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WATERFOLD BUSINESS PARK, BL9 7BQ

FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY

WATERFOLD BUSINESS PARK, BL9 7BQ FLOOD RISK ASSESSMENT

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1. INTRODUCTION

1.1 Appointment and Brief

Ramboll UK Limited (Ramboll) has been commissioned by Tritax Management LLP to undertake a Flood Risk Assessment including a surface water drainage strategy (FRA hereafter) to support planning for the redevelopment of the existing DLP site at Waterfold Business Park, Bury, BL9 7BQ.

1.2 Scope and Objectives

This report considers the risks of various sources of flooding to the site and the consequent change in risk of flooding to downstream receptors (such as people, property, habitats, infrastructure, and statutory sites) from the proposed development as a result of factors such as surface water runoff. A comparison is made between the current situation and the proposed future development.

This FRA has been carried out in accordance with the National Planning Policy Framework (NPPF)¹. It is to be used to assist the Local Planning Authority (LPA) and relevant statutory consultees when considering the flooding issues of the proposed development, as part of a planning application.

The following information is provided herein:

- A review of the flood risk to the site based upon flood data and the flood maps provided by the Environment Agency (EA) and the relevant Strategic Flood Risk Assessment (SFRA);
- An assessment of flood risk from all sources including tidal, fluvial, pluvial, groundwater and infrastructure failure to the proposed development;
- An assessment of the compatibility of the proposed development for its location based on flood risk and its proposed usage;
- Proposals for measures to mitigate the generation of surface water runoff as a result of the proposed development;
- Proposals to mitigate flood risk to the development.

1.3 Ramboll and Climate Change

Ramboll UK Ltd is a Partner for Sustainable Change and, as such, sustainability is central to our assessments and reporting. We have made specific considerations for climate change throughout this report, to ensure that our planning and design advice is supportive of an approach to ensure robust and sustainable societies.

Across every stage of the project lifecycle, Ramboll will endeavour to lead the discussion to incorporate Climate Change as part of the thinking, playing our part in ensuring preparedness in the face of increasing climatic variability.

1.4 General Limitations and Reliance

In preparation of the report and performance of any other services, Ramboll has relied upon publicly available information, information provided by the client and information provided by third parties. Accordingly, the conclusions reached in this report are valid only to the extent that

¹ GOV.UK, National Planning Policy Framework (updated July 2021) <https://www.gov.uk/government/publications/national-planning-policy-framework--2> (accessed August 2023)

the information provided to Ramboll was accurate, complete, and available to Ramboll within the reporting schedule.

The key sources of information used to prepare this report are footnoted within the document. Ramboll is unable to accept liability for the accuracy or otherwise of any information derived from third party sources.

Ramboll's services are not intended as legal advice, nor an exhaustive review of site conditions and/or compliance. This report and accompanying documents are initial and intended solely for the use and benefit of the client for this purpose only and may not be used by or disclosed to, in whole or in part, any other person without the express written consent of Ramboll. Ramboll neither owes nor accepts any duty to any third party, unless formally agreed by Ramboll through that party entering into, at Ramboll's sole discretion, a written reliance agreement.

Unless stated otherwise, the geological information provided is for general environmental interpretation and should not be used for geotechnical and/or design purposes.

2. POLICY FRAMEWORK

2.1 National Policy Framework, 2021

The National Planning Policy Framework and relevant planning practice guidance (NPPF) was most recently updated in July 2021, with flood risk remaining primarily regulated through planning policy². The NPPF requires that an FRA should be submitted with planning applications for all development sites within Flood Zones 2 and 3; and all development sites over 1 hectare (ha) in area to determine the risks of flooding from all sources including rivers, the sea, sewers, and groundwater. The NPPF sets out that flood risk should be defined according to Flood Zone 3 (High Probability), Flood Zone 2 (Medium Probability) and Flood Zone 1 (Low Probability).

In terms of flood risk, the NPPF classifies land uses according to vulnerability as follows:

- Essential infrastructure;
- Highly vulnerable;
- More vulnerable;
- Less vulnerable; and
- Water-compatible development.

2.2 Rochdale Borough Council Flood Risk Management Strategy

The Rochdale Borough Council's Flood Risk Management Strategy³ was implemented in March 2014 and is the overarching document on flood risk in the borough. The strategy draws together information from a number of sources and outlines how the borough will incorporate environmental and sustainability objectives into their flood risk work.

2.3 Greater Manchester Level 1 Strategic Flood Risk Assessment

Greater Manchester's Level 1 Strategic Flood Risk Assessment⁴ (SFRA) was adopted by the Greater Manchester Combined Authority in March 2019. The report assesses all known sources of flood risk, considering future climate change predictions to allow the Council to locate future development primarily in low flood risk areas. The SFRA also assists in preparing sustainable policies for the long-term management of flood risk.

2.4 Climate Change Guidance

The government's current climate change guidance⁵ for developers and their agents when they prepare flood risk assessments for planning applications, and development consent orders for nationally significant infrastructure projects, is provided online and seeks to minimise vulnerability and provide resilience to flooding and coastal change. The key climate change factors which are covered with regard to flood risk include:

- Peak river flow allowances which show the anticipated changes to peak flow by river basin district;
- Increased rainfall depths which affect river levels and land and urban drainage systems; and
- A range of allowances for each river basin district and epoch for sea level rise.

This online guidance was originally published in February 2016 and had been updated periodically, most recently in May 2022, to reflect changes in climate science such as updated sea level rise

² <https://www.gov.uk/government/publications/national-planning-policy-framework--2>

³ <https://www.rochdale.gov.uk/directory-record/142/flood-risk-management-strategy>

⁴ <https://www.bury.gov.uk/planning-building-control/flood-and-water-management/developments-flood-risk>

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

allowance to reflect latest climate change projections (UKCP18) which replaced previous projections (UKCP09).

2.5 Rochdale Borough Council Pre-application Response

In their pre-planning response dated 30 March 2023 (ref: PREAPP/00003/23), Rochdale Borough Council provided the following advice and comment in relation to surface water and flood risk:

- Policy G8 of the Core Strategy requires that new development does not lead to any form of increased flooding locally or further downstream, does not impede natural water and flood risk management, is not detrimental to existing or potential flood storage areas, and is itself well protected from flood risk;
- The site is in Flood Zone 2, and will therefore require a Flood Risk Assessment;
- A reduction of at least 50% of the current brownfield rate should be achieved; and
- It is advised that any attenuation system could include measures such as oversized pipes or geocellular tanks with a flow control device.

A copy of the pre-application response is included in Appendix A.

3. SITE DESCRIPTION

3.1 Application Site Description

The site is situated approximately 1.3 km south east of Bury town centre and extends to 4.8 hectares (ha) in area, as shown in Figure 1 (within the Figures section to the rear of this report). Directly north of the site are industrial units within Waterfold Business Park. To the east of the site lies the M66 motorway, with agricultural land situated beyond. A railway line/embankment and agricultural land is located to the south of the site. The River Roch is located to the immediate west of the site.

The site currently comprises a single large distribution warehouse and four floors of ancillary office accommodation. A lorry loading bay is located to the north of the warehouse, onsite car parking is to the east and south of the warehouse.

The site is located at approximate National Grid Reference (NGR) 381852, 410232. The nearest postcode is BL9 7BQ.

3.2 Site Visit

A site visit was carried out by George Black from Ramboll on the 17th of August 2023. It was noted that there are a number of drainage features located throughout the site, many of which consist of manholes and slotted drains. Observations from the site recorded that there was some slight ponding of surface water on the slotted drains due to a build-up of silt and vegetation within the drains. This was particularly the case in the car park in the north and southeast of the site. The site contact reported that the River Roch has not flooded in her time on site.

3.3 Site Topography

The site topography has been established using the available LiDAR (Light Detection and Ranging), aerial topographic data (acquired from the EA, included as Figure 2), along with the site Topographic Survey (included in Appendix B). Elevations on site range from 74.33 m Above Ordnance Datum (mAOD) to 74.98 mAOD. The lowest elevation site is recorded on the northern site boundary whilst the highest is located in the centre of the site.

An underpass is located to the east of the site beneath the M66, this is situated at approximately 76 mAOD whilst the M66 motorway is raised to approximately 82 mAOD. The railway embankment to the south of the site is situated at 90 mAOD, this increases to 92 mAOD passing over the M66. The bed of the River Roch to the west of the site is approximately 71 mAOD, this is approximately a 4 m decrease in elevation from the western site boundary.

3.4 Geological Setting

The British Geological Survey (BGS) map of the area (1:50,000 scale map series), accessed via online digital mapping⁶, indicates the site is directly underlain by the Pennine Lower Coal Measures Formation (Mudstone, Siltstone and Sandstone). Records show there to be Darwen Flags (Sandstone) present in the south of the site and Milnrow Sandstone in the west of the site.

Superficial deposits of Alluvium (Clay, Silt, Sand and Gravel) are present in the north, east and west of the site, whilst River Terrace Deposits (Sand and Gravel) are located in the south of the site.

⁶ The British Geological Survey (BGS) Geology of Britain Viewer.

^{25.6} https://mapapps2.bgs.ac.uk/geoindex/home.html?_ga=2.20478462.751019057.1623140982-555024661.1620222646 (accessed August 2023)

DEFRA's online Magic Map⁷ classifies the site as containing both a Secondary A bedrock and superficial drift Aquifer.

Secondary A Aquifer: "permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers."

3.5 Existing Site Hydrology

Figure 3 and 4 depict the extent of watercourses in proximity to the site. The closest surface water feature to the site is the River Roch immediately adjacent to the site's western boundary. The River Roch is a tributary of the River Irwell flowing in a southerly direction whereby the confluence with the River Irwell is situated approximately 3.2 km south west of the site.

Gipsy Brook is located approximately 150 m west of the site. The brook enters a culvert 1.4 km north of the site and flows in a southerly direction through Bury town centre until it joins the River Roch 0.24 km southwest of the site.

3.6 Existing Drainage

The existing drainage (both public and private) has been established based on a review of the United Utilities sewer records (included in Appendix C), observations made during the site visit and the topographic survey. The United Utilities sewer records indicate the following public sewers in proximity to the site:

- 350 mm dia. combined sewer running from northeast to southwest through the site, mainly through the car park;
- 225 mm dia. foul sewer running from north to south along the unnamed access road, discharging into the combined sewer described above; and
- 2no. abandoned sewers running through the car park.

No private sewer records were available as part of the study, however observations made during the site visit identified a network of drains, gullies and manholes indicating presence of a surface water system collecting runoff from the car park. The inferred destination for runoff is the combined sewer running through the site.

3.7 Existing Flood Defences

The extent of existing Environment Agency on the flood defences plan (Figure 5) indicates the following defences to be in proximity and believed to serve the site:

- Flood Embankment extending along the eastern bank of the River Roch from the playing fields to the Roch Viaduct;
- Natural High Ground extending on the western bank from the Roch Viaduct past the playing fields, all the way to the M66 bridge;

The EA Lower Roch Flood Mapping report from January 2018 states that the crest of the flood defence on the Roch Eastern Bank (Flood Embankment) is 75.50 mAOD. The report also states that flooding is exacerbated by the presence of the defences, as during they 'impede the flow of flood water into the channel'. It was identified from the hydraulic modelling that when removed, water levels drop to approximately 72.30 mAOD (lower than any of the topographic levels within the site).

⁷ DEFRA Magic Map <https://magic.defra.gov.uk/MagicMap.aspx> (accessed August 2023)

4. REVIEW OF BASELINE DATA

4.1 Fluvial and Tidal Flood Risk

In England, flood risk is regulated through planning policy, with key requirements being outlined in the NPPF. The primary resource for reviewing fluvial and tidal flood risk is the EA's indicative floodplain maps⁸. These classify risks as follows:

- Flood Zone 1 (Low Probability): annual probability of flooding less than 1 in 1,000 (<0.1%);
- Flood Zone 2 (Medium Probability): annual probability of flooding more than 1 in 1,000 (0.1%) but less than 1 in 100 (1%) for fluvial flooding or 1 in 200 (0.1%) for tidal flooding; and
- Flood Zone 3 (High Probability): annual probability of flooding of more than 1 in 100 (1%) for fluvial flooding or 1 in 200 (0.5%) for tidal flooding.

The EA flood map for the site is included in as Figure 6. The majority of the site is located in Flood Zone 2 (Medium Probability). A small extent of Flood Zone 3 (High Probability) extends along the River Roch to the rear of the flood defences.

A large portion of the site is shown to be served by the adjoining defences (Section 3.6), however these defences are reported to exacerbate flood risk with the result being that due to the defences, a large area of the site is situated in Flood Zone 2, whilst the undefended scenario would render the entire site Flood Zone 1.

4.2 Surface Water Flood Risk

The EA Flood Map for Surface Water⁹ delineates from pluvial sources (i.e., flooding caused by rainwater exceeding the capacity of infiltration to the ground or a drainage system) into the four following categories:

- Very Low: *each year, this area has a chance of flooding of less than 1 in 1,000 (<0.1%);*
- Low: *each year, this area has a chance of flooding of between 1 in 1,000 (0.1%) and 1 in 100 (1%);*
- Medium: *each year, this area has a chance of flooding of between 1 in 100 (1%) and 1 in 20 (3.3%); and*
- High: *each year, this area has a chance of flooding of greater than 1 in 20 (3.3%)*

The Flood Map for Surface Water is included as Figure 7. The majority of the site is shown to be at High risk of surface water flooding (>3.33%). Aerial imagery indicates the underpass to the east of the site consists of impermeable material and is located at a higher elevation than the site. Therefore as infiltration is not possible, any overland flow is directed into the site and flows along the southern boundary and is then directed north along the western boundary and along the northern warehouse façade.

The Greater Manchester Surface Water Management Plan (SWMP) generated 580 surface water hotspots based on the spatial relationship between modelled flood hazard output and local critical and vulnerable receptors. The Greater Manchester SFRA indicates the site is located in a surface water hotspot.

4.3 Groundwater Flood Risk

No information regarding groundwater levels was available as part of the study. An inference can be made that there is likely to be high seasonal groundwater associated with high river levels, and as the site could be considered relatively low-lying, groundwater flooding could occur. However,

⁸ EA's Flood Map for Planning <https://flood-map-for-planning.service.gov.uk/> (accessed August 2023)

⁹ EA Long Term Flood Risk Map <https://www.gov.uk/check-long-term-flood-risk> (accessed August 2023)

as there is no below-ground development proposed i.e. basement level, the risk of flooding from groundwater is considered to be low.

4.4 Sewer Flood Risk

United Utilities drainage records indicate a public sewer enters the site from the eastern boundary and extends through the south of the site, exiting at the southwest corner. United Utilities have indicated that the site is not at risk of flooding resulting from hydraulic overload of public sewers (see response in Appendix C). The Greater Manchester SFRA indicates there are no records of historic sewer flooding at the site.

4.5 Risk from Reservoirs, Canal, and Other Artificial Sources

The EA's online mapping¹⁰ suggests that the site is located in an area at risk of reservoir flooding. However, the mapping only represents the potential consequence of a catastrophic failure of a reservoir and the resultant release of the water retained within the reservoir. The mapping does not indicate the likelihood of such an event, which is considered to be of a very low probability.

There are no other artificial sources within the vicinity of the site, the risk of flooding is therefore low.

4.6 Recorded Flooding

According to the EA's published geo-spatial data¹¹ the site is not recorded to have previously suffered from flooding. The closest historical flood record is at a location 0.2 km northeast of the site adjacent to the River Roch, having occurred in December 2015.

¹⁰ <https://www.gov.uk/check-long-term-flood-risk>

Hy¹¹ <https://environment.data.gov.uk/>

5. HYDRAULIC MODELLING

5.1 Overview

Following a request for information by Ramboll, the EA have provided hydraulic modelling data relevant to the site. JBA Consulting was commissioned by the EA in 2016 to carry out a flood mapping study of the lower Roch between Rochdale and the River Irwell, to improve the understanding of flood risk. The model was completed using the topographic survey collected by the EA in 2016 and Flood Modeller – TUFLOW software.

Modelled outputs were created for the following Annual Exceedance Probabilities (AEPs): 1%, and 0.1% (1 in 100 and 1,000 years respectively).

5.2 Climate Change

In addition to the design AEPs, several climate change scenarios were undertaken. Current government guidance¹² suggests applying the central allowance (35% increase in river flow) to account for potential change by the 2080s when assessing industry buildings. The climate change guidance was most recently updated in May 2022, the modelling was undertaken prior to publication of this update and included a range of allowances. These were based on the Upper End, Higher Central and Central 2115 estimates (70%, 35% and 30%) from the 2018 climate change guidance. The 35% Higher Central increase has been adopted in order to align with the most recent government guidance.

5.3 Flooding Mechanism

A review of the detailed hydraulic model and fluvial flooding information has been used to develop the following report section, which seeks to identify in full detail the mechanism through which this could occur.

Flow Flow Routes

Flooding of the site is understood to occur as result of river levels in the Roch to the north of the site by Village Hotel becoming progressively higher eventually overtopping the crest of the defences. Following the topography of the wider Waterfold Business Park, overland of floodwater would occur, and eventually flow into the site. Due to not being able to disperse or flow back into the channel due to the presence of the defences, flood water would accumulate here until reaching the peak modelled level.

Flood level

The modelled flood levels for the site are as follows:

- 1 in 100 year event – 74.20 mAOD.
- 1 in 100 year plus 35% climate change event – 75.20 mAOD
- 1 in 1,000 year event - 75.26 mAOD.

It is understood these levels are inclusive of the impact of the flood defences.

Duration

Based on the large upstream catchment of 164 km² flooding would occur gradually over a number of hours, and result from sustained periods of seasonally wet weather. This is in contrast to smaller, more urbanised catchments which would subject to 'flashier' events. However, as a consequence this does mean that flooding could occur for longer. Although the duration would

¹² <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

vary significantly depending on event severity, a flooded duration of 6-24 hours could be expected.

Frequency

At present day, the site would not be susceptible to flooding during a 1 in 100 year flood. However, when factoring in future variability resulting from climate change, flooding to the site could occur, and also during an extreme 1 in 1,000 year event. Whilst it is not possible to project what flood events may occur in the future, given it would require an extreme or climate adjusted flood level, the likely occurrence of flooding can be considered to be infrequent.

Velocity of Flood Water

The flood velocity map (Figure 12) indicates that for the 1 in 100 year plus climate change event, the velocity of floodwater within the site would be low. This is a result of the accumulation of flood water resulting from the flood defences preventing flood water from dispersing. This in turn however leads to very low velocities of less than 0.1 m/s prevailing.

Depth

The following flood depths have been plotted for the 1 in 100, 1,000 and 100 year climate adjusted events. The depths have been calculated using some of the node points identified on the LiDAR plan (figure 2). These are summarised in Table 5.1 below.

Table 5.1 Peak Flood Depths

Node	Level (mAOD)	Flood Depth (m)		
		<u>1 in 100 year</u>	<u>1 in 100 year +CC</u>	<u>1 in 1,000 year</u>
1	74.33	0	0.87	0.90
2	74.10	0	1.10	1.13
3	74.38	0	0.82	0.85
4	74.35	0	0.85	0.88
5*	74.98	0	0.22	0.25
6	74.44	0	0.76	0.79
7	74.85	0	0.35	0.38
*existing building				

A review of the flood depths indicate there are some significant peak depths of flooding for 1 in 100 climate change 1 in 1,000 year events. Much of these would be above the depth that would be considered a risk to human life, and as such there is a requirement for the mitigation measures. It should again be noted that these flood levels are in part the result of the EA defences retaining flood water within the floodplain, preventing dispersal and causing significant depths of water to accumulate.

Hazard rating

The flood hazard map (Figure 12) indicates that for the 1 in 100 year plus climate change event, the flood hazard is relatively low. The exception to this is to the north and western extents of the site. As the flood velocity is known to be low for the majority of the site, the areas of higher flood hazard result from the flood depths, which for parts of the site are known to be high (Table 5.1).

Amount of Warning Time of Flooding

Given the size of the catchment upstream and the gauge at Blackford Bridge upstream of the site¹³, the site can expect to receive good quality and regular updates regarding the likelihood of flooding, which also collects data from regional weather forecasting. It is expected that this would enable a Flood Warning to be issued at least 12 hours prior to the onset of flooding.

5.4 Summary

As the site is situated in Flood Zone 2, a more detailed assessment of fluvial flooding is required. This has included collection of hydraulic modelling output for the River Roch hydraulic model, which Ramboll has used to produce a suite of maps which more accurately depict flood risk.

The outcome of this detailed assessment is that whilst the site does not flood during the 1 in 100 year event, deep flood could occur for the 1 in 100 plus climate change, and 1 in 1,000 year events. The depth of flooding is exacerbated by the EA flood defences which are identified as trapping flood waters once the defences are overtopped.

The location however will benefit from the flood warning service provided from the EA. Given the proximity of the site to one of the river level monitoring gauges, this is likely to allow accurate and up-to-date information to be provided to the site occupant once a flood warning has been issued for the area.

Due to the estimated flood depths of above 1 m, the mitigation measures will need to focus on ensuring safety to site occupants. This will include distribution of flood warnings when a flood event is expected, and a procedure for closing the site to ensure no personnel are present when there is a risk of flooding, more detail on the mitigation measures is included in Section 6.4.

¹³ <https://check-for-flooding.service.gov.uk/station/5013>

6. ASSESSMENT OF FLOOD RISK

6.1 Development Proposal

The proposed development consists of Redevelopment of existing premises, comprising full demolition; erection of new building for Class B8 purposes with ancillary offices; installation of external plant and gatehouse; hardstanding for servicing and parking; attenuation pond; and boundary enclosure. Vehicular access to the site is in the northeast corner via the existing roundabout.

The proposed site masterplan can be seen in Appendix D.

6.2 Flood Risk Vulnerability

According to Table 2 (Flood Risk Vulnerability Classification) in the Planning Practice Guidance to NPPF, General Industry buildings are classified as "Less Vulnerable".

Table 3 (Flood Risk Vulnerability and Flood Zone Compatibility) in the Planning Practice Guidance to NPPF, states that "Less Vulnerable" developments are appropriate to locate in Flood Zone 2

6.3 Mitigation Measures

The assessment of flood risk from all sources identifies a medium risk from fluvial flooding, and a medium/high risk of surface water flooding. The following mitigation measures are therefore proposed to keep the development safe across its lifetime.

Finished Flood Levels

At the time of writing, no Finished Floor Level (FFL) had been set. A review of the site Topographic Survey indicates the existing building floor level to be around 75.00 mAOD. If possible, the subsequent stage of site design should explore the potential for increasing FFL by around 200 mm to 75.20 mAOD. This would take the FFL to the 1 in 100 year plus climate change level, and furthermore result in less than 100 mm of flooding during an extreme 1 in 1,000 year event.

Finished Resilience/Resistance

If the setting of FFL or design of external levels to reduce the risk of flooding is not feasible, then flood resilient internal design should be considered. This approach concentrates on ensuring clean up after a flood can take place quickly, and that no permanent damage is done to the building or its contents. This could include measures such as:

- Use of flood gates, demountable structures on all building entrances to provide a flood proof seal and prevent ingress of flood water;
- Raising of internal fittings – as the development is to be distribution style warehouse, consideration should be given to raising all shelving/racking to +300 mm above floor level, to reduce the risk of products/stock becoming damaged should internal flooding occur;
- Raising of all electrical sockets 300 mm above floor level;
- Use of tiled/wood flooring and prevent use of carpeted floors;
- Use of air bricks and flood proof vents;
- Flood Proofing of Plant/EV Rooms

A number of suitable approaches are outlined in CIRIA C790 Code of Practice for Property Flood Resilience¹⁴.

Flood Warning and Evacuation Plan

An essential aspect of ensuring the safety of all site occupants from flood risk will be subscription to and effective distribution of Environment Agency flood warnings, and a procedure for site evacuation in the event of extreme flooding events. The plan should include the following:

- A system to communicate flood alerts and warnings to site occupants i.e. automated phone call/text message, siren, intercom announcement;
- A clear procedure setting out to occupants what to do in the event of a flood warning;
- A methodology/procedure for closing/securing of the site when flooding is expected, including a clear setting out of roles and responsibilities; and
- A clearly established protocol for the evacuation of the site.

The flood plan is to be developed in accordance with the Environment Agency guidance provided at the following link <https://www.gov.uk/government/publications/personal-flood-plan>

¹⁴ https://www.ciria.org/CIRIA/Resources/Free_publications/CoP_for_PFR_resource.aspx

7. SURFACE WATER DRAINAGE STRATEGY

7.1 Overview

The following section summarises the approach for managing surface water from the development. A Drainage Strategy Plan has been prepared and should be read in conjunction with this section of the report (Appendix E).

7.2 Disposal of Surface Water

Part H of the Building Regulations requires the disposal of surface water drainage from a development site to be in accordance with the following hierarchy:

- 1) To ground via infiltration;
- 2) To a watercourse;
- 3) To a surface water sewer or highway drain; and
- 4) To a combined sewer.

Each of the methods above will therefore be considered in turn, and will consider the site conditions.

No formal BRE testing had been undertaken as part of the drainage strategy at the time of writing. A review of the underlying site conditions (summarised in Section 3.3) suggests that the site is likely to be underlain predominantly by fluvial river deposits, which are characteristically of low and variable permeability. Disposal via infiltration is therefore deemed unsuitable.

The closest watercourse is the River Roch which flows north to south past the western site extent. One issue posed by making a connection to the watercourse is that the strip of land between the river and the site is owned by a third party, and a new discharge to the watercourse would therefore require a length of sewer to be requisitioned by United Utilities. However, as the discharge will contain surface water runoff from an industrial/commercial area, a sewer requisition could not be able to be made under the United Utilities guidance¹⁵. Additionally, if a direct connection was to be made to the watercourse the route would entail passing under the existing flood defence embankment which would have the potential to compromise the embankment integrity and performance. Discharge to the watercourse is therefore not considered feasible.

It is therefore proposed to retain the existing discharge from the site to the United Utilities sewer which runs from the north eastern to south western site extents. A number of connection points are envisaged, which are indicated on the drainage strategy plan.

7.3 Runoff Rates and Storage

A review of the site plan indicates there are five discrete impermeable areas that will form part of the overall drainage strategy, these are summarised below:

- Roof Area – 1.83 ha;
- HGV Area– 1.08 ha;
- Car park – 0.49 ha;
- Perimeter Access Road – 0.30 ha; and
- Access road – 0.16 ha.

¹⁵ www.unitedutilities.com/globalassets/documents/builders--developers-docs/9910-wwh-s98-guide-to-sewer-requisitions-jan2023-web-acc.pdf

The broad delineation of these areas is indicated on the Drainage Strategy plan (Appendix E). The equates to a total developable area of 3.68 ha.

The greenfield rate of runoff for the site was calculated using the Source Control module within the drainage modelling Software MicroDrainage, which utilises the Interim Code of Practice (ICP) Method, which is appropriate given the site area of less than 50 ha.

The greenfield runoff rate for the site is summarised in Table 7.1 below.

Table 7.1 Greenfield Runoff Calculation

Site Area (ha)	SAAR (mm)	Soil	Region	Storm Event (l/s)		
				1 in 1 year	1 in 30 year	1 in 100 year
3.68	1140	0.450	10	24.9	48.5	59.5

Based on retaining runoff from the site to a 1 in 1 year greenfield rate (25 l/s, taken as the closest practical rate to 24.9 l/s), the following required storage volume is calculated (Table 7.2 below). This was undertaken for the 1 in 100 year event plus 40% climate change.

Table 7.2 Storage Calculation

Rainfall Model	M5-60 (mm)	Ratio R	Critical season/ duration	Storage Required (m ³)
FSR	19.00	0.288	Winter, 360 minute storm	3,000

A copy of the MicroDrainage calculation sheets is included in Appendix F.

Table 7.3 below provides the schedule of the required storage from each area (corresponding the calculated impermeable area of each).

Table 7.3: Storage Calculation

Development aspect	Proposed Storage inc. dimensions	Total Storage (m ³)
Roof Area and Perimeter Road	Geocellular Tank 40m L x 40m W x 1.1m D	1,672
HGV and Car Parking	Geocellular Tank 72m L x 15m W x 1.2m D	1,231
Access Road	Storage Pond – area at cover = 279 m ² – area at base = 80 m ² – Pond active depth = 0.7m – Side slopes = 1 in 3	126
Total Storage		3,028

The arrangement of all proposed storage is indicated on the Drainage Strategy plan.

7.4 Treatment of Runoff

The treatment of runoff and removal of contaminants is summarised in Table 7.4 below.

Table 7.4: Summary of Treatment

Development Component	Contaminant Profile	Primary Treatment	Secondary Treatment
HGV parking	High Runoff likely to have heavier hydrocarbon contamination. Using the CIRIA Report C753 Indices, the pollutant loading profile will be as follows: - TSS = 0.8 - Metals = 0.8 - Hydrocarbons = 0.9	Road Gullies To provide removal of larger and lightly contaminated particles and sediment.	Full Retention Type II separator To remove oil, chemical and solids from the full flow of surface water to ensure they cannot contaminate the nearby environment. As a result of this, they are suitable for use in areas with a high risk of regular surface water contamination from petrol/oil.
Car Parking areas	Medium Runoff likely to have light hydrocarbon contamination.		Bypass Type I separator Engineered to achieve a hydrocarbon concentration of less than 5mg per litre, and also removing chemicals and solids from surface water.
Perimeter Access Road	Using the CIRIA Report C753 Indices, the pollutant loading profile will be as follows: TSS = 0.7		
Access Road	- Metals = 0.6 - Hydrocarbons = 0.7		Storage Pond With a retained water depth of 0.1m will remove larger particulate matter from Access Road Runoff.
Roof areas and building apron	Low Runoff likely to have no hydrocarbon contamination or other catchment pollution.	N/A	N/A

7.5 Managing Surface Water

Given the treatment and storage requirements of each, surface water will be managed across three catchments. The method for collecting, treating, storing, and discharging surface water is summarised below:

Catchment 1 - Roof Areas & Perimeter Access Road

Runoff will be collected via a series of gutters of appropriate spacing around the edge of the roof. These gutters will feed downpipes, which will in turn feed lateral drains running around the outside of the building. Runoff from the Perimeter Access Road will be collected via a series of gullies before being routed to a Type II hydrocarbon interceptor, before discharging to the Geocellular storage unit.

The lateral sewers will feed to a single Geocellular storage tank located within the Car Parking area, with the following layout detail:

- 1 m cover depth
- 1.1 m tank depth (2.1 m below ground level (bgl) storage invert)
- 40 m Length x 40 m Width x 1.1 m Depth
- 0.95 void ratio, providing a total of 1,672 m³ of storage
- The tank will discharge via a hydrobrake, designed to restrict flow to a rate of 14 l/s

Catchment 2 - HGV parking and Car Park

Runoff will be collected via a series of road gullies, to achieve this, all car park falls should be towards gulley locations, which reciprocally will be located in areas of proposed low spots.

With runoff having filtered through a road gullies, a series of lateral sewers will connect to a series of main drainage runs, which will in turn discharge to a Type II bypass interceptor, which will filter out hydrocarbons and sediment. From the interceptor, surface water will discharge to a geocellular unit situated below the HGV area, with the following layout detail:

- 1 m cover depth
- 1.2 m tank depth (2.2 m bgl storage invert)
- 72 m Length x 15 m Width x 1.2 m Depth
- 0.95 void ratio, providing a total of 1,231 m³ of storage
- The tank will discharge via a hydrobrake, designed to restrict flow to a rate of 10 l/s

Catchment 3 - Access Road

Runoff will be collected via a series of highway gullies, placed at suitable spacing along the carriageway edges. The camber of each lane of the carriageway should be appropriately cambered to provide a gradient towards road gullies.

Runoff will then be routed to the storage pond located adjacent to the site entrance, with the following detail:

- 1.2 m cover depth
- 0.1 m retained water depth, 0.3 m freeboard to cover
- 1 in 3 side slopes
- Discharge via a hydrobrake chamber, designed to restrict flow to a rate of 1 l/s.

7.6 Drainage System Maintenance

In order to ensure the long-term performance of the site's drainage network, drainage features should be periodically inspected and maintained with the indicative schedule below:

- Gullies and Linear Drains – To undergo regular clearance and jetting as required, typically every 6-12 months to remove debris and sediment from inlets;
- Geo-cellular storage - To be inspected every 6-12 months and include litter removal; annual inspection of inlets, outlets, and overflows along with repair and rehabilitation as required;
- Storage Pond – To be inspected every 12 months, dead vegetation removed as required, inlets cleared and slopes to be mowed/cleared. Perimeter/security fences to be inspected/repared as required; and
- Flow control device – To be inspected every 6–12 months, after a large storm event or after an observed deterioration in drainage system performance.

The above represents a typical maintenance schedule; a site-specific schedule should be fully developed and agreed upon detailed design of the site drainage. It is understood the drainage

would not be adopted by United Utilities, and as such the maintenance activities would be undertaken by the site occupant.

8. CONCLUSIONS

The proposed development comprises of a new warehouse with associated dock levellers, and parking facilities. The site is located in Flood Zone 2 (medium probability). The EA Flood Map for Surface Water shows the majority of the site to be at High risk of surface water flooding. It appears that overland flow is directed into the site from the underpass to the east below the M66 motorway.

The site visit carried out by Ramboll confirmed the presence of drainage assets on site that would be expected to reduce the surface water flood risk, however it was recorded that a number of drains on site are built up with silt and vegetation creating surface water pooling.

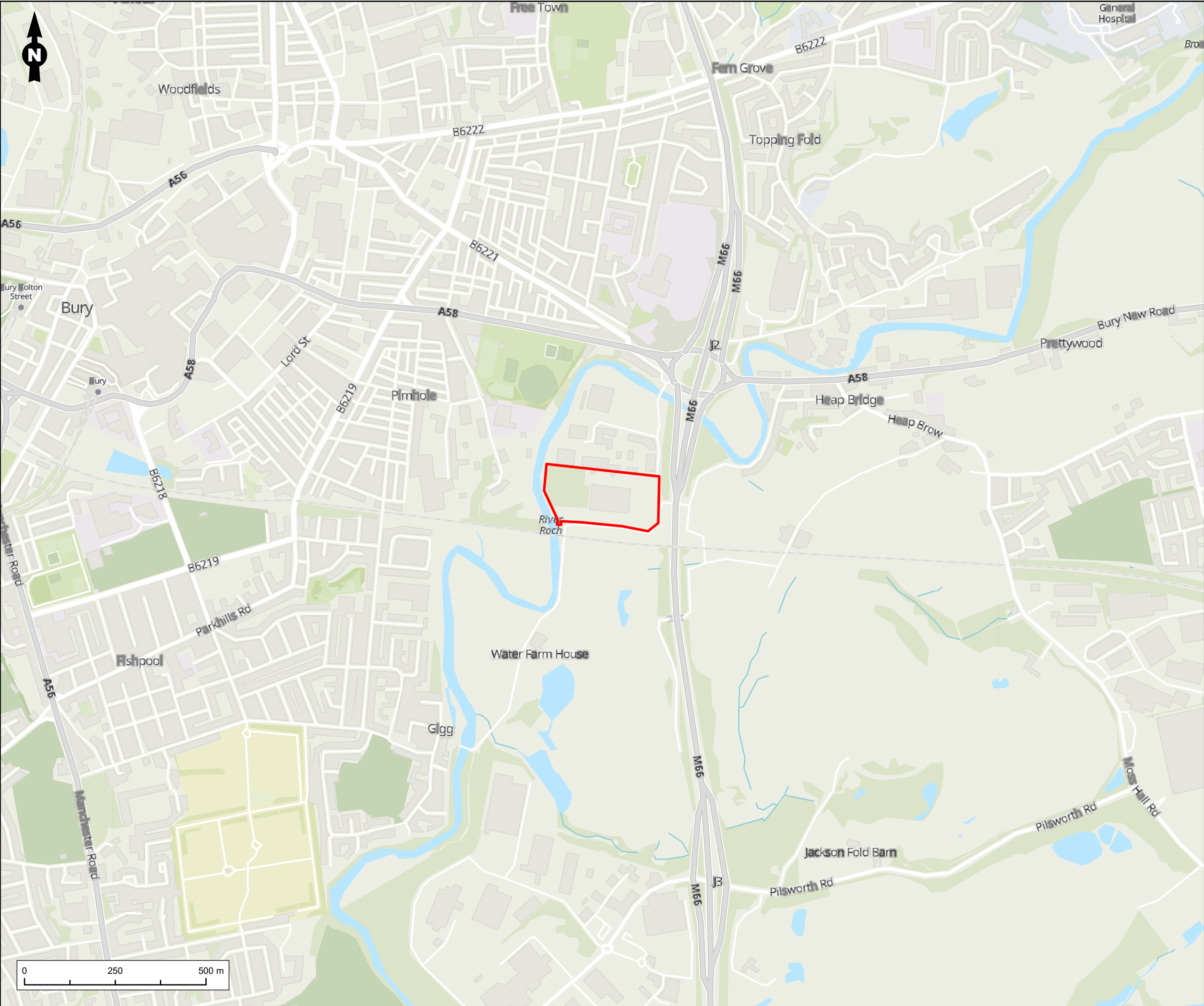
Hydraulic modelling provided by the EA indicate the site is at risk of flooding during the 1 in 1,000 AEP and the 1 in 100 +35% climate change AEP. Flood waters affect the majority of the site during both events. The mitigation proposed includes raising the FFL of the warehouse so that it is situated above the 1 in 1,000 AEP at 75.25 mAOD. Further mitigation includes using flood resistance materials and ensuring all external doors are waterproofed.

Based on the findings of this Flood Risk Assessment and in consideration of the recommendations made, it is concluded that any flood risk is appropriately managed by the development proposals over the lifetime of the development, taking climate change into account and fittingly for the vulnerability of proposed users.

No further flood risk assessment is deemed necessary.

FIGURES

1. SITE LOCATION
2. LIDAR PLAN
3. SITE HYDROLOGY
4. CHANNELS AND STRUCTURES
5. FLOOD DEFENCES
6. FLOOD MAP FOR PLANNING
7. SURFACE WATER FLOOD MAP
8. SURFACE WATER FLOW DIRECTIONS
9. HISTORIC FLOOD RECORDS
10. FLOOD DEPTHS – 1 IN 1,000
11. FLOOD DEPTHS – 1 IN 100 PLUS CLIMATE CHANGE
12. FLOOD VELOCITY – 1 IN 100 PLUS CLIMATE CHANGE
13. FLOOD HAZARD – 1 IN 100 PLUS CLIMATE CHANGE



Legend

Site Boundary

Figure Title

Site Location

Project Name

Waterfold Business Park

Project No./Filery ID

1620016197

Date

September 2023

Figure No.

1

Revision

1.0

Prepared By

MH

Scale

1:10,000 @A3

Client

Tritax Management LLP

RAMBOLL



Legend

 Site Boundary

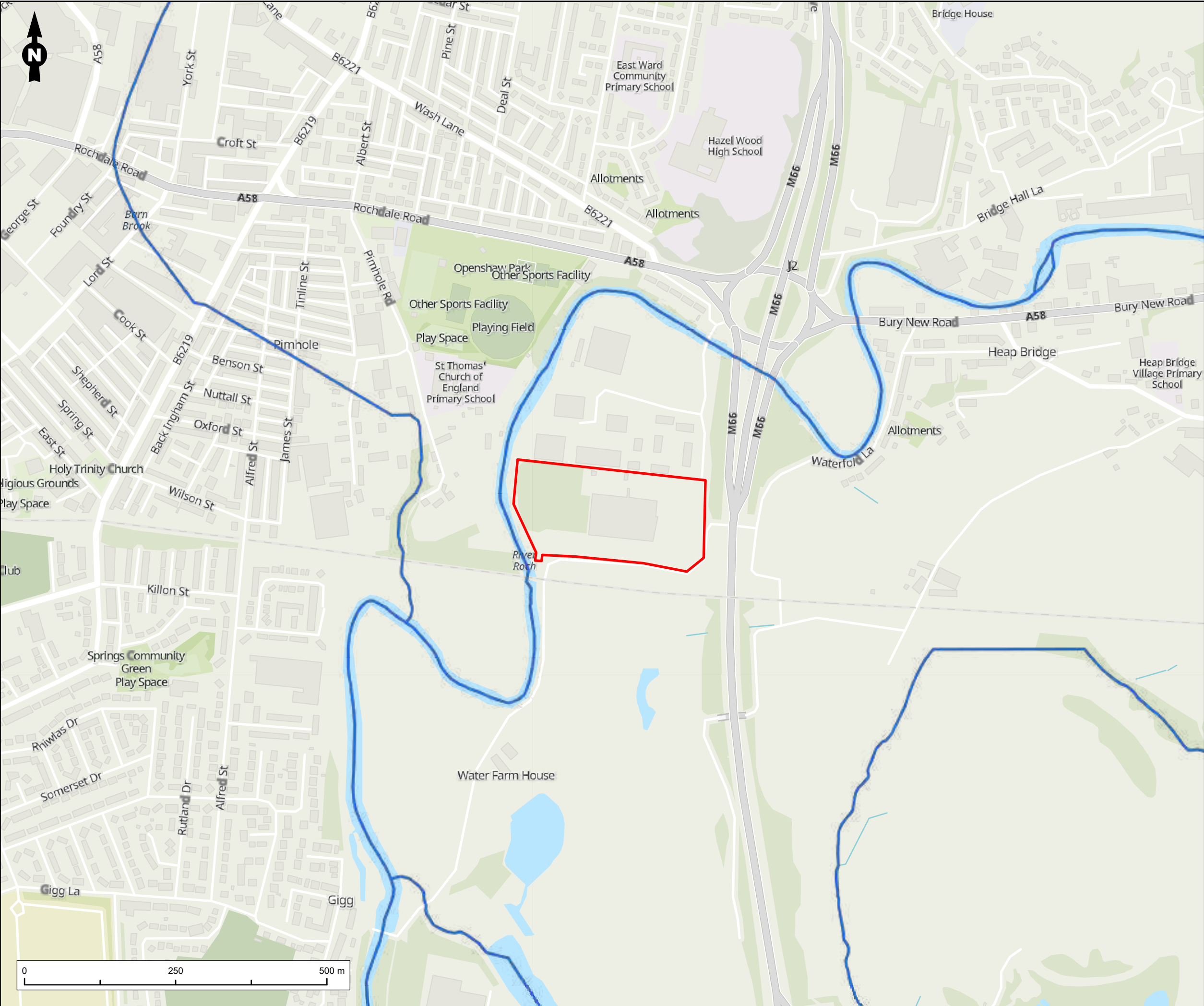
 Elevation Points

1m DTM

 >92mAOd

 <70mAOd

Figure Title		
LiDAR Data		
Project Name		
Waterfold Business Park		
Project No./Filey ID		
1620016197		
Date	Figure No.	Revision
September 2023	2	1.0
Prepared By	Scale	
MH	1:1,700 @A3	
Client	Tritax Management LLP	
		



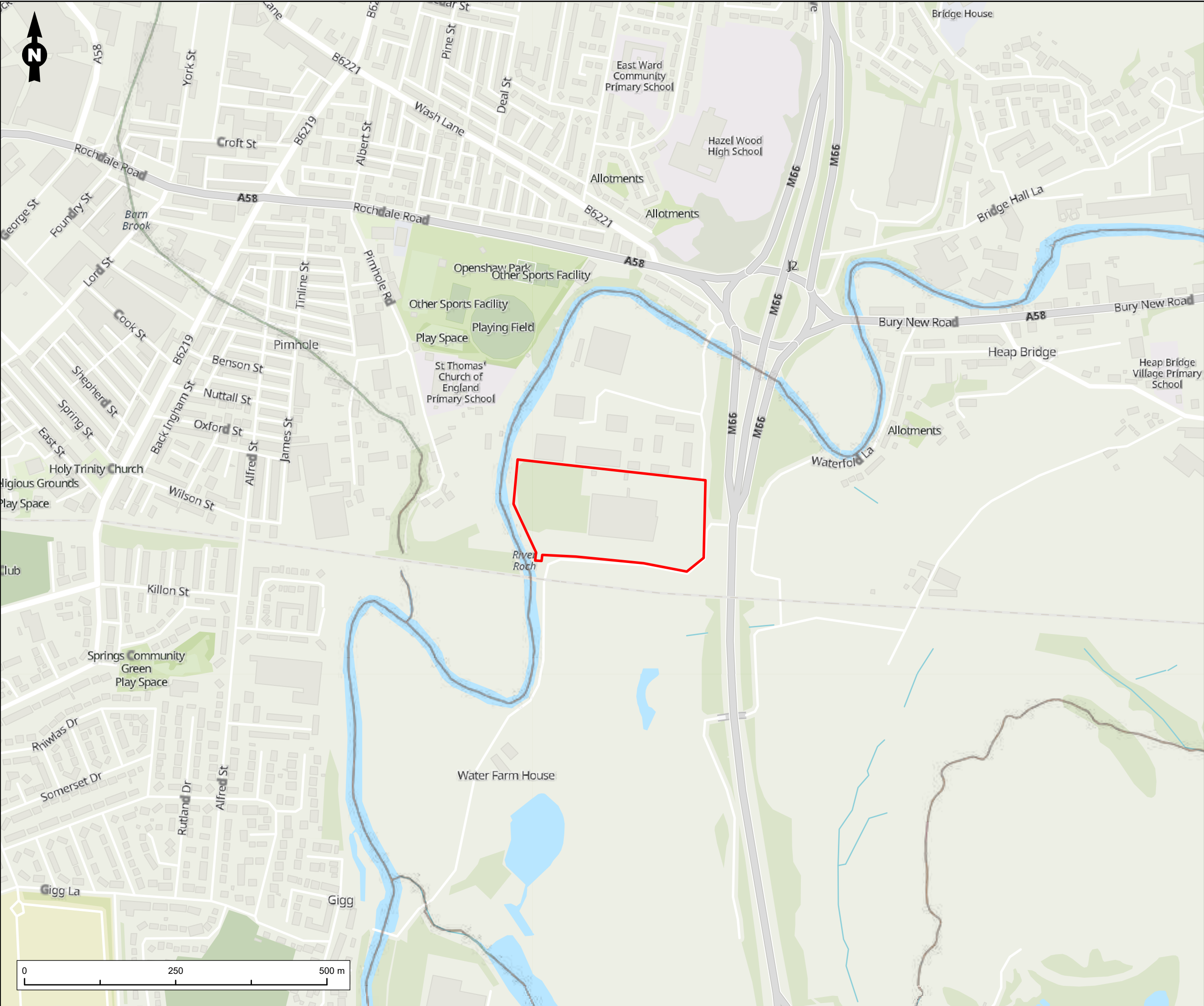
Legend

Site Boundary

Main Rivers

EA

Figure Title	
Site Hydrology	
Project Name	
Waterfold Business Park	
Project No./Filery ID	
1620016197	
Date	Figure No.
September 2023	3
Prepared By	Scale
MH	1:6,000
Client	
Tritax Management	
	



Legend

Site Boundary

Channels & Structures

Weir

Open Channel

Simple Culvert

Figure Title

Channels and Structures

Project Name

Waterfold Business Park

Project No./Filery ID

1620016197

Date

September 2023

Figure No.

4

Revision

1.0

Prepared By

MH

Scale

1:6,000 @A3

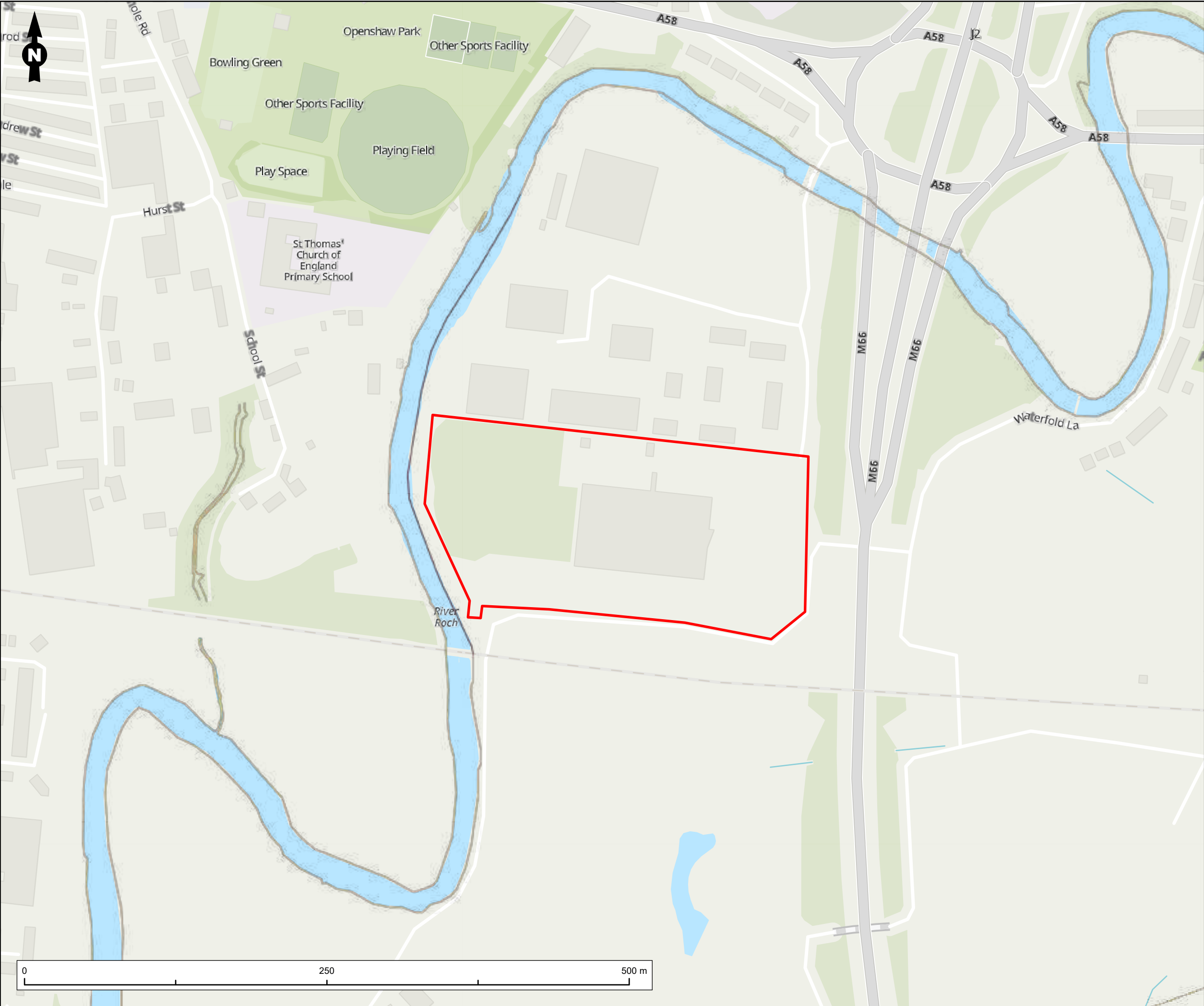
Client

Tritax Management LLP

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Coordinate System: British National Grid. Projection: Transverse Mercator. Datum: OSGB 1936.



Legend

Site Boundary

EA Flood Defences

Embankment

Natural High Ground

Figure Title

EA Flood Defences

Project Name

Waterfold Business Park

Project No./Filery ID

1620016197

Date

September 2023

Figure No.

5

Revision

1.0

Prepared By

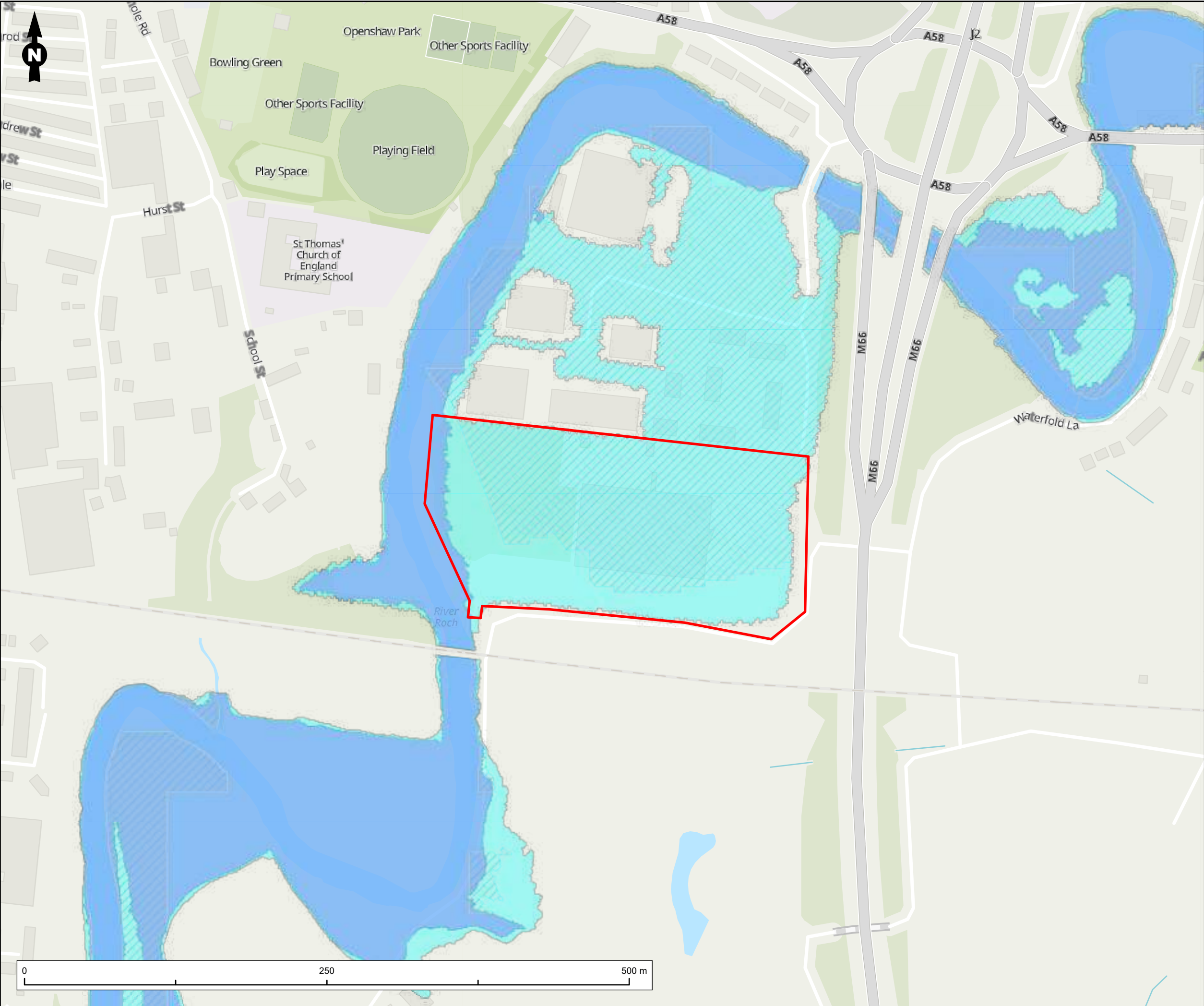
MH

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Client

Tritax Management LLP



Legend

Site Boundary

Flood Map for Planning

Reduction in Risk of Flooding from Rivers and Sea

Flood Zone 3

Flood Zone 2

Figure Title

EA Flood Map for Planning

Project Name

Waterfold Business Park

Project No./Filery ID

1620016197

Date

September 2023

Figure No.

6

Revision

1.0

Prepared By

MH

Scale

1:3,000 @A3

Client

Tritax Management LLP