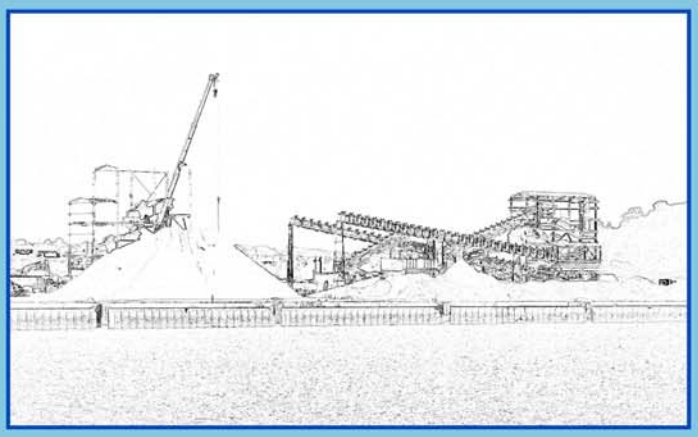

Local Development Framework

Medway

State of Medway Report

Minerals

January 2009

Medway Council

Serving You

State of Medway Report: Minerals
January 2009

State of Medway Reports

This is one of a series of factual reports that are being produced to inform the preparation of Medway's Local Development Framework or LDF. Each deals with a specific topic and draws together available information from a variety of sources.

The reports are intended to establish the current position and a baseline for further work. They also help in highlighting gaps in the information base. We would be pleased to hear from any interested party about any information sources that have not been referred to or gaps that should be addressed in future work.

At this preliminary stage no attempt has been made to identify issues arising from this research or options for addressing such issues. That will follow over the next few months but we would be happy to receive any initial suggestions now.

If you would like to comment on or respond to this report please use one of the methods set out in our 'Engagement Protocol', which is being widely publicised.

To monitor progress being made on the LDF please regularly check our website at www.medway.gov.uk/ldf.

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Although there are many naturally occurring minerals in the UK, there are few in Medway of commercial significance. Accordingly this paper only considers:

- Land won and marine dredged imports of sand and gravel, imports of crushed rock
- Chalk extraction
- Clay extraction

It does not cover brick earth deposits that are known to exist from the geological survey. The reason for this is that the industry has ceased in Medway and there has been no recent interest shown in restarting it.

Aggregates

1. Introduction

1.1 Aggregate is a broad term that applies to particulate materials used by the construction sector as a load-bearing medium and as a component part of a construction material such as concrete and asphalt. Aggregates can be entirely natural in their occurrence, such as sands and gravels laid down as alluvial by sedimentary processes and, semi-natural in the form of crushed and sized quarried rock from the Earth's upper crust (both being referred to as primary aggregate sources). Alternatively, man made, such as blast steel furnace slag can also be used as substitutes for natural and semi-natural aggregates. These are often referred to as secondary in origin. Waste materials such as construction and demolition wastes can be recycled to give rise to secondary aggregates also. Crushed and screen sized concrete materials and road metal plannings are typical examples.

1.2 For the vast majority of applications of aggregates, structural strength is the significant characteristic, chemical stability and bulk or volumes are important though subordinate properties. Modern building methods remain highly dependant on aggregate resources. Aggregates, both primary and secondary are used in road, rail and runway construction, concrete based architecture, commercial and residential properties and major civil engineering works. Construction activity will remain inextricably linked with the availability of aggregate resources of the right type and quantity.

1.3 This is well illustrated by the construction and materials supply sector's behaviour in the UK. In 2007, 274 million tonnes of aggregates of all types were produced. Of these primary land resources amounted to 190 million tonnes and marine resources amounted to 14 million tonnes. Secondary aggregates including recycled materials made up the remainder at 70 million tonnes, 26% of the total[1]. The Quarry Products Association's (QPA) Sustainable Development Report 2007 illustrates the trend in the UK to a less intensive use of aggregates by the construction sector (3 tonnes per £1,000 of construction output in 1955 to some 2.5 tonnes for the same output in 2006, though this did peak at 5 tonnes in the late 1970's). This is likely to be due to the rise in use of non-aggregate based construction and greater efficiency in aggregate use. However the underlying relationship between the construction sector and the need for resources has not significantly altered; that being increased levels of construction result in greater aggregates use in total.

[1]Quarry Products Association, Sustainable Development Report 2007. Page 31, Economic Prosperity. http://www.qpa.org/sus_report01.htm

1.4 One significant change that has occurred is the rise in the use of secondary aggregates from just over 10% in 1990 to almost 26% in 2007. The explanation for this change may be the advent of primary aggregate taxation (introduced in 2002 at a standard rate of £1.60 per tonne) and the introduction of landfill tax (first imposed in 1996) at a standard rate of £2 for inert materials. See following link (http://customs.hnrc.gov.uk).

1.5 Both taxation levers make recycled materials more cost effective and not simply waste. This results in a degree of displacement of primary aggregate production; see the Appendix entitled Market summary 1980-2006 at the following link to the QPA (http://www.qpa.org/sus_report01.htm). How far this displacement will go beyond the 26% observed by the QPA remains to be seen.

2. Policy Context

National Policy for Aggregates Provision

2.1 Aggregate production is regarded as a nationally important industry. The main planning policy advice is the National and Regional Guidelines for Aggregate Provision in England 2001-16.This states that the South East is required to produce 13.5 million tonnes per anum. Draft revised guidelines for aggregates provision 2005-2020 are currently out for consultation. The new draft guidelines reflect a reduction in demand by some 5% in England though the new national aggregates provision is awaited.

2.2 Essentially the industry has long timescales for the securing of sites with sufficient reserves to enable capital investment decisions to be made. Accordingly national guidance requires landbank policies to be developed by local mineral planning authorities to maintain safeguarded aggregate reserves in their areas. A bank of planning permissions to perpetuate a stock of permitted reserves for at least 7 years at normal, or anticipated, production rates in the administrative area is required. At the same time it is understood by the national guidance that the role of marine dredged supply, imports of crushed rock and secondary aggregates is increasing in importance in the overall pattern of supply given the finite nature of land-won reserves and the increasing environmental constraints placed on them.

Regional and Local Policy Provision for Aggregates

2.3 The combined Kent and Medway sub-regional apportionment as expressed by Policy M3 of the emerging South East Plan[2] is 2.53 million tonnes per anum, not counting imports. A revised sub-regional

[2] http://www.southeast-ra.gov.uk/southeastplan/plan/march_2006/core_document/009_seera_sep_d06.pdf

apportionment methodology was the subject of a consultation exercise that ended on the 8th August 2008. The regional assembly has not reached a final decision on what methodology to use. In terms of a Kent and Medway split the proposed options would give a spread of just over 300,000 to just under 200,000 tonnes per annum. Assuming the 13.25 million tonnes per annum regional requirement remains the same. If this were to reduce it is reasonable to expect the Medway sub-regional apportionment to go down commensurately when adopted as part of the South East Plan.

2.4 Policy M5 makes clear that mineral reserves, wharves and railheads should be safeguarded to enable future security of supply. Secondary aggregates production in Medway (covered by the Waste State of Medway Report) should be in the order of 200,000 tonnes per anum to accord with Policy M2.

2.5 The Kent Minerals (Construction Aggregates) Local Plan was adopted in December 1993. Despite its age it remains in force. Section 5 below deals with the detailed reserve assessments within the identified 'Areas of Search' that is relevant to the Medway area.

2.6 The plan supports the use of secondary aggregates and presumes to permit sites for their production subject to a consideration of their environmental impact.

3. Potential Reserves of Primary Land Won Aggregates in Medway

3.1 The naturally occurring sand and gravel deposits in the Medway area are the results of post-glacial event melt water outwash deposition. The last glaciation is called the Devensian. It covered most of the UK landmass at its furthest extent, lasting from 115,000 to 10,000 years before the present day. The glacial ice sheet ablated in situ as well as eventually retreating northwards when melting became more advanced with climate warming. This retreat was complete by the end of the Pleistocene epoch, some 10,000 years ago according to R.Anderson et al.[3] The melt water streams flowing out over the deposition basin (now the south eastern area of the UK and the North Sea which had been an impounded lake during the glacial event) were both braided (interlinked) and extensive.

3.2 As these channels meandered over this area (that included the Hoo Peninsular and the Isle of Grain as defined today) the land was returning to its previous levels due to the release of compression from the retreating ice sheet. This effect was more pronounced northwards

[3]R. Anderson, P. Bridges, M. Leeder and B.W. Sellwood 1995. A Dynamic Startigraphy of the British Isles, A Study in Crustal Evolution, (first edition 1979) published by Chapman & Hall, 2-6 Boundary Row, London SE1 8HN, Para 17e The story of the last glaciation: the Devensian, pages 269-272.

where the ice sheet had been thicker. Sea levels were lower during the glaciation event and then significantly rose to transgress the land as melt water release affected global sea levels. This event, called the Flandrian transgression ended some 7,500 years ago, resulting in present day levels. Geological evidence shows that the sea level rose some 120m. The effect on sedimentary basins that had received materials from the glacial event and its retreat was to both rework some glacial deposits and to bury others under alluvial and later marine sediments as the sea transgressed over these areas.

3.3 The sea level rise effects, coupled with the original deposition from the meandering braided streams that flowed out over the post-glacial landscape, resulted in a series of deep buried past channel deposits and higher up a series of river terraces of sand and gravel. These features are to be found in Medway and elsewhere in the South East Region (including Kent). Given that these deposits have not been significantly re-worked by repeated cycles of erosion and re-deposition since the end of the Pleistocene epoch they have a sand to gravel ratio and particle shape characteristics that makes them generally economically attractive for high specification concrete production. They are often referred to as flint gravels.

3.4 Page 136 of Chapter X, Pleistocene and Recent (continued), of the British Geological Survey's memoir entitled Geology of the Country Around Chatham, 1971 edition (1989 reprint) states that:

"The chief area of river gravels is that of the peninsula of Allhallows and the Isle of Grain, between the Thames and the Medway. Here, the Tertiary strata form a ridge of ground that rises above the 200-ft [61m.] *contour in Great Chattenden Wood, extending for a mile eastwards from Chattenden Farm, and again at Lodge Hill. The northern slopes of the ridge, on the Thames side, are steep and landslips in the London Clay are extensive (Plate VIa). To the north-east and east of High Halstow, Lodge Hill and Chattenden Farm, however, the surface slopes gently towards the Medway and the main spreads of gravel occur mantling these slopes from the highest point (240 ft* [75m.] *at Lodge Hill) down to about 50 ft* [15m]. *The higher spreads seldom exceed 5 ft* [1.5m] *or 6 ft* [1.83m.] *in thickness, and though they have been laid down as a series of terraces or river origin, as indicated by even bedding of intercalated sand seams, their fairly uniformly ochreous character and high content of cherts* [Flint is a variety of chert] *from the Lower Greensand* [an older sandstone strata].

The following terraces have been recognised:

4th Terrace	*150 ft* [45.7m.] *to 210 ft* [64m.] *O.D. or higher*
3rd Terrace	*40 ft* [12.2 m.] *to 150 ft* [45.7m.] *O.D.*
2nd Terrace	*40 ft* [12.2m.] *to 100 ft* [30m.] *O.D.*
Low terrace	*up to 50 ft* [15m.] *O.D.*
Buried Channel	*down to-99 ft* [-30m.] *O.D."*

3.5 The memoir goes on to detail the characteristics and occurrence of these terraced sand and gravel deposits. The following summarises the memoir's detailed description:

- The 4th Terrace only occurs around High Halstow and north west of Hoo St.Werburgh. The terrace appears variable in extent and depth and limited to a thickness of some 1.3m.

- The 3rd Terrace deposits are spread extensively over the area between High Halstow and Allhallows. Thicknesses of up to 1.8m. have been recorded.

- The 2nd Terrace is extensive in the Medway valley, significantly between Allhallows and Hoo St. Werburgh and eastwards to the Isle of Grain. Thicknesses of the deposit are variable, south west of Allhallows it is between 1.2 and 1.5m. and at the Isle of Grain it has been recorded at up to 2.4m.

- The Low Terrace is strongly associated with the deep Buried Channel deposits lower down. They are extensive within the Medway area showing a marked (logical) tendency to be present toward the lower slopes of the Hoo Peninsula close to the R. Thames and R. Medway. Toward the R. Thames in the St Mary's Marshes area sand and gravel thicknesses are reported to be in the order of 1.2 to 1.5m. Toward the R. Medway the deposits appear to be relatively thick when compared to the other terraces and occurs from Kingsnorth westward beyond Hoo St. Werburgh. Those in the vicinity of Kingsnorth are reported to be up to 3m. in thickness and those extending toward Hoo St. Werburgh are reported be between 1.8 and 3m. in thickness.

3.6 The Buried Channel sands and gravels are the lowest deposits from the Pleistocene glacial event, thus they are the oldest and the first to be laid down in the sequence. They are recorded resting on the underlying London Clay at a depth of –30m. O.D. They were formed when large-scale melt water sourced river channels scoured into the underlying London Clay during earlier phases of the main glacial ice sheet retreat when sea levels were still significantly reduced. These channels were subsequently filled with sands and gravels and other materials as the glacial retreat continued and channel flows reduced in energy. Sea levels rose and these channels became buried with significant quantities of alluvium and then the four terrace deposits were laid down.

3.7 These deep buried Channels have a complex history and their occurrence is generally known though the full extent would require detailed surveys. In the Medway area they reportedly occur from the Cliffe area to Egypt Bay and St. Mary's Bay on the R. Thames Estuary side of the Hoo Peninsula and at Grain on the Isle of Grain. Elsewhere they are reported to exist upstream on the R. Thames as far as the

Dartford Marshes and down stream as far as the Isle of Sheppey. The Chatham memoir gives the greatest depth of the base of the channel on the London Clay at –30m. O.D. Thicknesses of the infilling sands and gravels have been confirmed by specific borehole surveys in certain locations only.

3.8 Evidence submitted by the Weeks Group Ltd, in their Desk Study Report on Land at Cliffe for London Port Authorities, October 1991 for representation on the Kent Minerals, Construction Aggregates, Local Plan showed that in an area of 280 ha at Cliffe Marshes alluvium thicknesses are in the order of 12.5 to 15.8m. over much of the site, thickening to 21m. to the south. The inverse was observed for the sands and gravels; these are thicker in the north of the area toward the R. Thames with depths of up to 12.0m. recorded. The average over the survey area was found to be approximately 7m. At Grain the evidence for deposits come from an apparently unpublished source from Kent County Council, The Gravel Resources of North Kent, November 1987. Page 12, paragraph 11. states; "*Ten bore holes in the vicinity of Grain Refinery for British petroleum and British Gas have at best shown 7.0m. of gravel."* The Chatham memoir confirms that these deposits at Grain are overlain by alluvium of up to 30.6m. in thickness.

4. Permitted River Terrace Sand and Gravel Reserves in Medway

Perry's Farm, Isle of Grain

4.1 In May 1989 Kent County Council granted planning permission (ref. ME/88/1389) for the extraction of aggregates (2nd Terrace) with backfilling with inert wastes, construction of a conveyor tunnel and 2 new accesses. After a period of steady production extraction from the site has now virtually ceased.

4.2 In November 2007 Peter Brett Associates submitted an Environmental Impact Study to the Council for the use of the unexcavated part of the site (35 ha) for a hazardous waste landfill site. This estimated the remaining mineral reserve at 165-214,500 tonnes.

Land South of Stoke Road, Hoo St. Werburgh

4.3 On the 25th January 2006 Medway Council resolved to grant planning permission for the extraction and processing of 1.2 million tonnes of sand and gravel reserves (2nd and 3rd Terraces) and a concrete batching plant with restoration back to agriculture and water based conservation on land (89 ha) to the east of Hoo St. Werburgh. The applicant (Lafarge Aggregates UK) indicated in the application details that the reserve would be extracted over 10 years.

4.4 All but 9 ha of the entire site area of 89 ha is within an Area of Search subject to Policies CA6 and CA11 of the Kent Minerals Construction Aggregates Local Plan1993.

4.5 Total permitted reserves in Medway therefore amount to a maximum of 1.4 million tonnes as of November 2008.

5. Potential Unworked Reserves of River Terrace Sands and Gravels in the defined Areas of Search of the Kent Minerals, Construction Aggregates Local Plan 1993

5.1 Historically sand and gravel extraction has occurred at Grain at Rose Court Farm and more latterly Perry's Farm (since 1989). Toward St.Mary Hoo, Shakespeare and Barn Street Farms were subject to mineral extraction in the 1970's and 1980's. Further mineral reserves on the Hoo Peninsula are present as evidenced in the geological memoir but direct evidence for the extent of the materials over the entire peninsula and their economic viability can only be determined by borehole data and analysis of the materials.

5.2 Over the mineral bearing areas this has been done only in part, given that the costs are relatively high and those detailed surveys that have been done are generally the result of the landowner and the mineral industry agreeing to investigate the potential of the land in question. Different land ownerships may not coincide with the full geological extent of a deposit, precluding a comprehensive investigation of the reserves.

5.3 Prior to 1998 Medway was part of the then mineral planning authority, Kent County Council. Studies were undertaken in the formulation of the Kent Minerals, Construction Aggregates Local Plan 1993. The borehole data and associated maps were passed over to Medway Council in April 1998.

5.4 The detailed borehole data came from mineral companies and landowners. This and the available geological data informed the designation of land on the Hoo Peninsula and the Isle of Grain as Areas of Search in this plan. These areas serve to identify where minerals are believed to exist, and are free of major environmental or conservation constraints, though it should be understood that other reserves of a similar unconstrained nature may well exist that were not included in this plan for one reason or another.

5.5 For the purposes of this report these areas have been named in relation to their locality. Then available data for mineral reserves have been used to generate a potential economic reserve per area, as follows:

- Turkey Hall Farm 37.6 ha, 1,237,500 tonnes (proven)
- Stoke/Court Lodge Farm 20.3 ha, 0 tonnes (probable area was not bored but surrounding land was and showed uneconomic reserves)
- West of Beluncle Farm east of Tile Barn 20.6 ha, 681,654 tonnes (unproven)
- Kingsnorth House 6.7 ha, 165,978 tonnes (possible, unproven)
- Kingsnorth 15.2 ha, 401,185 tonnes (proven)
- Land east of Hoo St. Werburgh close to sewage works, 52 ha, 2,061,623 tonnes (possible maximum figure, borehole data is inconclusive and reserves may range down to 859,009 tonnes)
- Grain, North of B2001 15.3 ha, 660,000 tonnes (possible, unproven)
- Grain, South of B2001 20.7 ha, 886,609 tonnes (possible, unproven)

5.6 In summary, within the current defined Areas of Search in Medway:

- Total proven reserves for which there is robust evidence is in the order of 1,640,000 tonnes.
- Total unproven yet possible reserves where evidence is less robust range between 860,000 and 3,652,609 tonnes.
- Total possible reserves that are in part supported by borehole survey evidence nearby is 166,000 tonnes.

5.7 The unpublished report entitled The Gravel Resources of North Kent; November 1987 (that informed the Kent Minerals Local Plan) examined the available data for the river terrace sands and gravels (and the deep buried channel deposits) in North Kent as a whole. It concluded that, within Medway, the total estimated reserve of these higher river terrace deposits, outside the areas of strategic environmental constraint designations, was 6.4 million tonnes.

5.8 This review of the defined Areas of Search in Medway looked at both the published geological data and borehole data originating from survey work conducted in the late 1980's and early1990's which was held by Kent County Council. The total potential reserves, including that which is permitted and those that are proven and those that are possible but unverified comes to 6.3 million tonnes. This suggests robustness in the estimated size of the reserves, as both figures, which are derived independently, are largely comparable.

5.9 The 1987 study went on to examine the evidence for deposits in North Kent as a whole within the strategic environmental policy constrained areas. The total terrace gravel resources in this area were estimated at 9.9 million tonnes, of which 8.19 million tonnes is within the Medway area. This included deposits within and outside the currently defined Areas of Search.

6. Potential Reserves of Buried Channel Sands and Gravels in Medway

6.1 The occurrence of these deposits extends over a wide area of North Kent but the current borehole evidence is limited to investigations over specific areas. In Medway two areas have been investigated. They are Cliffe Marshes near to Lower Hope Point and between Newlands and Perry's Farm on the Isle of Grain.

Cliffe Marshes

6.2 The Port of London Authority's consultant (A.G Week & Partners Ltd) reported in 1991 that the area investigated (280 ha) would yield in the order of 30 million tonnes. It also confirmed that this deposit was overlain by up to 21m. of alluvium though for most of the site this is generally 12.5 to 15.8m.

Isle of Grain

6.3 Below the recently active 2nd Terrace sand and gravel quarry at Perry's Farm lies extensive Buried Channel deposits. The unpublished Kent County Council report on the gravel resources in North Kent 1987 states that *" The evidence currently available suggests that an area of 65 hectares, which might extend northwards,* [north of Grain refinery between Newlands and Perry's Farm] *could yield an average 5.6m. of gravel under a mean 8.6m. of alluvium to yield an 5.6 million tonnes of high quality gravel"*.

Total Buried Channel Deposits Identified in Medway

6.4 Given that the Buried Channel deposits have been identified by geological survey to exist over a large area of the R. Thames and R. Medway Estuarial zone at a depth of –30m. O.D. the surveyed areas results should be considered as only indicative of the overall reserves.

6.5 Total reserves for which there is reasonably robust evidence is 35.6 million tonnes

6.6 The economics of exploiting such a deposit are unknown. The material, and much of the overlying alluvium is below the water table. The thickness of the overburden is significant given that this would first have to be stripped off. The only economic method to work the valuable sands and gravels would appear to be either the use of grab bucket or suction dredging of the materials in a wet state for further processing to give rise to a clean and graded sand and gravel product. However the environmental impacts would also be substantial.

7. Aggregate Importation

7.1 Importation of both marine dredged aggregates and crushed hard rock are increasing in their importance for the overall aggregate supply as land-won aggregate reserves are coming under increasing environmental pressure. Some 21% of the sand and gravel requirements of England and Wales now come from the sea.

7.2 The marine aggregates industry also contributes to our balance of payments through exports to the near continent.

7.3 Licensed dredging areas typically lie six miles offshore and in water more than 20 metres deep, so avoiding any possibility of coastal erosion. Of some 640 square miles of seabed licensed for dredging in 1997, only 90 square miles – just 0.12 per cent of the UK continental shelf - was actually dredged. Direct delivery of marine aggregates to wharves on the Thames and subsequent delivery of much of that material by rail effectively removes 40,000 lorry loads from the streets of London in a typical year.[4]

7.4 Kent and Medway make significant contributions to both the national and regional supply of aggregates via importation from sea at wharves and through railheads. Both marine dredged and crushed rock aggregates are imported. Current imports are in the region of 6 million tonnes per annum[5] though the potential capacity has been estimated at 14.75 million tonnes per annum.

7.5 Medway's aggregate wharves are important regionally. There are three operational at this time; and one with planning permission but unimplemented. This is at Halling adjacent to the now abandoned chalk quarry owned by Cemex UK. This latter site is, in effect, the replacement for a wharf lost at the Rochester Riverside redevelopment area. The following list summarises the other sites:

- Grain Terminal, Thamesport, Isle of Grain, operated by Aggregate Industries UK Ltd
- North Sea Terminal, Cliffe, Rochester, operated by Brett Aggregates of the Brett Group UK
- Euro Wharf, Frindsbury, Rochester, operated by Hanson Aggregates of the Hanson Heidelberg Cement Group.

7.6 Of the three, Grain Terminal and Cliffe are major aggregate handling/production centres with a combined throughput of some 3 million tonnes per anum. The North Sea Terminal at Cliffe imports marine dredged material only originating from the English Channel and North Sea and the Grain Terminal imports crushed rock (granite) from

[4] www.qpa.org

[5] Kent Aggregate Imports Study. A Study of aggregate Imports into Kent & Medway (excluding road imports) on behalf of Kent County Council, page 19, Land & Mineral Management Ltd.

the super quarry in Scotland at Glensanda. Most of the production from these 2 sites serves the London/South East Region with distribution being achieved by transhipment via water and rail. Euro Wharf at Frindsbury imports both crushed rock and marine dredged aggregates, serving local markets without further transhipment, though the site is capable of this.

8. Overall Conclusion - Aggregates

8.1 The river terrace sand and gravel deposits of the Hoo Peninsula are reasonably well understood both geologically and economically given the industry's interest for the area. Permitted reserves are at present some 1.4 million tonnes, though 1.2 million tonnes have yet to be implemented. Further reserves within the current Areas of Search in the adopted minerals local plan have varying degrees of certainty. The available borehole evidence ranges from comprehensive to lacking for these areas. Proven reserves are in the order of 1.6 million tonnes, unproven but possible reserves supported by less robust evidence are in the order of 0.86 to 3.6 million tonnes and possible but unsupported by evidence reserves are in the order of 0.166 million tonnes.

8.2 Given that these are shallow deposits with a consequent lack of significant overburden and being above the water table makes them potentially attractive to the mineral industry. Also, the characteristics of the material are generally accepted as being of high quality, suitable for the production of high value added concrete products.

8.3 The continuing rise in secondary aggregate use, reported by the QPA as being 26% of all aggregate production in 2007, must displace the need for primary aggregates to a degree. However, the overall magnitude of aggregate need by the construction sector, running at 274 mt in 2007, demonstrates the need for new primary aggregate resources to replace permitted reserves that have been exhausted or are nearing exhaustion. Therefore, land won reserves of aggregates will remain an important part of mineral planning in the UK, including Medway for the foreseeable future.

8.4 Notwithstanding this there is doubt over the importance of the Buried Channel deposits. These are less well understood geologically. The studies in Medway have centred on Cliffe Marshes and Grain. The potential reserve yield of both areas is in the order of 35-36 million tonnes. The material appears to share the high quality characteristics of the shallower river terrace deposits yet their depth would present economic concerns to the mineral industry. Strip mining with large-scale wet restoration would appear to be the only cost effective method. Such schemes would be unlikely to be acceptable on environmental grounds given the national and international importance of the land designations at Cliffe, their proximity at Grain and the local amenity impacts, particularly on the settlement of Grain.

Chalk

9. Introduction

9.1 The Chalk formation in the southeast is responsible for the down land scenery of the North and South Downs. Both are Areas of Outstanding Natural Beauty with the South Downs a candidate for a National Park. So the Chalk has today afforded to society a distinctive landscape, perceived by many as unique and deserving conservation and enhancement. The Consultation Draft Kent Downs Management Plan 2009-2014 reflects the understanding of the importance of this landscape character in Kent. Medway's portion of the Kent Downs is no less important in this regard despite its relatively small overall proportion of the total area.

9.2 Chalk is a carbonate of calcium and magnesium laid down in an extensive (epicontinental) shallow (100m to 300m) tropical sea during the late Cretaceous some 65-70 million years ago. The origin of the material is biological. Marine phytoplankton (single cellular plants) that had calcium carbonate shells called coccoliths accumulated on the sea floor without other sedimentary materials being introduced that would have 'contaminated' the sediment. The environment was stable and accumulation of the dead phytoplankton sediment continued to allow considerable thicknesses to develop. Sponges and some bivalves managed to inhabit the Chalk sea floor that was probably too soft to allow for colonisation by reef forming organisms.

9.3 On compression through time the silica rich original sponge materials were mobilised and precipitated to form nodules and bands of silica called flint. This secondary deposit is characteristic of the Chalk in certain of its horizons.[6]

9.4 There are 3 sub-divisions of the Chalk: Upper, Middle and Lower.

9.5 The Lower Chalk is between 45m and 70m thick and typically has calcium carbonate contents in the range 63% to 88%. There are no flints in the Lower Chalk and it has high clay content, particularly towards the base where it overlies the Gault Clay.

9.6 The Middle Chalk is between 60 m and 70 m thick and typically has a calcium carbonate content in the range 93% to 97%. There are flints in the upper 43m of the sequence.

9.7 The thickness of the Upper Chalk varies according to how much it has been eroded. It varies between 85m and 400m, and typically has a

[6] R. Anderson, P. Bridges, M. Leeder and B.W. Sellwood 1995. A Dynamic Startigraphy of the British Isles, A Study in Crustal Evolution, (first edition 1979) published by Chapman & Hall, 2-6 Boundary Row, London SE1 8HN, Para 15f The Chalk sea, pages 240-243.

calcium carbonate content in the range 95% to 98%. There are flints throughout most of the Upper Chalk[7].

9.8 In direct terms, as a material, the Chalk has both physical and chemical properties that make it an important national resource. Firstly, it should be appreciated that the Chalk is a limestone capable of being used in its naturally occurring form or used to produce a chemical binder called lime or calcium oxide through a heating process to drive off carbon dioxide. Development of this process led to the creation of cement that is the binder for a material of high strength called concrete.

Physical Property Uses

9.9 In its 'as dug' form Chalk can be used as a low strength engineering fill, and harder horizons (such as the Melbourne Rock) have been used as a localised building material. Similarly, the associated flint that is to be found in the Middle and Upper Chalk has long been used as a general building material where extraction of the Chalk was occurring. This occurred from the Middle Ages until the 20th Century. Today, modern building materials and the industrialisation of their supply has made construction using flint expensive. It requires specialised techniques and supply is not always reliable given the corresponding changes in Chalk demand and exhaustion of long established Chalk quarries. At the same time restoration of flint bearing structures that are of historic importance is a specialist activity, requiring the supply of the appropriate form of flint into the future.

9.10 The high reflectance (albedo) of certain high purity Chalk (min of 98.9% calcium carbonate) makes it useful as a pigment in a wide range of applications. These include paper, pharmaceuticals, paint and plastics manufacture where high levels of whiting are needed.

Chemical Property Uses

9.11 Cement manufacture in the southeast has been the predominant industry associated with Chalk quarrying. A form of cement manufacture on a significant scale has been in existence since Roman times. Limestone was calcined to form lime, which was mixed with ground clays and pumice to produce hydraulic cement. With the coming of the modern industrial age, and up to the mid 1800's, cements were established as fast acting but slow strengthening binders used for building and coating (stucco) applications rather than for structural works. Though the second Eddystone Lighthouse (1755-9) had a purpose developed cement to enable a 12-hour hardening this was not developed further. Lime remained the main binder for construction mortars at the time and into the nineteenth century.

[7] MPG 10: Provision of raw material for the cement industry, DCLG 1991, Annex A: Geological factors in cement manufacture

9.12 By the 1840's modern high strength cement, that was reasonably fast setting was developed. Due to the similarity in appearance to Portland Limestone the material was called Portland Cement. The calcining temperature was higher than the early cements and the resulting clinker harder to grind into the powdered final product. The increase in production costs (more fuel and a more expensive grinding process) was offset by the higher strength of the material, making it much more versatile. Since the 1840's cement development has continued to tailor cements to a number of applications. These include expanding cements and cements using otherwise waste materials such as pulverised fuel ash from coal powered generating stations. The list is not exhaustive and it illustrates the complexities of the construction world's requirements.[8]

9.13 Chalk is a suitable raw material for the production of Portland Cement. It is found close to an area of demand in the southeast and is a soft rock, making extraction and preparation for calcination in rotary kilns cost effective. The degree of flint 'contamination' and moisture content are important factors bearing on the cost of production. Another advantage that attracted the cement industry to Chalk deposits is the very extensive nature of the deposit and its generally reliable chemical consistently at any location. This allows for a long production life at any chosen location.

9.14 The Chalk can be used to make lime like any other limestones. Lime can be used in a wide range of applications from acid neutralisation and water purification to construction materials and plastics and glass manufacture to agricultural applications, to flue gas desulphurisation where artificial gypsum is produced as a useful by-product. It can be used to produce mortars with the addition of water and aggregates and is of particular importance in restoring older buildings where lime mortar was used[9]. Raw Chalk can be used as a soil enhancer (to provide calcium and magnesium). It is slower acting than lime and has the advantage of being cheaper to produce. The supply to agricultural markets is done in the summer season when dryer conditions enable a Chalk powder to be produced for ease of spreading on the land.

10. Policy Context

National Policy for Chalk Provision

10.1 Cement production is regarded as a nationally important industry. The main planning policy advice has not changed since the last iteration of Minerals Planning Guidance 10: Provision of raw material for the cement industry in November 1991 (MPG10). Essentially it is understood that the industry has long timescales for the securing of

[8] www.cementindustry.co.uk
[9] www.britishlime.org

sites with sufficient reserves to enable capital investment decisions to be made. Landbank policies need to be developed by local mineral planning authorities to provide planning permissions for new production sites with at least 25 years of reserves and aim to maintain a stock of permitted reserves at established sites for at least 15 years of production. This requirement includes sites for clay and shale (if required) as well as limestone.[10]

10.2 For uses unrelated to cement manufacture the appropriate planning advice for Chalk is contained in Mineral Policy Statement 1: Planning and Minerals (MPS1). Essentially where a demand for a mineral exists the national objectives for minerals planning will apply; they being, amongst other things, to secure the adequate and steady supply of minerals needed by society and the economy within the limits set by the environment, assessed through sustainability appraisal, without irreversible damage[11].

Chalk Policy Provision in the South East Region and Kent/Medway

10.3 The Draft South East Plan 2006-2026 and subsequent publication of the Examination in Public Panel Report essentially reaffirms the landbank approach of MPG10[12].

10.4 For Kent and Medway the adopted Kent and Medway Structure Plan 2006 also applies. Policy M4 seeks to maintain throughout the Plan period the following landbanks for chalk and clay:

(a) at least 25 years of permitted reserves of chalk and clay for cement production;
(b) at least 15 years of permitted reserves of clay for brick and tile production;
(c) at least 10 years of permitted reserves of chalk for agricultural uses;
(d) adequate permitted reserves of chalk and clay for engineering, pharmaceutical and whiting manufacture.

10.5 Policy provision specifically in Medway for Chalk is contained in the saved policies of the Kent Minerals Plan Chalk and Clay adopted in December 1997[13]. The plan was formulated when cement manufacture at Halling, Rochester and Northfleet was occurring, reflecting the then economic conditions that enabled home production to be economic. However economic and market conditions have now changed and extraction and associated manufacture has ceased.

[10] MPG 10: Provision of raw material for the cement industry, DCLG 1991, Paragraphs 56 to 63 Landbanks

[11] Minerals policy Statement 1: planning and Minerals, DCLG 2006

[12] South East England Regional Assembly (www.southeast-ra.gov.uk), South East Plan 2006-2026, Section D6, Policy M4:Other Minerals, pages 172 to 173.

[13] http://www.kent.gov.uk/publications/environment/kent-minerals-local-plan-chalk-and-clay-saved-policies.htm?_SortDesc=True&_Page=1&_SortBy=DatePublished

10.6 These saved policies support the national policy approach of strategic landbanks and the safeguarding of mineral consultation areas. These being those locations close to the points of cement manufacture that are suitable as raw material reserves. Other saved policies address such development control matters as highways, dust control, plant and machinery and restoration of exhausted sites.

11. Current Permitted Chalk Reserves and Facilities in Medway

Chalk for cement production

11.1 Chalk quarrying for the cement manufacturing industry has had a long history in the Medway valley. The activity pre dated the first planning act in 1947; there were a myriad of small (in today's terms) independent firms operating on riverside locations backing onto quarries along the lower reaches of the River Medway valley.

11.2 Later on in the 20th Century rationalisation of productive capacity and the need to adjust to a modern mineral planning regime led to larger sites with a more strategic role and fewer, larger operators. In Medway the site at Halling became an important regional production centre. The original plant site pre dated the first planning act and was significantly expanded in the early 1970's by the Secretary of State on appeal, including increased Chalk reserves and a larger kiln. In 1995 the Environment Act came into force. This requires the owners and operators of mineral sites, both active and dormant, to submit to the mineral planning authority a scheme of working and restoration conditions to supersede any that may already exist.

11.3 The enlarged mineral quarrying permission called Pring's Quarry was regarded by the legislation in the late 1990's as an active Phase I site. Rugby Portland Cement Co Ltd, the then operators, duly applied to both register and recast the site's working and restoration conditions. Medway Council considered the details and approved them in late 1999. Rugby Portland Cement Co Ltd abandoned the reserves in Pring's Quarry in the early 2000's and an amended restoration scheme was approved to reflect this. Extraction ceased at Prings Quarry soon after and restoration commenced.

11.4 In the late 1980's an adjacent dry valley, Dean Valley, was granted permission (ref. ME/88/817) for chalk quarrying to supply the cement manufacture. Extraction did commence in the early 2000's, though ceased soon after. The permission had an abandonment condition where in the event of no working occurring for 2 years, and no further working likely, the permission is regarded as lapsed and the site has to be restored in accordance with an approved restoration scheme. Rugby Portland Cement Co Ltd had by this time been taken over by

the RMC group of companies. They were reappraising the economic viability of continuing to operate the quarry to supply the manufacturing site. During this time Dean Valley, as a permitted reserve of chalk, was considered to have formally lapsed by Medway Council.

11.5 Cemex UK subsequently bought out the RMC group and has apparently no intention to apply for new planning permissions for chalk extraction for cement production at the Halling site. Therefore there are no currently permitted reserves of chalk for cement manufacture in Medway. It would appear that increasing globalisation of the cement industry coupled with high costs and exacting environmental controls have undermined the scope for UK domestic production.

11.6 Cement clinker has also been imported to the site for grinding and crushing to serve the established market. The 1970's planning permission does not preclude this. The company are developing a cement product distribution site at Tilbury, due to open during 2008, to enable complete closure of the Halling site. Outline planning permission is being sought for mixed-use development including 300 square metres of employment land and 550 dwellings on the main plant site. The adjacent wharf and rail depot that served the cement production is to remain as operational land for the company.

11.7 Similarly Lafarge Cement UK have not progressed their planning permission for a major new chalk quarry and cement manufacturing plant at Holborough. A small proportion of the site (access and some of the plant site) is within Medway, and the rest is within Kent. However the permission has been legally implemented.

Chalk for whiting uses

11.8 Chalk for whiting purposes has to be of particularly high purity and deposits around Cliffe have this characteristic. The area had an active cement manufacturing industry that ceased in the 1970's. A planning permission at Salt Lane, Cliffe dating from this period allows extraction of significant chalk reserves that have been found suitable for use in paper and card whiting. In the early 2000's the operating company, Omya UK successfully updated the operating conditions pursuant to the requirements of the Environment Act 1995.

11.9 Omya UK[14] extract the Chalk and transport it away from the site to produce Ground Calcium Carbonate (GCC) and Precipitated Calcium Carbonates (PCC) for use at paper mills in paper and card production. The site has permitted reserves of 6 million tonnes. Extraction rates are in the order of 20-30,000 tonnes per anum with an approved low-level restoration scheme. The company do not anticipate a need for extending the site or securing additional reserves elsewhere at this time.

[14] www.omya.co.uk

Chalk for agricultural use

11.10 Medway has no commercial chalk quarrying activities to supply the needs of agriculture. This may have occurred in the past as evidenced by small scale quarrying in the open countryside where the land use is agriculture. Indeed under Part 6 of the Town and Country Planning (General Permitted Development) Order 1995 any extraction that is reasonably needed for the purposes of agriculture within that unit is permitted development subject to certain conditions.

12. Overall Conclusions - Chalk

12.1 The cement manufacturing industry is apparently limiting its quarrying operations in the region. Within Medway there has been a cessation and abandonment of significant reserves of chalk. The established cement manufacturing site, capable of continued production if kilned cement clinker were to continue to be imported is also being abandoned. Instead the cement market is to be served by an importation strategy in the future, as evidenced by Cemex UK's new importation wharf site at Tilbury in Essex. Whether or not chalk quarrying and cement production will return to Medway at some point in the future is a matter for conjecture, and any impetus would appear to rely on changes in economic conditions, particularly of production costs and the effects of carbon taxation.

12.2 Chalk of high purity suitable for whiting uses has significant reserves (potentially 200 years) at current extraction rates. Accordingly there is no need to identify additional reserves.

Clay

13. Introduction

13.1 Clay is the general name given to the weathered remains of other rocks that have been laid down in marine and estuarine environments and in extensive lakes. They differ in their mineralogical content giving rise to different characteristics and properties. They are predominantly composed of silicate minerals, often with associated ions of iron, calcium, magnesium and other metals.

13.2 In Medway the London Clay forms an extensive deposit that overlies the Chalk. It marks the end of the Mesozoic and the beginning of the Cainozoic periods some 56 million years ago. The environment of deposition was marine and estuarine as evidenced by the occurrence of fossil fish, turtles, crocodiles, bivalves, molluscs and crustaceans. The deposit occurs in varying thickness of up to 140 metres. Much of the Hoo Peninsula and the Isle of Grain represents the London Clay as it outcrops in Medway.[15]

13.3 Clay is used in many industrial processes, such as paper, cement production and chemical filtering. Clay can be fired in a kiln to form tiles and bricks and other ceramics. Different types of clay when used in conjunction with different types of additive minerals and firing conditions can produce such different ceramics as earthenware, stoneware and porcelain.

13.4 Being relatively impermeable to water it is also used where natural seals are needed, such as a barrier in landfills against leachate seepage into the surrounding strata. This property allied to a maleable nature makes clays also important to civil engineering structures such as in the cores of dams or flood defence embankments.

14. Policy Context

National Policy for Clay Provision

14.1 Where clay reserves are identified as important for cement production MPG10 is the relevant national planning policy advise. Essentially the same landbank figures for chalk reserves pertain to clay reserves. For established production sites 15 years worth of reserves should be maintained as a stock of planning permissions. For new sites the appropriate landbank is 25 years.

[15] R. Anderson, P. Bridges, M. Leeder and B.W. Sellwood 1995. A Dynamic Startigraphy of the British Isles, A Study in Crustal Evolution, (first edition 1979) published by Chapman & Hall, 2-6 Boundary Row, London SE1 8HN, Para 16d Tertiary environments in the British area, pages 251-254.

14.2 For engineering and other uses of clay MPS1 is the relevant planning policy advice at the national level. The main broad principles of mineral planning should apply. Essentially where a demand for a mineral exists policy should secure an adequate and steady supply of the mineral needed within the limits set by the environment, assessed through sustainability appraisal and without irreversible damage.

Clay Policy Provision in the South East Region and Kent/Medway

14.3 The Draft South East Plan 2006-2026 and the subsequent Panel Report does not address clay needs other than for tile and brick manufacture. Policy M4 looks to local mineral planning authorities to provide landbanks of permitted reserves to give at least 25 years of production. Agricultural and industrial clay resources are not covered.

14.4 In the Kent and Medway Structure Plan 2006, Policy M4 seeks to maintain throughout the Plan period the following landbanks for chalk and clay:

- at least 25 years of permitted reserves of chalk and clay for cement production;
- at least 15 years of permitted reserves of clay for brick and tile production;
- at least 10 years of permitted reserves of chalk for agricultural uses;
- adequate permitted reserves of chalk and clay for engineering, pharmaceutical and whiting manufacture.

14.5 Policy provision for clay in Medway is contained in the saved policies of the Kent Minerals Chalk and Clay Local Plan adopted in December 1997. Clay requirements other than for cement production are addressed in Policy CC1. Where a need is identified provision will be made subject to planning, landbank and other material considerations.

15. Current Permitted Clay Reserves and Facilities in Medway

15.1 Despite the extensive nature of London Clay in the Medway area there has not been any significant extraction. One site called Whitehall Farm, north of Grain village, had temporary permission to extract clay. This permission was extended a number of times, and the expiry date to extract the remaining reserves has been extended to the 31st December 2011. The current reserves on the site have not been quantified though the operator remains of the view that the limiting factor on reserves is the practical depth of extraction rather than any overall tonnage limitation. The need for more clay reserves centres on an assessment of two areas of use. They are clay for engineering use in landfill and contaminated land remediation and flood defence works.

15.2 The Environment Agency[16] have stated that their comments they made for the Kent Minerals Development Framework, Other Minerals (Non Aggregates) Development Plan Document 2007 in relation to clay needs remains the same. That is that the anticipated clay needs for flood risk management for the whole of Kent and Medway till 2021 is around 450,000 cubic metres.

15.3 For landfill engineering the need is more difficult to ascertain as it relies on the number, type and size of new landfill voids that may be required for the waste capacity requirements of any area. The Agency point out that a typical non-hazardous landfill site cell would need 40,000 cubic metres (30,000 cubic metres to line the cell and 10,000 cubic metres to cap it to a depth of 1 metre). If the cell were to be for hazardous waste the requirements would be multiplied by a factor of 5. Similarly an assessment of clay need for land remediation uses is difficult to ascertain. Several factors can affect this, including the rate of land remediation and the type and degree of contamination and whether or not the land is to be treated in situ rather than capped or back filled with clay.

16. Overall Conclusions - Clay

16.1 Though London Clay is abundant on the Hoo Peninsula, permitted reserves are limited. In the future there is likely to be an ongoing need for flood defence works of some description in the North Kent and Medway area and for land remediation purposes.

16.2 Landfill requirements are difficult to estimate as this depends on what type of landfill sites will be needed and their location.

16.3 The use of London Clay for brick and/or tile production has no local history in modern times. While it is technically possible that such an industry could re-emerge there are no indications that this is likely in Medway at this time.

[16] Environment Agency, Orchard House (Endeavour Park) London Road, Addington, West Malling, ME19 5SH