



10 Stretton Way, Huyton, Liverpool, L36 6JF

Flood Risk Assessment

For Pine Engineering Ltd

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February 2023

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10 Stretton Way, Huyton, Liverpool, L36 6JF

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Status	Final
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EXECUTIVE SUMMARY

The Site would be expected to remain dry in all but the most extreme conditions. The consequences of flooding are acceptable, and the development would be in accordance with the requirements of the National Planning Policy Framework (NPPF).

This Flood Risk Assessment (FRA) demonstrates that the Proposed Development would be operated with minimal risk from flooding, would not increase flood risk elsewhere and is compliant with the requirements of NPPF. The Proposed Development should not therefore be precluded on the grounds of flood risk.

1.0 INTRODUCTION

1.1 Background

This Flood Risk Assessment (FRA) has been prepared by KRS Enviro at the request of Pine Engineering Ltd to support a planning application for an extension to an industrial unit (“the Proposed Development”) at 10 Stretton Way, Huyton, Liverpool, L36 6JF (“the Site”).

This FRA has been carried out in accordance with guidance contained in the National Planning Policy Framework (NPPF)¹, associated Planning Practice Guidance on flood risk and coastal change² (PPG) and the PPG ‘Site-specific flood risk assessment checklist’. This FRA identifies and assesses the risks of all forms of flooding to and from the development and demonstrates how these flood risks will be managed so that the development remains safe throughout the lifetime, taking climate change into account.

It is recognised that developments which 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. 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.

1.2 National Planning Policy Framework (NPPF)

One of the key aims of the NPPF is to ensure that flood risk is taken into account at all stages of the planning process; to avoid inappropriate development in areas at risk of flooding and to direct development away from areas of highest risk.

It advises that where new development is exceptionally necessary in areas of higher risk, this should be safe, without increasing flood risk elsewhere, and where possible, reduce flood risk overall. A risk-based approach is adopted at stages of the planning process, applying a source pathway receptor model to planning and flood risk. To demonstrate this, an FRA is required and should include:

- whether a Proposed Development is likely to be affected by current or future flooding from all sources;
- whether it will increase flood risk elsewhere;
- whether the measures proposed to deal with these effects and risks are appropriate;
- if necessary, provide the evidence to the Local Planning Authority (LPA) that the Sequential Test can be applied; and
- whether the development will be safe and pass part c) of the Exception Test if this is appropriate.

The report findings are based upon professional judgement and are summarised below with detailed recommendations provided at the end of the report. The report includes rainfall data from the Flood Estimation Handbook (FEH) and hydrogeological information from the British Geological Survey (BGS). The assessment will summarise and refer to these datasets in the text.

¹ Ministry for Housing, Communities and Local Government (2021) National Planning Policy Framework: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf

² Communities and Local Government (2022) Planning Practice Guidance - Flood Risk and Coastal Change: <https://www.gov.uk/guidance/flood-risk-and-coastal-change>

1.3 Report Structure

This FRA has the following report structure:

- Section 2 describes the location and the existing and Proposed Development;
- Section 3 outlines the flood risk to the existing and Proposed Development;
- Section 4 details the proposed surface water drainage for the Site and assesses the potential impacts of the Proposed Development on surface water drainage;
- Section 5 describes the risk management methods used to mitigate all sources of flood risk;
- Section 6 details the Sequential and Exception Tests; and
- Section 7 presents a summary and conclusions.

2.0 LOCATION & DEVELOPMENT DESCRIPTION

2.1 Site Location

The Site is located at 10 Stretton Way, Huyton, Liverpool, L36 6JF (see Figure 1). The National Grid Reference (NGR) of the Site is 345908, 390197.



Figure 1 - Site Location

2.2 Existing Development

The Site is currently used for industrial purposes with an existing building on the Site (see Appendix 1).

2.3 Proposed Development

The Proposed Development is for an extension to the existing industrial building (see Appendix 1). Further details with regard to the Proposed Development can be found in the accompanying information submitted with the planning application.

2.4 Ground Levels

The Site rises from west to east with a minimum ground level of 25.37 metres Above Ordnance Datum (mAOD) immediately adjacent to the Longwood Mill Brook and a maximum ground level of 28.05mAOD adjacent to Stretton Way. The ground level at the location of the building and extension is 26.44mAOD.

2.5 Catchment Hydrology

The Longwood Mill Brook is located adjacent to the western boundary of the Site. There is an unnamed pond located approximately 200m to the north east of the Site.

2.6 Ground Conditions

The British Geological Survey (BGS) map³ shows that the bedrock deposits underneath the Site consists of the Pennine Middle Coal Measures Formation - sandstone. The superficial deposits consist of Till, Devensian - diamicton. Information from the National Soil Resources Institute⁴ details the Site area as being situated on slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils with impeded drainage.

³ <https://mapapps2.bgs.ac.uk/geoindex/home.html>

⁴ <http://www.landis.org.uk/soilscapes/>

3.0 FLOOD RISK

3.1 Sources of Flooding

All sources of flooding have been considered, these are; fluvial (river) flooding, tidal (coastal) flooding, groundwater flooding, surface water (pluvial) flooding, sewer flooding and flooding from artificial drainage systems/infrastructure failure.

3.2 Environment Agency Data

The Flood and Water Management Act 2010 gives the Environment Agency a strategic overview role for all forms of flooding and coastal erosion. They also have direct responsibility for the prevention, mitigation and remediation of flood damage for main rivers and coastal areas. The Environment Agency is the statutory consultee with regards to flood risk and planning.

Environment Agency Flood Risk Standing Advice for England, the NPPF and the Planning Practice Guidance to the NPPF has been consulted and reviewed during this FRA. This has confirmed the level of FRA required and that a surface water drainage assessment is to be undertaken. Information regarding the current flood risk at the site and local flood defences has been obtained from the Environment Agency (see Appendix 2).

3.3 Historic Flooding

Environment Agency data shows that the Site has not historically flooded. There are no records of anecdotal information of flooding at the Site including within the British Hydrological Society “Chronology of British Hydrological Events”. No other historical records of flooding for the Site have been recorded. Therefore, it has been concluded that the Site has not flooded within the recent past.

3.4 Existing and Planned Flood Defence Measures

Environment Agency data confirms that the Site is not protected against flooding by existing flood defence measures.

3.5 Environment Agency Flood Zones

A review of the Environment Agency’s Flood Zones indicates that the majority of the Site is located within Flood Zone 1 and has a ‘low probability’ of flooding as shown in Figure 2, with less than a 1 in 1000 annual probability of river or sea flooding in any year (<0.1%). Areas on the western boundary of the Site are located within Flood Zone 3 and have a ‘high probability’ of flooding with a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

It should be noted that the existing building and proposed extension are located within Flood Zone 1. Flood Zone 3 is situated on the very western boundary of the Site within the channel corridor and does not extend substantially into the Site.

The Flood Zones are the current best information on the extent of the extremes of flooding from rivers or the sea that would occur without the presence of flood defences, because these can be breached, overtopped and may not be in existence for the lifetime of the development. They show the worst-case scenario.

The Environment Agency Flood Zones and acceptable development types are explained in Table 1. Table 1 shows that some development types are generally acceptable in Flood Zones 1 and 3.

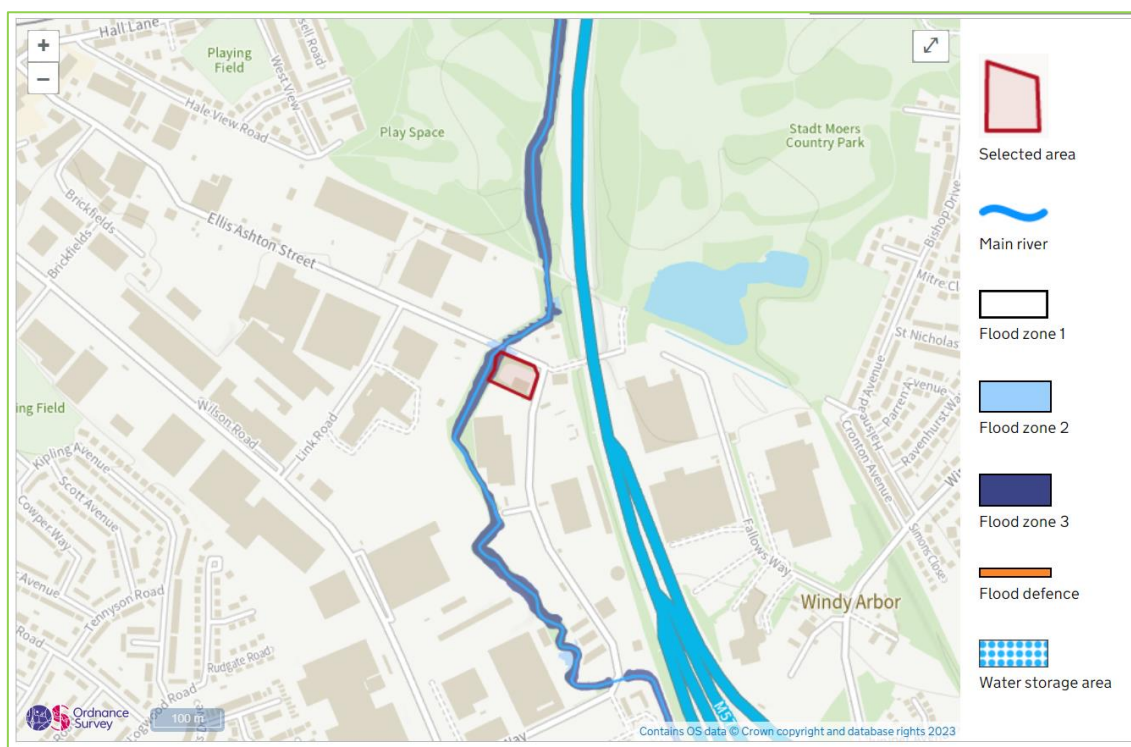


Figure 2 - Environment Agency Flood Zones

Table 1 - Environment Agency Flood Zones and Appropriate Land Use

Flood Zone	Probability	Explanation	Appropriate Land Use
Zone 1	Low	Less than a 1 in 1000 annual probability of river or sea flooding in any year (<0.1%)	All development types generally acceptable
Zone 2	Medium	Between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%) in any year	Most development type are generally acceptable
Zone 3a	High	A 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year	Some development types not acceptable
Zone 3b	'Functional Floodplain'	This zone comprises land where water from rivers or the sea has to flow or be stored in times of flood. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise:	Some development types not acceptable

		- land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or - land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding). Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)	
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3.6 Flood Vulnerability

In the Planning Practice Guidance to the NPPF, appropriate uses have been identified for the Flood Zones. Applying the Flood Risk Vulnerability Classification in the Planning Practice Guidance to the NPPF, the existing and proposed use is classified as 'less vulnerable'. The Proposed Development will not change the vulnerability of the Site to flooding or introduce a new use into the floodplain.

Table 2 of this report and the Planning Practice Guidance to the NPPF states that 'less vulnerable' uses are appropriate within Flood Zones 1 and 3. It should be noted that the existing building and proposed extension are located within Flood Zone 1.

Table 2 - Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Risk Vulnerability Classification	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception test required	✓	✓
Zone 3a	Exception test required	✓	✗	Exception test required	✓
Zone 3b 'Functional Floodplain'	Exception test required	✓	✗	✗	✗

Key: ✓ : Development is appropriate, ✗ : Development should not be permitted.

3.7 Climate Change

Projections of future climate change, in the UK, indicate more frequent, short-duration, high intensity rainfall and more frequent periods of long duration rainfall. Guidance included within the NPPF recommends that the effects of climate change are incorporated into FRA's. Recommended precautionary sensitivity ranges for peak rainfall intensities and peak river flows

are outlined in the flood risk assessments: climate change allowances guidance⁵. Table 3 shows peak river flow allowances by river catchment.

As per Environment Agency guidance, the anticipated lifetime of the development is deemed to be 75 years. The flood risk assessments: climate change allowances guidance recommends that for 'more vulnerable' uses in Flood Zone 3 that the central allowances are used. Therefore, the design flood level for the Site is the 1 in 100 year (+44%) event.

Table 3 - Peak River Flow Allowances by River Catchment

Catchment	Allowance Category	2020s	2050s	2080s
Lower Mersey Management Catchment	Upper	+32%	+55%	+90%
	Higher	+22%	+35%	+57%
	Central	+18%	+27%	+44%

3.8 Fluvial (River) Flooding

The Longwood Mill Brook is located adjacent to the western boundary of the Site. Therefore, fluvial flooding from the Longwood Mill Brook poses the primary flood risk to the Site. The Environment Agency have provided modelled water levels for the Site (see Table 4). The modelled water levels have been compared to the ground level at the Site and the areas within the vicinity of the Site to assess the flood risk in detail from model node 3. In this case as the 1 in 100 year (+44%) event is not available both the 1 in 100 year (+35%) and 1 in 100 year (+70%) events have been used to assess the effects of climate change.

Table 4 - Environment Agency Undefended Modelled Water Level (mAOD)

Eastings	Northings	10	25	75	100	100 (+35%)	100 (+70%)	200	1000
345929	390397	24.82	24.93	25.10	25.14	25.38	25.58	25.28	25.63

Water levels have been modelled at 25.14mAOD, 25.38mAOD, 25.58mAOD and 25.63mAOD during the 1 in 100 year, 1 in 100 year (+35%), 1 in 100 year (+70%) and 1 in 1000 year events, respectively. The Site has a minimum ground level of 25.37mAOD therefore, the Site will be flood free up to and including the 1 in 100 year event. However, the proposed extension to the existing industrial unit, where ground levels are higher at 26.44mAOD, will be flood free for all events up to and including the 1 in 100 year (+70%) and 1 in 1000 year events.

To the west of the Site, where the minimum ground level is 25.37mAOD, water depths of 0.01m, 0.21m and 0.26m may be experienced during the 1 in 100 year (+35%), 1 in 100 year (+70%) and 1 in 1000 year events, respectively. This area is located on the very western boundary of the Site within the channel corridor and does not extend substantially into the Site.

Any flooding to the west of the Site, would be of minor nature due to the flows and topography of the area and would not occur at the location of the proposed extension. The flooding would only inundate the area along the western boundary to a relatively low water depth and water velocity, will only last a short period of time, in very extreme cases.

Given the scale and nature of the Proposed Development and the size and location of the fluvial the fluvial flooding sources it has been concluded that fluvial flooding poses a low risk to the Site and the risk of fluvial flooding is considered to be of **low significance**. The risk from fluvial

⁵ <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#high-allowances>

flooding will be mitigated by using a number of property level protection measures to manage and reduce the overall risk at the Site (see Section 5.0).

3.9 Tidal (Coastal) Flooding

The Site is not located within the vicinity of tidal flooding sources and the risk of tidal flooding is considered to be **not significant**.

3.10 Groundwater Flooding

Groundwater flooding is defined as the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground under conditions where the normal range of groundwater levels is exceeded.

Groundwater flooding tends to occur sporadically in both location and time. When groundwater flooding does occur, it tends to mostly affect low-lying areas, below surface infrastructure and buildings (for example, tunnels, basements and car parks) underlain by permeable rocks (aquifers). Site ground conditions suggest a low potential for groundwater flooding. The risk of flooding from groundwater flooding is considered to be **not significant**.

3.11 Surface Water (Pluvial) Flooding

The Site is not situated near to large areas of poor permeability or areas with the geology and/or topography which may result in surface water flooding. The Site surroundings are relatively flat and there are no large catchments that would tend to generate surface water runoff towards the Site. Surface water flow flooding tends to occur sporadically in both location and time such surface water flows would tend to be confined to the streets around the Proposed Development.

The Environment Agency Surface Water flood map shows that the majority of the Site has a very low risk of surface water flooding (see Figure 3) with a chance of flooding of less than 1 in 1000 (0.1%) years. However, a small proportion of the Site has a low risk of surface water flooding with a chance of 1 in 1000 (0.1%) to 1 in 100 years (1%). The areas shown to be at risk of surface water flooding are associated with the Longwood Mill Brook, adjacent to the western boundary of the Site.

It should be noted that the above is the most conservative estimate of surface water flood risk. The flood risk from surface water is of a minor nature with low water depths and velocities being experienced. Therefore, the risk of flooding from surface water flooding is considered to be of **low significance**. The risk from this source will be further mitigated by using a number of property level protection measures to manage and reduce the overall flood risk at the Site (see Section 5.0).



Figure 3 - Environment Agency Surface Water Flood Map

3.12 Sewer Flooding

Sewer flooding occurs when urban drainage networks become overwhelmed and maximum capacity is reached. This can occur if there is a blockage in the network causing water to back up behind it or if the sheer volume of water draining into the system is too great to be handled. Sewer flooding tends to occur sporadically in both location and time such flood flows would tend to be confined to the streets around the development.

Any sewers will inevitably have a limited capacity so in extreme conditions there would be surcharges, which may in turn cause flooding. Flood flows could also be generated by burst water mains, but these would tend to be of a restricted and much lower volume than weather generated events and so can be discounted for the purposes of this assessment.

Given the design parameters normally used for drainage design in recent times and allowing for some deterioration in the performance of the installed systems, which are likely to have been in place for many years, an appropriate flood risk probability from this source could be assumed to have a return period in the order of 1 in 10 to 1 in 20 years. The provision of adequate level difference between the ground floors and adjacent ground level would reduce the annual probability of damage to property from this source to 1 in 100 years or less. The risk of flooding from sewer flooding is considered to be **not significant**.

3.13 Flooding from Artificial Drainage Systems/Infrastructure Failure

Reservoirs are located within the vicinity of the Site. The Environment Agency flood map shows that the Site is at risk of reservoir flooding when there is also flooding from rivers (see Figure 4) to the north and west boundary. This map shows the largest area that might be flooded if a reservoir were to fail and release the water it holds. The Environment Agency Reservoir flood map has been prepared for emergency planning purposes and for this reason they reflect a

worst-case scenario. Since this is a prediction of a worst-case scenario, it is unlikely that any actual flood would be this large.

Reservoir flooding is extremely unlikely; reservoirs in the UK have a very good safety record. There has been no loss of life in the UK from reservoir flooding since 1925. Since then reservoir safety legislation has been introduced to make sure reservoirs are well maintained.

The hazard is well managed through effective legislation and it is unlikely that the impact zone downstream of these reservoirs should not allow the Proposed Development. The risk of flooding from artificial drainage systems/infrastructure failure is considered to be **not significant**.

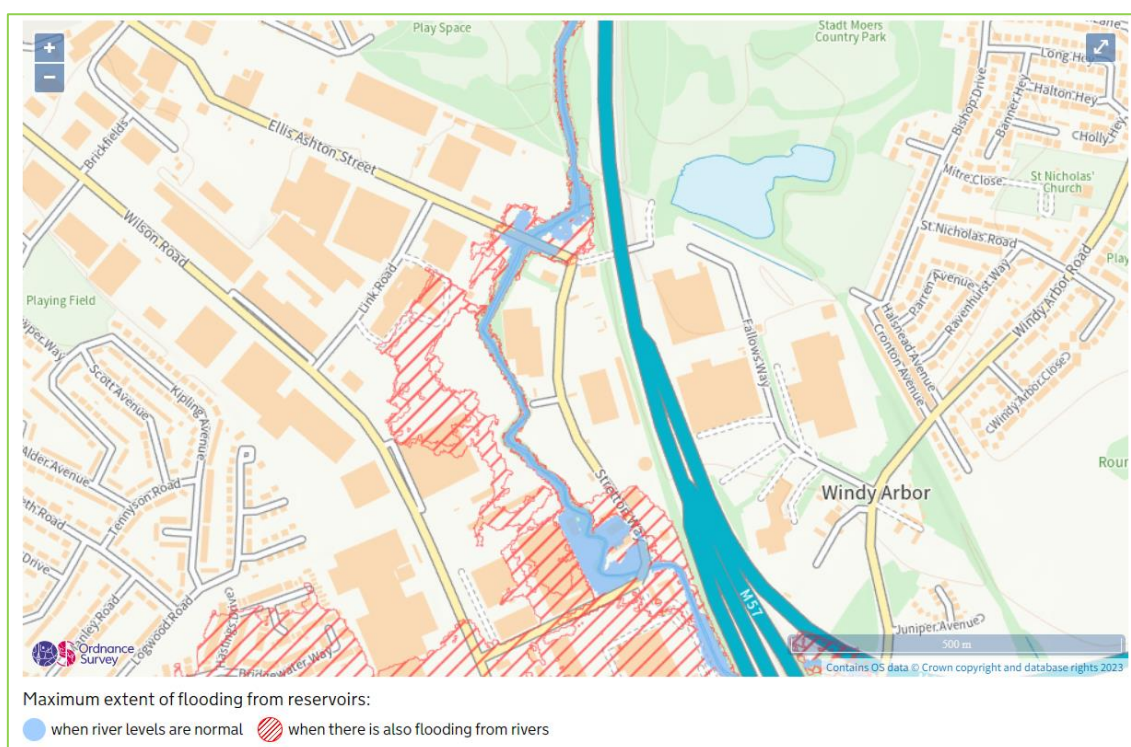


Figure 4 - Environment Agency Reservoir Flood Map

3.14 The Effect of the Development on Flood Risk

The proposed extension will be located outside of the 1 in 100 year (+70%) and 1 in 1000 year flood outlines and within Flood Zone 1. Therefore, this will ensure no detriment to the flood storage capacity of the Site. The Proposed Development will not impede the movement of floodwater across the Site. The topography of the Site will not be altered; therefore, the overland flow routes will not be altered. The overall direction of the movement of water will be maintained within the developed Site and surrounding area. The conveyance routes (flow paths) will not be blocked or obstructed.

In summary, there will no net loss in flood storage capacity or impact on movement of floodwater across the Site as a result of the Proposed Development.

3.15 Summary of Site Specific Flood Risk

A summary of the sources of flooding and a review of the risk posed by each source at the Site is shown in Table 5.

Table 5 - Risk Posed by Flooding Sources

Sources of Flooding	Potential Flood Risk	Potential Source	Probability/Significance
Fluvial Flooding	Yes	Longwood Mill Brook	Low
Tidal Flooding	No	None Reported	None
Groundwater Flooding	No	None Reported	None
Surface Water Flooding	Yes	Low Spots/Drainage Ditch	Low
Sewer Flooding	No	None Reported	None
Flooding from Artificial Drainage Systems/Infrastructure Failure	Yes	Reservoirs	None

The Site is unlikely to flood except in extreme conditions. The primary, but unlikely, flood risk posed to the Site is from fluvial flooding from the Longwood Mill Brook which is located adjacent to the western boundary of the Site however, the Site has no history of flooding. The majority of the Site is located within Flood Zone 1 with only the western boundary of the Site being located within Flood Zone 3.

The existing and proposed use is classified as 'less vulnerable', less vulnerable' uses are appropriate within Flood Zones 1 and 3 after completion of a satisfactory FRA. It should be noted that the proposed extension to the existing industrial unit is to be located in Flood Zone 1.

By comparing the Environment Agency modelling to the Site ground levels it has been shown that the Site will be flood free up to and including the 1 in 100 year event. However, the proposed extension to the existing industrial unit, where ground levels are higher at 26.44mAOD, will be flood free for all events up to and including the 1 in 100 year (+70%) and 1 in 1000 year events.

To the west of the Site, where the minimum ground level is 25.37mAOD, water depths of 0.01m, 0.21m and 0.26m may be experienced during the 1 in 100 year (+35%), 1 in 100 year (+70%) and 1 in 1000 year events, respectively. This area is located on the very western boundary of the Site within the channel corridor and does not extend substantially into the Site.

Any flooding to the west of the Site, would be of minor nature due to the flows and topography of the area and would not occur at the location of the proposed extension. The flooding would only inundate the area along the western boundary to a relatively low water depth and water velocity, will only last a short period of time, in very extreme cases.

Given the scale and nature of the Proposed Development and the size and location of the fluvial the fluvial flooding sources it has been concluded that fluvial flooding poses a low risk to the Site and the risk of fluvial flooding is considered to be of **low significance**. A secondary flooding source has been identified which may pose a **low significant** risk to the Site. This is:

- Surface Water Flooding

The areas shown to be at risk of surface water flooding are associated with low spots on the Site and the drainage ditch to the north of the Site.

The flood risk at the Site, will be further managed and mitigated by using a number of property level protection measures to manage and reduce the overall flood risk at the Site (see Section 5.0).

The proposed extension will be located outside of the 1 in 100 year (+70%) and 1 in 1000 year flood outlines and within Flood Zone 1. Therefore, this will ensure no detriment to the flood storage capacity of the Site. The Proposed Development will have no impact on the movement of floodwater across the Site.

This will ensure no detriment to the flood storage capacity of the Site. The overall direction of the movement of water will be maintained within the developed Site and surrounding area. The conveyance routes (flow paths) will not be blocked or obstructed. There will be no increase in the floodwater levels due to the Proposed Development. There will be no loss in flood storage capacity and no change in the on-site and off-site flood risk.

4.0 SURFACE WATER DRAINAGE

4.1 Surface Water Management Overview

It is recognised that consideration of flood issues should not be confined to the floodplain. The alteration of natural surface water flow patterns through developments can lead to problems elsewhere in the catchment, particularly flooding downstream. For example, replacing vegetated areas with roofs, roads and other paved areas can increase both the total and the peak flow of surface water runoff from the Site. Changes of land use on previously developed land can also have significant downstream impacts where the existing drainage system may not have sufficient capacity for the additional drainage.

An assessment of the surface water runoff rates has been undertaken, in order to determine the surface water options and attenuation requirements for the Site. The assessment considers the impact of the proposals compared to current conditions. Therefore, the surface water attenuation requirement for the developed Site can be determined and reviewed against existing arrangements.

The surface water drainage arrangements for any development Site should be such that the volumes and peak flow rates of surface water leaving a developed Site are no greater than the rates prior to the Proposed Development unless specific off-site arrangements are made and result in the same net effect.

4.2 Surface Water Runoff

It is understood that the existing surface water drainage infrastructure at the Site efficiently and effectively manages surface water runoff generated at the Site. The amount of impermeable surfaces will not change post-application compared to pre-application. The surface water runoff will not increase post-application compared to pre-application and there will be no increase in surface water flood risk to the Site and off-site locations.

5.0 RISK MANAGEMENT

5.1 Introduction

The flood risk at this location is considered suitable for ‘less vulnerable’ developments within the NPPF. In this flood zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development and the use of flood mitigation measures.

The flooding sources will be mitigated on the Site by using a number of techniques, and mitigation strategies to manage and reduce the overall flood risk at the Site. This will ensure the development will be safe and there is:

- Minimal risk to life;
- Minimal disruption to people living and working in the area;
- Minimal potential damage to property;
- Minimal impact of the Proposed Development on flood risk generally; and;
- Minimal disruption to natural heritage.

The flood risk at the Site will be reduced by mitigation measures; these are discussed in more detail below.

5.2 Finished Floor Level

The finished floor levels of the extension will be set no lower than the existing floor levels of the current industrial unit. It is recognised however that owing to limited headroom constraints, massing, planning policy and Building Regulations it is considered impractical to raise the finished floor levels further. Furthermore, the proposed building is ancillary infrastructure to the existing use of the Site and buildings on the Site and will therefore, need to have the same finished floor level as the existing Site and adjacent buildings.

5.3 Flood Resistance

Flood risk can be mitigated through the design of the building. Flood resistance measures are measures that help resist floodwaters entering a property (airbrick covers are an example of a flood resistance measure). Flood resistant measures will be used, including:

- The walls of the buildings will be thick.
- Sealant will be used around all external doors and windows.
- All windows will be located above the ground levels.
- All external doors and windows are constructed from hard wearing materials.

These factors will prevent water entering the property and make the property more resistant to seepage.

5.4 Flood Resilience

Flood resilience measures are designed in such a way as to reduce the cost and time required to reinstate the property should it be flooded (tiled floors are an example of a flood resilience measure). Robust materials and finishes will be used, including:

- all electrics wiring, switches, sockets, socket outlets etc. are to be located a minimum of 450mm above the finished floor level; and

5.5 Safe Access and Egress Route

The NPPF requires that, where required, safe access and escape is available to/from new developments in flood risk areas. Access routes should be such that occupants can safely access and exit their houses in design flood conditions. These routes must also provide the emergency services with access to the development during a flood event and enable flood defence authorities to carry out any necessary duties during the period of flood.

A safe access and egress route, including emergency access can be maintained for vehicles and/or by foot via the Site access and Stretton Way.

5.6 Residual Risk

The mitigation measures detailed above show that the flood risk can be effectively managed and therefore the consequences of flooding are acceptable. As such, the residual risk is considered to be acceptable for the lifetime of the development.

6.0 SEQUENTIAL APPROACH

6.1 Sequential and Test

The risk-based Sequential Test in accordance with the NPPF aims to steer new development to areas at the lowest probability of flooding (i.e. Flood Zone 1). However, where an individual proposes to develop a site in an existing flood risk area the consideration of alternative sites is not likely to be a realistic option. The planning applicant should state why there is no alternative available to them to develop.

It is impractical to suggest that there are more suitable locations for this development elsewhere. The cost of buying a similar site and the cost to construct a similar development would make it uneconomical. The Proposed Development is for the erection of an extension to an existing industrial unit. The Site proposals cannot be located in another site elsewhere they have to be located at this Site which has existing facilities and is ancillary to the existing use of the Site.

Furthermore, the Council's objectives are to sustain and enhance the vitality and viability of the region, and to ensure a wide range of homes to which people have easy access by a range of transport therefore, improving the overall quality of life. This is underpinned by the quality of the physical environment, social well-being, and economic and environmental improvements. The Council seeks to grant permission for developments that add to the vitality and viability of the region.

This Site will help to regenerate the region and will help to deliver these objectives. This Site will help encourage economic impetus that will in turn help deliver a stronger service function and mix of employment uses.

The Site proposals remain consistent with the relevant planning policies and are not at odds with the current use of the Site and can only enhance and preserve the employment base which currently exists. The Site is situated within a long established employment area as identified within the Local Plan.

The application is for a new, suitable flood-resilient design. The exposure of people and property will be minimised. The existing and Proposed Development is classified as 'less vulnerable', 'less vulnerable' uses are appropriate within Flood Zones 1 and 3 after the completion of a satisfactory FRA. Furthermore, the Proposed Development is for a 'less vulnerable' use linked to the existing business on the Site.

Furthermore, the sequential approach has been applied within the Site by locating the most vulnerable elements of the development in the lowest risk areas. The most vulnerable use, the proposed extension will be situated at a lower risk of flooding being wholly located in Flood Zone 1. From the above it is shown that there are overriding sustainability reasons for the development to be granted planning permission within Flood Zone 3. The development proposals should therefore be considered by the LPA to satisfy the Sequential Test as set out in the NPPF.

6.2 Exception Test

Applications for 'less vulnerable' uses located within Flood Zone 3 are not subject to the Exception Test as confirmed within Table 2 of this report and Table 3 of the Planning Practice Guidance to the NPPF. Therefore, the Exception Test will not need to be undertaken as part of this planning application.

7.0 SUMMARY AND CONCLUSIONS

7.1 Introduction

This report presents a FRA in accordance with the NPPF for the Proposed Development at 10 Stretton Way, Huyton, Liverpool, L36 6JF.

This FRA identifies and assesses the risks of all forms of flooding to and from the development and demonstrates how these flood risks will be managed so that the development remains safe throughout the lifetime, taking climate change into account.

7.2 Flood Risk

The Site is unlikely to flood except in extreme conditions. The primary, but unlikely, flood risk posed to the Site is from fluvial flooding from the Longwood Mill Brook which is located adjacent to the western boundary of the Site however, the Site has no history of flooding. The majority of the Site is located within Flood Zone 1 with only the western boundary of the Site being located within Flood Zone 3.

The existing and proposed use is classified as 'less vulnerable', less vulnerable' uses are appropriate within Flood Zones 1 and 3 after completion of a satisfactory FRA. It should be noted that the proposed extension to the existing industrial unit is to be located in Flood Zone 1.

By comparing the Environment Agency modelling to the Site ground levels it has been shown that the Site will be flood free up to and including the 1 in 100 year event. However, the proposed extension to the existing industrial unit, where ground levels are higher at 26.44mAOD, will be flood free for all events up to and including the 1 in 100 year (+70%) and 1 in 1000 year events.

To the west of the Site, where the minimum ground level is 25.37mAOD, water depths of 0.01m, 0.21m and 0.26m may be experienced during the 1 in 100 year (+35%), 1 in 100 year (+70%) and 1 in 1000 year events, respectively. This area is located on the very western boundary of the Site within the channel corridor and does not extend substantially into the Site.

Any flooding to the west of the Site, would be of minor nature due to the flows and topography of the area and would not occur at the location of the proposed extension. The flooding would only inundate the area along the western boundary to a relatively low water depth and water velocity, will only last a short period of time, in very extreme cases.

Given the scale and nature of the Proposed Development and the size and location of the fluvial the fluvial flooding sources it has been concluded that fluvial flooding poses a low risk to the Site and the risk of fluvial flooding is considered to be of **low significance**. A secondary flooding source has been identified which may pose a **low significant** risk to the Site. This is:

- Surface Water Flooding

The areas shown to be at risk of surface water flooding are associated with low spots on the Site and the drainage ditch to the north of the Site.

The flood risk at the Site, will be further managed and mitigated by using a number of property level protection measures to manage and reduce the overall flood risk at the Site.

The proposed extension will be located outside of the 1 in 100 year (+70%) and 1 in 1000 year flood outlines and within Flood Zone 1. Therefore, this will ensure no detriment to the flood storage capacity of the Site. The Proposed Development will have no impact on the movement of floodwater across the Site.

This will ensure no detriment to the flood storage capacity of the Site. The overall direction of the movement of water will be maintained within the developed Site and surrounding area. The conveyance routes (flow paths) will not be blocked or obstructed. There will be no increase in the floodwater levels due to the Proposed Development. There will be no loss in flood storage capacity and no change in the on-site and off-site flood risk.

7.3 Surface Water Drainage

It is understood that the existing surface water drainage infrastructure at the Site efficiently and effectively manages surface water runoff generated at the Site. The amount of impermeable surfaces will not change post-application compared to pre-application. The surface water runoff will not increase post-application compared to pre-application and there will be no increase in surface water flood risk to the Site and off-site locations.

7.4 Risk Management

The flood risk at the Site will be reduced by using a number of risk management measures to manage and reduce the overall flood risk at the Site. Measures used:

Finished Floor Level: The finished floor levels of the extension will be set no lower than the existing floor levels of the current industrial unit. It is recognised however that owing to limited headroom constraints, massing, planning policy and Building Regulations it is considered impractical to raise the finished floor levels further. Furthermore, the proposed building is ancillary infrastructure to the existing use of the Site and buildings on the Site and will therefore, need to have the same finished floor level as the existing Site and adjacent buildings.

Flood Resistance: Flood risk can be mitigated through the design of the building. Flood resistance measures are measures that help resist floodwaters entering a property (airbrick covers are an example of a flood resistance measure). Flood resistant measures will be used, including:

- The walls of the buildings will be thick.
- Sealant will be used around all external doors and windows.
- All windows will be located above the ground levels.
- All external doors and windows are constructed from hard wearing materials.

These factors will prevent water entering the property and make the property more resistant to seepage.

Flood Resilience: Robust materials and finishes will be used, including:

- all electrics wiring, switches, sockets, socket outlets etc. are to be located a minimum of 450mm above the finished floor level; and

Safe Access and Egress Route: A safe access and egress route, including emergency access can be maintained for vehicles and/or by foot via the Site access and Stretton Way.

7.5 Sequential Approach

The development proposals should be considered by the LPA to satisfy the Sequential and Exception Tests as set out in the NPPF.

7.6 Conclusion

In conclusion, the Proposed Development, would be expected to remain dry in all but the most extreme conditions. Providing the recommendations made in this FRA are instigated, flood risk from all sources would be minimised, the consequences of flooding are acceptable and the development would be in accordance with the requirements of the NPPF.

This FRA demonstrates that the Proposed Development would be operated with minimal risk from flooding, would not increase flood risk elsewhere and is compliant with the requirements of the NPPF. The development should not therefore be precluded on the grounds of flood risk.

APPENDICES

APPENDIX 1 – Existing and Proposed Site Layout

APPENDIX 2 – Environment Agency Data

