1 TECHNICAL FACTSHEET
The Site & Initial Excavations

Hockerton Housing Project
Bringing sustainability to life

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The Site

The development is located on a 10ha site located in the southeast segment of the junction of the A617 and the Southwell Road in the village of Hockerton to the North east of Nottingham (*see graphics on p.2*). Previous use of the land was essentially agricultural. The field has a slight slope downwards from the A617 to the south south west. The boundary to the south is a natural brook with a line of trees of varying maturity, at its closest is at about 40m from the west end of the line of houses.

The soil is silt & red clay and is mostly clear of stones. The only vegetation is at the surface with no sign of tree roots. Interestingly some minor archaeological items were found beyond the roadway at the west end of the building line and these were removed by a local archaeologist and a request was made not to disturb that area.

The 10ha site has allowed incorporation of features that enable the occupants to live in a sustainable and self-sufficient way. This includes crop cultivation and the rearing of animals. It has also allowed for large water catchment for the homes and waste disposal via a reed-bed system. (Note: The latter can be achieved on a single house plot)

The homes themselves consist of a terrace of five single storey dwellings which are earth-sheltered at the rear (North), such that the ground surface slopes and blends smoothly into the field at the back. South facing conservatories over-look a lake and wildlife pond (*see graphics on p.2*).

Aerial view of site showing road into site and earth covered development in front of lake. The A617 runs parallel with lake in NW area of image.

Before Development

Houses complete looking over lake

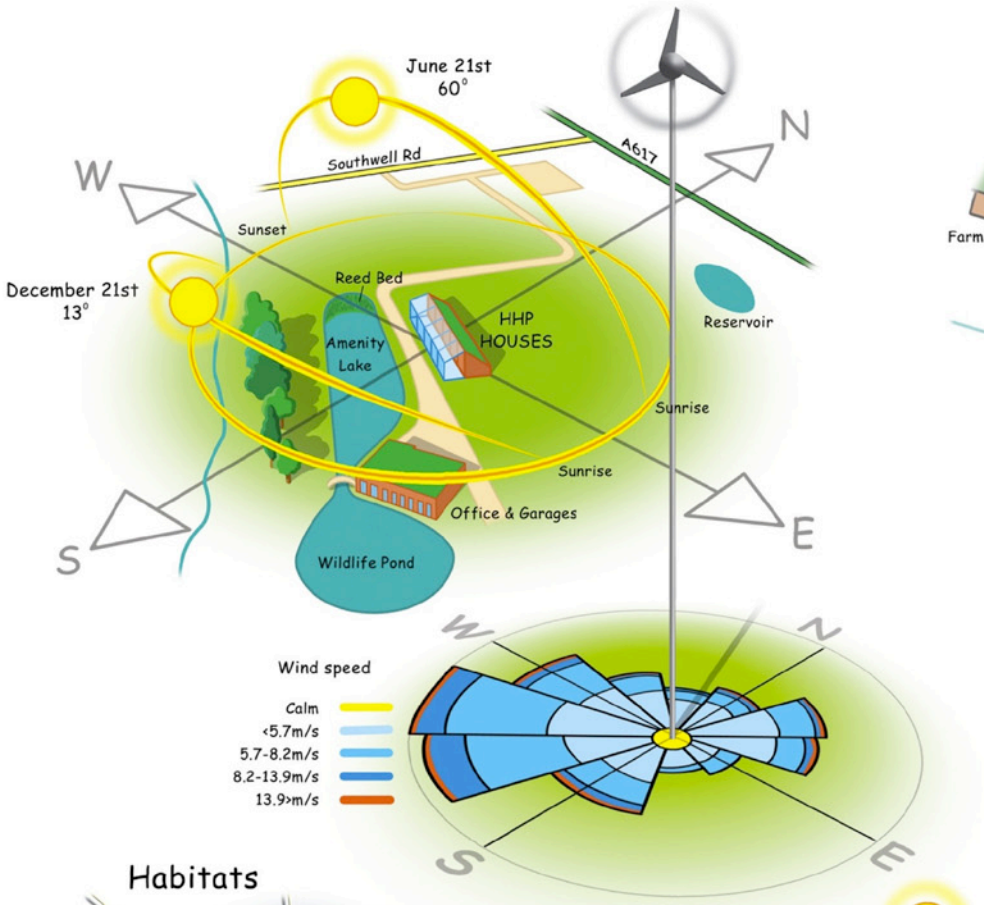
Other key facts!

(Diagrams 1-3 show graphically many of these details)

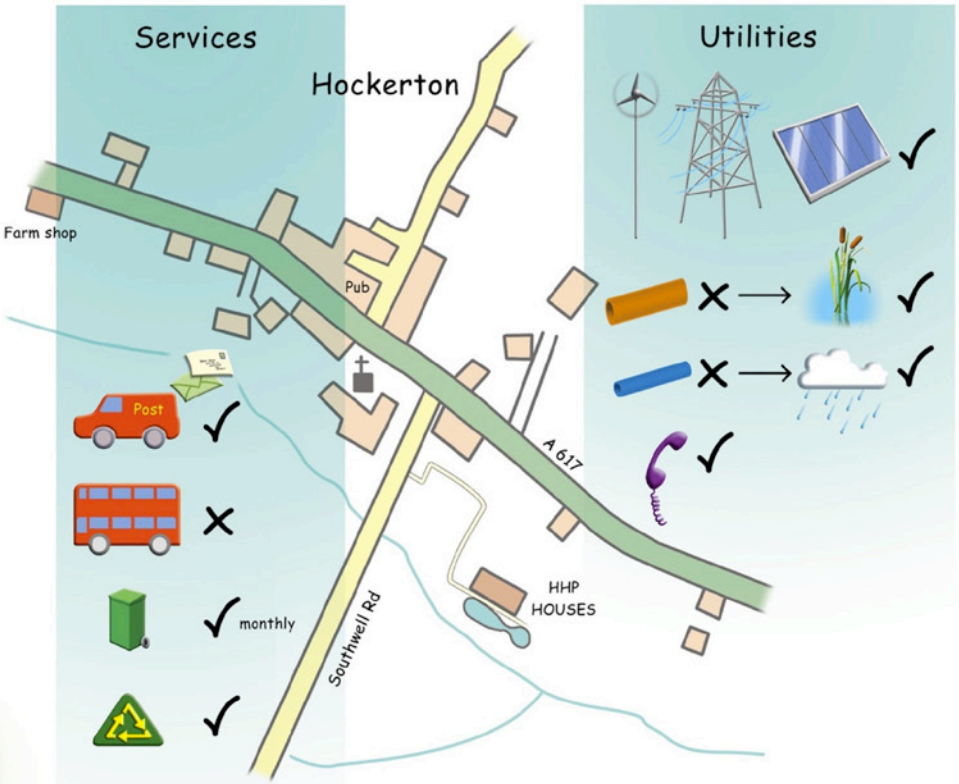
- Geographical location - rural Nottinghamshire with gently rolling countryside
- Nearest populations: Hockerton village (1/2m, circa 120), Southwell (2m, circa 15,000), Newark (7m, circa, 35,000), Nottingham (20m, circa 267,000)
- Natural resources: Small stream along southern boundary, woodland copses
- History: Site of medieval village of Hockerton on NW area of site with many archaeological finds during excavation. Large standing stones (positioned by HHP) locate ancient village yard. HHP road to homes follows course of medieval path.
- Orientation - SSW-facing on 4^{o} slope
- Predominant local land use: mixed farming, including arable and sheep
- Services: Off-grid from mains water and sewage, grid connected to power supply
- Transport corridors: “A” road to Newark and Mansfield, and “B” road to Southwell
- Public transport: Nearest regular bus link in Southwell and train link in Newark
- Local facilities: Farm shop/restaurant, pub, church, parish hall, telephone/post boxes

LOCATION

Natural Resources

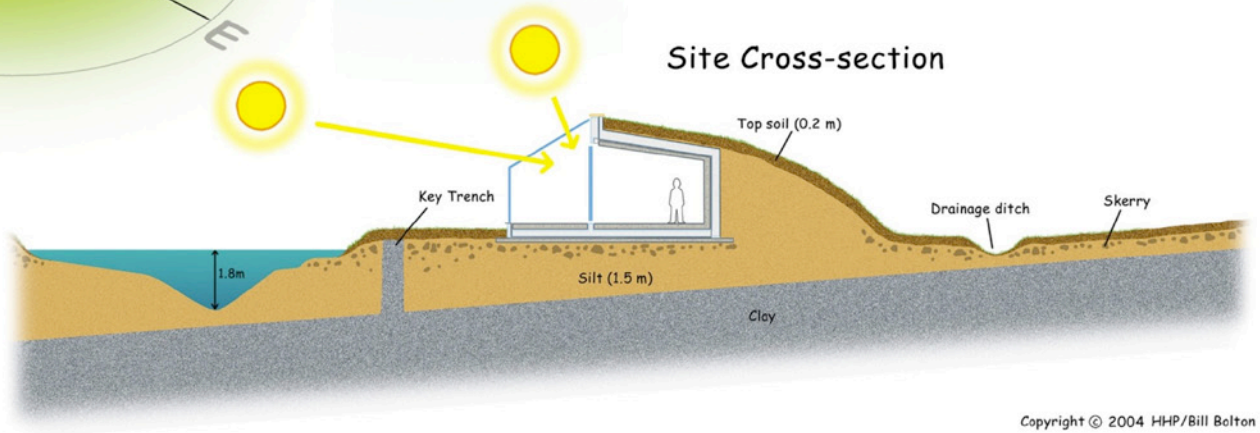


Local Resources



Habitats

Site Cross-section



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How easily could HHP be replicated on other sites?

The site is fairly typical of many other flat open fields in the UK.

There should be minimal shading from the South to maximise solar gain, which might have implications for size of a site – the open water at HHP prevents future development affecting this. Consideration should also be given to the location of wind turbines to ensure they are clear of turbulence from mature trees and buildings. Generally the development would not be unduly affected by future developments on its borders.

Although the site is relatively large for the size of development it does incorporate areas for food production, wildlife and recreation that at least in part displaces use elsewhere. A much smaller site could accommodate the key features of HHP The area taken by the houses, garden and road is only 1ha, or 10% of the site.

Food growing for self-sufficiency

Earth-covered slope at back (north side) of homes

Work in progress!

Space heating relies totally on heat from solar gain, incidental gains and heat from occupation. The heat is stored in the mass of the buildings (e.g. concrete/ blockwork) and released when the air temperature drops below that of the building fabric.

The elevation design (south facing aspect and with all glazing on south elevation), enhanced by the roof angling upwards makes good use of low winter sun penetrating to the back of the dwellings.

Winter scene at HHP – Despite snow and cold temperatures, on a day like this, the passive solar gain would exceed heat losses from homes

This design provides good internal daylighting as well as maximising on passive solar gain through the conservatories. The trees on the southern boundary are all deciduous increasing sunlight penetration once they lose their leaves in autumn. During the summer, shading is created within the homes due to the high angle of the sun - this reduces thermal gain and glare inside, when it is least wanted. Those rooms that are not so dependent on natural light, such as utility and bathing areas are located towards the rear of the homes. The terraced nature of the houses reduces the surface area of exposed walls in relation to internal volume. The houses are earth sheltered, with a minimum of 400mm of soil on the roof, which provides protection from the dominant cold north-easterly winds during winter and minimises the ecological footprint.

Excavations

Roadways and ditches

The siteworks commenced in August 1996 and the first job was to take the roadway from the public road to the site of the houses. The road is a private cul-de-sac and was made of rolled recovered brick hardcore and left unsurfaced for the duration of the construction work. Subsequently Yellowstone was used to improve the road surface.

Road to houses – rolled hardcore

Surface drainage swales were cut along the west side of the roadway, down the east side of the site and across the slope of the site 15m beyond the back wall of the houses. This protected the area of work on the houses from excess surface water, and later formed part of the water drainage/collection system for the non-potable water supply for the homes.

Replication issues

Uncovered drainage swales allows for easy access for future maintenance. It is good practice to leave the road useable but unsurfaced until the end of construction to avoid costly damage by heavy vehicles.

Lake

A lake was excavated to the front of the homes for a variety of purposes, including; recreational use, fish-farming, encouraging biodiversity and provide an area for the reed bed sewage treatment system. It is about 120m long by 30m wide and 2.4m deep along the centre. The lake was naturally filled by rainwater. The lake's level is controlled by use of a sluice gate allowing overflow into secondary pond systems, so that the lake depth is relatively constant.

Sluice gate being constructed

The total volume of the lake is approximately 3000m^3, and took less than two years to fill. Most of the excavated earth was used to form a bund incorporating a basin for a reservoir at the north side of the site. The remainder was used to create landscape features (the 'croissant' and 'doughnut') between the lake and brook at the south edge of the site. The main lake has shallow areas towards the edges to allow for different plant, fish and aquatic invertebrate species to thrive, whilst improving safety for occupants and visitors. The lake was waterproofed by a sealing key trench filled with clay down to the existing clay stratum.

A gabion wall of 75-150mm limestone was built across the west end to form the reedbed area with the top of the wall planted with irises.

Gabion wall being built at west end of lake

Lake partially filled – note shallow margins and gabion wall at far end

Replication issues

Puddling or pond liners are needed for wetland constructions in pervious areas. This increases the cost and energy used. Cost is also incurred if the excavated soil has to be transported away. Puddled clay is more eco-friendly than liners, but only realistic if there is a supply on site. Land forms created by spoil from excavation may need planning permission.

Reservoir

At the north side of the site, at the top of the field behind the houses, a reservoir 25m long and 2m deep (capacity of 150m^3) was excavated within the bund created from the spoil of the lake in front of the houses. The reservoir was initially lined with a Bentomat clay impregnated liner and covered with soil. However this proved unsuccessful with rapid leakage. After a year of investigation the suppliers concluded that the ability of the material to form a waterproof barrier had somehow been affected due to the 'hardness' of the water entering the reservoir. Limestone in a collecting sump may have been the origin of the hardness. After about a year this liner was replaced by a black plastic material, and the now waste bentomat used to cover edges to a depth of approx. 1m to reduce UV degradation of the plastic liner.

Replication

The liner was needed as the reservoir was formed in made up ground. The outlet pipe passes through the liner and out of the base of the reservoir in a sleeve, so a good seal is essential. In contrast the inlet pipe is taken over the bank near the surface.

Base of houses

For the base of the houses an area was excavated of approximately 102m by 12m along an east-west axis parallel to the length of the lake. The depth was half to one metre with a shallow side to the south. Within the north edge a 1.5m wide by 0.5m trench was formed to take the base footing. The topsoil was saved and the arisings were piled along the north side of the excavation for future use as cover for the houses. The machine-cut silt surface was impressively smooth and homogenous and completely free of any discontinuity from tree roots, other materials or earlier disturbance.

Replication

A final 50mm should always be scraped off just prior to concreting. A soil survey with trial holes and chemical analysis must always precede the foundation design. In our case a single 102m reinforced slab raft without movement joints was used in view of the undisturbed solid ground. There are/were no trees nearby.

Services

Around the site a number of small excavations were made for water and sewage tanks, and for interconnecting trenches for service pipes, drains and cables.

The tanks used were concrete rings with manhole access tops. Setting the cement seals of the rings was not an easy task. Although initially it might have been easier to put a small tank in the garden of each house, a single system offered longer term advantages for operation and maintenance.

Concrete rings to be used for water storage

Replication (Excavation generally)

The excavation work was carried out by a hired competent excavator driver. Detailed surveying, marking-out, and continuous supervision was required to minimise work. The advantage of having an undisturbed site would be lost if any excavations had to be reworked. Accurate marking-out of the base was necessary to obtain a level surface over 100m.

The cost of excavation of the base of the houses would be the same for any such work and use of a septic tank system is commonplace in the countryside without mains drains.

General Advice

Planning a climatically orientated layout will maximise the benefit from fine weather and offer protection from adverse weather. Good layout will improve building performance by reducing energy consumption and improving durability of the fabric.

What are the general issues when considering a site?

- Orientation of site for solar gain, exposure of site to prevailing winds and potential use of shelter provided by natural features and neighbouring buildings
- Accessibility to local services, amenities employment and transport modes
- Impact on site ecology/ biodiversity
- Potential for generating energy on site
- Soil conditions on site and risk of contamination
- Ground stability and risk of subsidence
- Risk of flooding.

Could some of land be used for purposes other than building?

- Make the landscape productive (e.g. retain or provide allotments, community gardens and other food production facilities).
- Create amenity areas of value to local residents (e.g. recreational land)
- Space for water features and black water treatment

How much use can be made of previously developed land?

- Investigate possibilities of using previously developed land before considering a greenfield site.
- Determine any potential hazards from land contamination
- Determine scope for reusing or refurbishing existing buildings on site

How can the landscape be managed more sustainably?

- Landscape plans should offer a diverse range of areas to create interest, community facilities and encourage wildlife.
- Cycle and pedestrian priority in all areas with integrated access throughout development.
- Extensive rainwater harvesting-drainage systems & waste treatment fully integrated with the landscape.
- Imitation of natural topography – extensive planting for amenity, biodiversity and screening.
- Development of new and/or existing areas of trees and woodland as a way of creating more attractive open space, recycling damaged land, reducing carbon in the atmosphere and improving air quality.
- Limit the importation of topsoils by making better use of what is available locally.
- Visually non-intrusive, non-polluting external lighting.
- Incorporate existing trees

How can the landscape be used to modify beneficially the local climate and reduce impacts of future climate change?

- Earth covered roof
- Plant shelterbelts as a buffer against noise and strong winds.
- Use deciduous trees to provide summer shading to south-facing elevations.
- Use water and vegetation to filter dust and air pollution.
- Design for increased rainfall, flooding , and gales in winter
- Design for decreased rainfall in summer (e.g. using drought-resistant plants).
- Courtyard layouts, L-shaped plans and walled gardens all create sheltered external space.

How do I maximise solar gain to reduce space heating requirements and minimise cooling needs?

The layout of a site will have an impact on both passive solar gain as well as the opportunities for active solar gain. You will need to consider the following:

- The site layout should offer access to solar energy for as many homes as possible.
- Avoid overshadowing between buildings by allowing adequate spacing.
- Orientate the main building elevations within 30 degrees of south.
- As far as possible the majority of the glazed area of a building should be orientated towards the south. Glazing on north elevations should be reduced to a minimum.
- Minimize winter shading of homes. This is particularly important if you are planning to install any active solar systems, such as photovoltaics. Deciduous trees lose leaves in winter and will let sunlight through. Coniferous trees will block out sunlight. Bear in mind the low angle of the winter sun!
- Locate main living spaces and conservatories on the south facing side of the building whilst maximizing the glazing. Deciduous trees can be planted to provide summer shade to prevent overheating, whilst maximizing solar gain in the winter when most needed.
- Provide exposed thermal mass where possible to absorb solar gain and avoid overheating.
- Provide shelter from prevailing winds in the form of trees or landscaping.
- Avoid permanent shading, such as net curtains and evergreen trees that reduce solar gain.

How do I minimise heat loss

Using or adapting the local environment of the home can help to reduce exposure to the elements, in particular wind, and reduce heat loss from the fabric of the building.

- Use of trees and other planting as windbreaks/ shelterbelts. This can be through use of what is already available (such as mature trees) or by careful new planting. However care must be taken that this does not in time create unwanted shading.
- Using buildings to shelter each other. This can either be by grouping buildings or by joining them, to avoid high speed uninterrupted airflow over them. Terraced homes are far more energy efficient than detached ones, since it reduces the surface area of exposed walls in relation to internal volume.
- Use of novel building forms such as earth-sheltering and underground homes. These make use of the landscape and ready available materials to reduce exposure to the elements.
- Avoid naturally cold sites, such as hill tops and frost pockets.

References

Hockerton Housing Project Construction Report, Sept 1998 (Databuild Ltd)

Further Resources

Websites

- **Bio-Regional Development Group** (www.bioregional.com) - innovative organisation working on a range of projects on sustainable uses of the local natural environment.
- **Royal Town Planning Institute** (www.rtpi.org.uk)
- **Sustainability Works** (www.sustainabilityworks.org.uk) - Include section on 'Land & Landscape'
- **UKCIP (**www.ukcip.org.uk) - For information on climate change and predicted future weather patterns, see
- **Urban and Economic Development group** (URBED) (www.urbed.co.uk)

Further Reading

- **Building a Sustainable Future – homes for an autonomous community** (GIR53) (Copies available from BRESCU enquiry line 01923 664258 or see www.housingenergy.org.uk).
- **By Design: Urban Design in the Planning System: Towards Better Practice** by DETR/ Commission for Architecture and the Built Environment (DETR 2000)
- **Low Impact Development** (S.Fairlie) (order via www.hockerton.demon.co.uk)
- [2]**Passive Solar Estate Layout (GIR 27)**
- [2]**Passive solar house designs** – the Farrans study (GIL 25)
- **Sherwood Energy Village** (www.sherwoodenergyvillage.co.uk) - Development on ex-colliery site at Ollerton
- [1]**Sustainable Housing Design Guide for Scotland** by Fionn Stevenson and Nick Williams (HMSO 2000)
- **Sustainable Settlements: a Guide for Planners, Designers and Developers** by H. Barton et al (University of the West of England, Bristol 1995).
- ***Towards an Urban Renaissance** by the Urban Task Force (HMSO London 1999).

[1] (order via www.tso.co.uk or Tel: 0121 236 9696)
[2] (Free copies available from BRESCU enquiry line 0845 1207799 or see www.housingenergy.org.uk).

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