Appledore Road, Tenterden
Minerals Assessment

Wates Developments

March 2021

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PLANNING / DESIGN / DELIVERY

Appledore Road, Tenterden
Minerals Assessment

Prepared on Behalf of Wates Developments

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1.0 SUMMARY

1.1 This Minerals Assessment has been prepared in accordance with policy DM7 of the 2016 Kent Minerals and Waste Local Plan.

1.2 This assessment demonstrates that mineral extraction is unviable and impractical and the need for the proposed non mineral development outweighs the need for the effected minerals.

1.3 The mineral resources affected by the Appledore Road proposal are the Sandstone found within the Tunbridge Wells Sand Formation and the Sandstone found within the Wadhurst Clay Formation.

1.4 Both mineral resources could potentially be used as building stone.

1.5 The market for these types of building stone is predominantly limited to use within the local building conservation and heritage sectors.

1.6 Demand for these stone types is likely to be very low, no existing quarries are extracting these mineral resources elsewhere.

1.7 The demand for building stone within Kent is not monitored due to the small-scale level of extraction and demand.

1.8 The Tunbridge Wells Sand Formation occurs across much of the southern part of Ashford Borough and across most of the neighbouring Tunbridge Wells Borough.

1.9 Sandstone within the Wadhurst Clay Formation occurs more locally around Tenterden.

1.10 Only the areas proposed for built development will potentially sterilise mineral resources. The proposed country park and playing fields will not sterilise the mineral resources located beneath them.

1.11 Only 1.52ha of the 24.5ha of land (6% of the Site) within the red line site boundary will potentially result in direct mineral sterilisation.

1.12 Existing mature vegetation, including the presence of “Important” hedgerows, veteran trees and the buffer zones to an Ancient Woodland, wetland areas (including GCN habitat) further restrict the opportunities for mineral extraction.

1.13 The adjacent High Weald Area of Outstanding Natural Beauty places a significant level of importance on protecting and retaining the existing mature landscape features.

1.14 The proximity of the existing residential properties would place significant environmental restrictions upon any proposed mineral extraction scheme, fundamentally reducing the economic viability of recovering the mineral.

1.15 If any mineral was extracted the resultant void would require significant levels of landfill of inert waste, or similar, in order to recreate a development platform to existing ground levels.

1.16 The strata beneath the Site is classed as a Secondary "A" aquifer; any mineral extraction within this resource area will draw down the ground water levels locally potentially affecting surface vegetation and creating subsidence. Any water collected within a working extraction would need to be treated most likely through a series of water lagoons before leaving the Site to ensure it was at an appropriate standard.

1.17 There is substantial justification for no further intrusive site investigations to be undertaken. Further drilling will not provide any further information that would alter the conclusions of this report.

1.18 Through consultation responses received from Kent County Council (KCC) Minerals and Waste team in relation to a previously submitted application (Ashford District Council, ADC, planning application reference 19/01788/AS) on the same site, the principle of developing the site for non-mineral extraction purposes has been accepted.

1.19 The extent of mineral sterilisation associated with the revised scheme is similar to the levels previously accepted by KCC. Therefore, in principle, the conclusions of this updated assessment should be supported by the KCC Minerals and waste team

2.0 INTRODUCTION

2.1 This Minerals Assessment has been prepared in accordance with the requirements of the 2016 Kent Minerals and Waste Local Plan (KMWLP). Based upon the available British Geological Survey (BGS) data for the area around the Site, the two separate mineral safeguarding areas are defined within the KMWLP that lie within the proposed red line boundary of the Site.

2.2 This is the second minerals assessment produced for the site area. A previous assessment, produced in December 2019, was submitted in relation to planning application (ADC planning ref: 19/01788/AS) which resulted in no objection from the Kent County Council (KCC) Minerals and Waste team. The extent of the mineral safeguarding affected by both proposals remains unchanged despite the application being markedly different (145 dwellings now compared to previously proposed 250).

2.3 The two separate mineral safeguarding areas are shown on the accompanying geological information drawing (drawing number 30688 – 003, Appendix D). The northernmost mineral safeguarding area relates to Sandstone, which is part of the Tunbridge Wells Sand Formation. The southernmost mineral safeguarding area relates to Sandstone that is part of the Wadhurst Clay Formation. Both mineral resources are designated as potential sources of building stone.

2.4 This assessment has been prepared following a review of the available information from the BGS, Kent County Council (KCC) and Historic England. In addition, feedback has been gained from minerals operators supplying building stone as well as engagement with the Stone Federation; the trade association for the natural stone industry.

2.5 This report seeks to comprehensively demonstrate that the potential mineral resources found under limited sections of the Site can be sterilised by the non-mineral development proposed by the Wates Developments' Appledore Road application. The policy mechanism for demonstrating this is outlined within DM7 of the KMWLP and the following report is structured around providing information to satisfy that policy.

2.6 The rest of this assessment is structured in the following sections:

- Section 3 - The proposed development;
- Section 4 – Planning Policy;
- Section 5 – The mineral resource;
- Section 6 – The mineral assessment; and
- Section 7 – Conclusions.

3.0 THE PROPOSED DEVELOPMENT

3.1 This Minerals Assessment has been prepared to accompany a hybrid planning application for a mixture of residential development, sports pitches and a public access country park on approximately 24.45ha of land between Appledore Road (B2080) and Woodchurch Road (B2067), Tenterden, Kent.

3.2 Site location is shown on drawing 30688-001, which is appended to this report (Appendix D). the proposed split in land uses on the Site are show in the image below.

Fig 3.1: Site Location Plan

3.3 The hybrid planning application which this assessment accompanies seeks approval for the following proposals:

a) Outline application for the development of up to 145 residential dwellings (40% affordable) including the creation of access points from Appledore Road (one all modes and one emergency, pedestrian and cycle only) and Woodchurch Road (pedestrian and cycle only), and creation of a network of roads, footways, and cycleways through the site. Provision of open space including children's play areas, sustainable urban drainage systems, landscape buffers and green links all on 12.35 ha of the site. (Matters for approval: Access)

b) Full planning permission for the change of land use from agricultural land to land to be used as a country park (8.66 ha), and land to be used as formal sports pitches (3.33 ha), together with pavilion to serve the proposal and the surrounding area. Including accesses, ancillary parking, pathways, sustainable urban drainage systems and associated landscaping'

3.4 The Appledore Road scheme is defined as the 'Site' throughout the remainder of the report. The applicant for the scheme is Wates Developments.

3.5 The Site has been designed to deliver the following key benefits:

- **Create much needed housing within Tenterden** - Affordability in Tenterden is a significant issue, house prices are 30% higher than the rest of the borough (ONS, MSOA 2018). Since 2009 this has increased by 53%. Tenterden has an increasing ageing population and a lack of key worker housing. In 2017/18 Ashford Borough Council identified that 117 people on the housing register in Ashford had a local connection to Tenterden;
- **Deliver much needed affordable housing** - New Affordable Homes allow young people access to Tenterden. Homes will be made available to local people and key workers. Approximately 100 affordable homes will be available on site;
- **Improves access to the countryside for existing and new residents -** Ashford Borough Council's Open Space Strategy (October 2017) confirms that there are issues with the quality of access to natural green spaces, even in rural areas of the borough. The land within the Site is currently privately owned with a single public access. The hybrid planning application which this mineral assessment supports proposes a 21-acre public country park that will provide over 2.5km of new footpaths;
- **Creates and new community sports hub for Tenterden -** It has been identified by both Ashford Borough Council (Playing Pitch Strategy, 2017) and Tenterden

Town Council that there is a need for more football pitches in Tenterden and specifically a new club house and new grass pitches to support teams. It is understood that with the possible redevelopment of the Recreation Ground, Tenterden Town Football Club is at risk of losing their home. The new pavilion and pitches could provide a new home for TTFC (Tenterden Town Football Club) and ensures the future of junior football in the town; and

- **The majority of the site will be publicly accessible open space –** the site will benefit from a programme of ongoing land management. A rich collection of meadows, wetlands, copses and woods will be created delivering a rich environment for people and wildlife.

3.6 A draft masterplan for the Site is shown in the image below.

Fig 3.2: Draft Masterplan

4.0 PLANNING POLICY

4.1 The following section outlines the relevant national and local planning policies that are applicable to the Site.

4.2 The determining local planning authority for the Site will be Ashford Borough Council however as minerals and waste issues are a County level matter, the relevant mineral safeguarding polices are contained within the Kent Minerals and Waste Local Plan (KMWLP) which was adopted in July 2016. KCC have also produced a separate Safeguarding Supplementary Planning Document (SPD) which was adopted in April 2017.

4.3 This assessment has also considered the latest draft version of the National Planning Policy Framework which was subject to consultation between January 2021 and March 2021.

National Planning Policy Framework – February 2019

4.4 Chapter 17 of the NPPF entitled "Facilitating the sustainable use of minerals" provides several policy details covering a wide range of matters relating to mineral planning. Paragraph 203 outlines the overall policy approach to mineral supply, recognising that mineral resources are finite and limited:

> **"203. It is essential that there is a sufficient supply of minerals to provide the infrastructure, buildings, energy and goods that the country needs. Since minerals are a finite natural resource, and can only be worked where they are found, best use needs to be made of them to secure their long-term conservation."**

4.5 Following this overarching policy position statement, the NPPF then outlines the specific measures that mineral planning policies should cover in paragraph 204. In relation to the safeguarding of mineral resources, the following clarification is made in sub section c) of paragraph 204:

> **"c) [minerals planning authorities should] safeguard mineral resources by defining Mineral Safeguarding Areas; and adopt appropriate policies so that known locations of specific minerals resources of local and national importance are not sterilised by non-mineral development where this should be avoided (whilst not creating a presumption that the resources defined will be worked)"**

4.6 The prescribed approach to mineral safeguarding is further explained within paragraph 206, which states:

> **"Local planning authorities should not normally permit other development proposals in Mineral Safeguarding Areas if it might constrain potential future use for mineral working."**

4.7 The following sections of this assessment will demonstrate that recovering the mineral resources found on site will be highly impractical as result of several reasons including the proximity of existing residential premises and the importance of retaining existing mature vegetation within the landscape. As a result, these restrictions will render any potential mineral extraction fundamentally impractical and economically unviable.

4.8 As a result, the development of the Appledore Road site will not constrain future mineral extraction, as is it is highly unlikely to ever occur given the site-specific constraints.

Draft updated National Planning Policy Framework – March 2021

4.9 The updated draft NPPF proposed a series of changes, primarily relating to improving the design quality of new developments. In addition to these changes a series of relevant changes were proposed to policy regarding mineral extraction.

4.10 The site is located above two known building stone mineral resources. Paragraph 210 of the amended NPPF, in sub clause f) notes that mineral planning authorities must consider how the extraction of building stone must be managed to ensure that the demand for stone used in the repair of heritage assets can be met. The policy removes the need to look at this demand locally or within the context of existing or relic quarries.

4.11 This proposed change could increase the potential importance of building stone reserves beneath the site. However, other constraints upon mineral extraction on site, that have been highlighted elsewhere in this report (see Section 6), still render the extraction of the mineral reserves unviable.

Kent Minerals and Waste Local Plan – Adopted July 2016

4.12 The KMWLP provides a significant amount of local detail regarding the geology and mineral resources within Kent. The plan sets out several general development control and allocation planning policies to guide and determine mineral planning applications.

4.13 In relation to mineral safeguarding, policy DM7 sets out the circumstances when non-minerals development may be acceptable at a location within a Minerals Safeguarding Area. This policy recognises that the aim of safeguarding is to avoid unnecessary sterilisation of resources and encourage prior extraction of the mineral where practicable and viable before non-mineral development occurs.

4.14 Policy DM7 states that where a non-mineral development affects a mineral safeguarding allocation the planning application should be accompanied by a "Minerals assessment". Policy DM7 states the following:

"Policy DM 7

Safeguarding Mineral Resources Planning permission will only be granted for non-mineral development that is incompatible with minerals safeguarding, where it is demonstrated that either:

1. **the mineral is not of economic value or does not exist; or**
2. **that extraction of the mineral would not be viable or practicable; or**
3. **the mineral can be extracted satisfactorily, having regard to Policy DM9, prior to the non-minerals development taking place without adversely affecting the viability or deliverability of the non-minerals development; or**
4. **the incompatible development is of a temporary nature that can be completed, and the site returned to a condition that does not prevent mineral extraction within the timescale that the mineral is likely to be needed; or**
5. **material considerations indicate that the need for the development overrides the presumption for mineral safeguarding such that sterilisation of the mineral can be permitted following the exploration of opportunities for prior extraction; or**
6. **it constitutes development that is exempt from mineral safeguarding policy, namely householder applications, infill development of a minor nature in existing built up areas, advertisement applications, reserved matters applications, minor extensions and changes of use of buildings, minor works, non-material amendments to current planning permissions; or**
7. **it constitutes development on a site allocated in the adopted development plan**

Further guidance on the application of this policy will be included in a Supplementary Planning Document."

4.15 Section 6 of this this Mineral Assessment directly addresses the criteria outlined in the policy above.

Kent Minerals and Waste Local Plan – Safeguarding Supplementary Planning Document Adopted April 2017

4.16 Further clarifications regarding how a minerals assessment required under policy DM7 of the KMWLP should be undertaken are listed within the KWMLP Safeguarding Supplementary Planning Document. The following Sections 5 and 6 of this assessment provide further, information, regarding the factors listed in Table 2 on page 16 of the Safeguarding SPD.

Early Partial review of the KMWLP and Mineral sites plan – Adopted September 2020

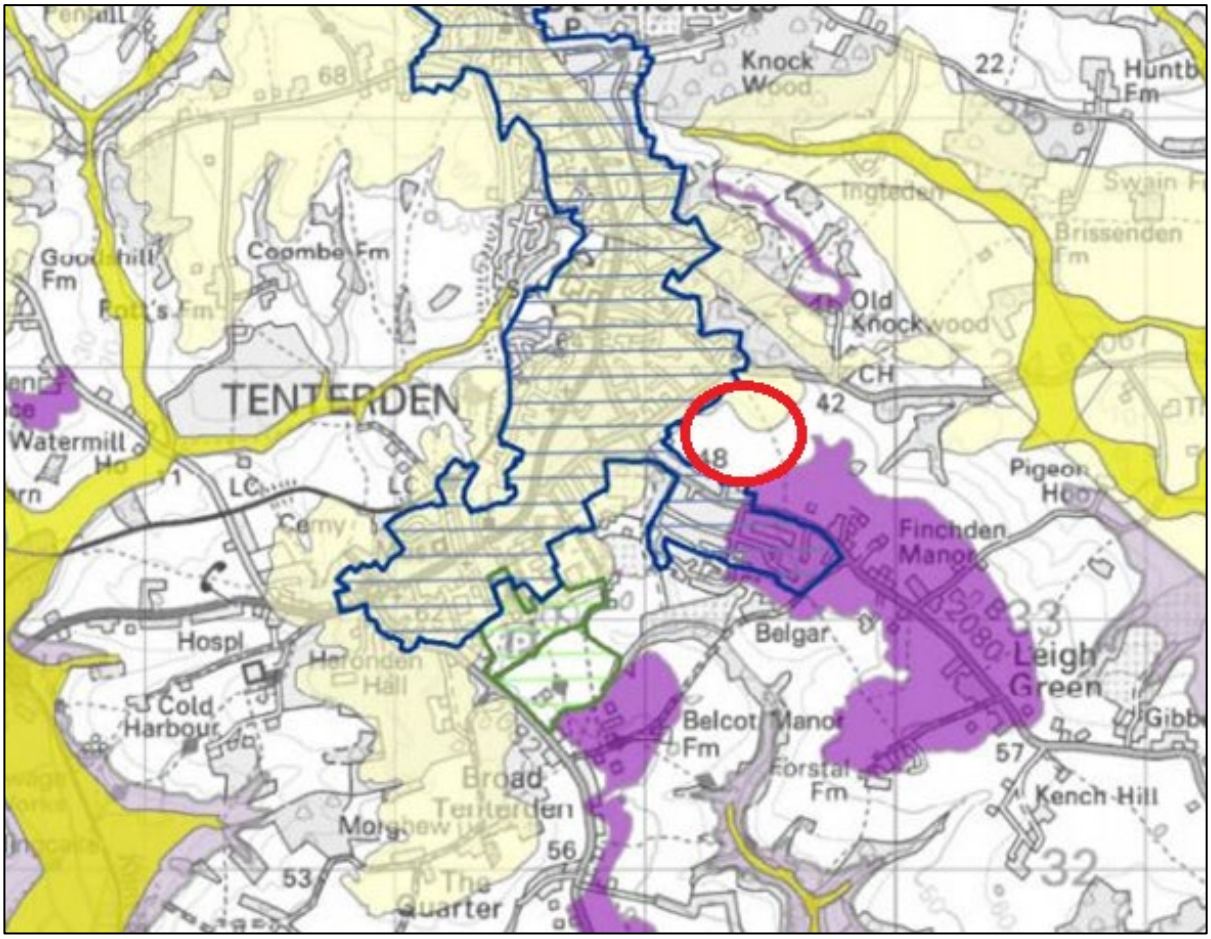
4.17 Since the submission of the previous minerals assessment the Minerals Sites Plan of the KMWLP and the accompanying Early Partial Review of the KMWLP have been progressed. Following a review of these documents it is confirmed that these have no material change to the safeguarding policy that is outlined in policy DM7 of the KMWLP.

5.0 THE MINERAL RESOURCE

5.1 The adopted KMWLP is accompanied by a series of Mineral Safeguarding maps for each of the Kent Borough Councils. The safeguarding maps identify the anticipated extent of superficial and bedrock mineral resource within each district based upon the available BGS data for that area. A copy of the mineral safeguarding map for Ashford Borough Council is attached to this report in Appendix A.

5.2 The safeguarding map in Appendix A shows that there are two separate mineral safeguarding areas that that fall within the red line boundary for the Appledore Road site. An extract from the Ashford Borough mineral safeguarding map is shown below (the broad location of the Site is circled in red)

Fig 5.1: Ashford Borough Mineral Safeguarding Map Extract



5.3 The pale-yellow area represents the Sandstone that is part of the wider Tunbridge Wells Sand Formation. The purple area represents Sandstone which is part of the Wadhurst Clay Formation. Both Sandstones form part of the Wealden Group which was laid down during the Lower Cretaceous period.

5.4 Both Sandstones' primary use is as a building stone. Given the low scale activity locally in the building stone industry compared to other minerals (e.g. aggregates), no publicly available monitoring of the demand and supply of building stone is undertaken by KCC.

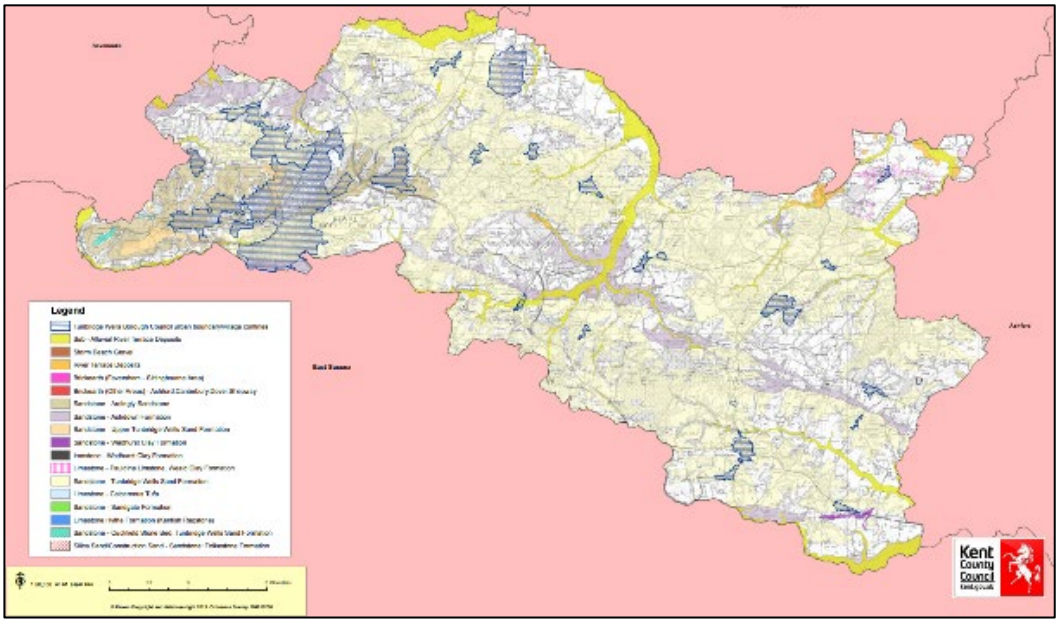
5.5 Drawing number 30688-004, Appendix D, overlays these mineral safeguarding areas over the proposed layout of the site. From that drawing the following is demonstrated:

- 5.4ha of land within the red line boundary lies within the Tunbridge Wells Sand Formation;
- Only 0.7ha (13%) of this area is directly affected by proposed building plots, the remainder is either part of the proposed playing fields, Country Park or lies beneath the retained tree belts and wetland areas.
- For the areas designated within the Wadhurst Clay Formation, only 3.9ha within the red line site boundary is affected; and
- Only 0.7ha (26%) of this area is directly affected by proposed building plots, the remainder is either part of the proposed playing fields, Country Park or lies beneath the retained tree belts and wetland areas.

Sandstone - Tunbridge Wells Sand Formation

5.6 In terms of geographical distribution, The Tunbridge Wells Sand Formation is relatively widespread across the southern portion of Ashford Borough Council (see Appendix A). The same mineral safeguarding designation also covers the vast majority of all the land within the neighbouring Tunbridge Wells Borough to the west (see **Fig. 5.2** extract from mineral safeguarding map below which highlights the sandstone resource in pale yellow).

Fig 5.2: Mineral Safeguarding Map Extract



5.7 The KMWLP notes in paragraph 2.316 that in relation sandstone from the Tunbridge Wells formation:

> **"2.3.15 Building stone, required for specialist or conservation work, is currently provided only from the ragstone (crushed rock) quarries of mid Kent. Other types of building stone, including Tunbridge Wells Sandstone and Bethersden Paludina Limestone, have been worked for local building materials but there are currently no active quarries."**

5.8 It is evident from the lack of any active quarries within Kent that are recovering the sandstone from the Tunbridge Wells Formation that demand for this mineral resource is low.

5.9 Historic England in 2017 produced a Strategic Stone Study entitled a *"Building Stone Atlas of Kent"* a copy of this report included in Appendix B. This report provides a description of the various building stone resources, including various sandstone, chalk, flint, clay and limestone formations across Kent. In relation to the Tunbridge Wells Sand Formation, the report says the following:

> **"The overlying Tunbridge Wells Sand Formation was the primary source of Wealden sandstone in Kent, with many lithological characteristics similar to the sandstones of the Ashdown Formation. The sandstones are generally fine to medium-grained, often cross-bedded and flaggy in places.**
>
> **To the west of Tunbridge Wells, the formation is divided into two sandstone units separated by a clay layer known as the Grinstead Clay. This clay layer is divided informally into upper and lower parts by the development of a thin cross-bedded, fine-grained sandstone, known as the Cuckfield Stone (named after a village in West Sussex). Numerous small building stone quarries, producing Wealden sandstone for local use, operated near Goudhurst. The variety of colours and textures can be seen in individual buildings from different phases of construction, for example in the medieval St Mary's Church in Goudhurst, where the colour variations and laminations in some of the beds provide distinctive features. The 19thcentury construction of Scotney House in the grounds of Scotney Castle used sandstone from quarries within the estate. The colour, texture and weathering patterns within the ashlar blocks are widely evident in the building's fabric. Staplehurst church makes extensive use of Tunbridge Wells Sandstone in parts of its external fabric (St George's Chapel, the Tower etc)."**

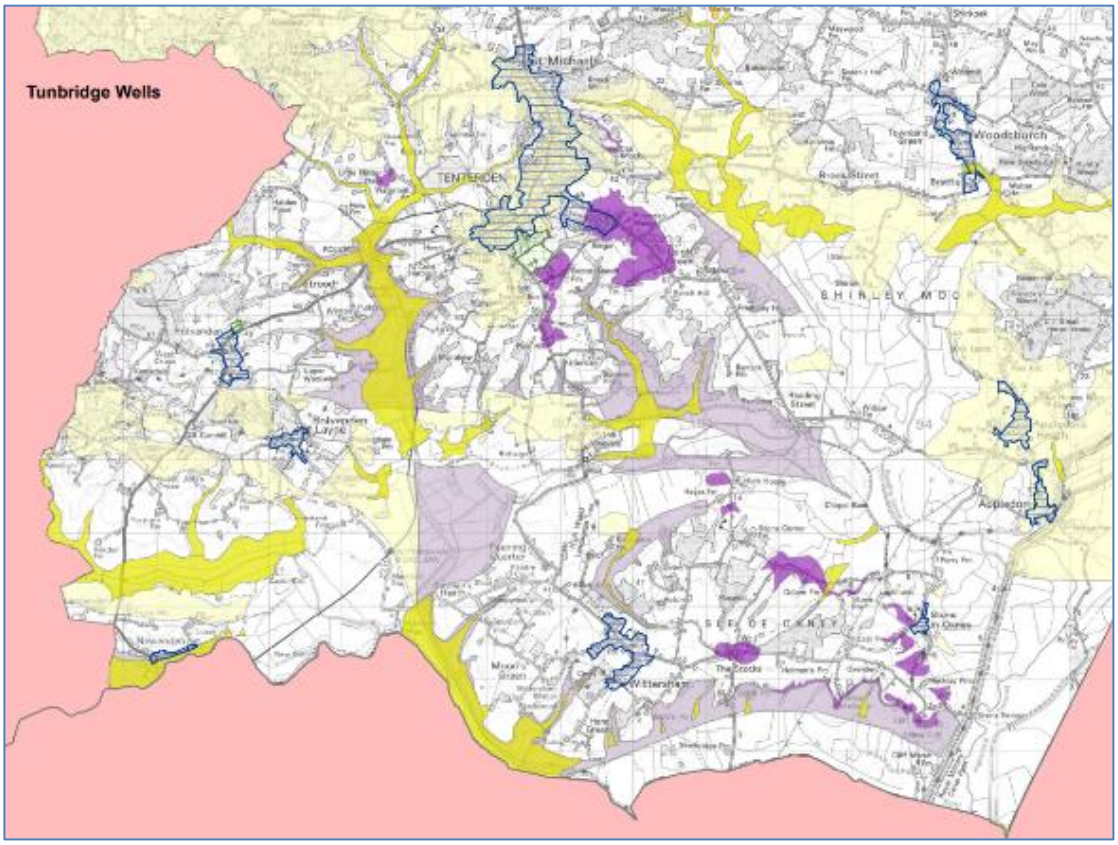
5.10 Given the widespread occurrence of the Tunbridge Wells Sandstone formation across Ashford and Tunbridge Wells Boroughs and the lack of active quarries recovering this particular mineral it can be concluded that demand for this type of stone is negligible to very low.

Sandstone – Wadhurst Clay Formation

5.11 The Wadhurst Clay Formation is mentioned multiple times throughout the KMWLP; however, it is only mentioned in relation to the much more prevalent clay element of the formation. No specific mentioned is made of the use of use of the sandstone within Wadhurst Clay Formation in terms of either active quarries recovering the mineral or customers with a specific need for that stone type.

5.12 The geographical spread of the Sandstone within the Wadhurst Clay Formation is limited to the southern portion of Ashford Borough, primarily localised around Tenterden. The extract shown below is taken from the Ashford minerals safeguarding plan (Appendix A) and shows the broad distribution of the mineral which is marked in purple.

Fig 5.3: Ashford Minerals Safeguarding Plan Extract



5.13 The Historic England Strategic Stone Study in Appendix B refers to the Sandstone from the Wadhurst Clay Formation and states the following:

> **"The Ashdown Formation is overlain by a predominantly argillaceous (clay/mudstone) sequence, the Wadhurst Clay, which also contains beds of siltstone/sandstone, limestone and ironstone, which have provided building stone locally. A number of thin calcareous sandstone beds were used as local building stone in the Tenterden area. The ironstone beds which formed the basis of the famed Wealden iron industry were largely worked from the basal part of this formation, but there is no evidence that they were used to any great extent as building stones."**

5.14 The BGS Strategic Stone Study Database has undertaken local geologists and historic buildings experts from each of 35 counties in England. For each county, using a combination of fieldwork and historic records and maps, a representative range of historic structures, from castles and cathedrals to houses and cottages, boundary walls, roofs, bridges, kerbs and paving, has been selected and the types of stones used, identified. This has enabled the most significant building stones in each county to be established and, where possible, the original source of stone for

a particular building or settlement was identified. In addition, the location of all quarries that produced these stones has been mapped, so that potential sources for conservation and new build can be recognised and safeguarded.

5.15 This exercise has been undertaken in Kent, highlighting the notable buildings constructed from sandstone. Based on this data base there are very limited number of structures that have been constructed from either from the Tunbridge Wells formation or the Wadhurst Clay formation sandstone. The nearest building made from the Tunbridge Wells sandstone to the site is the All Saints Church in Biddenden.

5.16 Given the limited geographical spread of the Sandstone from the Wadhurst Clay Formation and noting the statement above, it is reasonable to conclude that **the demand for the sandstone arising from the Wadhurst Clay Formation is negligible to low.**

Site Geological Investigations to Date

5.17 The hybrid planning application that this mineral assessment forms part of will be accompanied by Ground Appraisal report produced by Geo-environmental, dated 1 November 2017 (reference GE16690-GARv1PC171101).

5.18 The ground appraisal notes that the geology of the site does not contain any superficial deposits with both the Wadhurst Clay Formation and Tunbridge Wells Sand Formations being present beneath the Site.

5.19 In relation to the Tunbridge Wells Sand formation, the appraisal notes that it consists mainly of grey silt and yellowish fine silty sand with cemented beds of siltstone and sandstone at intervals. Irregular beds of red mottled 'catsbrain' clay are interbedded at several horizons.

5.20 The appraisal notes that Wadhurst Clay Formation consists of dark grey shales, clays and silty clays with subordinate beds of silt, sandstone, shelly limestone and clay ironstone. The shales are commonly finely banded. The shelly limestone, which is rarely more than 75mm in thickness, occurs in close association with the dark grey shales.

5.21 The appraisal notes that both the sandstone formations are designated as secondary 'A' aquifers, therefore it is anticipated that shallow ground water is likely to be present. This would indicate that any mineral extraction on site would most likely encounter ground water and associated draw down in ground water levels for the immediate surrounding areas.

5.22 A preliminary intrusive site investigation was undertaken as part of the appraisal, which comprised the following mineral resource relevant actions:

- The construction of 40No. machine excavated trial pits to depths of up to 3.00m;

- Trial pit soakage tests in general accordance with BRE Digest 365 within approximately 16 trial pits situated across site;
- 24No. window sample boreholes to a depth of 4.00m below ground level (bgl) with regular in situ testing and sampling;
- Installation of a 25mm diameter dual purpose ground gas and groundwater monitoring standpipes to a maximum depth of 4.00m bgl; and
- Laboratory based testing for geotechnical and environmental parameters.

5.23 In relation to the areas specifically marked as being safeguarded for minerals copies of the relevant borehole logs are included in Appendix C of this report. Borehole logs WS3 and WS5 are located within the mineral safeguarding area of the Site for Tunbridge Wells Sand Formation and borehole logs for WS15, WS16, WS17, WS18, and WS19 lie within the mineral safeguarding area for the Wadhurst Clay Formation. Considering the bore hole logs the following general comments can be made about both resources on site:

- All boreholes were shallow, none exceeded 4 m bgl;
- Boreholes within the Tunbridge Wells Sand Formation did not encounter consolidated sandstone, although loose sand and clay was present in all boreholes in this part of the site;
- Boreholes within the Wadhurst Clay Formation did encounter strong brown weathered sandstone, which is indicative of an outcrop of mineral strata, at a depth of 135cm (WS17) and 80cm (WS19) bgl; and
- Boreholes WS17 and WS19 were the only 2 drilled on site to encounter consolidated sandstone strata.

5.24 Whilst the drilling undertaken has been to a shallow depth, it does confirm the presence of the Wadhurst Clay sandstone formation in the southern part of the Site within the relevant safeguarded area. To the north of the Site, none of the boreholes picked up consolidated strata attached to the Tunbridge Wells formation, however sand was picked up in the subsoil horizons.

5.25 Further details regarding the onsite investigations undertaken to date can be found in the Ground Appraisal report produced by Geo-environmental which accompanies the hybrid planning application.

6.0 MINERALS SAFEGUARDING ASSESSMENT

6.1 The following section of the Mineral Assessment is structured to assess the Site against the criteria outlined within Policy DM7 of the KMWLP. Further clarifications regarding the interpretation of policy DM7 are provided within the KMWLP Safeguarding Supplementary Planning document adopted April 2017. Based on the details contained within those polices, this section of the mineral's assessment is structured to address the following points:

- The economic viability of the mineral considering its associated demand and need;
- The extent of sterilisation that would occur;
- Site specific considerations;
- Potential options for prior extraction; and
- Practicalities of mineral extraction.

Economic Viability of the Mineral, Demand and Need

6.2 From the information contained within both the Historic England Stone Study and the KMWLP the primary use of both the Tunbridge Wells Sand formation sandstone and the Wadhurst Clay Formation sandstone is linked heavily to use within the restoration and conservation of historic properties. It is unlikely that new buildings will use these sandstone types as there are no active quarries currently extracting these two stone types.

6.3 It is unlikely that the demand for this stone type will vary dramatically and any demand will be solely dictated by an individual restoration project that requires those specific stone types given its primary use within conservation and heritage sectors. A review of the BGS strategic stone study confirms that the majority of sandstone buildings in the surrounding area have been constructed using Kentish Ragstone as opposed to the mineral resources found on site.

6.4 Unlike other minerals, such as sand and gravel, hard rock and crushed rock, the supply of building stone is small to meet the often-niche market its serves (e.g. heritage and conservation sectors).

6.5 The need for a specific building stone type is most commonly driven by a specific need or customer being identified before the mineral is recovered. As a result, building stone quarries are often left unworked for years until the demand for that stone type arises.

6.6 A key factor in determining the viability and suitability of a building stone resource is to understand the aesthetic quality of the mineral. On site investigative drilling is a useful tool for most forms of mineral extraction, however due to the specific requirements of building

stone, on site drilling can only provide partially useful information which is limited to identifying the mineral and its location.

6.7 Anecdotally through discussions with representatives of the Stone Federation, deep intrusive drilling for building stone can confirm two things, the presence of the mineral and the certainty that the mineral deposit that has been drilled has been sterilised by the damage caused by the intrusive drilling. The act of intrusive drilling will fracture and disturb the mineral strata, rendering potentially useful stone blocks unusable due to drilling damage and the subsequent removal of core samples.

6.8 Important details for determining the suitability of a mineral type for use as a building stone cannot be accurately assessed through drilling alone. Aspects of the mineral resource such as the level of fracturing within the sandstone, particularly any vertical fractures and any staining or discolouration cannot be accurately assessed from intrusive drilling. This is a contributing factor in explaining why often building stone quarries are commenced when an outcrop is visible at the surface, when the quality of the mineral can be visually inspected.

6.9 Building stone can be used in many different forms from smaller pieces used as generally lower value walling stone, through to bigger blocks to be used for large scale dressing and decorative masonry. Examples of the typical uses for building stone are shown in the image below: **Fig 6.1**. In order to create these products further processing of the mineral is required to cut and shape to stone for its required use.

Fig 6.1: Examples of the Typical Uses for Building Stone

6.10 This cutting and refinement process generally produces significant volumes of waste rock. Recent discussions with members of the Stone Federation have confirmed that most operators work based on having to extract 2 tonnes of material for 1 tonne of processed and eventually sold stone. In some cases, this ratio can increase to 3 or 4 tonnes of waste rock for 1 tonne of finished product depending upon the final use.

6.11 Any building stone to be recovered from the site will need to be transported to a stone saw to be cut, processed and packaged before being sold. Whilst most building stone quarries do not have a facility like this on site, having access to one for the operator nearby helps to improve the viability accessing the resource.

6.12 Whilst the need to travel this distance with the mineral may not on its own render the stone extraction unviable, it is another factor in significantly reducing the demand for the stone and in turn reducing the economic viability of the resource.

6.13 In summary there is currently an inherent low demand for the mineral due to the nature of the sectors it could potentially supply. The aesthetic quality of both mineral resources is unknown and would remain largely so even after further drilling, which again will further limit any demand for these mineral resources.

The Potential Extent of Sterilisation which could occur as a Result of the Development

6.14 Of the 25.5ha within the red line site boundary, approximately 9.3 ha lies within a mineral safeguarding designation (36%). Of this approximately 9.3ha area, roughly 1.52ha is directly proposed for sterilisation by building plots, which equates to approximately 6% of the land within the redline boundary of the site based upon the development parcels shown on the site masterplan drawing (drawing refence 30688-004, Appendix D). The remaining circa 7.78ha of land within the mineral safeguarding area will either be public open space, playing fields, existing mature tree lines and field boundaries or areas of existing standing water or wetland corridors.

6.15 The proposed areas of public open space including the playing fields and Country Park to be created will not sterilise the extraction of the mineral resource. Surface infrastructure will be minimal and not create permanent features than cannot be cost effectively removed in order to access the minerals if required.

6.16 A key element of the proposed design for the site, given its proximity to the High Weald Area of Outstanding Natural Beauty (AONB), is placing the new development around several retained mature landscape features. This approach reduces the visual effect of the scheme upon the setting of both AONB and the town of Tenterden.

6.17 No proposals are being made to remove the vast majority of the existing mature field boundaries, tree lines or wetland areas. As a result, no change is proposed to the current level of sterilisation created by these features.

6.18 The extent of the areas affected by the two mineral safeguarding designations has been overlaid over two plans, one showing the different land uses within the proposed masterplan (drawing reference 30688-004, Appendix D) and another showing the location of the mature landscape features (drawing reference 30688-005, Appendix D).

6.19 Based upon the borehole logs contained within Appendix C of this report, it can be assumed that the level of overburden that needs to be excavated to access the Tunbridge Wells Sandstone Formation will be at least 4-5m bgl (the maximum extent of the depth of the boreholes undertaken on site to date). Any mineral extraction here will need to accommodate an overburden storage mound.

6.20 In relation to the Wadhurst Clay Sandstone Formation there are indications from the borehole results that the mineral resource is closer to the surface and less overburden will need to be recovered to extract the minerals in this part of the site.

6.21 In the case of both minerals, a full soil profile would need to be removed and stored in separate subsoil and topsoil mounds on site for the duration of any mineral operation. This requirement could further reduce the extent of the accessible minerals area if they needed to be stored within the area of the mineral resource which would be likely given the slow rate at which the mineral would be extracted given the demonstrated low demand.

6.22 Without being able to clearly establish the quality and suitability through a visual inspection of the mineral, no tonnage of anticipated minerals to be sterilised within the site has been identified. However, in terms of total surface area, of 0.78ha of the Tunbridge Wells Sandstone Formation and 0.74ha of the Wadhurst Clay Sandstone Formation (total 1.52ha) is sterilised by the proposed built development of the Appledore Road scheme.

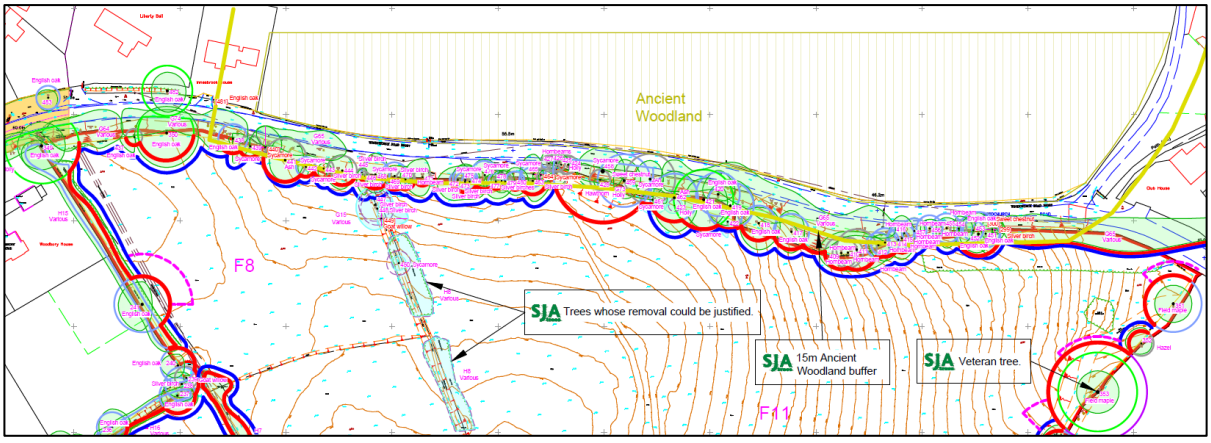
Site Specific Considerations

Natural Features

6.23 As noted above existing mature landscape features will be retained by the built development proposals. This detail is important given the site's location within the setting of the High Weald AONB and the Tenterden Conservation Area. The trees within the Tunbridge Wells Sand Formation provide a positive contribution to the setting of the adjacent High Weald AONB (location shown on drawing 30688-002, Appendix D) given their position in the landscape.

Figure 6.2: Photo Location of Trees Within the Tunbridge Wells Sand

Figure 6.3: Map Location of Trees Within the Tunbridge Wells Sand



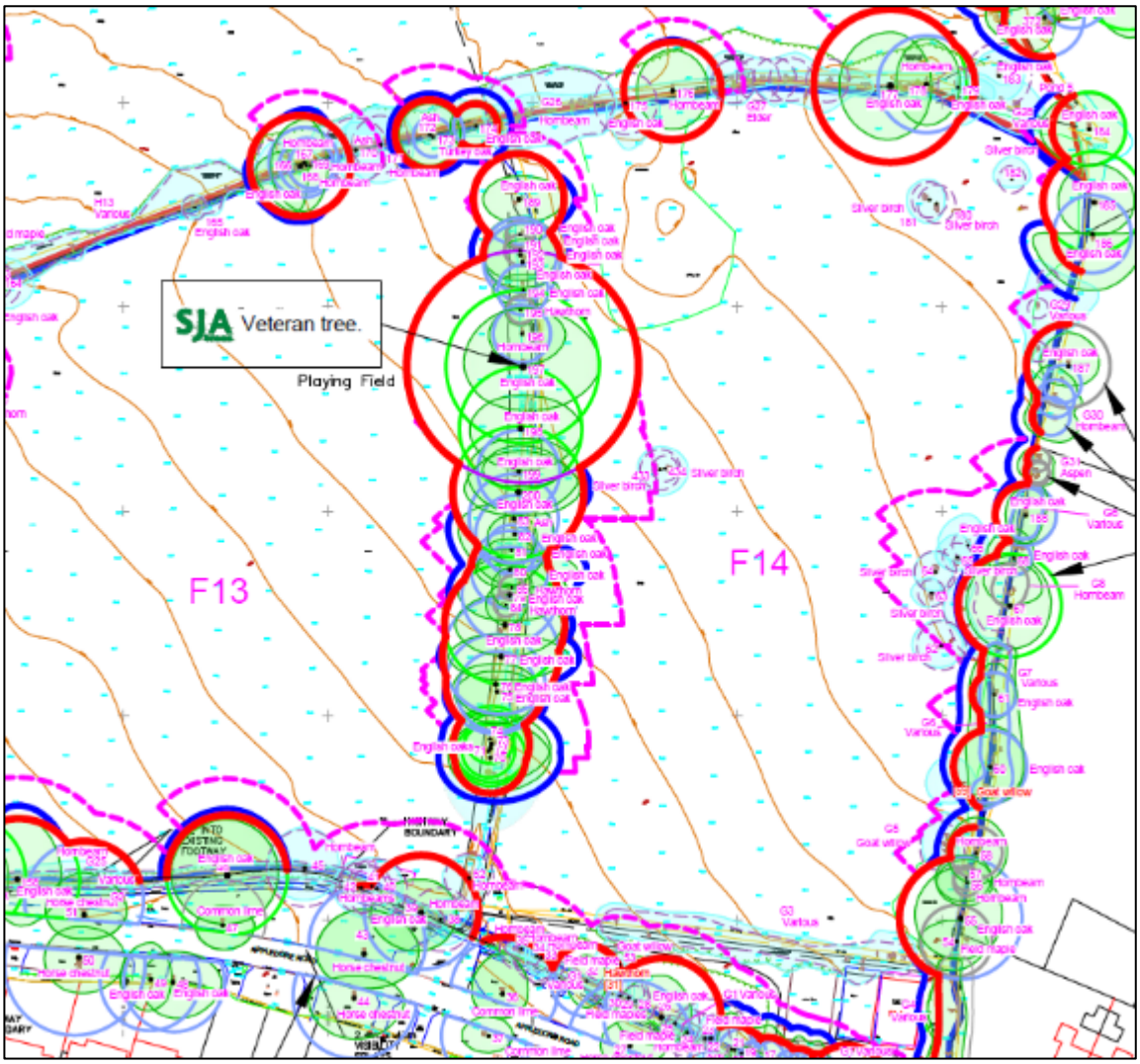
6.1 There is a well-established tree line/hedgerow that runs along the southern edge of Woodchurch Road (B2067) (see site aerial and extract from the tree survey shown above **Fig 6.2** and **6.3** above). This feature contains a variety of mature native species and meets the definition of 'important' under the 1997 Hedgerow regulations. The entire tree belt lies within a 15m buffer zone to the Ancient Woodland to the north of the B2067. In order to access any mineral found within this portion of the site from Woodchurch Road, a significant length of this woodland belt and "Important" hedgerow would also need to be removed to create a suitable vehicle entrance.

6.2 In addition, due to the age of the road, the route is reasonably undulating in both the horizontal and vertical alignments with a series of blind corners with relatively poor visibility. In order to achieve the required visibility splays on to Woodchurch Road suitable for HGV (required to transport any recovered mineral) movements, a substantial section this mature

landscape feature would need to be removed. This would present a significant constraint for any potential mineral recovery.

6.3 In relation to the southern part of the Site, designated as part of the Wadhurst Clay Formation, there are substantially more hedgerows that are classed as "important" and will constrain any mineral extraction activity. This part of the site also contains a veteran English Oak tree (tree number 197 see extract from tree survey below.).

Fig 6.4: Map Location of Veteran English Oak tree (tree number 197)



6.4 Paragraph 175 d) of the NPPF states that:

> **"development resulting in the loss or deterioration of irreplaceable habitats (such as ancient woodland and ancient or veteran trees) should be refused, unless there are wholly exceptional reasons and a suitable compensation strategy exists."**

6.5 In accordance with the above-mentioned policy the presence of this tree in this part of the site already sterilises a significant a portion of the mineral safeguarding area. The extraction

of sandstone from the Wadhurst Clay Formation does not present a wholly exceptional reason for the removal of the tree. This tree is not proposed for removal as part of the development proposals for the Site.

6.6 The wetland and surface water features that run across the Site also present a significant constraint to any potential mineral extraction. Both sandstone formations, as confirmed by the Geo – environmental assessment which accompanies this planning application, are classed as secondary "A" aquifers. The permanent removal of sections of these strata could result in a significant change in the hydrological and hydrogeological regime of the site, resulting in potential significant change to the existing surface water features within the site.

6.7 In addition to the potential effects upon ground water the possible removal of the existing drainage ditches and features should be avoided so that the status quo of the existing surface water drainage features can be maintained.

6.8 Any significant changes to the existing hydrology across the site would have a negative impact on the wildlife that are known to use the ditches as habitat, while possibly increasing the risk of flooding in Appledore Road (B2080).

Site Infrastructure

6.9 There is an overhead power line which runs north to south through the site, the route of the line is shown in the Geo-Environmental Ground Appraisal Report. The power line avoids the southern Wadhurst Clay Formation mineral safeguarding area however it bisects the area designated as part of the Tunbridge Wells Sand Formation. The presence of this power line will limit the potential for mineral to be recovered from this section of the Site. "Lift and shift" agreements are common however given the associated cost of doing so it may be likely that a network operator would seek to compensate the landowner for the sterilisation of the mineral rather than having to undertake the diversion of the electrical infrastructure.

Public Rights of Ways

6.10 Ashford Borough Council footpath reference number AB12 runs north to south through the site connecting Appledore Road with Woodchurch Road. The route is marked as "path" on all the plans attached to this mineral assessment. The path cuts directly through both mineral safeguarding areas. Whilst the presence of the footpath does not prohibit mineral extraction, it would need to be temporarily diverted to allow mineral extraction to take place and returned to its existing alignment once the exaction works had been completed. Any shear faces in the quarry would need to be removed and the route made accessible again as part of any restoration of the site. If a considerable amount of mineral is removed, it is likely that replacement material would need to be imported to the site to recreate the diverted right of

way on to a similar vertical and horizontal alignment. The cost of importing this material will have an impact upon the economic viability of the mineral resource.

Site Constraints/Designations

6.11 The High Weald Area AONB generally encircles Tenterden, however the built-up area of the town, including the site, are not within it. The extent of the High Weald AONB designation near the site is shown on the site location plan (drawing 30688-001, Appendix D).

6.12 The proposed Masterplan for the built development has recognised that the eastern part of the site forms part of the setting of the AONB and it has therefore been retained free of development as a publicly accessible Country Park to provide a high quality local amenity and so as not to impact on views into and out of the AONB or the landscape character of land within the setting of the AONB. It goes further in proposing improvements to the landscape character through landscape repair and enhancement.

6.13 The Ashford Landscape Character Assessment attributes moderate sensitivity to the landscape in this area and provides guidelines which include 'the need to conserve and reinforce the rural enclosed landscape which provides the immediate setting of the AONB'. The historic small-scale landscape pattern formed by hedgerows, tree belts and specimen Oaks, ponds and drainage ditches is still recognisable within the site and will be retained by the built development proposals.

6.14 Mineral extraction would significantly alter the landscape pattern through the loss of these characteristic features, alter the landform with the potential to affect panoramic views over the AONB. The permanent removal of these features through mineral extraction would have a significantly detrimental effect on local landscape character and the setting of the High Weald AONB east of Tenterden.

Proximity of other Development

6.15 Both mineral safeguarding resource areas are within 250m of nearby residential premises on Appledore Road (B2080) and Woodchurch Road (B2067). Some of the properties on the eastern end of the both roads will be immediate adjacent to any mineral extraction activity.

6.16 The cumulative extent of 250m zone from these residential properties is shown on the geological information plan (drawing 30688-003, Appendix D) which is appended to this report. The 250m limit has been used as a guide as there are generally no statutory distances that mineral operation must observe from residential properties however within that distance it is more likely that the effects of noise, air quality and vibration will need to be significantly controlled and mitigated to avoid having unacceptable impacts.

6.17 Any operations to recover the building stone will involve at least one drilling rig to cut the stone away from the strata and one excavator. There may be a diesel water pump running to de-water any excavations given the secondary aquifer nature of the mineral resources. Cumulatively these noise emissions could result in unacceptable increase above background noise levels at the nearest properties at the eastern end of the Appledore Road and Woodchurch Road.

6.18 The removal of building stone does require drilling and in some case the use of blasting to remove the mineral. The blasting is generally low key using black powder rather than the large-scale blasts undertaken at aggregate quarry using ANFO (Ammonium Nitrate), nonetheless they will be noticeable at the nearest properties. Restrictions regarding where and when blasting can take place on site would be imposed on any extraction especially where the development is adjacent to existing residential properties.

6.19 For the closest properties it is likely that significant restrictions on working method and operating times will be placed upon any mineral extraction in order to bring any of the environment impacts to within acceptable levels. These restrictions will further impact upon the economic viability of the mineral extraction limiting the rate of extraction and times of working.

Potential Options for Prior Extraction

6.20 As noted in earlier sections the market for the minerals identified within the safeguarding area is limited to a low demand supply into the heritage and conservation sectors. The demand is very low for both mineral types and it is reasonable to conclude that there is not a market that the mineral be extracted and supplied into in advance the built development being completed.

6.21 Economically it is unlikely to be viable to extract a mineral resource without a specific demand and need being identified given the significant upfront costs associated with extracting the mineral.

6.22 If a mineral resource was recovered in advance of the building works being completed, it is likely that usually inert building waste would need to be imported to the site and deposited as a landfill or material recovery to bring the site levels back up to the existing ground level. If this wasn’t undertaken it is likely that a significant void would be left near existing residential premises, new public access Country Park and statutory rights of way. It is likely that the costs associated with undertaking this would further limit the economic viability of any potential extraction.

Practicalities of Mineral Extraction

6.23 The proximity to the existing residential properties on Woodchurch Road (B2067) and Appledore Road (B2080), would, most likely result in a significant restriction on the Site operations. These restrictions could take the form of limiting the number of working days, operational hours, method of extraction (i.e. no blasting) and mineral movements to and from the site. Collectively it is likely that the proximity to these properties will significantly limit any extraction activity.

6.24 Ordinarily given the level of likely objection to a scheme and the required operational restrictions as a result of being close to existing properties, a mineral operator would not normally pursue a planning application for mineral extraction on a site with parameters such as this.

6.25 A scheme to allow larger vehicles including HGVs to access the Tunbridge Wells Sand Formation resource from Woodchurch Road (B2067) is unlikely to be achievable due to the presence of the mature tree belt and hedgerow on the southern side of the road, all of which is within a 15m buffer of an Ancient Woodland (see tree survey results of more detail). A significant level of tree clearance would be required to accommodate the access road and the associated required visibility splays needed for HGVs. As noted previously, the varying horizontal and vertical alignments of Woodchurch Road coupled with the 60mph speed limit would necessitate considerable visibility splays and the removal of mature vegetation. This further significantly reduces the practicality of mineral extraction taking place on the Site.

6.26 The mature landscape features (tree and hedgerow field boundaries and wetland areas) are proposed for retention as part of the built development proposals. These features contribute to the surrounding landscape character (see landscape assessment that accompanies the Appledore Road planning application) and are important in setting of the High Weald AONB from Tenterden. The existing ponds are an important feature for Great Crested Newts (A European Protected Species) and one of these ponds has been identified as a breeding pond. A mineral extraction scheme to remove these features would be significantly damaging and it is fair to conclude that it would not be likely to be granted planning permission.

6.27 A mineral extraction scheme would need to work around retaining these features and would most likely need to accommodate the following features to support mining operation:

- An exaction void;
- Overburden mound including the storage of waste rock;
- Topsoil and subsoil storage mounds;

- Water treatment areas - As the minerals are located within a secondary aquifer and ground ingress may occur. The water treatment areas will need to be large enough to allow a significant amount of rock sediment to settle from the collected water before being allowed to leave the site. This will require a relatively significant area in order to achieve the water quality parameters needed;
- Site staff welfare facilities;
- Vehicle maintenance and parking area;
- Visitor and site operative parking area; and
- Wheel wash and significant hardstanding run off before joining the main highway network to ensure no excess mud and debris is tracked on to the highway.

6.28 Whilst specific size requirements for all of the above mentioned infrastructure cannot be accurately defined, it is fair to conclude that given the importance of retaining the existing mature landscape vegetation, it would be impractical to attempt to recover the building stone from within the Wadhurst Clay and Tunbridge Wells sandstone Formations.

6.29 Significant and impractical compromises and restrictions on the site operations would need to be made to allow an environmentally sound mineral extraction scheme to be undertaken within either safeguarding area. Considering this, recovery of the minerals from within either sandstone formation would be impractical, and as a result would be very unlikely to occur under any circumstance.

7.0 CONCLUSION

7.1 In relation to the assessment criteria outlined in policy DM7 of the KMWLP, this minerals assessment demonstrates that several the following criteria have been met:

"2. that extraction of the mineral would not be viable or practicable; or"

7.2 The minerals found on site would be used as building stone. The market for both these mineral types is extremely limited given their likely use is limited to the relatively small sectors of conservation and heritage. It is reasonable to conclude that this small market would take limited volumes of stone over a prolonged period. In addition, there is no existing recorded demand for these types of mineral and no existing building stone quarries within Kent are extracting these stone types.

7.3 The extraction of the mineral would be significantly constrained in terms of working around retained mature vegetation and by the proximity of existing residential properties. Both mineral resources cannot be accessed without substantial mature vegetation removal. The northernmost Tunbridge Wells Sand Formation cannot be accessed without removing a mature "important" Hedgerow and tree belt, all of which lies within a 15m buffer of a designated Ancient Woodland. The existing mature vegetation is very important in relation to the setting of the High Weald AONB, adding further weight to the justification for protecting and retaining the existing mature tree lines and hedgerows.

7.4 The presence of existing residential properties immediately adjacent to both mineral resources would require several significant restrictions upon the site operations which would further reduce the economic viability of any mineral extraction.

7.5 Considering the details summarised above and other factors discussed within this report, the mineral resources found on site cannot be extracted in a viable or practical manner and as such the Appledore Road proposals satisfy this criterion.

"5. material considerations indicate that the need for the development override the presumption for mineral safeguarding such that sterilisation of the mineral can be permitted following the exploration of opportunities for prior extraction;"

7.6 In addition to satisfying the criteria outlined, the significant benefit of delivering new housing in an area of significant need, including 40% of which will be affordable, is a national priority should be afforded significant weight.

7.7 Furthermore, the NPPF also places a significant level of weight on the protection of veteran trees, which in the planning balance in this case considering the mineral effected outweigh the need for mineral extraction. The presence of the veteran tree within the Wadhurst Clay

Formation safeguarding area further reduces any potential mineral extraction area. These material considerations should override the protection of the mineral resources affected considering the very low demand and limited uses of those stone types.

7.8 Prior extraction of these mineral types is not practical given the location of the mineral resources and the impact the extraction would have upon being able to deliver the proposed development.

7.9 The Appledore Road proposal therefore also complies with criteria 5 of policy DM 7.

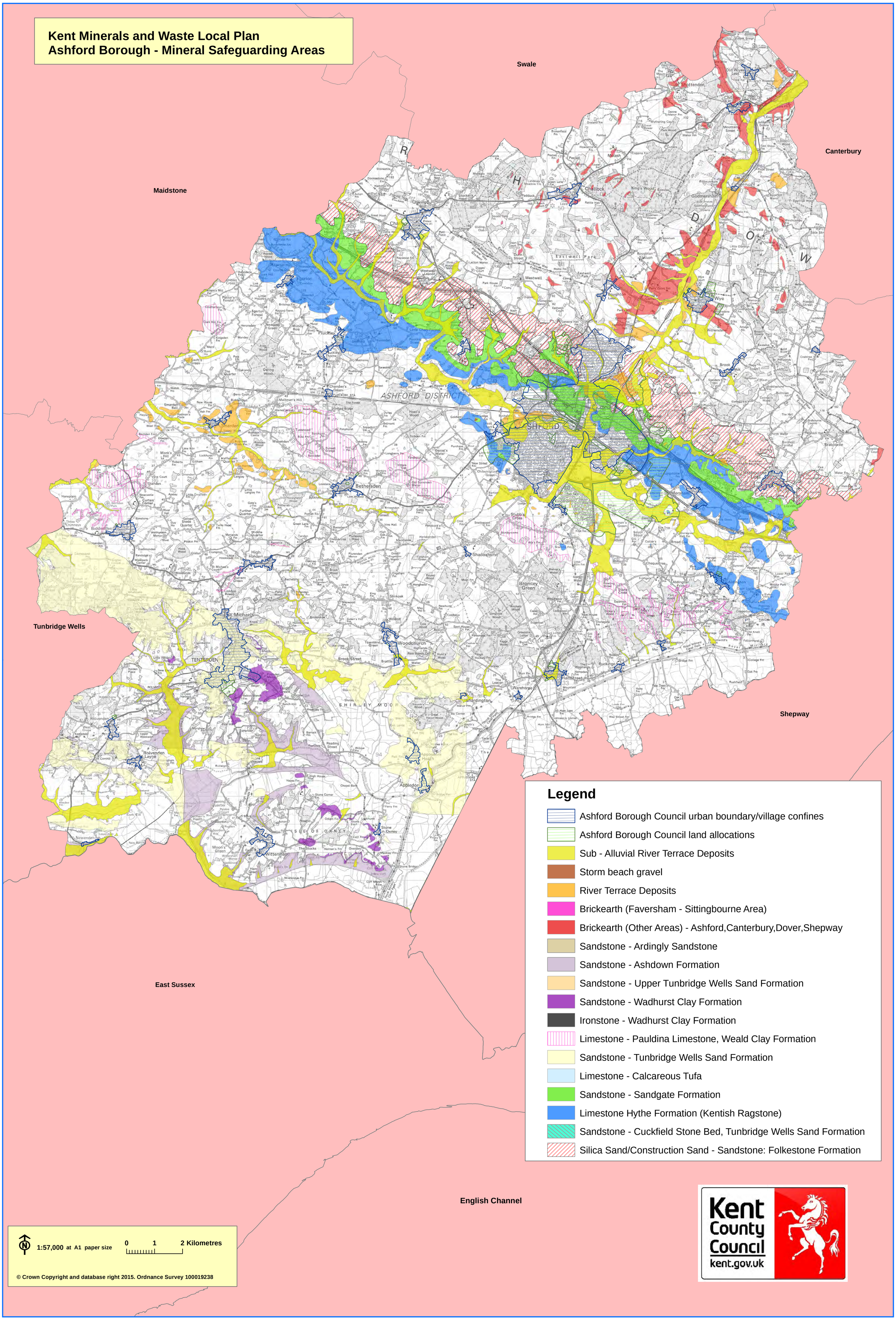
7.10 Furthermore, considering the above points, there is substantial justification for no further intrusive site investigations to be undertaken. Further drilling will not provide any further information that would alter the conclusions of this report.

7.11 The findings of this report originally produced for the 2019 application are relevant and applicable to the revised 2021 scheme. On this basis the no objection raised by the Kent County Council Minerals and Waste Team to the previous application should be similarly applied to this updated report and the revised scheme which it is submitted alongside.

APPENDIX A

Kent Minerals and Waste Local Plan
Ashford Borough Council Mineral Safeguarding Insert Map

Kent Minerals and Waste Local Plan
Ashford Borough - Mineral Safeguarding Areas



APPENDIX B

Historic England Strategic Stone Study – A Building Stone Atlas of Kent 2017

Historic England

Strategic Stone Study

A Building Stone Atlas of Kent

First published by English Heritage October 2011
Rebranded by Historic England December 2017

Introduction

The indigenous Kent building stones are all of sedimentary origin, and were predominantly quarried from the Cretaceous rocks of the county. They comprise mainly sandstones and sandy limestones. Flint, chalk, tufa and conglomerate have also been used in the past as vernacular building stone. The subtropical or tropical environments in which these sediments were deposited ranged from non-marine to marginal to open marine conditions. The non-marine sediments were laid down under fluvial, deltaic and estuarine conditions, giving rise to substantial lateral and vertical variability in the resultant clastic sequences (sandstone, siltstone and mudstone). The deposits of the marginal and marine environments were predominantly calcareous in nature.

Regional tectonism in the early Tertiary led to uplift, folding and erosion of these sediments, leaving an eroded west-north-west trending anticline across the county - a feature known geologically as the Wealden Anticline. Folding of these strata was accompanied not only by faulting but also by the formation of a number of minor subsidiary folds, which has led to a locally complex structural pattern.

Geographically, Kent includes the northern part of the area referred to as 'The Weald', bounded to the north by the chalk lands of the North Downs. Within the Weald there are distinct, low-lying clay areas known as 'The Low Weald' These are separated by two areas of higher ground – a sandstone region at the centre of the anticline, known as 'The High Weald', and the 'Greensand Ridge' (mainly sandy limestone) further to the north.

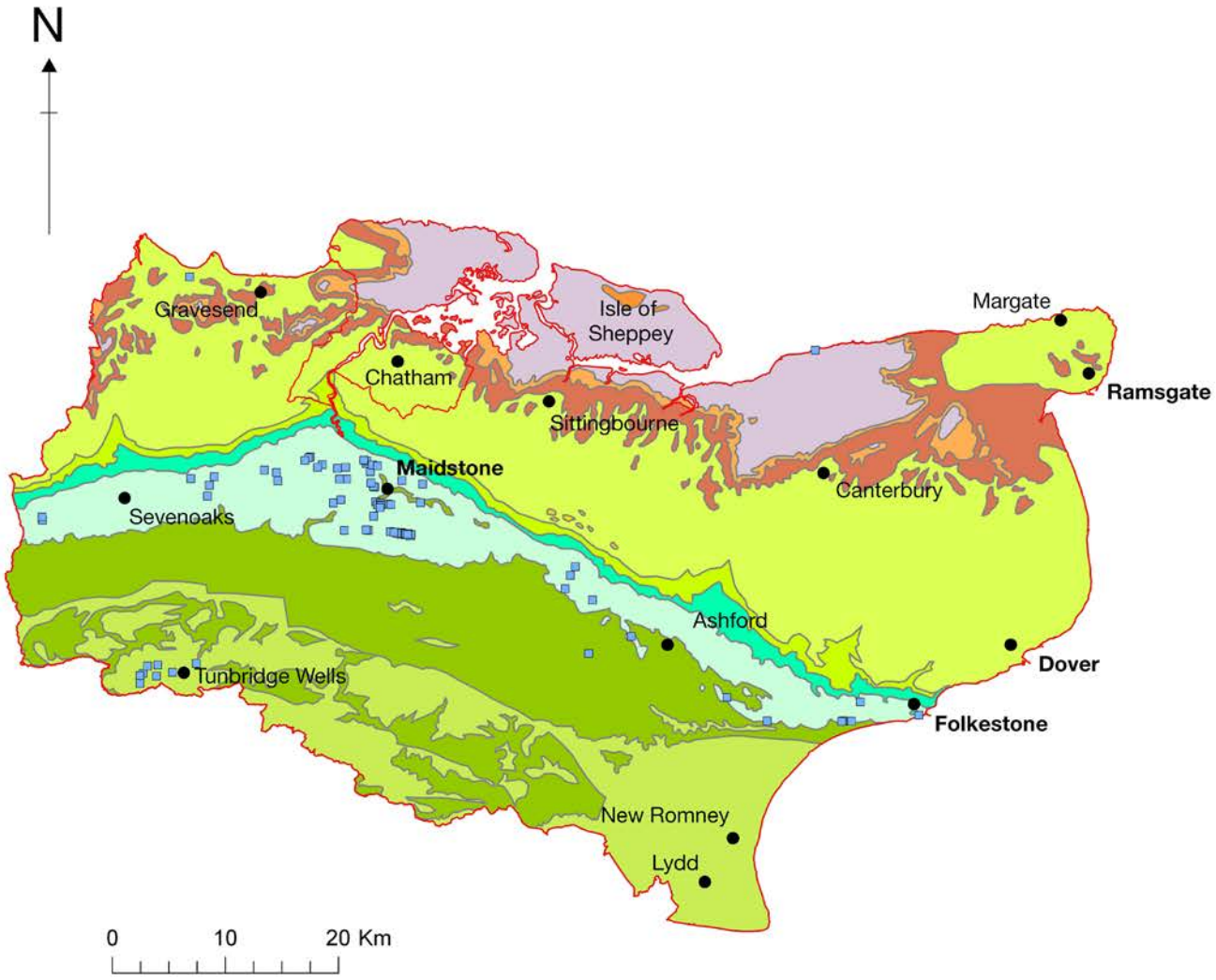
The early use of the county's stone resources by the Romans is evident, for example, in the Saxon Shore Forts at Reculver and Richborough.

In the 11C, the Norman invasion introduced new building techniques and ideas. This was followed by the construction of many large ecclesiastical buildings and castles in Kent. At this time, the lack of sufficient quantities of durable local freestone suitable for dressing and carving within the county, and the ready access by sea to the more familiar limestones from their homeland, such as Caen Stone, saw the importation of stones by the Norman builders into the south east of England for many new large building schemes e.g. the use of Caen Stone at Canterbury Cathedral.

The dissolution of the monasteries in the 16C made substantial quantities of Caen Stone available for re-use in subsequent building construction, often alongside other vernacular stones and local building materials including timber, brick, tile and recycled material from Roman structures, good examples being the walls of St Augustine's Abbey in Canterbury and the north wall of the Church of St Mary, Northgate, Canterbury. This has resulted in an eclectic mix of construction materials in many of the historic buildings of Kent.

Kent's building stones have generally been used within a short distance of the quarries from which they were worked, with the major exception of 'Kentish Ragstone', a durable sandy limestone. In addition to its widespread use locally, this building stone was transported in substantial quantities by boat along the rivers Medway and Thames to London, where it was extensively used for building in the city and in neighbouring counties from Roman times to the 19th century.

Kent Bedrock Geology Map



Kent Bedrock Geology

- BUILDING STONE SOURCES
- NEOGENE ROCKS (UNDIFFERENTIATED) - GRAVEL, SAND, SILT AND CLAY
- BRACKLESHAM GROUP AND BARTON GROUP (UNDIFFERENTIATED) - SAND, SILT AND CLAY
- THAMES GROUP - CLAY, SILT, SAND AND GRAVEL
- LAMBETH GROUP - CLAY, SILT, SAND AND GRAVEL
- THANET SAND FORMATION - SAND, SILT AND CLAY
- WHITE CHALK SUBGROUP - CHALK
- GREY CHALK SUBGROUP - CHALK
- GAULT FORMATION AND UPPER GREENSAND FORMATION (UNDIFFERENTIATED) - MUDSTONE, SANDSTONE AND LIMESTONE
- LOWER GREENSAND GROUP - SANDSTONE AND MUDSTONE
- WEALDEN GROUP - MUDSTONE, SILTSTONE AND SANDSTONE
- WEALDEN GROUP - SANDSTONE AND SILTSTONE, INTERBEDDED

Derived from BGS digital geological mapping at 1:625,000 scale, British Geological Survey ©NERC. All rights reserved

Lower Cretaceous

The oldest Kent building stones were sourced from the Lower Cretaceous succession. This is divided into two distinct lithological units. The lower unit is a thick non-marine clastic succession comprising the Wealden Group. The upper unit comprises marine sandstones and limestones of the Lower Greensand Group. Both groups contain rock units sufficiently hard and durable to have yielded building stone.

Wealden Group

The changing depositional environments have produced two distinct rock assemblages within this group, a lower sandstone-dominated sequence and an upper, clay/mudstone-dominated sequence.

The Wealden Group comprises the Ashdown, Wadhurst Clay, Tunbridge Wells Sand and Weald Clay formations. Each of these formations includes beds worked for building stone in Kent. The principal building stones of this group are the sandstones which are found in the south and west of the county. These sandstones were quarried in numerous relatively small-scale pits. Currently, however, there are no working Wealden sandstone quarries in the county and many of the old quarries are now largely unrecognisable in the landscape.

The use of building stones from the Wealden Group in Kent is evident in medieval churches, prestigious domestic properties and municipal buildings, where they have been commonly used as sandstone ashlar blocks. Elsewhere, the sandstone has been used as smaller coursed blocks or rubblestone, for example, as plinths to timber frame buildings, in bridge construction, for paving or boundary walling.

Ashdown Formation

The Wealden sandstones assigned to this formation are typically fine-grained light-coloured (off-white to orange), with distinctive rhythmic laminations in places. The principal sandstones come from the upper part of the Ashdown Formation.

These sandstones crop out in the south of the county, notably around Penshurst, where some of the material is cross-bedded and ferruginous. A '5ft to 20ft' bed of 'massive sandstone', the 'Top Ashdown Sandstone', has been identified locally (Shepherd-Thorn et al). However, the non-marine depositional setting has resulted in considerable lateral variations in lithology, and these variations are reflected in the stone-types used in the buildings in the areas close to the Ashdown Formation outcrop. The parish church of St. John the Baptist in the village of Penshurst - which sits on the Ashdown sandstone - is constructed of ashlar blocks of predominantly buff sandstone, much of which is weathered pale grey.

The rhythmic, parallel laminated structure in the stone work is much in evidence, and colour variations from off-white to light orange-brown can occur within each ashlar block. Some of the off-white sandstone is notably fine-grained.

The use of Wealden stone in a restored building in Tumbridge Wells.

Wadhurst Clay Formation

The Ashdown Formation is overlain by a predominantly argillaceous (clay/mudstone) sequence, the Wadhurst Clay, which also contains beds of siltstone/sandstone, limestone and ironstone, which have provided building stone locally. A number of thin calcareous sandstone beds were used as local building stone in the Tenterden area. The ironstone beds which formed the basis of the famed Wealden iron industry were largely worked from the basal part of this formation, but there is no evidence that they were used to any great extent as building stones.

Tunbridge Wells Sand Formation

The overlying Tunbridge Wells Sand Formation was the primary source of Wealden sandstone in Kent, with many lithological characteristics similar to the sandstones of the Ashdown Formation. The sandstones are generally fine to medium-grained, often cross-bedded and flaggy in places.

To the west of Tunbridge Wells, the formation is divided into two sandstone units separated by a clay layer known as the Grinstead Clay. This clay layer is divided informally into upper and lower parts by the development of a thin cross-bedded, fine-grained sandstone, known as the Cuckfield Stone (named after a village in West Sussex). Numerous small building stone quarries, producing Wealden sandstone for local use, operated near Goudhurst. The variety of colours and textures can be seen in individual buildings from different phases of construction, for example in the medieval St Mary's Church in Goudhurst , where the colour variations and laminations in some of the beds provide distinctive features. The 19th-century construction of Scotney House in the grounds of Scotney Castle used sandstone from quarries within the estate. The colour, texture and weathering patterns within the ashlar blocks are widely evident in the building's fabric. Staplehurst church makes extensive use of Tunbridge Wells Sandstone in parts of its external fabric (St George's Chapel, the Tower etc).

The variety of the sandstones used in the construction of many buildings in Kent: a part timber frame and stone building at Penshurst.

A sandstone plinth to a timber frame Wealden building in Chiddingstone.

Queens Mews Hawkhurst.

ARDINGLY SANDSTONE MEMBER

A massive, hard sandstone bed, more uniform in appearance, occurs towards the top of the Lower Tunbridge Wells Sand Formation and is known as the Ardingly Sandstone. This sandstone, which is medium-grained in the Tunbridge Wells area but finer-grained to the west, produces prominent topographic features, notably around Royal Tunbridge Wells (for example the High Rocks and Toad Rock). Quarries in the formation are known around the town, and Ardingly Sandstone is used quite widely within the centre of Tunbridge Wells.

The only quarry currently producing Wealden sandstone is located outside the county in West Sussex, at West Hoathly.

The Regency terrace near Calverley Park provides a good example of the use of typical Wealden sandstone. The sandstone appears particularly uniform both in colour and texture, although the houses are now blackened as a result of atmospheric pollution.

Scotney House, built in the 19C from stone quarried from the Scotney Castle estate.

Weald Clay Formation

The uppermost formation within the Wealden Group succession of Kent, the Weald Clay Formation, contains several discontinuous beds of fossiliferous freshwater limestone. The Wealden limestones which have been most widely used are characterised with the presence of numerous fossils of a large freshwater gastropod, 'Paludina' – Viviparus flaviorum. These limestones have been given a variety of local names including the 'Large and Small Paludina limestones' and occur in beds up to 30cm thick. In Kent, one of these fossiliferous limestones is widely known as the 'Bethersden Marble' (the term 'marble' being used as the stone is capable of taking a polish), and has been used extensively for decorative work, paving and building stone.

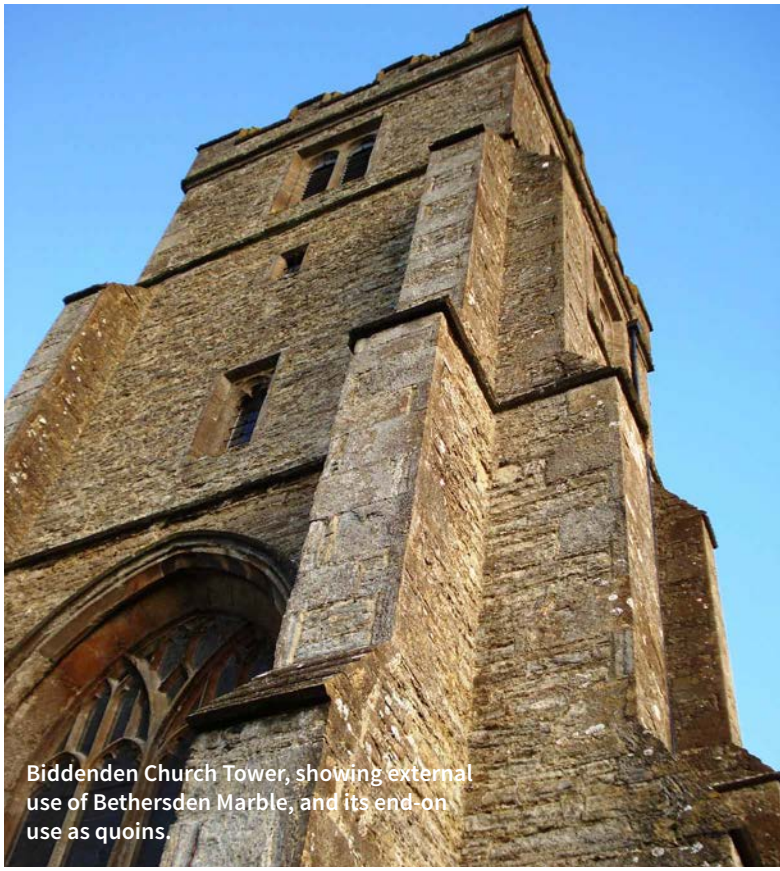
Although this building stone is named after the village of Bethersden, the limestone has been dug from various locations across the county. Some Wealden limestones have also been called 'Winkle Stone' because the small gastropods present are similar in character to the modern 'periwinkle' shell.

Wealden limestones have been used as external paving and kerbstones in the village of Biddenden, but their texture can best be seen in the flooring and internal decorative work in Canterbury Cathedral, and in churches such as St Margaret's in Bethersden. The moulding around the rim of the Norman font of St John the Baptist in Harrietsham provides a good example of finely carved 'Bethersden Marble'.

Good examples of the external use of Wealden Limestone, showing it to be a durable building stone, are provided by the 15C church towers at Tenterden and Biddenden, where it has been successfully used for quoins as well as for coursed walling stone. The Norman Herring Bone stonework at Staplehurst church was constructed using slabs of Small Paludina limestone.

The Dering Arms at Pluckley Station (right) provides an example of the use of 'Bethersden Marble' (which crops out to the south of the village), with Ragstone blocks. Potter (2002, 2004) has noted the local use of these Wealden (Viviparus) limestones in the fabrics of churches in the Romney Marsh area e.g. at Horne's Place and Newchurch.

Wealden limestone used in paving, kerbing and channel blocks in Biddenden.



Biddenden Church Tower, showing external use of Bethersden Marble, and its end-on use as quoins.

Dering Arms at Pluckley Station.

Lower Greensand Group

The Lower Greensand Group succession of the Weald Basin comprises the Atherfield Clay, Hythe, Sandgate and Folkestone formations. The deposits of this group include clays, sandstones and sandy limestones, which were deposited under shallow marine conditions. The sediments commonly contain the green iron-silicate mineral, glauconite, which is sometimes visible as individual grains in the sands and limestones and sometimes gives a greenish hue to the stones. Weathering of the glauconite can occur, giving rise to an orange brown coating or staining. In Kent, neither the Atherfield Clay Formation nor the Sandgate Formation appear to have rock units that were suitable for the production of building stone.

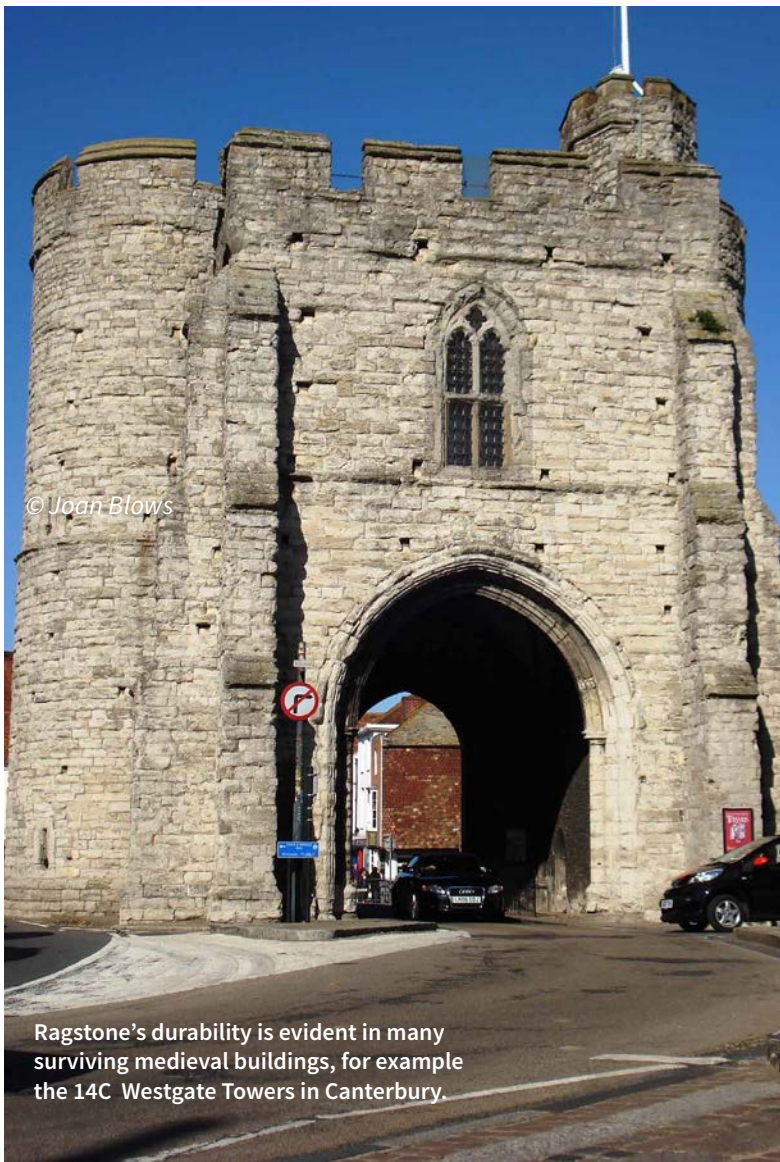
The principal building stone, from the Hythe Formation, is a hard sandy limestone, known as Kentish Ragstone, which forms the marked ridge along the northern edge of The Weald (The Greensand Ridge).

Hythe Formation

The Hythe Formation consists of interbedded layers of hard, well-cemented, sandy and glauconitic limestone (Ragstone) and softer, poorly cemented layers of argillaceous sandstone or calcareous sandstone (Hassock).However, this simple division into 'Ragstone' and 'Hassock' alone is insufficient to portray the considerable lithological variations that can occur within the formation both vertically and laterally, as a wide spectrum of stones are seen between these two end members. The individual beds of Ragstone suitable for building purposes are relatively thin, being up to 90cm in thickness generally. A measure of the considerable variation in the characteristics of the Ragstone can be seen across the county. Ragstone is a common term used to describe many building limestones across England and the term appears to have a number of different meanings.

Here, it refers to a sandy limestone, which presents an irregular, rough or ragged surface when hand cut and dressed. Sometimes the coarse shell debris also weathers out to form a rough surface.

Kentish Ragstone is typically a medium-grey limestone, occasionally with associated nodular or bedded chert layers. Variations in the proportions of quartz grains, glauconite and carbonate cement/matrix have contributed to the differing workability and weathering characteristics of the stone. Quarrymen gave numerous local names to the individual stone beds, or 'lanes', but these old names have now fallen into disuse. The various bed names are believed to have identified stones suitable locally for different building purposes – ashlar, rubblestone, paving etc. Although the generic term 'Ragstone' denotes the relative difficulty in working the material to produce dressed stone, historic examples of more high-quality dressed stone and tracery are evident throughout the county. However, Ragstone is more commonly seen as rubblestone walling, either coursed or uncoursed. It is the only Kent stone which has been widely transported for use outside the county boundaries,



Ragstone's durability is evident in many surviving medieval buildings, for example the 14C Westgate Towers in Canterbury.

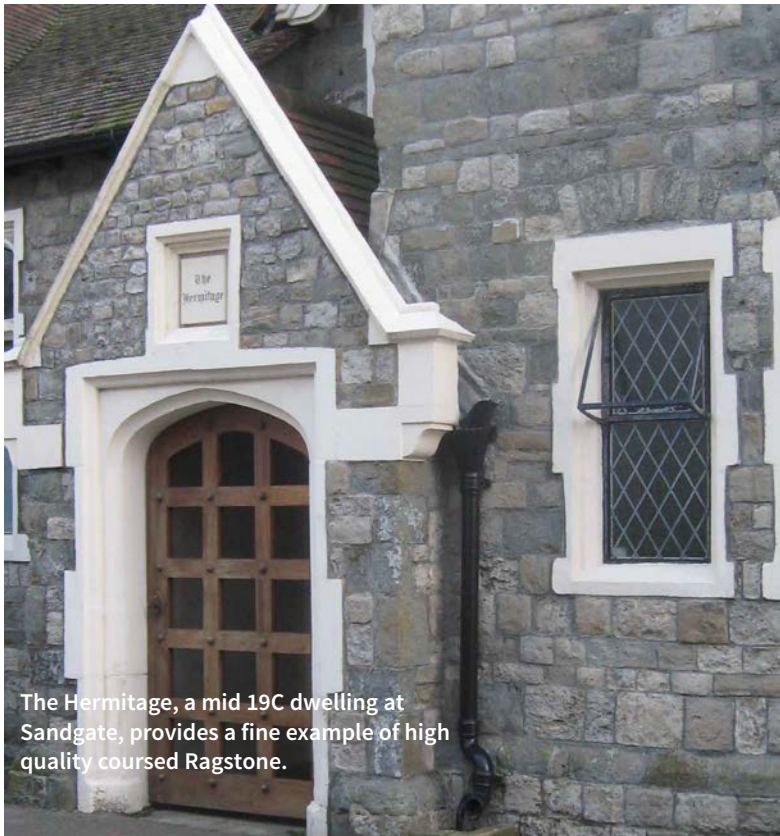
Kentish Ragstone has also been used in the construction of Knole House near Sevenoaks.

Examples of the Roman use of Kentish Ragstone can be seen in the foundations of their triumphal arch at Richborough (Rutupiae 85 AD), and in the 3C, in the jambs of the city gates in Canterbury (Durovernum Cantiacorum). In the 11C and 12C, cherty Kentish Ragstone rubblestone was used extensively in both Rochester Castle and in the cathedral. It was extensively used from the 12th to 16C for church construction in London and Essex, as well as in Kent.

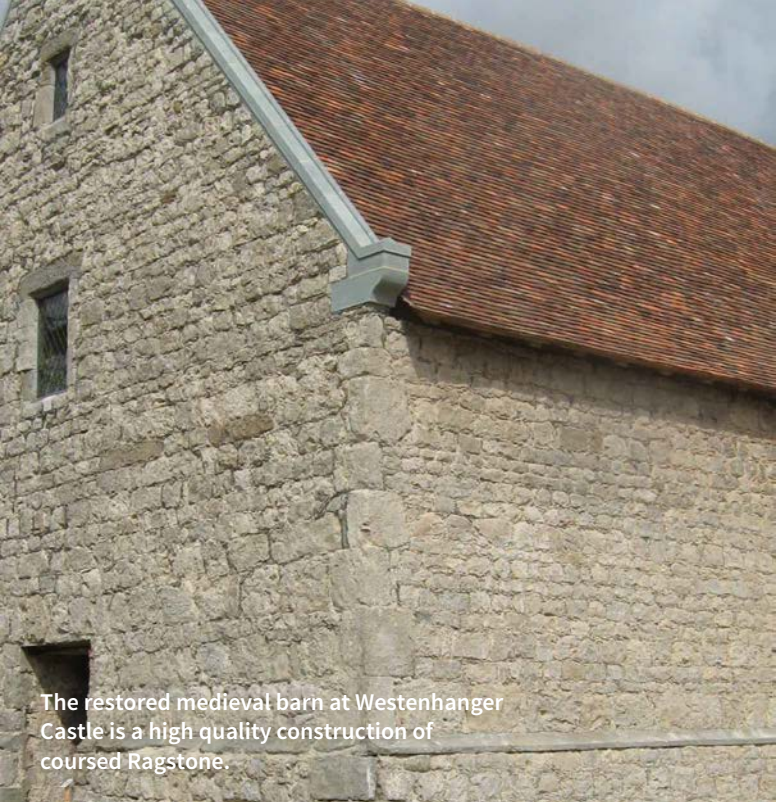
The use of Ragstone went into decline during the 17C as other materials (brick, Portland or Bath stone for example), became more fashionable and readily available. Nonetheless, quarrying continued, and extraction from underground mines in the Maidstone area is well-known. By the late 20C, however, Ragstone was used very little for building purposes.

Finer-textured Ragstone (particularly greenish or dark bluish-grey varieties) has also been used in string courses, plinths and tracery work, but is sometimes less durable in such situations.

The Hythe Formation has been quarried across the county. At the eastern end of the outcrop in the Folkestone-Hythe area, the stone is generally pale grey without coarse quartz grains and is shelly in places (although darker beds occur, notably the dark green sandy limestone in the vicinity of Hythe and Sellindge). The use of well-selected and well-worked stone can be seen to provide a durable and pleasing finish even in an exposed location, as in the defensive Napoleonic retaining wall at Battery Point, along the seafront at Sandgate.



The Hermitage, a mid 19C dwelling at Sandgate, provides a fine example of high quality coursed Ragstone.



The restored medieval barn at Westenhanger Castle is a high quality construction of coursed Ragstone.

Ragstone rubble walling was often used in conjunction with dressings of Jurassic limestone imported from outside the county, in the 19C Payne Smith School in Canterbury.

The skill needed to produce high-quality Ragstone is evident in the 18C Sevenoaks School, where the mortar is galleted with stone fragments.

In the east of the county, Ragstone was historically taken for building stone from the foreshore outcrops, evidenced by the presence of modern marine borings in some dressed stone blocks.

The Maidstone/Borough Green area contained the greatest concentration of quarries, many of which worked beds of good quality building stone. The Ragstone from these quarries was generally medium grey with some chert and locally small brown phosphatic nodules. Further west in the county, the Hythe Beds become more distinctly sandy and the stone tends to become more greenish-brown/orange-brown in colour as it weathers. A chert band, known locally as the Sevenoaks Stone, occurs at the top of the Ragstone sequence in the vicinity of the town itself.

Around Westerham and westwards towards Surrey, the beds comprise non-calcareous sandstone. In this part of the county, not only was the stone quarried from the surface, it was also mined in the area around Hosey Common for building purposes. Hythe Formation sandstone was used at Hosey Common. In recent years, there has been a perceived shortage of suitable Ragstone for building purposes, leading to the import of substitutes from further afield. Careful selection of stone blocks based upon their petrographic characteristics, together with the use of appropriate methods of extraction and working of the stone, can be used, however, to identify suitable Ragstone resources for new work and restoration. There is currently just one working Ragstone quarry in the county, Hermitage Quarry near Maidstone. This quarry mainly produces crushed rock aggregate, but is also able to supply rubblestone and dimension stone for masonry work.

Folkestone Formation

The Folkestone Formation typically consists of medium to coarse-grained sandstone, but bands of ferruginous sandstone or ironstone occur (particularly around the Borough Green area) and cherts have been noted in the outcrops of the Sevenoaks area. The names Ightham Stone and Oldbury Stone have been given to the durable building stones won from the hard siliceous deposits within the Folkestone Formation in the vicinity of the villages of Ightham and Oldbury. Their use has given a very distinctive character to buildings in the Oldbury village area.

Ferruginous, hard sandstone bands occur at several levels within the Folkestone Formation, and these were commonly used in the past for setts, by laying the stones end-on with the bedding planes vertical e.g. at Limpsfield and Westerham.

This hard ferruginous sandstone has also been used as rubblestone (alongside Ragstone, brick and tile) in houses found in the villages of the Wrotham–Borough Green area, notably in Wrotham Heath and Trottiscliffe. Towards the eastern end of the county, from Stanford to Folkestone, a facies change resulted in the deposition of a grey, coarse-grained, glauconitic, calcareous sandstone. This has been used historically, for example at the 12C Church of St Mary and St Eanswythe in Folkestone (below).

This lithology has been known as 'Folkestone Stone', although the same term has also been loosely used to describe Ragstone from the Hythe Formation which was also quarried from the Folkestone area. The Folkestone Stone from the Folkestone Formation can be distinguished by the presence of coarse sub-rounded quartz grains within the sandstone. Elsewhere in the town, high quality ashlar of the local sandstone is a prominant feature of many buildings of the late 19th century and early 20th century.

The church of St Mary and St Eanswythe in Folkestone.

The former 18C malthouse at Boxley.

Doggers

Hard, carbonate-cemented sandstone concretions – or 'doggers' – occurring within the formation at Sandling Junction near Hythe were used locally for walling stone.

Selborne Group

The Selborne Group includes the Gault and the Upper Greensand formations. Blocks of concretionary sandstone from the base of the Gault were used with dressed flints in the old Fisher Gate at Sandwich. Over much of Kent, the glauconitic sandstones that normally characterise the Upper Greensand Formation are not well developed. Despite the considerable importance of this sandstone unit elsewhere in south east England as a source of building stone, there are no known sources in the Kent area.

Upper Cretaceous

Chalk – a micritic limestone of biogenic origin – dominates the Upper Cretaceous succession of Kent.

Chalk Group

The Chalk Group crops out extensively throughout the North Downs and includes horizons of relatively hard stone, but it was not widely used as an external building stone due to its poor durability. It was, however, used in medieval times as rubblestone wall cores, for internal masonry walls and as block work in vaulted ceilings, the latter including those at Westgate Tower in Canterbury, St Mary's Church in Minster, in Thanet and St Peter and St Paul's church in Eyethorne. It was particularly useful in this latter context as it is a soft stone, easy to work into shaped blocks, and of relatively low density. Chalk has also been infrequently used externally with success, for example as ashlared chalk blocks in a former 18th-century malthouse at Boxley (above).

Lower Hardres church.

Flint used for plinths to medieval timber-framed buildings in Canterbury.

St Paul's Church, Canterbury.

Flint

Nodular and tabular layers of flint (cryptocrystalline silica) are found within the Chalk. Extensive remnant flint deposits are also commonly found in the Pleistocene gravels and beach gravels of the area. Flint has been extensively used since Roman times for building in areas close to the North Downs and the coast. It forms an extremely durable building stone and it is used in various contexts either in its 'as-found' form of irregular nodules with a weathered white cortex, or as knapped (dressed) and coursed flints displaying a typical black vitreous finish as can be seen at Lower Hardres church (top left). It has also been used for plinths to medieval timber framed buildings in Canterbury.

Different periods of construction within one building are often revealed by changes in the patterns of flint use. St Paul's Church, Canterbury (below left), shows this change in patterns of flint use.

The finest coursed, knapped flint work sometimes incorporates the use of galletting, with small flint slivers inserted in the mortar between the blocks which increases the strength and durability of the mortar. Flint wall construction normally necessitates the use of dressed dimension stone or brick to form quoins, and window and door surrounds. In addition to the local Kentish Ragstone, various imported Jurassic limestones have been use for this purpose, including Middle Jurassic Bath Stone, Cotswold limestones and Weldon and Clipsham stones (both Lincolnshire Limestone Formation). Flint is also extensively used for rubblestone fill in wall-cores e.g. Richborough Castle.

Tertiary

Paleogene

The Paleogene succession cropping out in Kent comprises the Thanet Sand, the Upnor, the Woolwich, the Reading, the Harwich, the London Clay and the Bagshot formations. These formations are generally soft and poorly consolidated, but do contain some harder cemented horizons which were used locally for building purposes in Kent.

Thanet Sand Formation

The 12C towers at Reculver church provide an example of use of Thanet Sandstone, a laminated fine sandstone which can still be seen as beds and doggers in the Thanet Formation cliffs and on the foreshore nearby (below).

The stone can be seen sporadically as individual 'slabby' blocks in east Kent, for example within the pre-12C city wall in the Northgate area of Canterbury (right).

Sometimes, the isolated blocks show evidence of their foreshore origin by virtue of the presence of marine borings. The Roman fabric of Richborough Castle includes Thanet sandstones, together with London Clay septaria, Puddingstone, Upper Greensand, Kentish Ragstone, Carrera Marble, Neidermendig lava and tufa.

Thanet Sandstone in the city wall in the Northgate area of Canterbury.

Thanet Sandstone can be seen as beds and doggers in the Thanet Formation cliffs and on the foreshore nearby.

Lambeth Group

The Lambeth Group, comprising the Upnor, the Woolwich and the Reading formations, is a variegated succession of variably cemented, coarse-grained, pebbly sandstones, which are occasionally glauconitic, ferruginous or calcareous in character.

Upnor Formation

This formation principally comprises fine to medium- grained, variegated glauconitic sands with blackened flint pebbles. Close to the boundary with the overlying Woolwich Formation is a hard, ferruginous sandstone, the Winterbourne Ironstone, which has had a limited use locally for building stone e.g. Boughton church (Potter 1999).

Woolwich & Reading Formations

Sarsen Stone

Isolated occurrences of a hard, quartz-cemented sandstone known as Sarsen Stone provided a local source of building material in the Medway area. These sandstones represent only the remnants of a much more extensive, largely un-cemented sandstone unit that covered much of the area during the Paleogene. Examples of their use can be seen in the Kit's Coty and Whitehorse megaliths, near Aylesford.

Thames Group

London Clay Formation

This formation comprises a succession of sandy and silty, glauconitic mudstones and clays, within which occur large tabular and spheroidal calcareous concretions - Septarian Nodules (or Concretions).

Septarian Nodules

These calcareous nodules are developed within the lower part of the London Clay Formation, and were principally quarried as a raw material for the manufacture of cement (Roman cement), often from foreshore outcrops. They are sometimes seen in the fabric of buildings built close to the coast e.g. at Richborough Castle and the parish Church at Herne in East Kent, where they have been used with a variety of local stone types.

A close-up of Septaria nodules.

Herne Church shows the use of Septaria nodules and also other local materials, including bands of knapped flints and Thanet Sandstone.

Bracklesham Group

Bagshot Formation

In Kent, this formation exists only as a small outcrop on the Isle of Sheppey, where it principally comprises pale coloured and variegated, loose sands with flint gravels. No hard indurated bands are evident in the succession and it is unlikely, therefore, that the formation was a significant source of local building stone.

Pleistocene

Tufa

Tufa is a freshwater carbonate deposit formed around springs. During the Pleistocene, the development of these tufa deposits appears to have been extensive. There are a number of locations in Kent, commonly associated with springs at the margin of the Hythe Formation or Chalk Group outcrops, where tufa deposits are still forming. Many older deposits have been quarried away, however, having served as sources of lime or occasionally building stone.

They are characterised by their hard and durable nature when lithified, and their highly porous structure and therefore low density, makes them ideal for use as wallstones and for vaulting in churches. It is believed that supplies of tufa for building were exhausted by late Norman times.

Blocks of pale-coloured, porous tufaceous limestone can be seen forming the quoins and dressings of the walls in the 12C tower of St Leonard's at West Malling (below). Locally derived tufa blocks were also used extensively in the construction of the Roman Lighthouse (Pharos) at Dover.

A number of churches in the Romney Marsh area have some tufa blocks in their fabric (e.g. at Lympne, West Hythe, Appledore and New Romney, some having been reused from the Roman Fort at Lympne; Potter 2002, 2004), as have several Norman churches in the Maidstone area.

The 12C tower of St Leonard's at West Malling. *© Joan Blows*

The 12C tower of St Leonard's at West Malling. *© Joan Blows*

Ferricrete used in the parish church of Sturry just to the east of Canterbury.

Ferricrete

In the Stour Valley, beds of locally-developed pebbly conglomerate from the river terraces were occasionally worked and used as a local building stone. Where these are iron-cemented, the term 'ferricrete' is adopted. Ferricrete walling can be seen for example in the 14C construction of the Stour Valley churches of All Saints in Westbere and Holy Cross Church in Hoath.

Coarse-grained, ferruginous cemented gravel blocks and quoin stones have also been described in the fabric of two churches at Appledore and Kenardington in the Romney Marsh area (Potter 2002, 2004).

Weathered Flint, Beach Cobbles & Ship's Ballast

Many of the flint cobbles used in buildings in Kent show the brown weathered coatings of flints sourced from the Tertiary and later deposits. Beach Cobbles are occasionally seen in smaller buildings along the coast whilst sandstone boulders from the Hythe Formation have been recorded in several churches in the Romney Marsh area (Potter 2002, 2004). A variety of more exotic stones (igneous and metamorphic) are also seen in the fabric of the churches in the area, and these are likely to have been derived from off-loaded ship's ballast (Potter 2002, 2004).

Imported Stones

There has been widespread use of building stones imported from France, notably the Caen Stone. This was much used by the Normans, for example in Canterbury for the construction of the Cathedral and St Augustine's Abbey. Stone was imported also from the Boulonnais, and from the area of Poitiers.

Glossary

Ashlar: Stone masonry comprising blocks with carefully worked beds and joints, finely jointed (generally under 6mm) and set in horizontal courses. Stones within each course are of the same height, though successive courses may be of different heights. 'Ashlar' is often wrongly used as a synonym for facing stone.

Calcareous: A rock which contains significant (10-50%) calcium carbonate principally in the form of a cement or matrix.

Carbonate: A general term used for sedimentary rocks consisting of 50 per cent or more of either calcite (calcium carbonate) or dolomite (magnesium carbonate).

Cement: The materials which bind the grains and/or fossil components together to form a rock.

Chalk: A very fine-grained white limestone composed principally of microscopic skeletal remnants known as coccoliths.

Conglomerate: A sedimentary rock made up of rounded pebbles (>2mm), cobbles and boulders of rock in a finer-grained matrix.

Dressings: To say a building is constructed of brick with stone dressings means that worked stone frames the corners and openings of the structure.

Facies: A term describing the principal characteristics of a sedimentary rock that help describe its mode of genesis e.g. dune sandstone facies, marine mudstone facies.

Ferruginous: Containing iron minerals usually in the form of an iron oxide which gives the rock a 'rusty' stain.

Flaggy: A finely laminated, sedimentary rock that splits into thin sheets when exposed to weathering.

Flint (or Chert): Hard, resistant beds or nodules composed of cryptocrystalline silica. The use of the term flint is restricted to nodules and beds that occur only in Chalk (Upper Cretaceous) rocks.

Fossiliferous: Bearing or containing fossils.

Freestone: Term used by masons to describe a rock that can be cut and shaped in any direction without splitting or failing.

Interbedded: Occurs when beds (layers or rock) of a particular lithology lie between or alternate with beds of a different lithology. For example, sedimentary rocks may be interbedded if there were sea level variations in their sedimentary depositional environment.

Ironstone: Sedimentary rock which is composed of more than 50% iron-bearing minerals.

Limestone: A sedimentary rock consisting mainly of calcium carbonate ($CaCO_3$) grains such as ooids, shell and coral fragments and lime mud. Often highly fossiliferous.

Lithology: The description of a rock based on its mineralogical composition and grain-size e.g. sandstone, limestone, mudstone etc.

Mudstone: A fine-grained sedimentary rock composed of a mixture of clay and silt-sized particles.

Outcrop: Area where a rock unit is exposed at the ground surface.

Phosphatic: Containing phosphate minerals, either dispersed as cements or in the form of nodules.

Quartz: The crystalline form of silica - silicon dioxide SiO_2.

Quoin: The external angle of a building. The dressed alternate header and stretcher stones at the corners of buildings.

Rubble: Rough, undressed or roughly dressed building stones typically laid uncoursed (random rubble) or brought to courses at intervals. In squared rubble, the stones are dressed roughly square, and typically laid in courses (coursed squared rubble).

Sandstone: A sedimentary rock composed of sand-sized grains (i.e. generally visible to the eye, but less than 2 mm in size).

Sedimentary rock: A rock that is commonly formed by the binding together (lithification) of sediment particles (e.g. sandstone, siltstone, mudstone, limestone).

Siliceous: A rock which has a significant silica content (non-granular) usually in the form of an intergranular cement e.g. siliceous limestone, siliceous sandstone.

Siltstone: A sedimentary rock composed of silt-sized grains (i.e. only just visible to the eye).

Tracery: An architectural term used primarily to describe the stonework elements that support the glass in a Gothic window. The term probably derives from the 'tracing floors' on which the complex patterns of late Gothic windows were laid out.

Tufa: A thin, surficial, soft (when fresh), spongy, incrustation around the mouth of springs, seams and streams carrying calcium carbonate in solution. (Often enveloping plant material).

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Further Reading

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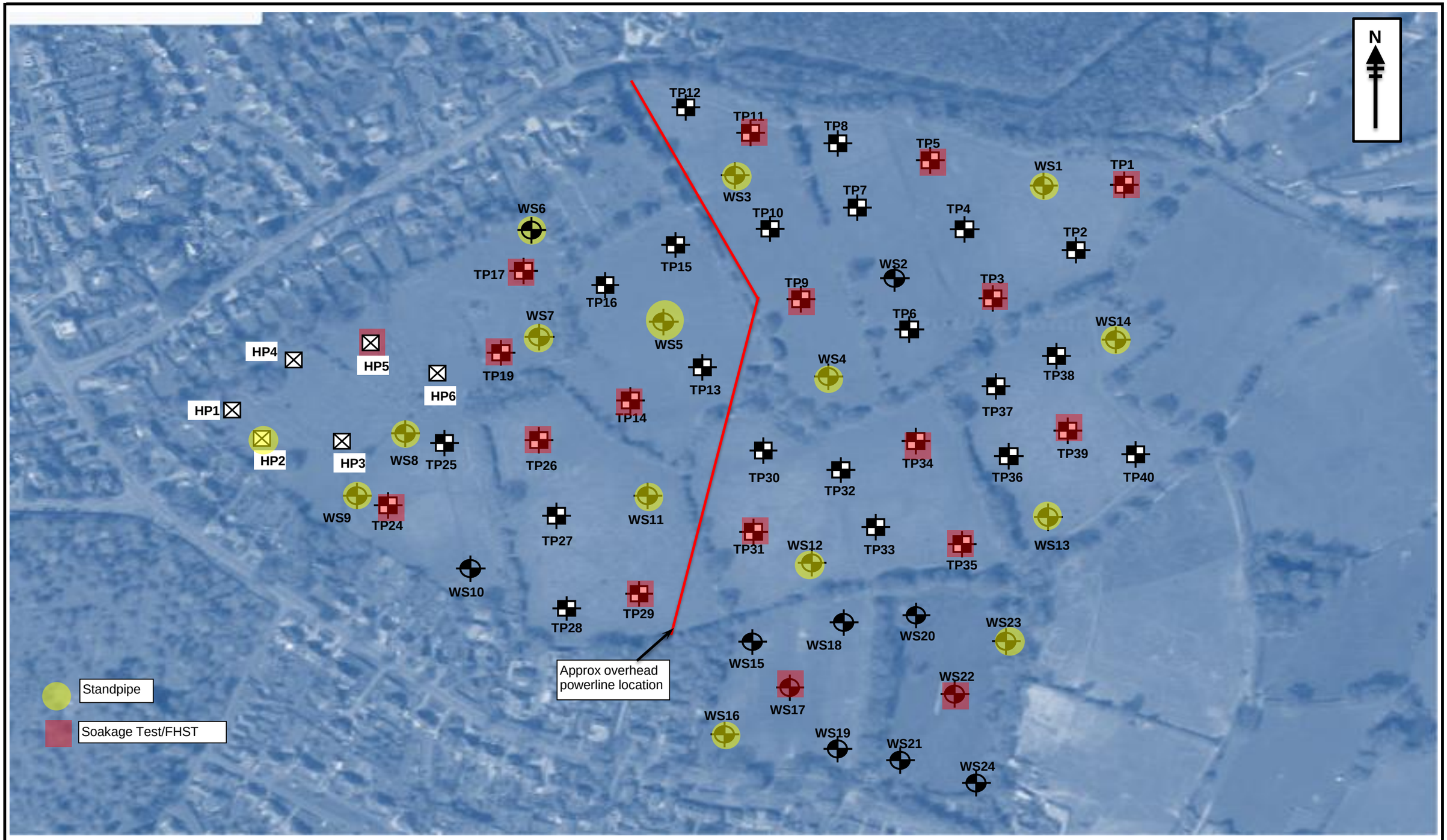
Communities and Local Government

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

APPENDIX C

Borehole Data Extracted from the Site Geo-environmental report (Borehole logs for WS3, WS5, WS1, WS15, WS16, WS17, WS18, WS19 and accompanying plan)



Project:	Appledore Road, Tenterden			**Title:**	Site Location Plan			**Revision:** v2
Address:	Land at Appledore Road, Tenterden TN30 7DD			**Date:**	16/08/2017			Geo-Environmental
Grid Ref:		**Scale:**	Not to scale	**Drawn:**	JK	**Figure:**	1	
Client:	Wates Developments			**Ref:**	GE16690			

Geo-Environmental	Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net	Borehole Log	Borehole No. **WS03** Sheet 1 of 1

Project Name:	Appledore Road	Project No. GE16690	Co-ords:	589438E - 133902N	Hole Type WLS
Location:	Appledore Road, Tenterden		Level:	0.00	Scale 1:25
Client:	Wates		Dates:		Logged By AJ

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	ES					Loose orangish brown clayey sand TOPSOIL
					0.20	-0.20		loose brown silty clayey fine SAND SUBSOIL with rootlets TUNBRIDGE WELLS SAND
		0.50	D					
					0.60	-0.60		Orangish brown and pale orangish brown and grey very silty fine SAND TUNBRIDGE WELLS SAND
		1.00	D					
					1.30	-1.30		Very stiff orangish brown and grey very silty sandy CLAY with occasional medium to coarse mudstone gravel. TUNBRIDGE WELLS SAND
		1.50	D					
		2.00	D		2.00	-2.00		Pale orangish brown, occasionally grey very silty fine SAND with weak SILTSTONE and MUDSTONE GRAVEL TUNBRIDGE WELLS SAND
					2.30	-2.30		End of Borehole at 2.30m
		2.50	D					

Casing		Water Strikes (mbgl)		Chiselling (mbgl)	
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to

Remarks

Refused on mudstone at 2.30m

AGS

Geo-Environmental	Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net	# Borehole Log	Borehole No. **WS05** Sheet 1 of 1

Project Name:	Appledore Road	Project No. GE16690	Co-ords:	589409E - 133823N	Hole Type WLS
Location:	Appledore Road, Tenterden		Level:	0.00	Scale 1:25
Client:	Wates		Dates:		Logged By TR

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
					0.10	-0.10		Loose dark brown sand. TOPSOIL
		0.20	ES					Pale brown clayey fine sand subsoil. TUNBRIDGE WELLS SAND
					0.30	-0.30		Stiff orange brown and grey silty CLAY with fine roots (0.60m) TUNBRIDGE WELLS SAND
		0.50	D					
		1.00	D					
		1.50	D		1.50	-1.50		Moderately strong light brown, brown and grey weathered MUDSTONE WADHURST CLAY
		2.00	D		2.00	-2.00		Moderately strong red brown weathered MUDSTONE WADHURST CLAY
		2.50	D					
		3.00	D					
		3.50	D					
		4.00	D		4.00	-4.00		End of Borehole at 4.00m

Casing		Water Strikes (mbgl)		Chiselling (mbgl)	
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to

Remarks

AGS

Geo-Environmental	Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net	Borehole Log	Borehole No. **WS15** Sheet 1 of 1

Project Name:	Appledore Road	Project No. GE16690	Co-ords:	589468E - 133560N	Hole Type WLS
Location:	Appledore Road, Tenterden		Level:	0.00	Scale 1:25
Client:	Wates		Dates:		Logged By TR

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
					0.10	-0.10		Loose dark brown sand TOPSOIL
		0.20	ES					Medium dense light brown clayey slightly gravelly fine SAND SUBSOIL. Gravel is medium angular TOPSOIL
		0.50 0.50	D D		0.45	-0.45		Very stiff orange brown and light grey silty gravelly CLAY. Gravel is fine to medium angular of sandstone and mudstone WADHURST CLAY
		1.00	D					
		1.50 1.50	D D					
					1.80	-1.80		Very stiff brown and grey weathered MUDSTONE WADHURST CLAY
		2.00	D					
		2.50	D		2.50	-2.50		End of Borehole at 2.50m

1 2 3 4 5

Casing		Water Strikes (mbgl)		Chiselling (mbgl)	
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to

Remarks

Refused on mudstone at 2.50m

AGS

Geo-Environmental	Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net	# Borehole Log	Borehole No. **WS16** Sheet 1 of 1

Project Name:	Appledore Road	Project No. GE16690	Co-ords:	589439E - 133477N	Hole Type WLS
Location:	Appledore Road, Tenterden		Level:	0.00	Scale 1:25
Client:	Wates		Dates:		Logged By TR

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
					0.05	-0.05		Dark brown sand. TOPSOIL
		0.20	ES					Medium dense light brown clayey slightly gravelly fine SAND SUBSOIL. Gravel is medium angular (land drain at 0.60m) TOPSOIL
		0.50	D					
					0.65	-0.65		Very stiff orange brown and light grey slightly silty gravelly CLAY. Gravel is medium to coarse angular of sandstone WADHURST CLAY
		1.00 1.00	D D					
		1.50 1.50	D D					
					1.90	-1.90		Very stiff orange brown silty gravelly CLAY. Gravel is fine to medium angular of ironstone WADHURST CLAY
		2.00	D					
		2.50	D					
					2.60	-2.60		Stiff brown and grey silty CLAY WADHURST CLAY
		3.00	D					
		3.50	D					
					3.70	-3.70		Very stiff grey MUDSTONE WADHURST CLAY
		4.00 4.00	D D		4.00	-4.00		End of Borehole at 4.00m

Depth scale: 1, 2, 3, 4, 5

Casing		Water Strikes (mbgl)		Chiselling (mbgl)	
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to

Remarks

AGS

Geo-Environmental	Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net	Borehole Log	Borehole No. **WS17** Sheet 1 of 1

Project Name:	Appledore Road	Project No. GE16690	Co-ords:	589498E - 133522N	Hole Type WLS
Location:	Appledore Road, Tenterden		Level:	0.00	Scale 1:25
Client:	Wates		Dates:		Logged By TR

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
					0.05	-0.05		Loose dark brown sand. TOPSOIL
		0.20	ES					Medium dense light brown clayey slightly gravelly fine SAND. Gravel is medium angular TOPSOIL
		0.50	D		0.45	-0.45		Firm orange brown and light grey silty CLAY WADHURST CLAY
		1.00 1.00	D D					
					1.35	-1.35		Strong brown totally weathered SANDSTONE WADHURST CLAY
		1.50	D		1.55	-1.55		End of Borehole at 1.55m

Casing		Water Strikes (mbgl)		Chiselling (mbgl)	
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to

Remarks

Refused on sandstone at 1.55m

AGS

Geo-Environmental	Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net	# Borehole Log	Borehole No. **WS18** Sheet 1 of 1

Project Name:	Appledore Road	Project No. GE16690	Co-ords:	589546E - 133580N	Hole Type WLS
Location:	Appledore Road, Tenterden		Level:	0.00	Scale 1:25
Client:	Wates		Dates:		Logged By TR

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
					0.05	-0.05		Loose dark brown sand TOPSOIL
		0.20	ES					Medium dense light brown clayey slightly gravelly fine SAND SUBSOIL. Gravel is medium angular TOPSOIL
		0.50 0.50	D D		0.60	-0.60		Stiff orange brown and light grey silty gravelly CLAY. Gravel is fine to medium angular of sandstone WADHURST CLAY
		1.00 1.00	D D					
					1.20	-1.20		Very stiff brown and occasional grey weathered MUDSTONE WADHURST CLAY
		1.50 1.50	D D		1.60	-1.60		End of Borehole at 1.60m

1 2 3 4 5

Casing		Water Strikes (mbgl)		Chiselling (mbgl)	
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to

Remarks

Refused on mudstone at 1.60m

AGS

Geo-Environmental	Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net	Borehole Log	Borehole No. **WS19** Sheet 1 of 1

Project Name:	Appledore Road	Project No. GE16690	Co-ords:	589534E - 133459N	Hole Type WLS
Location:	Appledore Road, Tenterden		Level:	0.00	Scale 1:25
Client:	Wates		Dates:		Logged By TR

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
					0.05	-0.05		Dark brown sand. TOPSOIL
		0.20	D					Medium dense light brown clayey slightly gravelly fine SAND with roots. Gravel is medium angular TOPSOIL
					0.40	-0.40		Very stiff light grey brown silty gravelly friable CLAY. Gravel is medium to coarse angular of sandstone WADHURST CLAY
		0.50 0.50	D D					
					0.80	-0.80		Strong light brown weathered SANDSTONE WADHURST CLAY
		1.00	D					
					1.10	-1.10		End of Borehole at 1.10m

1
2
3
4
5

Casing		Water Strikes (mbgl)		Chiselling (mbgl)	
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to

Remarks

Refused on sandstone at 1.10m

AGS