

SUSTAINABILITY REPORT AND SCHEDULE OF RENEWABLE ENERGY ASSETS



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**Proposed Live-Work development on land adjacent to Homeland,
Eaugate Road,
Whaplode Drove, PE12 0SP**

Client : Mr S. Jeffs

Date October 2019

Project No JDA/2018/195

1.0 Introduction :

1.1.1 This statement provides an assessment of the proposals by John Dickie Associates for the construction of an earth sheltered dwelling on land adjacent to Homeland, Eaugate Road, Whaplode Drove, PE12 0SP

In submitting this statement, the aim is to briefly explain the sustainability principles which have been used to formulate the design solution.

It is the purpose of this document to set out details of the proposed mechanical and electrical installation and all the items to be included in the proposed dwelling that would make it both innovative and sustainable.

- **An animation of the proposed development can be viewed on YouTube - https://www.youtube.com/watch?v=sMipmd_C7xQ**

SUPERSTRUCTURE ;

Following to formation of an ICF (insulated concrete forms) raft/floor slab, the walls and roof of the building will be created using ICF panels by NUDURA or equivalent.



The Insulating Concrete Forms (ICFs) are special formwork blocks for interior and exterior walls made from expanded polystyrene foam (similar to that used for thermal cups) with interior ties - see above. This is one of the most energy efficient building systems on the market

NUDURA Insulated Concrete Forms meet codes for Passivhouse. Passive design minimizes the energy requirements of a building by making best use of assistance from natural factors; typically passive buildings will have a passive solar strategy (highly glazed south façade, a sun space or conservatory) combine this with the high level of thermal efficiency that ICF offer it allows householders the ability to reduce heating and artificial lighting requirements.

The so-called “carbon payback time” is very short - see below ;

- NUDURA is manufactured from recycled or recyclable material.
- NUDURA buildings produce little waste during construction, all waste is 100% recyclable.
- NUDURA® forms emit no CFC or HCFC's.
- NUDURA® forms are manufactured under strict guidelines using only processes that are non ozone-depleting.
- IMPROVED INDOOR AIR QUALITY – NUDURA eliminates air gaps, minimizing the potential formation of mould growth and draft paths. The end result is an airtight structure that enables building mechanical systems to heat, cool and ventilate the structure more efficiently, creating a healthier living and working environment for building occupants.
- AIR PERMEABILITY – NUDURA homes have tested below 1 m³/h.m²

EARTH SHELTERING

There are basically two different types of earth-sheltered house designs: ‘underground’ which means the entire house is built below grade and ‘bermed’ which is built either above ground or partially below and with earth covering one or more walls. This proposal is a ‘bermed’ type of property.

Earth sheltered homes avoid over heating in the summer and to retain heat in the winter.

Earth sheltering takes advantage of the natural resource of soil as a thermal mass, insulating the structure against the elements and providing energy saving properties. The earth's mass naturally absorbs heat and retains it, gradually releasing it into its surrounds and (in the case of an earth shelter) the adjacent dwelling. Because of the high density of earth, its change in temperature occurs slowly in what is known as ‘thermal lag’, resulting in a fairly constant temperature compared to the fluctuations experienced in the outside air. As such, earth sheltering takes advantage of passive solar building design, reducing the need for energy-intensive heating and cooling systems. The earthen walls also

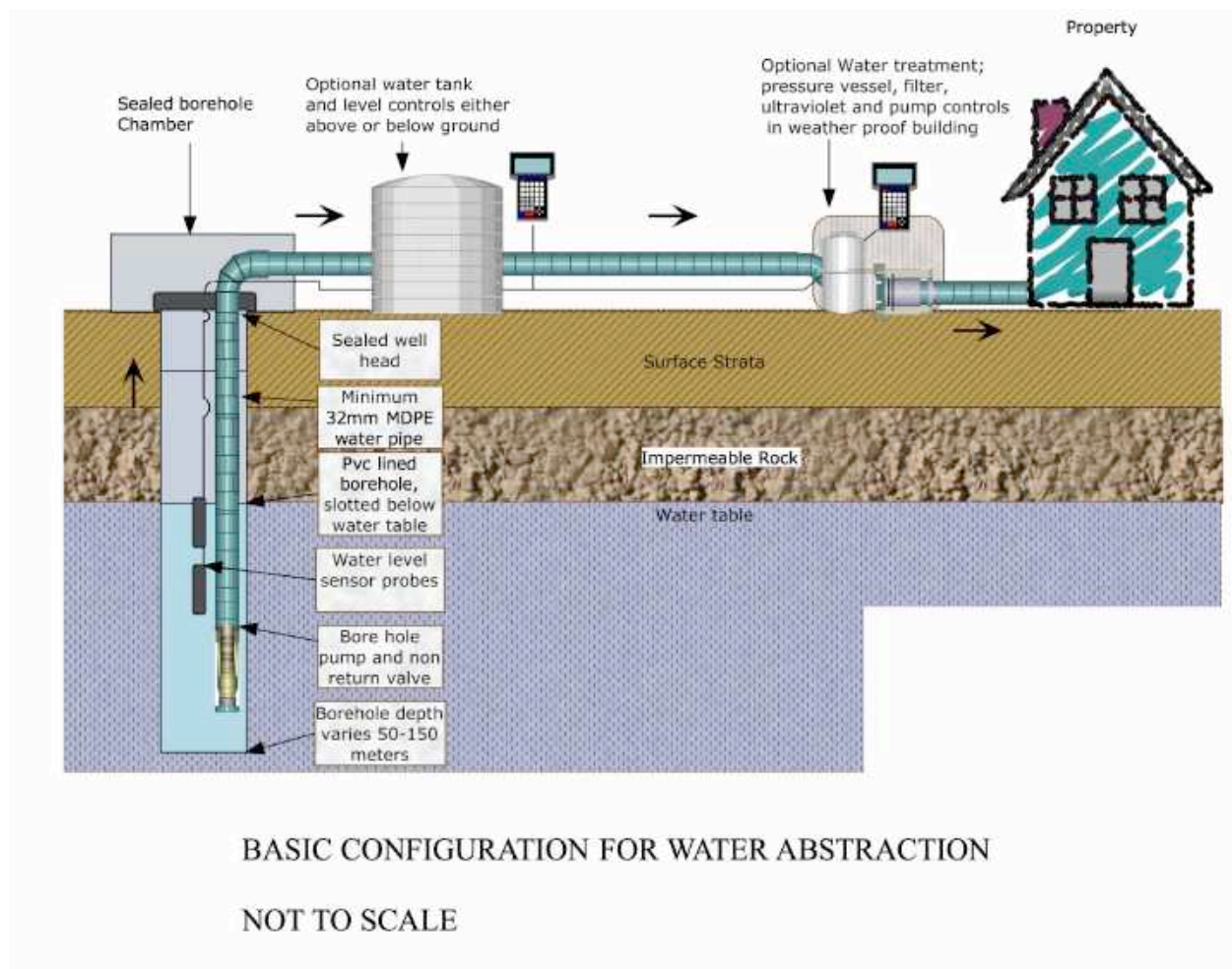
protect against cold winter winds and limit the escape of warm air through gaps around windows and doors.

The ICF walls and roof will be designed by a structural engineer to withstand the loads from the earth berming - the walls will be designed to act as waterproof 'retaining walls'. The ICF flat roof will be similarly designed to withstand live and dead loads from the earth covering over the dual waterproofing membranes.

To ensure overheating is limited we are proposing the installation of controllable intergrated shading to the West and South Elevations.

WATER SUPPLY

An Abstraction Licence to sequester water from an on-site borehole will be secured from The Environment Agency if required - a license is required to abstract more than 20 cubic metres per day - an average house requires circa 1 cubic metre per day. In England, Wales and Scotland, if the borehole supplies water for domestic use, or to make food or drink that will be sold, then the Environmental Health Department of your Local Authority has an obligation to test the water. The abstracted water will be filtered and stored in order to provide a viable potable water supply to the property.



SEWAGE TREATMENT PLANT

A Biorock Monobloc 3 sewage treatment syatem will be installed on-site as ahown on drawing no JDA/2017/895/SW.001 - no electricity is required.

Installation details ;

Capacity - 3000 litres

Length - 3790mm

Width - 1200mm
Height - 2000mm
Weight - 478kg

Primary tank - clarifies the sewage coming from the residence by retaining oils, fats and greases and organic solids. The water passes through an effluent filter before discharging into the BIOROCK reactor. The BIOROCK Media in the Bioreactor treats the sewage naturally with an aerobic digestion process (Secondary Treatment) and a filtration process (Tertiary Treatment).



SOLAR ARRAY

A circa 30 sq m South facing photovoltaic array is proposed along the rear of the concrete roof structure - refer to section and site drawings
The output from the array will be in the order of circa 4kW - 3,500 kWh. CO2 saved over 25 years = 40 tons plus.

ON - SITE UTILITY BATTERY STORAGE

The renewable energy captured by the solar array will be stored in a Lithium Utility Battery - circa 6.4 kWh with 3.2kWh expansion pack - by LG or similar. This asset will be located as shown on the floor layout

Voltage Range : 45.2 V ~ 58.1 V

SCHEDULE OF RENEWABLE ENERGY ASSETS AND SUSTAINABILITY

6000 cycles at 90% DoD (+25°C)
Maximum discharge current 110A
Nominal voltage (DC) 51.8V
Cooling via natural convection

Excess electricity will be exported to the Western Power mains system in Eugate Road via a 'two way Meter'. The connection will also provide emergency power back.

AIR SOURCE HEAT PUMPS

It is proposed to install 2no Air Source Heat Pumps - they will be located in the hardstanding areas shown
The units will be Mitsubishi Ecodan single phase PUHZ-W85VHA2 or equivalent.

SOUND PRESSURE LEVEL AT 1M (dBA) - 45The system will provide hot water and heating and, in summer months can be switched to provide cooling.



The GSHP Installation will comply with the Domestic Building Service Compliance Guide - Dept for Communities and Local Government 2001 and BS EN15450 Tables C1 & C2 with a Seasonal Performance Factor (SPF) of at least 2.7.

The heating system is to be underfloor with water supply temperatures in the range of 30c to 40c. The Coefficient of Performance (CoP) is to be not less than 2.2 for space heating and 2.0 for domestic hot water. The Seasonal Performance Factor will be no worse than as described in Table C1 of BS EN 15450. The system will meet the minimum requirements for installation and controls in Table 35 for heat pumps.

The water distribution system is to be arranged for reverse return operation or arranged with a low loss manifold system to maximize efficiency and ease commissioning and future maintenance. Pipework not contributing to the space heating system will be insulated to prevent heat loss. External pipework between the unit and the house to be insulated to the TIMSA Guide. The internal water distribution circuit should be protected by an anti freeze solution as recommended by the GSHP manufacturer.

For full heating, the GSHP and any supplementary domestic HW heating should be capable of supplying water in the range of 60c to 65c. The domestic hot water (DHW) system should include a tank thermostat and a time clock to optimise the time taken to heat the water.

Heat pump unit controls to include :

1. control of water pump operation (internal and external)
2. control of water temperature for the distribution system
3. control of outdoor fan operation

4. defrost control of external airside heat exchanger
5. protection for water flow failure
6. protection for high water temperature
7. protection for high refrigerant pressure
8. protection for air flow failure

External controls to include :

1. room thermostat to regulate the space temperature and interlocked with the heat pump operation
2. timer to maximize the operation of the heat pump

WOOD BURNER INSTALLATION

Space heating will be augmented by the installation of a Clearview 750 14 kw unit - refer to floor layouts. HETAS approved installation. Flue to be fitted in compliance with Approved Document J BS EN 15287, BS EN 1443, BS EN 1806 and manufacturer's details.



LIMITING THE EFFECTS OF SOLAR HEAT GAINS IN SUMMER

Reasonable provision is to be taken to limit solar gains in compliance Approved Document L1A.

Excessive Solar gains to be checked using SAP 2009 Appendix P and consideration given to provision of adequate daylight as detailed in BS 8206 -2 Code of Maintaining Adequate Level of Daylight.

AIR PERMEABILITY AND PRESSURE TESTING

Reasonable provision shall be made to ensure the extension is constructed to minimise unwanted air leakage through the new building fabric. The new dwelling to be pressure tested by a specialist registered with the British Institute of Non-destructive Testing in compliance with Regulation 43 of the Building Regulations.

The measured air permeability to be not worse than $10 \text{ m}^3/(\text{h.m}^2)$ at 50 Pa or in compliance with the TER design limits, ensuring the DER calculated using the measured air permeability is not worse than the TER.

Where the dwelling is not to be tested an assessed air permeability to the value of $15 \text{ m}^3/(\text{h.m}^2)$ at 50 Pa is to be assumed for the purpose of the TER.

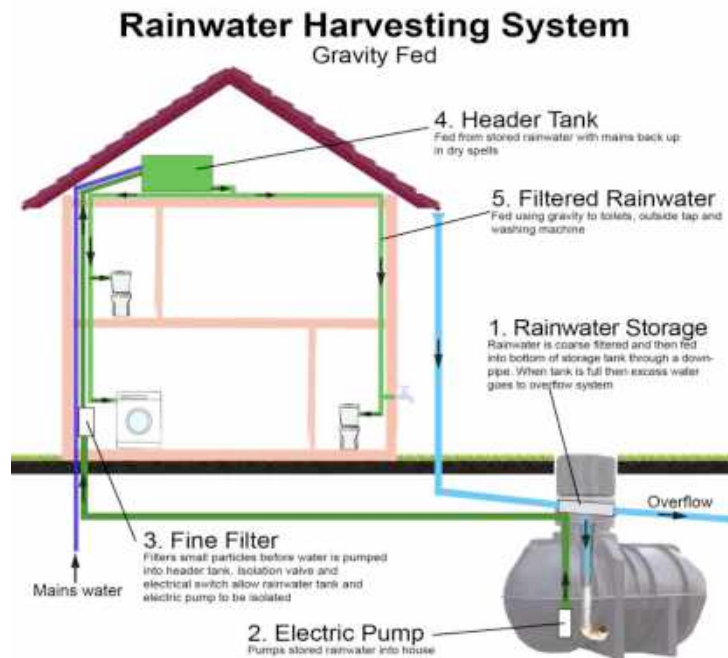
If the required air permeability is not achieved, then remedial measures should be undertaken and a new test carried out until satisfactory performance is achieved.

A copy of the test results to be sent to Building Control no later than 7 days after the test has been carried out.

The Design Air Pressure target is to be between 3 and 4.

RAINWATER WATER HARVESTING

It is proposed to install a 'direct' rainwater harvesting system. A 'direct' system collects and sends water directly to the points of use. It includes a backup connection from the mains (abstraction in this case) cold water supply fed into the harvesting tank. The tank will receive a partial low-level refill from the mains supply as and when required. The sequestered water will be filtered and used for a variety of purposes including cistern flushing, outside taps, irrigation and washing machine.



WATER EFFICIENCY

The estimated water consumption not to exceed 125 litres per person per day in accordance with Approved Document G2. Water Efficiency to be calculated using the 'Water Efficiency Calculator for New Dwellings' and results submitted to building control before works commence on site.

Water calculation to be in compliance with Code for Sustainable Home Level 3/4 as stipulated by the local Planning Authority. Example calculation below;

WC 5/3 (dual flush)
Taps (excluding kitchen taps) 4
Baths 180
Shower 8
Kitchen sink taps 6
Washing machine 8.17 (not supplied)
Dishwasher 1.25 (not supplied)
Water recycling 0 (not supplied)
Predicted per capita consumption (Code) 103.28

Note ;

The manufacturers of specific M&E plant and equipment is indicative and subject to an equivalent change.

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