UWF: UNDERGROUND WATER FEATUIRES AND BASEMENT EXCAVATION

UWF 1: SCREENING

Intent

1. When applications for basement development are submitted, applicants generally possess only limited understanding of the geological, hydrological and hydrogeological complexity of the Redington Frognal Area.

2. This means that complex engineering issues affecting neighbouring properties are left to be resolved by section 106 agreements and under the Party Wall Act 1996, leaving many unresolved issues and typically incurring high levels of expenditure by neighbours for the commission of reports by expert consultants[1].

Ground Movements

3. The ground beneath Redington Frognal is a complex layering of Bagshot Sand, Claygate Member and band D of the London Clay Formation. The top two layers have a high silt and sandy component rendering them susceptible to high water conductivity, as well as being potentially less stable: even band D of the London Clay Formation, while less permeable, still has a variable but significant silt content with a degree of erodability, and can contain water under pressure in sand partings.

4. Excavation of the earth creates stresses in the ground: vertical, horizontal and water stress. Prior to excavation all these stresses are perfectly balanced. Digging will cause the sides of the trench to cave in, the base to rise and the water to drain out of the soil .

5. The excavation for a basement also causes change to the water pressures in the ground. Groundwater flow becomes diverted beneath neighbouring properties, requiring water drainage measures to be incorporated. When the water pressure in the soil decreases, this causes the soil to consolidate. This can lead to brick failure and plastic failure, if the water pressure in the soil is affected. If drainage is introduced, the water pressure decreases and soil particles move, creating soil consolidation. These changes in the ground are 99% irreversible[2].

6. Very little evidence exists of damage to neighbouring properties, because home owners do not wish to affect the saleability of their properties. But a few examples are in the public domain, such as a Camden-owned property on Finchley Road. This demonstrated that soil consolidation takes ten years to occur and that this is the time lag between construction and cracks and distortions beginning to appear.

Commented [CB1]: Unless the ground is appropriately supported and its groundwater managed.

Commented [CB2]: "brittle" not "brick"

Commented [CB3]:

Commented [CB4R3]: ,once started,

Commented [CB5]: can take ten years to complete

[1] To follow

[2] Dr. [redacted], Distinguished Research Fellow, Faculty of Engineering, Department of Civil and Environmental Engineering, Imperial College London

Ground water movements

7. Redington Frognal is situated on the southern and western slopes of Hampstead, one of the largest and highest hills in London, with the highest rainfall of the Greater London area, and much of it located on the flank of this large hill. As a consequence, a significant number of Redington Frognal streets are downward sloping, where hard standing or building footprint enlargement produces additional surface run-off and drainage requirement, increasing flood risk in storm periods to vulnerable lower areas such as Frognal and West Hampstead.

8. In parts of Redington Frognal the 'water table' ground water flow (across the top of both the Claygate beds and band D of the London Clay Formation) is constant and rapid. Basement excavation can sometimes break into continuous flow of these water tables, but also will constrain and divert the ground water present throughout the area. ~~causing~~ erosion of the high silt and sand content of Redington Frognal's soil types leading to significant volume loss. This can result in the subsidence and cracking of neighbouring buildings, causing water ingress, and the formation of cavities under roadways and services.

9. A report by Alan Baxter for the Royal Borough of Kensington and Chelsea[3] notes that, where basements constructed in clay, they "effectively form a hole in the clay which can fill up with water and which is not able to drain away naturally. Although the hole appears to be completely filled in by the new basement structure which displaces water, the hydrostatic water pressures in the basement are present because of water at the interface between the clay and the basement construction up to the top of the clay or slightly higher than this depending on the ground conditions above the clay. This issue needs to be carefully considered in the design. The structure needs to be designed to resist the hydrostatic pressure unless something is done to relieve it. Flotation can also be an issue, particularly for basements in clay subsoil beneath rear gardens or internal basements with little load on top of them."

10. To better understand the complexity of the area and its sub surface water features, Redington Frognal Neighbourhood Forum commissioned a study by Arup of the area's sub surface water features. This includes a detailed map of all known spring lines, underground streams, ponds, wells, soggy gardens and pumps, showing that many streets lie above, or in very close proximity to, underground streams and spring lines.

11. The policy seeks to ensure that potential problems arising from basement excavation are addressed at application stage. It also aims to prevent water damage to nearby properties arising from the diversion of underground water features. This policy applies to all applications involving excavation for basement development. Basement development is defined as the construction or extension of one or more storeys of accommodation below the prevailing ground level of a site or property.

Commented [CB6]: constantly present

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Commented [CB8]: at times can be

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Commented [CB10]: Sometimes velocities of flow can be sufficient to cause

Commented [CB11]: small but

Commented [CB12]: This problem is accentuated when swimming pools are constructed as care must be taken to ensure their structure remains stable when they are emptied.

Commented [CB13]: Unfortunately this map is misinterpreted by those unfamiliar with the subject as indicating that water does not exist other than where shown. Groundwater is everywhere and the Arup map simply records its manifestation at or near ground level.

[3] *Residential Basement Study Report, December 2012*, by Alan Baxter for the Royal Borough of Kensington and Chelsea

UWF 1: Screening

i. Screening measures to be undertaken, prior to determination of the planning application, include review of the map developed for Redington Frognal Neighbourhood Forum, Arup Fig 7 – Results Map (Rev. F3 21.5.16). A copy of the
a) the site of the proposed basement and properties within four buildings, in each direction, of the proposed basement;
b) all existing and proposed basements within a radius of 200 metres;
c) areas of claygate member beds, Bagshot sands, gravel and band D of the London Clay Formation.

ii. Contours of predicted vertical settlement and predicted impacts on neighbours, both upstream and downsream, must be included with all planning applications.

iii) Evidence must be provided that damage to neighbouring properties will be less than or equal to 1 on the Burland Scale.

iv) The number, type and expected position of cracks to neighbouring properties must also be indicated.

Application

12. A copy of the review of the map developed for Redington Frognal Neighbourhood Forum, Arup Fig 7 – Results Map (Rev. F3 21.5.16) is to accompany all planning applications involving basement excavation. Neighbours within four properties from the site of the basement excavation are to be provided with detailed calculations of the design ~~and calculations~~, i.e. not merely the preliminary design calculations. These must include contours of predicted vertical settlement and the predicted impacts on neighbours.

13. The cumulative effect of several underground developments in proximity can be more significant than the impact of a single basement. Applicants must provide a map showing all existing and proposed basements within a minimum radius of 200 metres, including their extent and ground conditions, in order to assess the cumulative basement impact. The map must also show all known sub surface water features, as identified by Arup in the "Arup Fig 7 – Results Map (Rev. F3 21.5.16)".

14. Differing soil types, eg claygate member beds, Bagshot sands, gravel and band D of the London Clay Formation must also be mapped, indicating the site of the proposed basement and existing and other proposed basements within a minimum radius of 200 metres.

14. Burland Scale tests and a ground movement assessment will be required from the applicant, prior to the determination of the planning application. Applicants must show the number, type and expected position of cracks to neighbouring properties and their ratings on the Burland Scale.

15. Justification for the assessment of the Burland Scale damage level assessment is also to be provided. Planning consent will not be granted for basement excavation which is likely to occasion damage greater than 1 on the Burland Scale.

Commented [CB14]: based on site specific facts

Commented [CB15]: It must be remembered that cumulative effects includes those for groundwater; that means ground water levels around the area need to known and measured in response to rainfall.

Commented [CB16]: Unlikely to get that agreed as feasible. Suggest replace with "understand that the Burland calculations relate to walls with no windows or doors and judge accordingly when assessing the relevance of their calculations to the delicate structures that may be nearby"

Commented [CB17]: Note the limit is "no greater than one" and that can mean for delicate structures, almost zero.

Recommendation

It is desirable to daylight the clean water section of the underground Cannon Stream between Redington Gardens and Heysham Lane. This will relieve pressure on the sewer network and reduce the risk of surface water flooding downstream in West Hampstead, where floods occurred in 2002[4].

UWF 2: BASEMENT IMPACT ASSESSMENTS

Intent

16. Camden's Local Plan Policy A5 has a clear requirement to demonstrate that basement development "does not cause harm to the amenity of neighbours, affect the stability of buildings, cause drainage or flooding problems, or damage the character of areas or the natural environment".

17. It therefore requires a Basement Impact Assessment (BIA) to follow the stages set out below:

– screening: researching maps, photos and flood vulnerability
– scoping: consideration as to how potential problems be solved?
– site investigation and study
– impact assessment. This is a prediction of the short and long-term impact and is based on judgment
– review and decision making.

18. However, under the Local Plan, decisions on whether to grant planning consent are made on the basis that the work will proceed according to plan. But, works do not always proceed according to plan, and there are examples of harm which has been caused to properties in Redington Frognal, as a result of nearby basement excavation[5].

19. This policy, therefore, requires more rigorous site investigations and seeks to ensure that potential problems arising from basement excavation are addressed at or before application stage. It also aims to prevent water damage to nearby properties arising from the diversion of underground water features.

[4] Managing flood risk in Camden: The London Borough of Camden flood risk management strategy
[5] to follow

UVF 2: Basement Impact Assessments

i. BIAs are required to include, as a minimum, the following information and data:

a) The sequencing of the basement excavation and construction;
b) Results from the inspection of different soil layers observed in several bore hole over a period of at least six months. This information is to be provided for differing weather conditions.
c) Soil samples must be substantial: auger or corkscrew bore holes will not be sufficient.
c) Water levels and water pressure measurements taken over a period of at least six months.
d) Bore holes data and ground movement and ground water flow calculations, mus be included as part of a factual report. An interpretative report will not be sufficient.

ii. Lateral drainage and digging by hand will be required, where basement excavatio necessitates the installation of drainage

iii. The BIA must demonstrate that no harm will be caused to the natural environmen and that trees will not be felled or liable to die.

iv. A BCP, written by a structural engineer, is to accompany the BIA, to be submitted at the time of applying for planning consent. The BCP must set out ways in which potential problems arising from ground movement will be resolved.

Application

20. The sequencing of the basement excavation and construction, and how the work affects ground movements, are of utmost importance and this must be set out in the BIA. Planning consent is to be linked to geotechnical instrumentation.

21. The excavation of a basement will create an apron aquifer and it will be necessary to dig holes in the soil, inspect the soil below ground and identify the different soil layers. The soil must be inspected and the sides of the holes checked for signs of caving in during different weather conditions, including how the sides of the holes respond to rain.

22. The BIA is to include calculations of ground movements by a qualified structural engineer, to be prepared in accordance with Camden's CPG Basements and Lightwells . Ground movements and ground water flow calculations will be required for different soil types and conditions, taking account of the differing rates at which water travels through differing soil types.

23. Drillings must be carried out over a period of at least six months, and in differing weathers, in order for water levels and pressures to be measured over time. Samples must be substantial and samples from corkscrew or auger bore holes will not be acceptable.

24. The data and information gained from the monitoring of bore holes and from ground movement and ground water flow calculations, must be included as part of a factual report. An interpretative report will not be sufficient.

Commented [CB18]: ? seems out of place or something missing

Commented [CB19]: Based on ground characterisation provided by a qualified geologist; both the engineer and the geologist should be chartered.

Commented [CB20]: Not drillings but measurements of water level

Commented [CB21]: alone

25. Lateral drainage and digging by hand will be required, where basement excavation necessitates the installation of drainage.

26. The BIA must demonstrate that no harm will be caused to the natural environment and that trees will not be felled or become liable to die.

27. A basement construction plan (BCP), written by a structural engineer, is to accompany the BIA, to be submitted at the time of applying for planning consent. The BCP must set out ways in which potential problems arising from ground movement will be resolved.

Commented [CB22]: and ground water