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# **Flood Risk Assessment for Proposed Residential Apartments On Burnside Avenue, Chapel-en-le-Frith SK23 0BA**

**REPORT PREPARED ON BEHALF OF KAPETIL LTD.**

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August 2012  
Report QA No: 12086  
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## **PLANS**

**PLAN 1: Site Location Plan**

**PLAN 2: Proposed Development Plan with EA Flood Zones Superimposed**

**PLAN 3: Topographical Survey**

**PLAN 4: United Utilities Sewer Plan**

**PLAN 5: Conceptual SUDS Plan**

## **APPENDICES**

**APPENDIX 1: Site Photographs**

**APPENDIX 2: Environment Agency Flood Data, Map & Other Correspondence**

**APPENDIX 3: Geological Report**

## 1. Introduction & Aims

The site comprises an area of land just over 0.1 hectare in size, located within an area of land that is bordered by Burnside Avenue to the North and by Black Brook to the west, south and east. The road crosses the brook at the northwestern corner of the site and also at the extreme eastern corner of the site. Black Brook is classed as main river, the site is located on the confluence of Black Brook and Warm Brook with Black Brook flowing in a northwesterly direction as it passes around the site. The National Grid Reference for the site (NGR) is 405991 381285.

The site is wider towards the eastern side; thinning out to the west and is located within a residential area. The land to the southwest and on the opposite side of Black Brook is largely undeveloped, although there are a few properties just to the south-east, alongside Warm Brook. The site is currently undeveloped (grassland and trees) and accessed directly from Burnside Avenue. The proposals for the development are for apartments within the eastern section with car parking areas located to the west and north-western corner of the site. The proposals also incorporate some open spaces with some grassed areas alongside Burnside Avenue and some trees remaining alongside Black Brook. Photographs of the site are presented in Appendix 1. This report is intended to assist in the discharge of planning conditions relating to flood risk.

The high point of the site is the southeastern corner where the height of the land is around 209.76 m AOD. The land falls to the west and south with heights down to 207.44 m in the west and 208.36 m in the south, before dropping down to the brook. Banktop levels are around 207.28 metres to the east, 207.16 metres to the south, falling to 206.25 metres to the western extent of the site. A topographical survey plan (to OS datum) of the existing site is presented in Appendix 5.

The Environment Agency flood map in Appendix 2 indicates that the north and central areas of the site are located largely within Flood Zone 1 (low annual flooding probability of <0.1%). The middle section of the site is shown to be located within Flood Zone 2 of the river where the probability of flooding of the site is between 1% - 0.1% i.e. between a 1 in 100 and a 1 in 1000 year probability. Flood Zone 3 where there is a risk of flooding of greater than 1% or 1 in 100 year appears to be restricted to a very small section of the southern perimeter of the site and to the river channel.

The extent of Flood Zone 3 at this location is not clear from the flood maps initially issued by the Environment Agency. Further discussion and communication with the Agency have clarified this situation and copies of the correspondence are included within appendix 2 for any further clarification.

The Technical Guidance to the National Planning Policy Framework (ref ii) states that planning applications for development proposals of one hectare or greater in Flood Zone 1 and all proposals for new development in Flood Zones 2 and 3 should be accompanied by a Flood Risk Assessment (FRA).

This report therefore seeks to assess the risks of flooding from and to the future site land use (residential apartments) with consideration of climate change and to identify how these flood risks will be managed in terms of site's redevelopment. The report will also outline the potential opportunities to reduce the probability and consequences of flooding to the surrounding area.

## **2. Flood Risk Assessment**

### **2.1. Site Flood Zones & Proposed Development**

The Environment Agency flood zone map has been superimposed on the proposed development map and this is included as Plan 2. The plan shows that the bottom section of the site lies within zone 2 with respect to flood risk assessment. The residential properties are classed as 'more vulnerable' and as such development within flood zones 1 and 2 is acceptable (Technical Guidance to the National Planning Policy Framework – ref ii).

### **2.2. Sources of flooding and predicted flood levels**

The main source of flooding at the site would be directly from the adjacent Black Brook. The High Peak SFRA (Strategic Flood Risk Assessment - refer to section 2.4 and reference vi) confirms that there are no records of flooding from artificial sources but that surface water is also a contributing factor.

The SFRA also raises some issues of the accuracy of the flood plans within the High Peak area; however at the location of this site i.e. adjacent to the confluence of Warm Brook with Black Brook, there do not appear to be any recognised discrepancies. The nature of the land and geology with steep narrow river channels, leads to rapid rises in flood levels within the High Peak area and in a number of locations the flood zones coincide with a deepening of the flood waters during the higher return period events rather than a lateral spread of flood waters. Flood waters are often characterised by high flow velocities.

At the proposed location of the apartments, the flood map indicates that part of the site is within a Flood Zone 2 area, with the higher return Flood Zone 3 restricted to a small area on the southern site boundary and to the channel of Black Brook. This concurs with the SFRA, which describes Flood Zone 2 as affecting a large area encompassing a number of properties at the Black Brook/Warm Brook area. However, mention is also made of the fact that a number of properties on Burnside Avenue fall within Flood Zone 3. The Environment Agency's water node levels 1, 2, 3 and 4 are located immediately adjacent to the development site, with nodes 1 and 2 being alongside the car parking areas and 3 and 4 near to the apartments.

The 1% AEP (1 in 100 year annual exceedance probability) plus climate change levels at node points 1 and 2 are 207.82m and 207.87m respectively whilst at node points 3 and 4 these levels are 208m and 208.14m respectively. Node point 4 is located on

Black Brook, just above the confluence with Warm Brook and the modelled flow at this node point for the 1 in 100 year event plus climate changes is correspondingly lower at 6.3 cumecs compared with 9.95 to 9.96 downstream of the confluence.

The site is therefore located immediately adjacent to the Black Brook at a point where there is a significant increase in flow i.e. at the confluence with Warm Brook. The brook also passes beneath Burnside Avenue to the eastern side of the site via a box culvert which may channel and restrict flow during extreme flooding events (see photos 5 and 6). To the west of the site Black Brook passes beneath both a road and a foot bridge (see photos 14 and 15).

Peak Associates would suggest that a suitable precautionary approach to establishing minimum finished levels which takes into account climate change would be to take the predicted peak water level for the 1 in 100 year return period (node points 1-4) and add a 600mm freeboard allowance for the proposed buildings and a 300mm freeboard allowance for access roads/drives, parking and pedestrian areas.

The modelled peak water level for nodes points 3 and 4 (those closest to the apartment buildings) are 208 and 208.14 metres AOD. However ground levels over the area of the site where the apartments are to be located vary from 208.26 to just over 209 metres AOD. A minimum of raising of the southernmost sections of the apartment blocks will therefore be required.

The car parking and cycle parking areas are generally on the lower and more western areas of the site. Node points 1, 2 and 3 are all close to these locations. It is suggested that node point 3 should be used as the modeled flood level (208 metres AOD) is slightly higher and thus using this data will afford greater protection to the site.

The suggested minimum finished levels for the development are therefore:

- Minimum Finished Floor Levels for apartment blocks = 208.74 metres (208.14 + 600 mm)
- Minimum Finished Level for access roads/drives, parking, cycle parking and pedestrian areas = 208.3 metres (208 + 300).

### **2.3. The Sequential & Exception Tests**

The proposed end use of the site (residential apartments) falls within the 'More Vulnerable' classification when referring to Table 2 of the Technical Guidance to the National Planning Policy Framework (ref ii). When referring to table 3 of the Technical Guidance, it is clear that the development of this land use is appropriate in Flood Zone 1 and 2.

A small area of the site falls within Flood Zone 3. However this area is restricted to parking and open spaces. Amenity open space is classed as water-compatible

development when referring to Table 2 of the Technical Guidance (ref ii) and acceptable within Flood Zone 3.

The minimum finished floor level of the flats should be compliant with the minimum levels stipulated in section 2.2.

## **2.4. Review of The High Peak Borough Council's SFRA**

Black Brook is a tributary of the River Goyt, which ultimately flows into the River Mersey. It is within the area of the High Peak Borough Council.

The area covered by the High Peak Borough Council includes the Peak District National park, where the Council has no planning powers. The area outside of the National park is referred to as the High Peak plan area, for which the SFRA study area covers.

The plan area falls into 2 sections, of which the area including Chapel-en-le-Frith falls into the more west and southern area.

The following key information has been extracted from the High Peak Borough Council's Strategic Flood Risk Assessment (ref vi) in order to further inform this site specific FRA:

### **'Fluvial Flood Risk in the High Peak Area'**

4.5 ' In general, the non Main Rivers in the Borough have narrow flood zones, contained by the local steep gradients. The smaller tributaries which feed them occur in abundance, but due to their small size they do not have Flood Zones. It is clear that many of these watercourse, although small do pose local flood risk issues. In addition, local knowledge suggests that the Borough is covered by pipelines and springs which are not identified on OS maps. Site specific FRA's will be required for all new developments, to appropriately take these drainage systems into account.'

4.5.1 'Black Brook rises south-east of Chapel-en-le-Frith where the Flood Zones are very narrow. Flowing north of Chapel-en-le-Frith the flood zones remain narrow and mainly affect industrial buildings. It is then met on the left bank by Warm Brook, which flows directly through Chapel-en-le-Frith. The flood plain is very narrow and flood risk is constrained by this, exhibited by the fact that Flood Zones 2 and 3 are identical in most places. The effect of the culvert under Market Street has also been modeled to show the actual risk, therefore only Flood Zone 2 affects this area. Downstream, Flood Zone 2 affects a large area encompassing a number of properties at the Black Brook/Warm Brook confluence.

As Black Brook continues north a number of properties fall into Flood Zone 3 at Burnside Avenue. At Chapel Milton it is then met on the right bank by an unnamed

tributary. This drains a very rural area to the north where very few properties are affected....’

‘....The onset of flooding in the plan area and indeed the Borough is deemed to be rapid due to the steep catchment, causing high water velocities. Certain types of flooding can be directly hazardous to people. Shallow, slow moving water presents very little threat to life, whilst fast flowing, deep water is more hazardous. The nature of flood risk in the High Peak is more characteristic of the latter description. River corridors are characterized by steep, incised channels which, when in flood, produce deep, sometimes fast flowing flood waters. Higher return periods do not tend to produce a greater aerial extent of flooding, rather, the flood depth increases. This is relevant across the plan area of the High Peak and indeed the Borough, and is illustrated by the fact that across the study area, the difference in the aerial extent of Flood Zones 2 and 3 is often marginal. The incised nature of river channels means that there is limited flood plain for flood flows to spread, resulting in deeper flooding than would be experienced in flatter areas. The severity of the hazard (i.e. rise of water, water velocities and depth) will also have impact on the consequence of a flood event. The Flood Zone maps, however, only provide information on the likelihood of flooding and do not convey the impact of flooding. Whilst hazard maps do not currently exist for the study area, the local fluvial setting leads to the conclusion that flood hazard is deemed to be of particular relevance to the High Peak. The river catchments can cause high runoff and rapid response (exacerbated by the geological conditions, as described in section 1.7.3), resulting in flashy flows which can be conveyed downstream to the plan area.

Floods result from out of bank flows, though this is made worse by local channel restrictions and under capacity structures, i.e. some culverts are not big enough to adequately convey flood flows. This results in back-up of river flows and flooding. The combination of rapid runoff and the catchment’s flashy responses, as well as steep gradients, means water velocities in the flooded areas can be high. If coupled with a depth of around 1 m, this would pose a high flood hazard (for example it would not be possible to stand in this water). If the need to apply the Exception Test is required in the High Peak, a level 2 SFRA would need to assess this hazard.’

#### ‘4.6 Issues With Existing Flood Zone Maps’

Exert from Table 4.3.

| Applicable to          | Location                 | Watercourse | Problem                                                                                 |
|------------------------|--------------------------|-------------|-----------------------------------------------------------------------------------------|
| High Peak<br>Plan Area | SE of Chapel-en-le-Frith | Black Brook | Misalignments at the upstream section of Main River, and at locations along its length. |

#### ‘4.7 Flooding from Other Sources Information’

Within this section of the SFRA, there are no records of flooding to properties within the SK23 postcode area, from artificial sources as recorded in the Water Company’s DG5 Register.

#### ‘4.8.2 Surface Water Flooding

.....It is clear that the High Peak is sensitive to surface water flooding and this should be taken into consideration as part of future development. Sir Michael Pitt’s interim report of the summer floods put forward a number of recommendations to improve the way that surface water is currently managed. These included:

1. Establishing Surface Water Management Plans....
2. Clarifying responsibilities for ownership and adoption of sustainable drainage systems- encouraging SUDS as a viable alternative to connecting into sewers.
3. Reviewing automatic right to connect (Section 106 of the water Industry Act 1991

.....’

#### ‘6.3 Summary of Environment Agency Policies and Options.....

Goyt catchment (central part of plan area, including New Mills, Hayfield, Whaley Bridge, Chinley and Chapel-en-le-Frith): continue with existing or alternative actions to manage flood risk at the current level (accepting that flood risk will increase over time from this baseline.) Continuing the current level of maintenance will ensure that river conveyance and the river structures, such as culverts, bridges and weirs, are maintained to the appropriate standard.....’

‘...the Black Brook FAS was constructed in August 1994. The National Rivers Authority (NRA) commissioned Scott Wilson Kirkpatrick to undertake a flood alleviation study of a 6.5Km reach of the Black Brook between Chapel-en-le-Frith and the river’s confluence with the River Goyt, downstream of the village of Buxworth. Historically a number of properties have been affected by flooding along the watercourse with extensive flooding occurring in 1973, estimated as a 1 in 50 year event. Since 1973 a number of local improvements were made to the watercourse by landowners and the NRA. These have included channel regrading, widening and bank raising....’

## **2.5 Evacuation and emergency measures**

Access to the site is directly from Burnside Avenue, which is within a flood zone 1 area, with a much reduced flooding risk. The minimum floor levels proposed for the roads should therefore be sufficient to ensure safe access and egress to and from the site and security from flooding events. This minimum finished level will ensure that

the site's vehicle and pedestrian infrastructure remains at least 300mm above the 1:100 year flood plain of Black Brook.

The site access would also act as the route for site evacuation for the residents. As the proposed site layout does include development of apartments within flood zone 2 and in view of the reported rapid rise and velocity of flood waters within the area (see section 2.4), and the fact some of the existing properties on Burnside Avenue are reported to be within Flood Zone 3, it is recommended that the site is registered with the Environment Agency's early flood warning system. This would provide residents the time to evacuate before flood waters reached the potentially affected apartments. The upper floors of the apartments provide additional security for any residents who may fail to evacuate immediately. Residents should be advised of the evacuation procedures.

It is notable that the Environment Agency's policy is for maintenance of existing flood defenses within the Chapel-en-le-Frith area (see section 2.4). No new defenses are planned at the time of preparation of this report.

### **3. Conceptual sustainable drainage scheme for the site.**

The site is currently undeveloped and the nature of the development for apartments with parking areas and access roads will increase the areas of roofs and hard standing and will contribute to the surface water runoff and potential flooding within the locality. The SFRA (section 2.4 and ref. vi), does refer to the issue of surface water flooding within the locality.

The developers of the site therefore have both obligation and opportunity to further reduce the potential downstream impact of surface water runoff generated at the new development by the use of sustainable urban drainage systems (SUDS) to match the 1:30 year Greenfield runoff rate if possible. The feasibility and selection of appropriate SUDS techniques will be largely dependent on the results of intrusive ground investigations, soil chemical testing and subsequent infiltration tests at the site.

The concept of a sustainable urban drainage system (SUDS) has been incorporated into the conceptual drainage system for the site in order to comply with the Flood and Water Management Act 2010. This will involve surface water retention and/or infiltration features within the scheme, that will retain rainwater for subsequent discharge to the watercourse at a slower rate of discharge, in line with the Greenfield runoff rate for the area. It is essential that such schemes do not compromise the new properties and present a risk of flooding upstream of the existing flood plain.

The geology for the site comprises alluvium overlying Millstone Grit. Site investigations and infiltration tests will confirm the depth of the alluvium and its capacity for infiltration. A copy of the geological report is included in appendix 3.

The conceptual design is presented on Plan 5. This shows the storage areas and proposed drainage routes off the site. However the detailed design calculations and capacities have not been performed at this stage. Assuming that the conceptual design is acceptable to the Local Authority, a more detailed design will be presented. This may well require further consultation and agreement with the Authority's SAB.

The land rises steeply to the north of the site and the SUDS design attempts to follow the natural drainage routes, as far as possible, with the ultimate discharge point being located to the north-western corner of the site.

The conceptual design has attempted to ensure that all runoff will pass through two treatment trains, in accordance with CIRIA. Plan 5 shows the main components of the drainage scheme to comprise of permeable pavement for the roads and pathways with tarmac service strips (locations to be agreed). These then subsequently link into filter drains. These features should be installed to encourage downward percolation of the rainwater from the site.

An 8m strip between the development and the riverbank must be retained in order to permit access for the Environment Agency to inspect and maintain the watercourse and the developer should bear this in mind if there are any further modifications to the site layout.

The United Utilities sewer plan is included as Plan 4. This shows that the public foul sewer crosses the western side of the site to join the sewer located within Burnside Avenue to the north of the site such that foul connections should be relatively straightforward. However, it is strongly recommended that a pre-development enquiry is sent to United Utilities to advise them of these proposals.

There is also a large surface water drain of 1200 mm diameter running through Burnside Avenue. This is shown as a private sewer with an outfall to Black Brook at the northwestern corner of the development site. The line of the outfall drainage appears to be virtually on the development site boundary and care must be taken not to damage this drain during the development phase. As this drain is shown as private, connection of any site surface water into this outfall drainage has not been considered within this report. However this option should be considered, if agreement can be reached with the owners, as this will remove the requirement for the construction of an additional outfall drain from the site. Assuming that site conditions are favourable for infiltration of surface water, discharge of the drainage from the site into this outfall would be minimal. However, this will require confirmation via site investigations.

The route of this outfall drain may actually be just within the site boundary and is likely to be protected by historic drainage rights. It would be prudent for the ownership to be confirmed and these rights formalised via a legal agreement.

There is some discrepancy between the United Utilities plan and the information supplied by the Environment Agency, in that Warm Brook appears to be referred to as Smithy Brook by United Utilities.

#### 4. Conclusions & Recommendations

The Environment Agency flood map in Appendix 2 indicates that most of the site is located within Flood Zone 1 (low annual flooding probability of <0.1%) and flood zone 2 (probability of flooding of between 0.1-1%). A small section of the site is located within Flood Zone 3 (probability greater than 1%).

The principal source of flooding is directly from the adjacent Black Brook, which borders the site to the east, west and north. The confluence of Black Brook with Warm Brook, is located at the southernmost extent of the site.

The SFRA for the area reports that due to the nature of the steep river channels in the area, the flood plain is largely restricted to the river channels and that flood zone 2 and 3 cover largely the same area in a number of locations, with an increase in depth of the water during the less frequent events. However, the nature of the flooding results in fast flowing flood waters that can make standing up impossible when waters reach depths of 1 metre or more.

The suggested minimum finished levels for the development are therefore:

- Minimum Finished Floor Levels for apartment blocks = 208.74 metres (208.14 + 600 mm)
- Minimum Finished Level for access roads/drives, parking, cycle parking and pedestrian areas = 208.3 metres (208 + 300).

The level proposed for the access roads will provide safe access and egress from the site during flooding, as the access is directly onto Burnside Avenue, which is within Flood Zone 1 at this location. However, in view of the reported rapid rise and velocity of floodwaters in the region, it is recommended that the site is registered with the Environment Agency's early flood warning system and that all residents are made aware of the site evacuation procedures

The raised finished floor levels, roads, pedestrian and parking areas to comply with the minimum levels suggested should only occur within the area of Flood Zone 1 and 2 where this is required. The Environment Agency does not permit land raising within Flood Zone 3.

In terms of the development to occur within the Flood Zones 1 and 2 areas of the site, the 'more vulnerable' residential apartment use is considered appropriate and compliant with the sequential test in the Technical Guidance to the National Planning Policy Framework (ref ii).

The Technical Guidance does not however permit the development of a highly vulnerable land use within Flood Zone 3. Flood Zone 3 is limited to a small area along the southern boundary and is restricted to open space/car parking. This is in line

with the sequential test; however in view of the restriction on land raising the developer may wish to review his proposals to ensure that development in Food Zone 3 is restricted to open space and not impacting on the car parking areas.

A sustainable urban drainage systems (SUDS) scheme has been presented in order to limit the surface water run off from the site and potential impacts on localised and downstream flooding. However, the feasibility and selection of appropriate SUDS techniques will be largely dependent on the results of intrusive ground investigations, soil chemical testing and subsequent infiltration tests at the site.

Pre-development enquiries with United Utilities will be required in order to verify the feasibility of the proposed foul drainage connections. There are no dedicated public surface water sewers within the vicinity of the site.

Ownership of the surface water drain and outfall to Black Brook located at the northwest corner of the site should be confirmed and the possibility of connecting the limited overflow from the site SUDS scheme into this outfall investigated.

## 5. References

- (i) National Planning Policy Framework. Department for Communities and Local Government. March 2012.
- (ii) Technical Guidance to the National Planning Policy Framework. Department for Communities and Local Government. March 2012.
- (iii) PPS25: Development and Flood Risk - December 2006.
- (iv) BS EN 752:2008: Drain and sewer systems outside buildings.
- (v) [www.uksuds.com](http://www.uksuds.com)
- (vi) Peak Sub Region STRATEGIC FLOOD RISK ASSESSMENT (SFRA) September 2008. Halcrow Group Ltd.

# PLANS