

Land at Moorhall Road, Harefield, Uxbridge, UB9 6PE

Reference: 490 FRA- 002

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FLOOD RISK ASSESSMENT

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Purpose of this report

- 1.1 RIDA Reports Ltd has been appointed to undertake a Level 2 – Scoping Study Flood Risk Assessment for a development located at UB9 6PE.

Objectives

- 1.2 The objectives of this FRA are to demonstrate the following:
 - * Whether the proposed development is likely to be affected by current or future flooding.
 - * Whether the proposed development will increase flood risk elsewhere.
 - * Whether the flood risks associated with the proposed development can be satisfactorily managed.
 - * Whether the measures proposed to deal with the flood risk are sustainable.

Documents Consulted

- 1.3 To achieve these objectives the following documents have been consulted and/or referenced:

The National Planning Policy Framework (NPPF)
CIRIA C753 document The SuDS Manual, 2015
Local Flood Risk Management Strategy (LFRMS)
Level 1 Strategic Flood Risk Assessment (SFRA)
Aerial photographs and topographical survey of the site
British Geological Society Records
Local Council flood Maps
Environment Agency flood maps
The CIRIA publication 'C635 Designing for exceedance in urban drainage— Good practice'

Development Site and Location

- 2.1 The site is located at Moorhall Road, Harefield. The nearest post code is UB9 6PE. Refer to appendix A for site location plan.
- 2.2 The current use of the site is a greenfield . The current use vulnerability classification of the site is Water compatible. The site is located in the River Flood Zone 3. Refer to Appendix B for more details.

Development Proposals

- 2.3 The proposed development includes the construction of a barn for storage. Refer to Appendix B for layout of the proposed development.
- 2.4 The vulnerability classification of the proposed development is Less vulnerable with an estimated lifetime between 20 and 50 years.

Site Hydrology and Hydrogeology

Hydrology	2.5 The River Corne is located approximately 300 m away from the development.
Aquifer	2.6 The development is located within a secondary aquifer type A. Aquifers type A consist of permeable layers capable of supporting water supplies at a local rather than strategic scale. They are generally aquifers formerly classified as minor aquifers.
Source Protection Zone	2.7 The site is located within a source protection zone 1. This zone is defined as the 50 day travel time from any point below the water table to the
Groundwater Levels	2.8 The ground water levels for this site are unknown.

Site Geology

Bedrock	2.9 The British Geological Society records of the site show that it is located within the Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated) - Chalk.
Superficial Deposits	2.10 The British Geological Society records show that the superficial deposits are Alluvium - Clay, Silt, Sand and Gravel.

National Planning Policy Framework (NPPF)

- 3.1 The NPPF and its technical guidance is a set of planning policies with the key objective to contribute to the achievement of sustainable development. As part of it, they ensure that flood risk and sustainability are taken into account during the planning process. This ensures that developments are not located in flood risk areas and directs developments to lower risk areas. The NPPF applies a sequential risk-based approach to determining the suitability of land for development in flood risk areas. The NPPF also encourages developers to seek opportunities to reduce the overall level of flood risk through the layout of the development and the application of Sustainable Drainage Systems (SuDS).

The Flood and Water Management Act (2010)

- 3.2 The Flood and Water Management Act aims to reduce the flood risk associated with extreme weather events. It provides a robust management of flood risk for people, homes and businesses and also encourages the use of SuDS for developments. A robust SuDS strategy should take into account the recommendations given in this Flood Risk Assessment.

Strategic Flood Risk Assessment (SFRA)

- 3.3 Planning policy with regard to development and flood risk in the area is detailed in the Local Flood Risk Management Strategy (LFRMS) which was published in 2015. The proposed development site is located within the administrative boundary of the London Borough of Hillingdon.
- 3.4 The SFRA commits to direct new development to locations at lowest flood risk. The SFRA provides information on the levels and flood hazards that could result from flooding. The Environment Agency flood zone maps and the SFRA ignore the presence of existing flood defences when defining the potential extent of flooding.
- 3.5 This report follows the guidance given in the Local Flood Risk Management Strategy by evaluating the flood risk and providing relevant flood mitigation.

4.1 The NPPF guidance states that the sequential test "is designed to ensure that areas at little or no risk of flooding from any source are developed in preference to areas at higher risk. This means avoiding, so far as possible, development in current and future medium and high flood risk areas considering all sources of flooding including areas at risk of surface water flooding."

Applicability of the Sequential Test

4.2 The flood risks were determined by identifying all the sources of flooding and assessing their possible impact and likelihood to the development. It is confirmed that the development is:

- In Flood Zone 3
- At Low risk of surface flooding
- At high risk of groundwater flooding
- Outside of a critical drainage area
- Outside of an area with sewer flooding

4.3 Due to the flood risk on the development, a sequential test is required for this site. Due to the nature of the building (farm barn), it must be located near the fields surrounding the site. It is unlikely that there may be any reasonably available sites in areas with a lower probability of flooding that would be appropriate to accommodate the type of development and be available.

Exception Test

4.2 Fluvial flood risk was assessed using the Environment Agency Flood Zone Maps and the sequential risk-based approach recommended in the NPPF guidance. The exception test requirement takes into account the flood risk vulnerability of land uses in relation to the flood zone categorisation. These parameters are assessed in order to determine whether the development requires an exception test or it is not appropriate.

Step 1 4.3 The proposed development falls within The Environment Agency Flood Zone 3. The Flood Zone 3 is considered to have a high probability of flooding with a 100 years or less annual probability or >1%AEP.

Step 2 4.4 Within Table 2 (Flood Risk Vulnerability Classification) of the NPPF Planning Practice Guide, the proposed development is classified as 'Less vulnerable'.

Step 3

4.5 The Flood Risk vulnerability and Flood Zone incompatibility table of the NPPF Planning Practice Guide states that Less vulnerable developments do not require an exception test in this area.

The Exception Test

4.6 The exception test is not required.

5.1 The development has been assessed for all potential flood risks such as river and tidal flood risk, surface water flooding, flooding from groundwater, reservoir flood risk and drainage systems.

Historic Flooding

5.2 The site does not benefit from flood defences. The Environment Agency records show that the area around the site has not been flooded in the past.

Flooding from river and sea

5.3 The proposed development falls within The Environment Agency Flood Zone 3. The Flood Zone 3 is considered to have a high probability of flooding with a 100 years or less annual probability or >1%AEP.

5.4 The climate change allowances are as per the vulnerability of the development, the design life of the building, and the flood zone classification. The climate change allowance for this development is 21%. The nearest climate change allowance provided by the Environment Agency has been taken to complete this assessment.

5.5 The levels provided by the Environment Agency are shown in table 1 below. Further details are provided in appendix D.

Flood Levels

Return Period	Flood Level (m AOD)
1 in 20 (5%)	36.23
1 in 100 (1%)	36.34
1 in 200 (0.5%)	36.38
1 in 100 + 20%(CC)	36.41
1 in 1000 (0.1%)	37.22

5.6 The flood risk levels taken to complete this assessment is: 36.41m AOD. This is the 1 in 100 + 20%(CC) level.

5.7 A flood water level of 36.41m AOD is expected. The depth of water is 0.11m.

Surface water (overland flows) flood risk

5.8 The Environment Agency maps show that the flood risk from surface water is low. A residual risk of localised shallow ponding remains likely. The Environment Agency surface water flood risk maps are defined through application of a specific procedure based on digital terrain models and assumptions regarding losses to infiltration and/or urban drainage. The surface water flood maps is defined by the Environment Agency as follows.

5.9 *"The nationally produced surface water flood mapping only indicates where surface water flooding could occur as a result of local rainfall. It does not fully represent flooding that occurs from:*

- Ordinary watercourses*
- Drainage systems or public sewers caused by catchment-wide rainfall events*
- Rivers*
- Groundwater*

Due to the modelling techniques used, the mapping picks out depressions in the ground surface and simulates some flow along natural drainage channels, rivers, low areas in floodplains, and flow paths between buildings. Although the maps appear to show flooding from ordinary watercourses, they should not be taken as definitive mapping of flood risk from these as the conveyance effect of ordinary watercourses or drainage channels is not explicitly modelled. Also, structures (such as bridges, culverts and weirs) and flood risk management infrastructure (such as defences) are not represented.

The nationally produced surface water flood mapping does not take account of the effect of pumping stations in catchments with pumped drainage. No allowance is made for tide locking, high tidal or fluvial levels where sewers cannot discharge in to rivers or the sea."

5.10 The strategic flood risk for the London Borough of Hillingdon confirms that the flood risk for the site is Low.

5.11 On the basis of Environment Agency and the Strategic flood risk assessment's surface water mapping, it is concluded that the site is at Low risk of flooding from surface water sources. The depth of water is potentially below 300mm. For the purpose of this assessment a depth of water of 0.15m has been taken as the most relevant depth to the site.

Flooding from drainage systems in adjacent areas

5.12 The council records have been reviewed. The flooding from drainage incidents maps were not found in the Strategic Flood Risk Assessment. Therefore, for the purpose of this report, it has been assumed that the risk of flooding from drainage systems is low.

Reservoirs Risks

5.13 The Reservoir Flood Map (RFM) produced by the Environment Agency do not show the risk to individual properties of dam breach flooding. The maps do not indicate or relate to any particular probability of dam breach flooding. The maps were prepared for emergency planning purposes and can be used to help reservoir owners produce on-site plans and the Local Resilience Forum produce off-site plans, and to prioritise areas for evacuation/early warning in the event of a potential dam failure. The RFM shows that the development could be within the possible dam breach flooding path. See Appendix C.

Groundwater flood risk

5.14 The British Geological Survey's flood risk susceptibility maps show that the development has potential for groundwater flooding above ground level. Groundwater levels would tend to vary seasonally and are influenced by ground and meteorological conditions and proximity to water features. The groundwater flooding risk for this site is considered to be high. Refer to appendix C for record drawings.

Critical Drainage Areas

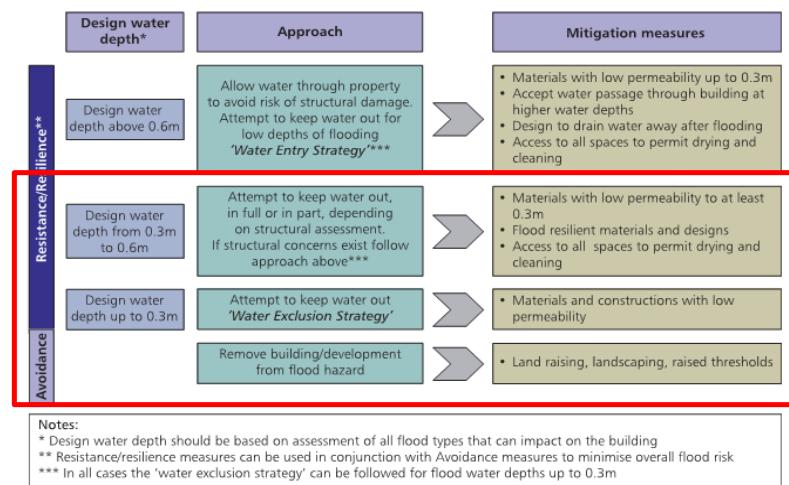
5.15 The Strategic Flood Risk Assessment was reviewed as part of this assessment. However, it does not show the critical drainage areas within the council. For the purpose of this report, it has been assumed that the site is outside of a notified critical drainage area.

- 6.1 The Flood hazard assessment has demonstrated that the site is:
 - In Flood Zone 3
 - At Low risk of surface flooding
 - At high risk of groundwater flooding
 - Outside of a critical drainage area
 - Outside of an area with sewer flooding
- 6.2 Under the NPPF it is necessary to demonstrate that, for any new development on the site, it is possible to provide an adequate level of flood protection for personnel working or living at the development.

Flood Protection

- 6.3 Where possible, flood protection for this development is typically provided by establishing the development's floor levels 300mm above the 1:100 year flood level, including allowance for climate change.
- 6.4 The flood levels have been obtained from the Environment Agency. This information is used to make the fluvial flood risk assessment for this development
- 6.5 The appropriate 1:100+CC reference level for the proposed development site is 36.41 mAOD. The existing ground level at the site is an average of 36.3mAOD. The finished floor should be 36.71mAOD. It would involve a height differential of up to 0.41m.
- 6.6 It is not possible to achieve this FFL due to access and site constraints. A level of 36.45mAOD is achieved. This level is as per the same FFL of the existing building. Therefore the following flood protection interventions should be provided.
- 6.7 The flood resilience strategy for the development has been based on the CLG 2007 Improving the Flood Performance of New Buildings. See figure below. The strategy is based on the water level within the proximity to the building.

Rationale for flood resilient and/or resistant design strategies.



6.8 The design water depth for this site is 0.15m. The development should utilise building materials that are suitable for a 'water exclusion strategy'. Materials classified as "Good" (highlighted in red) in the Figure below shall be used for construction upto the water depth.

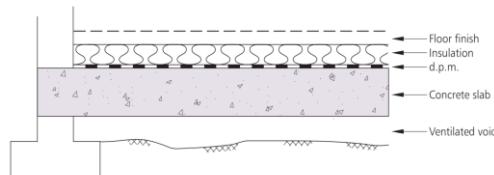
Figure 2: Flood resilience characteristics of building materials (based on laboratory testing)

Material	Resilience characteristics*		
	Water penetration	Drying ability	Retention of pre-flood dimensions, integrity
Bricks			
Engineering bricks (Classes A and B)	Good	Good	Good
Facing bricks (pressed)	Medium	Medium	Good
Facing bricks (handmade)	Poor	Poor	Poor
Blocks			
Concrete (3.5N, 7N)	Poor	Medium	Good
Aircrete	Medium	Poor	Good
Timber board			
OSB2, 11mm thick	Medium	Poor	Poor
OSB3, 18mm thick	Medium	Poor	Poor
Gypsum			
Gypsum Plasterboard, 9mm thick	Poor	Not assessed	Poor
Mortars			
Below d.p.c. 1:3(cement:sand)	Good	Good	Good
Above d.p.c. 1:6(cement:sand)	Good	Good	Good

Resilience characteristics are related to the testing carried out and exclude aspects such as ability to withstand freeze/thaw cycles, cleanability and mould growth

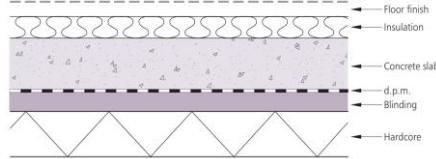
6.9 Foundations: Suspended concrete floor slabs at least 150mm thick is the preferred option. Suspended slabs can also be used. There should be a minimum space of 150mm ventilated void between the ground level and the bottom of the floor slab. Damp proof membranes should be included in the design. Floor insulation should be of the closed-cell type. Under floor services using ferrous materials should be avoided. Ceramic/concrete-based floor tiles, sitting on a bed of sand, cement render and water resistant grout can be used. See figures below.

Suspended Concrete Slab detail



- Reinforced concrete slab at least 150mm thick and complying with structural requirements for uplift forces
- Damp proof membrane of polythene at least 1200 gauge
- Insulation as rigid closed-cell material
- Ceramic tiles or stone floor finishes and including skirting boards.

Ground bearing Concrete Slab detail



- Hardcore bed at least 100mm thick of well compacted inert material, blinded with fine inert material to provide a smooth base
- Damp proof membrane of polythene at least 1200 gauge
- Concrete slab at least 150mm thick
- Insulation as rigid closed-cell material
- Ceramic tiles or stone floor finishes and skirting boards.

6.10 Concrete blocks used in foundations should be sealed with an impermeable material or encased in concrete to prevent water movement from the ground to the wall construction.

6.11 Services and fittings (communications wiring, heating systems, electrical services, water, electricity and gas meters) should be placed at above the flood level. Where possible, all service entries should be sealed (e.g. with expanding foam or similar closed-cell material). Closed cell insulation should be used for pipes which are below the predicted flood levels.

6.12 The general precautionary measures to mitigate the risk of groundwater flooding in this development are:

- Ground floor threshold levels are proposed to be raised a minimum of 150mm above ground level as freeboard to allow for uncertainty.
- Provide flow paths around the proposed development which groundwater will take in the event of groundwater emergence.
- It is proposed to add a tanking membrane upto 200mm above the ground level.

As these measures would mitigate the risks from groundwater flooding, it is considered the risk from groundwater has been managed.

7.1 The NPPF specifically stipulates that consideration should be given to potential off-site flood impacts of any proposed development. These off-site impacts are in relation to:

- Surface water management
- Flood flow conveyance, storage and climate change

Surface Water Management

7.2 The surface water run-off will be disposed using SuDS techniques. The aim is to provide a sustainable design that accommodates the proposed attenuation volume and replicated the existing drainage regime using the SuDS hierarchy is shown in the figure below.

7.3 The SuDS techniques highlighted in red below could be used on site. This assessment is based on the ground conditions and the potential discharge points available.

The SuDS Hierarchy (Source:EA Thames region, SuDS a practical guide)

Most Sustainable	SuDS technique	Flood Reduction	Pollution Reduction	Landscape & Wildlife Benefit
	Living roofs	✓	✓	✓
	Basins and ponds - Constructed wetlands - Balancing ponds - Detention basins - Retention ponds	✓	✓	✓
	Filter strips and swales	✓	✓	✓
	Infiltration devices - soakaways - infiltration trenches and basins	✓	✓	✓
	Permeable surfaces and filter drains - gravelled areas - solid paving blocks - porous pavements	✓	✓	
	Tanked systems - over-sized pipes/tanks - storm cells		✓	
Least Sustainable				

7.4 With no increase in the rate of surface water discharge from the site, compared to the site in its current configuration, the proposed development would have no adverse impact on surface water flood risk at the site or surrounding area. The SuDS should be designed at detailed project stage.

Flood Flow conveyance and storage

7.5 Due to the size of the development and its location on the flood zone, flood compensation for this development is not required.

- 8.1 This flood risk assessment has identified the potential flooding mechanisms that could affect the site. This assessment has concluded that the development site requires additional flood risk mitigation strategies so all the flood risk can be addressed.

Site access and public safety

- 8.2 This assessment has demonstrated that the proposed development will have no adverse impact on flood risk in the area surrounding the site. Available evidence indicates that the development would result in no change in surface water generation. There is therefore no basis to indicate that, with respect to flood risk, the proposed development would have adverse impact on public safety.
- 8.3 It will be necessary to ensure that all building users are fully informed of procedures to be implemented during threat of imminent flooding.

Flood Warning and evacuation

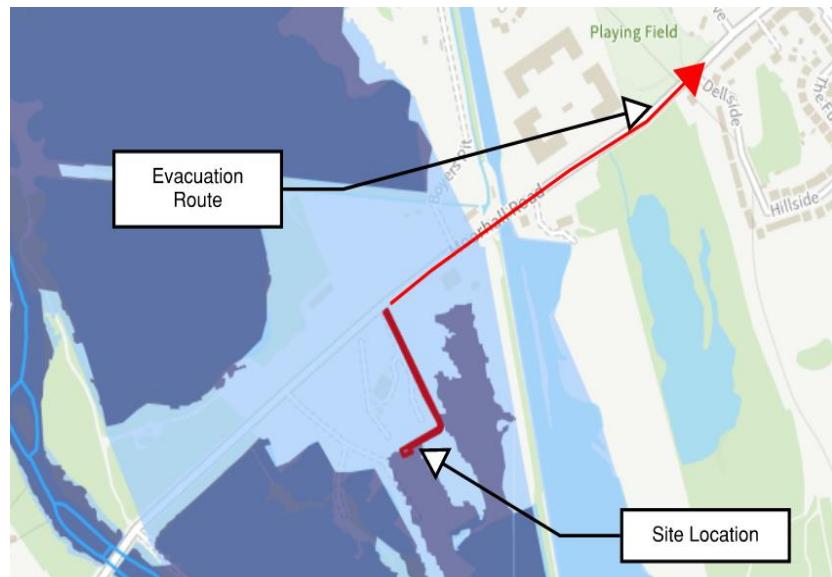
- 8.4 The site is located within an area that is covered by the Environment Agency Flood Alert service. It is recommended that the proposed development is registered with this service to receive early warning of imminent flood hazard.
- 8.6 The occupants of the site are encouraged to sign up to the alerts and should use these to form an appropriate Flood Management and Evacuation Plan tailored to their operations prior to occupation of the site. Table 4 below shows the actions that will be taken for each flood warning.
- 8.7 Action to be taken in the event of Alarm being Raised or Flood Warning Received:
 - a. **Raise the alarm and evacuate the site following the established Fire Drill procedures. The main assembly as per the main house fire drill assembly point.**
 - b. **Contact Emergency Fire Services (999) if necessary and/or Environment Agency Floodline: (0845 988 1188) if event was not expected.**
 - c. **If safe to do so, locate and turn off key services e.g. water, gas & electricity.**
 - d. **Follow the routes below to evacuate the site completely.**

Actions that will be taken for each flood warning

Warning	Message	Timing	Action
 FLOOD ALERT	Flooding is possible. Be prepared.	2 hours to 2 days in advance of flooding.	- Be prepared for flooding. - Prepare a flood kit.
 FLOOD WARNING	Flooding is expected. Immediate action required.	Half an hour to 1 day in advance of flooding.	- Act now to protect your property. - Block doors with flood boards or sandbags and cover airbricks and other ventilation holes. - Move pets and valuables to a safe place. - Keep a flood kit ready. - Move any critical equipment and information to a safe location
 SEVERE FLOOD WARNING	Severe flooding. Danger to life.	When flooding poses a significant threat to life and different actions are required.	- Be ready should you need to evacuate from the property. - Co-operate with the emergency services and call 999 if you are in immediate danger.
Warning Removed	No further flooding is currently expected for your area.	Issued when a flood warning is no longer in force.	- Flood water may still be around and could be contaminated. - If you've been flooded, ring your buildings and contents insurance company as soon as possible.

8.8 Safe egress is achievable by following Moorhall Road, which is shown to be beyond the extent of flooding. See figure below for details.

Evacuation Route



- 9.1 It is concluded that subject to the proposed mitigation measures, the site can be developed in accordance with the provisions of the NPPF and the requirements of the Environment Agency and the local planning authority.
- 9.2 It is proposed that a formal Flood Warning and Emergency Response Plan is developed for the proposed development to communicate flood emergency response procedures to all the occupants of the site.
- 9.3 This report demonstrates that the proposal will be safe, in terms of flood risk, for its design life and will not increase the flood risk elsewhere.