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Project ref: 3174

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Dear Simon

**White Cross Farm Quarry; Comment on potential for impact on private water supply borehole at Windward House, Wallingford**

Background

The proposed quarry at White Cross Farm, Wallingford, would extract sand and gravel from a shallow deposit located on the western bank of the River Thames. The submitted planning application was supported by a hydrogeological impact assessment (HIA) (Hafren Water, August 2021).

Subsequent to the submission of the Planning Application a response was received from the Environment Agency (EA) (22<sup>nd</sup> October 2021 EA ref WA/20201/129358) objecting to the proposals. One of the responses stated *'Insufficient information to determine risks to potable water supplies'*. (EA response quoted in italics) The Windward House domestic abstraction is located approximately 50m south of phases 2 and 3. The EA continue *'Our main concern is surrounding the groundwater supply to this abstraction, from our assessment of the groundwater environment, review of supplied information and the cumulative impact of the neighbouring New Barn Farm site, there is a risk of significantly reducing recharge and the direct lowering of groundwater levels into this area.'*

Hafren Water was commissioned to prepare a response to the comments and the outcome is given below.

Proposed mitigation measures

The potential for impact upon the Windward House waterwell was identified during the HIA, consequently mitigation measures were proposed. These are discussed within Section 5.1 of the above referenced HIA report.

To mitigate the risk to the waterwell, mineral extraction within Phases 2 and 3, the closest to the waterwell, would begin in the south. This will allow the early placement of clay overburden against the southern face of the quarry void. This will create a low permeability barrier between the proposed extraction area and the private water supply. Laboratory testing of the overburden indicated that permeabilities of between 8x10<sup>-11</sup> and 1x10<sup>-10</sup>m/s can be achieved.

The piezometers along the southern site boundary will be monitored weekly to allow the early identification of any adverse impact, in the unlikely event of its occurrence.

Notwithstanding the very small likelihood of impact due to the proposed mitigation measures, the issues have been assessed, as discussed below.

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### Characterising the Windward House borehole

In order to meaningfully assess the potential for impact upon the waterwell its characteristics have to be known. These include the borehole depth, screened section, abstraction rates and drawdown during use. Simon Rees of Greenfield Enviro Limited attempted to find this information by contacting the property owner. (Telephone conversation 29<sup>th</sup> November 2021) However, the owner was 'not minded' to provide access to the waterwell. He added that he did not feel that he should provide any data relating to his well as it was 'clearly linked to the level of the Thames.' Consequently, it has not been possible to determine the characteristics of the waterwell.

Due to the non-co-operation of the site owner the potential for impact has had to be assessed by alternative means.

### Saturated thickness of the sand and gravel aquifer

Data shows that the groundwater level within the closest monitoring borehole to Windward House (GM 16/6) varies between 1.22 and 1.64m below ground level. (bgl) The base of the sand and gravel in the borehole was recorded at 2.4 m bgl. The saturated thickness of the aquifer in the vicinity within the Application Area at the closest point to Windward House is thus known to be extremely limited, varying being between 0.76m and 1.18m. It is difficult to envisage how an aquifer with such a limited saturated aquifer thickness could consistently supply the Windward House waterwell. For this reason, it is considered probable that the waterwell is installed into the chalk, which is situated at depth beneath the marly clay encountered beneath the mineral.

### Estimated water usage

Neither the pump specification nor the actual abstraction volumes from the Windward House waterwell are known, for the reasons stated above. Consequently, abstraction rates have had to be estimated. For supply planning in the UK daily water use per person is taken to be c150 litres. (Source: WaterUK) Therefore, assuming that there are 4 residents in the property the volume of abstraction from the waterwell may be expected to be c600l/day. For a worst-case situation, a volume of 1.2m<sup>3</sup> (ie twice the likely volume) per day of abstraction has been used in this assessment. This equates to a very small equivalent constant demand of approximately 0.01 l/second.

### Groundwater flow direction

The inferred groundwater flow direction within the sand and gravel aquifer within the Application Area and its environs was previously determined and reported within the HIA referenced above. The contours are shown on Drawing 3174/HIA/07 within the HIA. It can be seen that the groundwater flow is broadly eastwards, towards the River Thames.

The source of supply to the waterwell would be groundwater flow, and would be replenished naturally from the west. ie From an area that would be un-affected by the proposed mineral extraction. It is noted that the New Barn Farm site is located well to the north of the Windward House waterwell.

### Recharge

An estimate of recharge / groundwater throughput in the sand and gravel can be made using the Darcy relationship, which is of the form:

$$Q = kiA$$

Where            Q = groundwater flow (m<sup>3</sup>/day)  
                      k = hydraulic conductivity (m/d) conservatively estimated to be 10m/d  
                      i = hydraulic gradient = 0.004 (based on inferred groundwater contours)  
                      A = cross-sectional area of the saturated sand and gravel aquifer and  
                      assuming a 50m width = 50m<sup>2</sup>

The estimated groundwater throughflow is thus estimated to be 3.6 m<sup>3</sup>/d, which equates to 0.04 l/s.

It can be seen that the potential recharge to the waterwell, which will be supplied by groundwater flow from the west, is approximately 4 times the volume which may be abstracted.

#### Summary

The potential for impact to occur upon the Windward House waterwell was identified during the investigation for the HIA which supported the Planning Application. Robust mitigation measures, including the placement of a clay barrier and groundwater level monitoring are proposed.

It was not possible to determine the details of the waterwell due to the non-co-operation of the owner of Windward House.

The proven easterly groundwater flow within the sand and gravel aquifer is such that recharge to the Windward House waterwell will not be affected by either the White Cross Farm or New Barn proposed developments.

Recharge available to the aquifer in the vicinity of the waterwell is estimated to be approximately 4 times the volume which is considered likely to be abstracted.

On the basis of the above comments the potential for the proposed development to impact adversely upon the Windward House waterwell is considered to be insignificantly small.

Yours sincerely



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Director