FLOOD RISK ASSESSMENT FOR MR A NAZIR DEVELOPMENT AT 128 THORNTON ROAD BRADFORD BD1 2DX

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1.0 INTRODUCTION

The proposed scheme is located on Thornton Road B1645 located to the north west of the city centre in a part urbanized part industrial area. The buildings local to the site are derelict and renovated mill buildings whilst across the road a large 6 storey apartment block together with stone mill buildings are evident.

Architectural 3d View of the Proposed Development

The planning application proposal state that the scheme is the conversion of warehouse to form 10 flats with retention of retail use to ground floor and basements, formation of internal raised roof area and new windows, dormer to existing roof, new glazing on ground floor for retail. Below is the proposal as detail by AK Innovative Design Solutions Ltd.

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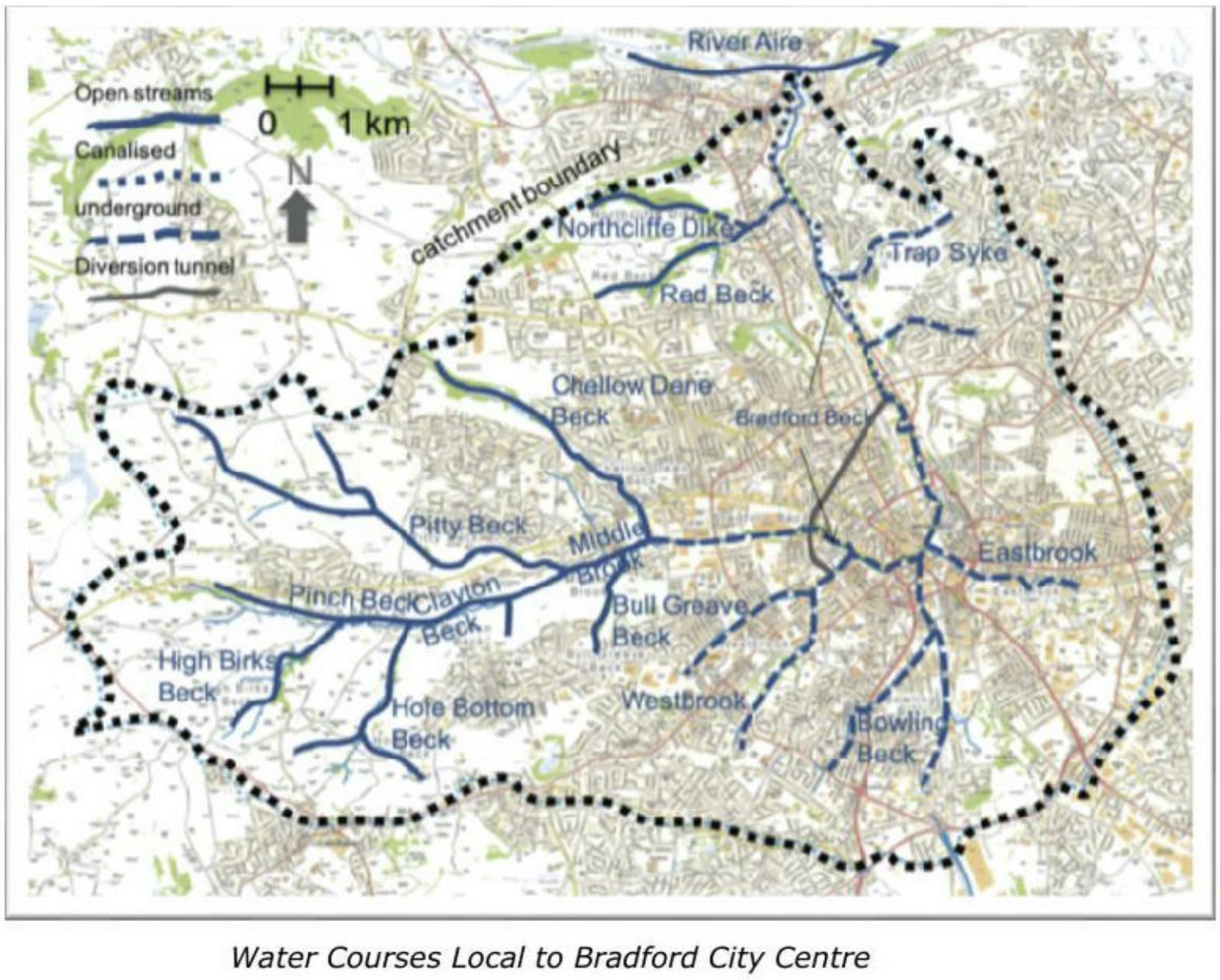
1.1 Notable Site References

Postcode	**BD1 2DX**
Eastings	**415798**
Northing	**433098**
Ordnance Grid Ref	**SK 157330**
Elevation (AOD)	**125m**

1.2 Geography

Bradford is not built on any substantial body of water but is situated at the junction of three valleys, one of them, that of the Bradford Beck which rises in moorland to the west, and is swelled by its tributaries, the Horton Beck, Westbrook, Bowling Beck and Eastbrook. At the site of the original ford, the beck turns north, and flows towards the River Aire at Shipley. Bradfordale (or Bradforddale) is a name given to this valley. It can be regarded as one of the Yorkshire Dales,



Water Courses Local to Bradford City Centre

though as it passes through the city, it is often not recognised as such. The beck's course through the city centre is culverted and has been since the mid-19th century.

On the 1852 Ordnance Survey map it is visible as far as Sun Bridge, at the end of Tyrrell Street, and then from beside Bradford Forster Square railway station on Kirkgate. On the 1906 Ordnance Survey, it

disappears at Tumbling Hill Street, off Thornton Road, and appears north of Cape Street, off Valley Road, though there are culverts as far as Queens Road.

The Bradford Canal, built in 1774, linking the city to the Leeds and Liverpool Canal took its water from Bradford Beck and its tributaries. The supply was often inadequate to feed the locks, and the polluted state of the canal led to its temporary closure in 1866: the canal was closed in the early 20th century as uneconomic.

1.3 Geology

The underlying geology of the city is primarily carboniferous sandstones. These vary in quality from rough rock to fine, honey-coloured stone of building quality. Access to this material has had a pronounced effect on the architecture of the city. The city also lies within the north western parts of the Yorkshire Coalfield which is mostly composed of carboniferous coal measures.

4.0 KEY AIMS OF THE REPORT

The scope of this report is to report on the findings of an assessment of flood risk for the development in accordance with the National Planning Policy Framework previously the Planning Policy Statement 25 (PPS25). The objectives of this report are as follows:

- Identify and quantify flood risk to and from the site;
- Consider possible approaches to mitigating flood risk on site;
- Outline the drainage strategy for the site.

The report will also provide environmental assessments to the planning application which has been submitted prior to this.

Current guidance on development and flood risk identifies several key aims for a development to ensure that it is sustainable in flood risk terms. These aims are as follows:

- the development should not be at a significant risk of flooding and should not be susceptible to damage due to flooding;
- the development should not be exposed to flood risk such that the health, safety and welfare of the users of the development, or the population elsewhere, are threatened;
- normal operation of the development should not be susceptible to disruption as a result of flooding;
- safe access to and from the development should be possible during flood events;
- the development should not increase flood risk elsewhere;
- the development should not prevent safe maintenance of watercourses or maintenance and operation of flood defenses;
- The development should not be associated with an onerous or difficult operation and maintenance regime to manage flood risk. The responsibility for any operation and maintenance required should be clearly defined;
- future users of the development should be made aware of any flood risk issues relating to the development;

- the development design should be such that future users will not have difficulty obtaining insurance or mortgage finance, or in selling all or part of the development, as a result of flood risk issues;
- the development should not lead to degradation of the environment;
- The development should meet all the above criteria for its entire lifetime, including consideration of the potential effects of climate change.

This Flood Risk Assessment is undertaken with due consideration of these sustainability aims and has been prepared to ensure that the proposed scheme conforms.

5.0 FLOOD RISK ASSESSMENT

5.1 The National Planning Policy Framework (NPPF)

The aim of NPPF (previously PPS25) is to ensure that a flood risk is considered at all stages in the planning process and to direct development away from the areas of highest risk. Where new development is necessary in such areas the policy aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall.

The flood risk considers the following:

Source refers to the origin of a hazard (e.g. heavy rainfall, strong winds and surge).

Pathway is the connection between a particular source and a receptor that may be harmed. For example, the pathway may consist of the flood defences and flood plain between flow in a river channel (the source) and the development (the receptor). In local flood risk management, pathways could be flow routes like roads and gullies.

Receptor is what may be harmed. For example, in the event of heavy rainfall (the source) flood water may flow across the flood plain (the pathway) and flood the proposal (the receptor) that may suffer material damage (the harm or consequence). It is recognised that developments that are designed without regard to flood risk may endanger lives, damage property, cause disruption to the wider community, damage the environment, be difficult to insure and require additional expense on remedial works.

5.2 Potential Sources of Flooding

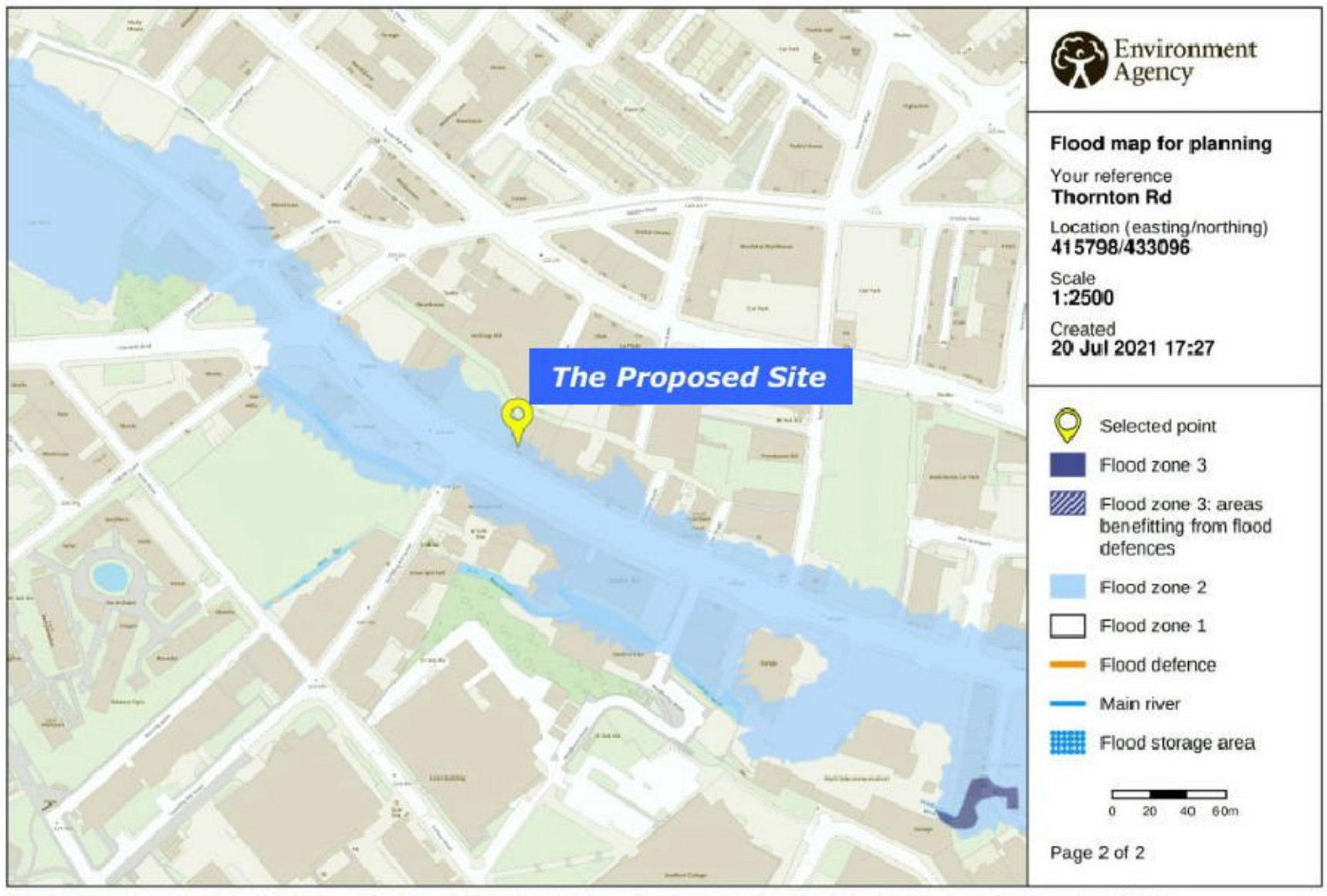
From the location of the proposed site it is apparent that flooding can occur from several sources and may have an impact on the development depending on the characteristics of the flood and the vulnerability of the development to flooding. Consideration to climate change may result in a change the frequency, patterns and severity of flooding and potentially lead to more damaging floods in the future. The following table indicates the sources of flooding considered local to the site

Source	Present (Y/N)	Risks
Canal	Yes	The Leeds and Liverpool canal runs through the Bradford District and is managed by the Canal and River Trust. Flooding has been recorded when the River Aire overtops into the canal causing increased flood risk to communities located close to the canal network. It is therefore considered a minimal risk
River	Yes	The Bradford Beck runs through the centre of Bradford and is situated a few 50 metres from the development.

Sea	No	No coastlines are located local to the site.
Overland	Yes	No exceedent events beyond capacity of the sewers.
Groundwater	Yes	No phase 1 or 2 site investigation is available at present. EA maps do indicate that the area has a low risk of flooding due to ground water
Sewers	Yes	As the site is located within the suburb it is expected that the sewers are designed to have a capacity sufficient to prevent surcharge.
Infrastructure Failure	No	
Reservoirs	Yes	The Leeshaw and Leeming reservoirs serve Bradford and are located approx. 10 miles to the West of the city. Highly unlikely any flooding will be a result of a reservoir failure. As periodic checking of the structure will be carried out

According to the Environmental Agency maps and data available on their web page it refers to the site as situated in a medium risk area from potential floods from rivers or sea. **Flood Zone 2** - land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year.

A more detailed study of the potential sources of flooding and the extents of them are indicated of the following maps. The following flood maps are produced by the Environment Agency.



Flood Zones Relative to the Proposed Development

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5.3 FLUVIAL FLOODING

5.3.1 Canal Flood

The Leeds and Liverpool canal runs through the Bradford District and is managed by the Canal and River Trust. Flooding has been recorded when the River Aire overtops into the canal causing increased flood risk to communities located close to the canal network. It is therefore considered a minimal risk

Flooding can include occur in canals where water is retained above natural ground level. The risk of flooding along a canal is considered to be residual and is dependent on a number of factors. As canals are manmade systems that are heavily controlled, it is unlikely they will respond in the same way as a natural watercourse during a storm event. Flooding is more likely to be associated with residual risks, similar to those associated with river defences, such as overtopping of canal banks, breaching of embanked reaches or asset (gate) failure.

5.3.2 River Flood

Fluvial, or riverine flooding, occurs when excessive rainfall over an extended period of time causes a river to exceed its capacity. The damage from a river flood can be widespread as the overflow affects smaller rivers downstream, often causing dams and dikes to break and swamp nearby areas.

There are two main types of river flooding:

- Overbank flooding occurs when water rises overflows over the edges of a river or stream. This is the most common and can occur in any size channel.

- Flash flooding is characterized by an intense, high velocity torrent of water that occurs in an existing river channel with little to no notice. Flash floods are very dangerous and destructive not only because of the force of the water, but also the hurtling debris that is often swept up in the flow.

the River Aire that runs through the centre of the district. The River Wharfe can also be described as posing significant risk towards the north-east of the district however the Bradford Beck due to the proximity of to the site is considered the greater risk.

The Bradford Beck begins as a number of springs around Keelham which merge into Pinch Beck running towards Bradford Dale before eventually making its way to Bradford City Centre. Other streams and watercourses join Bradford Beck before joining the River Aire at Shipley. Bradford Beck within the city boundary is constrained by culverts and open channels.

5.4 PLUVIAL FLOODING

Pluvial (Surface Flood)

Description of source surface water flooding usually occurs when high intensity rainfall generates runoff which flows over the surface of the ground and ponds in low lying areas, before the runoff enters a watercourse or sewer. It can be exacerbated when the ground is saturated and/or when watercourses or road drainage systems have insufficient capacity to cope with the additional surface water runoff.

There are two common types of pluvial flooding:

- Intense rain saturates an urban drainage system. The system becomes overwhelmed and water flows out into streets and nearby structures.

- Run-off or flowing water from rain falling on hillsides that are unable to absorb the water. Hillsides with recent forest fires are notorious sources of pluvial floods, as are suburban communities on hillsides.

Flood Risk from Surface Water – Produced from Environment Agency Information (Low Risk 1 in 1000-year event)

Analysis of the EA Surface Water Depth Map for the following storm scenarios has been carried and the table below highlights the effect on surface wood flooding.

Surface Water Flood Event	Locations	Flood Depths (mm)
High - each year, the area has a chance of flooding of greater than 1 in 30 (3.3%)		
Medium - each year, the area has a chance of flooding of between 1 in 100 (1%) and 1 in 30 (3.3%)		
• Low - each year, the area has a chance of flooding of between 1 in 1000 (0.1%) and 1 in 100 (1%)	Flooding indicated to front of property but confined to the highway.	Below 300mm

Without a full topographical survey, it is difficult to determine what impact on the property should a surface water event be recognized, however the site appears relatively flat and is above the level of the highway. However, if a recorded 300mm is experienced there is a low possibility that flood depths may cause damage to the internal areas of the building and should be mitigated.

5.5 SEWER FLOODING

No contact has presently been made with Bradford City Council Street to determine whether the area local to the site has suffered from any flooding as a result of overloaded sewers. From public information, available online no historical flooding had been reported. A further enquiry to the authority should be made to confirm that the public sewers the foul sewer is not overloaded when the proposed scheme is commissioned however the overall impermeable footprint together with the toilet facilities will remain unchanged.

Yorkshire Water is responsible for the management of the drainage networks across the county.

5.6 RESERVOIR FLOODING

While there is a risk in this area of flooding from reservoirs it is extremely unlikely, and the Environmental Agency does not indicate any threat. The only threat would be an uncontrolled release of water from a reservoir. Although not confirmed there are no known reports of anyone dying since 1925 as a result of reservoir flooding. All large reservoirs must be inspected and supervised by reservoir panel engineers on a yearly basis. As the enforcement authority for the Reservoirs Act 1975 in England, the Environment Agency are responsible for ensuring that reservoirs are inspected regularly, and essential safety work is carried out.

The Bradford area group of reservoirs are located approximately 5 miles to the west of Bradford and consist of six dams of a traditional Pennine type embankment construction. All the dams were constructed in the latter half of the 19th century to supply Bradford's ever-increasing demand for water. The reservoirs are Leeshaw and Leeming which are located to the South of Haworth and which discharge ultimately into the River Worth, and Thornton Moor, Stubden, Doe Park and Hewenden which are in cascade and are located in and around the village of Denholme, and discharge into the River Aire at Shipley.

Reservoir flooding is extremely unlikely to happen. There has been no loss of life in the UK from reservoir flooding since 1925.

There have been no recorded incidents of reservoir flooding within Bradford City Centre

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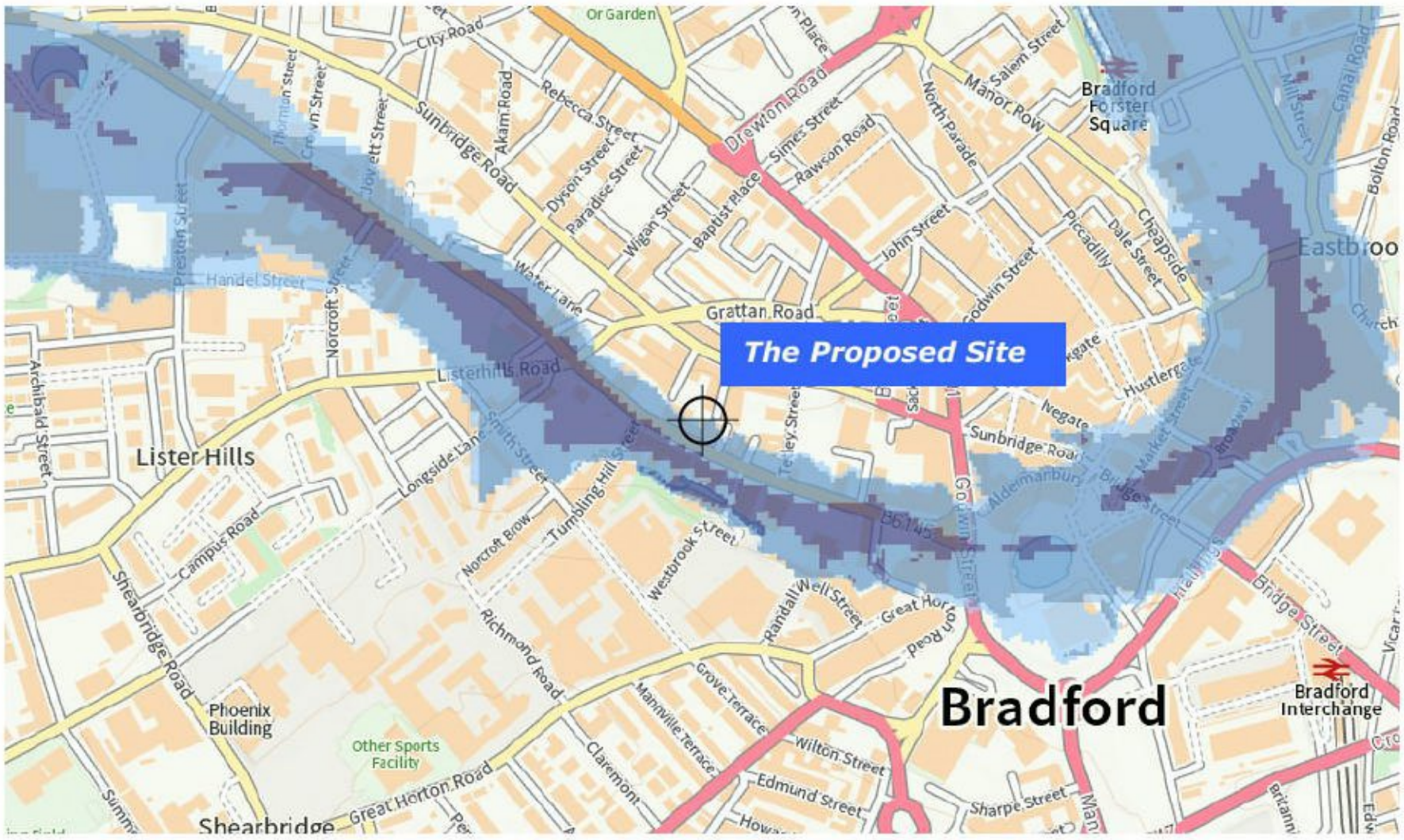

Flood Risk from Reservoirs – Produced from Environment Agency Information

6.0 GROUNDWATER

Flooding from groundwater can happen when the level of water within the rock or soil underground known as the water table rises. When the water table rises and reaches ground level, water starts to seep through to the surface and flooding can happen. This means that water may rise through floors or underground rooms such as cellars or basements. This may be a problem as the property is located in a hollow.

Groundwater flooding is much slower to occur than river flooding – it will usually happen days, weeks or even months after heavy or prolonged rainfall. And it may last weeks or even months.

Flooding from groundwater is most common in areas where the underlying bed rock is chalk, but it can also happen in locations with sand and gravel such as in river valleys. Some parts of the country are more prone to groundwater flooding than others.

The underlying geology of the city is primarily carboniferous sandstones. These vary in quality from rough rock to fine, honey-coloured stone of building quality. Access to this material has had a pronounced effect on the architecture of the city. The city also lies within the north western parts of the Yorkshire Coalfield which is mostly composed of carboniferous coal measures. Therefore, basements and any below ground structures must be considered a risk and suitable mitigation measures should be put in place.

7.0 HISTORIC FLOODING

Extract statement from Bradford City Council flood risk states the there is only limited available date for historic flooding of Bradford Beck. However, flood risk from the beck has been a problem in the past due to the increased urbanisation resulting in the large proportion of hard surfaces increasing surface water run-off. Initially all the areas drained into Bradford's combined system which was unable to cope with the population increase. Further sewers were constructed which reduced the surcharge on the existing system and the

untreated water diverting into the culverted Bradford Beck which also did not have sufficient capacity to cope resulting in significant flooding of the beck once every ten years.

The beck underwent a flood alleviation scheme in the early 1990s. A 3.7m tunnel was constructed that runs west of Bradford Beck and the city centre and emerges in an open section into Bradford Beck near to Canal Road. The risk of flooding according to CBMDC is significantly reduced by the diversion tunnel and presently since commissioning no floods have be reported in the city centre.

No significant forms of flooding caused by sewers have been recorded and are stated as localised to specific private dwellings.

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8.0 FLOOD RISK VULNERABILITY CLASSIFICATION

Essential infrastructure

Essential transport infrastructure (including mass evacuation routes) which must cross the area at risk.
Essential utility infrastructure which must be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. Wind turbines.

Highly vulnerable

Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding.
Emergency dispersal points.
Basement dwellings.
Caravans, mobile homes and park homes intended for permanent residential use3.
Installations requiring hazardous substances consent4. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as "essential infrastructure").

More vulnerable

Hospitals. Residential institutions such as residential care homes, children's homes, Social services homes, prisons and hostels.
Buildings used for dwelling houses, student halls of residence, drinking Establishments, nightclubs and hotels.
Non–residential uses for health services, nurseries and educational Establishments.
Landfill and sites used for waste management facilities for hazardous waste6.
Sites used for holiday or short-let caravans and camping,

Less vulnerable

Police, ambulance and fire stations which are *not* required to be operational during flooding.
Buildings used for shops, financial, professional and other services,
Restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non–residential institutions not included in "more vulnerable", and assembly and leisure.

- Land and buildings used for agriculture and forestry.
- Waste treatment (except landfill and hazardous waste facilities).
- Minerals working and processing (except for sand and gravel working).
- Water treatment works which do *not* need to remain operational during times of flood.
- Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).

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9.0 SURFACE WATER DESIGN & CONSIDERATIONS.

The existing site consists of a large brick façade three storey warehouses built around the 1860's. The internal layout is uninterrupted clear space with 6 number cast iron columns supporting a grillage of steel beams supporting the floors above. A basement occupies the footprint of the building.

We do not envisage discharging any more surface water into the public sewer in Thornton Road as the footprint if the building will be unchanged. The existing underground system serving the premises will remain and be continued to be used after the work has been completed.

Appropriate uses and definitions classified for this development are appropriate to the following zones.

- **Building Used for Domestic Dwelling – More vulnerable**

Therefore, as the development is within flood zone 2 and has a classification of more vulnerable an exception test must be considered. (See table 1 below)

Flood Risk Compatibility

Flood Zone	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	S	S	S	S	S
Zone 2	S	S	Exception Test Required	**S**	S
Zone 3a	Exception Test Required	S	x	Exception Test Required	S
Zone 3b	Exception Test Required	S	x	x	x

Key: S Development is appropriate x Development should not be permitted

Flood Zone 2 – medium probability – definitions

Areas deemed to be in flood zone 2 have been shown to be at less than 1% - 0.1% chance of flooding in any year, this is sometimes known as having a 1:1000-year chance.

There are restrictions in terms of flood risk in a flood zone 2 areas particularly basements and the assessment address the issues of flooding to both property and people and forms part of the planning application and areas deemed to be at high risk of flooding from rainfall known as Critical Drainage Areas, however, Bradford City Council in conjunction with DEFRA deemed the area as having no significant risk.

Flood risk assessment requirements - All development proposals in this zone must have a flood risk assessment to identify the level of flood risk to the property which will make the building and the occupants safer and ensure no increased of flooding elsewhere, therefore:

Policy aims - In this section, the report will discuss the possibilities to:

- reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems;

- relocate existing development to land in zones with a lower probability of flooding; and
- create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage

Owing to the development situated within a medium vulnerable area and in accordance with the requirements of the NPPF it classifies the area a more vulnerable development to flooding hence must be in accordance with the following.

10.0 SEQUENTIAL APPROACH

According to NPPF the Sequential Test gives preference to locating new development in Flood Zone 1. The property is within a Flood Risk and deemed it Zone 2 by the Environmental Agency the Local Authority has deemed it necessary that this proposal is accompanied with a suitable Flood Risk Assessment report.

The proposed scheme is the refurbishment and conversion of an existing mill building into a retail unit at ground floor followed by three storeys of apartments, the upper floor part off the converted roof structure. The development does not affect the overall footprint. No car parking or hard standing areas are part of the planning application.

There is encouragement from Historic England to convert old abandoned mill buildings into modern apartment living within the city limits. The property at 128 Thornton Road has been submitted to provide this facility. The property is located on the back edge of the footpath and is the end of a block of similar buildings. This part of the city does have similar buildings, however careful consideration has been given to this location.

As a modern development of flats across the road has been built this type of conversion is a benefit to the City and will form part of the Bradford City Centre Masterplan in particular the area called The Valley. An extract from the masterplan follows and states:

04. The Valley.
Brings the Beck and Brook to the surface to cleanse and green.
Rejuvenates the Thornton Road corridor and acts as a catalyst for the refurbishment of adjacent heritage warehouses.
Introduces a new habitat into the city.
Develops new spaces for discovery, experimentation and learning - a wetlands centre,
a prototype playground and a multi-sensory garden.
The character and likely programme of the four neighbourhoods
are described on the following pages...

The proposal will encourage professional people to the city providing growth within, bespoke retail outlets will diversify the shopping experience and allow Thornton Road and surrounding to flourish.

The proposal has been selected for the advantages and expectations Bradford City is proposing and can only be an asset in the future growth of the city.

11.0 THE EXCEPTION TEST

The exception test for this development in a flood zone 2 is not required.

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12.0 PROPOSED FLOOD PROOFING & MITIGATION MEASURES

The following measures have been noted following the instigation of the proposed development in order to manage flood risks at the site.

Consequences of flooding in the worst instances can result in fatalities as well as damaging property and disrupting lives and businesses. It can have severe consequences for people, such as financial loss, emotional distress, and health problems.

There are a number of key factors which affect the scale and severity of the consequences as follows:

- source and type of flooding;
- depth and velocity of flood water;
- duration of flooding;
- rate of onset of flooding;
- rate of rise of flood water;
- presence or absence of debris in the flood water;
- degree to which people and/or assets are exposed to the flood water.

Consideration of damage to the buildings sub and superstructure in relationship to the depth of the flood water is itemized in the following table

13.0 Possible Property Damage

Depth of Floodwater	Damage to the building	Damage to services and fittings
Below ground floor level	Possible erosion beneath foundations, Causing instability and settlement Possible corrosion in metal components (e.g. Joist hangers) Excessive moisture absorption in timber, Causing warping Cracking of ground floor due to uplift pressures Accumulation of contaminated silt Structural and material weaknesses from Inappropriate drying Rot and mould	Damage to electrical sockets and other services to basements and cellars Damage to fittings in basements And cellars
Ground level to half a metre above floor level	Build-up of water and silt in cavity walls, with potential reduction in insulating properties, for some materials immersed floor insulation may tend to float and cause screeds to debond Damage to internal finishes, such as wall coverings and plaster linings Floors and walls maybe affected to varying degrees (e.g. swelling) and may require cleaning and drying out Timber based materials likely to require Replacement damage to internal and external doors and skirting boards Corrosion of metal fixings Rot and mould	Damage to water, electricity and gas meters Damage to low level boilers and Some under floor heating systems Damage to communication Wiring and services Carpets and floor coverings may Need to be replaced Timber based kitchen units are Likely to require replacement Electrical appliances may need to be replaced insulation on pipework may need replacing damage to

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		higher units, Electrical services and appliances
Half a metre and above	Increased damage to walls (as above) Differential heads of greater than 0.6m across walls could cause structural damage, although this will vary depending on the structure of the building. Damage to windows can be caused by much smaller differential pressures High speed flow around the building perimeter can lead to erosion of the ground surface; there is also the potential risk of damage to the structure from large items of floating debris, e.g. tree trunks damage to water, electricity and	Damage to higher units, Electrical services and appliances Gas meters Damage to low level boilers and some underfloor heating systems Damage to communication wiring and services Carpets and floor coverings may Need to be replaced timber-based kitchen units are Likely to require replacement Electrical appliances may need to be replaced insulation on pipe work may need replacing

14.0 FLOOD PROOFING

14.1 Raising of floor levels

Consideration should be given to the raising of floor levels above the anticipated maximum flood level ensures that the interior of the property is not directly affected by flooding, avoiding damage to furnishings, wiring and interior walls. It is highlighted that plumbing may still be impacted as a result of mains sewer failure.

The proposal which is in a flood zone 2 zone must address the flooding influence from surface water, ground water and sewers. It is not considered practical to increase the level of the floor level however the surfaces at the entrance and exit below the assumed security roller doors should be bunded approximately 50mm high or higher subject to disabled access to restrict the ingress of flood water should an event occur. Provision of a waterproof skirt to prevent water entering the building under the doors should be considered.

14.2 The Basement

It is assumed that the basement will form part of the retail unit providing storage for the shop. The basement must primarily checked to ensure that wall and floor are tanked by a specialist company. If no tanking is evident then it is recommended that a suitable membrane and tanking system is used and would expect a collector gully and submersible pump are located within the floor to allow any collected water to be pumped to the surface drainage and ultimately to the public sewer. There must be sufficient information passed to the tenant of the shop for him/her to understand the dangers of the basement if a severe event is recognized and door should be locked, however this must be overridden from the inside to avoid anyone from being stranded. The tenant should periodically check the pump to ensure it is working and be encouraged to stack/store valuable items at ground floor level to minimize loss.

All lighting shall be suspended from the underside of the ground floor and plug sockets or consumer units should be dissuaded from installation within the basement.

14.2 Services and Drainage.

All new underground drains if deemed necessary will include non-return valves where viable to prevent the backflow of diluted sewage as it is assumed that the surrounding public sewers are combined.

Water, electricity and gas meters will be located above predicted flood level.
Electrical sockets will be installed above flood level for ground floors to minimise damage to electrical services and allow speedy re-occupation. Electric ring mains will be installed at a height above 900mm with drops to ground floor sockets and switches. Sockets and light switches should be installed above the maximum 900mm possible flood depth as reported earlier. See also basement mitigation measures.

Vulnerable Infrastructure- In order to minimise the disruption to the operation of the site and limit the damage of key equipment consideration of siting the sensitive plant on raised concrete plinths should be given should extreme flooding occur.

Heating systems such as boiler units and ancillary devices including thermostats will be installed above predicted flood level.

Wiring for telephone, TV, Internet and other services should be protected by suitable insulation in the distribution ducts to prevent damage. Any proposed design solution for flood insulation on all

14.3 Staff & Employees

It is imperative that there is no sleeping accommodation provided on site. Safe refuge and welfare facilities for all site occupants should be considered, we would ask that if flooding is anticipated then access to the stairs leading to the upper apartments is granted to allow staff to reach a safe level pending rescue by the emergency services.

14.4 Residence

The residence of the apartments are not considered at risk and mitigation measures are not considered necessary as the lower apartments are 3.0m above ground level.

14.5 Internal Considerations and *Flows* Project

Where applicable use standard gypsum plasterboard and studding for nonloadbearing walls will be provided throughout to allow speedy and cost-effective replacement should a flood ensue. Plastic skirting to perimeter walls are to be used within the ground floors of the new building.

If a, kitchen/canteen is to be provided on the ground floor consideration should be given to providing 300mm high plinths for the white goods and kitchen units to ensure damage is limited.

14.5 Water tightness

The placement of a temporary watertight seal across doors, windows and air bricks to avoid inundation of the building interior. This may be suitable for relatively short periods of flooding; however, the porosity of brickwork may result in damage being sustained should water levels remain elevated for an extended period. Security shutters to the retail outlet to be fitted with a proprietary skirt to prevent excessive ingress of water.

15.0 FLOOD MITIGATION

15.1 Doorways and Thresholds

To minimize ingress of water during the flood a watertight flood gate will be provided and will be installed by the site's maintenance team should a flood event occur, although not a permanent solution it will prevent a large amount of the water washing into the property. This threshold flood dam will be provided for ground floor access doors all gates and will be able to be stored away until a flood warning is given. A similar

system should be considered across the roller shutter doors should extreme floods be predicted, these will again be manually installed when a flood alert is given.,

15.2 Flood Warning System and Evacuation Plan

The site falls within the Environment Agency's Flood Warning Area for Bradford and therefore will receive flood alerts and warnings which can be accessed online. However, the owner of the property should continue to be vigilant and refer to any warning for the area local to the site

Within the Bradford as elsewhere in England, the responsibility for flood warning rests primarily within the Environment Agency. It provides flood warnings for designated Flood Warning Areas that are based on risk categories, which consider factors such as the likelihood and impact of flooding, and the resulting risk for each area. The Environment Agency has supplied the details of present flood warning arrangements for the Borough. However, the Environment Agency continuously updates its flood warning system and therefore the relevant Agency Area staff should be contacted for the latest information.

Environment Agency web page will provide detailed information of any pending floods local to the area for up to five days. In addition, warnings are given out as news bulletins on local radio and television and as an automated message that is sent to telephone numbers that have registered to be contacted in this way. The warning systems are based upon the recognised approach of issuing messages as follows:

Flood Watch – this suggests that flooding of low-lying areas and roads is expected and persons living in flood zone 3 should be prepared to take action.

Flood Warning – flooding of vulnerable homes & businesses is expected in the next few hours. People receiving this warning should take appropriate measures to safeguard their possessions and erect any local flood defences they have.

Severe Flood Warning – severe and widespread flooding within the flood zones is expected in the next few hours. People should prepare for flooding and make sure they either move to higher ground or to another place of safety.

All Clear – this is a message give out following any of the three warnings above to inform people within the vulnerable areas that the immediate flooding risk has passed.
The flood warning system adopted by the Environmental Agency is shown below.

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CODE	DESCRIPTOR	LEAD TIME	PUBLIC ADVICE
 FLOOD ALERT	Flooding is possible. Be prepared.	Two hours to two days in advance of flooding.	Be prepared to act on your flood plan. Prepare a flood kit of essential items. Monitor local water levels and the flood forecast on the Environment Agency Website.
 FLOOD WARNING	Flooding is expected. Immediate action required.	Half an hour to one day in advance of flooding	Move family, pets and valuables to a safe place. Turn off gas, electricity and water supplies if safe to do so. Put flood protection equipment in place.
 SEVERE FLOOD WARNING	Severe flooding. Danger to life.	When flooding poses a significant threat to life	Stay in a safe place with a means of escape. Be ready should you need to evacuate from your home. Co-operate with the emergency services. Call 999 if you are in immediate danger.
Warnings no longer in force	No further flooding is currently expected in your area.	When river or sea conditions begin to return to normal.	Be careful. Flood water may still be around for several days. If you have been flooded, ring your insurance company as soon as possible

The owners of the property should be informed of the procedures during a flood and it is recommended this flood risk assessment is issued to them. The information should include.

- Ensure that you understand the flood warning system;
- Turn off gas, electricity and water at the mains;
- Unplug electrical items and raise them as high as possible above the floor if at ground floor level;
- Move furniture and any sentimental items raise them as high as possible above the floor if at ground floor level;
- Install sandbags and / or flood boards to external doors, cover up airbricks;
- Put sandbags on top of manholes;
- Move your car to higher ground if possible;
- If there are any vulnerable neighbours (disabled) living nearby ensure that they are also
- prepared;
- House gullies should be cleared of debris, leaves etc, to help flood water drain
- away;

- Plug sinks/baths and put a sandbag in the toilet bowl to prevent backflow.
- Stay aware of developing conditions by listening to local radio and/or using the
- Environment Agency's public information service Floodline.

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The owners should also be informed what to do during a flood, these will include:

- Keep listening to local radio;
- Call the Environment Agency Floodline for advice (0845 988 1188 and
- www.environment-agency.gov.uk);
- Be prepared to co-operate with the emergency services i.e. in the event of
- evacuation;
- Put plugs in the bath and sinks, put sandbags on top of them, place sandbags into
- toilets to prevent backflow and disconnect electrical appliances etc;
- Try and move as much as possible upstairs, but don't take any risks;
- Think about your valuables which should include things that can't be replaced such
- as treasured photographs and don't forget your insurance policy;
- If you do have to be evacuated from your property because of flooding, make sure
- your premises are secure and don't leave windows open in the hope it will help to
- dry out the property. Notify the Police that your property has been vacated;
- Wait for floods to subside.

15.2 Safe Route of Access / Egress

In the event of a severe flood warning the site is may be surrounded in surface flood water therefore if possible the staff, owners of the apartments and any public should make their way to a refuge ensuring they have mobile phones with them and contact the rescue services. It is understood a possibility that civic areas will be made available during excessive events. Although this cannot be verified.

If the flood water is minimal it is advised that the pedestrian or car driver turn right out of the site and continue along Thornton Road turning left into Woodhead Road and continuing along passed the University until higher ground is found. It may be possible to seek higher ground within the University campus. These roads and carparks are at a higher level and will provide refuge until instructed by the rescue services.;

Do not enter any deep flood water find an alternative route.

If using a vehicle, the egress from the property is similar, however the vehicle should not enter any flood waters that cross the escape route. The car should be turnaround and a new route found.

This report has been prepared by

[redacted]

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Director

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