



Cherwell District Council
PLANNING OFFICER
Cherwell District Council
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Our Ref UA001881-UU41R-03
Your Ref 10/01780/HYBRID
Direct Line

12 October 2012

Dear Jenny

DISCHARGE OF CONDITION 67- DEVELOPMENT OF EXEMPLAR PHASE OF NORTH WEST BICESTER ECO TOWN

This report letter presents an update to the Flood Risk Assessment (FRA) 3501-UA001881-UU41R-03 dated June 2011; regarding groundwater flood risk in relation to Planning Condition No.67 of the Decision Notice dated 10th July 2012.

Planning Condition 67 states

“No development approved by this permission shall begin until a scheme to avoid the risk of ground water flooding in accordance with Section 2.4.3 of the Flood Risk Assessment 3501- UA001881- UU41R-03 (Hyder, June 2011) has been submitted to, and approved in writing by, the local planning authority. The scheme shall be fully implemented and subsequently maintained, in accordance with the timing / phasing arrangements embodied within the scheme or within any other period as may subsequently be agreed, in writing, by the local planning authority”. An extract of Section 2.4.3 is contained in **Appendix A**.

Hyder Consulting (UK) Limited was commissioned in August 2012 to undertake a Supplementary Ground Investigation & Geotechnical Design Report (hereafter referred to as “The Report”, Document reference 0001-UA004014-UP32-R-02-GI-F) to assist in discharging the above condition. The Report explores the following two issues further:

- To further understand the potential risk of groundwater flooding presented in Section 2.4.3 of the June 2011 FRA; and
- To undertake further infiltration testing to confirm the SuDS suitability on site.

The Report draws upon a number of previous reports for the larger Bicester Eco Development site and includes supplementary ground investigation work including trial pits and window samples undertaken in August 2012. Section 5.3 of this report states

“No groundwater was encountered within 11 of the trial pits excavated. However, groundwater was noted as seepage within trial pits, TP60 at 1.7m bgl and TP61 at 1.2m bgl in.”



The groundwater encountered in these two trial pits were noted as minor seepage within the superficial deposits, indicating small amounts of perched water held within the local soil, not the actual groundwater level. A copy of The Report can be found in **Appendix B** of this letter.

Therefore, geotechnical investigation indicates that groundwater is not an issue across the site and it is deemed that the risk of groundwater flooding to the site is **low risk** and the need for mitigation is minimal.

The Report indicates that the ground is of reasonable permeability on site and that discharge of surface water to superficial aquifers would not present a groundwater flood risk. This therefore allows the drainage on site to include infiltration of surface water as part of the SuDS design, maintaining the existing hydrological regime and avoid increased discharges to the watercourses.

The drainage strategy drains water away from properties into less vulnerable areas such as roads which follow the SuDS treatment train; incorporating soakaway blankets; swales and rills prior to discharge to watercourse via attenuation ponds.


To further minimise the risk of properties flooding, external elevation of the development will direct water away from properties; and into the SuDS systems.

It is also worth clarifying that the original FRA report (see Appendix A) identified that "*The evidence collected therefore indicates the potential for groundwater flooding in the Exemplar site is very limited and is unlikely to be a source of flood risk*" and that a potential high risk was only assigned on a precautionary basis due to information from ground investigation in the **surrounding area** (i.e. off site) which encountered shallower groundwater. However, the additional ground investigation undertaken and monitoring of boreholes (see table 2.1 of **Appendix C** Technical Memorandum dated 2 June 2011) on site provide greater clarity relative to groundwater conditions on the Exemplar site and enable the risk of groundwater flooding to be considered as low risk.

Therefore, the application site is now considered at low risk from groundwater flooding, and as such there is no minimum threshold requirement due to flood risk. In addition, whilst the proposed development layout does not yet specifically identify the finished floor levels of all the residential units at this stage, levels in low lying areas of the development are being increased typically by a minimum of 300mm, further reducing the groundwater flood risk. The development should however include standard raised thresholds to prevent minor local surface flows from entering properties during heavy rainfall.

In summary, additional geotechnical testing to investigate this issue indicates the risk of groundwater flooding is low and that the development is being designed in a way that will further reduce this risk and the consequences should flooding occur.

Yours sincerely

A handwritten signature in black ink, appearing to read "P. Harker", written over a horizontal line.

Philip Harker
Technical Director
Land Development

Appendix A:
Extract of Section 2.4.3 of the FRA 3501-UA001881-UU41R-03

2.4 Sources of Flood Risk

2.4.1 Fluvial Flooding

The EA flood maps that cover the site are based upon a coarse DTM and JFLOW modelling and as such do not take account of the impacts of climate change and are therefore not suitable for use within a FRA to determine the extents of flood zones in relation to building location and associated finished floor levels. Therefore, detailed hydraulic modelling has been undertaken as part of this FRA. This modelling is discussed in Section 3.

2.4.2 Tidal Flooding

As the eco development is located significantly inland it is considered to be at **low** risk of Tidal Flooding.

2.4.3 Groundwater Flooding

The Ground Investigation (Hyder, 2010) indicates that with the exception of the Forest Marble Formation cropping out in the floors and sides of the valleys, the whole of the site area is underlain by the Cornbrash Formation. This is a local aquifer and water strikes have been recorded in shallow, site-investigation boreholes drilled within the site area.

The Forest Marble Formation, may hold small quantities of water in any limestone bands present, but the upper part generally acts as an aquiclude between the Cornbrash Formation and the underlying White Limestone Formation. There are no boreholes drilled through the Forest Marble Formation in the site area that record water strikes within it.

The White Limestone Formation constitutes a major aquifer in the area, which provides some sources of public supply. There are several boreholes in the wider area, some within the site area, that penetrate this formation.

The site is isolated from the major aquifer in the White Limestone Formation by clay layers within the Cornbrash and, particularly, the Forest Marble formation. The potential for groundwater flooding is therefore restricted to superficial horizons in or above the Cornbrash, and is therefore quite limited.

The geology is indicated in the sketch cross section (Figure 2-), extracted from the BGS detailed report (BGS 2008). The major aquifer is the White Limestone Formation is confined, isolated from the surface by the aquiclude within the Forest Marble. The Cornbrash and Forest Marble formations have a combined thickness of 6 - 8 metres. The aquifer is therefore unlikely to be a source of groundwater on the site.

Groundwater movement is generally SE down dip, but locally to watercourses, and groundwater within the Cornbrash and Forest Marble is likely to be in continuity with the surface water (BGS 2008).

Groundwater strikes in the site investigation arise from the Cornbrash Formation and more permeable horizons within the Forest Marble. The quantity of water from these sources is limited because the strata are relatively thin, the catchment area is restricted and the permeability is generally only moderate.

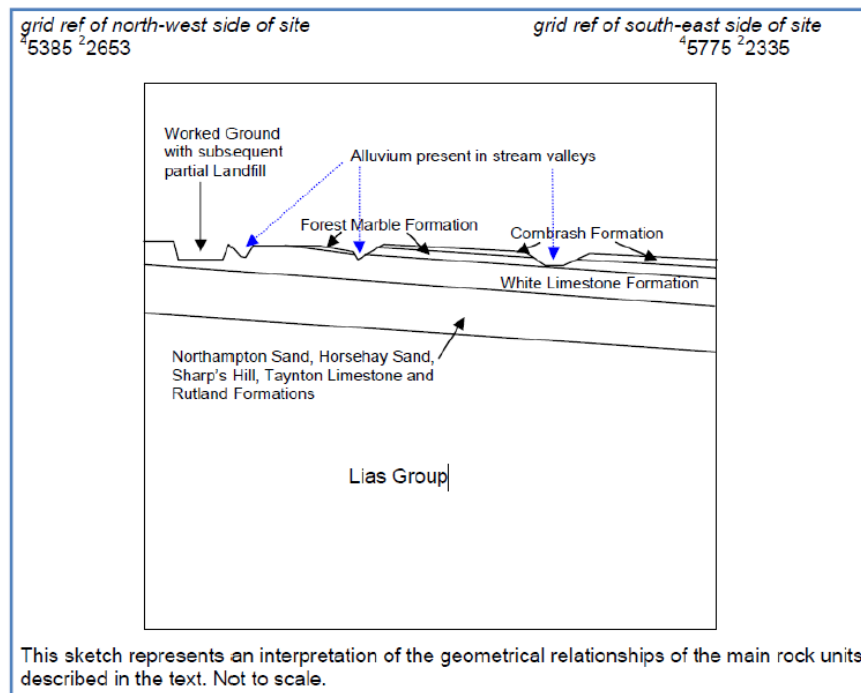


Figure 2-1 Simplified cross section through Exemplar site (BGS 2008)

The Environment Agency (EA) Groundwater Vulnerability Map on the EA website has been reviewed to determine the vulnerability of the groundwater underlying the Site with the following conclusions:

The superficial deposits are not classified as an aquifer. The underlying Cornbrash Formation is classified as a Secondary A Aquifer, which comprises "permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers."

Additional boreholes and trial pits were drilled across the site during August 2010, the location of these are shown in Appendix C. Due to the drilling process, it was not possible to carry out groundwater monitoring of the boreholes during the ground investigation. Five of the six trial pits excavated were found to be dry, with TP1 striking water at a depth of 2.9 m below ground level (bgl).

The observation of high groundwater during a heavy rainfall event during the site investigation work suggested water being held above the more permeable layers in the Cornbrash by less permeable horizons. The observations of groundwater at the boreholes which were left open for monitoring are shown in Table 2-1. Although limited, these indicate fairly steady water levels, mostly well below ground level. Borehole 11, situated in the southern part of the Eco Development area away from the Exemplar site, has the highest levels, but these are still a reasonable distance below the ground surface.

Table 2-1 Groundwater Monitoring Results

Borehole Number	Water level (m bgl)		
	13/09/2011	05/10/2011	10/11/2011
1	3.1	3.1	3.22
3	3.05		2.72
5	6.3	6.5	
10	2.38		2.08
11	1.1	1.42	1.21

The evidence collected therefore indicates the potential for groundwater flooding in the Exemplar site is very limited and is unlikely to be a source of flood risk.

Groundwater monitoring results following completion of the ground investigation are ongoing. Initial results from a monitoring visit on 13 August 2010 showed standing water levels between 3.1 m bgl and 6.3 m bgl, which suggest that excavation for foundations will not encounter groundwater as the excavation required for the proposed development will typically be less than 2 m bgl.

However, excavations undertaken during the ground investigation within the surrounding area were carried out after heavy rain and encountered shallower groundwater levels above the limestone. Therefore, where foundations are based at shallow level on top of the limestone, some groundwater flooding may be expected following heavy rain.

It is therefore expected that parts of the site would be considered at **high** risk of groundwater flooding. However, the proposed houses and other buildings would be located outside of these areas. Potential mitigation measures that would normally be used to protect the portions of site at risk from groundwater flooding would include:

- The provision of preferential flow paths away from the buildings to the surface water drainage system;
- Locating buildings outside the areas of highest risk;
- The provision of damp proof courses and tanking if required.

The drainage strategy for the Exemplar site will include infiltration of surface water as part of its SUDS design to maintain the existing hydrological regime and avoid increased discharges to the watercourses (refer to Section 4). This will change the local groundwater regime by displacing current infiltration from the building footprint to new infiltration areas.

The groundwater data available suggests that groundwater levels will permit infiltration across most of the Exemplar site but local groundwater conditions will be considered during the detailed design to ensure that infiltration is feasible and that discharge of water to superficial aquifers does not present a groundwater flood risk.

With the incorporation of mitigation measures and a SUDS strategy, the site can be considered to be at **low** risk of groundwater flooding.