

Full Name Dr. Alan Thompson

Qualifications and Membership

B.Sc. (hons) Physical Geography and Geology (Class II(i))
University of Liverpool (1978).

*Awarded **P.G.H. Boswell Prize**, Geology Department 1978*

Ph.D. Geomorphology, University of Liverpool (1984).

C. Geol. Chartered Geologist (1991).

F.G.S. Fellow of the Geological Society of London (1991).

*Awarded the **I.C.E. Telford Prize**, for a paper on "The Role of Geomorphology in Flood Risk Assessment", Institution of Civil Engineers, 2003.*

M.R.T.P.I. Chartered Member of the Royal Town Planning Institute (2013).



Professional Activity

- (2004 - present): Organising Committee member of Extractive Industry Geology Conferences – a Company Limited by Guarantee;
- (2006 - 2008): Elected Chairman, Extractive Industry Geology (EIG) Conference, held at Cardiff University in June 2008
- (1998 - 2002): Committee Member of the Geological Society Environment Group
- (1994 - 1997): Committee Member of the British Geomorphological Research Group

Nationality British

Year of Birth 1956

Present Position **Director**, Cuesta Consulting Limited (established January 2005).

Undertaking independent consultancy work in the fields of minerals planning, environmental geology, geomorphology and the water environment, primarily for mineral operators, Mineral Planning Authorities, English Heritage and Defra. From January 2005 to June 2012 this work was carried out on a part time basis, in parallel with similar part time work as the Director of Earth Sciences at Capita Symonds Limited - details of which are provided separately below.

Professional Experience:

2005 to date

Cuesta Consulting Limited:

Projects to date, listed in reverse chronological order

Mountsorrel Quarry Public Inquiry (*Lafarge Tarmac Trading Limited, 2014/15*)

Expert witness regarding the strategic importance of this major, rail-linked granite quarry in Leicestershire, and of the surrounding igneous rock resources. This work followed on from Cuesta's earlier work for Lafarge, in 2011-2013, but related more specifically to an objection by Lafarge Tarmac to a proposed housing development close to the existing quarry. If permitted, that development would sterilise part of the resources and constrain the future expansion of the quarry. Proofs of evidence, presented at a Public Inquiry in October 2014, focused on the National need for the continued operation of the quarry and on the principle of safeguarding the associated resources.

Oxfordshire Local Aggregates Assessment. (*Oxfordshire County Council, 2014*)

Cuesta worked again with Land Use Consultants to prepare an updated Local Aggregates Assessment (LAA) for Oxfordshire. In compliance with the National Planning Policy Framework, the assessment was based on the average of the

previous 10-years' sales figures together with an analysis of local factors. In the case of concreting sand & gravel and crushed rock, this entailed making upward adjustments to compensate for the fact that local production of these materials had been significantly reduced, during the recent recession, as a result of temporary commercial decisions by a major operator to mothball certain quarries and import crushed rock from elsewhere.

Assessment of the Need for Prior Extraction of Sand & Gravel Resources.

(Michael Cunningham Architects, 2014)

Investigation of sand & gravel resources beneath a site being proposed for residential development in North Wales. The site falls partly within a Minerals Safeguarding Area where the Local Plan policy requires the feasibility of prior extraction to be examined as part of the planning application. Work has involved a rapid desk study of the local geology and available borehole information, and preparing recommendations for the scope of further ground investigations, should these be required by the Local Planning Authority.

Bryants' Lane Quarry ROMP Review *(Central Bedfordshire Council, 2014)*

Liaison with the mineral operator and his design consultants, on behalf of Central Bedfordshire Council, to review the proposals for further extraction of specialist silica sand and final restoration of the quarry, as part of the ROMP (Review of Old Mineral Permissions) process.

First Review of the Regional Technical Statements for North Wales and South Wales. *(Welsh Government, 2013 - 2014)*

15-month review and revision of the Regional Technical Statements for North Wales and South Wales. These are the documents which, in the Welsh minerals planning system, identify the expected regional and sub-regional apportionment of future aggregates provision, taking account of likely future demand, existing landbanks, the proximity principle and the notion of environmental capacity. The work involved close liaison with the Regional Aggregate Working Parties (RAWPs) for each region, comprising key representatives from industry, mineral planning authorities and Natural Resources Wales (NRW), as well as wider (public) consultation and presentations to the elected Members of all mineral planning authorities in Wales.

West Sussex Wharves & Railheads Study. *(West Sussex County Council, 2013)*

Cuesta worked in conjunction with Land Use Consultants to advise the County Council on the capacity requirements for safeguarding wharves and railheads as part of the emerging West Sussex Minerals Local Plan (MLP) and the Shoreham Harbour Joint Area Action Plan (JAAP). Cuesta's work involved reviewing historical production, import and export data for crushed rock, land-based sand & gravel and marine-dredged aggregates and using this to assess future aggregates demand within the County.

Monmouthshire Local Development Plan Examination.

(Monmouthshire County Council, 2013)

Cuesta was asked to provide a supplementary statement regarding the safeguarding of aggregate resources within Monmouthshire, and to present this at the Minerals and Waste session of the LDP Examination, in June 2013. As with the earlier work for Torfaen, this was needed to explain the Council's reliance on Cuesta's previous (2009) report on aggregate safeguarding across the whole of the 'Former Gwent' area, in preference to the more recent but less detailed national safeguarding map of Wales, produced by the British Geological Survey in 2012.

Torfaen Local Development Plan Examination.

(Torfaen County Borough Council, 2013)

Appointed by Torfaen CBC to prepare for and attend the Minerals and Waste session of the LDP Examination, in May 2013. This was needed to support the Council's reliance on Cuesta's previous (2009) report on aggregate safeguarding across the

whole of the 'Former Gwent' area, in preference to the more recent national safeguarding map of Wales, produced by the British Geological Survey in 2012.

Preferred Area for Limestone Extraction at Trefil, Blaenau Gwent (*Gryphonn Quarries Limited, 2012*)

Evidence was provided, on behalf of a small independent quarry operator, to support the inclusion of a Preferred Area for future mineral extraction adjacent to the existing Trefil Quarry in Blaenau Gwent. Evidence presented at the Examination of the Local Development Plan convinced the Inspector to allow the inclusion of the Preferred Area, despite objections from the Countryside Council for Wales (CCW), regarding the designation of a proposed new geological SSSI which overlaps the site. The site, which lies close to the boundary of the Brecon Beacons National Park, falls within an area of abundant 'interstratal karst' dolines - collapse features within an outcrop of Millstone Grit resulting from dissolution of the underlying Carboniferous Limestone. The site also forms part of the only location within Blaenau Gwent which the Local Authority can allocate for future limestone extraction, in accordance with the requirements of the South Wales Regional Technical Statement (RTS). Subsequent to the LDP Hearing, in November 2012, representations were made to CCW regarding opportunities to reconcile the need for both mineral extraction and geoconservation within the area.

Assessing the Impact of Aggregate Extraction on the Historic Environment of Cumbria (*English Heritage/ Cumbria County Council, 2012 - 2014*)

Cuesta provided specialist geological input to this 2-year project for English Heritage and Cumbria County Council, acting as a specialist sub-consultant to Oxford Archaeology North. The project had the aim of informing and facilitating the improved curation of the archaeological resource in relation to mineral extraction for Cumbria. It dealt with all areas of land-based aggregate extraction in the county, excluding the Lake District National Park, the Yorkshire Dales National Park and Areas of Outstanding Natural Beauty. Cuesta's input involved identifying target areas for reconnaissance-level archaeological investigations in areas where mineral extraction is most likely to take place in the next 10 to 20 years. The work covered all areas of natural sand & gravel resources within the study area, and potential future extensions to existing hard rock aggregate quarries within the Carboniferous Limestone, the Silurian flagstones to the south and east of Kendal (used as high PSV roadstone) and the Ordovician Borrowdale Volcanics near Millom (used as very high PSV roadstone).

The National Importance of Mountsorrel Quarry (*Lafarge Aggregates 2011 - 2013*)

A report was prepared on behalf of Lafarge Aggregates Limited, regarding the strategic need for further permitted reserves at this major, rail-linked granite quarry in Leicestershire. The work was originally in connection with a planning application relating to a proposed extension of the quarry but also entailed input to a series of open days to explain the quarrying proposals to local communities. Mountsorrel is one of the largest and deepest crushed rock aggregate quarries in England, and is of strategic importance in supplying high quality concreting aggregate by rail into Eastern England, London and the South East. It also the country's main supplier of rail ballast to Network Rail and supplies a much wider range of construction products by road to closer destinations.

Planning Control of Subsidence arising from Gypsum Dissolution (*2011- 2014*)

Support has been given to local residents in Ripon, North Yorkshire, who are concerned over the way in which policies for the control of development in areas prone to gypsum-related subsidence are being implemented by Harrogate Borough Council. The policies were developed on the basis of a 1996 report by the former Symonds Travers Morgan (Thompson *et. al*, 1996), which had investigated the causes and distribution of subsidence arising from the natural dissolution of underground gypsum deposits. Advice was given in relation to two individual planning applications which were defeated on the grounds of inadequate information regarding ground stability, and in relation to the emerging District-wide Local Plan.

Biodiversity and Geodiversity: A Guide for Mineral Operators

(MIRO, 2011 and 2012)

This guide, produced by Cuesta for the Minerals Industry Research Organisation (MIRO) and updated to April 2012, provides a concise and straightforward explanation of the legislation, policy requirements and good practice guidance available to mineral operators in dealing with biodiversity and geodiversity issues at each stage of quarry development. It identifies the key requirements, from pre-operational planning and design, to operational and post-operational stages of development, emphasising both the need for, and benefits of, protecting and enhancing these aspects of the natural environment. Comprehensive references are given to other sources of more detailed information and guidance. The guide can be accessed at MIRO's sustainable aggregates Website:

<http://www.sustainableaggregates.com/sourcesofaggregates/landbased/bioandgeodiversity/introduction.htm>

Torr Quarry Environmental Statement

(Aggregate Industries, 2009 - 2010)

Cuesta provided an assessment of the need for further mineral extraction and a review of alternatives at this strategically important, rail-linked limestone quarry in the eastern Mendips, as part of the Environmental Statement associated with Aggregate Industry's application to deepen the quarry to just above sea level. The quarry is one of the largest in England, supplying crushed rock aggregate by rail to depots in central London and throughout the South East. The application was successful. This work followed similar input to the previous, application to extend and deepen the quarry in 1999/2000, when it was operated by Foster Yeoman limited.

An Ecosystems Approach to Long Term Minerals Planning in the Mendip Hills – Phase II *(Defra/MIRO, 2009 - 2010)*

Cuesta provided the technical direction for Phase II of this project for MIRO, led by Capita Symonds with additional support from David Jarvis Associates. The aim of Phase II was to use Defra's Ecosystems Approach to develop an innovative, strategic and holistic framework for planning the long term future of sustainable aggregate extraction and restoration in the Mendip Hills. The Mendips form one of the most important sources of hard rock construction aggregates in England, and the scale of quarrying involved inevitably changes the landscape. Historically, minerals planning policies have sought to minimise that impact at individual quarries, hiding them from view, as far as possible, but also transforming the landscape into an alien, disjointed pattern of deep, steep-sided, water-filled holes. The concept examined here is that, by taking a more strategic, longer-term approach, this piecemeal approach could be replaced by a more far-sighted scheme with larger-scale restoration options that are designed, from the outset, to make more positive contributions to the landscape, environment and economic well-being of the area. This study demonstrated how the Ecosystems Approach can be used, both to develop this kind of holistic, long-term vision in more detail, and to assess the relative merits of this compared to alternative strategies. The final report and individual quarry assessments can be downloaded from MIRO's 'Sustainable Aggregates' Website:

http://www.sustainableaggregates.com/library/links/links_onsite/L0151.htm

Minerals Planning Application – Reach Lane Quarry

(Central Bedfordshire Council, 2009)

Cuesta was engaged by Central Bedfordshire Council to provide an independent review of an application for the extraction of silica sands at Reach Lane Quarry, Heath & Reach, Bedfordshire. The critical issue was whether or not the applicant had adequately demonstrated the need for the mineral, by reference to the range of specialist markets involved and the different types and qualities of sand remaining within the site.

An Ecosystems Approach to Long Term Minerals Planning in the Mendip Hills – Phase I (*Somerset County Council / Natural England, 2008 - 2009*)

Cuesta Consulting and Capita Symonds were appointed by Somerset County Council to undertake the feasibility stage of this project, with funding from Natural England's Aggregates Levy grants scheme. The aim of the project was to investigate the feasibility of using Defra's Ecosystems Approach to develop an innovative, strategic and holistic framework for planning the long term future of sustainable aggregate extraction and restoration in the Mendip Hills – one of the most strategically important sources of construction aggregate in England. The purpose of such a framework would be to guide the location and form of essential future quarrying activity in the Mendips in such a way that enables this to continue (subject to continuing need) with a minimum of adverse impacts and conflicts with other land use requirements, and with optimum beneficial effects on the landscape, economy and ecosystem services. The work provided a starting point for a much larger and more detailed project, the second phase of which began in 2009 (see above).

Mineral Allocations and Safeguarding of Aggregate Resources in SE Wales (*Torfaen, Blaenau Gwent, Newport & Monmouthshire Councils, 2008 - 2009*)

Cuesta was appointed jointly by the four unitary authorities in South East Wales to undertake studies of potential limestone, sandstone and sand & gravel aggregate resources for safeguarding in their Local Development Plans, and to assess the possibility of making allocations for future supply in accordance with the requirements of the 2008 South Wales Regional Technical Statement.

Advice on Sub-Regional Apportionment of Aggregate Reserves (*Torfaen Borough Council, 2007 - 2008*)

Provision of expert advice on the feasibility or otherwise of achieving the apportionment targets allocated to them by the emerging Regional Technical Statement (RTS) for South Wales. No previous mineral working has taken place in this small unitary authority, but the new RTS process, which seeks to take account of environmental capacity and the proximity principle to generate alternative supply patterns, requires the Borough to identify the potential for future working.

Bedfordshire & Luton Minerals Development Framework: Silica Sand Technical Study (*Bedfordshire County Council, 2007 - 2008*)

Re-appointed by Bedfordshire County Council to undertake this follow-up study to Cuesta's earlier work on aggregate landbanks within the County. This work focused on the future extraction of silica sand from the Woburn Sand Formation and sought to establish the need (or otherwise) for new sites to be included within the Site Allocations Plan, taking account of other permitted reserves within the County in the same geological formation. The work entailed a detailed examination of individual end uses matched to differences in the geological characteristics of the sediments in different locations.

Tir Pentwys Minerals Planning Application (*Torfaen Borough Council, 2007 - 2008*)

Cuesta was appointed by Torfaen Borough Council to provide technical advice in relation to the determination of a planning application to extract high specification (skid resistant) aggregates from the spoil tip of a former opencast coal mining operation. The work focused on assessing the quality of the material (Pennant Sandstone) in relation to the need argument put forward by the applicant. Particular attention was given to the proportion of reclaimed material likely to meet the exacting requirements for skid-resistant road surfacing aggregate (on which the need for extraction was predicated), compared to the volumes of lower grade fill and unsaleable fines. The ratio was of concern to the planning authority since it would affect the commercial viability of the operation and the duration of the permission. Advice was also given on the eligibility of the proposal for exemption from the Aggregates Levy.

Blyth Estuary Strategy: Scientific Advice (*Blyth Estuary Group, 2006 - 2007*)

Appointed by the Blyth Estuary Group (representing several local councils on the Suffolk coast) to provide specialist technical advice in support of their challenge to the

Environment Agency's proposed strategy for managed realignment of coastal defences along the Blyth Estuary. The work involved critically examining some of the fundamental assumptions regarding rates of estuary sedimentation that had been used by the Agency's consultants in a hydrodynamic model which underpins the preferred option. Working closely with the local community, evidence was gathered relating to historical and contemporary elevations of active mudflats and saltmarsh. This was combined with the analysis of core samples and geomorphological evidence of sedimentation, and a detailed position paper was submitted to and discussed with the Environment Agency.

**Bedfordshire & Luton Minerals and Waste Development Framework:
Aggregates Landbank Study** (*Bedfordshire County Council, 2005 - 2006*)

Engaged by the Minerals Planning department to carry out a detailed assessment of the current availability of concreting aggregate, building sand and specialist silica sand reserves within the County and to advise on the necessity and practicality of maintaining separate landbanks for each mineral type. The work entailed site visits to the majority of sand pits in Bedfordshire, in order to build up the 'robust and credible evidence base' needed to underpin the new style Development Framework.

ALSF Science Co-ordinator - Land Based Aggregates (*Department of the Environment, Food and Rural Affairs, 2005 - 2007*)

Appointed by Defra to co-ordinate environmental and technical research on land-based aggregates funded by the Aggregates Levy Sustainability Fund (ALSF), for the period from January 2005 to March 2007. The work involved advising on research requirements and reporting on completed research across all areas of ALSF funding in England, including liaison with eleven separate funding bodies. Topics covered ranged from optimising the efficiency of primary aggregate production and the use of alternative materials, to the avoidance and control of environmental impacts and the creation of environmental improvements through mineral restoration. A report was produced on the achievements of research completed during the first five years of the ALSF and on thematic priorities for future research, as perceived by a wide range of consultees.

CPD Training Modules for Mineral Planning Officers (*Office of the Deputy Prime Minister and MIRO, 2004 - 2007*)

This was a joint project between Leeds University and Capita Symonds', to which Cuesta also made an important contribution. Overall, the project aimed to address a critical need, identified by the Royal Town Planning Institute, for professional training for existing and prospective minerals planning officers, and others, so that they are better equipped to deal efficiently and effectively with applications for aggregate extraction and the control of related environmental impacts. Towards the end of the project, Cuesta took responsibility for the finalisation and subsequent updating (in 2010) of two particular training modules: **Module 1: The Regulatory Framework** (dealing with relevant planning and environmental legislation and policy) and **Module 3: Minerals and Waste Planning: Professional Practice** (covering the practical side of the planning system).

1989 to June 2012:

(part time from January 2005 to June 2012, in parallel with similar work for Cuesta Consulting)

Capita Symonds Limited.

(formerly Symonds Group / Symonds Travers Morgan / Travers Morgan Limited):

Director of Earth Sciences, responsible for the technical direction of major projects across a range of disciplines including environmental and engineering geology, geomorphology, hydrogeology and landscape. Also responsible for business development in these and related fields across a range of Government Departments and Agencies, Local Planning Authorities and the minerals industry.

Major projects, listed in reverse chronological order:

South Downs National Park - Soft Sand Study (*SDNPA, 2012*)

Technical Director for this study which provided information to support the development of new apportionments for soft sand provision between the newly-created

South Downs National Park Authority and adjoining MPAs. The study brought together information supplied by the existing MPAs for this area (East Sussex, West Sussex and Hampshire), resource mapping from the British Geological Survey and the results of discussions with local mineral operators. It examined existing and historical supplies and markets, future allocations or potential allocations within existing and emerging Development Plans, and potential alternative sources of soft sand outside the National Park. It highlighted the sustainability issues which would need to be examined if future policies were to necessitate a change from existing supply patterns.

Aggregates Levy Scientific Referrals (*HMRC, 2011 - 2012*)

Independent expert, appointed by Her Majesty's Customs and Revenue to provide geological assessments of the claims made by various mineral operators for exemption of certain products from the Aggregates Levy. This contract followed directly on from a previous one to provide the same service between 2006 and 2010. In addition to routine referrals involving the inspection, sampling and testing of material from individual quarries, the work also involved the investigation of more complex cases, including the use of limestone dust within concrete and asphalt products.

Managing Landscape Change resulting from Mineral Extraction in North Yorkshire (*North Yorkshire County Council and English Heritage, 2011 - 2012*)

Technical Director for this innovative project, carried out by Capita Symonds and Oxford Archaeology North, with additional support from Cuesta Consulting Ltd. The study covered the whole of North Yorkshire, excluding the National Parks, and provided an evidence base on the sensitivities to landscape change likely to be associated with future quarrying activity. The work covered all types of surface mineral extraction, from sand & gravel and crushed rock aggregates to building stone, brick clay, silica sand, Chalk and shallow coal. For each mineral type (subdivided by depositional environment in the case of sand & gravel), the study examined the relationships between resource distribution, geomorphology, landscape character, biodiversity, geodiversity, archaeology and historic landscape evolution. It also considered the potential impacts associated with each type of mineral working and the corresponding landscape, biodiversity and historic environment sensitivities in each of the resource areas. The findings, completed in April 2012, will directly inform the development of policies within North Yorkshire County Council's Minerals Core Strategy. The reports can be accessed via the North Yorkshire County Council Website as follows:

<http://www.northyorks.gov.uk/index.aspx?articleid=20126>

South West Sub-Regional Apportionment Options for Future Aggregates Supply (*South West Councils, 2009 - 2010*)

Technical Director for this follow-up to Capita Symonds' 2004 - 2005 study for the former South West Regional Assembly. The aim of the new project was to explore technically viable options for future aggregates supply patterns which may be more sustainable than the existing market-led scenario.

Hard Rock and Sand & Gravel Safeguarding Areas in Ynys Môn (*Isle of Anglesey Council, 2009 - 2010*)

Technical Director for this study aimed at the identification/designation of Hard Rock and Sand & Gravel Safeguarding Areas for inclusion within the Ynys Môn Local Development Plan. The work involved reviewing existing and emerging national and regional policy guidance on aggregates safeguarding; identification of the best geological resource information available for the area; identification of known and potential aggregate resources which are, or may become of economic importance in the foreseeable future; and making recommendations as to the appropriate safeguarding areas in terms of GIS outlines and explanatory text. Evidence in support of the soundness of these recommendations may, in due course, be given at the LDP Examination in Public.

The Restoration and Aftercare of Coal and Aggregates Workings in Wales
(*Welsh Assembly Government, 2009*)

This project involved a rapid review, for the Welsh Assembly Government's planning policy branch, of the extent and adequacy of restoration and aftercare at opencast coal and aggregate minerals sites in Wales which had ceased working, either permanently or temporarily, within the preceding 10 year period. The research was required to provide a national 'snapshot' of the current effectiveness of restoration and aftercare Planning Conditions and whether or not they have been satisfactorily implemented. It was also required to evaluate compliance with the Conditions by mineral operators, identify best practice and, where necessary, identify the obstacles preventing satisfactory restoration. The report can be accessed on the Welsh Government Website, as follows:

<http://wales.gov.uk/topics/planning/planningresearch/publishedresearch/cawresearch2009/?lang=en>

Benefits and Opportunities: Integrating Geodiversity and Landscape with reference to the European Landscape Convention (*Natural England, 2008 - 2009*)

This research was required to inform the way in which Natural England integrates its geodiversity and landscape work (at national, regional and local levels) and to inform and enhance the way in which the European Landscape Convention (ELC) is delivered across and beyond Natural England. The research found that Natural England's landscape work would benefit from greater inclusion and use of geodiversity information: a better understanding of geodiversity would add to the interpretation of landscape distinctiveness and quality; whilst an understanding and recognition of geomorphological processes could provide a vital aspect of managing and predicting landscape change - particularly in terms of landscape responses to future climate change.

Strategic Assessment of the Value and State of Scotland's Geodiversity and Development of the Basis for a National Policy Framework: Geodiversity Attributes and Trends (*Scottish Natural Heritage, 2008 - 2009*)

This research was required to identify and assess potential geodiversity attributes and indicators, which could be used by SNH to monitor the contribution which geodiversity makes to society. It was also required to identify and evaluate additional parameters which could be used as part of a surveillance framework, designed to monitor changes over time in geodiversity-based ecosystem services. The report's recommendations contributed to a wider study being undertaken by Scottish Natural Heritage and the British Geological Survey to develop an evidence base to inform the development of a national policy framework for geodiversity in Scotland.

Evaluation of the Regional Aggregate Working Parties (RAWPs) in Wales
(*Welsh Assembly Government, 2007 - 2008*)

Project Director of this research project which examined the workings of the managed aggregate supply system in Wales, over the period since devolution. The project focused in particular on the role and performance of the RAWPs and on the new approach represented by the recently completed Regional Technical Statements. The research involved stakeholder consultation by means of a questionnaire survey, meetings and workshops, the development of evaluation criteria and reporting. An executive summary of the report can be accessed via the Welsh Government Website, as follows:

<http://wales.gov.uk/topics/planning/planningresearch/publishedresearch/rawpsexec;jsessionid=BEB87E191438A957FF6DE0272CDA03A6?lang=en>

Reasons for the Decline in Aggregate Reserves in England
(*Department of Communities and Local Government and MIRO, 2007 - 2008*)

Technical Director and principal author of this major research project commissioned by DCLG and funded through the Aggregate Levy Sustainability Fund. The work was undertaken in response to the findings of a previous report by the British Geological

Survey which demonstrated that aggregate reserves in England were declining – especially in the case of sand & gravel reserves in London and the South East. Our research provided an in-depth quantitative analysis of mineral planning application data (rates and tonnages of submissions, outcomes and length of determination periods), together with a qualitative analysis of the views of Mineral Planning Authorities, RAWP secretaries and quarry operators on the reasons for the observed decline. The work produced a series of evidence-based conclusions and recommendations for actions needed to monitor and stabilise the level of reserves at appropriate levels in future years. The final report can be downloaded from MIRO's 'Sustainable Aggregates' Website:

http://www.sustainableaggregates.com/library/links/links_onsite/L0020.htm

Ghyll Scaur Quarry Environmental Statement (*Aggregate Industries, 2007*)

Project Director for Capita Symonds' input to this major planning application and Environmental Statement seeking a time extension of the existing planning permission at this strategically important high specification aggregates quarry in Cumbria. Capita Symonds' input related primarily to traffic and transport issues (including rail and shipping options) but a critical aspect was relating these to the fundamental need argument for the specialist aggregates produced at this site, which are needed for skid-resistant road surfacing applications in many parts of the UK. The application was successful.

Aggregates Levy Scientific Referrals (*HMRC, 2006 - 2010*)

This work involved independent geological assessments of the claims made by various mineral operators for exemption of products from the Aggregates Levy. Justification for the claims commonly related to the applicant's view that 51% or more of the product comprised 'shale' or some other exempt material. Our task in each case involved site inspection of the source quarries, verification of the links between product stockpiles and source areas within the quarry, certificated sampling of the stockpiles, commissioning and review of petrographic and other laboratory testing, as appropriate, and the preparation of reports for HMRC.

Good Practice Guidance on Controlling the Effects of Surface Mineral Working on the Water Environment (*DCLG and MIRO, 2005 - 2008*)

Project Director and principal author of this major research project, which has updated the former DETR's Guide to Good Practice on "*Reducing the Effects of Surface Mineral Workings on the Water Environment*" (Thompson *et al* 1998), bringing it into line with the requirements of the Water Framework Directive and other recent and emerging legislation. The full report can be obtained from Capita Symonds and a related 'benchmark' report can be downloaded from MIRO's Sustainable Aggregates Website at:

http://www.sustainableaggregates.com/library/links/links_onsite/L0084.htm

The research also produced a separate report giving draft policy recommendations on the subject to DCLG. This was deliberately designed as a draft Annex on the Water Environment to Minerals Policy Statement 2: *Controlling and Mitigating the Environmental Effects of Minerals Extraction in England*. However, the Government's latest reforms of the planning system, as set out in the 2007 White Paper, meant that the Annex was never issued, other than as a research report. That report can be accessed via the Sustainable Aggregates Website, as follows:

http://www.sustainableaggregates.com/library/links/links_onsite/L0017.htm

Managing the Interface between Planning and Licensing with respect to Quarry Dewatering (*Department of Communities and Local Government (formerly ODPM), the Environment Agency and MIRO, 2004 - 2007*)

Project Director and lead researcher for this high profile research project, prompted by the introduction of the Water Act 2003. The aim of the project was to develop a procedural framework and corresponding guidance for managing the interface between the planning and licensing regimes when the present licensing exemptions on

quarry dewatering are lifted in accordance with the Water Act 2003. The framework is needed to facilitate a smooth transition between the two regimes and to ensure that adequate control of environmental impacts is maintained without imposing an undue burden on the minerals industry. The report can be downloaded from MIRO's Sustainable Aggregates Website using the following link:

http://www.sustainableaggregates.com/library/links/links_onsite/L0011.htm

Mitigating the Impacts of Quarry Dewatering (*MIRO, 2004 - 2007*)

Project Director of this long term practical research project which builds upon the recently completed MIRO/Environment Agency-funded project on "*Optimising the Efficiency of Recharge Features as a Mechanism for Mitigating the Impacts of Quarry Dewatering*". The work incorporated more extensive and longer term field experiments than were possible in the original study, and covered a wider range of mitigation techniques, from recharge trenches to injection wells and low permeability barriers, allowing comprehensive, evidence-based guidance on best practice techniques to be developed. The various reports can be accessed through MIRO's Sustainable Aggregates Website using the following link:

http://www.sustainableaggregates.com/library/links/links_onsite/L0037.htm

Company Geodiversity Action Plans (*MIRO, 2004 - 2006*)

Project Director of this study which aimed to develop a suitable approach and methodology for aggregates companies to use in the production of Company-wide Geodiversity Action Plans (cGAPs). Such plans need to blend realistic geological conservation and business objectives in order to promote the sustainable use of geological resources for amenity, education and research. The main output was a peer-reviewed Guide to Good Practice on all of the stages involved in the preparation of cGAPs, from initial geodiversity audits and the identification of conservation objectives linked to quarrying operations, through to the prioritisation of objectives and the development of a realistic, company-wide action plan integrated with wider business objectives. The report can be downloaded from MIRO's Sustainable Aggregates Website using the following link:

http://www.sustainableaggregates.com/library/links/links_onsite/L0541.htm

Expert Witness on Geology and Geomorphology at the South Downs National Park Public Inquiry. (*Countryside Agency, 2004*)

Appointed by the Countryside Agency in May 2004 to provide Expert Witness evidence on geological and geomorphological issues at this long running Public Inquiry. My task was specifically to rebut the argument put forward by objectors that the proposed National Park should be confined to the outcrop of the Chalk and to demonstrate how geological and geomorphological factors were able to provide strong unifying links between the Chalk and non-Chalk areas within the proposed Designation Boundary. Evidence presented to the Inquiry in December 2004.

Technical and Strategic Assessment of Current Aggregate Reserves and Potential Use of Secondary & Recycled Aggregates in the South West Region (*South West Regional Assembly, 2004 - 2005*)

Project Director and lead researcher for this strategically important investigation that aimed to identify the potential opportunities, practicalities and sustainability implications of alternative patterns of sub-regional apportionment of future aggregates supply for the whole of the South West region, for the period 2001 - 2016. The work specifically considered the opportunities for substituting crushed rock and secondary china clay aggregates for natural sand and gravel, but in a pragmatic way that takes account of the economic and environmental implications of the transportation involved.

Lower Lea Valley Regeneration Strategy Environmental Statement (*London Development Agency, 2003 - 2004*)

Co-ordinator of geological and hydrogeological input to this major Environmental Impact Assessment, carried out by Symonds to support the planning applications for

the Lower Lea Valley Regeneration Strategy, including the proposed site of London's bid for the 2012 Olympic Games.

The Sustainable Use of High Specification Aggregates in England.

(Office of the Deputy Prime Minister and MIRO, 2003 - 2004)

Project director for this 18-month programme of research, funded by the ODPM's share of the Aggregates Levy Sustainability Fund. The project built on the original "High Specification Aggregates" study undertaken by Travers Morgan Limited in 1992/93. The original study was the first attempt to investigate the availability and need for these specialist types of aggregate, but did not attempt to deal with what was then the emerging concept of sustainability. The new study redressed that balance by incorporating a comparative sustainability assessment of alternative scenarios for the supply of high specification (skid-resistant) road surfacing materials, using the innovative methodology developed in previous work for the Welsh Assembly Government. The new study also provided an updated assessment of both supply and demand, taking account of the substantial changes that had taken place since 1992 in asphalt technology – particularly the use of thin surfacings. The report can be accessed via MIRO's Sustainable Aggregates Website using the following link:

http://www.sustainableaggregates.com/library/links/links_onsite/L0057.htm

Planning for the Supply of Natural Building and Roofing Stone in England &

Wales *(Office of the Deputy Prime Minister, 2002 - 2003)*

Project director for this 18-month strategic research project, investigating land use planning issues relating to the supply of indigenous building stone and roofing stone throughout England and Wales. The research included detailed case studies focusing on each of the main sectors of the market in different parts of the country, including Portland Limestone, 'York' Sandstone, and Welsh Slate, together with specialist stones worked on a much smaller scale for local restoration projects. The research was published in March 2004 and directly informed the development, by ODPM and the Welsh Assembly, of annexes to Minerals Planning Statement 1 and technical advice notes, respectively.

Identification of Hydrological 'Buffer Zones' at the Margins of Lowland Raised Bogs throughout the UK *(English Nature, 2003)*

Project Director of this important work to develop a system for identifying the extent of land, at the margins of SSSI and SAC-designated raised bogs, within which control over groundwater levels needs to be exerted in order to maintain the sites in 'favourable condition', as required by the European Habitats Directive. The work includes a review of groundwater modeling approaches and involves close liaison with the statutory conservation agencies in England, Wales, Scotland and Northern Ireland.

Assessing Impacts of the Aggregates Levy on Northern Ireland. *(HMRC, 2003)*

Project Director of this study for HM Customs & Excise, evaluating the impacts of the Aggregates Levy on producers and users in Northern Ireland which, uniquely within the UK, has a land border with another country where the Levy does not apply.

The Hydrological Behaviour of Flooded Sand & Gravel Pits and its' Implications for the Functioning of the Enclosing Aquifers. *(MIRO, 2003 - 2004)*

Technical input to this 13-month research project, funded by MIRO through the Minerals Industry Sustainable Technology (MIST) programme. The work was coordinated by Professor Paul Younger at the University of Newcastle upon Tyne, and carried out in collaboration with Lafarge Aggregates Ltd. Our contributions included designing, installing and implementing a programme of monitoring at each of three flooded sand and gravel pits, to examine how the pit lakes interacted with the surrounding aquifer in different situations.

Optimising the Efficiency of Recharge Features as a Mechanism for Mitigating the Impacts of Quarry Dewatering. (*MIRO, Environment Agency, Tarmac Southern, Lafarge Aggregates, RMC Aggregates UK, & Hanson, 2003 - 2004*)

Project Director of this 18-month research project, originally funded by MIRO and a consortium of aggregate producers, but now extended by match funding from the Environment Agency. The project involved documenting case study information for situations where recharge features have been used for this purpose (currently there is a dearth of published information), and developing and monitoring one or more experimental sites over a 12 month period of investigation. The project output can be accessed via the following links on MIRO's Sustainable Aggregates Website:

http://www.sustainableaggregates.com/library/links/links_onsite/L0024.htm

http://www.sustainableaggregates.com/library/links/links_onsite/L0088.htm

The Influence of Aggregate Quarrying in River Floodplains on Flood Risk and Biodiversity (*MIRO, Lafarge Aggregates & RMC Aggregates UK, 2003 - 2004*)

Project Director of this 12-month research project, funded by MIRO through the Minerals Industry Sustainable Technology (MIST) programme. The project documented case study information provided by both minerals industry partners, the Environment Agency, English Nature and other stakeholders. It delivered an independent research report on the ways of minimising the adverse effects of quarrying on flood risk and biodiversity in river floodplains, and (just as importantly) on the ways of maximising the potential benefits. The report can be accessed via MIRO's Sustainable Aggregates Website, using the following link:

http://www.sustainableaggregates.com/library/links/links_onsite/L0094.htm

Reduction of Sediment Discharge into Fleet Pond from the MOD's Long Valley Training Area. (*Defence Estates, 2003*)

Specialist advice on geomorphology, hydrology and sediment transport was provided to Defence Estates in order to identify a 'sustainable', low maintenance solution to the problems of sediment discharge into the Fleet Pond from an area of heathland used for training by mechanised infantry. Liaising closely with the Environment Agency, English Nature, Hart District Council and the Fleet Pond Society, a package of innovative solutions was developed and taken through to formal consultation.

Geological Conservation of Unconsolidated Sediments in Quarry Exposures. (*DTLR/ English Nature, 2002*)

Project director for this study of the problems involved in the geological conservation of unconsolidated sediments in quarry faces. The work highlighted the different responsibilities of quarry operators, developers, land use planners, English Nature, and the Health and Safety Executive. It also reviewed current practice, using the findings from a literature search, two case study visits and information from key practitioners. The study concluded that (in common with archaeology) management techniques, rather than engineering solutions, offer greater potential benefits to the conservation of soft sediments. It also noted the potential benefits to be gained of raising the profile of geological and geomorphological conservation in quarries, and highlighted the potential use of the Aggregates Levy Sustainability Fund to support this objective.

Geomorphological Validation of Extreme Flood Outline Modelling (*DEFRA, 2002*)

Project director for this important field verification of a new flood modelling technique developed in response to the policy requirements of PPG 25. Intensive geomorphological field investigations were carried out in selected study reaches within the Ribble catchment in North West England. Flood outlines were compared with the geomorphological limits of river floodplains and terraces and systematic errors in the initial modelling output were identified, enabling the model to be improved.

Flood Risk Assessment for Planning (*Welsh Assembly Government, 2001 – 2003*)

Project director for this strategic research project to develop an innovative methodology for flood risk assessment to support the revised Technical Advice Note (15) on Development and Flood Risk, issued for consultation in July 2003. The study drew lessons from the widespread flood events of autumn 2000, and developed a methodology that combined traditional engineering-based approaches with a detailed understanding of fluvial geomorphology and hydrology. In this way, the study identified a system that is capable of reducing flood risk to new development and of allowing for the likely impacts of future climate change.

Woburn Fuller's Earth Public Inquiry (*Bedfordshire County Council, 2001*)

Successfully argued Bedfordshire County Council's case that there was no over-riding need for fuller's earth extraction at Woburn, at a Public Inquiry following an appeal by Steetley Woburn Bentonite Limited. The work focused on whether or not the clay at Woburn had physical and chemical properties that gave it unique performance characteristics compared with other bentonite sources in the UK and worldwide. Proofs of evidence were prepared and presented at the Inquiry.

Comparative Environmental Assessment of Land and Marine Sand and Gravel.
(*Welsh Assembly Government, 2001 - 2002*)

Project director for this detailed follow-up to our earlier work on land-based sand and gravel resources in S.E. Wales. The aim of this project was to examine more closely the relative sustainability implications (environmental, social and economic impacts) of alternative scenarios for the supply of aggregates in the region focusing, in particular, on the comparison between marine dredging and land-based extraction. The study included a detailed geomorphological assessment of coastal processes and coastal sediment movement, and incorporated the use of an innovative sustainability assessment procedure, developed by Symonds for this purpose. The work has directly informed the development of minerals planning policy in Wales, especially the Technical Advice Note on Aggregates, and will also inform the Government View with respect to future dredging licenses.

Torr Quarry Environmental Statement. (*Foster Yeoman Ltd., 1999*)

Project manager for our multi-disciplinary input to the preparation of an Environmental Statement for this limestone 'super-quarry' in Somerset. Our work included analysis of the strategic importance of Torr in supplying aggregates by rail to southeast England, and its role in supporting the implementation of MPG6 policies on sustainable mineral extraction. It also included an assessment of landscape impacts; restoration design (including geomorphological landform replication, linked to geotechnical slope stability assessments and ecological requirements); traffic and transportation impacts; and a review of the environmental implications of alternative options.

Minerals Industry's Contribution to Geological Conservation (*English Nature*)

Project director for this preliminary study for English Nature, the Quarry Products Association, and the Silica and Moulding Sands Association. The study aims to inform future guidance on geological conservation within active and disused mineral sites in England.

Review of Guidance on the Conservation, Management and Usage of Geological and Geomorphological Sites (*English Nature*)

Project director for this study to provide revised guidance that will enable those involved in geological conservation to safeguard sites against damaging activities, to manage sites in a manner which conserves the features of interest; and to take actions to raise the awareness of our geological and geomorphological heritage.

Impact of Extant Planning Permissions on SSSIs in England (*English Nature*)

Project director for this work for English Nature, on the impact of extant planning permissions on Sites of Special Scientific Interest (SSSIs) throughout England. The survey compiled information on the extent to which SSSIs were perceived (by English

Nature's conservation officers) to be under threat from different types of permission, and the findings have helped to inform future Government policy on this issue.

Groundwater Abstraction Licence, Panshanger Quarry, Hertfordshire
(Lafarge Aggregates)

Project director for this work to obtain an upgraded groundwater abstraction licence for a sand & gravel quarry working Quaternary deposits above the Chalk aquifer, and alongside a high quality Chalk stream (the River Mimram). The work included a water loss and mass balance on the existing and proposed abstraction of water needed for mineral washing. The site was instrumented and monitored over a period of several weeks to provide the evidence needed to estimate overall water losses to the satisfaction of the Environment Agency.

Modelling and Monitoring of the Impacts of Quarry Dewatering, Stonecastle Farm, Kent (Lafarge Aggregates)

Project director for this detailed groundwater modelling exercise for the proposed 6-phase extension of an existing sand & gravel quarry located within the River Medway floodplain. The modelling was undertaken using MODFLOW with Groundwater Vistas to simulate numerous steady state scenarios for summer and winter conditions for each phase of operation. It was also used to examine the effects of wet working and other mitigation methods, including the use of recharge features and low permeability barriers. The work was undertaken specifically with a view to providing evidence at a forthcoming Public Inquiry. Regular monitoring of groundwater conditions around the site is still ongoing.

Geotechnical Assessments (RMC Aggregates)

Project director for the Geotechnical Assessment of two sand and gravel sites in south-east England, carried out in accordance with the Quarries Regulations 1999. Work included geological and geotechnical field data collection, slope stability analysis and assessment of significant hazards

Geotechnical Assessments (Lafarge Aggregates)

Project director for the Geotechnical Assessment of numerous sand and gravel sites in eastern and southern England, carried out in accordance with the Quarries Regulations 1999. Work included geological and hydrogeological desk studies, field data collection, specification and supervision of surveys and ground investigations, review of geotechnical data, slope stability analysis and assessment of significant hazards

Flood Impact Documentation, Uckfield (Environment Agency)

A detailed photographic and geomorphological survey was carried out of the maximum historical flood event on the River Uck on 12 October 2000. This information, together additional evidence from oblique aerial photography, was subsequently used to compile a detailed, GIS-based map of the flood limits covering an area of more than 12km². The map will assist the Agency in gaining a detailed understanding of flood magnitude, mechanisms and pathways.

Appraisal of Land-Based Sand & Gravel Resources in SE Wales
(National Assembly for Wales)

Project manager for this detailed appraisal of potential sand and gravel resources across the whole of industrial South Wales and the Brecon Beacons. Work included extensive geomorphological mapping of potential mineral-bearing landforms, based on a detailed knowledge of glacial processes; a survey of planning and environmental constraints; and an assessment of economic factors that would influence prospects for future working. Also includes an assessment of alternative future supply options, including secondary, recycled and imported aggregates.

Kent Thameside Development – Dartford (Prologis)

Project director for this multi-disciplinary assessment of the factors which might constrain a major flagship development project located on brownfield land alongside

the Dartford Marshes. Our work has encompassed assessing the feasibility of prior mineral extraction, potential impacts on groundwater resources and existing groundwater abstractions within the Chalk aquifer, geotechnical investigations, and contamination investigations. The comprehensive study of the water environment, supported by ongoing monitoring of baseline conditions, included detailed consideration of groundwater / surface water interactions.

Quinquennial Review of the Minerals, Land Instability and Waste Planning Research Programme, 1994/95 to 1998/99. (DETR)

Project manager for this comprehensive, strategic review of the DETR's Minerals, Land Instability and Waste Planning research programme. The final report included recommendations for a broadening of scope to cover all physical and environmental aspects of land use planning, and greater integration of the disciplines involved.

Charnwood Integrated Waste Management Facility Environmental Statement (Hanson Waste Management)

Geological input to the engineering and environmental design and Environmental Assessment for this major new Integrated Waste Management Facility within a former igneous rock quarry in Leicestershire. Symonds carried out all aspects of the work, from initial site investigations and hydrogeological studies (including groundwater modelling), through to the design of landfill lining and capping systems, outline working plan and cell phasing design, gas and leachate management, site facilities design, site layout, landscaping and restoration plan, surface water management, air quality, noise, vibration, traffic management and transport impacts.

Reducing the Effects of Surface Mineral Workings on the Water Environment. (DETR)

Project manager for this 2 year programme of research for DETR. Work involved a detailed review of the effects of surface mineral workings on all aspects of the water environment, and of the methods and effectiveness of different ways of monitoring and mitigating such effects. The main output from the study was a detailed guide to good practice, designed for use by mineral operators and mineral planning authorities.

Environmental Geology in Land Use Planning (DETR)

Project manager for two separate DETR research contracts with a total value of £400,000, carried out between 1995 and 1998. Output included a comprehensive Guide to Good Practice on Environmental Geology in Land Use Planning, a more concise Advice Note for planners and developers, and a detailed report on the implications for emerging policy issues. The latter included a section on managing constraints and liabilities associated with natural and man-made hazards.

Geomorphological Slope Stability Assessment, Isle of Wight (Southern Water)

Project manager for this geomorphological study, carried out to assist in the design of a water storage tank in an area of disturbed, landslipped ground near the coast. The work involved a full geomorphological survey and interpretative report commenting on the postulated mechanisms for movement and design recommendations.

Assessment of Subsidence Hazard Due to Gypsum Dissolution in Ripon (DETR)

Project Manager for this major, £210,000 research commission from the Department of the Environment and Harrogate Borough Council. Work included development of a GIS-based conceptual model of the hydrogeological and other factors controlling gypsum dissolution and related subsidence hazard; complete revision of the solid and drift geological maps for the area (in conjunction with BGS); preparation of a new hazard zonation map; and development of detailed policies and procedures to enable the Local Planning Authority to deal with the issue.

Tonyrefail Quarry Investigation (Brunswick Developments)

Project manager of this 6-month geological investigation for a possible new, high specification aggregates quarry in the Pennant Sandstones of South Wales. Work included deep borehole investigations, core logging, and geological interpretation.

Detailed Hydrotechnical Recharge Studies, Wadi Ghulaji

(Ministry of Water Resources, Sultanate of Oman).

Geomorphological and Geological interpretation of satellite images as part of a major hydrogeological investigation to assess the feasibility of groundwater recharge dams in part of the Northern Oman mountains. Subsequent field mapping was carried out to verify the image interpretation.

Armourstone Quarry Development, Norway

Project Manager of a desk study investigation into the geological, economic and financial feasibility of a proposed hard-rock quarry development for the production of armourstone on the west coast of Norway. Work included a detailed assessment of the geotechnical characteristics of the rock (eclogite), in terms of its suitability for coastal armourstone, dimension stone and aggregate production.

High Specification Aggregates for Road Surfacing Materials (DoE).

Project Manager of this £225,000 research commission for the Department of the Environment, investigating all existing and potential new resources of skid-resistant road aggregates throughout the UK. Work included a detailed review of specification requirements; collation and review of supply and demand statistics; a comprehensive programme of field investigations - logging, sampling and testing outcrops in quarries and road cuttings throughout England and Wales; and geological, planning and economic assessments of prospective resources.

Stability of Scree Slopes in Relation to Blasting Vibrations, Eire. (Burmin/Tara)

Engaged by Burmin – part of the Tara Mining Group – to carry out geomorphological mapping, assessment of mountain scree-slope stability and consideration of the effects of blasting vibrations induced by proposed mining development, as part of a larger Environmental Impact Study for the Croagh Patrick Gold Mining prospect, Connemara.

Channel Tunnel High Speed Rail Link: Steering Group. (Union Railways)

Engaged by Union Railways to provide geomorphological, geological and geotechnical advice on the proposed route of the CTRL. Advised on the geotechnical properties of overconsolidated Gault Clay in areas affected by intense periglacial activity (based on specialist knowledge obtained from previous work on the M20 motorway widening scheme). Also advised on the requirements for geomorphological mapping of slope instability within the Gault Clay outcrop; and on the occurrence of deep scour hollows developed beneath the floodplain of the River Thames.

Road Construction and Motorway Widening Schemes (DoT/HA)

Geotechnical and geomorphological desk studies and field investigations in connection with road construction and motorway widening schemes for the Department of Transport / Highways Agency. Schemes included: A55 North Wales Coast Road; A6 Disley-High Lane Bypass (Peak District); M27 Motorway (Hampshire); M1 Motorway (Nottinghamshire); A1(M) Motorway (Hertfordshire); and the M20 Motorway in Kent.

Tonyrefail Industrial Estate, S. Wales. (Welsh Development Agency)

Reconnaissance geomorphological mapping, aerial photograph interpretation, terrain analysis and geotechnical hazard assessment of a 60 ha site proposed for industrial development. Subsequently carried out trial pitting to substantiate geomorphological interpretations.

Photo-Geomorphological Surveys of Gas Pipeline Routes (Transco)

Project Manager for reconnaissance-level studies of ground conditions, potential geotechnical hazards and engineering implications along the proposed route corridors for three new gas transmission pipelines in Buckinghamshire, Cambridgeshire and Devon. Work involved aerial photograph interpretation, walk-over surveys and geotechnical assessments

Pool River Diversion, Sydenham (*British Gas*)

Geomorphological advice on meander geometry, channel capacity and grading/shape characteristics for imported bedload material for the diversion and realignment of the Pool River within a contaminated industrial site. Also advised on slope stability aspects of the scheme, based on field examination of relict shear planes within the underlying London Clay, and co-ordinated an extensive programme of ground investigations to address geotechnical, hydrogeological and contamination issues.

Depositional Environments of Sand & Gravel Aggregates, Iceland.

Continuation of research begun at Liverpool University into the geomorphology, sedimentology and historical development of glacial and glacio-fluvial landforms and sediments at the margins of the Vatnajokull ice-cap in south east Iceland and the Jostedalsbreen ice cap in Norway.

- Jul - Sept 1989** **H.J. Banks and Company**
- Consulting Geologist advising on mineral development at two sites in Cheshire and East Yorkshire. Work included geomorphological mapping and sedimentary facies modelling of Quaternary glacial deposits, followed by detailed volume and quality determination of sand and gravel reserves. Also provided advice on optimum excavation strategy for sub-water table working, to maximise the recovery of material to meet specification requirements for particular concrete tiles and other products.
- 1987 – 1989** **The University of Liverpool**
- Research Associate in Engineering Geology Unit, Department of Earth Sciences. Acting as full time project geologist on sand and gravel resource assessment contract in Warwickshire for the DoE. Responsible for comprehensive desk study of previous site investigation and laboratory testing data; planning and co-ordination of new borehole investigations; and assessment of resource volumes.
- 1981 – 1987** **Liverpool Polytechnic**
- Senior Research Assistant and Part Time Lecturer in Earth Sciences. Research included extensive fieldwork in Iceland and Norway, investigating processes, landforms and sediments in contemporary glacial environments. Also involved in DoE-funded assessments of sand and gravel resources in Shropshire and Gwynedd.
- 1978 – 1981** **The University of Liverpool**
- Full time postgraduate research in fluvial geomorphology and sedimentology: studying rates and causes of river channel changes in response to flood events in northwest England. The research included an investigation of the effects of historical land use change and artificial drainage on catchment hydrology. Ph.D. awarded in 1984 for thesis entitled "*Long and Short Term Channel Changes in Gravel Bed Rivers*".

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