Transpennine Route Upgrade
Flint Street Compound Hub

Flood Risk Assessment

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1. INTRODUCTION

1.1. Purpose of the Report

1.1.1. This report summarises the assessment of flood risk for a proposed development at Flint Street, and where necessary provides an appraisal of possible mitigation measures to reduce the flood risks to acceptable levels. The following tasks have been undertaken.

- A review of existing data and information.
- An assessment of the flood risks to the site, and the possible flood risks which could occur as a result of the proposed development.
- Where necessary, an assessment of the proposed measures to reduce the flood risk to acceptable levels.

1.2. Background

1.2.1. This study has been carried out in accordance with the National Planning Policy Framework (NPPF)[1]. As part of the planning process, the NPPF requires a flood risk assessment (FRA) from proposed developments that are:

- Within Flood Zones 2 or 3 including minor development and change of use.
- More than 1 hectare (ha) in Flood zone 1.
- Less than 1 ha in Flood zone 1 with a change of use in development type to a more vulnerable class (for example, from commercial to residential), where the development could be affected by sources of flooding other than rivers and the sea (for example, surface water drains or reservoirs).
- In Flood zone 1 with critical drainage problems as notified by the EA.

1.2.2. The Environment Agency (EA) Flood Maps[2] have been reviewed and show that the proposed development Site lies within Flood zone 2, therefore an FRA is required.

1.2.3. The broad aim of the NPPF is to reduce the number of people and properties within the natural and built environment at risk of flooding. To achieve this aim, planning authorities are required to ensure that flood risk is properly assessed during the initial planning stages of any development.

1.2.4. Responsibility for this assessment lies with developers and they must demonstrate the following:

- Whether the proposed Development is likely to be affected by flooding.
- Whether the proposed Development will increase flood risk to adjacent properties.
- That the measures proposed to deal with any flood risk are sustainable.

1.2.5. The developer must demonstrate to the Local Planning Authority and the EA that the existing flood risk or the flood risk associated with the proposed development can be satisfactorily

[1] Technical Guidance to the National Planning Policy Framework
[2] Environment Agency Flood Map for Planning

managed.

1.3. Environment Agency Requirement

1.3.1. The detail and complexity of an FRA should reflect the level of risk to the proposed development. Guidance is available on the EA's website[3]. The guidance is based on the requirements for different development scenarios, based on the size of the development and the location within the floodplain. The proposed development is within Flood Zone 2, indicating a medium risk of fluvial flooding to the development site. The FRA should therefore contain:

- A location plan and a site plan. The site plan should show the existing site, development proposals and identify any structures which may affect local hydraulics.
- Surveys showing existing and proposed site levels.
- Consideration of whether the site falls within the functional floodplain.
- Details of any flood alleviation measures in place.
- Information on all potential sources of flooding and the impact of flooding on the site
- An assessment of how users of the development can avoid exposure to flooding in and around the development, including whether safe access and exit can be provided for routine and emergency access under both frequent and extreme flood conditions.
- An assessment of how the layout and form of development can be used to reduce or minimise flood risk.
- An assessment of the capacity of any drains or sewers, existing or proposed, on the site during various flood events.
- An assessment of the volume of surface water run-off likely to be generated from the proposed development, and proposals for surface water management according to sustainable drainage principles, with the aim of not increasing, and where practicable, reducing the rate of runoff from the site as a result of the development.
- The likely impact of any displaced water on third parties caused by alterations to ground levels or raising flood embankments.
- The potential impact on rivers or coastal areas, and the likely longer-term stability and sustainability of existing defences.
- The potential impact of climate change (CC) which could affect the probability and intensity of events in the future.
- The remaining (known as residual) risks to the site.
- Consideration of the proposal relative to any existing Strategic Flood Risk Assessment (SFRA) carried out by the local authority.

1.4. Flood Risk

1.4.1. Flood risk includes the statistical probability of an event occurring and the scale of the potential consequences. The risk is estimated from historical data and expressed in terms of the expected frequency (or 'return period') of a flood of a given magnitude. The 10-year, 50-year and the 100-year floods have a respective 10%, 2% and 1% chance of occurring in any given

[3] Environment Agency Flood Risk Assessment GuidanceT

year (this is termed the Annual Exceedance Probability [AEP]); Table 1 provides a summary of the relevant AEP and corresponding return periods.

1.4.2. However, over a longer period, the probability of flooding is considerably greater. For example, for the 100-year return period flood:

1. There is a 1% chance of the 100-year flood occurring or being exceeded in any year.
2. A 26% chance of it occurring or being exceeded in a 30-year period.
3. A 51% chance of it occurring or being exceeded in a 70-year period.

Table 1 – Outline of AEP and Corresponding Return Period of Flood Events

AEP (%)	Return Period (Years)
50%	2
10%	10
5%	20
4%	25
2%	50
`1%	100
0.5%	200
0.1%	1,000

2. SITE AND PROPOSED DEVELOPMENT DESCIPTION

2.1. Existing Site

2.1.1. The Site is located at grid reference SE 14686 18261 as is shown in the site location plan in Figure 1. It borders Alder Street to the east, Kirklees Council buildings to the south, restaurants and residential properties to its west, and a footpath bordered with trees north and northwest. The Site is also <400m from Huddersfield Broad Canal and <950m from River Colne.

2.1.2. The site is located west of the existing TRU Hillhouse compound. The site is currently owned by Kirklees Council and was previously used for car parking and office buildings. The site is currently providing temporary car parking provision for the TRU scheme.

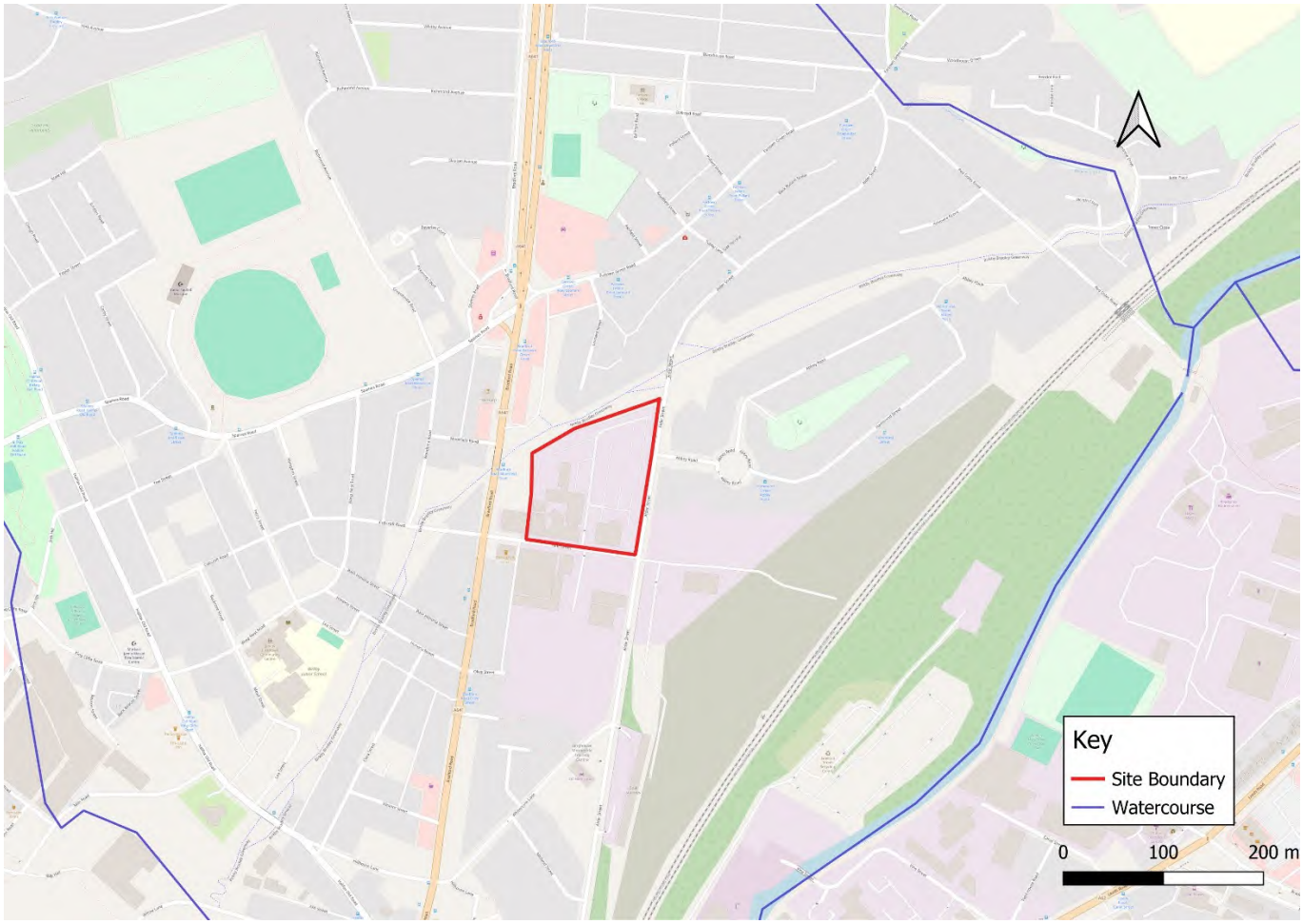

Figure 1 -Site Location

2.2. Proposed Development

2.2.1. The proposals seek to provide a new compound hub facility to support the upgrading of the TransPennine line between Huddersfield and Westtown. The site will be accessed via the existing access point off of Flint Street.

2.2.2. The proposals for this compound are as follows:

- Retention of existing asphalt surfacing
- Minor resurfacing of the car park area where required using compacted aggregates MOT Type 1 – 2, (Ministry of Transport standard stable sub-base for road surfaces and pathways;
- Provision of 200 parking spaces including 12 disabled bays, and larger vehicle bays (parking for site staff and staff working on wide TRU upgrade scheme);
- Installation of 50 electric vehicle (EV) charging points;
- Installation of LED lighting across site;
- Utility connections for power, water and sewage; and
- Construction and use of single tier modular building (provides 80 desk office and 150 person multipurpose briefing/induction room.

2.2.3. In terms of site drainage, all facilities using a water supply/toilet will be connected to the main sewer and rainwater fall will be directed towards the existing drainage system.

2.3. Topography

2.3.1. Figure 2 shows the that the proposed development site is situated on a flat topographic terrain.

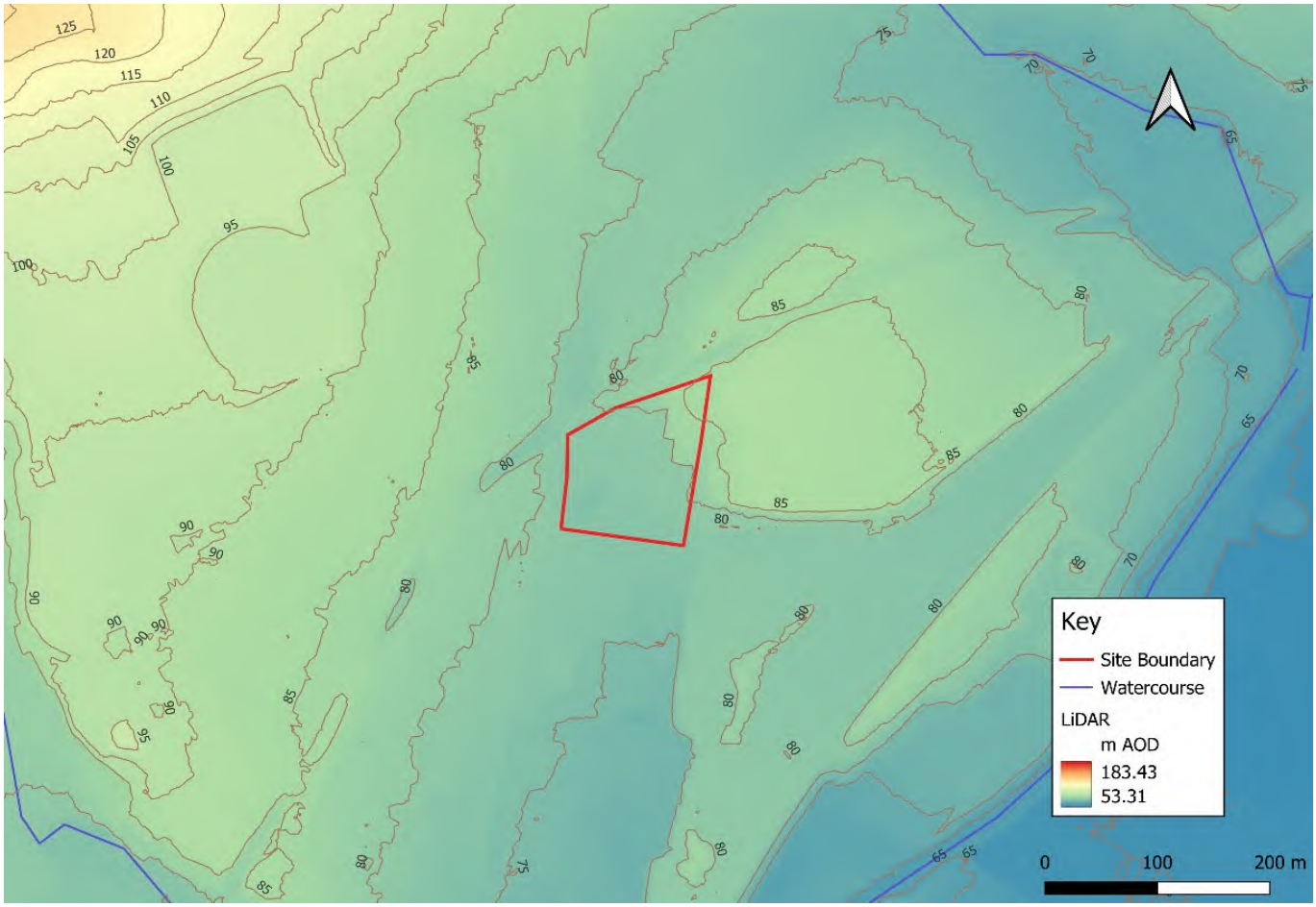

Figure 2 - Topographic Terrain of the Proposed Development Site[4]

[4] DefraSurvey Data Download

2.4. Geology

2.4.1. The Site is underlain by bedrock geology of Pennine Lower Coal Measures Formation. The British Geological Survey (BGS) describes the lithology as “interbedded grey mudstone, siltstone and pale grey sandstone, commonly with mudstones containing marine fossils in the lower part, and more numerous and thicker coal seams in the upper part”. There was no recording of the superficial geology of the site.

3. EXISTING DATA AND INFORMATION

3.1. Kirklees Local Flood Risk Management Strategy (LFRMS)

3.1.1. Kirklees is a large district council in West Yorkshire with an area that is 40% urbanised and 60% rural in character, most of which lies in the Pennine hills. It has 27 large reservoirs in the Pennines operated by Yorkshire Water, and the main rivers in this district are Rivers Colne and Calder which flow to River Aire, draining 85% of the area, and River Dearne flowing to River Don, draining the rest of the area.

3.1.2. Due to sources of flooding identified in the LFRMS such as groundwater and sewer, and Kirklees combination of rural and urban areas, it is said to have a relatively high level of flood risk compared to similarly sized authorities. Additionally, flood risk is projected to increase because of climate change and pressures from new development. Hence, the importance of Kirklees LFRMS objectives which have been listed below:

- Improve the level of understanding of local flood risk within the LLFA.
- Improve the level of understanding of local flood risk amongst partners and stakeholders.
- Ensure that local communities understand their responsibilities in relation to local flood risk management.
- Maximise the benefits from partnership working with flood risk partners and our stakeholders.
- Actively manage flood risk associated with new development proposals.
- Take a sustainable approach to flood risk management (FRM); balancing economic, environmental and social benefits from policies and programmes.
- Improve and/or maintain the capacity of existing drainage systems by targeted maintenance.
- Encourage proactive, responsible maintenance of privately-owned flood defence and drainage assets.
- Influence planning policies and land allocations in Local Plans to take account of flood risk.
- Maximise opportunities to reduce surface water run-off from the upper catchments.
- Identify projects and programmes which are affordable, maximising capital funding from external sources.
- Ensure local FRM knowledge is aligned with the Councils emergency planning procedures.

3.1.3. These objectives were constructed to reflect the communities' aspirations and priorities, holding affordability and achievability at the forefront.

3.1.4. Kirklees has experienced relatively minor community-wide flooding. Nonetheless, several flooding events have occurred, resulting in damage to properties and infrastructure. Some of these flood events occurred in the summers of 2002 (Holmfirth), 2004 (Milnsbridge, Ravensthorpe), and 2007 (Multiple locations). It should be noted that a post-analysis of the 2007 flooding in the Yorkshire region by the EA indicated that approximately 70% of the flooding in the region was due to surface water rather than fluvial flooding.

3.2. River Calder Catchment Flood Management Plan[5]

3.2.1. The River Calder falls under Humber River Basin District. There are eight distinct sub-areas within the Calder Catchment Flood Management Plan based on physical characteristics, flood sources, and risk levels. These sub-areas will allow the EA and Kirklees LLFA to promote flood risk management approaches, policies, and actions that are most appropriate to deliver the various Government and regional strategies. The most appropriate approach to managing flood risk for each sub-area has been identified and allocated one of the six generic flood risk management policies.

3.2.2. The proposed development site falls into sub-area 6- Colne, Holme and Fenay Beck where flooding comes from River Colne, River Holme, sewers, surface water and Huddersfield Broad Canal. In 2009, it was estimated that 5,278 properties were at risk of flooding with a projected increase to 5,355 in the future.

3.2.3. The vision and preferred flood risk management policy for this sub-area is Policy Option 5 which is for areas of moderate to high flood risk where there is room for further action to reduce flood risk. It is of utmost importance that the ability to improve the condition and function of the upland environment is developed for the purpose of reducing runoff rates and frequency of local floods. This ties in with a key intention to make the rivers part of the urban landscape. This approach is set out to contribute positively towards wider economic, social and environmental benefits and it will be achieved by partnering with relevant organisations.

3.3. Calder Catchment Strategic Flood Risk Assessment (Kirklees Council)

3.3.1. The SFRA[6] indicates that there are inadequate and partial records of historical flood events because of insufficient funding and a failure to recognize the importance of documenting and evaluating such incidents in this borough. Strategic planning for the mitigation of future flood risk has not been copious as understanding of flood mechanisms is limited.

3.3.2. However, the SFRA refers to Kirklees' LFRMS which lists areas at risk from future fluvial and surface flooding in Huddersfield such as Dalton, Aspley, and Leeds Road Corridor; none of which is in close proximity to the Site being assessed. Kirklees Surface Water Management Plan (SWMP)[7] corroborates this using limited information available on areas that suffered flooding in the summer of 2007.

3.4. Environment Agency Flood Map for Planning

3.4.1. The EA Flood Map for Planning[8] published by the EA contains Flood Zones for use in accordance with the NPPF. It is a high-level strategic illustration of the flood risk extent along main rivers. In addition, the flood zone extent illustrated in the Flood Map for Planning does not consider the possible impacts of surface water flood risk, the probability of changing flood risk consequential to climate change, and fluvial or coastal flood defences.

3.4.2. In this case, Flood Zone 2 has a medium probability which is land having an annual probability of river flooding between 1% (1 in 100 years) and 0.1% (1 in 1,000 years). Flood Zone 3 represents a high probability of flooding from rivers with a 1% probability or greater of flooding (100 year) occurring in any given year. The Flood Map of this area in Figure 1 reveals that the

[5] Calder Catchment Flood Management Plan
[6] Calder Catchment Strategic Flood Risk Assessment (SFRA) - Volume II (Kirklees Council)
[7] Kirklees Surface Water Management Plan (SWMP)
[8] Environment Agency Flood Map for Planning

proposed development Site sits in Flood Zone 2.

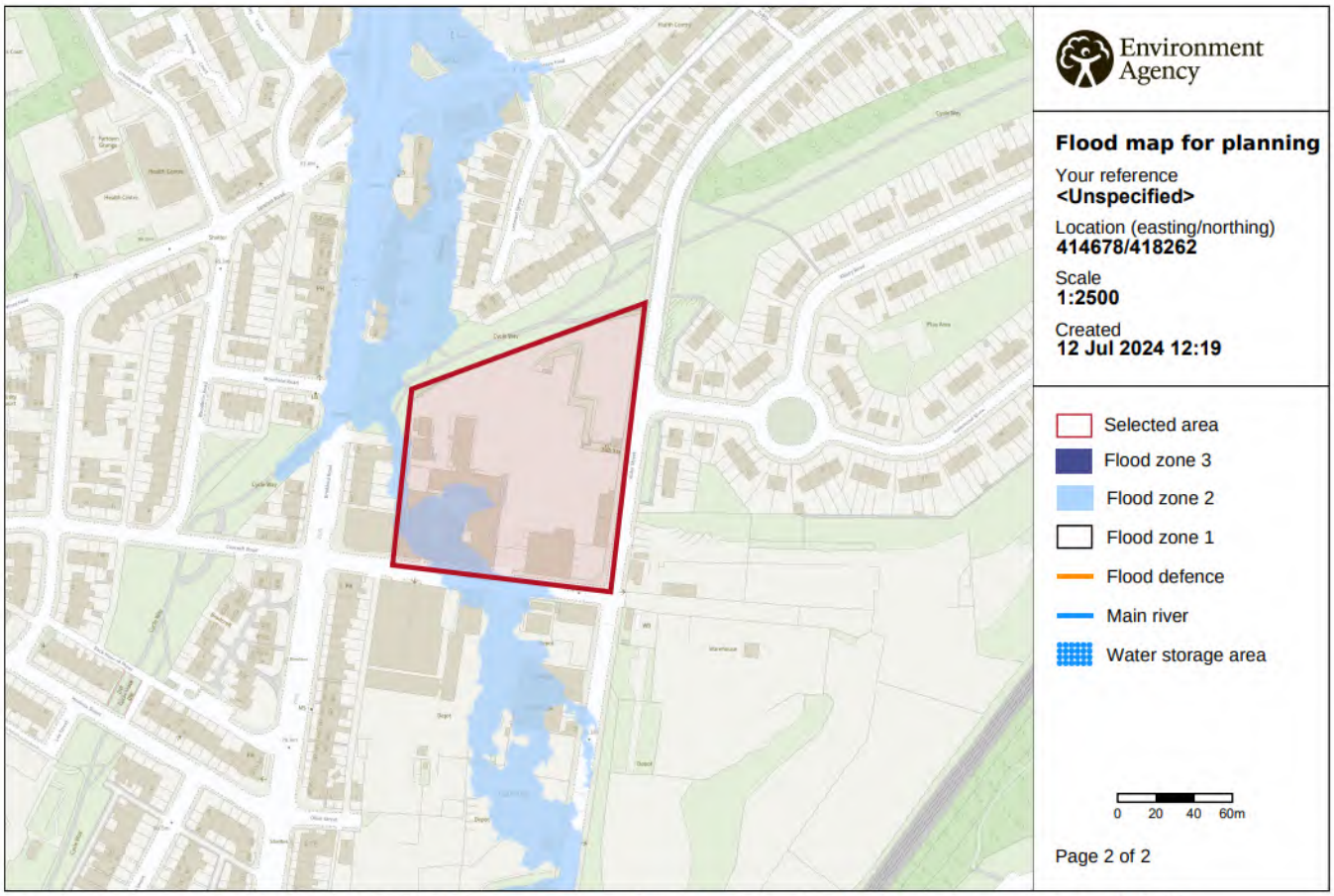

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Figure 1 - Environment Agency Flood Map for Planning

3.5. Surface Water Flood Risk Map

3.5.1. Surface water flooding is the inability of rainwater to drain away through normal drainage systems because of low availability of permeable surfaces to aid the drainage. This phenomenon leads to pooling or flowing of rainwater over impermeable surfaces. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.

3.5.2. 'High' risk of surface water flooding means that this area has a 3.3% chance of flooding each year. 'Medium' risk of surface water flooding means that this area has a chance of flooding of between 1% to 3.3% each year. 'Low' risk of surface water flooding means that this area has a chance of flooding of between 0.1% to 1% each year. 'Very low' risk of surface water flooding means that the area has a chance of flooding of less than 0.1% each year.

3.5.3. The Surface Water Flood Risk map[9] in Figure 2 and Figure 3 shows areas within the Site as

[9] GOV.UK- Check your long term flood risk

being at ‘medium’ to ‘low’ risk of surface water flooding extent.

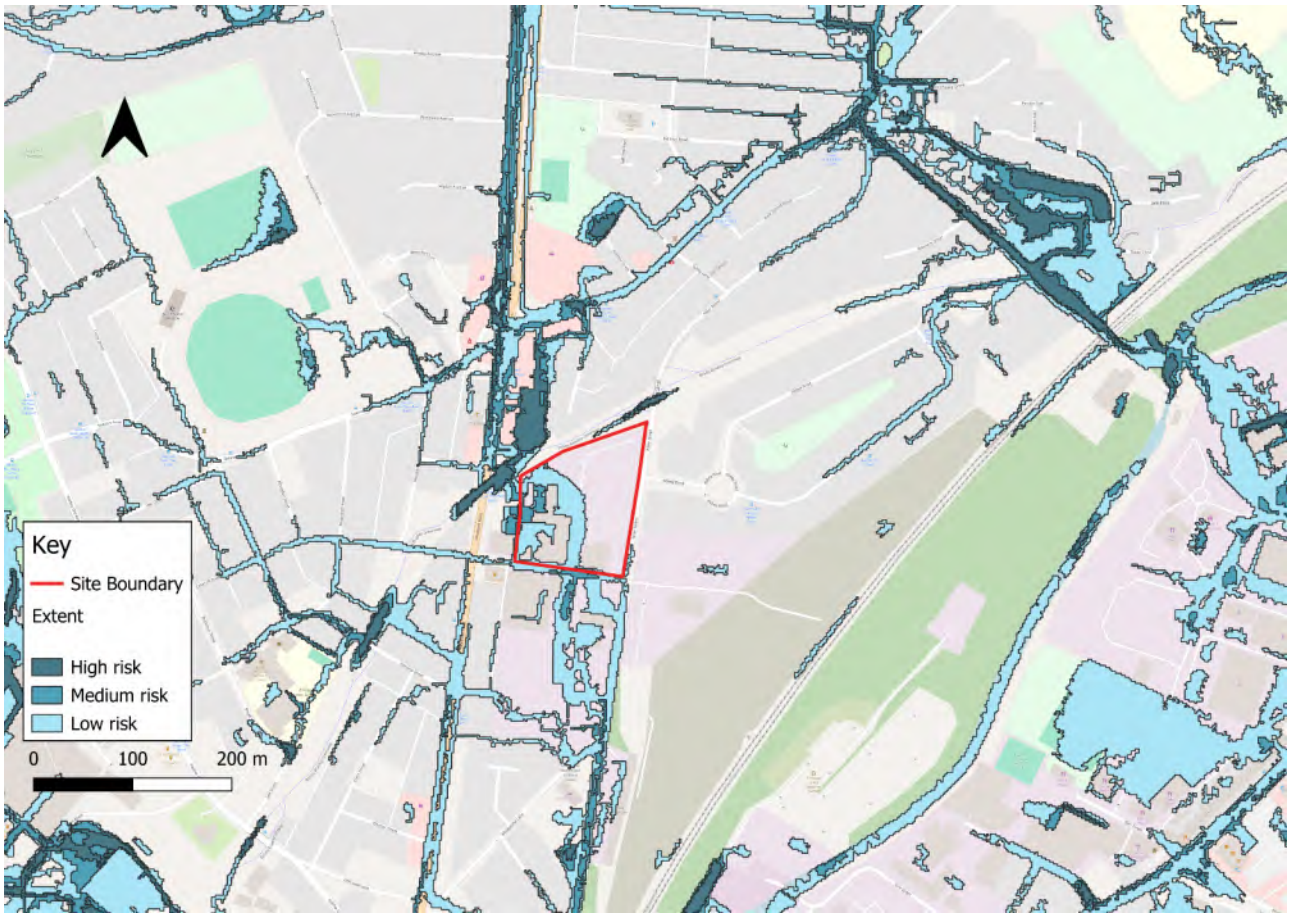


Figure 2 - Surface Water Flood Risk Map

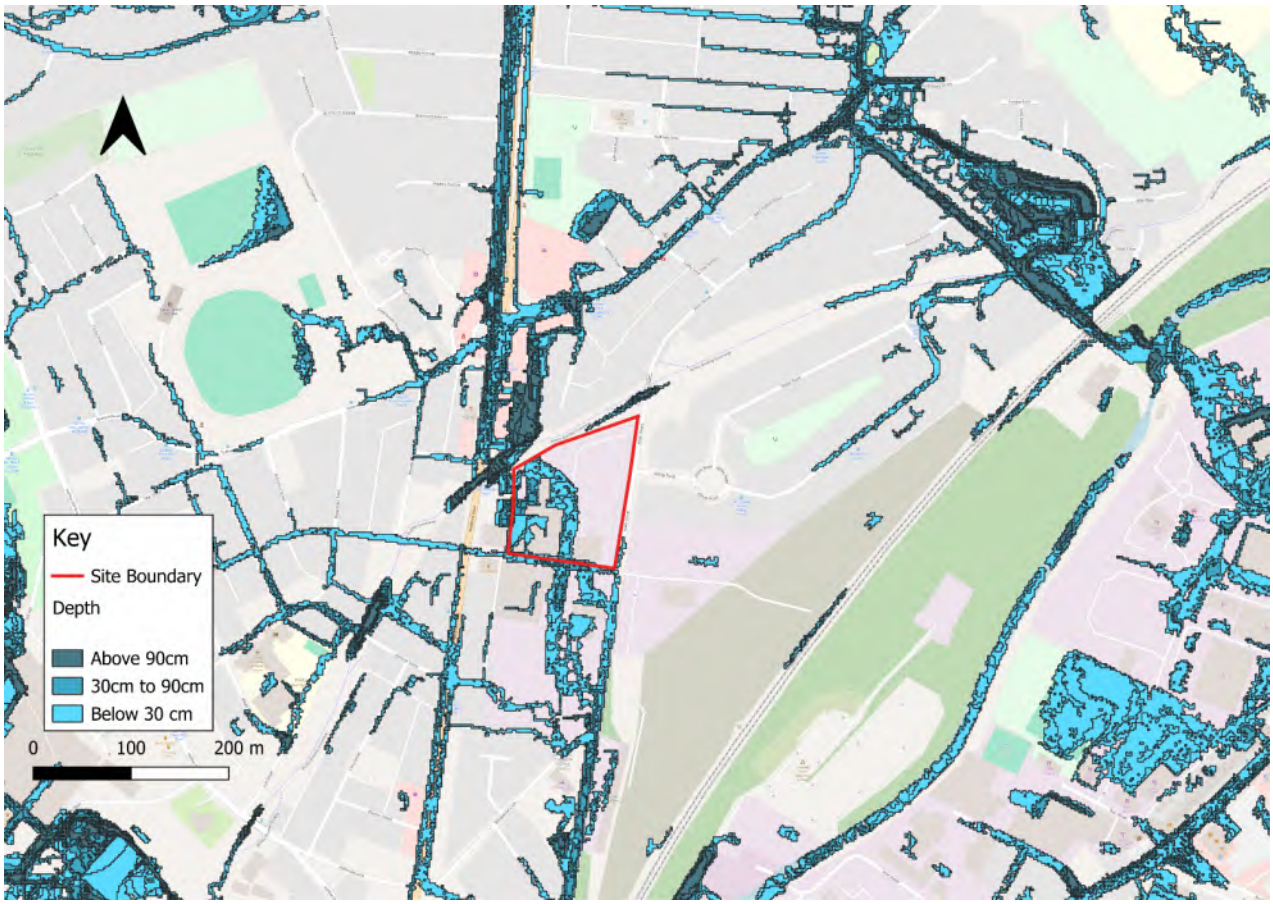


Figure 3 - Low Surface Water Flood Risk Map

3.5.4. The Low Risk Surface Water Flood Depth Risk map in Figure 3 shows that a significant section west of the site at risk of flooding to a depth mostly below 30cm.

3.6. Reservoir Flood Risk Map

3.6.1. The reservoir flood risk map in Figure 4 shows that the Site is not at a risk of flooding in the extremely unlikely event of a dam or reservoir failure.

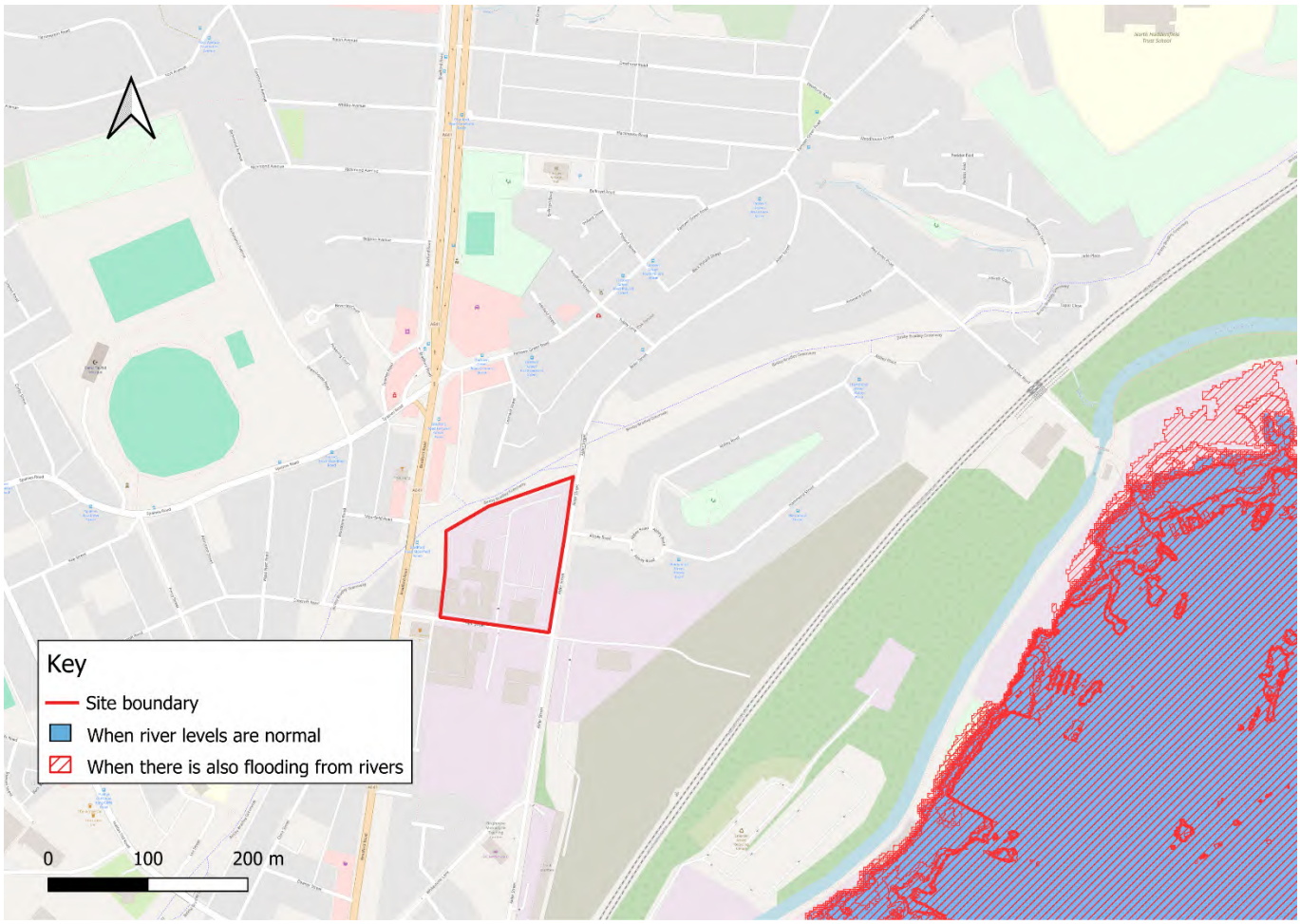


Figure 4 - Reservoir Flood Risk Map

3.7. Canal Flooding

3.7.1. Flooding risk within canals such as overflowing canal banks, bank collapse and blockages depend on different factors, natural and anthropogenic. These risks are managed by the continuous inspection and maintenance of the canals by the relevant authority. The canal network in Kirklees is maintained and owned by the Canal & River Trust. No public record of historic flooding of the canal closest to the Site, Huddersfield Broad Canal, has been found.

3.8. Groundwater Flooding

3.8.1. The SFRA does not state records of groundwater flooding incidents within Kirklees borough area, and flooding from groundwater is unlikely in this area. Nevertheless, it is recognised that the risk of groundwater flooding is by nature highly variable and heavily dependent upon local conditions at any particular time. Given the degree of variability and uncertainty that exists when considering the potential risk of groundwater flooding, it is important to ensure development is not placed at unnecessary risk.

3.9. Historical Flooding

3.9.1. The Historic Flood Map shows areas of land that have previously been flooded. It does not include flooding from surface water, except in areas where there is difficulty in determining if the source is fluvial or surface water, but the prominent source is fluvial.

3.9.2. An area that is not covered by the Historic Flood Map is not an indicator that the area has never been flooded but rather that the records of flooding may not have met the criteria for inclusion. The pattern of flooding in this area may also have been altered naturally and/or anthropogenically hence leading to the area flooding or not flooding under different circumstances. The presence of flood defences, structures and other infrastructure are taken into account in this map. It includes flood extents that may have been affected by overtopping, breaches or blockages. Figure 5 shows that there has been no historic flooding in this Site.

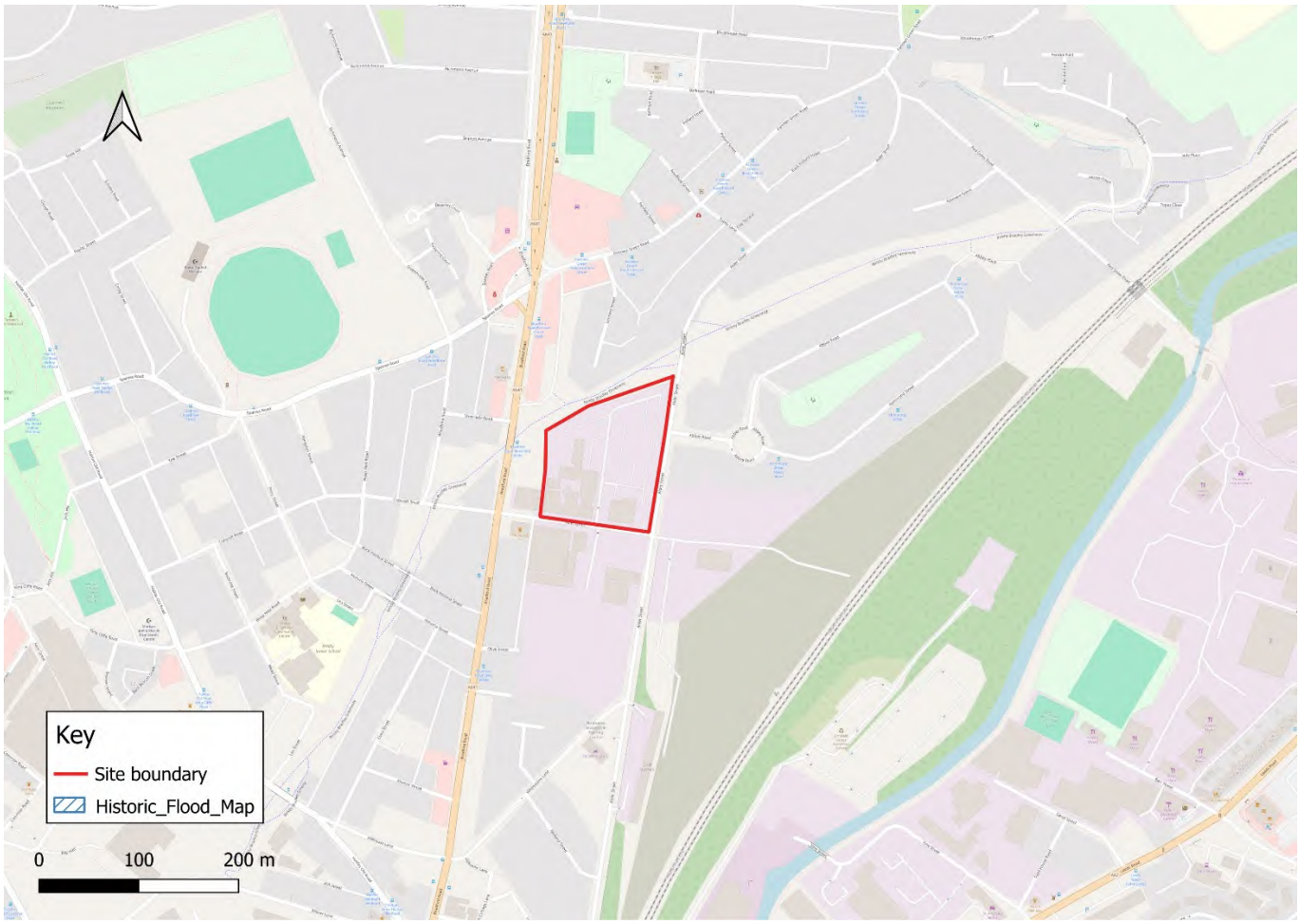


Figure 5 - Historic Flood Map of the Proposed Development Site

3.10. Site Drainage

3.10.1. Artificial drainage systems within or near the Site may present a risk of flooding through the capacity exceedance or the structural, hydraulic, geotechnical, mechanical or operational failure of the system infrastructure or engineering installations. Blockage and structural failure incidents tend to be isolated and unpredictable, which occur due to accumulation in drainage channels, poorly designed and constructed drainage systems, inadequate maintenance,

accidental incidents, and chronic pressures.

3.10.2. If the existing drainage systems are amended or augmented to receive flows from the proposed development Site, the capacity of these systems could be exceeded and thus lead to flooding within the Site.

3.11. Flood Warning

3.11.1. The EA provides 3 types of flood warning in areas at risk of flooding from rivers, the sea, and groundwater where applicable:

- Flood alert- notification of possible flooding.
- Flood warning- notification of expected flooding.
- Severe flood warning- notification that flooding could be a risk to life and significant disruption to communities. This can be issued before, during or after the flood.

3.11.2. Using the latest available technology, staff monitor rainfall and river levels 24 hours a day and use this information to forecast the possibility of flooding.

3.11.3. The proposed site is situated within Yorkshire Flood Warning and Flood Alert area, highlighted in Figure 6, in the geographical area of the River Colne and Fenay Beck catchment.

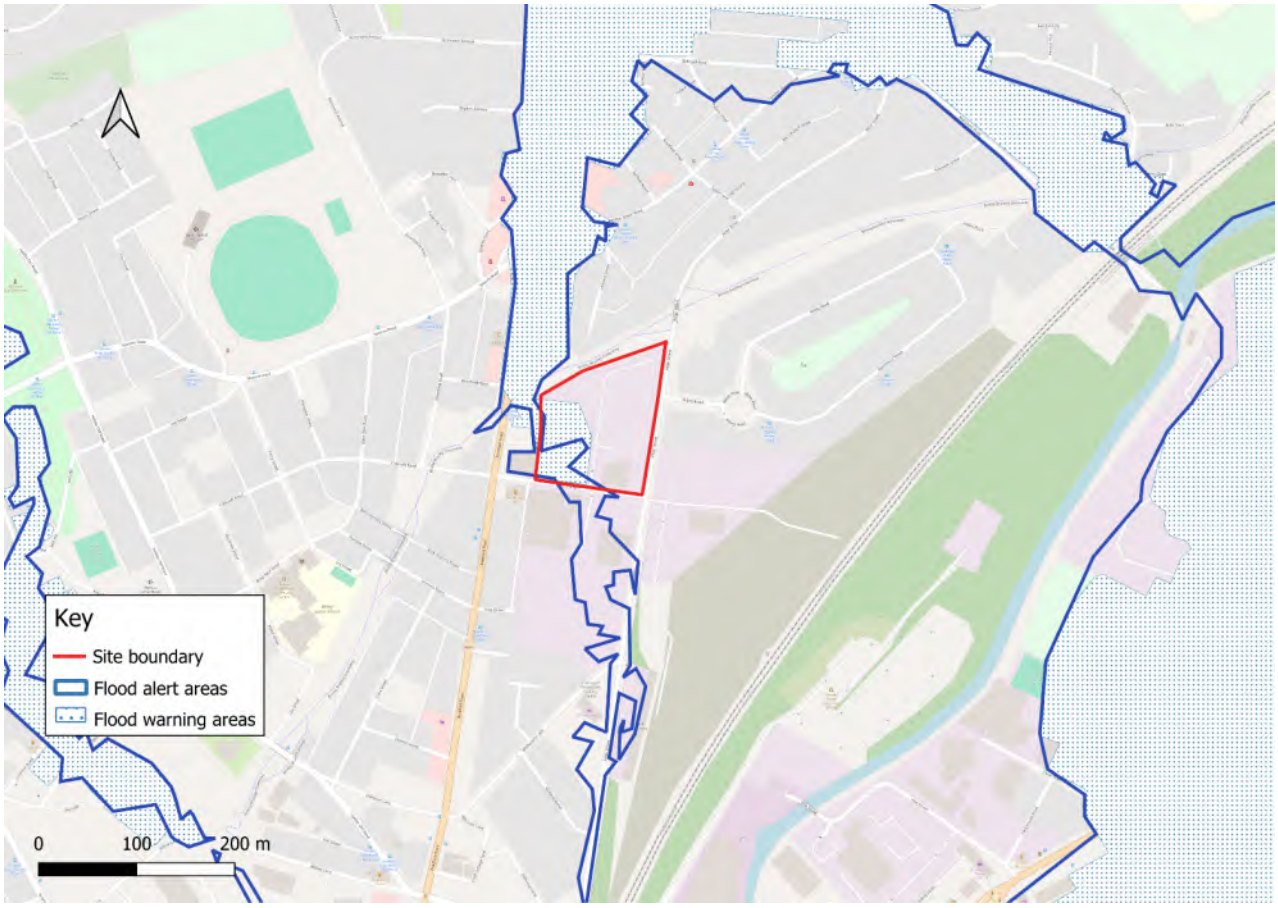


Figure 6 - Flood Alert and Warning Map of Proposed Development Site

4. ASSESSMENT OF FLOOD RISKOverview

4.1.1. This FRA has included the following tasks:

- Identification of the site-specific requirements for an FRA for the development of the site.
- Data collection.
- Assessment of potential risk of flooding to or from the site.
- Requirements for mitigation measures.

4.2. Sources of flood risk

4.2.1. There are several sources of flood risk and flood mechanisms which have been investigated as part of this FRA. The potential sources of flood risk are:

- Fluvial flooding
- Surface water flooding
- Groundwater flooding
- Sewer flooding
- Other sources, e.g., reservoir, canal- Huddersfield Broad Canal

4.3. Fluvial flood risk

4.3.1. Based on the EA Flood Map for Planning, the Site falls within Flood Zone 2 which represents less than 0.1% (1 in 1,000 years) annual probability of flooding from rivers or the Furthermore, based on the Historic Flood Map, the Site has not previously experienced flooding.

4.4. Surface water flood risk

4.4.1. The EA surface water flood risk extent map shows that the Site is at a range of medium to low-risk surface water flooding extent, but the site is predominantly at low risk.

4.4.2. Based on the EA surface water flood maps, past flood events, it can be deduced that high intensity rainfall may result in surface water flows and areas of ponding within the development Site. This may be due to the process of high rainfall intensity exceeding infiltration capacity of the ground, floor levels, the landscape management practices of the surrounding area, or the waterlogging of the ground beneath the Site.

4.5. Groundwater flood risk

4.5.1. There is no recorded incident of groundwater flooding within or in proximity of the Site. Nevertheless, prolonged periods of rainfall in the surrounding catchment can lead to an increase in groundwater levels and contribute to groundwater flooding. It is difficult to confirm the possible extent of groundwater flooding within this area without understanding the local processes and undertaking groundwater monitoring.

4.6. Sewer flood risk

4.6.1. The water company that serves Kirklees district is Yorkshire Water, therefore Yorkshire Water is responsible for the management of the urban drainage system including surface water and foul sewerage. However, the risk of localised flooding associated with the existing sewer system is difficult to pinpoint, as there is limited information on sewer flooding in the Site.

4.6.2. Nevertheless, artificial drainage systems and infrastructure within or in close proximity to the Site may present a risk of flooding through the exceedance of the systems' capacity or the structural, hydraulic, geotechnical, mechanical or operational failure of the system infrastructure. Blockage and structural failure incidents tend to be isolated and unpredictable. Nonetheless, risk from surcharged sewer flooding is considered low although residual risk remains during extreme events and incidents of sewer blockage.

4.7. Climate change

4.7.1. Climate change is expected to have a major influence on future flood risk. Climate models predict that the UK will experience wetter winters, while summers are expected to be drier overall. However, there will be a rise in the occurrence and strength of convective rainfall events, including thunderstorms and this could impact the frequency and severity of surface water flooding.

4.7.2. The EA Flood Map does not currently take account of future climate change. The NPPF advises that the effects of climate change at a regional level are likely to increase rainfall intensities and river peak flows; therefore, these impacts should be considered in the preparation of site specific FRAs.

4.7.3. The EA Climate Change Allowances[10] have been adopted for use in this assessment. As shown in Figure 1 ,the Aire and Calder Management Catchment peak river flow allowances were used for the proposed development, using the 2080s Central 23%, Higher 31%, and Upper 51% climate change allowances.

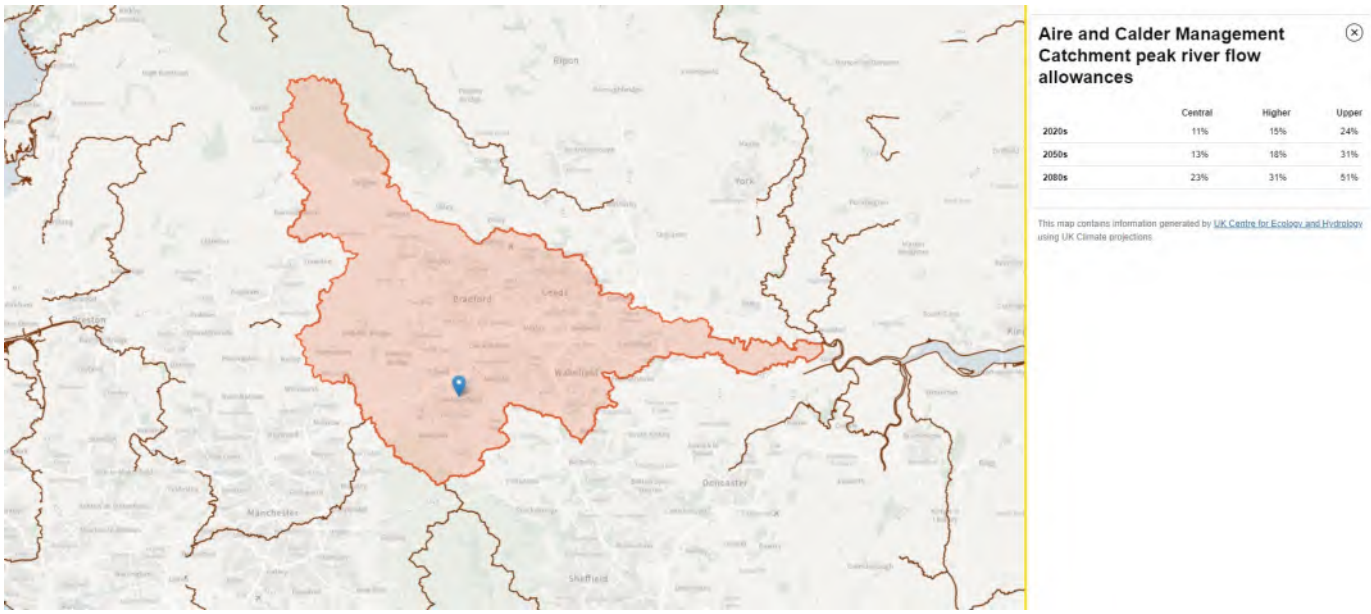


Figure 1 - The Aire and Calder Management Catchment peak river flow allowances

5. MITIGATION OF FLOOD RISK

5.1. Overview

[10] Defra Climate Change Allowances

5.1.1. Section 4 identified the potential flood risks to the Site. This section sets out the principles of how these risks will be mitigated through appropriate design and operation of the Site.

5.2. Fluvial flooding

5.2.1. On the EA Flood Map for Planning, the Site is situated in Flood Zone 2: medium probability of flooding. However, the proposed development is a minor development with no overall change of use. The proposed development is also classed as 'Less vulnerable' and is thus an acceptable development in this flood zone.

5.3. Pluvial / surface water flooding

5.3.1. The NPPF requires that new developments do not exacerbate flood risk by reducing the current flood storage capacity of a site or by increasing the runoff from the site. Any surface water flood risk should be managed by directing overland flow away from the infrastructure and assets, and then contained/conveyed within the proposed development site or a drainage system is appropriately designed to ensure there is no increased off-site overland flow.

5.3.2. It is understood that the proposed development will utilise existing systems with no change in hardstanding or additional surface water runoff from the site. This planning application will be supported with a detailed surface water drainage strategy.

5.4. Flooding form sewers

5.4.1. For the purpose of this assessment, any new surface water runoff collection and conveyance systems to service the Site will be designed and installed in accordance with current guidance and regulations. Therefore, the risks of failure of the onsite drainage systems are not considered significant.

5.5. Flooding from Groundwater

5.5.1. It is difficult to confirm the possible extent or depth of groundwater flooding within the Site area without understanding the local processes and undertaking groundwater monitoring. However, with due consideration of the Site's underlying hydrogeological condition and no recorded incident of groundwater flooding, groundwater flooding is an unlikely source of flood risk to the Site.

5.6. Flooding for other sources

5.6.1. The Site is not at risk of flooding from canals or other artificial sources. The Site is also not at risk of inundation in the unlikely event of a reservoir failure with normal river levels or in wet conditions. No mitigation action is deemed necessary for flood risk from other sources.

6. CONCLUSIONS AND RECOMMENDATION

6.1.1. This FRA assesses the potential flood risk to and from the proposed development site at Flint Street in accordance with the NPPF.

6.1.2. The EA Flood Map for Planning shows that the Site is located in Flood Zone 2; therefore, at medium risk of fluvial flooding.

6.1.3. According to the NPPF, the proposed development is categorised as 'Less vulnerable'. As such, is an acceptable development in this flood zone.

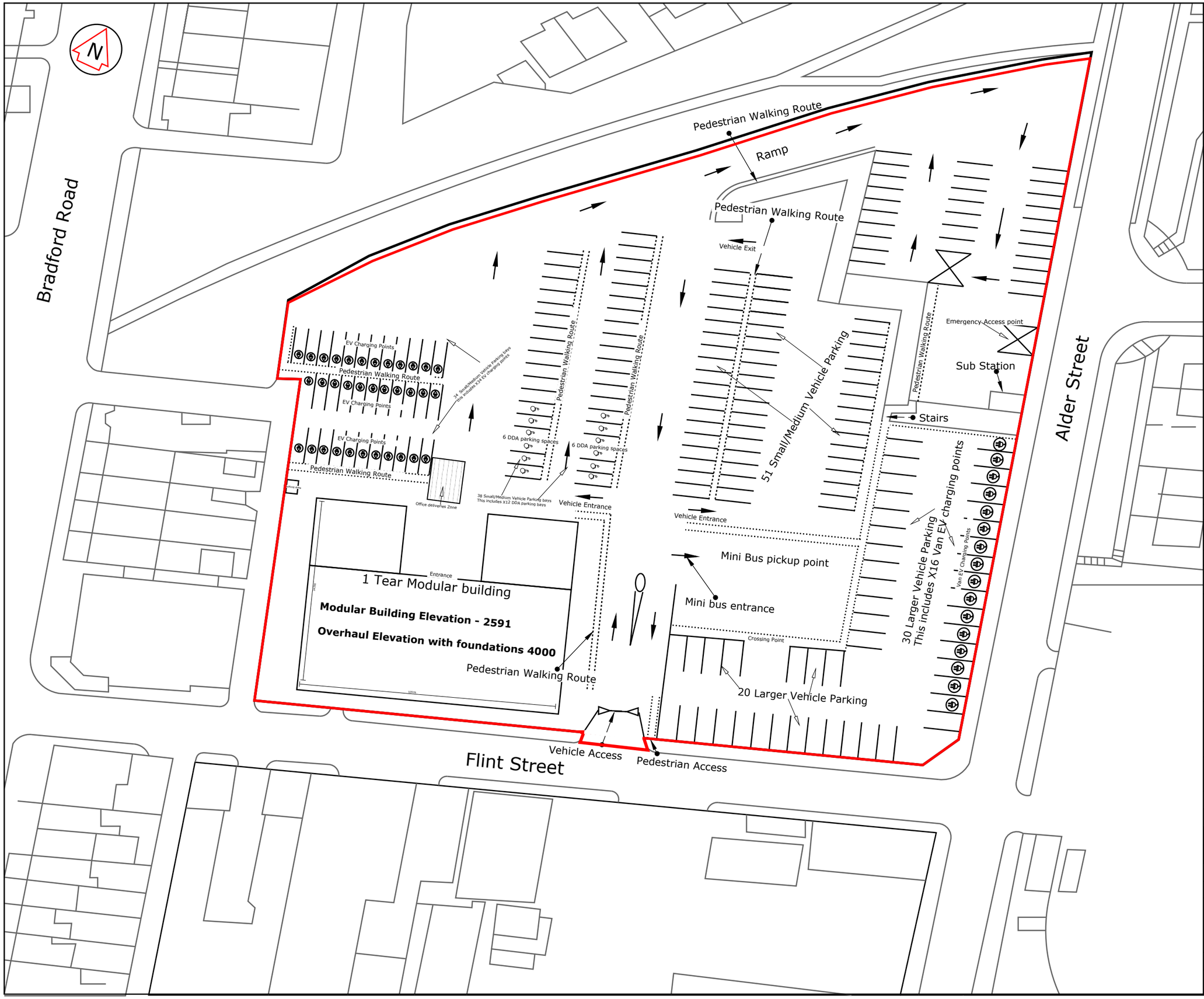
6.1.4. The Site is situated within an area classified as having a medium (1% to 3.3%) to low (0.1% to 1%) risk of surface water flooding extent and below 30cm depth of surface water flooding in 'low' risk scenario.

6.1.5. It is understood that the proposed development will utilise existing systems with no change in hardstanding or additional surface water runoff from the site. This planning application will be supported with a detailed surface water drainage strategy.

6.1.6. A residual risk of flooding from the potential failure of artificial drainage systems within the Site will always remain. Therefore, the proposed development should incorporate features that can mitigate any residual risk of flooding, by providing overland flow paths that are designed to convey flows away from the proposed development Site.

APPENDICES

APPENDIX A – PROPOSED DEVELOPMENT



Legend

- Pedestrian Walking Route
- Traffic Flow
- Proposed Infastructure

Notes

1 - Do not Scale from this drawing.

2 - This drawing is the proposed layout for the Flint Street TRU Hub.

3 - Before construction layout may change.

4 - Any changes to this drawing must be authorised by the TRU W3 PC Lead

5- Elevation:
Modular building 2591
Overhaul elevation with foundations 4000

6 - Modular dimensions, 32979 by 24250

Rev	Date			
FS01.1	29/12/24	First Issue	LW	
FS01.2	14/01/25	Second Issue	LW	
FS01.3	15/01/25	Third Issue	LW	

Status

TRANSPENNINE ROUTE UPGRADE

Location
Flint Street, Huddersfield

Drawing Title
Planning Drawing
Flint Street, TRU Hub

Contract Title
West of Leeds

Reference **W4/VB/001**

Designed	Lee Woods	Date 29/12/24
Drawn	Lee Woods	Date 29/12/24
Checked		Date
Approved		Date

Scale

Revision **FS01.3**

Network Rail
Waterloo General Offices
London
SE1 8SW
www.networkrail.co.uk