The Water House
Millfield Lane, N6

On behalf of:
The City of London
Hampstead Heath

Mr & Mrs A Beare
Dormers, 49 Fitzroy Park

&
Mr & Mrs D Dale
The Wallace House

October 2013

The Water House, Millfield Lane N6

Report on behalf of the City of London, Mr & Mrs Beare & Mr & Mrs Dale

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Executive Summary

- This report reviews the available information for the recent planning application to demolish the existing house and rebuild a new house with two basement areas at The Water House, Millfield Lane, N6.
- The geological and groundwater conditions in the area are complex but there is considerable evidence of springs and underground water flow in the area.
- The comments relate to London Borough of Camden's current planning guidance CPG4 and in particular DP 27:
  - a) Structural stability issues
  - b) Groundwater issues
  - c) Cumulative Effects

- The documents submitted for planning do not address the most critical boundary condition which is adjacent to the garden boundary with No49 Fitzroy Park. The recently constructed basement on the site of No51 Fitzroy Park had similar level difference and subsequently required three substantial trees to be removed and has caused significant damage to the drive. This is a significant omission in the documents – ref DP 27a. (See section 3.4)
- The form of temporary works retaining structure – a king Post wall with precast panels will result in a degree of ground movements which can cause local instability issues -ref DP 27a. (See section 3.6)
- The proposals require the retaining wall structure to be permeable to allow any groundwater flows to pass through it but the proposed solution is unlikely to permit this to happen – ref DP 27b. (See section 6.2)
- The fin drainage system around the house cannot be maintained and so will silt up – ref DP27 b. (See section 6.3)
- The ground and surface water drainage drawings do not indicate how water is drained off-site. They are extremely misleading. (See section 5.3)
- The surface water disposal system drains all the rainwater off site at a rate far in excess of the greenfield run off rate and significantly increases the total volume of water drained into the sewer. It does not meet the stated aims of their own appointed consultant (Haycock) and will result in a reduction of the ground water supply to the ponds. Ref – DP 27b. (See section 8.3)
- The drainage proposals during construction could be inundated leading to overground flooding to the Bird Sanctuary Pond. (See section 4.5)
- The land drainage system collects rainwater falling on the gardens and diverts it to a soakaway which the applicants advise is unlikely to provide any significant re-infiltration. It then directs excess groundwater via the rainwater harvester to the combined sewer. This is major flaw in the design and this approach will not be acceptable to the local drainage authority – ref DP 27b. The drainage proposals during construction could be inundated leading to overground flooding to the Bird Sanctuary Pond. (See section 7.4 and section 9.5)
- The proposals for dealing with surface water and groundwater on the site concentrates them all together into the main drainage sewer. This is totally contrary to the PPS25, good practice, and the stated principles of the design. The diversion of the groundwater into the

main sewer is completely unacceptable in this situation and is a fundamental flaw in the design. It will upset the balance of groundwater in the area and could lead to the pond in the garden of No. 55 drying up.

- The BIA only considers cumulative effects in a cursory way and appears totally inadequate – ref DP 27c.
- The Construction Management Plan underestimates the volume of excavation material and over estimates the amount of material which can or needs to be stored on site. The number of HGV's for the removal of excavated materials could increase by a factor of 2.5.
- The Haycock Environmental Consultancy do not appear to have reviewed the proposal critically as the proposals fail to achieve the principle of maintaining greenfield run off rates. (See section 7.3)

1.0 Brief

1.1 General

Alan Baxter & Associates have been appointed by the City of London in conjunction with neighbours to the development, Mr & Mrs Beare and Mr & Mrs Dale, to review the engineering, geotechnical and hydrogeological issues associated with the planning application for the redevelopment of the Water House, Millfield Lane (ref No. 2011/4390/P & 2011/4392/C). This review is based on information prepared for the Planning Application during 2011 and additional information submitted for the revised Planning Application in June 2013, and takes account of information obtained by ABA relating to recent developments in the area including No. 51 and No. 53 Fitzroy Park.

The documents submitted for planning which have been considered are listed in Appendix A of this report.

This review is to address the following points:

- Comment on the BIA in relation to LBC's current planning guidance, in particular DP27.
  - a) structural stability issues ;
  - b) groundwater issues in both temporary and permanent condition; and
  - c) cumulative impacts
- Consider the impact on the neighbouring properties and boundary fences with the development site, in particular:
  - 49 Fitzroy Park and
  - The Wallace House
  - The potential impact on the pond in No. 55 Fitzroy Park
  - The effect on the Bird Sanctuary Pond on Hampstead Heath and reduction of the catchment area as a result of the larger footprint of the new building.

1.2 The Parties Involved

1.2.1 The Architects for the scheme are Spence Harris Hogan Associates (SHH).

1.2.2 The civil and structural engineers for the scheme are Haskins Robinson and Waters (HRW). Their role also includes the conceptual proposals for the basement king post retaining wall structure and the drainage around the basement (the fin drain). HSW have also prepared one A4 sheet which sets out the surface Water Drainage strategy – this cross refers to SWP drawing 2391-PH01-04.

1.2.3 The Mechanical, Electrical and Public Health engineers for the scheme are Slender Winter Partnership (SWP). They produced the drawings which show the drainage proposals for foul and surface water drainage.

1.2.4 Haycock Associates were a hydrological consultant appointed to advise on groundwater issues. This firm is no longer in operation but has been re-established as Haycock Environmental Consultants (HEC).

1.2.5 RSK Environmental Ltd (RSK) carried out the second site investigation for the project and also produced the Basement Impact Assessment (BIA) for the project.

2.0 The Context

2.1 General

2.1.1 The Water House is a detached house on a large site on Millfield Lane adjacent to the east side of Hampstead Heath. The site lies within the catchment area of the River Fleet which is fed by springs which flow into the Highgate Ponds at the source of the Fleet.

2.1.2 The area around the site has been developed since the 1920's. Most of the original houses have been redeveloped since then, and more recently a significant number of the properties have been or are in the process of being rebuilt, many with basements.

2.1.3 There is a historic pond in the grounds of No. 55 which is immediately adjacent to the site. This is a shallow pond which appears to have originally been supplied by a stream called Highgate Brook. This stream no longer exists, perhaps because it was originally culverted or perhaps because the supply of water from various springs reduced as more of the area was drained. However the pond still exists and, while the water level does vary seasonally, it has not been known to dry up even during periods of sustained drought. It is sustained by rainwater in the area flowing down the hill generally from north east to south west as groundwater flows above the London Clay, overground flow and by a series of unrecorded land drains.

2.1.4 Many of the properties in the vicinity have all either recently had significant works carried out to them or are in the process of applying for planning permission for major works. As a consequence of this, extensive site investigations have been carried out of the ground conditions and ground water in the area. The investigations to date have not found any land drains feeding the pond in the grounds of No55 Fitzroy Park. It is therefore highly likely that the water feeding the pond comes from local rainfall on the surrounding soft landscaped areas in combination with groundwater flows down from Highgate Hill. The contours of the ground indicate that there was a channel in this area (see 2.2.1) which may now be partly filled with Head Deposits or Down wash and which may still have a below ground water flow. It is possible that some of the water which originally fed this channel is now collected and drained into the public sewers or is picked up by land drains of which there are few records.

2.1.5 The Water House was substantially redeveloped in the 1990's. There is reputed to be a spring under the footprint of the house and the previous owners of over 60 years regularly had problems with groundwater. We have been told that this water fed the pond in the grounds of No55 Fitzroy Park. We understand that it is for these reasons that the house was named The Water House.

2.1.6 There is a pond in the gardens of The Water House which is understood to be artificial. The pond is noted to dry up during extended dry periods. The source of water supply for this pond has not been identified but it is most likely to be local rainwater run off only i.e. it is now part of the groundwater regime in the area.

2.2 Geology

2.2.1 The local geology of the Highgate area consists of Bagshot Sands over Claygate Beds over London Clay. At the top of Highgate Hill, the Bagshot Beds are at or near the surface. These run out down the hill and the Claygate Beds become the near surface geology. At Millfield Lane the Claygate Beds run out and London Clay is found close to the surface.

Geologically the Claygate Beds form the upper levels of the London Clay Formation. The Claygate Beds are typically identified as finely inter-bedded sequences of orange-brown clay, silt and fine grained sands. The Claygate Beds are very variable but the sand layers contain groundwater which can flow where there is continuity of the permeable layers.

There is often a layer of Head Deposits or Downwash at the surface which relates to the natural erosion of the Bagshot Sands and Claygate Beds since the last Ice Age with the superficial material being carried down the slopes.

Springs occur at the junctions of the Bagshot Sands and the Claygate Beds and also in areas within the Claygate Beds where there are permeable layers out-cropping, or at the junction between the Claygate Beds and the underlying London Clay which is generally considered to be impervious.

It is these springs, together with excess rainwater which historically fed the Highgate Brook as mentioned in 2.1.3, which flowed into the pond in No. 55 and into the Highgate Ponds*.*

2.2.2 The Water House is sited in an area where the underlying geology is London Clay with a layer of between 0.5m and 1.8m of made ground, which is likely to relate to previous construction work on the site. The material is variable and likely to be made up of re-worked Down Wash or Head Deposits combined with more modern building materials and topsoil. Some of this material is permeable and will permit groundwater flows.

2.3 Site Investigations

2.3.1 A site investigation was carried out by GEA in 2008 and a second site investigation was carried out by RSK in February 2011 both of which found similar ground conditions.

These investigations have confirmed the 0.5-1.8m layer of made ground which comprises brown silty clay or slightly sandy to very sandy slightly gravelly silty clay. This indicates the variable nature of the made ground. The London Clay was described as locally soft and slightly gravelly in its uppermost parts (possibly elements of head deposits) near the surface.

2.3.2 In one borehole (WS2 by RSK) water was struck at 1.7m below ground level. This was in an area of made ground with bricks, pottery, wood and coal. The water level rose to 1.0m below ground level. This borehole was terminated. Water was encountered in another borehole (adjacent to the artificial pond) at a depth of 3.8m below ground level which rose to 1.0m below ground level.

2.3.3 All the other boreholes were found to be dry when constructed. However, standpipes were installed in a number of these and the recorded water levels gradually rose to between 0.5m and 2.0m below ground level.

2.3.4 RSK concluded that there is a perched water table at the junction of the made ground (possibly re-worked Head Deposits) and London Clay interface, due to the infiltration of rainfall. We consider that this represents a slow flow of ground water at this junction rather than a perched water table, which is typically found where there is a layer of permeable material over impermeable ground on a sloping site.

2.3.5 The standpipe monitoring has indicated slow seepages within the London Clay although the permeability of the material appears to be very low. These seepages are from the pore water pressure within the London Clay, and may in part contribute to the source of groundwater to the pond in No55.

3.0 Structural Stability Issues – DP27 (a)

3.1 Policy DP27 (a) requires that the developer must demonstrate appropriate methodologies to maintain the structural stability of the building and neighbouring properties.

3.2 The designers have prepared three overall hydrogeological sections which indicate the basement construction in relation to the Wallace House and the boundary with No. 51 Fitzroy

Park. According to these sections there are no changes in ground level at the boundary with No 51 Fitzroy Park. At the boundary with The Wallace House there is a 1.25m level difference which means that a retaining structure will be required. The Wallace House itself is some 7m (approximately) away from the boundary so its foundations will not be undermined by the excavations required to construct The Water House. However the boundary structure and the garden will be affected.

3.3 The garden level of No. 49 Fitzroy Park is in the region of 2m above the ground level of The Water House. There is a fence/retaining structure on the boundary. While this does not appear robust, it has obviously performed this function for the last 20 years or more. Within No. 49 beyond the fence, the ground slopes up by approximately a further metre to the level of a swimming pool on the site of No. 49 about 4m away from the boundary.

The proposed new basement at The Water House is to be built close to this boundary. The overall retained height of the ground across the boundary line will therefore be between 4m and 5m as shown on sketch 1675/113/100.

3.4 The applicants for The Water House development have not provided any detail of how they propose to deal with the change of level at the boundary and how they will retain the ground. The stability of the land at No. 49, their 20m swimming pool and a number of trees close to the boundary requires that a substantial retaining structure be designed and constructed in a way which minimises ground movements across the boundary. The pool plant room is in the corner close to the site boundary and there are a number of drains/water pipes which run close to the boundary. The absence of details at the boundary between The Water House and No. 49 Fitzroy Park means that Camden's policy DP27 (a) has not been complied with.

A basement has recently been constructed on the site of No. 51 Fitzroy Park where there was a similar level difference across the boundary with No.49. This has caused the retaining fence structure to move resulting in significant damage to the drive of No. 49. As a consequence three 18m mature ash trees had to be removed as concerns were raised about their long term stability given their root zones were compromised.

3.5 The proposed levels along The Water House boundary with The Wallace House could cause undermining of the existing boundary fence and soft landscaping on The Wallace House site. A king post retaining wall system is indicated adjacent to the proposed garage on Haskin Robinson Waters drawings 901/SK/021 but is not provided for the remainder of the driveway on The Water House site, which is up to 1m-1.5m lower than the adjoining ground level. To satisfy DP 27 (a), details of how the level changes at the boundary are to be constructed should be provided. There is a Mulberry tree in the ground of the Wallace House and this could be at risk from the proposed changes to the ground levels. This should be assessed by an appropriately qualified arboriculturist as it appears to have been omitted from consideration.

3.6 The proposed king post wall appears to consist of steel column sections with precast concrete panels dropped in between the flanges. During construction there will be areas of unsupported ground in the excavation faces. There will be a gap between the precast panels and the excavated ground which will allow a degree of ground movement which will be in addition to the movements which occur when installing any king post wall. This is not an appropriate form of construction, particularly due to the proximity of the boundary and the significant level difference of up to 5m with No 49 Fitzroy Park. Details of the measures which will be taken to protect this boundary from ground movements and local instability must be resolved prior to determination of the planning application in order to satisfy DP 27(a). The fact that the most onerous boundary condition has been ignored by the designers and within the BIA is unacceptable.

4.0 Groundwater Generally (reference DP27 (b))

4.1 In the vicinity of the Water House the site investigation indicates that there is between 0.5 and 1.8m of "made ground" over the London Clay. The London Clay has very low permeability and hence does not allow any significant flow of groundwater through it. The made ground is much more variable and allows a degree of flow at the interface with the London Clay down the hill. The rate of flow can vary significantly over short distances. Where there is connectivity between more permeable areas, there can be a flow of groundwater within the made ground. (See 2.3.4 and 2.3.5)

4.2 In areas where the underlying geology is London Clay and where the ground is relatively level, rainwater is generally absorbed by the topsoil or any fill. This is normally taken up by plants or evaporation during dry periods. Following prolonged rainfall, excess water ponds on the surface. When the ground slopes, there will be a gradual flow of water down the slope within the made ground above the London Clay. The extent to which and the locations where this happens will depend on the permeability of the made ground or the topsoil which is variable. If the amount of rainfall exceeds the rate at which the water can seep away then excess rain water will remain on the surface and flow downhill as surface run off.

4.3 In the areas up the hill from Fitzroy Park and Millfield Lane, Bagshot Sands are present at the top of Highgate Hill which are permeable. Rainfall falling here will be absorbed by the ground and seep downhill as groundwater forming springs at the interface with the less permeable Claygate Beds beneath. Originally these would have fed a stream, Highgate Brook, which flowed towards the pond in the garden of No. 55 Fitzroy Park.

4.4 Locally to the site the general topography of the area slopes downhill significantly. As a result groundwater will flow from the north, downhill towards The Water House. Excess rainfall which cannot be absorbed by the ground will also flow in this direction as surface run off. While the finished ground levels in the area may have been locally modified by landscaping, the surface levels of the London Clay beneath will not have changed overall so the groundwater flows on top of the London Clay will remain. This groundwater then flows generally towards the pond in No. 55 Fitzroy Park and towards Highgate ponds.

4.5 The adjacent site, known as The Wallace House has very similar overall topographical and geographical features as The Water House. While this was being re-constructed the pool excavation flooded and this lead to the contamination of the Ladies pond. The sources of the water were reported to be partly surface water but significant groundwater seepages were also noted during excavations. The attempts which were made to control the groundwater were unsuccessful. A perimeter drainage channel is proposed for The Water House project to collect rainwater and any groundwater during the construction stage. However, there is a risk that this drain could be inundated leading to excess rainwater and groundwater flowing over Millfield Lane towards the Ladies Pond. This would contaminate the pond.

4.6 The evidence from the previous renovation of the Water House also supports the groundwater concerns. While the work was being carried out it is reported that there was evidence of hydraulic connectivity with the pond in No55 Fitzroy Park, which lead to the pond being severely contaminated. It is noted that a land drain which is reported to flow from the Water House is recorded as being dry, but there may be other unrecorded drains or underground flows, so the historic precedent should not be ignored.

5.0 Groundwater Management and Drainage Issues

5.1 There are three separate issues which need to be considered as part of the planning application as set out in DP 27 (b)

- Groundwater
- Rainwater falling on soft landscaping
- Rainwater falling on hard surfaces

5.2 The following principles should be adopted in the design:

a) The groundwater should be kept in the ground and drainage routes provided to allow the groundwater to pass around any basement areas or below ground obstructions. It should not be drained to soakaways and must not be drained to any public sewers.

b) Rainwater falling in soft landscaped areas should not be drained – it should be allowed to percolate into the underlying soils or to flow at existing interfaces. It should not be concentrated by land drains flowing to soakaways and it must not drain to any public sewers.

c) Rainfall falling on hard surfaces should be directed to a storage system. Ideally, the total area of hard surfaces should be no more than currently exists and the design should seek to reduce both the rate and total volume of the rainfall drained off the site to greenfield run off rates. If the extent of hard surfaces proposed is greater than currently exists, the design should seek to reduce both the rate and total volume of rainfall drained off site. The additional area of drainage should be directed to a separate system and returned to the ground water to maintain the water supply within the catchment area. Haycock Associates who were appointed by the developer recommends that run off from the site should be limited to 'greenfield rates'.

5.3 The groundwater and drainage system are shown on SWP drawing No 2391-SKPI04. This drawing does not show that there is any connection to the public sewer and the only outlet is via the gravel filled trench to the Heath. This drawing is extremely misleading as the BIA notes that it drains to the combined public sewer at a high rate (6l/Sec). This drawing should fully describe how water is disposed of in accordance with the principles of PPS 25 or the stated design principles before planning consent can be granted.

5.4 The drainage proposals do not achieve the principles set out in 5.2 a,b & c above and as explained in section 6,7 & 8 this is a significant flaw in the planning application which must be addressed prior to determination.

6.0 The Construction Proposals effects on Groundwater – DP27 (b)

6.1 The existing building is to be demolished and the artificial pond in the garden removed. A new larger building will be constructed with two new separate basement areas located away from the existing basement swimming pool as is shown in the Basement Impact Assessment (BIA) Figure No7. Some of the demolition arising's are to be crushed and used to infill the existing swimming pool or as granular fill but the remainder is to be taken off site.

6.2 The principle adopted for the construction of the new basements is to build them within a king post wall which is described as permeable.

There are a variety of different types of king post walls including some which act as flood defences. While the type of king post wall typically used to provide temporary works for the construction of a basement would not be considered to be water resistant, they form a very

significant barrier to the flow of groundwater and so cannot be described as permeable. Details of the proposed wall should be provided or the proposals should be revised to provide an alternative type of retaining structure such as contiguous piles where there will be clear gaps between each of the piles which will allow any groundwater to pass through freely to the fin drain.

6.3 The Engineer's drawings show a drain described as a fin drain (which appears to be a 120mm width land drain up to 2.5m deep) to be constructed around the basement (but within the "permeable" king post wall) prior to the excavation of the basement and to remain in place as part of the permanent works.

The drawing notes that this fin drain will provide free passage of water around the basement to protect the basement during excavation from flooding during works and provides attenuation (storage) capacity in the long term for groundwater on site.

Having considered the proposals, we believe there are fundamental flaws in the proposals and comment as follows:

- There are no details to show how any groundwater gets through the "permeable" king post wall, or examples of where the designers have used this previously in such a manner.
- It does not seem feasible to construct a 120mm wide fin drain (with a porous pipe) in excess of two metres deep, as the width of the excavation is too narrow.
- There are no details of how this fin drain will remain in place when the ground is excavated. Also if it was surcharged with groundwater through the "permeable" king post wall, how is the hydrostatic pressure resisted prior to the basement being constructed? It appears highly likely that this system will not work during construction, leading to water ingress into the excavation.
- If it was able to be constructed how would the drain be accessed to maintain it should it become silted up as commonly happens with land drains?
- The Slender Winter Partnership (SWP) drainage drawing No. 2391-SKP104 shows that this fin drain extends around the basements and the whole perimeter of the house. It is unclear whether the intention is to connect into the land drainage system. If so, the drain is at too low a level (approximately 2m below ground level) to connect to the other land drains which are assumed to be in the region of 600mm below ground level.

6.4 The proposals for collecting rainwater and excess ground water are shown on SWP's drawing No. 2391-SKP104. The fin drain around most of the house connects to a system of land drains under the lawn which are directed towards a new soakaway constructed in the location of the artificial pond by the boundary with No55 and Millfield Lane. It appears that the fin drain is intended to act as a reservoir for groundwater and rain falling on the ground which, when full, connects to the land drains, ultimately draining to the soakaway 1.8m deep, 3.0m long and 1.8m wide. The soakaway is constructed in the impermeable London Clay which has a very low infiltration rate and when full overflows into a catch pit either to a rainwater harvester, or to an overflow gravel filled trench under Millfield Lane towards Hampstead Heath. The drawings or the reports do not make it clear how this is arranged i.e. whether the overflow first goes to the rainwater harvester or the overflow trench. The proposals therefore will drain excess groundwater away to a public sewer via the rain water harvester, or will cause surface flooding to the Bird Sanctuary Pond, neither of which are acceptable, and do not comply with DP 27 (b).

7.0 The Construction Proposals – Rainwater falling on soft landscaping

7.1 A system of land drains is provided under the garden area which collects excess rainwater which percolates into the ground and directs it to a soakaway.

7.2 This proposal as presented is fundamentally flawed as the approach should not be to concentrate groundwater flows but to allow groundwater to remain in the ground and "flow" along existing routes. The soil within the landscaped areas should act as a "sponge" to hold groundwater during periods of heavy rainfall and allow it to slowly seep away.

7.3 The upper parts of the soakaway will be in fill or made ground but the re-infiltration rate will be low due to the limited area contact with the made ground where water can drain. There will be little infiltration into the London Clay beneath the made ground.

7.4 When the soakaway is full it directs the water either to a rainwater harvester of to a gravel filled trench under Millfield Lane and will cause surface water flooding to the Bird Sanctuary Pond. The drawings fail to make it clear so it is not possible to establish the true nature of the proposals. This must be clarified before any final decision is taken. It is unacceptable to permit water from land drains to be directed to a public sewer. This does not meet the requirements of DP 27 (b)

8.0 The Construction Proposals – Rainwater falling on hard surfaces

8.1 Rainwater falling on the roof and hard surfaces is collected in a series of catch pits and drain runs and directed towards a rainwater harvester – as shown on drawings 2391-SKPI04. This drawing does not show any connection to the main sewer. The only obvious drainage point is a connection to a gravel filled trench under Millfield Lane (see 7.4 above). If this was the only drainage outlet it would result in significant overground flooding to the Bird Sanctuary Pond. It is not acceptable and does not meet the requirements of DP 27 (b).

8.2 The BIA notes that the proposed building's footprint covers approximately 10% more of the site area which can reduce the volume of rainfall absorbed by the ground in the catchment area. However, an independent architect has confirmed the plot ratio is actually increasing from 14.7% to 34.3%, which would mean that 20% more of the soft garden landscape will be lost.

8.3 The BIA notes that the rainwater harvester is connected to the combined sewer and discharges at a rate of 6 l/sec, presumably using a hydrobrake. This is a very high discharge rate for a site of this size and there is no justification for this flow rate. There has been no attempt to limit the rate of drainage off site or to return any of the rainfall to the catchment area. This could cause the local water table to drop which could impact on water supply to trees in the area.

8.4 The rainwater harvester is required to provide storage for extreme rainfall events. However, even when full, it can fully drain within a half hour period which is extremely fast.

8.5 If the combined sewer becomes surcharged, then excess water will be directed via the gravel filled trench to the Heath and case local flooding. This is unacceptable. The proposals do meet the requirements of DP 27 (b). We have been advised that, during construction of The Wallace House, the sewer was used to de-water the site. This surcharged the drain causing sewerage to flood the gardens of No 55 Fitzroy Park and the Bird Sanctuary Pond.

9.0 Assessment of the drainage Proposals DP 27(b)

9.1 The Hydrological impact of the development on local and surface groundwater was assessed by Haycock Associates and is summarised in their report updated on May 2012. It notes in section 2.3 “we believe that the treatment of surface water is contra to the principles of PPS25 and the requirements of a developer to ensure run off is maintained (at) a “greenfield” rate equivalents in order to maintain the flows to a catchment and maintenance of water based habitats. These principles are also present in the Habitats Directive and the Water Framework Directive”.

We concur with this statement.

9.2 HRW have produced a surface water drainage strategy which is to drain all the surface water off site via the combined sewer at a controlled rate and to provide storage using a 12000 litre rain water harvester for the difference between a 1 in 30 and a 1 in 100 year rainfall event.

The BIA prepared by RSK also indicates that on site retention of surface water will be provided to store the difference between a 1 in 30 and a 1 in 100 year rainfall event. It is not clear whether this storage assessment relates to the original or proposed site development area. This means that the discharge rate will be far in excess of the greenfield run off rates and so will reduce groundwater flows to the catchment area.

9.3 Haycock Environmental Consultants (HEC) Ltd were asked to review the RSK Basement Impact Assessment report dated January 2013. (Refer to letter from HEC dated 15 February 2010 addressed to engineers Haskins Robinson Water (HRW)). Issue 2 relates to the surface water and groundwater drainage systems and notes that HRW amended the drawings as a result of concerns about the management of surface water and their initial intention to direct this water to surface water sewers. Haycocks letter refers to drawing 2391-SKPH03 surface water strategy. This drawing was produced by Slender Winter Partnership (SWP) and not HRW. The drawing is titled Proposed Foul Water drainage and has nothing to do with surface water drainage. Drawing 2391 SKPH04 relates to the proposed surface water drainage but does not show any discharge routes other than a gravel trench under Millfield lane. There is no attempt to control any discharge of surface water to greenfield rates.

It therefore appears that HEC has not critically reviewed the drawings or the surface water/groundwater disposed proposals prepared by HRW. The drawing does not provide any details of how surface or groundwater is discharged from the site. Therefore the current proposals totally fail to achieve the principle of maintaining greenfield run off rates. This was a fundamental flaw in the original application and it appears that nothing has changed in the revised application. HEC have either not been provided with the BIA or they have not read it.

9.4 We have assessed the greenfield run off for a site of this area in this location as being in the region of 1l/sec. If the site was undeveloped this will either flow to local ditches or across Millfield Lane to the Heath. The proposed discharge rate to the combined sewer appears to be in the region of 6l/sec i.e. 6 times the green field run off rate (reference the BIA).

9.5 The system of land drains is directed to the soakaway. When the soakaway is full it either overflows to the rainwater harvester or to the gravel drain under Millfield Lane. The system proposed significantly reduces the potential infiltration in the area contrary to the stated aims in the Haycock May 2012 report. It is not acceptable to drain groundwater to the land sewers. The proposals do not comply with the requirements of DP 27 (b).

10.0 Construction Management Plan (CMP) Vehicle Movements for Excavation

10.1 We have carried out a preliminary review of the excavation volumes based on the limited amount of information available. Our assessment is that the total volume of excavation will be in the region of 10% more than that stated in the CMP.

10.2 An initial assessment has also been made of the material which could be re-used, on site, based on the limited level information available. Our estimate is that a maximum of 12-15% of this material could be re-used. However, it is far from certain that the material can be stored on site when site access, tree protection zones, working space, site compound etc. are taken into account.

10.3 If all the excavated material was taken off site this would result in approximately 380-390 vehicle movements which is more than 2.5 times that noted in the CMP. Also, if material cannot be stored on site, a further 50-55 vehicle movements will be required to remove the excavated material and later to bring material back to site. This results in approximately 280 additional vehicle movements in addition to the 146 allowed for in the CMP.

11.0 Cumulative Impacts – DP27 (c)

11.1 DP27 (c) requires the applicants to consider the cumulative effects of development on the water environment. The Basement Impact Assessment refers to The Wallace House, No. 49, 51 and 53 Fitzroy Park, but considers that they are widely separated and that they are at different levels that there is little risk of any cumulative effects. As a consequence have not provided an analysis as part of DP27(c). This conclusion is not justified in these circumstances.

11.2 Based on the topography and geology of the area the following developments should be assessed for cumulative effects on ground water

- The Wallace House
- 49 Fitzroy Park
- 51 Fitzroy Park
- 53 Fitzroy Park
- The Water House

In order to review the implications of the cumulative effects of all these basements the following information should be considered in relation to DP 27 (c)

1. A full and coordinated level survey of the whole area affected.
2. Detailed site investigations including boreholes and trial pits for each site. This should also include long term monitoring of groundwater levels using stand pipes in all boreholes. Permeability test details of the upper permeable layers would be beneficial.
3. Details of any existing and proposed land drains on each of the site if available.
4. Details of all existing and proposed surface water and Foul sewage for each site.
5. Locations of all known soakaways.
6. Location and construction details of all existing or proposed basements, including the temporary works used to construct them and how they have dealt with groundwater.
7. Historical records of any springs or surface flood events in the area.

11.3 The approach that was to be adopted for No. 51 and proposed for No. 53 is to install a drainage system around the new basements and to feed any groundwater back into the ground via soakaways maintaining as far as possible the status quo of the groundwater regime in the area, though this appears not to have been achieved at No. 51 (see below).

The basement of No. 51 is now complete and we understand a new land drain has been installed which runs along the boundary with The Water House which connects to a soakaway. It has been reported that the soakaway overflows following heavy rain due to the low infiltration rate. There is therefore a risk that this could lead to surface flooding running on to the site of The Water House following the natural topography of the area.

Similar issues could occur for No. 53 when this basement is constructed and this is likely in part to flow towards the site of The Water House as well as the pond in No. 55.

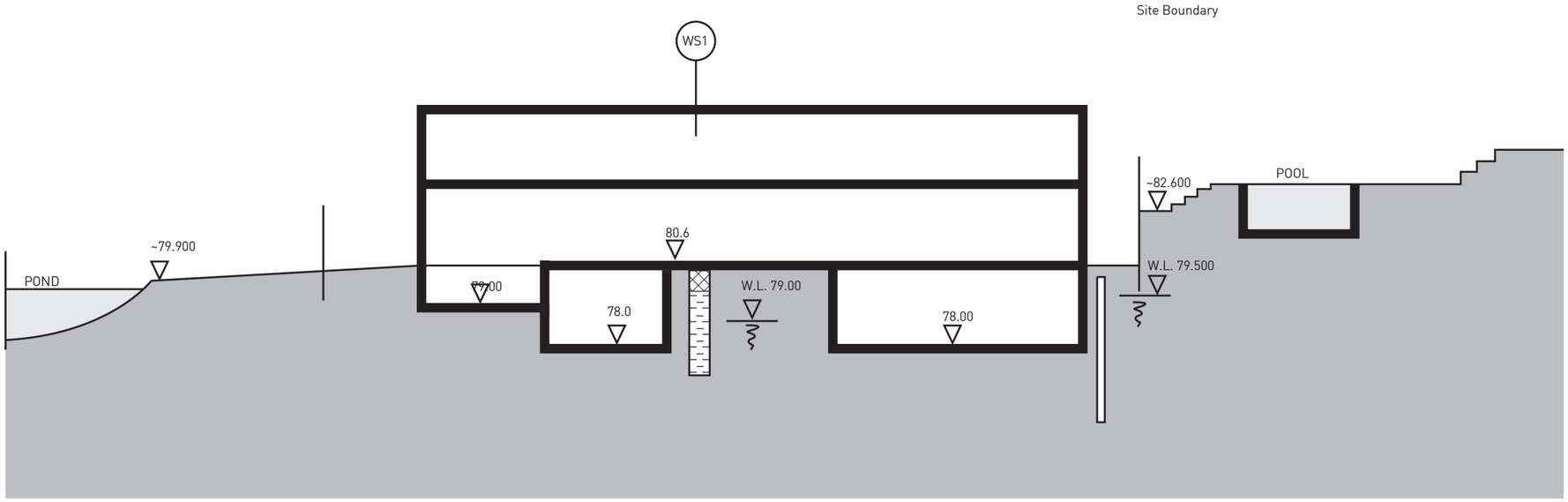
It is highly likely that, during periods of heavy rain, surface water flow and any sub-surface water flow will be directed to the site and it may be more prone to flooding due to the drainage systems proposed resulting in surcharging onto the Heath and Bird Sanctuary Pond.

APPENDIX A

- Surface water drainage strategy and drawings: o 901/SK/021 P7 o 901/SK/022 P5	HRW	January 2011
- Geotechnical, hydrogeological and geo-environmental site investigation report	RSK	February 2011
- Hydrological Impact report	Haycock	June 2011
- Architect's drawings: o 633(PL)001 rev. E o 633(PL)010 rev. B o 633(PL)011 rev. B o 633(PL)013 rev. C o 633(PL)014 rev. C o 633(PL)020 rev. E o 633(PL)021 rev. E o 633(PL)022 rev. E o 633(PL)023 rev. E o 633(PL)302 rev. E	SHH	July 2011
- Engineering Report	SWP	August 2011
- Engineering Drawings: o 2391-SKPH01 rev. A o 2391-SKPH02 rev. B o 2391-SKPH03 rev. B o 2391-SKPH04 rev. C	SWP	August 2011
- Basement Impact Assessment	RSK	January 2013
- Hydrological Impact letter	Haycock	February 2013
- Construction management plan	CPA/Motion	March 2013

THE WATER HOUSE

NO 49 FITZROY PARK



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