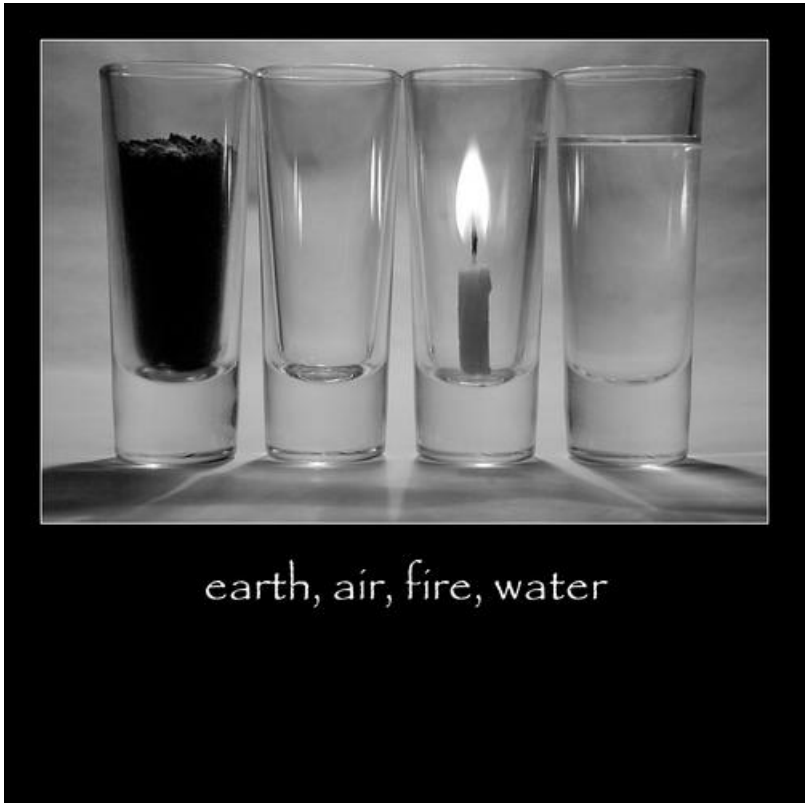
A Consulting Engineer's Perspective of the Geothermal Industry

Geothermal Live 2008

Keith Horsley - Associate
Hoare Lea Consulting Engineers

Introduction – The four elements



Hoare Lea

- Hoare Lea are a firm of Consulting Engineers specialising only in the design and inspection of Engineering Systems for Buildings.
- Hoare Lea is a partnership, wholly independent and owned by the Partners.
- 700 staff in 10 offices around the UK.
- Winner of the BSJ ‘Large Consultancy of the year Award’ for the last 2 years and 4 times in the last 10 years.
- Work in most industry sectors. Particularly active in commercial, education, retail, residential and healthcare sectors.
- Actively engaged in the implementation of sustainable engineering solutions.

Hoare Lea

Ground Source Energy Systems Experience
Completed Projects

- The National Forest Millennium Discovery Centre, East Midlands (completed 2001)
- Royal Veterinary College, Potters Bar (completed 2003)
- Alexandra Park School, Haringey (completed 2004)
- Chelsea Building Society, Cheltenham (completed 2007)
- Haybridge High School, Worcestershire (completed 2007)
- Caerphilly County Borough Council, Tredomen (completed 2008)

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Ground Source Energy Systems Experience

Selection of projects currently on site or in detailed design

- One New Change, London
- Oxford University, Earth Sciences Building
- Bracknell & Wokingham College
- Wandsworth Riverside Quarter, Phase 3
- Highbury College
- Bankside, Tate Modern
- Loughborough University Sports Park Development
- 2-20 Winchester Road, Camden

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Case Study :Royal Veterinary College

Client: The Royal Veterinary College

Architect: Nicholas Hare Architects

Contractor: Wates

This 4,200m^2, three-storey building acts as a gateway to the College, providing teaching space and housing the main administrative and IT functions, library and cafe.

A sustainable low energy design approach was adopted. The building's environmental design works with the architecture and structure to reduce solar loads through engineering the building shape, orientation and facades, and exposing concrete soffits.

Natural and displacement ventilation is used along with perimeter heating and archive close control air conditioning.

Case Study :Royal Veterinary College

- 50 x 100m deep vertical closed loop ground heat exchangers
- 500 kW capacity
- Reverse cycle heat pumps not available – complicated valve arrangements to produce “reversibility”
- Producing chilled water (6/12°c) for fresh air cooling (displacement ventilation with exposed concrete slab solution)
- Producing low temperature hot water (45/40°c) for fresh air heating.
- Owner occupier with low energy agenda

Case Study : Chelsea Building Society

Client: Chelsea Building Society

Project Manager: Gleeds Management Services

Architect: Dyer Associates

Contractor: Moss Construction

Winner – Best Office of the Year, Building Services Awards

Regional Winner - Corporate Workplace South of England, BCO Awards

The Chelsea Building Society's 3-storey, 4,000m^2 headquarters comprises cellular and open-plan offices, a call centre, training suite, restaurant, break out rooms and a state of the art computer operations facility.

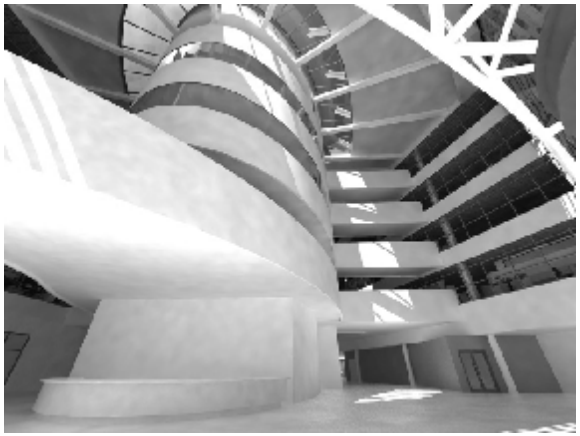
Key features include ground source heat pumps and comfort cooling provided via displacement ventilation with passive chilled beams. Extensive zonal control for temperature and lighting ensures efficient energy use, and a SUDS drainage system is provided to the external areas of the building. Passive design features incorporated include external south-facing brise soliel and neutral, low 'e' solar control glazing to minimise solar heat gain in summer, whilst maximising daylight.

Case Study : Chelsea Building Society

- 120 x 100m deep vertical closed loop ground heat exchangers serving two buildings
- Supplemented by dry air cooler
- 1000 kW heating capacity, 600 kW cooling capacity
- Producing chilled water (6/12°c) for fresh air cooling, fan coil units and chilled beams
- Producing low temperature hot water (45/40°c) for fresh air heating
- Owner occupier who wanted a green building to “sell” relocation to their staff

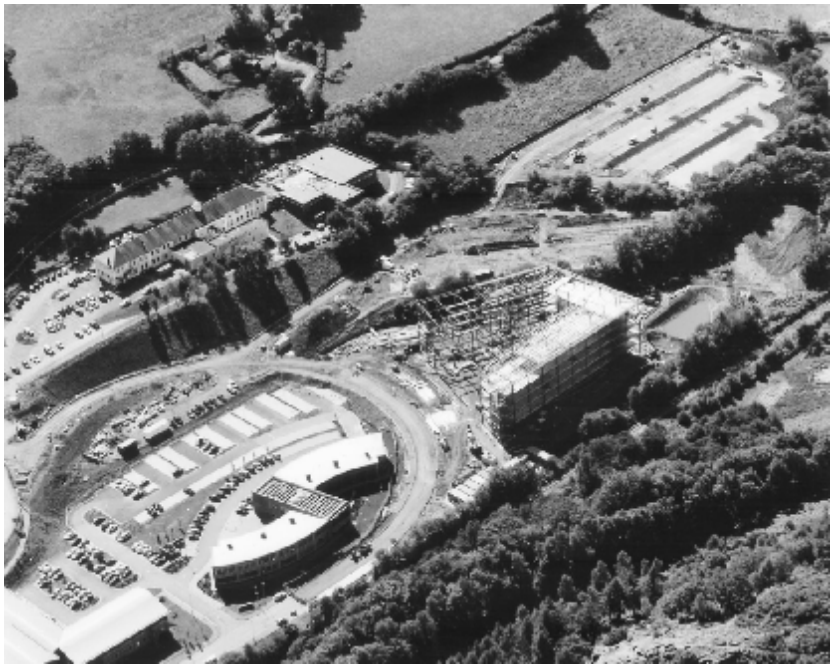
Case Study : Caerphilly County Borough Council

A new corporate headquarters building for Caerphilly County Borough Council providing 13000m^2 of office space over 5 floors and including a council chamber, kitchen, restaurant, registrar suite, FM and communications room.



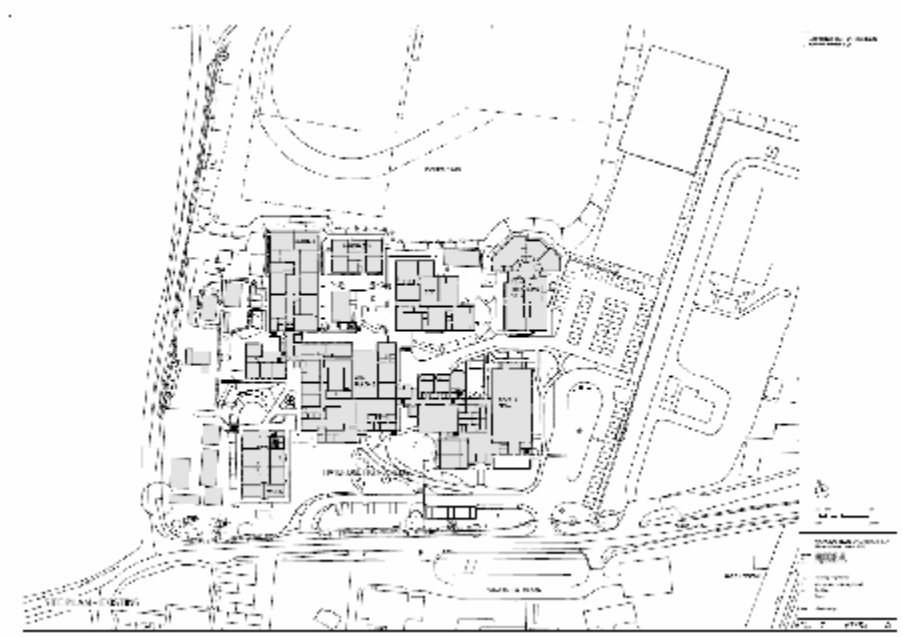
Case Study : Caerphilly County Borough Council

- 120 x100m deep vertical closed loop ground heat exchangers
- 1130kw heating capacity
- 722kw cooling capacity
- Producing chilled water (6/11º C) for fresh air cooling and fan coil units
- Producing low temperature hot water (45/40º) for fresh air heating and underfloor heating



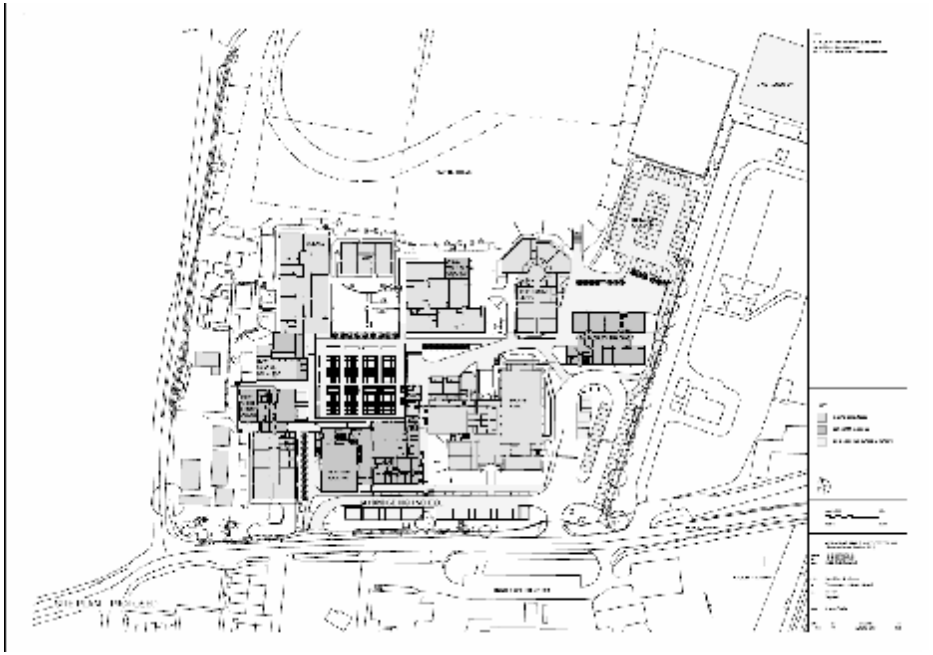
Case Study : Haybridge High School, Hagley

- Existing high school site
- Expansion to accommodate two additional year groups
- New 18-classroom faculty building
- New central administration building (replacing existing, demolished) containing ICT suite, library, multi-use hall, dining area.



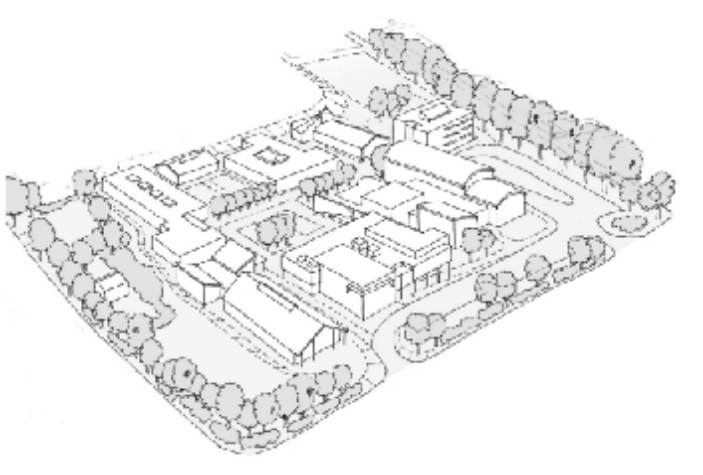
Case Study : Haybridge High School, Hagley

- Conversion and extension of existing classroom block into sixth form centre
- Extension to science block
- Extension to design technology block
- Extensive underground services diversions
- Central plant upgrades
- Construction cost £14M



Case Study : Haybridge High School, Hagley

Client:	Worcestershire County Council
Architect:	Nicholas Hare Architects
Engineering Systems Consulting Engineer:	Hoare Lea
Civil & Structural Engineer:	Price & Myers
Cost Consultant:	Turner & Townsend
Project Manager:	Gleeds
Main Contractor:	Miller Construction
Mechanical & Electrical Installer:	CA Sothers
Ground Source Energy System Specialist Contractor:	Geothermal International



Case Study : Haybridge High School, Hagley

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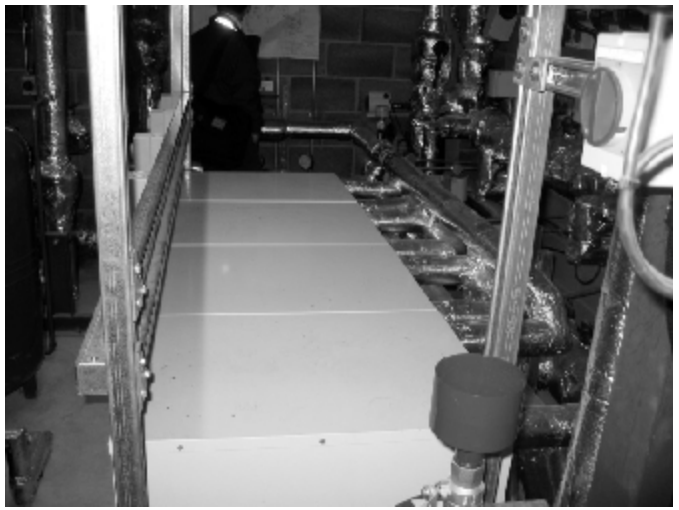
Case Study : Haybridge High School, Hagley

- 14 vertical closed loop heat exchangers, between 70-100m deep
- 100 kW cooling capacity, 70 kW heating capacity
- Generating chilled water at 6°c for cooling ICT suite via fan coil units
- Generating low temperature hot water at 50°c for underfloor heating, also some fan coil units and fresh air heating coils



Case Study : Haybridge High School, Hagley

- No “renewables” contribution requirement imposed by planning authority
- Pre-2006 Building Regulations Part L
- But WCC brief called for energy efficient systems
- WCC already familiar with technology

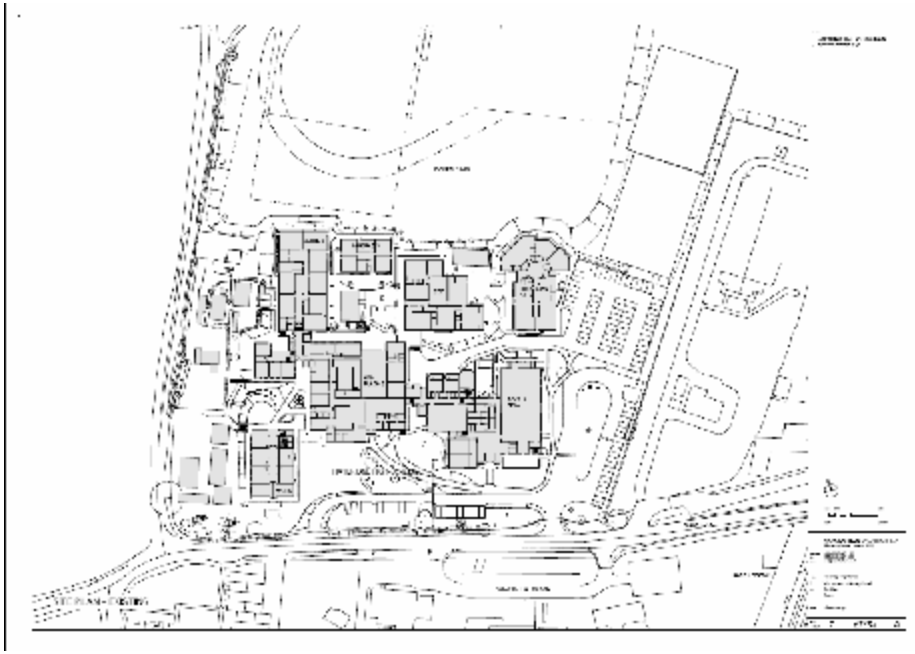
Case Study : Haybridge High School, Hagley

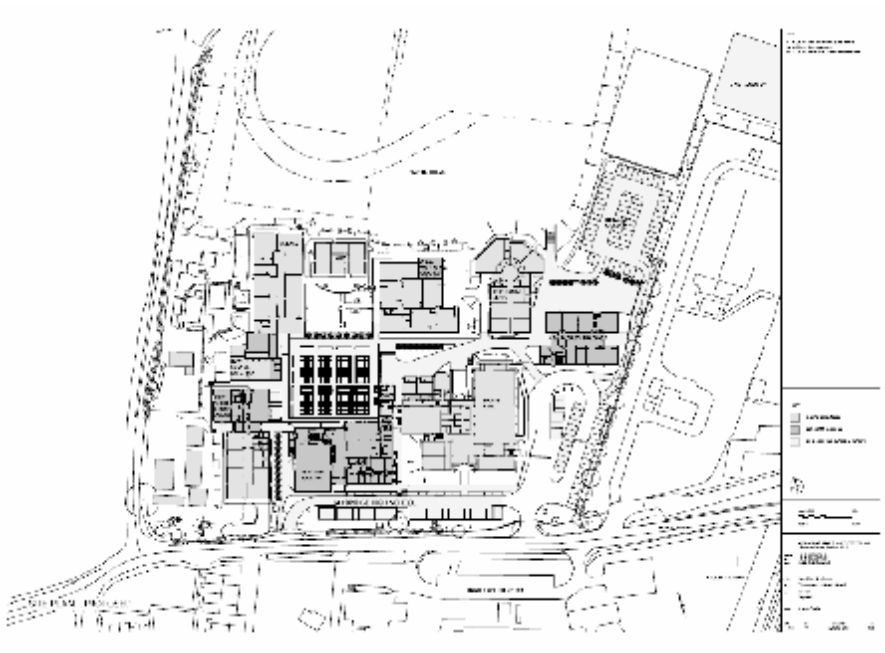
- GSES justified on payback (approx. 9 years)
- Cooling-led strategy, provides entire cooling requirement of ICT suite
- Avoided need for external heat rejection plant

Case Study : Haybridge High School, Hagley

- Cooling needed to be operational in time for occupation of main building
- Existing main building could not be demolished until new main building occupied
- Borehole field to go underneath footprint of existing main building
- Temporary dry cooler provided so heat pumps could be commissioned before boreholes drilled

Case Study : Haybridge High School, Hagley





Case Study : Haybridge High School, Hagley

- Meant that drilling took place in close proximity to completed building…

  … and was one of the last operations on site rather than one of the first.

Case Study : Haybridge High School, Hagley

- Drinking water extraction borehole
- Liaison with EA
- Water company's concerns
- Client agreed to additional measures to protect drinking water supply
- Disposal of water produced by drilling process

Case Study : Haybridge High School, Hagley

- Disposal of water produced by drilling process

Case Study : Haybridge High School, Hagley

- Change in strata encountered at 70m on part of site – two additional boreholes required

- Commissioning of sliding header arrangement controls required close liaison between GSES specialist, M&E contractor, controls specialist and consulting engineer

The M&E Consulting Engineer's Perspective

- Step change in prevalence of technology on projects in last 12-24 months

- Drivers
  - New Part L
  - "Renewables" contribution requirements of local authorities
  - Increased confidence as technology becomes more established in UK

- Relatively small number of established contractors. Selection of contractor may restrict choice of heat pump

- Specialist contractors are valuable source of design advice

The M&E Consulting Engineer's Perspective

- Need to appoint specialist contractor early as their design impacts on the sub-structure…

  … but M&E often not sufficiently advanced at this stage for whole GSES package to be priced

- Demarcation of design responsibility needs to be made clear at the outset

- Demarcation of installation responsibility needs to be made clear at the outset and interfaces defined

- Specialist contractor's position in the contractual chain needs to be considered

The M&E Consulting Engineer's Perspective

- What level of specification is appropriate? What information should specification contain?
- Specialist GSES contractor familiarity with consultants' standard specifications
- Problems "in the ground" – not previously a concern of M&E engineers – now they are!
- Who takes the risk?
- Drill test borehole where possible

The M&E Consulting Engineer's Perspective

- Where possible, keep boreholes away from completed / occupied buildings (and off critical path)
- Importance of commissioning and controls
- How to prove specified performance is achieved?

Thank you for your attention…