – Importation of Restoration Material

3.2 All access for importation of restoration materials is to be via the junction of A283 and The Hollow (at its southern end) utilising the former Windmill Landfill site access previously operated by Biffa. Vehicles will use this access to off-load material which will be inspected for suitability and sorted. Material suitable for the restoration of the quarry will be transported via conveyor (which will pass underneath The Hollow using an established conveyor tunnel). Any material that is deemed unsuitable will be removed offsite.

3.3 Existing and proposed access arrangements are shown in **Figure 3.1** with the approximate site boundary shown in red.

Figure 3.1 Existing and Proposed Site Access Arrangements



The Hollow/Landfill Access

3.4 All restoration materials will be brought to the site via the access for the existing, former Windmill Landfill. It is 125m to the northwest of the A283/The Hollow junction.

3.5 The Hollow is derestricted and therefore subject to the national 60mph speed limit. If speeds were that high in practice, such an access would therefore require a visibility splay of 2.4m * 215 as per DMRB CD109 table 2.10 (March 2010). However, given the character, layout and nature of the lane, it is considered highly likely that vehicle speeds will be substantially lower, at about 30mph, in practice, and that appropriate visibility splays can be provided at this access for the actual vehicle speeds. To determine this, an ATC vehicle speed survey should be undertaken when conditions are such that WSCC are satisfied that speeds and volumes have returned to nearer 'normal'.

3.6 It should be noted that this access previously served the Winmill Landfill site, operated by Biffa, with no know issues in accommodating approximately 500 movements per day. The access is not currently in use and has been gated and the north-eastern lane has material within the carriageway preventing usage. To be used for access again this material will need to be removed in addition to plants that have grown on the carriageway. Once the material within the carriageway is removed the access will have two separate lanes, each approximately 4m wide. The planned vehicle and material reception area will provide adequate room for HGV's to turn and leave the site in forward gear. This is shown in **Appendix B**.

3.7 A swept path analysis has been included with the access plan to demonstrate that tipper trucks will be able to safely enter and exit the site onto The Hollow without conflict. The swept path analysis is shown in **Appendix C.**

Proposed Internal Access Arrangements

3.8 The former landfill access from The Hollow will be accessed by HGV's importing restoration material required to restore excavated areas of the quarry. The existing access road from the former landfill access on The Hollow varies from a minimum of 4m to a maximum of 16m. Narrow sections have sufficient forward visibility and the risk of conflict is negligible as adjacent wider section by the access and to the north may be used as passing places. As this was previously in use for HGV's depositing waste material to the landfill there is no reason to expect any issues with a smaller volume of movements resulting from the proposed development.

3.9 The majority (97.5%) of deliveries to the restoration material reception area in the former Windmill Landfill site will be by 20-tonne tipper trucks with the remainder (2.5%) being delivered by various sized smaller trucks. Within the reception area adequate turning room will be provided which will enable the HGV's to enter the site, unload and then turn within the site to re-enter the highway in forward gear. This will allow all internal HGV movements to be undertaken safely and without coming into conflict with any other road users.

3.10 Both the existing sand processing and sales area and the proposed inert restoration material reception area are well located with connections provide either via the A24 for sand sales or the A283 for the importation of inert restoration material.

3.11 The existing access road will be assessed prior to usage to determine what maintenance works may be required to ensure HGV's can use the road without issues. Any maintenance works required should be minimal and limited to removal of undergrowth and repairing any minor damage to the surface to ensure it can be used once again safely by HGV's.

3.12 The swept path analysis in **Appendix C** details the movement of two HGV's and shows a worst-case scenario. This will allow two HGV's to pass, which is required to minimise the risk of possible conflict between entering/exiting HGV's to/from the site.

Proposed Car Parking

3.13 Horsham District Council and West Sussex Council parking standards were interrogated but no formal standards are detailed specifically for this type of development and should therefore be considered on a case-by-case basis.

3.14 Car parking for the proposed development is shown in **Appendix B**. Given the proposed usage it is unlikely that large-scale parking will be required on site.

Proposed Cycle Parking

3.15 Due to the nature of the proposed development, it is likely that the requirement for cycle parking will be minimal. It is proposed that at least 2 cycle spaces will be made available on site to accommodate for local access by cycle.

4 Traffic Generation and Distribution

Existing Site Uses

4.1 The existing planning permission (WS/15/97) permits the extraction and processing of sand. The current planning permission has no limit on the number of vehicles entering of egressing the site for the purpose of exporting processed sand. In addition, the site benefits from three further planning permissions all of which involve additional vehicle movements:

- Planning permission DC/554/05 (WS) allows for the importation of 5,000 tonnes per annum of soils and peat
- Planning permission DC/2151/07 (WS) which allows for the importation of up to 10,000 tonnes per annum of aggregates (for blending)
- Planning permission DC/2319/06 (WS) which allows the continued use of a concrete batching plant (which is situated within the sand processing area), which utilises sand from the quarry in addition to imported aggregate and cement

4.2 Although the existing site generates a number of trips, these journeys will all access the site via the A24-The Hollow junction and are not permitted to access the site from the A283-The Hollow access.

4.3 When operational, the Windmill landfill site generated over 500 movements a day. These stopped some time ago (2004). It should be noted that the proposed site access strategy of restoration materials being transported via the A283/The Hollow junction and The Hollow-Landfill access junction is identical to the 500 daily movements previously associated with the Landfill, with no known issues.

Proposed Site Uses – Traffic Generation

4.4 The restoration proposed would require the importation of approximately 2,700,000m^3 of inert restoration material. It is proposed that up to 345,000m^3 of restoration material will be imported annually with the total importation being complete within 8 to 10 years.

4.5 In the Request For Scoping Opinion it was estimated that this could involve up to 500 lorry movements on an average day. The Scoping Opinion suggested that a maximum, as well as average, should be considered.

4.6 We have reviewed the likely number of lorry movements. 97.5% of the traffic importing the inert restoration material will be 20-tonne load bearing tippers each carrying about 9m^3 of compacted inert restoration material. The remaining 2.5% of journeys will be completed by various sized tippers carrying an average of about 4m^3 of compacted material.

4.7 Calculations for the transport of material are provided below (264 days represents 5.5 days over 48 operational weeks per year):

- 345,000m^3 * 97.5% = 336,375m^3 / 9m^3 =37,375 inbound trips per annum/264 days = 142 2-way trips per day
- 345,000m^3 * 2.5% = 8,500m^3 / 4m^3 = 2,125 inbound trips per annum / 264 days = 8 2-way trips per day

4.8 These are averages, taking into account the full lorry load potential and what is likely to be realised. A total of 150 inbound trips (300 total 2 way) would then be produced per day by 142daily * 20-tonne tipper trucks and 8 daily * various sized tipper trucks (with capacity of 4m^3). The schedule of these movements is detailed below in **Table 3.1**.

Table 3.1 Daily HGV Trips

Size of vehicle	No. of daily loads	No. of daily movements	Days/times of operation	Period
20 tonnes	142	284	Monday – Friday (0700-1800) Saturday (0700-1300)	8 years (96 months)
Various (capacity of 4m^3)	8	16	Monday – Friday (0700-1800) Saturday (0700-1300)	8 years (96 months)

4.9 The Scoping Opinion estimate of 500 lorry 2=way movements per day is therefore likely to represent the maximum.

4.10 Additionally, it is estimated that up to 10% of material brought to site will be screened and crushed before being taken off site, this will already be accounted for as they would be "return loads" and thus not an additional trip.

4.11 The assessment of the A283/The Hollow junction has been based on the average of 300 2-way movements per day.

Proposed Site Uses – Traffic Generation

4.12 The A24 provides connections to the M25 and London and A264 for Crawley and Gatwick in the north and A27 for Portsmouth in the west and Brighton and Hove in the east. The A264 also provides connections to the M23.

4.13 All vehicles exiting the restoration material reception area will leave via the junction of The Hollow/A283 and head southbound towards the Washington Roundabout. It is here that the A283 connects to the A24, allowing vehicles to head north for Horsham/M25 via the A24, south for Worthing and A27 west via the A24 or east for Shoreham, providing connections to Brighton & Hove in the east.

4.14 All drivers should be briefed in advance that they may only use the A283-The Hollow junction in order to make deliveries. In order to aid with this the possibility of signage being placed at the A24-The Hollow junction should be explored to clearly indicate no access for restoration material deliveries. Additional measures such as CCTV at the A24-The Hollow junction and GPS tracking of deliveries should also be explored to ensure all deliveries use the approved delivery route. Drivers will also be instructed in advance to maintain speeds of below 30mph when on The Hollow to ensure safety.

4.15 Where practical all delivery drivers should be asked to enter the site from the west. This will lower the number of right turns into the A283-The Hollow junction. Whilst it is recognised this will not be practical for all deliveries it should be encouraged where possible.

5 Assessment of A283/The Hollow Junction

5.1 In order to assess the viability of the A283/The Hollow Junction a Junctions 9 (PICADY) model has been created.

5.2 The Junctions 9 (PICADY) model covers the AM peak (0800-0900) and PM peak (1700-1800) as these are the busiest periods on the road and mostly likely to be impacted by the movements associated with the proposed development.

5.3 Given the current national situation relating to the Covid-19 virus new ATC surveys are not currently possible to assess traffic volumes as vehicle movements are likely to be lower than normal and thus not a realistic representation of movements. As such existing movements on the Hollow have been estimated.

5.4 It should be noted that the previous Windmill Landfill usage which had the same access strategy had 500 daily movements associated compared to only 300 daily movements for the proposed inert restoration material delivery.

5.5 The Junctions 9 (PICADY) model uses the following parameters:

- East and westbound movements for the A283 come from data acquired from WSCC from their permanent traffic monitoring programme of strategic roads (Site number: 00000035, Site Reference: A0283120L0). This data has been recorded in 2019, for a conservative assessment the 7-day average movements for neutral months (Apr, May, Jun, Oct & Sept) have been used. The data available only had daily traffic figures, for a stringent assessment it has been assumed that 15% of daily traffic is in the AM peak (0800-0900) and PM peak (1700-1800). HGVS are 4% of vehicle movements as per WSCC survey data. The full Survey data can be found contained within in **Appendix D**
- Tempro growth factor from 2019 to 2028 to represent future growth until the end of the 8-year delivery period. (growth factor is for Horsham District, Rural trunk roads). AM peak growth: 1.1357. PM peak growth: 1.1374
- With 300 2-way daily delivery movements, and site weekday operation from 0700-1800, this would equate to 25 deliveries per hour. This (with rounding) equates to 13 arrivals and 13 departures. Although all are expected to arrive from and depart towards the roundabout junction of the A283 and the A24, a worst case assessment of junction performance has been carried out, assuming inbound lorries all turn right into the Hollow and outbound lorries turn right out onto the A283.
- Other traffic movements for The Hollow have been estimated as there is no available existing count data. For a robust assessment it is assumed that there will be 100 movements in and out of The Hollow in the AM and PM peak (distributed as 50% east and 50% west). This is likely to be significantly in excess of the actual movements to and from The Hollow and has been used as a stringent assessment.

5.6 The Junctions 9 (PICADY) Model results are shown below in **Table 4.2**.

Table 4.2: Junctions 9 (PICADY) model results for A283-The Hollow junction

	AM Peak (0800-0900)			PM Peak (1700-1800)		
	Queue (PCU)	Delay (s)	*RFC	Queue (PCU)	Delay (s)	*RFC
The Hollow	**0.8**	**24.13**	**0.44**	**0.8**	**24.19**	**0.44**
A283	**1.0**	**5.18**	**0.27**	**1.0**	**5.18**	**0.27**

5.7 The model results indicate that with the stringent assessment as set out in paragraph 4.5, the junction would operate well within capacity with a maximum RFC of 0.44 on The Hollow in the AM and PM peak. There should be no concerns in relation to the capacity of this junction relating to the movements from the proposed development. The full Junctions 9 (PICADY) model results can be found contained **in Appendix E**.

***RFC= Ratio of Flow to Capacity, 1.00 is complete saturation of junction, RFC's of 0.85 and above represent a junction which will begin to experience congestion due to traffic volumes.**

6 Conclusion

6.1 Rock Common Quarry is an operational sand quarry located north and south of The Hollow to the northeast of Washington in West Sussex. The proposed development is for the importation of 2,700,000m^3 of inert engineering material necessary to ensure a safe and sustainable restoration of the quarry. It is proposed that up to 345,000m3 of material will be imported per annum.

6.2 This proposal includes both the continued use of the existing access serving the sand processing area plus the re-opening and use of the existing access that previously served the now closed Windmill Landfill.

6.3 Restoration material will be imported to a “restoration material reception area” (to be created within the former Windmill Landfill Site) making use of an existing access which was previously used for the Windmill Landfill. This access is located approximately 125m to the northwest of the A283/The Hollow junction. Sand will continue to be processed and exported from the existing processing area using the permitted access which is some 275m southeast of the junction of The Hollow/A24. It is proposed that all traffic importing restoration material will use the A283/The Hollow Junction and then The Hollow/Landfill Access. This will avoid conflict between the importation of restoration material and the existing sand production usage.

6.4 Previously the Landfill access was used for approximately 500 2-way movements associated with the previous Landfill usage which ceased operation in 2004. As such with appropriate restoration it should be suitable for the proposed development which will generate on average approximately 300 2-way movements, with a potential maximum of 500.

6.5 Modelling of the A283/The Hollow junction demonstrates that with a stringent assessment the junction operates well within capacity.

6.6 This Transport Statement concludes that the development proposals are in accordance with local and national policy from a transport perspective and demonstrates that with minor improvements to visibility of the A283-The Hollow junction and appropriate restoration works to The Hollow-Landfill access junction there will be no severe impact results from the proposals. Therefore, there is not considered to be a reason to refuse the planning application on transport grounds.

- End of Report -

Appendix A

Crash Map Reports

crashmap.co.uk

Crash Date:	Monday, August 24, 2015	**Time of Crash:**	2:15:00 PM	**Crash Reference:**	**2015471504872**

Highest Injury Severity:	Slight	**Road Number:**	A283	**Number of Casualties:**	1
Highway Authority:	West Sussex			**Number of Vehicles:**	2
Local Authority:	Horsham District			**OS Grid Reference:**	512890 113284
Weather Description:	Fine without high winds				
Road Surface Description:	Wet or Damp				
Speed Limit:	50				
Light Conditions:	Daylight: regardless of presence of streetlights				
Carriageway Hazards:	None				
Junction Detail:	Not at or within 20 metres of junction				
Junction Pedestrian Crossing:	No physical crossing facility within 50 metres				
Road Type:	Single carriageway				
Junction Control:	Not Applicable				

For more information about the data please visit: *www.crashmap.co.uk/home/Faq*
To subscribe to unlimited reports using CrashMap Pro visit *www.crashmap.co.uk/Home/Premium_Services*

powered by agilysis

Vehicles involved

Vehicle Ref	Vehicle Type	Vehicle Age	Driver Gender	Driver Age Band	Vehicle Maneouvre	First Point of Impact	Journey Purpose	Hit Object - On Carriageway	Hit Object - Off Carriageway
2	Car (excluding private hire)	1	Male	36 - 45	Vehicle proceeding normally along the carriageway, not on a bend	Back	Other	None	None
1	Car (excluding private hire)	11	Female	36 - 45	Vehicle proceeding normally along the carriageway, not on a bend	Front	Commuting to/from work	None	None

Casualties

Vehicle Ref	Casualty Ref	Injury Severity	Casualty Class	Gender	Age Band	Pedestrian Location	Pedestrian Movement
1	1	Slight	Driver or rider	Female	36 - 45	Unknown or other	Unknown or other

crashmap.co.uk

Crash Date:	Tuesday, December 01, 2015	**Time of Crash:**	6:56:00 AM	**Crash Reference:**	**2015471507399**
Highest Injury Severity:	Slight	**Road Number:**	A283	**Number of Casualties:**	1
Highway Authority:	West Sussex			**Number of Vehicles:**	1
Local Authority:	Horsham District			**OS Grid Reference:**	513076 113428

Weather Description: Fine without high winds

Road Surface Description: Wet or Damp

Speed Limit: 60

Light Conditions: Darkness: no street lighting

Carriageway Hazards: None

Junction Detail: Not at or within 20 metres of junction

Junction Pedestrian Crossing: No physical crossing facility within 50 metres

Road Type: Single carriageway

Junction Control: Not Applicable

For more information about the data please visit: *www.crashmap.co.uk/home/Faq*
To subscribe to unlimited reports using CrashMap Pro visit *www.crashmap.co.uk/Home/Premium_Services*

crashmap.co.uk

Vehicles involved

Vehicle Ref	Vehicle Type	Vehicle Age	Driver Gender	Driver Age Band	Vehicle Maneouvre	First Point of Impact	Journey Purpose	Hit Object - On Carriageway	Hit Object - Off Carriageway
1	Car (excluding private hire)	-1	Male	21 - 25	Vehicle proceeding normally along the carriageway, not on a bend	Front	Journey as part of work	Kerb	None

Casualties

Vehicle Ref	Casualty Ref	Injury Severity	Casualty Class	Gender	Age Band	Pedestrian Location	Pedestrian Movement
1	1	Slight	Driver or rider	Male	21 - 25	Unknown or other	Unknown or other

Crash Date:	Sunday, April 30, 2017	**Time of Crash:**	5:00:00 PM	**Crash Reference:**	**2017471702382**

Highest Injury Severity:	Slight	**Road Number:**	A283	**Number of Casualties:**	1
Highway Authority:	West Sussex			**Number of Vehicles:**	1
Local Authority:	Horsham District			**OS Grid Reference:**	512986 113394
Weather Description:	Raining without high winds				
Road Surface Description:	Wet or Damp				
Speed Limit:	50				
Light Conditions:	Daylight: regardless of presence of streetlights				
Carriageway Hazards:	None				
Junction Detail:	T or staggered junction				
Junction Pedestrian Crossing:	No physical crossing facility within 50 metres				
Road Type:	Single carriageway				
Junction Control:	Give way or uncontrolled				

For more information about the data please visit: *www.crashmap.co.uk/home/Faq*
To subscribe to unlimited reports using CrashMap Pro visit *www.crashmap.co.uk/Home/Premium_Services*

Vehicles involved

Vehicle Ref	Vehicle Type	Vehicle Age	Driver Gender	Driver Age Band	Vehicle Maneouvre	First Point of Impact	Journey Purpose	Hit Object - On Carriageway	Hit Object - Off Carriageway
1	Car (excluding private hire)	6	Male	21 - 25	Vehicle proceeding normally along the carriageway, not on a bend	Nearside	Other	None	Wall or fence

Casualties

Vehicle Ref	Casualty Ref	Injury Severity	Casualty Class	Gender	Age Band	Pedestrian Location	Pedestrian Movement
1	1	Slight	Driver or rider	Male	21 - 25	Unknown or other	Unknown or other

crashmap.co.uk

Crash Date:	Saturday, June 24, 2017	**Time of Crash:**	11:18:00 AM	**Crash Reference:**	**2017471703706**
Highest Injury Severity:	Slight	**Road Number:**	A283	**Number of Casualties:**	1
Highway Authority:	West Sussex			**Number of Vehicles:**	1
Local Authority:	Horsham District			**OS Grid Reference:**	512963 113387
Weather Description:	Fine without high winds				
Road Surface Description:	Dry				
Speed Limit:	50				
Light Conditions:	Daylight: regardless of presence of streetlights				
Carriageway Hazards:	None				
Junction Detail:	T or staggered junction				
Junction Pedestrian Crossing:	No physical crossing facility within 50 metres				
Road Type:	Single carriageway				
Junction Control:	Give way or uncontrolled				

For more information about the data please visit: *www.crashmap.co.uk/home/Faq*
To subscribe to unlimited reports using CrashMap Pro visit *www.crashmap.co.uk/Home/Premium_Services*

Vehicles involved

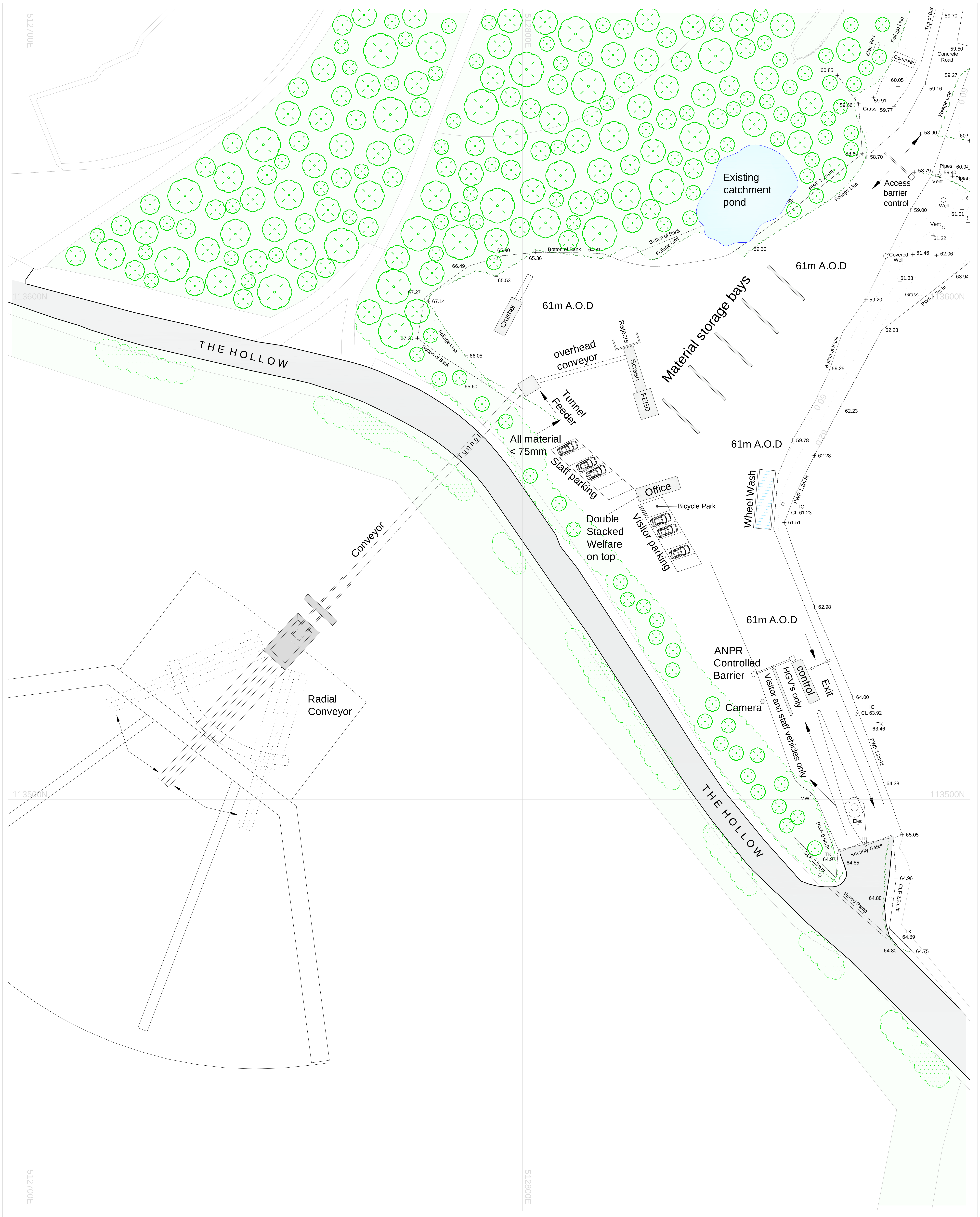
Vehicle Ref	Vehicle Type	Vehicle Age	Driver Gender	Driver Age Band	Vehicle Maneouvre	First Point of Impact	Journey Purpose	Hit Object - On Carriageway	Hit Object - Off Carriageway
1	Car (excluding private hire)	15	Male	26 - 35	Vehicle proceeding normally along the carriageway, on a right hand bend	Front	Other	None	Wall or fence

Casualties

Vehicle Ref	Casualty Ref	Injury Severity	Casualty Class	Gender	Age Band	Pedestrian Location	Pedestrian Movement
1	1	Slight	Driver or rider	Male	26 - 35	Unknown or other	Unknown or other

Appendix B

Materials Reception Area Layout



Legend:

SCALE BAR

0 10 20 50

REVISIONS

Date	Description	By
//	//	//
//	//	//
//	//	//
//	//	//

N

TERRESTRIA LIMITED

TERRESTRIA LIMITED
T/A MgM Consulting
6 Engine Mews,
Hampton-in-Arden,
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B92 0AZ

Mob - 07712779525
e-mail - mick@terrestria.co.uk

Client

DUDMAN ROCK COMMON LIMITED

Job Title
ROCK COMMON QUARRY

Project Title
Planning application to vary approved restoration

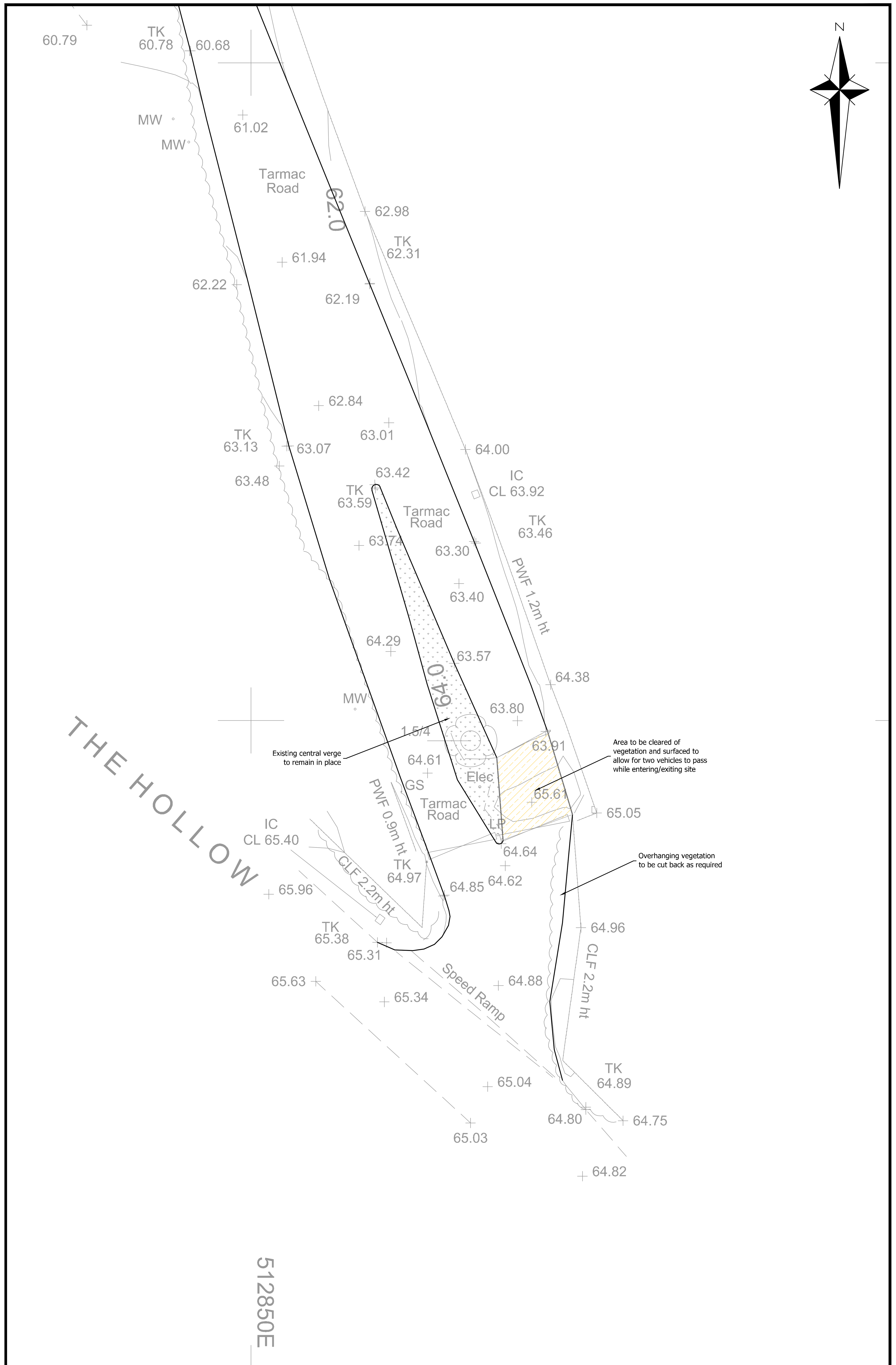
Scale	Date	Drawn by	Checked
1:500@A2	SEP 2020	SW	MM

Dwg. title
Layout of proposed restoration material reception area

DWG No.
DRCL/RCRA/WP-02

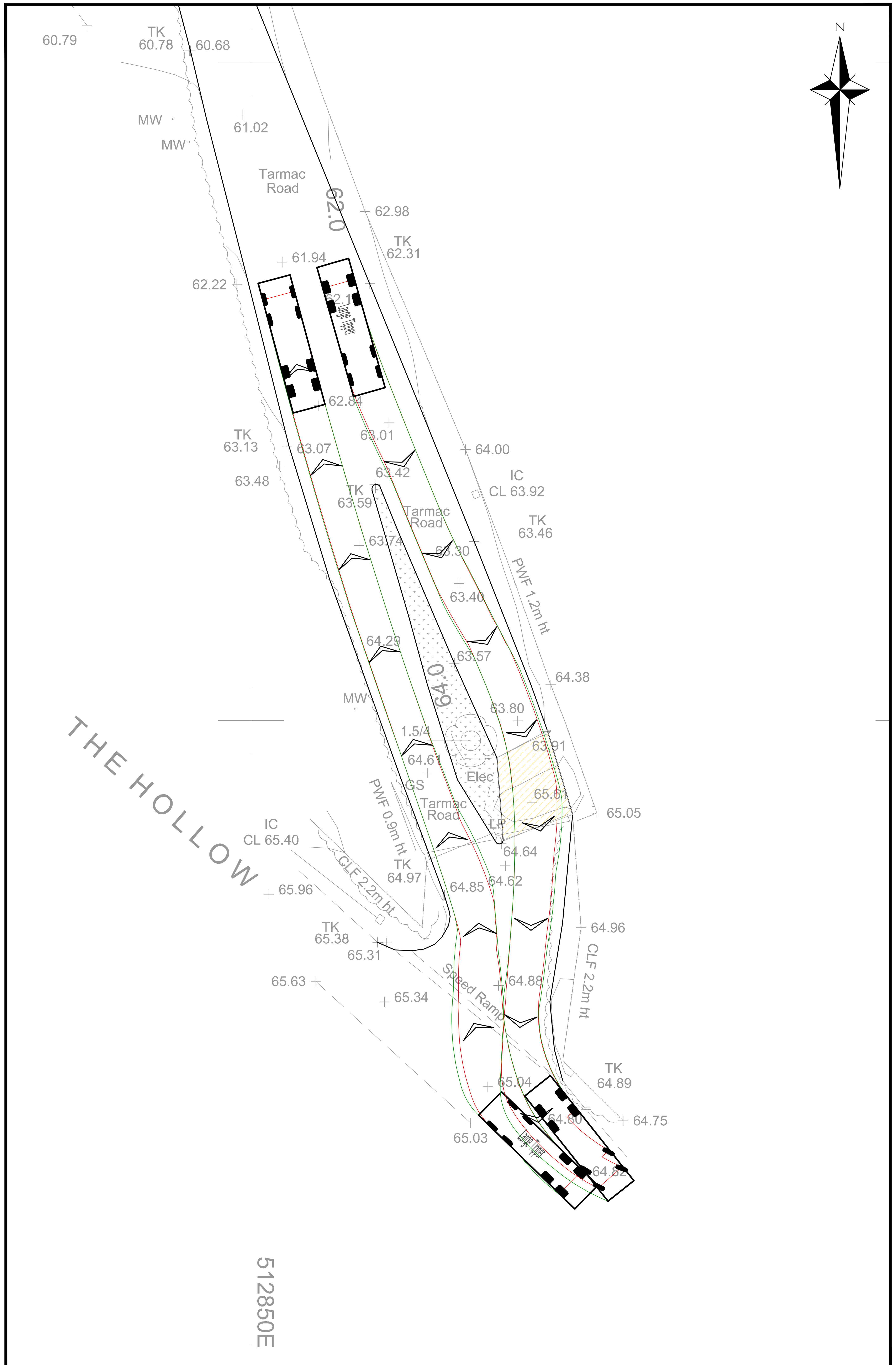
Appendix C

HGV Swept Path Analysis for Landfill Access



LAYOUT

1:200



VEHICLE TRACKING

1:200

GENERAL NOTES

1. The location, size, depth and identification of existing services that may be shown or referred to on this drawing have been assessed from non intrusive observations , record drawings or the like. The contractor shall safely carry out intrusive investigations, trial holes or soundings prior to commencing work to satisfy himself that it is safe to proceed and that the assessments are accurate. any discrepancies shall be notified to gta prior to works commencing.

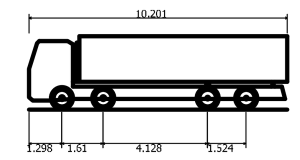
2. Tender or billing drawings shall not be used for construction or the ordering of materials.

3. Do not scale. All dimensions and levels to be site confirmed.

4. This drawing shall be read in conjunction with all relevant architects, consultants drawings and specifications, together with H&S plan requirements.

5. Copyright : This drawing must not be copied, amended nor reproduced without the prior written agreement of gta.

6. All drawings specifications and recommendations made by gta are subject to Local Authority and other relevant Statutory Authorities approval. Any works or services made abortive due to the client proceeding prior to these approvals is considered wholly at the Clients risk. gta hold no responsibility for resulting abortive works or costs.



Large Tipper	
Overall Length	10.201m
Overall Width	2.500m
Overall Body Height	2.893m
Min Body Ground Clearance	0.343m
Max Track Width	2.500m
Lock to lock time	6.00s
Kerb to Kerb Turning Radius	11.550m

Vehicle wheels outline

Vehicle Body envelope

Rev	Amendments	Date	Dsn	Chk
P1	INITIAL ISSUE	16.07.2020	JMW	RF

Status: FOR PLANNING

Client: DUDMAN AGGREGATES LIMITED

Architect:

Project: THE HOLLOW, WASHINGTON WEST SUSSEX

Title: ACCESS AND TRACKING PLAN

Date	Scale @ A1
JULY 2020	1:200

Clients Ref.	Project Ref.
	10684

gta Civils & Transport

Gloucester House, 66a Church Walk, Burgess Hill, West Sussex, RH15 9AS
Tel.01444 871444 Web: www.gtacivils.co.uk

Drawing Number	Rev.
10684/101	P1

Appendix D

WSCC Survey Data for A283

Site Numb 00000035 Site Refere A0283120L01 Grid Ref 516721,112537
STEYNING A283 WASHINGTON ROAD, WEST OF B2135
Vehicle Count Report Year 2019 Channel: Eastbound

	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Ave.	7-Day Ave.
24 Dec									
31 Dec		3320	5864	6623	6935	4755	4039	5686	5317
7 Jan	7066	7568	7645	7570	7834	5266	4219	7537	6738
14 Jan	7390	7767	7921	7875	7812	4976	4201	7753	6849
21 Jan	7263	7810	7657	7708	7696	5305	4150	7627	6798
28 Jan	7596	7875	8056	7476	6293	5532	4489	7459	6760
4 Feb	7340	8069	7767	8040	9008	5523	3878	8045	7089
11 Feb	7813	8074	8462	8135	8486	5379	4746	8194	7299
18 Feb	6962	7736	7860	8027	8071	5852	5294	7731	7115
25 Feb	7949	8245	8478	7958	8105	6272	4115	8147	7303
4 Mar	7826	8134	8071	8234	8124	5529	4359	8078	7182
11 Mar	7986	7560	8082	7952	7869	5277	4831	7890	7080
18 Mar	7648	7921	8234	8098	8311	5919	5707	8042	7405
25 Mar	7797	8282	8441	8328	8576	7089	5873	8285	7769
1 Apr	7684	7990	8192	7865	8101	5916	5153	7966	7272
8 Apr	7348	7155	8095	8005	8275	6630	5470	7776	7283
15 Apr	7588	8119	8111	8315	6049	6343	5196	7636	7103
22 Apr	5852	8011	8423	8451	8243	6076	5180	7796	7177
29 Apr	7843	8411	8981	8660	8428	5984	5581	8465	7698
6 May	5234	8252	8183	8275	8544	6102	5670	7698	7180
13 May	7797	8299	8650	7784	8371	5989	5162	8180	7436
20 May	7835	8337	8766	8856	8702	6200	6516	8499	7887
27 May	6571	7975	8337	8272	8202	6545	5593	7871	7356
3 Jun	7946	8036	8339	8406	7937	5813	5599	8133	7439
10 Jun	7227	8500	8267	8332	8384	6332	5300	8142	7477
17 Jun	8118	8110	8453	8502	8967	6294	5397	8430	7692
24 Jun	7921	8485	9135	9187	8931	6197	5339	8732	7885
1 Jul	8111	8317	8782	8997	9039	6458	5171	8649	7839
8 Jul	7898	8181	8430	8518	8442	6567	6065	8294	7729
15 Jul	8189	8322	8448	8142	7946	5684	5253	8209	7426
22 Jul	7523	8182	8305	8063	8072	5591	5754	8029	7356
29 Jul	7827	7614	8169	8268	8553	5901	5295	8086	7375
5 Aug	7272	7628	7885	8005	7590	5426	5187	7676	6999
12 Aug	7237	7876	7326	8007	7520	5951	5097	7593	7002
19 Aug	7262	7731	8404	8509	8438	6704	6156	8069	7601
26 Aug	5978	7725	7720	8152	7939	6083	5705	7503	7043
2 Sep	7664	7753	7899	8135	8005	5180	5366	7891	7143
9 Sep	7630	8077	7885	8295	8072	5409	4959	7992	7190
16 Sep	7493	8046	8533	8288	8488	7606	4368	8170	7546
23 Sep	7831	7516	8368	8009	7979	6075	4277	7941	7151
30 Sep	7576	7821	8359	8015	8074	6059	4990	7969	7271
7 Oct	7868	7695	8277	8165	7814	5676	4569	7964	7152
14 Oct	7570	8064	8226	8251	8100	5604	4694	8042	7216
21 Oct	7558	8058	8102	7716	8081	5433	4988	7903	7134
28 Oct	7322	7950	7768	7399	7454	4599	4751	7579	6749
4 Nov	7784	7902	8394	8277	8245	5608	4588	8120	7257
11 Nov	7568	7939	8146	8087	7805	5578	4487	7909	7087
18 Nov	7739	7970	8101	8206	8175	5506	4971	8038	7238
25 Nov	7502	7827	8355	8194	8018	5655	4623	7979	7168
2 Dec	7826	8022	8795	8102	7970	5895	4870	8143	7354
9 Dec	8109	8014	8260	8013	8016	5594	4247	8082	7179
16 Dec	7591	7964	8172	7946	9326	5591	4800	8200	7341
23 Dec	7956	5222	2587	3505	5098	4503	4096	4874	4710
30 Dec	5084	4589						4836	

Site Numb 00000035 Site Refere A0283120L01 Grid Ref 516721,112537
STEYNING A283 WASHINGTON ROAD, WEST OF B2135
Vehicle Count Report Year 2019 Channel: Westbound

	Mon	Tue	Wed	Thu	Fri	Sat	Sun	5-Day Ave.	7-Day Ave.
24 Dec									
31 Dec		3582	5982	7001	7148	4955	4689	5928	5612
7 Jan	7445	8179	8586	8462	8282	5316	4389	8191	7237
14 Jan	7884	8316	8471	8597	8369	5138	4389	8327	7309
21 Jan	7789	8445	8258	8250	8220	5434	4353	8192	7250
28 Jan	7708	8029	8495	7732	6432	5038	4282	7679	6817
4 Feb	7513	8158	8350	8533	7862	5552	4054	8083	7146
11 Feb	8132	8548	8877	8684	8801	5575	5016	8608	7662
18 Feb	7495	8569	8656	8611	8660	6055	5478	8398	7646
25 Feb	8686	9016	9252	10663	8791	6175	4340	9282	8132
4 Mar	8402	8974	8739	8999	8683	5717	4507	8759	7717
11 Mar	8568	8120	8822	8654	8537	5363	4912	8540	7568
18 Mar	8232	8555	8947	8804	8943	6070	5944	8696	7928
25 Mar	8567	8965	9161	9004	9342	6947	6028	9008	8288
1 Apr	8395	8652	8837	8487	8920	6147	5436	8658	7839
8 Apr	8087	8033	8799	8835	8882	6392	5549	8527	7797
15 Apr	9053	8748	9287	9571	6212	6216	5237	8574	7761
22 Apr	5697	8661	9445	9294	9300	6398	5406	8479	7743
29 Apr	8923	9630	9760	9631	9537	6335	5602	9496	8488
6 May	5254	9236	9190	9073	9627	6248	5736	8476	7766
13 May	8748	9220	9425	9077	9068	6254	5159	9108	8136
20 May	8665	9279	9660	9664	10432	7422	6504	9540	8804
27 May	5850	9319	9436	9754	9877	6511	5458	8847	8029
3 Jun	8629	8781	9101	9299	8751	6027	5522	8912	8016
10 Jun	8037	9352	8912	9105	9573	6490	5307	8996	8111
17 Jun	8959	8958	9125	9358	9997	6406	5400	9279	8315
24 Jun	8388	9274	9852	9922	9857	6525	5443	9459	8466
1 Jul	8594	8984	9560	9875	9856	6553	5187	9374	8373
8 Jul	8713	9057	9179	9771	9485	7118	5926	9241	8464
15 Jul	8549	9284	9361	9308	9073	5819	5489	9115	8126
22 Jul	8345	8833	9077	8921	8882	5867	6182	8812	8015
29 Jul	8540	8203	8889	8924	9051	6007	5555	8721	7881
5 Aug	7947	8334	8644	8842	8163	5646	5333	8386	7558
12 Aug	7555	8556	7759	8646	8116	6155	5167	8126	7422
19 Aug	7855	8484	8866	9368	9227	6807	6125	8760	8105
26 Aug	5548	8317	8444	9158	8618	6291	5544	8017	7417
2 Sep	8330	8438	8523	8824	8731	4831	5545	8569	7603
9 Sep	8452	8839	8729	9140	9071	4992	4450	8846	7668
16 Sep	8260	9210	9269	8946	9353	7049	4370	9008	8065
23 Sep	8570	8614	8904	8723	8496	6258	4429	8661	7713
30 Sep	8177	8500	8962	8680	8552	6062	5164	8574	7728
7 Oct	8082	10084	8909	8865	8528	5749	4685	8894	7843
14 Oct	8422	8825	8689	8902	8746	5888	4856	8717	7761
21 Oct	8112	8807	8716	8405	8752	5540	5147	8558	7640
28 Oct	7807	8187	8378	8010	7940	4578	4870	8064	7110
4 Nov	8635	8829	9041	8888	8878	5754	4685	8854	7816
11 Nov	8318	8552	9043	8861	8415	5723	4682	8638	7656
18 Nov	8439	8721	8988	8800	8810	5553	5008	8752	7760
25 Nov	8123	8439	8763	8725	8824	5606	4904	8575	7626
2 Dec	8441	8553	9828	8844	8378	6033	4801	8809	7840
9 Dec	8549	8432	8825	8471	8489	5716	4344	8553	7547
16 Dec	8156	8557	8879	8487	9838	5669	5135	8783	7817
23 Dec	7262	5282	2733	3708	5171	4596	4158	4831	4701
30 Dec	5373	4615						4994	

Appendix E

Junctions 9 (PICADY) for A283-The Hollow

Junctions 9

PICADY 9 - Priority Intersection Module

Filename: A283-The Hollow.j9
Path: W:\Projects\10684 TS Dudman Rock Common, The Hollow, Washington\2.8 Project Data\C. Misc\Junctions 9 Models
Report generation date: 21/09/2020 19:46:48

»2028, AM
»2028, PM

Summary of junction performance

	AM			PM		
	Queue (PCU)	Delay (s)	RFC	Queue (PCU)	Delay (s)	RFC
	2028					
Stream B-AC	0.8	24.13	0.44	0.8	24.19	0.44
Stream C-AB	1.0	5.18	0.27	1.0	5.18	0.27

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle.

File summary

File Description

Title	(untitled)
Location	
Site number	
Date	21/09/2020
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Enumerator	GTACIVILS\Atanner
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	PCU	PCU	perHour	s	-Min	perMin

Analysis Options

Calculate Queue Percentiles	Calculate residual capacity	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
		0.85	36.00	20.00

Demand Set Summary

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D1	2028	AM	2019 surveyed movements growthed to 2028 using Tempro. Other movements are as set out in Accompanying Transport statement	ONE HOUR	08:00	09:30	15
D2	2028	PM	2019 surveyed movements growthed to 2028 using Tempro Other movements are as set out in Accompanying Transport statement	ONE HOUR	17:00	18:30	15

Analysis Set Details

ID	Network flow scaling factor (%)
A1	100.000

2028, AM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	2.47	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Arms

Arms

Arm	Name	Description	Arm type
A	A283 southwest		Major
B	The Hollow		Minor
C	A283 Northeast		Major

Major Arm Geometry

Arm	Width of carriageway (m)	Has kerbed central reserve	Has right turn bay	Visibility for right turn (m)	Blocks?	Blocking queue (PCU)
C	6.50			81.0	✓	0.00

Geometries for Arm C are measured opposite Arm B. Geometries for Arm A (if relevant) are measured opposite Arm D.

Minor Arm Geometry

Arm	Minor arm type	Lane width (m)	Visibility to left (m)	Visibility to right (m)
B	One lane	3.00	56	20

Slope / Intercept / Capacity

Priority Intersection Slopes and Intercepts

Junction	Stream	Intercept (PCU/hr)	Slope for A-B	Slope for A-C	Slope for C-A	Slope for C-B
1	B-A	505	0.090	0.228	0.143	0.325
1	B-C	637	0.095	0.241	-	-
1	C-B	621	0.235	0.235	-	-

The slopes and intercepts shown above do NOT include any corrections or adjustments.

Streams may be combined, in which case capacity will be adjusted.

Values are shown for the first time segment only; they may differ for subsequent time segments.

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D1	2028	AM	2019 surveyed movements growthed to 2028 using Tempro. Other movements are as set out in Accompanying Transport statement	ONE HOUR	08:00	09:30	15

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		✓	675	100.000
B		✓	113	100.000
C		✓	738	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	B	C
From	A	0	50	625
	B	63	0	50
	C	675	63	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	4
	B	10	0	0
	C	4	10	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max LOS
B-AC	0.44	24.13	0.8	C
C-AB	0.27	5.18	1.0	A
C-A				
A-B				
A-C				

Main Results for each time segment

08:00 - 08:15

Stream	Total Demand (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
B-AC	85	375	0.227	84	0.3	12.990	B
C-AB	114	868	0.132	113	0.3	5.075	A
C-A	441			441			
A-B	38			38			
A-C	471			471			

08:15 - 08:30

Stream	Total Demand (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
B-AC	102	336	0.302	101	0.4	16.063	C
C-AB	166	924	0.180	165	0.5	5.050	A
C-A	497			497			
A-B	45			45			
A-C	562			562			

08:30 - 08:45

Stream	Total Demand (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
B-AC	124	282	0.442	123	0.8	23.698	C
C-AB	269	1006	0.267	267	1.0	5.171	A
C-A	544			544			
A-B	55			55			
A-C	688			688			

08:45 - 09:00

Stream	Total Demand (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
B-AC	124	281	0.442	124	0.8	24.126	C
C-AB	270	1007	0.268	270	1.0	5.180	A
C-A	543			543			
A-B	55			55			
A-C	688			688			

09:00 - 09:15

Stream	Total Demand (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
B-AC	102	336	0.302	103	0.5	16.361	C
C-AB	167	926	0.181	169	0.6	5.050	A
C-A	496			496			
A-B	45			45			
A-C	562			562			

09:15 - 09:30

Stream	Total Demand (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
B-AC	85	374	0.227	86	0.3	13.168	B
C-AB	116	869	0.133	116	0.4	5.092	A
C-A	440			440			
A-B	38			38			
A-C	471			471			

2028, PM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	2.47	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D2	2028	PM	2019 surveyed movements growthed to 2028 using Tempro Other movements are as set out in Accompanying Transport statement	ONE HOUR	17:00	18:30	15

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		✓	676	100.000
B		✓	113	100.000
C		✓	739	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	B	C
From	A	0	50	626
	B	63	0	50
	C	676	63	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	4
	B	10	0	0
	C	4	10	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max LOS
B-AC	0.44	24.19	0.8	C
C-AB	0.27	5.18	1.0	A
C-A				
A-B				
A-C				

Main Results for each time segment

17:00 - 17:15

Stream	Total Demand (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
B-AC	85	374	0.227	84	0.3	13.003	B
C-AB	115	868	0.132	113	0.3	5.073	A
C-A	442			442			
A-B	38			38			
A-C	471			471			

17:15 - 17:30

Stream	Total Demand (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
B-AC	102	336	0.302	101	0.4	16.087	C
C-AB	167	925	0.180	166	0.5	5.046	A
C-A	498			498			
A-B	45			45			
A-C	563			563			

17:30 - 17:45

Stream	Total Demand (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
B-AC	124	281	0.442	123	0.8	23.758	C
C-AB	269	1007	0.267	268	1.0	5.169	A
C-A	544			544			
A-B	55			55			
A-C	689			689			

17:45 - 18:00

Stream	Total Demand (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
B-AC	124	281	0.443	124	0.8	24.190	C
C-AB	270	1008	0.268	270	1.0	5.180	A
C-A	543			543			
A-B	55			55			
A-C	689			689			

18:00 - 18:15

Stream	Total Demand (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
B-AC	102	336	0.303	103	0.5	16.386	C
C-AB	168	926	0.181	169	0.6	5.049	A
C-A	497			497			
A-B	45			45			
A-C	563			563			

18:15 - 18:30

Stream	Total Demand (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
B-AC	85	374	0.227	86	0.3	13.183	B
C-AB	116	869	0.133	117	0.4	5.088	A
C-A	441			441			
A-B	38			38			
A-C	471			471			

Civil Engineering - Transport Planning - Flood Risk

APPENDIX G

Archaeological Assessment and Heritage Statement

DEVELOPMENT ARCHAEOLOGY SERVICES Ltd

AN ARCHAEOLOGICAL DESK BASED ASSESSMENT & HERITAGE STATEMENT

FOR LAND AT THE ROCK COMMON QUARRY, THE HOLLOW, WASHINGTON, WEST SUSSEX.

[Site Centred at National Grid Reference TQ 12503 13464]
West Sussex HER Reference Number: 2020-127

PREPARED FOR MGM CONSULTING
ON BEHALF OF THEIR CLIENTS - DUDMAN ROCK COMMON LTD.
(DUDMAN GROUP OF COMPANIES)

By

Neville Hall
&
C. A. Pine MA BSc.

November 2020

Contents

Illustrations

Appendices

Summary

This archaeological desk based assessment study has been prepared for MGM Consulting on behalf of their clients - Dudman Rock Common Ltd. - in advance of the proposed winning, working, extraction and processing of sand, the importation of inert classified engineering and restoration material, the stockpiling and treating of the imported material, the placement of the imported material within the quarry void and the restoration and landscaping of the quarry at Rock Common Quarry, The Hollow, Washington, West Sussex.

*Sand extraction has been taking place within the site area since the early 20th century, with a particular expansion in such activity having taken place here during the course of the late 20th century. Consequently, any archaeological activity and finds, which may have been situated within the already worked, three designated areas, of these assessment sites (**Sites A-C**), would have been removed. So, any considerations of likely archaeological potential on these sites will thus be hypothetical.*

*Archaeological evaluation in 1995 and excavation in 2001 on Rock Common to the north-east of **Area B**, identified a concentration of Mesolithic flint working activity. It is considered that there may have been a potential for similar such archaeological activity and finds to be made within these assessment sites, though this is thought to be **unknown**.*

*Ground surface clearance in Old Furze Field and in Sand Corner Lane Field prior to sand extraction within **Area A** located finds of Roman pottery, a 4th century AD coin and a single cremation. It is considered likely that other contemporary archaeological activity and finds from this period may also have been removed by the subsequent sand extraction here, the potential for which for which would have been assessed as **high**, but by their removal is now **unknown**.*

*Further ground surface clearance in Old Furze Field and in Sand Corner Lane Field prior to sand extraction within **Area A** also identified sherds of medieval pottery. Medieval holloways have been identified from aerial photographs and from the 1995 evaluation on Rock Common within the eastern fringes and beyond of **Area B**. It is concluded that it is highly possible that further such archaeological activity and finds would have been made in these areas, but would have been removed by the subsequent sand extraction. The potential for this is considered to be **high**, though because of their removal is now **unknown**.*

*The map regression undertaken for this study has identified much evidence for former post-medieval enclosure boundaries within the bounds of **Area A**, by contrast within **Areas B and C**, which were under rough grasslands or heathlands. The site of a post-medieval brick and tile works was situated within **Area B**. There is also evidence for post-medieval earthworks comprising a trackway and holloways that have been identified within the eastern fringes of **Area B** and just beyond from aerial photographic analysis and by the evaluation of 1995. Nearly all of this identified post-medieval archaeological activity would have already been removed by the sand extraction taking place within these areas. So, it is concluded that the potential for archaeological activity and finds from this period to be made in much of these assessment sites would have been **high**, but because of their removal is now **unknown**.*

There are also a number of both designated and non-designated heritage assets from the post-medieval period which have been identified by this study as being situated in close proximity to these various assessment sites. The identified designated heritage assets consisting of the Grade II listed Green Farmhouse, the Grade II listed Rock House, the Grade II listed Rock Windmill and the Grade II listed Sandhill Farmhouse. The identified non-designated heritage assets comprise the site of the 19th century out farm to the north-east of Green Farm, the 18th century farmstead at Green Farm and the 18th century farmstead at Sandhill Farm.

It is considered the development proposals will result in nil impact to any of the recorded Listed or locally significant

structures present within the study area. It is considered that there will be no significant modification in terms of setting / views to and from any listed building or building recorded as being of local architectural or historic interest.

The extensive sand extraction which has already taken place within the three designated areas of these assessment sites, would have already removed any archaeological potential and finds from these areas. So, there will be no considerations of any potential impact as in all instances, any such considerations will inevitably have become unknown in nature.

The proposed changes which are to take place within these various assessment sites will be material considerations in respect of the potential impact that these proposed changes may have on the settings and significance of the various identified designated and non-designated heritage assets which have been identified as being in close proximity to these assessment sites. In all instances, it is considered that there will be ***no impact*** *from the proposed changes within the various assessment sites to the settings and significance of these various heritage assets, as in all cases all of these assets cannot be directly viewed from the various assessment sites themselves due to heavy, dense and mature intervening tree and hedgerow cover.*

A nearby scheduled monument, a bowl barrow on Chanctonbury Hill, is situated some 1.5km to the south of the site boundary. It is considered that there will be no significant impact upon either the setting and nil impact to the fabric of this nationally important designated heritage asset, from development proposals. Proposed restoration is likely only to have a significant beneficial effect as regards views from the monument towards the application site area.

1.0 Introduction

1.1 This pre-planning application archaeological desk-based assessment study was commissioned by MGM Consulting on behalf of their clients - Dudman Rock Common Ltd. Its purpose is to assess, without the use of intrusive methods, the archaeological potential of land at the Rock Common Quarry, The Hollow, Washington, West Sussex. This will form the basis for a decision-making process that will seek to address the interests of the developer, while ensuring that archaeological resources, if present, and at risk, are not needlessly compromised as a result of developing the site.

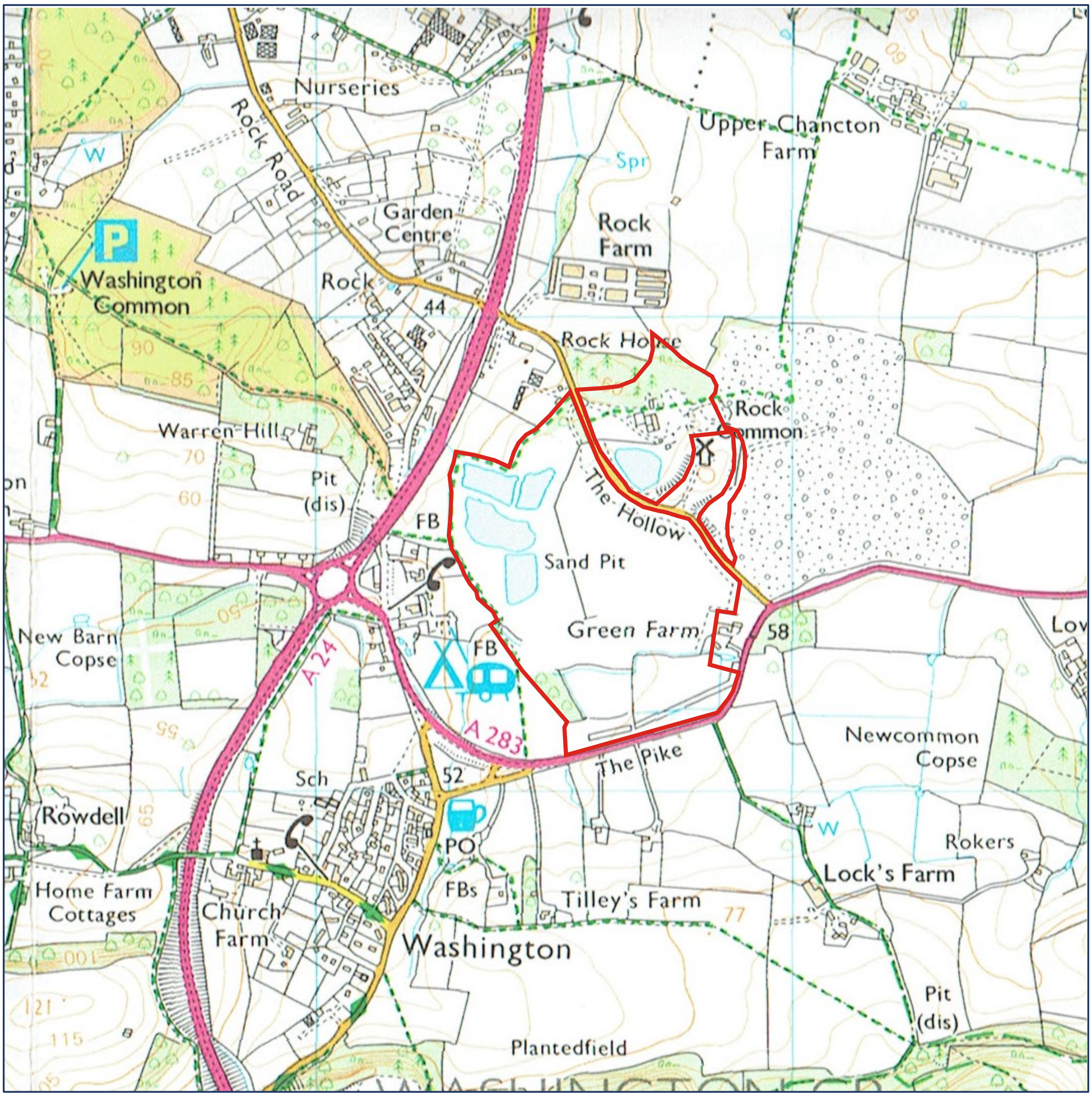


Figure 1: Site location at scale 1:25,000. The assessment site is shown outlined in red. (O.S. copyright licence no. 100048723)

2.0 Site location and description

2.1 The assessment sites comprise three distinctive and separate blocks of land, (which for the purposes of this survey have been designated as **Areas A-C** [**Figure 2**]), that are situated to the north-east and to the south-west of The Hollow. Part of the southern boundary of **Area A** is formed by the modern A283 trunk road. The area of the current and main sand extraction quarry (**Area A**) is of 27.19 hectares in extent. The current sand processing area (**Area B**) is of 5.52 hectares in area and the proposed material reception area and an associated internal access to the sand processing area (**Area C**) is of 0.93 hectares in extent. This comprises a total of 33.64 hectares in extent of the current planning application area.

2.2 Rock Common Quarry is an active sand quarry, which is located approximately 0.35km to the north-east of the village of Washington. This settlement along with the assessment sites are situated within the modern civil parish of Washington, administrative district of Horsham, county of West Sussex [**Figures 1 and 2**].

2.3 The assessment sites were situated on well drained coarse and fine loamy soils of the Fyfield 1 Series that lie over interbedded sands and sandstones. These deposits in turn overlie Upper Greensands and Gaults of the Cretaceous [Soil Survey, 1983; BGS, 1984].

2.4 The site gross site area is centred at approximately: National Grid Reference: TQ 12503 13464.

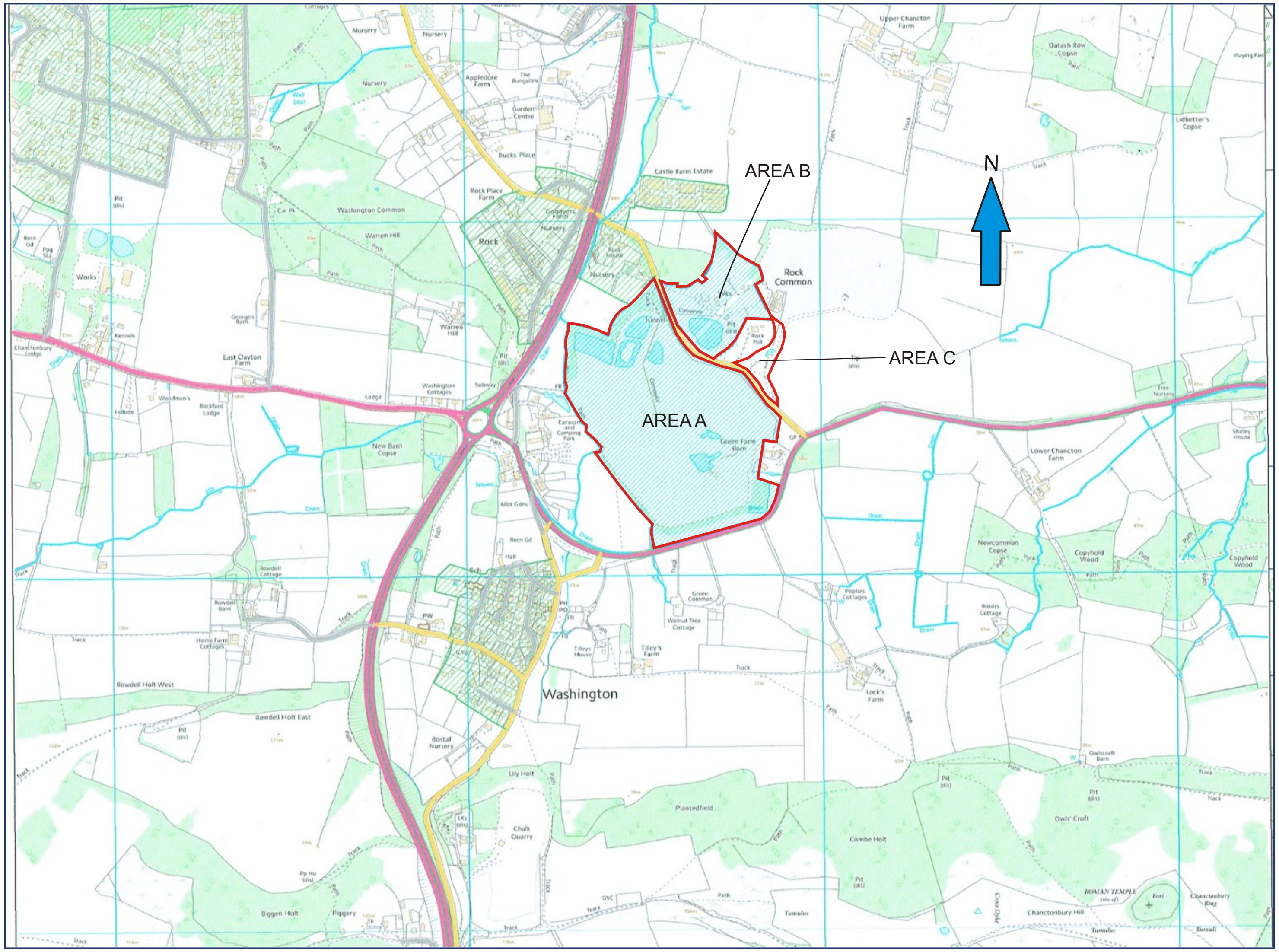


Figure 2: Site location showing sub-divisions of the gross assessment site: (**Areas A-C**) at an original scale of 1:5,000.

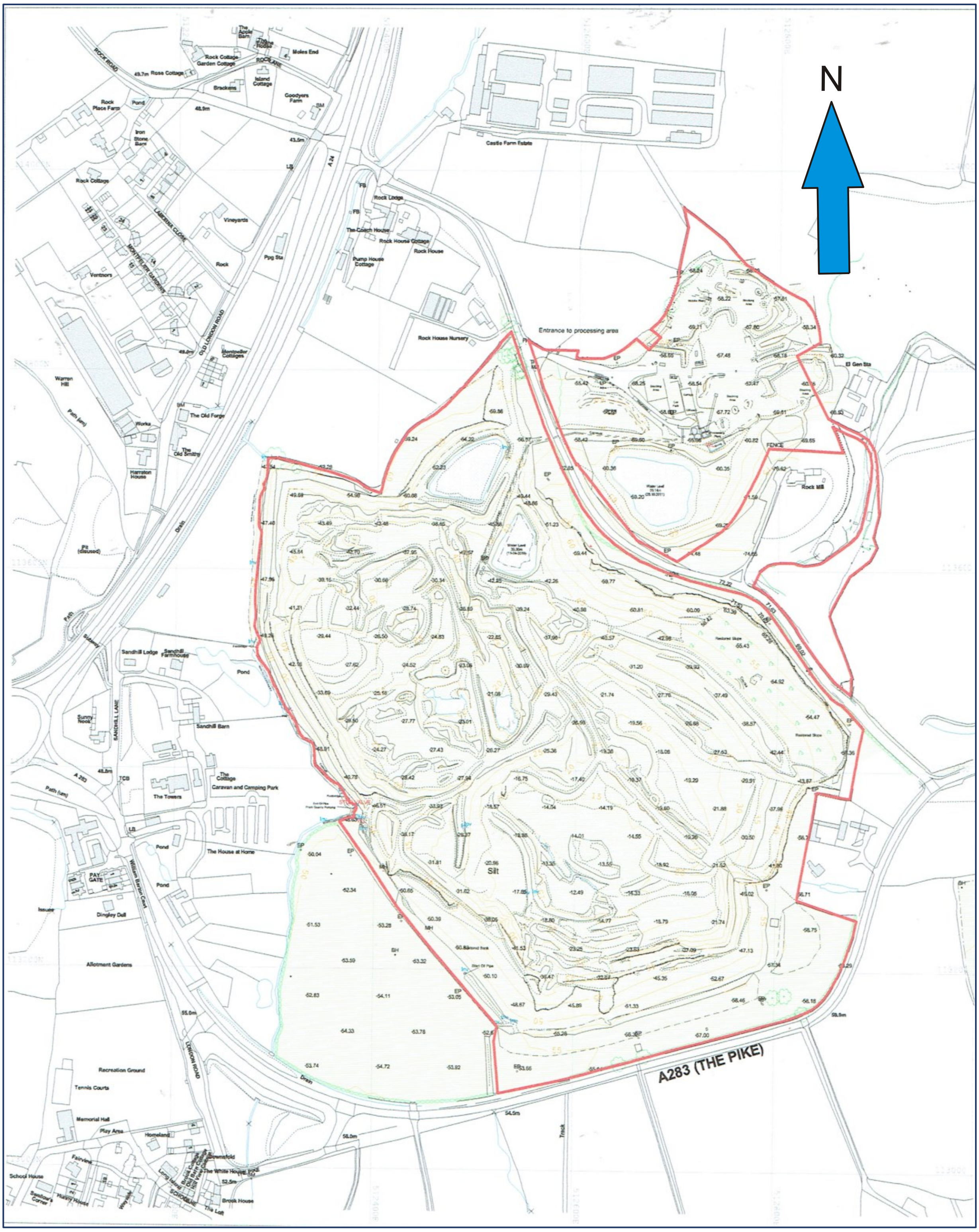


Figure 3: Plan showing the current layout of the assessment sites within the planning application boundaries (marked in red) at an original scale of 1:2,500.

Figure 4: Plan showing the proposed final restoration layout of the assessment sites within the planning application boundaries (marked in red) at an original scale of 1:2,000.

3.0 Objectives and methods

3.1 The purpose of this report is to establish the presence or absence of archaeological remains that may be vulnerable to the works associated with the proposed development; to assess their potential significance and the extent to which the proposed works are likely to affect them.

3.2 The report is based on information derived from the following sources: -

- The West Sussex Historic Environment Record (WSHER);
- The National Heritage List of Historic England (NHL);
- Published early Edition Ordinance Survey maps from the online National Library of Scotland; and
- A walkover survey of the environs of the assessment sites by Neville Hall and Christopher Pine of Development Archaeology Services Limited.

3.3 A search of the West Sussex Historic Environment Record (HER) was undertaken for listed buildings, archaeological sites, findspots and previous archaeological investigations within a 1km radius centred on National Grid Reference TQ 12503 13464. The results of this search are presented below as **Appendix 1** and their respective locations are shown on **Figure 11**.

3.4 Copies of published Ordnance Survey maps of the area of the assessment site were obtained from the online National Library of Scotland and comprise **Figures 5-10** in this study. The results of an historical map regression are presented in **Section 6.1** of this assessment.

3.5 A number of digital photographs of the environs of the assessment sites were taken during the walkover survey, which was undertaken on the 3rd of October 2020. The results of the walkover survey are presented in **Section 6.2** of this study.

4.0 Planning background

4.1 This pre-planning application archaeological desk based assessment study has been prepared for MGM Consulting and their clients - Dudman Rock Common Ltd. in advance of the proposed winning, working, extraction and processing of sand, the importation of inert classified engineering and restoration material, the stockpiling and treating of the imported material, the placement of the imported material within the quarry void and the restoration and landscaping of the quarry at the Rock Common Quarry, The Hollow, Washington, West Sussex. This study will be submitted as part of a larger Environmental Impact Assessment document, to West Sussex County Council (the Local Minerals Authority), to inform and to be in support of this a forthcoming planning application.

5.0 Archaeological and historical background

5.1 A search was undertaken of the West Sussex County Historic Environment Record (WSHER) for a 1km radius which was centred on National Grid Reference TQ 12503 13464.

5.2 A Mesolithic flint working site occurs at Warren Hill (**Site No. 42**, HER MWS3178). Finds from this site have included a quartzite pebble mace head, flint works debris to the north of two sand pits here and a sandstone pebble hammer from Rock Sandpit.

5.3 A scatter of Mesolithic flint flakes were recovered during an archaeological excavation of 2001 on Rock Common, but were not *in situ* (**Site No. 69**, HER MWS7255).

5.4 Surface clearance in The Old Furze Field and in Sand Corner Lane Field, which took place in the early 1970s prior to sand extraction here, located sherds of Roman and medieval and later pottery (**Site No. 32**, HER MWS438). Further finds recovered from this location included a 4th century AD Roman coin and the base of a fire that contained fragments of bone. This was thought to have been a cremation burial, also of possible Roman date (**Site No. 33**, HER MWS439).

5.5 Numerous Roman and post-medieval metal finds and some possible Roman copper alloy vessels have been found to the south of Washington (**Site No. 41**, HER MWS7811).

5.6 A hoard of c.3,000 coins has been found at Upper Chancton Farm (**Site No. 36**, HER MWS6391). The hoard included silver pennies from Edward the Confessor to Harold II and were found in a jar at the farm in 1866. The hoard was deposited at about the time of the Norman Conquest of AD1066.

5.7 The earliest documentary reference to the settlement at Washington dates from AD946-955 when it is referred to as *Wessingatun*. At the time of the Domesday of AD1086, it was referred to as *Wasingetune*. The place name itself is derived from an Old English personal name of *Wassa,* the connective participle *inga* and the Old English *tun*, hence 'the farmstead/village of the followers of a man called Wassa' [Mills, 2003].

5.8 The parish church of St Mary on The Street, Washington is a Grade II* listed church of medieval origin, which consists of a chancel, a nave with aisles, a south porch and a west tower (**Site No. 27**, HER DWS5282, MWS1172, NHL 1027198). The west tower is of 15th century date and the north arcade of the nave is of 12th century origin. Otherwise the church was largely rebuilt between 1866-71.

5.9 Green Common Farm at Washington is the site of a medieval farmstead (**Site No. 37**, HER MWS10974). This is a single sided loose courtyard farmstead with a detached farmhouse that was set away from the yard. It was in an isolated location, and only the farmhouse survives.

5.10 No. 4-5, Rock Lane is the site of a medieval and later 'L'-plan regular courtyard out farm or field barn with additional elements to the main plan (**Site No. 45**, HER MWS9262). The farmhouse is detached and set away from the yard. The site is within a village location and is extant.

5.11 The earthworks of possible medieval house platforms are situated to the east of the village of Washington (**Site No. 73**, HER MWS442).

5.12 Prior to a proposed land fill site at Rock Common, an archaeological evaluation was undertaken in 1995 (**Site No. 54**, HER MWS4490, EWS48). On the steep north-eastern slope of the site, a minimum of four parallel and shallow strip lynchets were found of which two were sectioned. These were interpreted as the remains of a medieval or earlier field system.

5.13 The earthworks of medieval or post-medieval holloways on Rock Common have been identified on aerial photographs of 1948, but these have all since been quarried away. One was to the north-east of the windmill (**Site No. 72**, HER MWS4974). The archaeological evaluation on Rock Common in 1995 identified a further north-south orientated holloway to the east of a modern footpath, this is also visible on aerial photographs. The archaeological excavation on Rock Common in 2001 recorded a late Pleistocene trough, which was interpreted as being of natural geological origin. Ten pieces of worked flint were also recovered, which dated to the end of the last glacial period.

5.14 Tilleys Farm or Lily Farm at Washington is a medieval 'L'-plan regular courtyard farmstead which has additional elements to the main plan (**Site No. 38**, HER MWS12953). The farmhouse is detached and set away from the yard. It is in an isolated location and is still extant.

5.15 Nos. 4 and 5, Rock Lane is a Grade II listed former early 16th century farmhouse with a later 18th century wing added to the south. The building now comprises two cottages (**Site No. 1,** HER DWS6064, NHL 1240931).

5.16 Fern Cottage, School Lane, Washington is a Grade II listed 17th century or earlier timber framed building (**Site No. 10**, HER DWS5280, NHL 1027196).

5.17 Tilley's Farmhouse, Brighton Road is a Grade II listed 17th century or earlier timber framed building (**Site No. 30**, HER DWS6469, NHL 1354090).

5.18 Tilleys Cottage, Worthing Road is a Grade II listed 17th century or earlier timber framed building (**Site No. 28**, HER DWS5246, NHL 1027163).

5.19 Tilley's Farm Cottage, Brighton Road is a Grade II listed 'L'-shaped timber farmed building of 17th century or earlier origin (**Site No. 29**, HER DWS6114, NHL 1284747).

5.20 Apple Barn, Rock Road is a Grade II listed 'L'-shaped timber framed barn of 17th century or earlier date with an east-west wing that was added in the 18th century (**Site No. 2**, HER DWS5278, NHL 1027194).

5.21 Green Common Farmhouse, Brighton Road is a Grade II listed 'L'-shaped timber framed building of

17th century or earlier origin (**Site No. 12**, HER DWS6113, NHL 1284745).

5.22 Corner House, How Man and The Old Cottage, The Street, Washington is a Grade II listed block of three cottages (**Site No. 9**, HER DWS6102, NHL 1182115). The Old Cottage is a medieval former open Hall House thought to date from c.1300AD and the others are of probable 17th century origin or earlier.

5.23 Sandhill Farmhouse, London Road is a Grade II listed building consisting of two parallel ranges (**Site No. 22**, HER DWS6115, NHL 1284756). The front range is of 17th century origin with the back range of 18th-19th century date. Sandhill Farm is an 18th century three sided 'L'-plan loose courtyard farmstead with additional detached elements to the main plan (**Site No. 48**, HER MWS13498). The farmhouse is detached and set away from the yard. The farmstead is within an isolated location and is extant.

5.24 The Old Forge, School Lane, Washington is a Grade II listed former smithy that is dated to 1732 (**Site No. 15**, HER5279, NHL 1027195).

5.25 Bank, Cottage, The Street, Washington is a Grade II listed 18th century cottage (**Site No. 3**, HER DWS6109, NHL 1284704).

5.26 South Cottage, School Lane, Washington is a Grade II listed 18th century cottage (**Site No. 23**, HER DWS6009, NHL 1182076).

5.27 A Grade II listed 18th century or earlier barn is situated to the south of the farmhouse at Church Farm, The Street, Washington (**Site No. 4,** HER DWS6013, NHL 1182122). This barn was the subject of a programme of historic building recording in 2006 (HER MWS8530). The survey identified that the barn was originally a fully timber framed crown posted structure of five bays with a canopy over the entrance to the central bay. The barn is thought to have been built between the 15th and 18th centuries.

5.28 Rock Place Farmhouse, Rock Road is a Grade II listed 18th century house (**Site No. 18**, HER DWS6110, NHL 1284717). Rock Place Farm is an 18th century dispersed cluster farmstead (**Site No. 46**, HER MWS10310). This is within a village location and has undergone a significant loss of traditional buildings.

5.27 Green Farmhouse, Brighton Road is a Grade II listed farmhouse (**Site No. 13**, HER DWS5274, NHL 1027190). This building consists of two parallel ranges. The east range is of 18th century date and the west range of 19th century origin. Green Farm is an 18th century 'U'-plan regular courtyard farmstead with additional detached elements to the main plan (**Site No. 47**, HER MWS10987). The farmhouse is detached and set away from the yard. The farmstead is within an isolated location and is extant.

5.28 Rock Farmhouse, Rock Road is a Grade II listed late 18th century cottage (**Site No. 16**, HER DWS5276, NHL 1027192).

5.29 Rose Cottage, School Lane, Washington is a Grade II listed 18th century cottage (**Site No. 21**, DWS6472, NHL 1354093).

5.30 Weavers Cottage, School Lane, Washington is a Grade II listed 18th century cottage (**Site No. 31**, HER DWS6111, NHL 1284722).

5.31 Nos. 1 and 2, Rose Cottage, The Street, Washington are two Grade II listed houses (**Site No. 20**, HER DWS5285, NHL 1027201). No. 1 is of early 18th century date and No. 2 of late 18th to early 19th century origin.

5.32 Church Farmhouse, The Street, Washington is a Grade II listed farmhouse which has two parallel ranges (**Site No. 6**, HER DWS6476, NHL 1354096). The north range is of early 19th century date and the south wing of later 19th century origin. An early 19th century flint garden wall to the east of Church House is also Grade II listed (**Site No. 11**, HER DWS6476, NHL 1354097). Church Farm at Washington is a 19th century three sided 'L'-plan loose courtyard farmstead with additional elements to the main plan. The farmhouse is detached and set away from the yard. The farmstead is within a village location and is extant (**Site No. 50**, HER MWS9763).

5.33 The Old Vicarage, The Street, Washington is a Grade II listed early 19th century building (**Site No. 26**, HER DWS6108, NHL 1284693). The stables to the west of the Old Vicarage are Grade II listed and of early 19th century date (**Site No. 24**, HER DWS5283, NHL 1027199).

5.34 The Frankland Arms public House, Worthing Road is a Grade II listed early 19th century building (**Site No. 25**, HER DWS5245, NHL 1027162).

5.35 The site of a post-medieval brickworks occurred to the south of Warren Hill and is featured on the First Edition O.S. map of 1875 (**Site No. 49**, HER MWS5149).

5.36 Church House, The Street, Washington is a Grade II listed early 19th century house (**Site No. 7**, HER DWS5284, NHL 1027200),

5.37 Clematis Cottage, School Lane, Washington is a Grade II listed early 19th century cottage (**Site No. 8**, HER DWS6008, NHL 1182071).

5.38 Rock House, Rock Lane is a Grade II listed early 19th century house (**Site No. 17**, DWS6007, NHL 1182011).

5.39 Rock Windmill, Rock Lane is a Grade II listed smock windmill dated to 1827 (**Site No. 19**, HER DWS6471, MWS5645, NHL 1354092). This has been converted into a residential dwelling. The sweeps, cap and fantail are absent and there is no machinery inside.

5.40 Brook House on the Worthing Road is a Grade II listed house that was constructed in c.1830 (**Site No. 5,** HER DWS5244, NHL 1027161).

5.41 Locks Farm at Washington is an extant 19th century farmstead (**Site No. 34**, HER MWS12156). This is arranged as a single sided loose courtyard farmstead with additional detached elements to the main plan. The farmhouse is detached and set side onto the yard. The farmstead is within an isolated location and has undergone a partial loss of traditional buildings.

5.42 The site of a former 19th century out farm occurs to the north-west of Rokers (**Site No. 35**, HER MWS13060). This was a single sided loose courtyard out farm or field barn. The site was in an isolated location and has been demolished.

5.43 Tilley's Cottage at Washington is a partially extant 19th century farmstead (**Site No. 39**, HER MWS13774). This is an 'L'-plan regular courtyard farmstead with additional detached elements to the main plan. The farmhouse is detached and set away from the yard. It is within an isolated location and has undergone a significant loss of traditional buildings.

5.44 The site of a former 19th century out farm or field barn is situated to the south of Washington (**Site No. 40**, HER MWS13104). This was a single side loose courtyard out farm or field barn and was in an isolated location. The site has been demolished.

5.45 The site of a former 19th century out farm is located to the north-west of Washington (**Site No. 43**, HER MWS12805). This was an 'L'-plan regular courtyard out farm or field barn. It was in an isolated location and has been demolished.

5.46 The site of a former 19th century out farm was situated to the north-east of Green Farm (**Site No. 44**, HER MWS14104). This was a single sided loose courtyard out farm or field barn, which was in an isolated location. The site has been demolished.

5.47 Prior to a proposed landfill site at Rock Common, an archaeological evaluation was carried out in 1995 on The Mount, a post-medieval house (**Site No. 55**, HER MWS4491, MWS7254, EWS48). The Mount, a well and an associated outbuilding were known to have existed on the site from the early 19th century. Both buildings survived as ruins with terraced platforms to the rear. To the west of the house was a large modern rubbish midden and the remains of a wooden outhouse.

5.48 A slightly curving ditch or hollow representing the remains of a holloway or trackway of post-medieval date has been identified from a map of 1780 as a former trackway to Rock Common (**Site No. 60**, HER MWS4973).

5.49 The site of a former post-medieval to modern brick and tile works was situated on Rock Common and within the northern portion of this assessment site (**Site No. 56**, HER MWS4812). This was in operation in the 1950s and 1960s.

5.50 A K6 telephone kiosk on The Street, Washington is Grade II listed and of 20th century origin (**Site No.

14, HER DWS6076, MWS11420, NHL 1260816).

5.51 A 20th century war memorial stands within the churchyard of the parish church of St Mary (**Site No. 52**, HER MWS10038).

5.52 A spread of mostly 20th century occupation debris consisting of glass and ceramic fragments denoting a former occupation site of this period on Rock Common and to the south of the Mount was identified by the evaluation of 1995 and also by the excavation here of 2001. Some 19th century material was also included within this spread (**Site No. 57**, HER MWS4969, EWS48).

5.53 An undated woodland boundary bank is visible on the ground along the north-western edge and the northern boundary of a plantation at Rock Common. An accompanying ditch extends to the south and east of the bank (**Site No. 51**, HER MWS4970).

5.54 An undated former land boundary or linear earthwork with a scarp slope to the north and an indication of a hollow to the immediate south is situated on Rock Common (**Site No. 58**, HER MWS4871).

5.55 An undated eroded bank or linear earthwork has been identified on Rock Common (**Site No. 59**, HER MWS4972).

5.56 An undated and eroded bank or linear earthwork has been recorded on Rock Common (**Site No. 61**, HER MWS4975). A map of Lower Chancton Farm shows a small oval shaped former plantation at this location and a semi-circular cropmark is visible at this location on aerial photographs.

5.57 A short length of an undated bank or linear earthwork with a possible associated ditch to the south have been identified on Rock Common (**Site No. 62**, HER MWS4976-7).

5.58 An east-west orientated and undated bank or linear earthwork representing a former woodland boundary has been recorded on Rock Common (**Site No. 63**, HER MWS4978).

5.59 The eastern woodland boundary bank to Rock Common has been identified and recorded (**Site No. 64**, HER MWS4979).

5.60 A short length of eroded and undated ditch has been recorded on Rock Common (**Site No. 65**, HER MWS4980).

5.61 An undated and slightly curving bank or linear earthwork follows the line of a woodland track on Rock Common (**Site No. 66**, HER MWS4981). There are also indications of an associated ditch on its western side. This feature was thought to represent the remains of a trackway that extended from Rock Common to Upper Chancton Farm, which was mapped in 1806.

5.62 An undated splayed ditch or eroded holloway has been identified on Rock Common (**Site No. 67**, HER

MWS4982).

5.63 The line of an undated former field boundary represented by the line of a ditch is situated on Rock Common (**Site No. 68**, HER MWS5647).

5.64 There have been a number of previous archaeological investigations within the search area for this study. In 1995, prior to a proposed landfill site at Rock Common, an archaeological evaluation was carried out (**Site No. 53**, HER MWS4488, EWS48). On the western slope of the central hill, test pits produced finds of Mesolithic and earlier flint working in a relatively undisturbed state. A further concentration of worked flints was found near the base of the eastern slope of the hill. This was followed by an archaeological excavation in 2001 (**Site No. 53**, HER MWS4488). This identified a concentration of Middle-Late Mesolithic flintwork. The area of the excavation was defined by the prior archaeological test pitting and took place within an area known as 'The Rough'. The Mesolithic assemblage consisted of over 50,000 pieces of worked flint, including Horsham microliths and microburins. There were some residual finds of Late Glacial artefacts. The material appeared to be largely *in situ*. The distribution is interpreted as suggesting that re-tooling and repairing of hunting equipment was undertaken around a series of hearths, that were represented by burnt flint. Some Neolithic flintwork was also recovered.

5.65 Two archaeological watching briefs have taken place at the parish church of St Mary at Washington. The first in 2009 and the second in 2012 during internal works within the church and other works within the parish churchyard. This included the laying of a new floor in the nave, aisles and tower and the construction of an external extension for a new WC and associated service trenches. The internal works required the removal of the current church floor and the lowering of levels within the tower and at the eastern and western ends of the nave (**Site No. 70**, HER MWS1171, EWS1570). During the 2009 watching brief, a trench was excavated between the Sandman Family tomb and the north wall of the church in the location of the proposed WC extension. A large brick lined grave lay below the chest tomb. A brick was removed from the arched roof of the grave to reveal six coffins.

5.66 During the second watching brief of 2012, the extension trench for the WC was excavated. This identified parts of four *in situ* inhumation burials. During the 2009 watching brief, a service trench was excavated against the churchyard wall to insert a waste connection pipe through to the adjoining property. No archaeological features or finds were identified here. During the second watching brief of 2012, a second service trench that connected the waste pipe with the WC extension was excavated. This continued around the east end of the church to connect up with the mains. An east-west orientated brick wall was found to the east of the waste connection pipe. This was interpreted as an earlier and undated former retaining wall for the churchyard. As the service trench passed the east window of the chancel, a stone foundation was identified. This was considered to be the base for an earlier monument, that was demolished when the chancel was extended in the 19th century.

5.67 The laying of the new floor within the nave, aisles and tower mostly reused the existing spaces beneath the extant pew platforms. However, at the east end of the nave, at the west end of the nave and within the tower, the ground beneath the pews needed to be lowered further. A small trench was excavated at the east end of the nave, to the south of the central aisle for a new sleeper wall. A north-south aligned wall foundation was identified here. This foundation had in turn been cut to the north by a brick wall, which ran east-west, under the central aisle of the nave and on under the chancel floor. The stone wall foundation was thought to be that which supported the original medieval wall that had divided the nave and chancel and which had been demolished as part of the 19th century alterations. The brick wall which cut through this earlier wall foundation was probably linked to the earlier heating system within the church.

5.68 At the west end of the nave, a rubble filled hole was recorded within a mortar layer and extended to the east where some damaged brickwork was recorded. This was associated with the earlier church heating system or was a brick lined grave. The stone foundation to the existing church tower was identified at the western and southern ends of this trench.

5.69 Within the tower, the ground surface below two pew platforms was reduced. To the east of a northern trench, a shallow rectangular hole was identified within which were the remains of a timber post. A number of pits were also identified. The rectangular hole and the circular pits may have contained supporting timbers for an earlier first floor within the tower. A tiled floor was found within a southern trench. A space below the southern pew platform appeared to have been filled with these tiles. The tiles extended to up against the walls of the tower on the south side. Set within the tiles was a ledger stone, only part of which extended into the trench, the remainder lay beneath the central aisle of the tower. The ledger stone had been inserted into the pre-existing tile floor, since the tiles had been cut to allow for it. The date of the tiled floor was uncertain. It was thought to preceded the 18th century ledger stone and was either contemporary with or later that the late 15th or early 16th century tower. There was no trace of an earlier floor below.

5.70 The removal of some aluminium plates from the nave floor enabled a limited photographic record to be made of the Victorian heating system of the church and in particular of a stove. The stove was installed in 1889. Overall, the watching briefs identified two significant archaeological features. One was part of the original wall that divided the nave from the chancel and the other were the remains of an historic floor surface within the tower. Both of these features could not be precisely dated.

5.71 In 2008, a geophysical survey was undertaken on land at Rock Common in advance of a development for a landfill site **(Site No. 71**, HER EWS1404). This survey did not identify any anomalies of archaeological origin. The archaeological potential of this site was thus considered to be low.

6.0 Site specific search/investigation results

6.1 Cartographic and documentary information [Figures 5-10]

6.1.1 Copies of published Ordnance Survey (O.S.) maps were obtained from the online National Library of Scotland and from the West Sussex Historic Environment Record (HER). The earliest map consulted in this study comprised an extract from the one inch to one-mile scale Ordnance Survey map of 1813. However, this map was not utilised in this study as it does not appear to be very comparable or compatible in terms of content and detail in relation to the later and published Ordnance Survey maps, which were used in this study.

6.1.2 The earliest map consulted for this study comprised an extract from the First Edition six inch to one-mile scale Ordnance Survey (O.S.) map of 1879. This map comprises **Figure 5** of this study. This map shows the main body of the assessment site (**Area A**), which lies to the south-west of The Hollow and to the north of the present A283, occupying a number of enclosures along with portions of other enclosures within its current bounds. One enclosure to the north is designated as 'rough grassland' or 'heathland' and forms a part of Rock Common on this map. The second and larger area of the assessment site, which for the purposes of this survey is designated as **Area B**, lies within the area of Rock Common on this map and is entirely composed of further areas of rough grassland or of heathland. The third and the smallest of the areas of this assessment site, which is designated as **Area C** is also similarly entirely made up of rough grassland or of heathland and consists of a further portion of Rock Common.

6.1.3 An extract from the Second Edition six inch to one-mile scale Ordnance Survey (O.S.) map of 1898 forms **Figure 6** of this assessment. This map shows no change to the layout of **Areas B and C** to the north east of The Hollow having taken place between 1879 and 1896, both areas remaining as areas of rough grassland and heathland. Within the main body of the area of this assessment site - **Area A** - to the south-west of The Hollow, one field boundary within the western portion of the site has been removed creating a larger enclosure here along with the addition of a new field boundary at the southern fringes of the assessment site.

6.1.4 An extract from the Third Edition six inch to one-mile scale Ordnance Survey (O.S.) map of 1910 comprises **Figure 7** of this assessment study. Within the main body of the assessment site - **Area A** -, there has been relatively little change to the layout of this portion of this assessment site with the addition of a new enclosure boundary within the central portion of this area. Within the southern portion of **Area C,** an area here is designated for the first time as a 'sand pit', thus illustrating that sand extraction first began on this site in the early 20th century. By contrast, there was no change to the internal layout of **Area B** between 1896 and 1910.

6.1.5 An extract from the 1:1,250 scale Ordnance Survey (O.S.) map of 1961 forms **Figure 8** of this study. Within the main body of this assessment site to the south-west of The Hollow - **Area A**, little change to the internal layout of this part of the site has occurred between 1910 and 1961, with the exception of the removal of a field boundary within the western portion of the site here. By contrast all of the designed

Area C and the southern portion of **Area B** to the north-east of The Hollow are now occupied by sand pits or areas of sand extraction.

6.1.6 An extract from the 1:1,250 scale Ordnance Survey (O.S.) map of 1971 comprises **Figure 9** of this assessment. This map shows that no change took place within any of the designated three areas of this assessment site between 1961 and 1971 with the sand extraction occupying the same areas of **Areas B and C** to the north-east of The Hollow.

6.1.7 An extract from the 1:10,000 scale Ordnance Survey (O.S.) map of 1982 forms **Figure 10** of this study. This map shows that major changes had taken place to the area of these assessment sites between 1971 and 1982. Within **Area A**, designated as the main body of this assessment site to the south-west of The Hollow, nearly all of **Area A** by 1982, was devoted to sand extraction, with the exception of its southern fringes and a portion at the northern end of the site. The area of sand extraction within **Area B** to the north-east of The Hollow has also expanded slightly in extent with a works associated with this extraction now occupying this area of the site. Within **Area C**, also to the north-east of The Hollow, a second works now occupies much of the area of this portion of the assessment site. S it is clear from this map regression, that the extraction of sand here underwent a major expansion between 1971 and 1982.

6.1.8 **Figures 2 and 3** show the current layout of the assessment sites or of **Areas A-C**.

6.2 Site walkover survey [Plates 1-20]

6.2.1 A walkover survey was made by Christopher Pine and Neville Hall of Development Archaeology Services Limited on the 3rd of October 2020 of the environs of the assessment sites (**Areas A-C**), for the purpose of recording the present appearance and environs of the assessment sites and noting any features which might indicate surviving archaeological remains. This included a digital photographic record, which includes images of various built **designated and non-designated heritage assets** that are situated in close proximity to these assessment site. The weather conditions were overcast, though with good visibility.

6.2.2 **Plate 1** presents a view of the various farm outbuildings of the 18th century farmstead of Green Farm (**Site No 47**), which is known as Green Farm Barns. **Plate 2** furnishes a view of the nearby and associated Grade II listed Green Farmhouse (**Site No. 13**). Although these various designated and non-designated heritage assets are situated to the immediate east of the main body of the assessment sites (**Area A**), they cannot be directly viewed from **Area A** itself due an intervening dense and a heavy and dense screen of mature trees and hedgerow cover.

6.2.3 **Plates 3** shows the nearby Green Farm Barns, which is the site of a 19th century out farm to the north-east of Green Farm (**Site No. 44**) and to the east of **Area A** of the assessment sites. Similarly, this site cannot be directly viewed from **Area A**, due to intervening heavy, dense and mature tree and hedgerow cover.

6.2.4 **Plate 4** presents a view of the Grade II listed Sandhill Farmhouse (**Site No. 22**). This is situated to the west of **Area A** and cannot be directly viewed from **Area A** due to heavy and intervening dense and mature tree and hedgerow cover

6.2.5 **Plates 5-13** provide a number of general views of the main body of the assessment site, which for the purposes of this study is designated as **Area A**. These various images were taken from the north-eastern site boundary of **Area A** and from the south-western frontage of The Hollow.

6.2.6 **Plate 14** features the entrance to the **Area B** of the assessment sites and was taken from the north-eastern frontage of The Hollow.

6.2.7 **Plates 15 and 16** present images of the Grade II listed Rock House (**Site No. 17**). This designated heritage asset is located to the north of the assessment sites and similarly cannot be directly viewed from either **Area A or Area B** of the assessment sites due to heavy, dense and mature intervening tree and hedgerow cover.

6.2.8 **Plates 17 and 18** furnish several general views of **Area C** of the assessment site from the north-eastern frontage of The Hollow.

6.2.9 **Plates 19 and 20** present detailed images of the Grade II listed Rock Windmill (**Site No. 19**). Dense and mature tree and hedgerow cover surround the lower levels of this designated heritage asset. It is considered that only the uppermost levels of this taller building can be directly viewed from **Area C** of the assessment sites itself.

6.2.10 **Assessment of potential development impact on the listed building**

6.2.11 Refer to Table A, below for assets of significance of recorded built heritage assets proximal to the proposed development area.

Table A: SUMMARY OF IMPACT / EFFECT ON LISTED BUILDINGS/HERITAGE ASSETS WITHIN AND PROXIMAL TO PROPOSED DEVELOPMENT SITE AREA. [refer to Figure A for location].

Built Heritage assets	Description	Period	Impact assessment	Mitigation
Green Farm Barns (**Site No 47**)	18th century farmstead at Green Farm.	PM	The main significance of this asset lies in its fabric and its association with surrounding / proximal buildings [44] & [13] The proposed development will have no physical impact to the fabric of this building. The setting, views from and to this asset will remain largely unaffected during the proposed development phase. Any moderate effect [after re-instatement] will have a net beneficial effect to the setting.	Undertake sympathetic landscape restoration between proposed new works areas during re-instatement program.
Green Farmhouse (**Site No. 13**).	Green Farmhouse, Brighton Road. Grade II listed farmhouse of 18th & 19th century origin.	PM	The main significance of this asset lies in its fabric and association with surrounding / proximal building elements [47] & [44]. The proposed development will have no physical impact to the fabric of this building. The setting, views from and to this asset will remain largely unaffected during the proposed development phase. Any moderate effect [after re-instatement] will have a net beneficial effect to the setting.	Undertake sympathetic landscape restoration between proposed new works areas during re-instatement program
Green Farm (**Site No. 44**)	Site of a 19th century outfarm to the NE of Green Farm.	PM	As stated for [site 13] The main significance of this asset lies in its fabric and association with surrounding / proximal building elements [13 & 47]. There will be no physical impact on the fabric during development The setting, views from and to this asset will remain largely unaffected during the proposed development phase. Any moderate effect [after re-instatement] will have a net beneficial effect to the setting.	Undertake sympathetic landscape restoration between proposed new works areas during re-instatement
Grade II listed Sandhill Farmhouse (**Site No. 22**).	Sandhill Farmhouse, London Road. Grade II listed 17th-19th century Grade II listed building.	PM	The main significance of this asset lies in its fabric. There will be no physical impact on the fabric during development The setting, views from and to this asset will remain unaffected during the proposed development phase	Undertake sympathetic landscape restoration between proposed new works areas during re-instatement
Grade II listed Rock House, **(Site No. 17]**	Rock House, Rock Lane. Grade II listed early 19th century house.	PM	The main significance of this asset lies in its fabric. There will be no physical impact on the fabric during development	Undertake sympathetic landscape restoration between proposed new works areas during re-instatement
Grade II listed Rock Windmill **[Site 19]**	Rock Windmill, Rock Lane. Grade II listed smock windmill dated to 1827.	PM	The significance of this asset lies both in the fabric and its views both from and towards the asset. Views towards the proposed reception area are at present minimal / nil.	Ensure re-instatement and post reclamation processes allow views towards this asset to be maintained or enhanced.

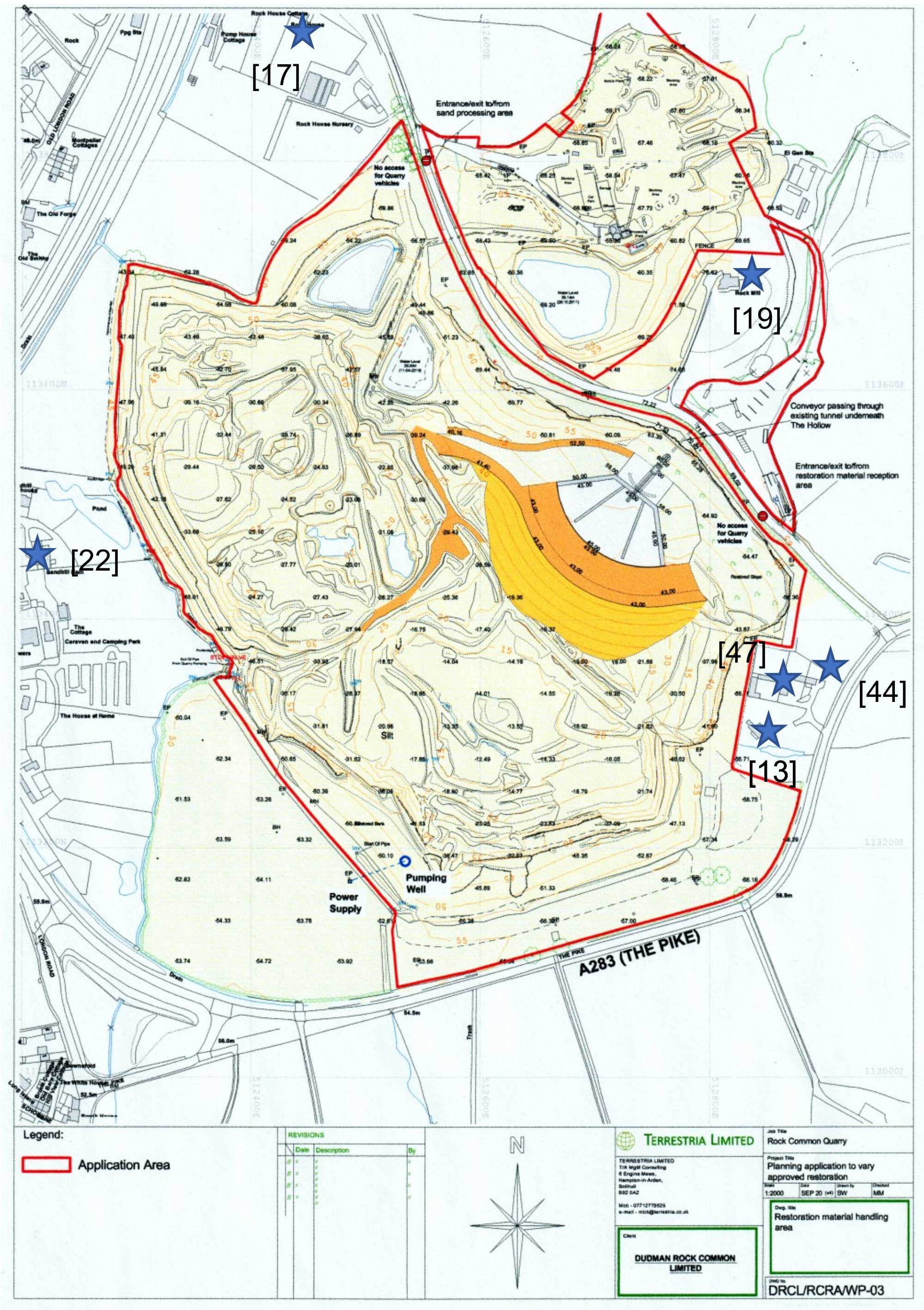


Figure A: Location of Listed and NDHA's within and proximal to proposed development area.

Refer to Table A for asset specific impact assessment. / review.

Plate 1: View of the outbuildings of the 18th century farmstead at Green Farm, (Site No. 47), from the south-west

Plate 2: View of the Grade II listed Green Farmhouse, (Site No. 13), from the east

Plate 3: View of the site of the 19th century out farm at Green Farm Barns, (Site No. 44), from the south-west

Plate 4: View of the Grade II listed Sandhill Farmhouse, (Site No. 22), from the south

Plate 5: View of centre main body of the assessment sites (Area A), from the north-east

Plate 6: View of the main body of the assessment sites (Area A), from the north-east

Plate 7: View of the main body of the assessment sites (Area A), from the north-east

Plate 8: View of the main body of the assessment sites (Area A), from the north.

Plate 9: View of the main body of the assessment sites (Area A), from the north-east

Plate 10: View of the main body of the assessment sites (Area A), from the north-east

Plate 11: View of the main body of the assessment sites (Area A), from the north

Plate 12: View of the main body of the assessment sites (Area A), from the north

Plate 13: View of the entrance to Area B of the assessment sites, from the south-west

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Plate 14: View of the Grade II listed Rock House, (Site No. 17), from the east

Plate 15: View of the Grade II listed Rock House, (Site No. 17), from the east

Plate 16: View of Area C of the assessment sites, from the north-west

Plate 17: View of Area C of the assessment sites, from the north-west

Plate 18: View of the Grade II listed Rock Windmill, from the south-west

Plate 19: View of the Grade II listed Rock Windmill, from the west

7.0 Assessment of archaeological potential

7.1 Sand extraction has been taking place here since the early 20th century, with a particular expansion in such activity having taken place here during the course of the late 20th century. Consequently, any archaeological activity and finds, which may have been situated within the three designated areas of these assessment sites (**Sites A-C**), would have already long been removed. So, any considerations of likely archaeological potential on these sites will thus be hypothetical.

7.2 Archaeological evaluation in 1995 and excavation in 2001 on Rock Common to the north-east of **Area B**, identified a concentration of Mesolithic flint working activity. It is considered that there may have been a potential for similar such archaeological activity and finds to be made within these assessment sites, though this is thought to be **unknown**.

7.3 Ground surface clearance in Old Furze Field and in Sand Corner Lane Field prior to sand extraction within **Area A** located finds of Roman pottery, a 4th century AD coin and a cremation. It is considered highly likely that other contemporary archaeological activity and finds from this period may also have been removed by the subsequent sand extraction here, the potential for which for which would have been assessed as **high**, but by their removal is now **unknown**.

7.4 Further ground surface clearance in Old Furze Field and in Sand Corner Lane Field prior to sand extraction within **Area A** also identified sherds of medieval pottery. Medieval holloways have been identified from aerial photographs and from the 1995 evaluation on Rock Common within the eastern fringes and beyond of **Area B**. It is concluded that it is highly possible that further such archaeological activity and finds would have been made in these areas, but would have been removed by the subsequent sand extraction. The potential for this is considered to be **high**, though because of their removal is now **unknown**.

7.5 The map regression undertaken for this study has identified much evidence for former post-medieval enclosure boundaries within the bounds of **Area A**, by contrast within **Areas B and C**, which were under rough grasslands or heathlands. The site of a post-medieval brick and tile works was situated within **Area B**. There is also evidence for post-medieval earthworks comprising a trackway and holloways that have been identified within the eastern fringes of **Area B** and just beyond from aerial photographic analysis and by the evaluation of 1995. Nearly all of this identified post-medieval archaeological activity would have already been removed by the sand extraction taking place within these areas. So, it is concluded that the potential for archaeological activity and finds from this period to be made in much of these assessment sites would have been **high**, but because of their removal is now **unknown**.

7.6 There are also a number of both designated and non-designated heritage assets from the post-medieval period which have been identified by this study as being situated in close proximity to these various assessment sites. The identified designated heritage assets consisting of the Grade II listed Green Farmhouse, the Grade II listed Rock House, the Grade II listed Rock Windmill and the Grade II listed Sandhill Farmhouse. The identified non-designated heritage assets comprise the site of the 19th century outfarm to the north-east of Green Farm, the 18th century farmstead at Green Farm and the 18th century farmstead at Sandhill Farm. The settings and significance of these various assets will be material considerations in respect of any proposed changes within these assessment sites.

7.7 It is considered the development proposals will result in nil impact to any of the recorded Listed or locally significant structures present within the study area. It is considered that there will be no significant modification in terms of setting / views to and from any listed building or building recorded as being of local architectural or historic interest.

7.8 It should also be recognised that there was also always the potential for previously unknown archaeological activity and finds to have been made on these assessment sites. This consideration is particular pertinent in relation to the various undated earthworks such as a ditch, a linear earthwork, a holloway and a former field boundary, which have been identified on Rock Common to the east of **Area B**. It is thus considered that similar other such undated earthworks may also have already been removed by the sand extraction within this site area.

8.0 Impact on archaeological resources

8.1 It has been noted that the extensive sand extraction which has already taken place within the three designated areas of these assessment sites, would have already removed any archaeological potential and finds from these areas. So, there will be no considerations of any potential impact as in all instances, any such considerations will inevitably have become unknown in nature.

8.2 It has also been noted earlier that the proposed changes which are to take place within these various assessment sites will be material considerations in respect of the potential impact that these proposed changes may have on the settings and significance of the various identified designated and non-designated heritage assets which have been identified as being in close proximity to these assessment sites. In all instances, it is considered that there will be **no impact** from the proposed changes within the various assessment sites to the settings and significance of these various heritage assets, as in all cases all of these assets cannot be directly viewed from the various assessment sites themselves due to heavy, dense and mature intervening tree and hedgerow cover.

8.3 A nearby scheduled monument, a bowl barrow on Chanctonbury Hill, is situated some 1.5km to the south east of the site boundary. [See Figure 2a]. It is considered that there will be no significant impact upon either the setting and nil impact to the fabric of this nationally important designated heritage asset, from the development proposals. Proposed restoration is likely to have only a beneficial effect as regards views towards the site area, from the monument.

Figure A2: Shows relative locations between the study site **[A]** and Chanctonbury Ring **[B]** [SAM: List Entry No. 1015114].

9.0 Archaeological Mitigation and Residual Effects

9.1 As considered earlier, as there has been much extraction of sand already within the various assessment sites since the early 20th century along with expanded such activity in the late 20th century, this extraction process will have already removed any likely archaeological resource and finds that were identified earlier in this study within the areas of these assessment sites. This being the case and whether any consideration of the potential impact of this development may have on this potential may have been low or high, the subsequent removal of such archaeological activity and finds by this long term sand extraction process, must render any considerations of such potential impact from development as being unknown.

9.2 As such considerations are unknown, it follows that any possible archaeological mitigation measures beyond this initial archaeological desk-based assessment, will be rendered academic and could thus not be carried out. This in turn would render any residual effects from this development proposal as nil or negligible.

10. Acknowledgements

10.1 Development Archaeology Services Ltd. would like to thank MGM Consulting and the Dudman Group of Companies Ltd. for commissioning this archaeological desk-based assessment study. Thanks, are also extended to Rachael Salter of the West Sussex Historic Environment Record for her kind assistance. as regards accessing reviewed data.

11.0 Bibliography

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Extract from the Second Edition six inch to one-mile scale Ordnance Survey (O.S.) map of 1898, map sheet no. Sussex 51NW.

Extract from the Third Edition six inch to one-mile scale Ordnance Survey (O.S.) map of 1910, map sheet no. Sussex 51NW.

Extract from the 1:10,560 scale Ordnance Survey (O.S.) map of 1961, map sheet no. TQ 11 SW.

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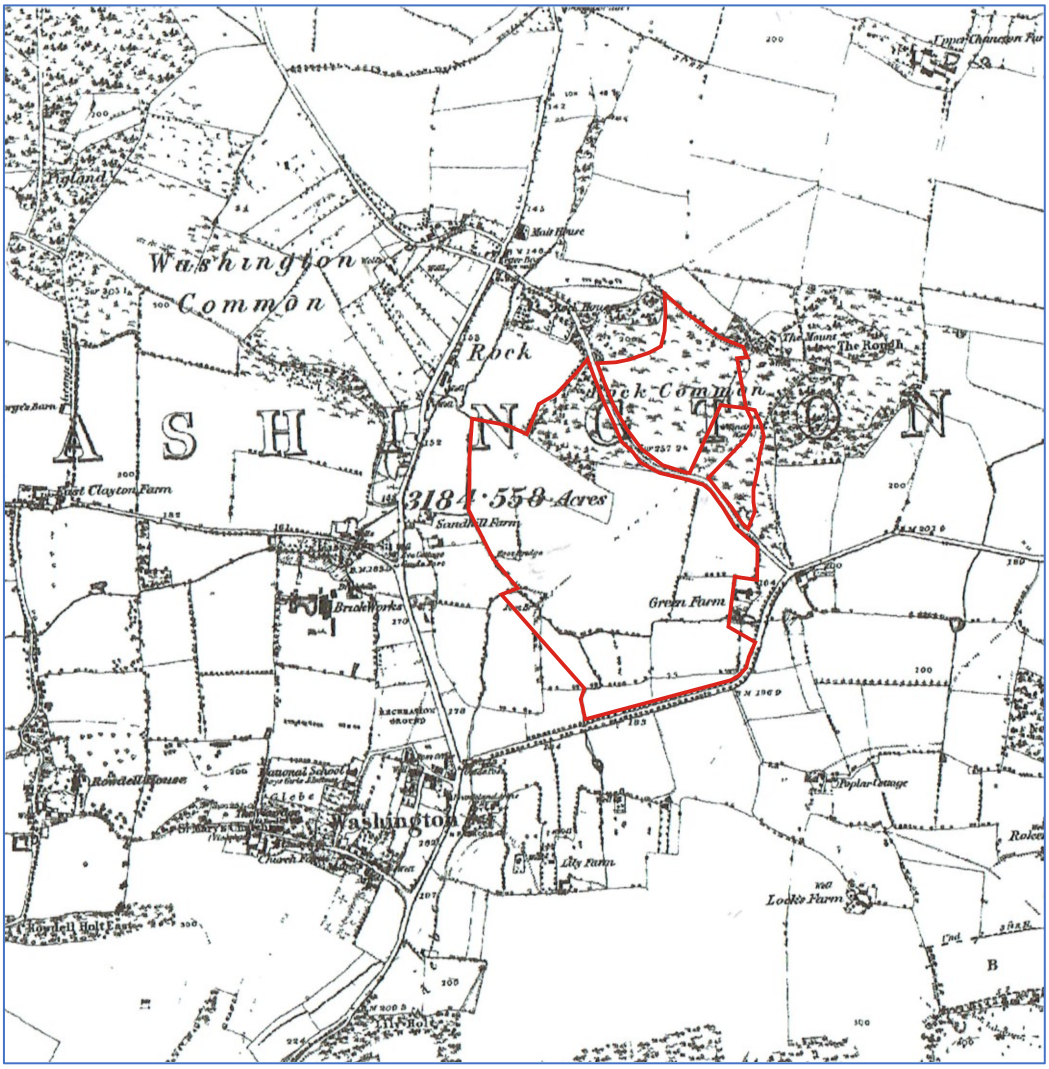

Figure 5: Extract from the First Edition six inch to one-mile scale Ordnance Survey (O.S.) map of 1879, map sheet no. Sussex 51NW. The boundaries of the assessment sites are shown outlined in red.

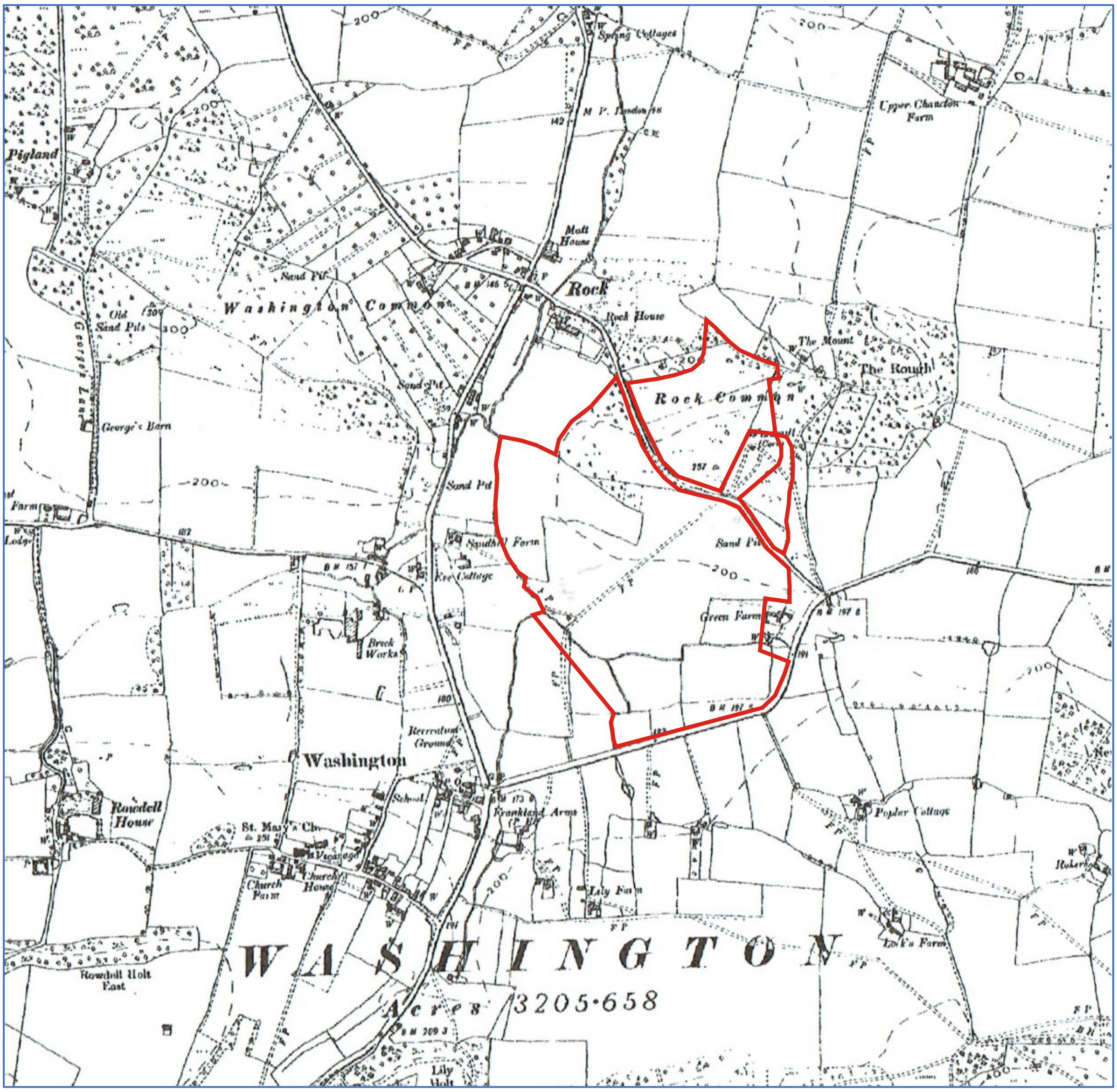

Figure 6: Extract from the Second Edition six inch to one-mile scale Ordnance Survey (O.S.) map of 1898, map sheet no. Sussex 51NW. The boundaries of the assessment sites are shown outlined in red.

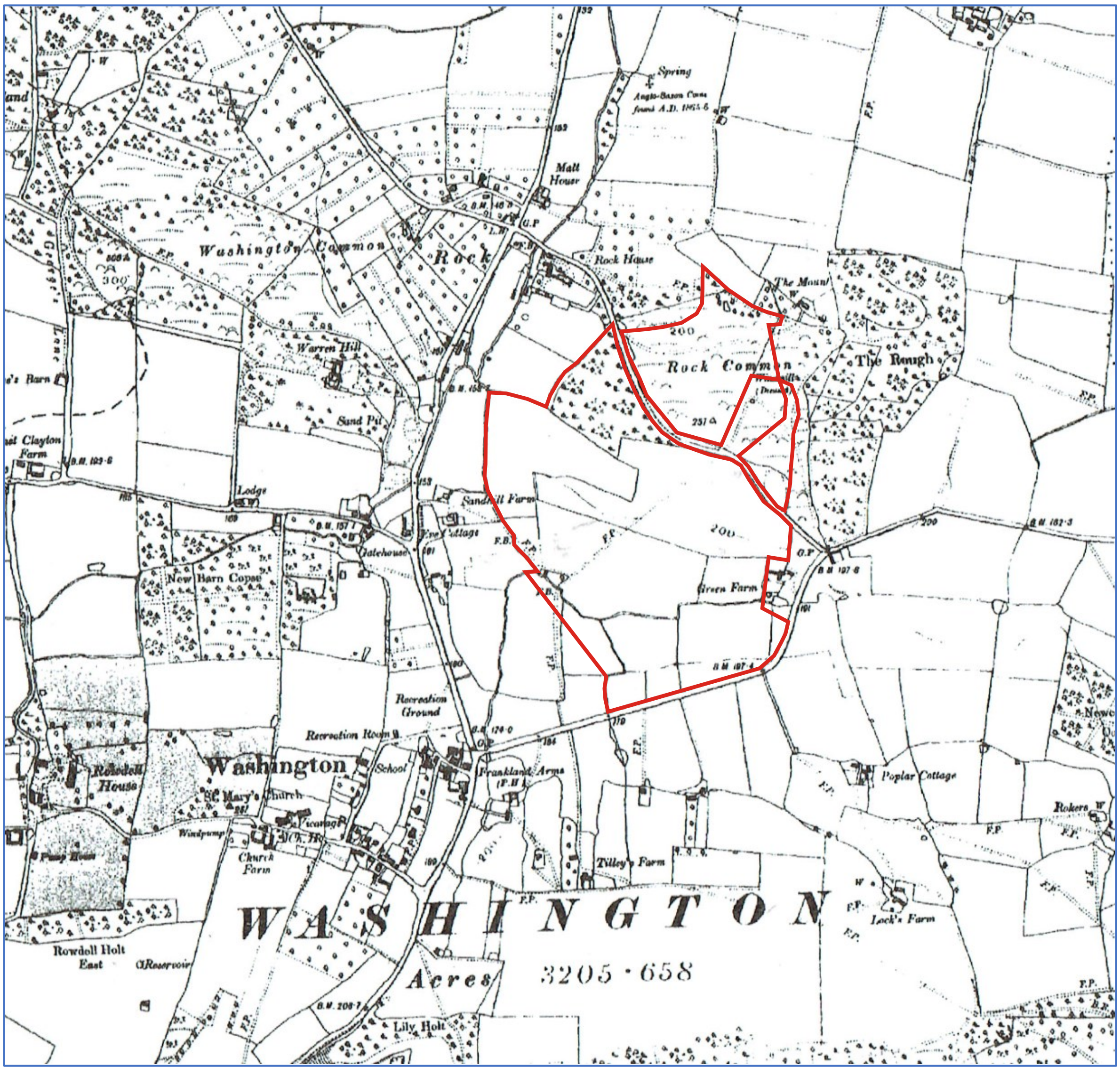

Figure 7: Extract from the Third Edition six inch to one-mile scale Ordnance Survey (O.S.) map of 1910, map sheet no. Sussex 51NW. The boundaries of the assessment sites are shown outlined in red.

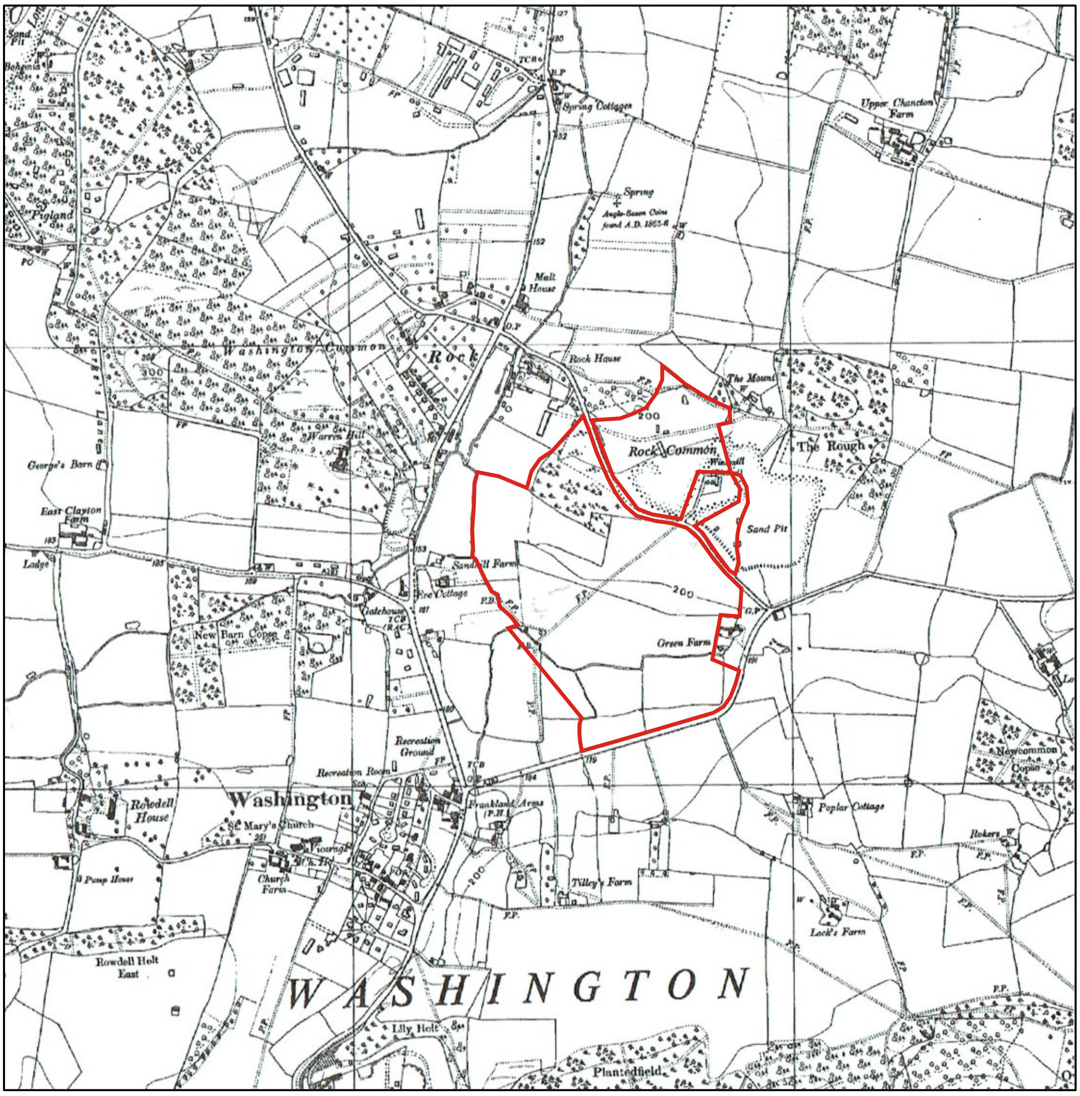

Figure 8: Extract from the 1:10,560 scale Ordnance Survey (O.S.) map of 1961, map sheet no. TQ 11 SW. The boundaries of the assessment sites are shown outlined in red.

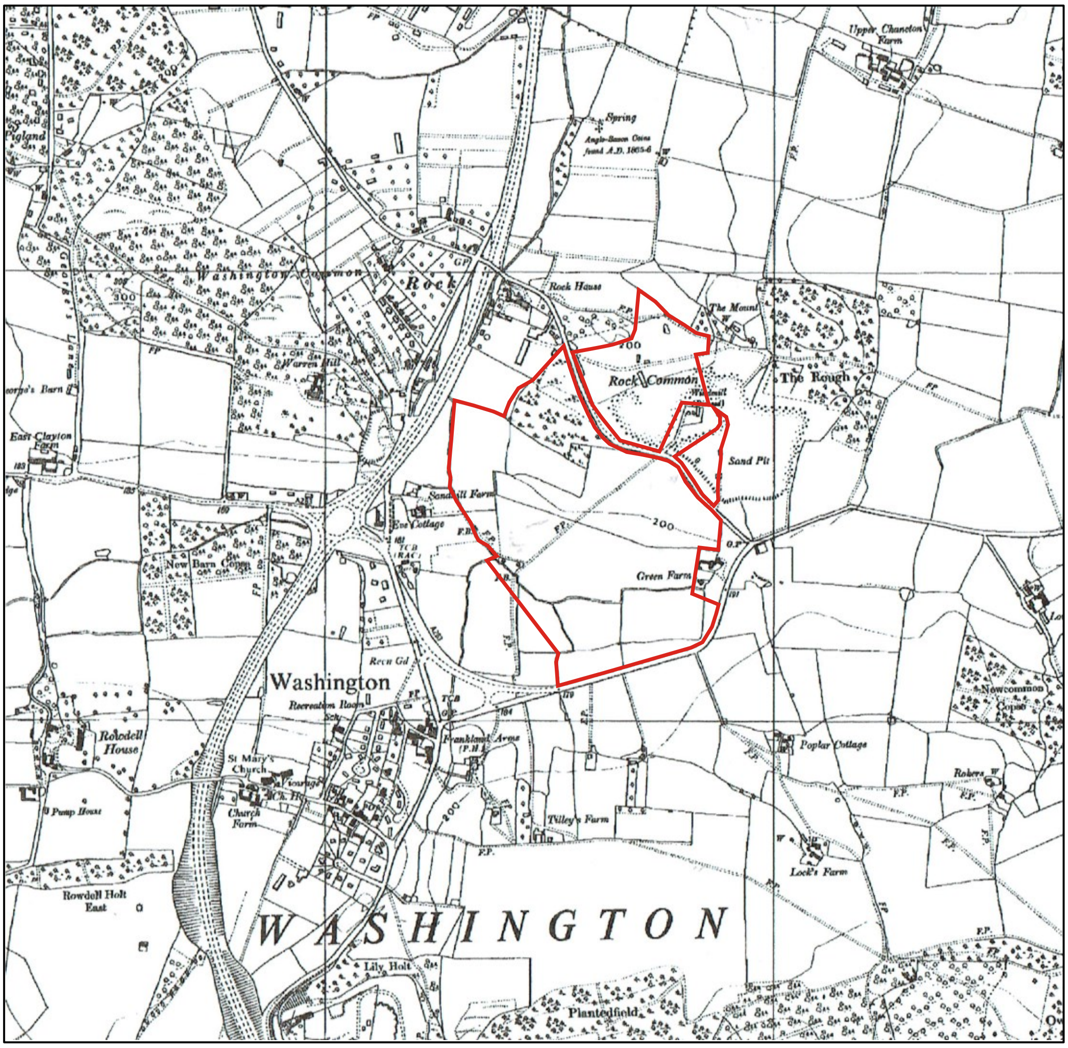

Figure 9: Extract from the 1:10,560 scale Ordnance Survey (O.S.) map of 1971, map sheet no. TQ 11 SW. The boundaries of the assessment sites are shown outlined in red.

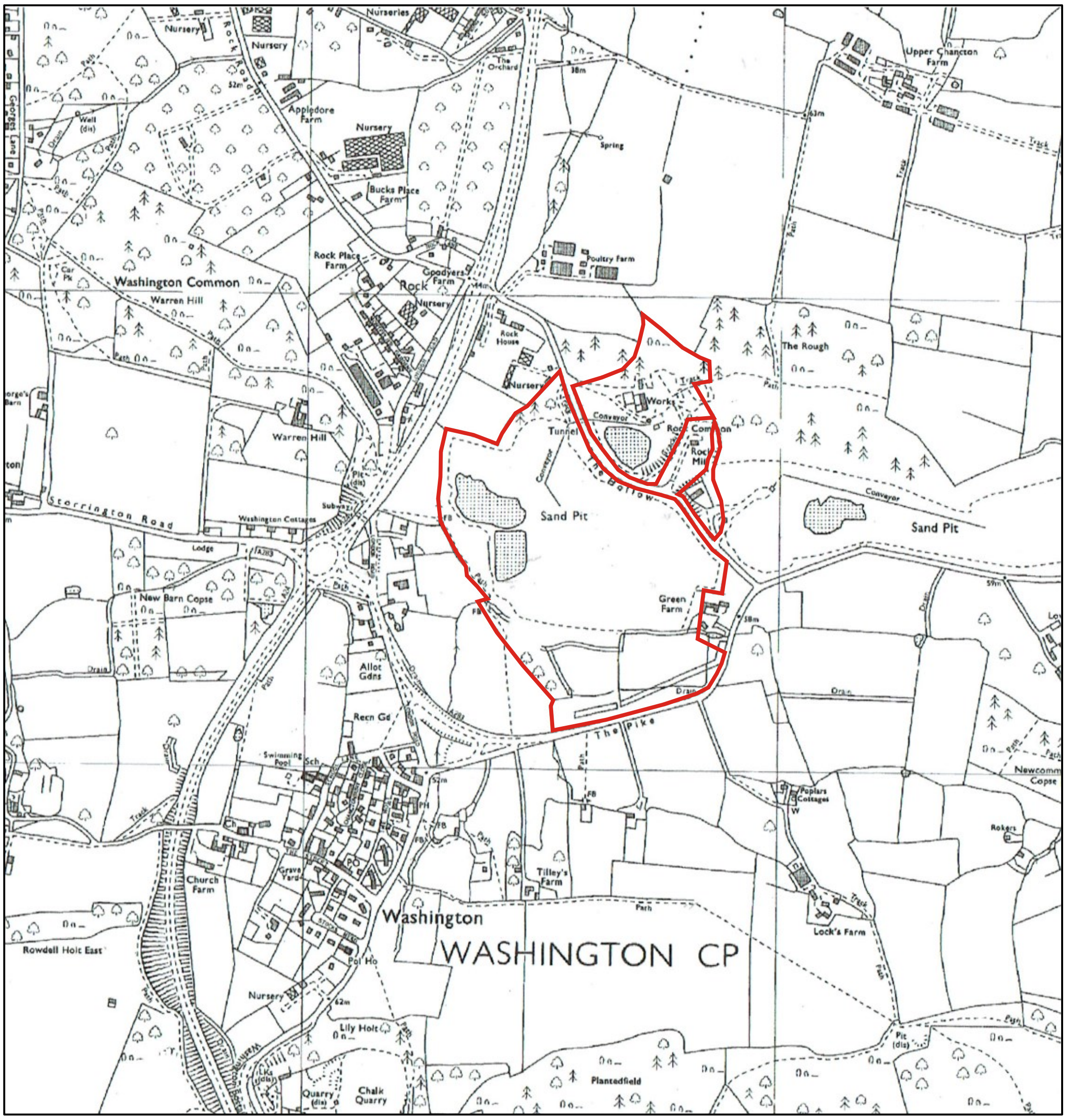

Figure 10: Extract from the 1:10,000 scale Ordnance Survey (O.S.) map of 1982, map sheet no. TQ 11 SW. The boundaries of the assessment sites are shown outlined in red.

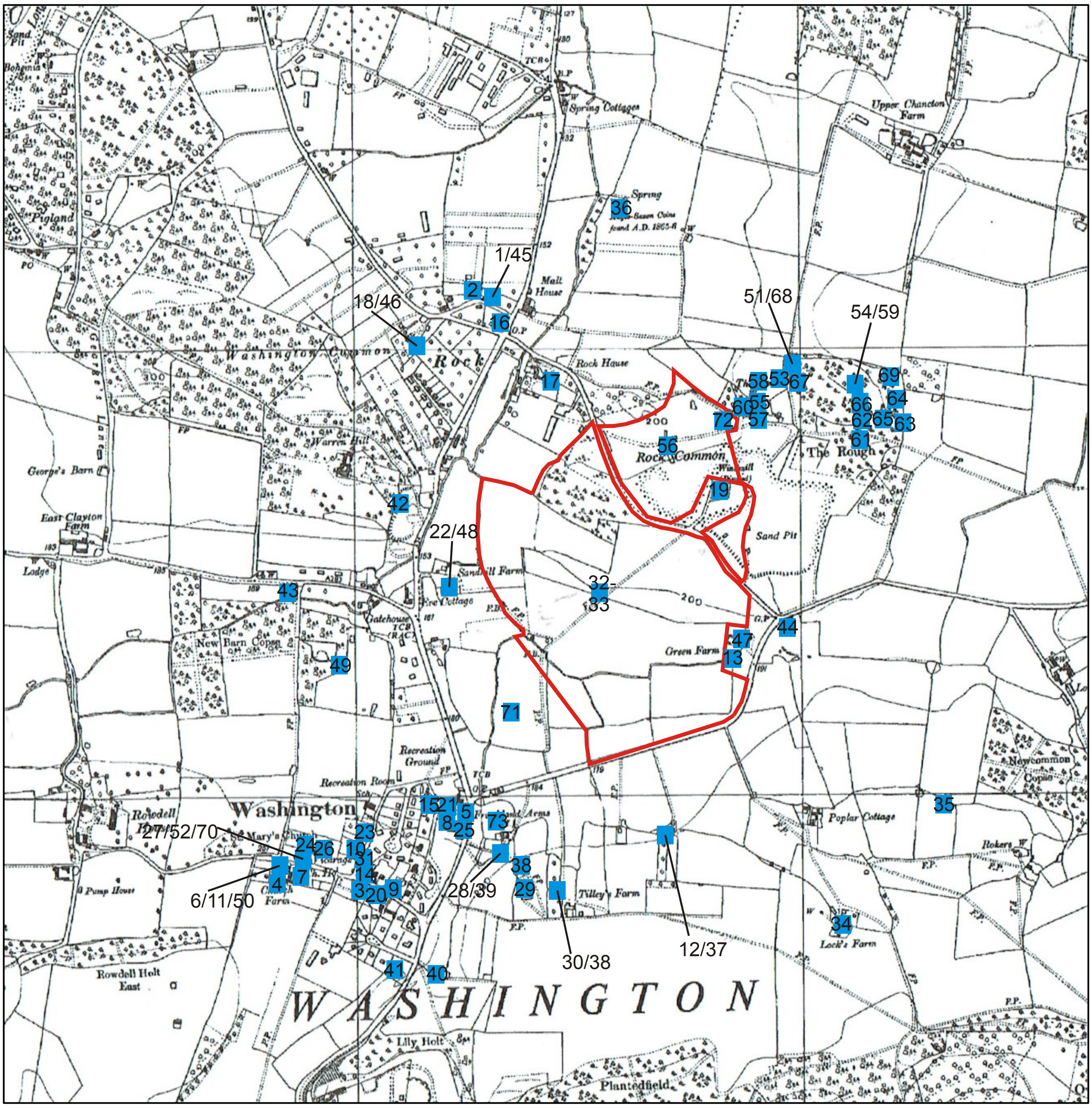

Figure 11: Cultural Heritage Data from the West Sussex Historic Environment Record (HER). The assessment sites are shown outlined in red.

Appendix 1: Cultural Heritage Data from the West Sussex Historic Environment Record (WSHER)

Site No.	HER No.	NGR (TQ)	Description	Period
1	DWS5064, NHL 1240931	1230 1412	Nos. 4 & 5, Rock Lane. Grade II listed early 16th century former farmhouse.	MD/PM
2	DWS5728, NHL 1027194	1227 1413	Apple Barn, Rock Road. Grade II listed 17th century or earlier barn.	PM
3	DWS6109, NHL 1284704	1201 1280	Bank Cottage, The Street. Grade II listed 18th century cottage.	PM
4	DWS6013, MWS8530, NHL 1182122	1182 1282	Barn at Church Farm, The Street. Grade II listed 18th century or earlier barn.	PM
5	DWS5244, NHL 1027161	1224 1296	Brook House, Northing Road. Grade II listed house of c.1830.	PM
6	DWS6475, NHL 1354096	1184 1284	Church Farmhouse, The Street. Grade II listed 19th century farmhouse.	PM/MO
7	DWS5284, NHL 1027200	1188 1283	Church House, The Street. Grade II listed early 19th century house.	PM
8	DWS6008, NHL 1182071	1220 1294	Clematis Cottage, School Lane. Grade II listed early 19th century cottage.	PM
9	DWS6012, NHL 1182115	1208 1278	Corner House, How Man & The Old Cottage, The Street. Group of 3 Grade II listed cottages, one of c1300AD date & others of 17th century origin.	MD/PM
10	DWS5280, NHL 1027196	1199 1286	Fern Cottage, School Lane. Grade II listed 17th century or earlier cottage.	PM
11	DWS6476, NHL 1354097	1192 1283	Grade II listed early 19th century garden wall to the E of Church House.	PM
12	DWS6113, NHL 1284745	1269 1290	Green Common Farmhouse, Brighton Road. Grade II listed 17th century or earlier building.	PM
13	DWS5274, NHL 1027190	1288 1334	Green Farmhouse, Brighton Road. Grade II listed farmhouse of 18th & 19th century origin.	PM
14	DWS6076, MWS11420, NHL 1260816	1202 1281	Grade II listed 20th century telephone kiosk on The Street.	MO
15	DWS5279, NHL 1027195	1216 1297	The Old Forge, School Lane. Grade II listed former smithy dated to 1732.	PM
16	DWS5279, NHL 1027192	1233 1406	Rock Farmhouse, Rock Road. Grade II listed late 18th century cottage.	PM
17	DWS6007, NHL 1182011	1244 1393	Rock House, Rock Lane. Grade II listed early 19th century house.	PM
18	DWS6110, NHL 1284717	1212 1403	Rock Place Farmhouse, Rock Road. Grade II listed 18th century house.	PM

Site No.	HER No.	NGR (TQ)	Description	Period
19	DWS6471, MWS5645 NHL 1354092	1281 1369	Rock Windmill, Rock Lane. Grade II listed smock windmill dated to 1827.	PM
20	DWS5285, NHL 1027201	1206 1276	Nods 1 & 2, Rose Cottage, The Street. Grade II listed houses of 18th & 19th century date.	PM
21	DWS6472, NHL 1354093	1220 1296	Rose Cottage, School Lane. Grade II listed 18th century cottage.	PM
22	DWS6115, NHL 1284756	1220 1350	Sandhill Farmhouse, London Road. Grade II listed 17th-19th century Grade II listed building.	PM
23	DWS6009, NHL 182076	1201 1290	South Cottage, School Lane. Grade II listed 18th century cottage.	PM
24	DWS5283, NHL 1027199	1189 1287	Grade II listed early 19th century stables to the W of the Old Vicarage.	PM
25	DWS5283, NHL 1027162	1223 1293	The Frankland Arms public House, Worthing Road. Grade II listed early 19th century building.	PM
26	DWS5283, NHL 1284693	1192 1287	The Old Vicarage, The Street. Grade II listed early 19th century building.	PM
27	DWS5282, MWS172, NHL 1027198	1187 1286	Parish church of St Mary, The Street. Grade II* listed.	MD
28	DW5246, NHL 1027163	1232 1287	Tilleys Cottage, Worthing Road, Grade II listed 17th century cottage.	PM
29	DWS6114, NHL 1284747	1238 1278	Tilley's Farm Cottage, Brighton Road. Grade II listed 17th century building.	PM
30	DWS6469, NHL 1354090	1245 1278	Tilley's Farmhouse, Brighton Road. Grade II listed 17th century building.	PM
31	DWS6111, NHL 1284722	1200 1282	Weavers Cottage, School Lane. Grade II listed 18th century building.	PM
32	MWS438	124 135	Surface clearance in Old Furze Field and Sand Corner Lane Field prior to sand extraction recovered sherds of pottery.	RO/MD
33	MWS439	124 135	Surface clearance in Old Furze Field and Sand Corner Lane Field prior to sand extraction located a possible cremation & a 4th century AD coin.	RO
34	MWS12156	1310 1271	Locks Farm, 19th century farmstead.	PM
35	MWS13060	1333 1297	Site of a 19th century outfarm to the NW of Rokers.	Pm
36	MWS6391	1261 1432	Hoard of coins found at Upper Chancton Farm in 1866.	EM
37	MWS10974	1268 1290	Green Common Farm, historic farmstead.	MD
38	MWS12953	1246 1276	Tilleys Farm or Lily Farm, historic farmstead.	MD
39	MWS13774	1233 1289	Tilley's Cottage, 19th century farmstead.	PM
40	MWS13104	1218 1259	Site of a 19th century outfarm to the S of Washington.	PM
41	MWS7811	121 126	Finds of metal objects made to the S of Washington.	RO/PM

Site No.	HER No.	NGR (TQ)	Description	Period
42	MWS3178	1211 1364	Flint working site at Warren Hill.	ME
43	MWS12805	1186 1345	Site of 19th century outfarm to the NW of Washington.	PM
44	MWS14104	1297 1338	Site of a 19th century outfarm to the NE of Green Farm.	PM
45	MWS9262	1227 1413	Site of an outfarm at 4-5, Rock Lane.	MD/PM
46	MWS10310	1214 1403	18th century farmstead at Rock Place Farm.	PM
47	MWS10987	1285 1332	18th century farmstead at Green Farm.	PM
48	MWS13498	1219 1348	18th century farmstead at Sandhill Farm.	PM
49	MWS5149	1195 1330	Site of a brickworks to the S of Warren Hill.	PM
50	MWS9763	1183 1282	Church Farm, 19th century historic farmstead.	PM
51	MWS4970	1288 1399	Woodland boundary bank at Rock Common.	UN
52	MWS10038	1188 1284	20th century war memorial within the churchyard of the parish church of St. Mary.	MO
53	MWS4488, EWS48	1293 13918	Evaluation in 1995 & excavation in 2001 identified a concentration of flint working on Rock Common.	ME
54	MWS4490, EWS48	1310 1391	Field lynchets on Rock Common identified by evaluation in 1995.	MD
55	MWS4491, MWS7254, EWS48	1291 1387	The Mount, house on Rock Common recorded by evaluation in 1995.	PM
56	MWS4812	127 137	Site of a brick & tile works in operation in the 1950s & 1960s.	PM/MO
57	MWS4969	1290 1388	Spread of occupation debris at Rock Common.	MO
58	MWS4971	1286 1390	Land boundary or linear earthwork on Rock Common.	UN
59	MWS4972	1285 1390	Eroded boundary bank or linear earthwork on Rock Common.	UN
60	MWS4973	1283 1386	Line of a former trackway to Rock Common.	PM
61	MWS4975	1319 1371	Linear earthwork on Rock Common.	UN
62	MWS4976-7	1319 1376	Linear earthwork on Rock Common.	UN
63	MWS4978	1323 1374	Linear earthwork on Rock Common.	UN
64	MWS4979	1323 1383	Linear boundary bank on Rock Common.	UN
65	MWS4980	1321 1377	Eroded ditch on Rock Common.	UN
66	MWS4981	1314 1384	Curving bank or linear earthwork on Rock Common.	Un
67	MWS4982	1298 1391	Splayed ditch or eroded holloway on Rock Common.	UN
68	MWS5647	1295 1389	Line of a former field boundary on Rock Common.	UN
69	MWS7255	1320 1390	Flint scatter found on Rock Common.	ME
70	EWS1570, MWS1172	1187 1285	Watching briefs in 2009 & 2010 located archaeological activity & finds within the church and also outside within the parish churchyard.	UN/MD/PM
71	EWS1404	1240 1318	Geophysical survey on land at Rock Common in 2008 did not identify any archaeological anomalies. The archaeological potential of the site was considered to be low.	UN
72	MWS4974	1281 1381	Holloways on Rock Common identified on APs & by the 1995 evaluation.	MD/PM
73	MWS442	124 128	Earthworks of possible house platforms to the east of Washington.	MD

ABBREVIATIONS

PA - Palaeolithic
NE - Neolithic
ME - Mesolithic
BA - Bronze Age
IA - Iron Age
RO - Roman
EM - Anglo-Saxon
MD - Medieval
PM - Post-medieval
MO - Modern
UN - Uncertain