

GWK STRUCTURAL SOLUTIONS LTD **CONSULTING ENGINEERS**

Flood Risk Assessment & Outline Drainage Strategy

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- **Project Title:** Flood Risk Assessment & Outline Drainage Strategy
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Executive Summary

The proposal is for the construction of a residential development, with landscaping and associated car parking, situated off Waterfold Lane, Heywood, Bury, BL9 7JY. The overall red line site boundary is approximately 0.872ha in plan footprint.

According to the Environment Agency (EA) Indicative flood maps, the main development area is located in Flood Zone 1 with the northern periphery adjacent the River Roch located in Flood Zone 3, i.e. land assessed as having greater than 1 in a 100 year ($>1.0\%$) annual probability of fluvial flooding in any year. A detailed assessment of the modelled flood levels from the Environment Agency against the site-specific topographical survey has proved that in fact the flood water will not pass out of bank and therefore the site can be considered to be located fully in Low-Risk Flood Zone 1.

The development target has been assessed against the National Planning Policy Framework (NPPF) 'Sequential Test'. Taking into consideration that the application is for a residential development in Flood Zone 1, Tables 1 & 2 of the NPPF have been appraised to confirm that the development is appropriate and an Exception Test would not be required.

The Flood Risk Assessment has considered all other forms of flooding and overall, has found that the site is at low risk of flooding from all other sources.

During extreme flood events a safe dry access route is assured from the development site to the surrounding raised highways to the southwest. Safe access for the Emergency Services and egress for the occupiers is assured for higher order storm events up to and including the 100-year event due to the increased ground levels to this side.

There is no residual flood risk from the development site to the surrounding district due to the mimicking in storm water flow rates to the adjacent watercourse. The development does not therefore increase the risk of surface water flooding to other adjacent neighbourhoods. Out of chamber or gully flooding for the extreme 100 year plus climate change event may potentially occur within the development site and is classed as exceedance flows. Flood water from such events will be contained within the site but away from the new buildings.

Sustainable Drainage Systems (SuDS) in the form of Prevention, Source Control and Site Control methods will be incorporated. An outline surface water drainage strategy assessment forms part of this report.

There will be no additional foul water runoff generated by the development and thus does not present an increased flood risk to the surrounding district.

1.0 Introduction

GWK Structural Solutions Limited (GWK) has been appointed by Franstep Limited to prepare this Flood Risk Assessment (FRA) and Drainage Strategy Report to support a planning application for the proposed construction of a residential development with landscaping and associated car parking on land situated off Waterfold Lane, Heywood, Bury, BL9 7JY.

The assessment has been undertaken in line with Section 14 of the 'National Planning Policy Framework' (NPPF) plus the accompanying Technical Guidance on Flood Risk. The current outline Architectural Plans can be found in Appendix A provides an indication of the proposed development within the site. This report has been commissioned by Franstep Limited and is specific to their interests in the development proposals as described by the Architectural plan in Appendix A.

The report has been commissioned to identify any flood related issues associated with the proposed development and any likely constraints that could be imposed, plus to consider the drainage strategy for it. The following issues have been suggested by the Environment Agency (EA), Rochdale Borough Council as Lead Local Flood Authority (LLFA) and United Utilities (UU), and subsequently addressed within this report.

- Identify available data relating to flood risk at the site.
- Determine whether the site is at risk from flooding from all sources, including from breach or overtopping of any existing flood defences, surface water flooding and/or ground water flooding.
- If at risk from any source, devise appropriate measures to prevent flood risk whilst not compromising the flood risk elsewhere.
- Consider the flood risk from all other sources.
- Determine the current surface water drainage regime and assess any potential increase in surface water runoff as a result of the proposed development.
- Discuss Sustainable Drainage Systems (SuDS) as an option for reducing surface water flood risk.
- Devise an appropriate outline surface water drainage strategy (including calculation where appropriate) to deal with any potential increase in surface water runoff and include for climate change.
- Consider the recommendations of the Rochdale Borough Council Strategic Flood Risk Assessment (SFRA).
- Assess mitigation measures & off site impacts, and define any residual risks.

2.0 Development Description and Location

2.1 Site Location

The site is referenced in Figure 1, and a site location map is provided in Appendix A.

Item	Brief Description
Project name	Land Off Waterfold Lane.
Site address and location	Land off Waterfold Lane, Heywood, Bury, BL9 7JY.
Council Area	Rochdale Borough Council
Approximate Grid Reference	OS: 382295, 410389
General Locality	The site is located in the Heap Bridge area some 3km to the east of Bury Town Centre.

Figure 1 Site Referencing Information

2.2 Existing Site Description

The full site (Red Line Boundary) is irregular in plan shape and covers the full site. The area proposed for development is currently unused land with areas of gravel, tarmac and heavily overgrown areas of shrubbery, particularly to the west and north. For the purposes of surface water runoff the site can be classed as 'Greenfield'.

The general area is a mixed area of highways, motorways and industrial buildings beyond the M66 Motorway. There is an M66 slip road running adjacent to the proposed site to the west. To the south and east is Waterfold Lane with the River Roch flowing along the northern eastern boundary, generally in a westerly direction.

Figure 2 overleaf identifies the overall site location details. Further details of the existing layout can be seen on the plans in Appendix A.

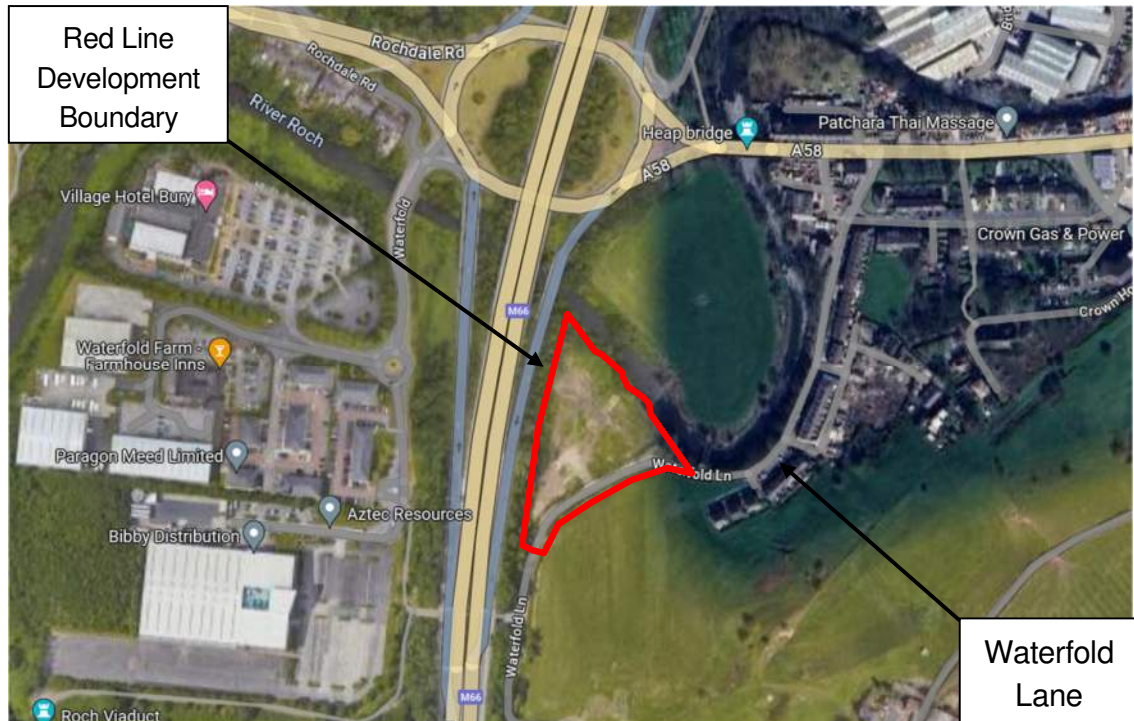


Figure 2 Site Location

2.3 Topography

A review of the topographical survey would indicate the development area to hold the highest level in the centre at circa 78.60m AOD. The ground then falls away in all directions with a steep bank leading down to the River Roch holding a water level of circa 73.30m AOD. The ground also falls in a southerly direction where a level adjacent Waterfold Lane is 77.10m AOD.

2.4 Hydrology

The closest identified watercourse is the River Roch flowing generally in a westerly direction along the northern boundary and then beneath the M66 motorway. The bed levels are approximately 5m below the ground level of the site.

3.0 Planning Policy and Consultation

3.1 Planning Policy Framework

The flood maps provided by the Environment Agency (EA) locate the main development site within Flood Zone 1 i.e. land assessed as having a less than 1 in a 1000 year (<0.1%) annual probability of fluvial flooding in any year. As a requirement of the new NPPF (2025), Section 14, the proposed development should satisfy the requirements of the Sequential Test and where applicable the Exception Test.

Sequential Test:

Under the NPPF (2025), Zone 1 is defined as Low probability flood risk. The proposal is for a residential development with external parking, which in line with Table 1 is classified as 'More Vulnerable'.

Placing both these criteria into Table 2 (Flood Risk Vulnerability and Flood Zone 'Incompatibility'), More Vulnerable development in Flood Zone 1 determines that 'Development is Appropriate.'

Exception Test:

As the Sequential test is passed, the Exception test is therefore not required.

3.2 Strategic Flood Risk Assessment (SFRA)

Along with Oldham Council and Bury Council, in November 2009 JBA Consulting were commissioned by Rochdale Borough Council to undertake a Level 1 Hybrid Strategic Flood Risk Assessment. The purpose of the SFRA is to assess and map all known sources of flood risk including fluvial, surface water, sewer, groundwater and all impounded water bodies, taking into account future climate change predictions.

A summary of the main elements from the SFRA are detailed below. The full report can be obtained from the Rochdale Borough Council website.

- SFRA provides a detailed understanding of flood risks across the borough from all sources.
- The main source of fluvial flooding in Rochdale is from the River Roch.
- Development should aim to deliver greenfield runoff rates on greenfield sites up to a 1 in 100-year storm event, considering climate change.

- Development should be designed so that there is no flooding to the development in a 1 in 30-year event and so that there is no property flooding in a 1 in 100 year plus climate change event.
- For all sites, development proposals should look at opportunities to incorporate SuDS to reduce the risk of surface water flooding.
- All proposed developments must ensure that foul and surface water are kept separate.
- Full sequential and exception tests to be carried out (where applicable).
- Flood Resilient construction to be used where applicable.
- Safe dry access and egress to be assured.

3.3 Statutory Authority Correspondence

GWK have consulted with the EA. Refer to Appendix E for further details on the flood data received via a Product 4 request.

4.0 Definition of Flood Hazard

4.1 Generally

Flood risk to the proposed development site is considered from all sources of flooding, as defined by the NPPF (2025).

4.2 Sources of Information

The NPPF (2025) requires the developer to consider the impact of runoff generated by the proposed development onto the downstream catchment, and to assess the risk of runoff from the surrounding district impacting on the development's footprint. Further, the report is to consider flood risk from all other sources. The following section defines the flood risk receptors and anticipated flood risk. Section 4.8 then tabulates the probability of flooding and the likely impacts.

Figure 3 summarises the main sources of information used in the identification of flood risk.

Source of Information	Details
Environment Agency Flood Map	From EA website and Product 4 Flood Data
United Utility Sewer Records	Various Maps
Historic Maps	From various websites
Rochdale Borough Council SFRA	Report & Various Maps

Figure 3 Sources of information used in the identification of flood risk.

4.3 Flooding from Rivers (Fluvial)

As mentioned in earlier sections, the closest identified watercourse is the River Roch flowing generally in a westerly direction along the northern boundary.

Figure 4 below locates the site on the Environment Agency's indicative flood plain map. It is clear from this that the red line boundary lies on the periphery of the current statistical fluvial floodwater model footprint generated by the River Roch. The flood maps locate the site within Flood Zone 1 but on the periphery of high-risk Flood Zone 3, i.e. land assessed as having greater than a 1 in 100 (>1.0%) annual probability of

fluvial flooding in any year. The risk from fluvial flood water therefore requires further consideration. Refer to Section 5 for details.

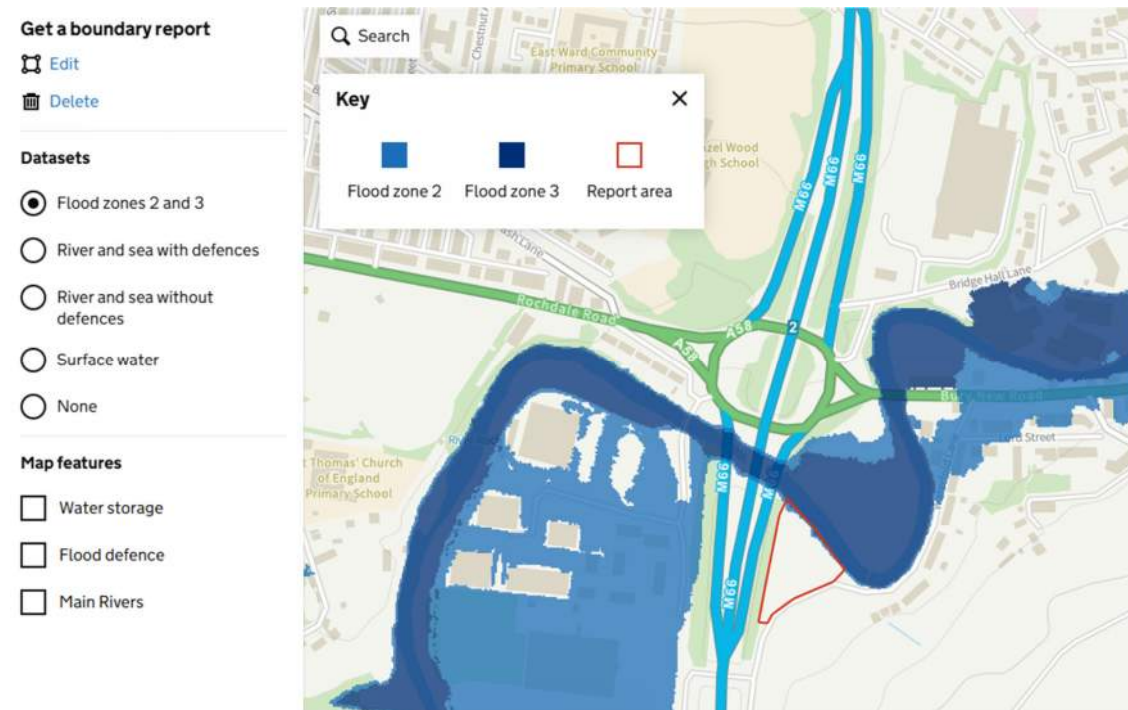


Figure 4 The EA's Indicative 100-year Flood Plain Map

4.4 Flooding from Land (Overland Flow)

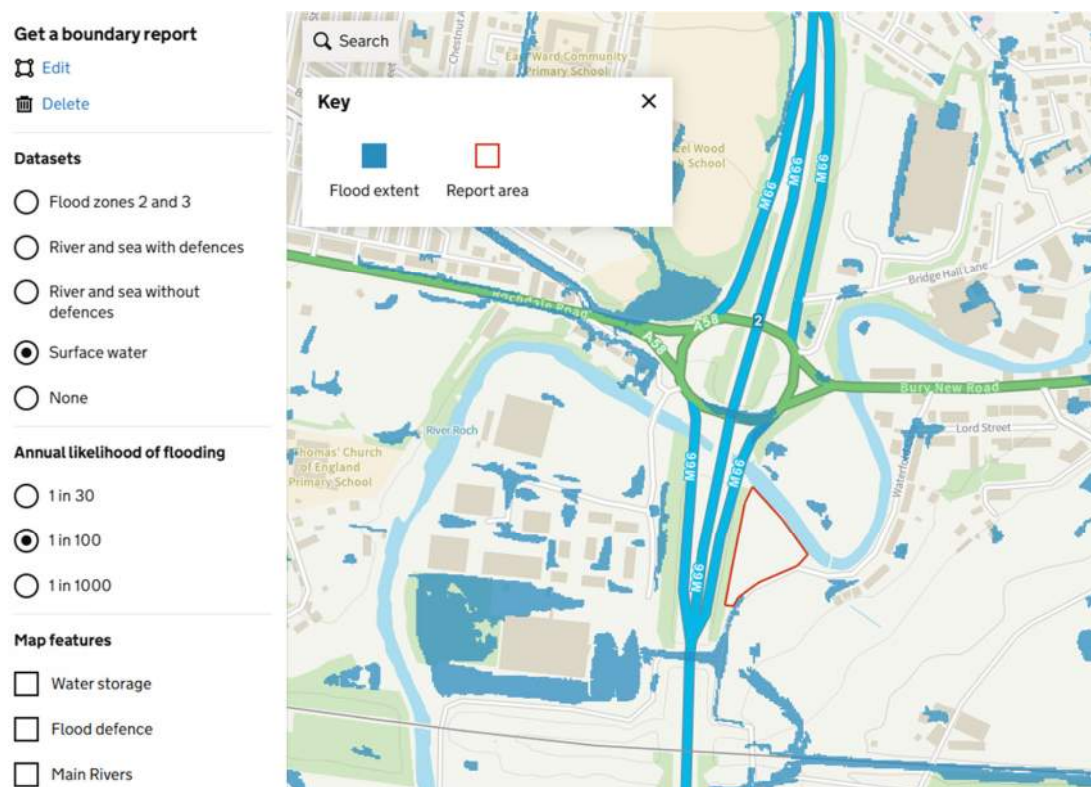
The EA descriptions for the High, Medium and Low risk scenarios for surface water flooding are as follows:

- High risk means that each year this area has a chance of flooding of greater than 3.3%.
- Medium risk means that each year this area has a chance of flooding between 1% and 3.3%.
- Low risk means that each year this area has a chance of flooding between 0.1% and 1%.
- Very Low risk means that each year this area has a chance of flooding of less than 0.1%.

The existing site has a moderate fall in all directions from the centre. Waterfold Lane is located along the southeastern boundary at a slightly lower ground level with any surface water directed to the adjacent River. The western boundary encompasses the elevated M66 slip road with existing land drainage at the base. In light of this there is limited risk of overland flows causing any flood risk to the new development buildings.

The EA's indicative surface water maps from the EA website (see Figure 5 below) indicate the site to be at very low risk from surface water flooding. The area of the new buildings have no flooding due to its elevated location. New drainage will also be incorporated into the layout to collect both permeable and impermeable rainwater runoff such that the only ponding from exceedance flooding will be located in controlled areas.

Figure 5 The EA's Indicative Surface Water Flood Map



4.5 Flooding from Sewers and Private Drainage

United Utilities (UU) sewer records have been reviewed and confirm there are no sewers passing through the site. Located to the southeast is a 1370mm diameter combined sewer at circa 10m depth. Beyond this a 450mm diameter combined water public sewer flowing in a south westerly direction. Full details can be found in Appendix F. Both these sewers will have lower ground levels than the FFL's of the development building, thus posing a low risk.

No existing private drainage has been identified within the site. All new drainage will be private, maintained by the property owners and designed in line with their approved guidance. Further details can be found in Section 6. Based on the available information, flood risk from surcharged or flooded sewers is considered to be low.

4.6 Flooding from Groundwater

A site specific intrusive phase 2 site investigation has been carried out at the site and has identified the groundwater levels at circa 2.5-3.0m BGL.

The Rochdale Council Level 1 Strategic Flood Risk Assessment (SFRA) indicated that no groundwater flooding has been experienced in the locality of the development site.

Also noted that there are no basements proposed and the adjacent watercourse is set lower down than the main development site, thus further reducing the risk.

4.7 Flooding from Artificial Sources

The site is not at risk of flooding from any other sources.

4.8 Summary

Below is a table summary of the flood risks associated with the development site.

Source	Flood Risk	Likely Impacts	Remarks
Tidal	Low	Low	Site located in Low-Risk Flood Zone 1 from Tidal Flooding.
Fluvial (Watercourse)	Medium	Low	Main development area located in low-risk Flood zone 1. However, the northern boundary abutting Flood Zone 3 from the River Roch. Further Assessment carried out in Section 5.
Surface (Overland Flood Flow)	Low	Low	The site and surrounding area are relatively flat. No risk of overland flows due to existing buildings and highways. New development levels will remove this.
Sewers	Low	Low	No existing combined water sewers passing through development. Sewers beyond site lower than new building. All new drainage to take account of any potential flood risk and be sized accordingly.
Groundwater	Low	Low	No indication through Phase 2 site investigation or SFRA that site at risk of groundwater flooding.
Artificial Sources	Very Low	Low	Not considered relevant at site specific level.

Figure 6 Flood Risk Summary

5.0 Assessment of Flood Risk on Proposed Development

5.1 Summary

As discussed in Section 3, the development site has been categorised in accordance with the SFRA and EA Flood Maps as being located on the periphery of a high flood Risk Area from fluvial flooding. This is related to flood risk from the River Roch.

It is evident from the previous section that there is one medium flood risk area (fluvial) that requires further assessment.

Other flood risk sources such as groundwater, sewer and overland flows have been considered and have been found not to be a flood risk generator to the site.

5.2 Flooding from the River Roch (Fluvial)

The EA have been consulted and have confirmed that the indicative flood maps have been prepared using modelled data taken from the Lower Roch 2017 Study.

Figure 7 provides the various flood level data from this model at the nearest node point, which is immediately adjacent to the site.

The Environment Agency data provided refers to the application of updated climate change allowances for peak river flows for catchments across the UK in February 2016, with further updates released in 2021.

Based on the 'More Vulnerable' land use assuming a design life of greater than 100 years; the central allowance (2080's) should be assessed; **+35%**.

Node Ref:	1 in 100 year (1% AEP)	1 in 100 year + Climate Change (1% AEP + 35%)	1 in 1000 year (0.1% AEP)
1444502	75.86m AOD	76.44m AOD	76.75m AOD

Figure 7 : Peak Flood Level of the River Roch

The top of bank ground level at the site boundary ranges from 76.95m AOD to 78.35m AOD. This clearly indicates that the water will not in fact pass out of bank and thus poses no risk. Furthermore, the finish floor level of the new units will be no lower than 78.40m AOD. This provides a significant freeboard and therefore demonstrates that the site is located outside of both Medium Risk Flood Zone 2 and High-Risk Flood Zone 3 (including the allowance for climate change). In light of this no further assessment is required.

6.0 Outline Drainage Strategy

6.1 Existing Drainage

The UU sewer records have been reviewed and confirm there are no sewers passing through the site. Located to the southeast is a 1370mm diameter combined sewer at circa 10m depth. Beyond this a 450mm diameter combined water public sewer flowing in a south westerly direction.

No existing private drainage has been identified within the site.

6.2 Existing Runoff

The development site is currently classed as unmade. Therefore, in terms of runoff characteristics can be classed as greenfield.

Figure 8 below defines the existing Greenfield runoff rate.

Existing Site Area (ha)	1 Year	30 Year	100 Year
0.87	4.9 l/s	9.6 l/s	11.8 l/s

Figure 8 Existing Greenfield Runoff Rate

6.3 Geology

A review of the local borehole records and an anecdotal review of desk-based information would indicate that the underlying ground encompasses silts and clays.

A site-specific intrusive Phase 2 Site Investigation has been carried out at the site. This has identified Made Ground encompassing sands and clays to a maximum depth of 2.35m BGL. This is overlain by clays and clayey sands and gravels to depth. Groundwater depths were recorded as between 1.77m and 2.87m BGL.

Furthermore, soakaway tests were carried out at two locations. For both tests, the water levels failed to drop to a depth that could be recorded and thus proved that infiltration at this site is not feasible. Refer to Appendix G for details.

6.4 Hydrological Assessment

As discussed in previous sections, a review of the topographical survey, OS Maps and Environment Agency maps would indicate the closest surface water feature to be the River Roch, located along the northern boundary of the proposed development flowing in a westerly direction.

6.5 Sustainable Drainage Systems (SuDS) Assessment

SuDS Objectives

Sustainable drainage developed in line with the ideals of sustainable development is collectively referred to as Sustainable Drainage Systems (SuDS). At a particular site, these systems are designed both to manage the environmental risks resulting from urban runoff and to contribute wherever possible to environmental enhancement. SuDS objectives are therefore to minimise the impacts from the development on the quantity and quality of the runoff and maximise amenity and biodiversity opportunities (CIRIA C753, 2015).

SuDS Design Themes

The 'Management Train Approach' should be central to the surface water drainage strategy of the proposed site. The main objective is treatment and control of runoff as near to the source as possible protecting downstream habitats and further enhancing the amenity value of the site. This concept uses a hierarchy of drainage techniques to incrementally reduce pollution, flow rates and volumes of storm water discharge from the site, and is as follows:

- i. **Prevention** – The use of good site design and housekeeping measures to prevent runoff and pollution and includes the use of rainwater reuse / harvesting.
- ii. **Source Controls** – Control of runoff at source or as close to source as possible (e.g. soakaways, green roofs, pervious pavements).
- iii. **Site Control** – Management of water in a local area and can include below ground storage / attenuation, detention basins, large infiltration devices.
- iv. **Regional Control** – Management of water from a site or various sites and can include wetlands and balancing ponds.

SuDS Site Constraints

SuDS techniques are suitable for all sites; therefore, an assessment of the existing site is required so that SuDS limitations can be determined.

- *Land Use Characteristics:* The size and type of development enable the potential range of prevention, source control and site control SuDS devices to be considered.
- *Site Characteristics:* A site investigation has been carried out at the site with the findings that infiltration techniques would not be suitable.
- *Catchment Characteristics:* The site is currently classed for drainage purposes as 'Greenfield' and the discharge rate from the site will need to mimic where possible the predevelopment runoff rates. As such, Greenfield rates will apply with a minimum of 5l/s applied to prevent blockage.
- *Environmental and Amenity Performance:* The inclusion of SuDS within the overall development is a key driver in providing both amenity and habitat creation. All types of SUDs will be considered and blended into the landscaping zone, if possible. Safety for all future users is paramount and so best practice guidance will be incorporated so that these devices blend into the surrounding without the need for significant safety precautions. Maintenance plans will be prepared for all SuDS devices that are included.

SuDS Methods

Figure 9 and 10 on the following pages provide an assessment of various above and below ground SuDS methods that can provide water quality treatment and management of flows to reduce runoff rates and volumes and whether they can be suitably incorporated at this development site. The purpose of this assessment is to set out options to be considered at the planning stage with consideration to time constraints, viability and lifetime maintenance of the residential development.

Method	Comment	Suitability for Development
Green Roofs	Can be used on suitable low-rise buildings to provide retention, attenuation and treatment of rainwater, and promotes evaporation and local biodiversity.	<u>Not suitable:</u> Architectural proposals for the residential development with pitched roofs that are not viable.
Water Butts	Plastic tanks placed at the base of rainwater down pipes to collect rainwater runoff from the roof areas.	<u>Suitable:</u> Could potentially be placed on the rear RWP's.
Rainwater Harvesting	Rainwater harvesting reduces the total runoff volume from the developed site and reduces treated water consumption.	<u>Not Suitable:</u> - Additional costs of installation would have a severe effect on the viability of the development. - Running and maintenance costs would not be acceptable to our client and future occupiers. - The ability to restrict peak flow rates and short-term peak volumes is non-existent where a critical storm event occurs.
Infiltration Options	Reduces total run off volume from the development.	<u>Not Suitable:</u> Ground conditions are not conducive to infiltration.
Permeable Surfacing (Infiltration)	- Reduces total run off volume from the development. - Can be used to enhance water quality.	<u>Not Suitable:</u> Ground conditions are not conducive to infiltration.

Method	Comment	Suitability for Development
Permeable Surfacing (Standard)	• Can be used to enhance the quality of runoff water. • Sub-base provides 'source' storage and reduces the volume of storage downstream. • The storage can be created with selection of the stone fill or plastic box stems. • Impermeable membrane at base of construction to prevent impact on pavement stability.	<u>Suitable:</u> • New parking bays are to be constructed in permeable surfacing with lined outfall.
Swales, basins and ponds	• Provide areas for above ground surface runoff storage. • Swales also allow filtering of particulate matter, improving water quality	<u>Suitable:</u> • Small pond is to be included to the north of the site.
Bio-Retention	• Collect and retain run-off to help improve water quality, prior to discharge in piped system on infiltration.	<u>Suitable:</u> • Rainwater planters to be included on the RWP's

Figure 9 Surface SuDS Methods

Method	Comment	Suitability for Development
Geocellular Storage	• Suitable for sites with insufficient space for basins etc. • Suitable for sites where topography prevents the use of open basins etc.	<u>Suitable:</u> • Subject to detailed design and drainage layout.
Large Diameter Pipes, Culverts or Tanks	• Suitable for sites with insufficient space for basins etc. • Provide a volume of below ground storage with a high void ratio and good man entry provision to allow for future maintenance and cleaning. Generally, be suitable for adoption by the statutory water company	<u>Not suitable:</u> • The scheme is not large enough to require oversized pipes. • Limited depth also negates this option

Figure 10 Sub-Surface SuDS Methods

SuDS Hierarchal Approach

Based on the SuDS assessment in Figure 9 and 10, plus an assessment of the local site conditions, the SuDS hierarchal approach for discharge of surface water at the development site is considered in greater detail below:

Method	Suitability	Suitability for Development
Infiltration to Ground	No	Phase 2 site investigation would indicate that the underlying cohesive soils would not be suitable.
Connection to Watercourse	Yes	Existing watercourse adjacent the site to be used with new outfall constructed.
Connection to Surface Water Sewer	No	Higher options possible.
Connection to a Combined Sewer	No	Higher options possible.

Figure 11 SuDS Hierarchal Approach

SuDS Design Philosophy

SuDS assessment and hierarchical approach discussed in Figure 9, 10 and 11 above has defined the overall SuDS strategy. Thus, the SuDS philosophy for the development site is the promotion of Prevention, Source Control and Site Control techniques with outfall at restricted rates to the adjacent watercourse.

The following design philosophy is proposed:

- Surface water treatment using the 'Management Train' approach to remove and isolate contamination at all SuDS facilities prior to conveyance to the existing drainage infrastructure.
- Prevention measures in the form of water butts to the rear RWP's, rainwater planters to the RWP's and tree pits.
- Source control in the form of permeable surfacing.
- Site control in the form of a small attenuation pond and Geocellular attenuation tank with flow control.

6.6 Climate Change

In May 2022, the Environment Agency released updated climate change allowances for peak rainfall intensities which should be applied to new developments. Rather than nationwide allowances, each area will have its own peak rainfall allowances. In the case of the Heap Bridge area, this is the Irwell Management Catchment peak rainfall allowances.

Based on the nature of development, a lifespan in excess of 100 years is anticipated. Therefore, the potential climate change allowance for the 2070's ranges between 30% for the central allowance and 45% for the upper end allowance. As such, an allowance of 45% for climate change on peak rainfall intensity will be included in calculations.

6.7 Outline Surface Water Drainage Strategy

The general principle of the surface water drainage strategy is to collect the runoff from the roof of the new residential units via the downpipes. The water will then be directed to a new below ground surface water drainage network that will pick up the runoff from the access road and driveways, and outfall to the adjacent River Roch at a restricted rate of 5l/s. Attenuation will take the form of a small attenuation pond and geocellular tank. Other SuDS in the form of water butts, rainwater planters, tree pits and permeable surfacing will also be incorporated.

The proposed private drainage layout for the new development building will be designed in accordance with BS EN 752: 2008 and Building Regulations Part H guidance. This is to indicate no surcharge for the 2-year storm event and no flooding for up to the 30-year storm event.

The proposed drainage layout for the new development site will be designed in accordance with Design & Construction Guidance (DCG), BS EN 752: 2008 and Building Regulations Part H guidance, i.e., up to the 30-year storm return period criterion and tested for the 1 in 100-year return period including a 45% increase to account for climate change to confirm that there is no flood risk to the properties.

In the case of this development, the hydraulic calculations have proved that there is no flooding up to the 100yr + 45% climate change event.

The surface water drainage strategy is indicated on the GWK drawing in Appendix C with calculations in Appendix D.

Any future drainage calculations carried out as part of a site wide drainage strategy or for the final development layout must include the appropriate increase in rainfall to satisfy the future Climate change allowances.

6.8 Maintenance

This section is intended to give an overview of the operation and maintenance of the drainage features included with the drainage strategy and in relation to typical details. Where proprietary products are specified, the manufacturer's instructions and recommendations should be followed in priority to this document unless specifically noted otherwise due to project constraints. The recommended operations and frequencies are typical only and should be more frequent initially to ensure that there are no unforeseen issues with the operation and then adjusted to suit the site requirements.

There are three types of maintenance activities associated with surface water drainage systems. The SuDS Manual, CIRIA C753, defines these as:

- Regular Maintenance – 'basic tasks undertaken on a frequent and predictable schedule' including vegetation management, litter and debris removal, and inspections.'
- Occasional Maintenance – 'tasks that are likely to be required periodically, but on a much less frequent and predictable basis than the routine tasks (sediment removal is an example.'
- Remedial Maintenance – 'intermittent tasks that may be required to rectify faults associated with the system, although the likelihood of faults can be minimised

by good design. Where remedial work is found to be necessary, it is likely to be due to site-specific characteristics or unforeseen events, and as such timings are difficult to predict.

Specific maintenance needs should be monitored, and maintenance schedules adjusted to suit the location and condition of the drainage feature in question.

Inspection, Manhole and Catchpit Chambers

The appropriate health and safety equipment must be used when accessing manholes. Confined space certificates must be held by any personnel entering a manhole and the appropriate permits should be obtained from the Maintenance Manager prior to any access.

Pipes are proprietary products, and the materials can vary across the site and as such where used the manufacture's recommendations should be followed. Regardless of the product used, the pipes will be fully compliant with the drainage specification.

Pipes are intended to be the main conveyance across the development and where oversized they form the attenuation volume required by the limitation of the discharge rate. They are intended to be dry except for during rainfall events. These have been designed to be self-cleaning where possible for smaller diameter pipes, and for larger diameters the risk is reduced due to the overall pipe size.

Access for maintenance is provided through access chambers and manholes.

Regular inspection and maintenance are important to identify areas which may have been obstructed / clogged and may not be drainage correctly thus exposing the development to a greater level of flood risk.

Channels & Gullies

Channels and gullies should be inspected and cleaned in accordance with the manufacturer's details. Channel units can be cleaned through the use of a high-pressure hose; this can be fed into the channel system through access units strategically placed along the channel run. The throat section of channel units should be kept clear at all times to ensure uninterrupted flow of surface water into the drainage channel and any debris within the throat should be removed.

Locking bolts should be replaced and sufficiently tightened, taking care that the bolt heads do not stand above the top surface of the cover or grate. If covers are allowed to move within their frame, this may cause damage to the frame or seating.

Maintenance schedule	Required action	Typical frequency
Regular Maintenance	Remove manhole and chamber covers to sewers and flow control on network—inspect to ensure water is flowing freely and that the water flow route is unobstructed. Remove debris and silt as required.	Half Yearly Undertake one of these inspections after leaf fall in autumn
Occasional Maintenance	None required	
Remedial Actions	Re-line or replace pipework if unable to clear blockages by jetting.	As required
Monitoring	Inspect chambers for build-up of silt and debris	Half yearly

Figure 12 – Operation & maintenance requirements for pipe network, manholes & inspection chambers, drainage channels & gullies.

Attenuation storage

Geocellular tanks are modular storage systems made with plastic units. These units can be assembled to achieve the required volume and usually on multiple layers. Generally, the units have 95% of voids content and are used to create an efficient below ground structure to store surface water.

The geocellular units and surrounding geotextile are proprietary products and therefore manufacturer's recommendations should also be taken into consideration.

Access for maintenance should be provided by an access shaft located on the tank and from the manhole chambers downstream of the tank.

Regular inspection and maintenance are important for the effective operation of attenuation tanks as designed. As the feature is buried, a regular inspection regime is very important to ensure the correction functionality of the surface water drainage network.

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually.
	Remove debris from the catchment surface (where it may cause risks to performance).	Monthly.
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockages by sediment, algae or other matter; remove and replace surface infiltration medium as required.	Annually.
	Remove sediments from pre-treatment structures and/or internal forebays.	Annually, or as required.
Occasional Maintenance	Remove sediment from pre-treatment structures and/or internal forebays	Annually, or as required
	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed.	Annually
Remedial Actions	Survey inside of tank for sediment build-up and remove if necessary.	Every 5 years or as required.

Figure 13 – Operation & maintenance requirements for Attenuation Crates - Based on CIRIA SuDS Manual 2015

Porous Paved Area

Permeable surfacing enables any water landing on the surface to infiltrate directly to ground at source, thus acting close to a permeable surface.

Regular inspection and maintenance are important for the effective operation of the permeable surfacing to allow it to work efficiently through its design life.

Maintenance schedule	Required action	Typical frequency
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surfaces from adjacent impermeable areas as this is most likely to collect the most sediment.
Occasional Maintenance	Stabilise and mow contributing and adjacent areas.	As required
	Removal of weeds or management using glyphosate applied directly into the weeds rather than spraying	As required – once per year on less frequently used pavements.
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the surface.	As required
	Remedial works to any depressions, rutting and cracked considered detrimental to the structural performance or a hazard to users, and replace lost jointing material.	As required
	Rehabilitation of surface and upper substructure by remedial sweeping.	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Inspect for evidence of poor operation and/or weed growth -if required, take remedial action.	Three-monthly, 48 hours after large storms in the first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies.	Annually

Figure 14 – Operation & Maintenance requirements for Porous Paved Area – CIRIA SuDS Manual 2015

6.9 Foul Water Drainage

New foul drainage will outfall to the existing combined sewer located beyond the southern boundary, subject to a S106 sewer connection application to UU.

The proposed private drainage layout for the new development site will be designed in accordance with BS EN 752: 2017 and Building Regulations Part H guidance.

7.0 Management Measures, Off Site Impacts & Residual Risk

7.7 Flood Risk Management Measures

The assessment has proved that there is no fluvial flood risk to the proposed development from the surcharge of the River Roch.

The surface water drainage strategy for the new development site will be to limit the surface water runoff to existing Greenfield discharge rates with attenuation measures incorporated. The new surface water networks will be designed in line with current British Standard guidance up to the 100-year storm return period including an allowance for climate change.

The use of SUDS in the form of prevention, source control and Site Control measures will help to minimise the flood risk impact to the surrounding sewers and watercourses.

There will be a site management health and safety document prepared in respect of the final development. This will include the required maintenance regime for the on site drains and drainage facilities such as the channels, gullies, pipes, manholes and all SUDS facilities.

Should any flooding occur from the new sewers and drains it will be directed away from the new buildings to the car parking areas.

7.2 Offsite Impacts

The redevelopment of the site does not impair the hydraulic continuity of any watercourse and the current “local hydraulics” of distributing watercourses / outfalls. The Development footprint does not cross or cover any existing or declared future catchment flood defences. Consequently, the Applicant does not propose to augment or compromise the current catchment defences.

Surface water runoff will mimic the pre-development regime and utilises SuDS solutions to satisfy the site constraints.

By mimicking the pre-development peak runoff at its point of discharge into the adjacent sewers by the inclusion of SuDS, this will reduce surface water flooding impact onto the downstream catchment.

As there is no flood displacement or increased rate of runoff as part of this proposal into the adjacent sewers, the proposed development will therefore not increase flood risk onto its locality.

7.3 Residual Risk

With careful design of the drainage elements as described above there will be no residual flood-related risks that will remain after the development has been completed.

Flood risk to people and property can be managed but it can never be completely removed; a residual risk remains after flood management or mitigation measures have been put in place. The only known flood related residual risk that will remain after flood management or mitigation measures have been put in place will be the risk of flooding from the drainage networks beyond the extreme event. By raising the building levels the risk is mitigated.

Appendix A – Architect Drawings



NOTES

This drawing is the property of Equilibrium Architects and copyright is reserved by them. This drawing is not to be copied or disclosed by or to any unauthorised persons without the prior written consent of Equilibrium Architects.

Do not scale from this drawing.

All dimensions are to be checked on site prior to construction, manufacture of any components and ordering of materials and equipment.

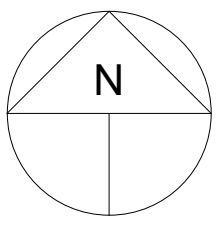
Any discrepancies are to be reported to the architect for clarification.

All materials and workmanship to be in accordance with the current British Standards and codes of practice.

This drawing is to be read in conjunction with all relevant Architectural, Structural Engineers, Mechanical Engineers, Electrical Engineers and Specialists drawings and specifications.

As with all construction projects the CDM 2015 regulations apply and the work on this project may require both the issue of a notification to the HSE (because of the duration of the works on site) and the client may also need to appoint a Principal Designer because there may be more than one contractor working on site. The Principal Designer will be able to coordinate the pre-construction information and also ensure that all duty holders under CDM comply with their relevant duties.

The building owner is to serve a Party Wall Act Notice as applicable to adjoining property owners as outlined in The Party Wall Act 1996. The Building Contactor is to verify the thickness of the party walls prior to commencement of the proposed works.



REV	DESCRIPTION	CHECK	DATE
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CLIENT
FRANSTEP LIMITED

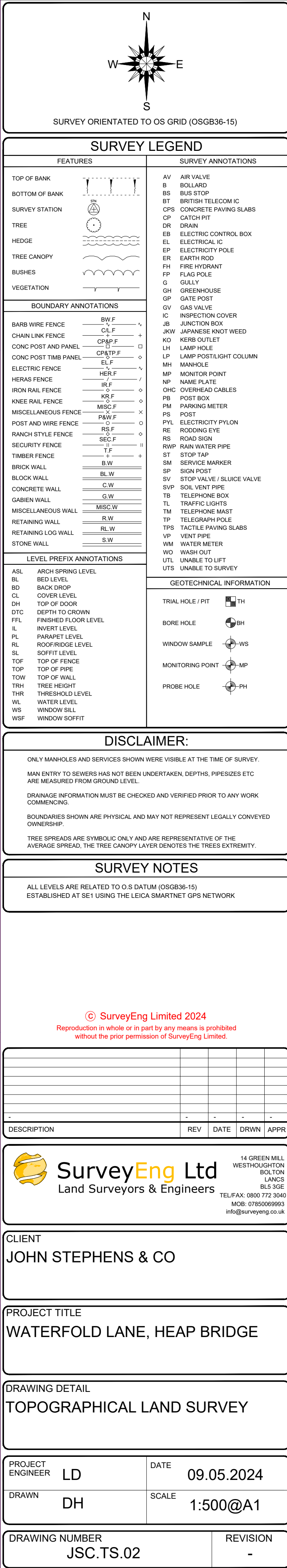
PROJECT
**Proposed Residential Development
Waterfold Lane, Heywood, BURY, BL9 7JY**

DRAWING
**Proposed Site Plan
Option 6**

SCALE	DATE	DRAWN	CHECKED
1:300 @ A1	April 2026	PMAB	
DRAWING NO.	CAD REFERENCE NO.	REVISION	
R-0832-11			



Appendix B – Topographical Survey



Appendix C - GWK Design Drawings

SURFACE WATER DRAINAGE

CONSIDERATION HAS BEEN GIVEN TO THE HIERARCHY OF DRAINAGE OPTIONS FOR THE SITE AS FOLLOWS:

- DISCHARGE INTO GROUND – A DETAILED PHASE 2 SITE INVESTIGATION HAS BEEN COMPLETED AND INDICATES THE UNDERLYING GROUND TO BE TILL, ENCOMPASSING CLAYS AND SILTS. IN LIGHT OF THESE FINDINGS, INFILTRATION IS DISCOUNTED.
- DISCHARGE TO SURFACE WATER BODY – NEW CONNECTION TO BE MADE TO ADJACENT RIVER ROCH AT RESTRICTED RATES.
- DISCHARGE TO SURFACE WATER SEWER, HIGHWAY DRAIN OR OTHER DRAINAGE SYSTEM – NO SURFACE WATER SEWER IN CLOSE PROXIMITY.
- DISCHARGE TO COMBINED WATER SEWER – HIGHER OPTIONS AVAILABLE.

SUMMARY

NEW CONNECTION TO BE MADE TO THE RIVER ROCH AT A RESTRICTED RATE OF 5L/S.

SUDS TO ENCOMPASS:

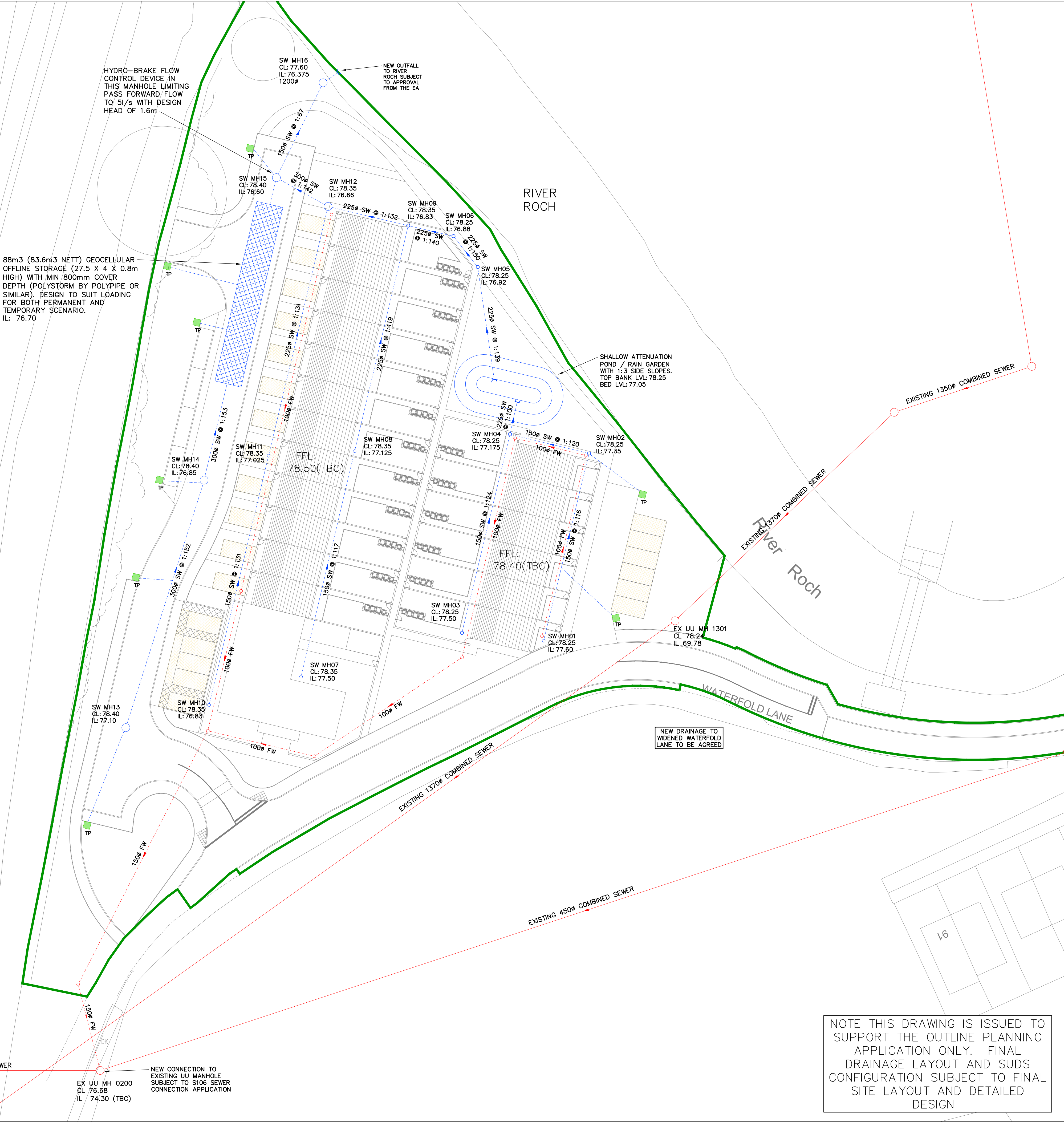
- WATER BUTTS / RAINWATER PLANTERS
- TREE PITS
- PERMEABLE SURFACING
- FLOW CONTROL CHAMBER.
- SMALL ATTENUATION POND
- GEOCELLULAR TANK

SUMMARY

IMPERMEABLE AREA: 3240m² (TOTAL)
OUTFALL LOCATION: WATERCOURSE
PEAK DISCHARGE RATE: 5L/S
ATTENUATION VOLUME: 160m³ (100YR+ 45% CC)

FOUL WATER DRAINAGE

FOUL WATER GENERATED BY THE NEW DEVELOPMENT WILL DISCHARGE UNRESTRICTED TO THE COMBINED SEWER TO THE SOUTH OF THE SITE VIA A NEW CONNECTION.



NOTES: –

- ALL LEVELS ARE IN METRES.
- ALL DIMENSIONS ARE IN MILLIMETRES.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE ACCURACY OF ALL DIMENSIONS AND LEVELS AND FOR THE CORRECT SETTING OUT OF THE WORK ON SITE UNLESS NOTED OTHERWISE.
- THE CONTRACTOR SHALL ENSURE ALL NECESSARY PRECAUTIONS ARE TAKEN TO PROTECT EXISTING SERVICES DURING THE WORKS.

KEY

- EXISTING COMBINED WATER SEWER
- EXISTING SURFACE WATER SEWER
- PROPOSED FOUL WATER DRAINAGE
- PROPOSED SURFACE WATER DRAINAGE
- PERMEABLE SURFACING
- SITE BOUNDARY

No	DATE	DRAWN	REV'D	ENG.	AMENDMENT
D	10.09.26	PG	GWK		TREE PITS ADDED
C	22.04.26	PG	GWK		SITE PLAN UPDATED
B	28.07.25	PG	GWK		GENERAL UPDATES
A	17.06.24	PG	GWK		ISSUED FOR INFORMATION



GWK STRUCTURAL SOLUTIONS LTD
CONSULTING CIVIL & STRUCTURAL ENGINEERS
37 ANGLESEY DRIVE, POYNTON, STOCKPORT, SK12 1BU
Email: gareth@gwks.co.uk
Web: gwkstructuralsolutions.co.uk

CLIENT	FRANSTEP LIMITED		
PROJECT	WATERFOLD LANE, HEYWOOD, BURY		
DRAFTER	PG	ENGINEER	GWK
TITLE	DRAINAGE STRATEGY PLAN		
SCALE	DRAWING No	DATE	AMDT
1:300	GK4468-C-001	07.06.24	D

NOTE THIS DRAWING IS ISSUED TO SUPPORT THE OUTLINE PLANNING APPLICATION ONLY. FINAL DRAINAGE LAYOUT AND SUDS CONFIGURATION SUBJECT TO FINAL SITE LAYOUT AND DETAILED DESIGN

Appendix D – Outline Attenuation Calculations

Calculated by:	Paul Graveney
Site name:	Waterfold Lane
Site location:	Heap Bridge

Site Details

Latitude:	53.58919° N
Longitude:	2.27147° W
Reference:	2486307168
Date:	Jun 18 2024 10:39

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	0.72
-----------------------	------

Methodology

Q _{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Notes

(1) Is $Q_{\text{BAR}} < 2.0$ l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

Hydrological characteristics

	Default	Edited
SAAR (mm):	1063	1063
Hydrological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

(3) Is $\text{SPR/SPRHOST} \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

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OK, I AGREE

MORE INFO

By clicking the Accept button, you agree to us doing Greenfield runoff rates

Default

Edited

Q_{BAR} (l/s):	5.67	5.67
1 in 1 year (l/s):	4.93	4.93
1 in 30 years (l/s):	9.63	9.63
1 in 100 year (l/s):	11.79	11.79
1 in 200 years (l/s):	13.43	13.43

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

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By clicking the Accept button, you agree to us doing so.

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	10	Maximum Rainfall (mm/hr)	150.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	1.000	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	x

Adoptable Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
374	1200	749	1500
499	1350	900	1800

>900 Link+900 mm

Max Depth (m)	Diameter (mm)	Max Depth (m)	Diameter (mm)
1.500	1050	99.999	1200

Circular Link Type

Template	Freeform Carrier	Auto Increment (mm)	75
Shape	Circular	Follow Ground	✓
Barrels	1		

Available Diameters (mm)

100 | 150

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)	Invert Level (m)
SW01	0.020	4.00	78.250	450	0.650	77.600
SW02	0.017	4.00	78.250	450	0.900	77.350
SW03	0.013	4.00	78.250	450	0.750	77.500
SW04			78.250	450	1.075	77.175
POND			78.250	450	1.200	77.050
SW05			78.250	450	1.330	76.920
SW06			78.300	450	1.420	76.880
SW07	0.020	4.00	78.350	450	0.850	77.500
SW08	0.020	4.00	78.350	450	1.225	77.125
SW09			78.350	450	1.520	76.830
SW10	0.020	4.00	78.350	450	0.950	77.400
SW11	0.017	4.00	78.350	450	1.325	77.025
SW12			78.350	450	1.690	76.660
SW13	0.113	4.00	78.400	1200	1.300	77.100
SW14	0.069	4.00	78.400	1200	1.550	76.850
TANK			78.400	100	1.700	76.700
SW15	0.015	4.00	78.400	1350	1.800	76.600
SW16			78.100	1200	1.725	76.375
OUTFALL			76.000	100	0.625	75.375

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	SW01	SW02	29.000	0.600	77.600	77.350	0.250	116.0	150	4.52	108.4
1.001	SW02	SW04	12.000	0.600	77.350	77.250	0.100	120.0	150	4.74	106.4
2.000	SW03	SW04	31.000	0.600	77.500	77.250	0.250	124.0	150	4.57	107.9
1.002	SW04	POND	5.000	0.600	77.175	77.125	0.050	100.0	225	4.80	105.9
1.003	POND	SW05	18.000	0.600	77.050	76.920	0.130	138.5	225	5.07	103.6
1.004	SW05	SW06	6.000	0.600	76.920	76.880	0.040	150.0	225	5.17	102.8
1.005	SW06	SW09	7.000	0.600	76.880	76.830	0.050	140.0	225	5.27	101.9
3.000	SW07	SW08	35.000	0.600	77.500	77.200	0.300	116.7	150	4.63	107.4
3.001	SW08	SW09	35.000	0.600	77.125	76.830	0.295	118.6	225	5.11	103.2
1.006	SW09	SW12	12.500	0.600	76.830	76.735	0.095	131.6	225	5.45	100.5
4.000	SW10	SW11	38.000	0.600	77.400	77.100	0.300	126.7	150	4.71	106.7
4.001	SW11	SW12	38.000	0.600	77.025	76.735	0.290	131.0	225	5.27	102.0
1.007	SW12	SW15	8.500	0.600	76.660	76.600	0.060	141.7	300	5.56	99.6
5.000	SW13	SW14	38.000	0.600	77.100	76.850	0.250	152.0	300	4.50	108.6
5.001	SW14	TANK	23.000	0.600	76.850	76.700	0.150	153.3	300	4.80	105.9
5.002	TANK	SW15	6.000	0.600	76.700	76.600	0.100	60.0	300	4.85	105.5
1.008	SW15	SW16	15.000	0.600	76.600	76.375	0.225	66.7	150	5.76	98.6
1.009	SW16	OUTFALL	4.000	0.600	76.375	75.375	1.000	4.0	150	5.78	98.5

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.932	16.5	7.8	0.500	0.750	0.020	0.0	73	0.921
1.001	0.916	16.2	14.2	0.750	0.850	0.037	0.0	109	1.031
2.000	0.901	15.9	5.1	0.600	0.850	0.013	0.0	58	0.803
1.002	1.307	52.0	19.1	0.850	0.900	0.050	0.0	94	1.211
1.003	1.109	44.1	18.7	0.975	1.105	0.050	0.0	102	1.065
1.004	1.065	42.3	18.6	1.105	1.195	0.050	0.0	104	1.031
1.005	1.103	43.8	18.4	1.195	1.295	0.050	0.0	102	1.055
3.000	0.929	16.4	7.8	0.700	1.000	0.020	0.0	72	0.915
3.001	1.199	47.7	14.9	1.000	1.295	0.040	0.0	87	1.065
1.006	1.138	45.2	32.7	1.295	1.390	0.090	0.0	142	1.236
4.000	0.891	15.7	7.7	0.800	1.100	0.020	0.0	74	0.887
4.001	1.140	45.3	13.6	1.100	1.390	0.037	0.0	85	1.002
1.007	1.319	93.2	45.7	1.390	1.500	0.127	0.0	149	1.313
5.000	1.273	90.0	44.4	1.000	1.250	0.113	0.0	149	1.268
5.001	1.267	89.6	69.6	1.250	1.400	0.182	0.0	200	1.395
5.002	2.033	143.7	69.4	1.400	1.500	0.182	0.0	147	2.015
1.008	1.233	21.8	115.5	1.650	1.575	0.324	0.0	150	1.256
1.009	5.074	89.7	115.3	1.575	0.475	0.324	0.0	150	5.168

Pipeline Schedule

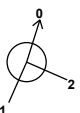
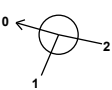
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	29.000	116.0	150	Circular	78.250	77.600	0.500	78.250	77.350	0.750
1.001	12.000	120.0	150	Circular	78.250	77.350	0.750	78.250	77.250	0.850
2.000	31.000	124.0	150	Circular	78.250	77.500	0.600	78.250	77.250	0.850
1.002	5.000	100.0	225	Circular	78.250	77.175	0.850	78.250	77.125	0.900
1.003	18.000	138.5	225	Circular	78.250	77.050	0.975	78.250	76.920	1.105
1.004	6.000	150.0	225	Circular	78.250	76.920	1.105	78.300	76.880	1.195
1.005	7.000	140.0	225	Circular	78.300	76.880	1.195	78.350	76.830	1.295
3.000	35.000	116.7	150	Circular	78.350	77.500	0.700	78.350	77.200	1.000
3.001	35.000	118.6	225	Circular	78.350	77.125	1.000	78.350	76.830	1.295
1.006	12.500	131.6	225	Circular	78.350	76.830	1.295	78.350	76.735	1.390
4.000	38.000	126.7	150	Circular	78.350	77.400	0.800	78.350	77.100	1.100
4.001	38.000	131.0	225	Circular	78.350	77.025	1.100	78.350	76.735	1.390
1.007	8.500	141.7	300	Circular	78.350	76.660	1.390	78.400	76.600	1.500
5.000	38.000	152.0	300	Circular	78.400	77.100	1.000	78.400	76.850	1.250
5.001	23.000	153.3	300	Circular	78.400	76.850	1.250	78.400	76.700	1.400
5.002	6.000	60.0	300	Circular	78.400	76.700	1.400	78.400	76.600	1.500
1.008	15.000	66.7	150	Circular	78.400	76.600	1.650	78.100	76.375	1.575
1.009	4.000	4.0	150	Circular	78.100	76.375	1.575	76.000	75.375	0.475

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	SW01	450	Manhole	Adoptable	SW02	450	Manhole	Adoptable
1.001	SW02	450	Manhole	Adoptable	SW04	450	Manhole	Adoptable
2.000	SW03	450	Manhole	Adoptable	SW04	450	Manhole	Adoptable
1.002	SW04	450	Manhole	Adoptable	POND	450	Manhole	Adoptable
1.003	POND	450	Manhole	Adoptable	SW05	450	Manhole	Adoptable
1.004	SW05	450	Manhole	Adoptable	SW06	450	Manhole	Adoptable
1.005	SW06	450	Manhole	Adoptable	SW09	450	Manhole	Adoptable
3.000	SW07	450	Manhole	Adoptable	SW08	450	Manhole	Adoptable
3.001	SW08	450	Manhole	Adoptable	SW09	450	Manhole	Adoptable
1.006	SW09	450	Manhole	Adoptable	SW12	450	Manhole	Adoptable
4.000	SW10	450	Manhole	Adoptable	SW11	450	Manhole	Adoptable
4.001	SW11	450	Manhole	Adoptable	SW12	450	Manhole	Adoptable
1.007	SW12	450	Manhole	Adoptable	SW15	1350	Manhole	Adoptable
5.000	SW13	1200	Manhole	Adoptable	SW14	1200	Manhole	Adoptable
5.001	SW14	1200	Manhole	Adoptable	TANK	100	Manhole	Adoptable
5.002	TANK	100	Manhole	Adoptable	SW15	1350	Manhole	Adoptable
1.008	SW15	1350	Manhole	Adoptable	SW16	1200	Manhole	Adoptable
1.009	SW16	1200	Manhole	Adoptable	OUTFALL	100	Manhole	Adoptable

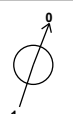
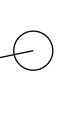
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW01	77.434	15.593	78.250	0.650	450				
						0	1.000	77.600	150
SW02	88.147	37.458	78.250	0.900	450				
						1	1.000	77.350	150
						0	1.001	77.350	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
SW03	65.795	20.287	78.250	0.750	450					
						0	2.000	77.500	150	
SW04	75.774	42.881	78.250	1.075	450		1	2.000	77.250	150
						2	1.001	77.250	150	
						0	1.002	77.175	225	
POND	77.638	48.814	78.250	1.200	450		1	1.002	77.125	225
						0	1.003	77.050	225	
SW05	74.588	61.525	78.250	1.330	450		1	1.003	76.920	225
						0	1.004	76.920	225	
SW06	67.703	71.286	78.300	1.420	450		1	1.004	76.880	225
						0	1.005	76.880	225	
SW07	40.441	43.973	78.350	0.850	450					
						0	3.000	77.500	150	
SW08	46.590	61.747	78.350	1.225	450		1	3.000	77.200	150
						0	3.001	77.125	225	
SW09	52.045	74.576	78.350	1.520	450		1	3.001	76.830	225
						2	1.005	76.830	225	
						0	1.006	76.830	225	
SW10	23.982	48.310	78.350	0.950	450					
						0	4.000	77.400	150	
SW11	30.706	64.245	78.350	1.325	450		1	4.000	77.100	150
						0	4.001	77.025	225	
SW12	36.720	78.912	78.350	1.690	450		1	4.001	76.735	225
						2	1.006	76.735	225	
						0	1.007	76.660	300	
SW13	4.815	46.976	78.400	1.300	1200					
						0	5.000	77.100	300	
SW14	14.419	65.769	78.400	1.550	1200		1	5.000	76.850	300
						0	5.001	76.850	300	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
TANK	17.310	74.554	78.400	1.700	100		1 5.001	76.700	300
SW15	22.357	87.600	78.400	1.800	1350		1 5.002 2 1.007	76.700 76.600	300 300
SW16	30.350	96.707	78.100	1.725	1200		1 1.008	76.600	150
OUTFALL	40.520	98.814	76.000	0.625	100		1 1.009	76.375	150

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
Rainfall Events	Singular	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	20.000	Additional Storage (m³/ha)	20.0
Ratio-R	0.400	Starting Level (m)	
Summer CV	1.000	Check Discharge Rate(s)	x
Winter CV	1.000	Check Discharge Volume	x

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	40	0	0
100	45	0	0

Node SW15 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	76.600	Product Number	CTL-SHE-0097-5000-1600-5000
Design Depth (m)	1.600	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.0	Min Node Diameter (mm)	1200

Node TANK Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	76.700
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	110.0	110.0	0.800	110.0	139.7	0.801	0.0	139.7

Node POND Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	77.050
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	200

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	20.0	20.0	1.200	140.0	144.9

Approval Settings

Node Size	✓	Maximum Full Bore Velocity (m/s)	3.000
Node Losses	✓	Proportional Velocity	✓
Link Size	✓	Return Period (years)	
Minimum Diameter (mm)	150	Minimum Proportional Velocity (m/s)	0.750
Link Length	✓	Maximum Proportional Velocity (m/s)	3.000
Maximum Length (m)	100.000	Surcharged Depth	✓
Coordinates	✓	Return Period (years)	
Accuracy (m)	1.000	Maximum Surcharged Depth (m)	0.100
Crossings	✓	Flooding	✓
Cover Depth	✓	Return Period (years)	30
Minimum Cover Depth (m)		Time to Half Empty	x
Maximum Cover Depth (m)	3.000	Discharge Rates	✓
Backdrops	✓	Discharge Volume	✓
Minimum Backdrop Height (m)		100 year 360 minute (m ³)	
Maximum Backdrop Height (m)	1.500	First Flush	✓
Full Bore Velocity	✓	Return Period (years)	30
Minimum Full Bore Velocity (m/s)		First Flush Depth (mm)	5

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	109.521	30.991	1 year 1440 minute winter	3.326	1.326
1 year 15 minute winter	76.857	30.991	30 year +40% CC 15 minute summer	376.189	106.449
1 year 30 minute summer	71.439	20.215	30 year +40% CC 15 minute winter	263.992	106.449
1 year 30 minute winter	50.133	20.215	30 year +40% CC 30 minute summer	244.900	69.298
1 year 60 minute summer	48.435	12.800	30 year +40% CC 30 minute winter	171.860	69.298
1 year 60 minute winter	32.179	12.800	30 year +40% CC 60 minute summer	163.225	43.136
1 year 120 minute summer	30.053	7.942	30 year +40% CC 60 minute winter	108.443	43.136
1 year 120 minute winter	19.966	7.942	30 year +40% CC 120 minute summer	98.613	26.061
1 year 180 minute summer	23.233	5.979	30 year +40% CC 120 minute winter	65.516	26.061
1 year 180 minute winter	15.102	5.979	30 year +40% CC 180 minute summer	74.617	19.202
1 year 240 minute summer	18.475	4.882	30 year +40% CC 180 minute winter	48.503	19.202
1 year 240 minute winter	12.274	4.882	30 year +40% CC 240 minute summer	58.245	15.393
1 year 360 minute summer	14.169	3.646	30 year +40% CC 240 minute winter	38.697	15.393
1 year 360 minute winter	9.210	3.646	30 year +40% CC 360 minute summer	43.710	11.248
1 year 480 minute summer	11.185	2.956	30 year +40% CC 360 minute winter	28.413	11.248
1 year 480 minute winter	7.431	2.956	30 year +40% CC 480 minute summer	34.053	8.999
1 year 600 minute summer	9.182	2.511	30 year +40% CC 480 minute winter	22.624	8.999
1 year 600 minute winter	6.274	2.511	30 year +40% CC 600 minute summer	27.658	7.565
1 year 720 minute summer	8.203	2.199	30 year +40% CC 600 minute winter	18.898	7.565
1 year 720 minute winter	5.513	2.199	30 year +40% CC 720 minute summer	24.485	6.562
1 year 960 minute summer	6.768	1.782	30 year +40% CC 720 minute winter	16.456	6.562
1 year 960 minute winter	4.483	1.782	30 year +40% CC 960 minute summer	19.901	5.240
1 year 1440 minute summer	4.949	1.326	30 year +40% CC 960 minute winter	13.183	5.240

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year +40% CC 1440 minute summer	14.225	3.812	100 year +45% CC 240 minute winter	52.280	20.795
30 year +40% CC 1440 minute winter	9.560	3.812	100 year +45% CC 360 minute summer	58.701	15.106
100 year +45% CC 15 minute summer	505.670	143.087	100 year +45% CC 360 minute winter	38.157	15.106
100 year +45% CC 15 minute winter	354.856	143.087	100 year +45% CC 480 minute summer	45.550	12.038
100 year +45% CC 30 minute summer	332.000	93.944	100 year +45% CC 480 minute winter	30.262	12.038
100 year +45% CC 30 minute winter	232.982	93.944	100 year +45% CC 600 minute summer	36.875	10.086
100 year +45% CC 60 minute summer	222.268	58.739	100 year +45% CC 600 minute winter	25.195	10.086
100 year +45% CC 60 minute winter	147.669	58.739	100 year +45% CC 720 minute summer	32.556	8.725
100 year +45% CC 120 minute summer	134.215	35.469	100 year +45% CC 720 minute winter	21.879	8.725
100 year +45% CC 120 minute winter	89.169	35.469	100 year +45% CC 960 minute summer	26.340	6.936
100 year +45% CC 180 minute summer	101.219	26.047	100 year +45% CC 960 minute winter	17.448	6.936
100 year +45% CC 180 minute winter	65.795	26.047	100 year +45% CC 1440 minute summer	18.700	5.012
100 year +45% CC 240 minute summer	78.690	20.795	100 year +45% CC 1440 minute winter	12.567	5.012

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.95%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW01	10	77.650	0.050	4.0	0.0388	0.0000	OK
15 minute summer	SW02	10	77.424	0.074	7.4	0.0400	0.0000	OK
15 minute summer	SW03	10	77.541	0.041	2.6	0.0207	0.0000	OK
15 minute summer	SW04	10	77.248	0.073	9.8	0.0116	0.0000	OK
15 minute summer	POND	12	77.113	0.063	9.8	1.4799	0.0000	OK
15 minute summer	SW05	12	76.988	0.068	7.3	0.0109	0.0000	OK
15 minute summer	SW06	13	76.947	0.067	7.2	0.0106	0.0000	OK
15 minute summer	SW07	10	77.551	0.051	4.0	0.0318	0.0000	OK
15 minute summer	SW08	10	77.186	0.061	7.9	0.0298	0.0000	OK
120 minute summer	SW09	88	76.943	0.113	7.0	0.0180	0.0000	OK
15 minute summer	SW10	10	77.451	0.051	4.0	0.0298	0.0000	OK
15 minute summer	SW11	10	77.086	0.061	7.3	0.0252	0.0000	OK
120 minute summer	SW12	88	76.943	0.283	9.9	0.0450	0.0000	OK
15 minute summer	SW13	10	77.201	0.101	22.5	0.2898	0.0000	OK
15 minute summer	SW14	10	76.995	0.145	36.1	0.2926	0.0000	OK
120 minute summer	TANK	90	76.943	0.243	19.6	25.3560	0.0000	OK
120 minute summer	SW15	90	76.943	0.343	9.9	0.5476	0.0000	SURCHARGED
120 minute summer	SW16	88	76.399	0.024	4.6	0.0277	0.0000	OK
120 minute summer	OUTFALL	88	75.398	0.023	4.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SW01	1.000	SW02	4.0	0.581	0.242	0.2012	
15 minute summer	SW02	1.001	SW04	7.3	0.867	0.450	0.1009	
15 minute summer	SW03	2.000	SW04	2.5	0.658	0.159	0.1194	
15 minute summer	SW04	1.002	POND	9.8	0.943	0.188	0.0520	
15 minute summer	POND	1.003	SW05	7.3	0.755	0.166	0.1743	
15 minute summer	SW05	1.004	SW06	7.2	0.719	0.170	0.0602	
15 minute summer	SW06	1.005	SW09	7.1	0.648	0.162	0.0848	
15 minute summer	SW07	3.000	SW08	3.9	0.759	0.238	0.1802	
15 minute summer	SW08	3.001	SW09	7.8	0.806	0.164	0.3914	
120 minute summer	SW09	1.006	SW12	7.0	0.689	0.154	0.3648	
15 minute summer	SW10	4.000	SW11	3.9	0.735	0.246	0.2002	
15 minute summer	SW11	4.001	SW12	7.3	0.768	0.161	0.5100	
120 minute summer	SW12	1.007	SW15	8.7	0.235	0.094	0.5919	
15 minute summer	SW13	5.000	SW14	22.4	0.826	0.249	1.0350	
15 minute summer	SW14	5.001	TANK	37.0	1.773	0.413	0.5774	
120 minute summer	TANK	5.002	SW15	5.7	0.227	0.040	0.3944	
120 minute summer	SW15	1.008	SW16	4.6	1.284	0.211	0.0554	
120 minute summer	SW16	1.009	OUTFALL	4.6	2.577	0.051	0.0071	50.9

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 99.10%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW01	10	77.804	0.204	13.7	0.1578	0.0000	SURCHARGED
180 minute winter	SW02	176	77.739	0.389	5.0	0.2091	0.0000	SURCHARGED
180 minute winter	SW03	176	77.739	0.239	1.8	0.1210	0.0000	SURCHARGED
180 minute winter	SW04	176	77.739	0.564	6.7	0.0897	0.0000	SURCHARGED
180 minute winter	POND	176	77.739	0.689	14.9	37.6447	0.0000	SURCHARGED
180 minute winter	SW05	176	77.739	0.819	12.3	0.1302	0.0000	SURCHARGED
180 minute winter	SW06	176	77.739	0.859	12.8	0.1366	0.0000	SURCHARGED
180 minute winter	SW07	176	77.739	0.239	2.7	0.1507	0.0000	SURCHARGED
180 minute winter	SW08	176	77.739	0.614	5.4	0.2984	0.0000	SURCHARGED
180 minute winter	SW09	176	77.739	0.909	13.0	0.1445	0.0000	SURCHARGED
180 minute winter	SW10	176	77.739	0.339	2.7	0.1966	0.0000	SURCHARGED
180 minute winter	SW11	176	77.739	0.714	5.0	0.2970	0.0000	SURCHARGED
180 minute winter	SW12	176	77.739	1.079	12.4	0.1715	0.0000	SURCHARGED
180 minute winter	SW13	176	77.739	0.639	15.2	1.8334	0.0000	SURCHARGED
180 minute winter	SW14	176	77.739	0.889	22.6	1.7967	0.0000	SURCHARGED
180 minute winter	TANK	176	77.739	1.039	26.5	83.6606	0.0000	SURCHARGED
180 minute winter	SW15	176	77.739	1.139	13.6	1.8199	0.0000	SURCHARGED
15 minute winter	SW16	11	76.400	0.025	4.7	0.0280	0.0000	OK
120 minute summer	OUTFALL	58	75.398	0.023	4.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SW01	1.000	SW02	12.6	0.724	0.764	0.5105	
180 minute winter	SW02	1.001	SW04	5.0	0.788	0.307	0.2113	
180 minute winter	SW03	2.000	SW04	1.8	0.596	0.112	0.5457	
180 minute winter	SW04	1.002	POND	6.7	0.834	0.129	0.1989	
180 minute winter	POND	1.003	SW05	-12.1	0.664	-0.273	0.7159	
180 minute winter	SW05	1.004	SW06	-12.3	0.635	-0.291	0.2386	
180 minute winter	SW06	1.005	SW09	-12.8	0.494	-0.291	0.2784	
180 minute winter	SW07	3.000	SW08	2.7	0.685	0.163	0.6162	
180 minute winter	SW08	3.001	SW09	4.9	0.489	0.103	1.3920	
180 minute winter	SW09	1.006	SW12	-11.6	0.585	-0.257	0.4971	
180 minute winter	SW10	4.000	SW11	2.7	0.649	0.171	0.6690	
180 minute winter	SW11	4.001	SW12	4.4	0.454	0.098	1.5113	
180 minute winter	SW12	1.007	SW15	11.9	0.244	0.127	0.5986	
180 minute winter	SW13	5.000	SW14	13.9	0.692	0.154	2.6759	
180 minute winter	SW14	5.001	TANK	21.6	1.023	0.241	1.6196	
180 minute winter	TANK	5.002	SW15	11.0	0.156	0.077	0.4225	
180 minute winter	SW15	1.008	SW16	4.7	1.292	0.216	0.0564	
15 minute winter	SW16	1.009	OUTFALL	4.7	2.594	0.053	0.0073	69.3

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 98.24%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	SW01	232	78.216	0.616	2.9	0.4768	0.0000	FLOOD RISK
240 minute winter	SW02	232	78.216	0.866	5.4	0.4651	0.0000	FLOOD RISK
240 minute winter	SW03	232	78.216	0.716	1.9	0.3623	0.0000	FLOOD RISK
240 minute winter	SW04	232	78.216	1.041	7.3	0.1655	0.0000	FLOOD RISK
240 minute winter	POND	232	78.216	1.166	30.6	91.4753	0.0000	FLOOD RISK
240 minute winter	SW05	232	78.216	1.296	26.1	0.2060	0.0000	FLOOD RISK
240 minute winter	SW06	232	78.216	1.336	26.5	0.2124	0.0000	FLOOD RISK
240 minute winter	SW07	232	78.216	0.716	2.9	0.4510	0.0000	FLOOD RISK
240 minute winter	SW08	232	78.216	1.091	5.8	0.5301	0.0000	FLOOD RISK
240 minute winter	SW09	232	78.216	1.386	26.8	0.2203	0.0000	FLOOD RISK
120 minute summer	SW10	72	78.224	0.824	7.5	0.4778	0.0000	FLOOD RISK
240 minute winter	SW11	232	78.216	1.191	5.4	0.4953	0.0000	FLOOD RISK
240 minute winter	SW12	232	78.216	1.556	23.1	0.2474	0.0000	FLOOD RISK
60 minute summer	SW13	39	78.275	1.175	65.2	3.3722	0.0000	FLOOD RISK
60 minute summer	SW14	39	78.253	1.403	100.4	2.8363	0.0000	FLOOD RISK
120 minute summer	TANK	72	78.222	1.522	74.6	83.6644	0.0000	FLOOD RISK
240 minute winter	SW15	232	78.216	1.616	24.0	2.5818	0.0000	FLOOD RISK
240 minute winter	SW16	232	76.400	0.025	5.0	0.0287	0.0000	OK
240 minute winter	OUTFALL	232	75.399	0.024	5.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute winter	SW01	1.000	SW02	2.9	0.550	0.176	0.5105	
240 minute winter	SW02	1.001	SW04	5.4	0.788	0.332	0.2113	
240 minute winter	SW03	2.000	SW04	1.9	0.596	0.119	0.5457	
240 minute winter	SW04	1.002	POND	6.6	0.807	0.127	0.1989	
240 minute winter	POND	1.003	SW05	-25.8	-0.648	-0.585	0.7159	
240 minute winter	SW05	1.004	SW06	-26.1	-0.657	-0.617	0.2386	
240 minute winter	SW06	1.005	SW09	-26.5	-0.665	-0.604	0.2784	
240 minute winter	SW07	3.000	SW08	2.9	0.676	0.177	0.6162	
240 minute winter	SW08	3.001	SW09	5.4	0.441	0.113	1.3920	
240 minute winter	SW09	1.006	SW12	-22.7	0.584	-0.501	0.4971	
120 minute summer	SW10	4.000	SW11	7.4	0.751	0.470	0.6690	
240 minute winter	SW11	4.001	SW12	4.9	0.454	0.109	1.5113	
240 minute winter	SW12	1.007	SW15	-19.3	-0.274	-0.207	0.5986	
60 minute summer	SW13	5.000	SW14	60.9	0.923	0.677	2.6759	
60 minute summer	SW14	5.001	TANK	97.5	1.436	1.089	1.6196	
120 minute summer	TANK	5.002	SW15	38.9	0.553	0.271	0.4225	
240 minute winter	SW15	1.008	SW16	5.0	1.309	0.227	0.0585	
240 minute winter	SW16	1.009	OUTFALL	5.0	2.629	0.055	0.0075	125.4

Appendix E – Environment Agency Correspondance

Flood risk assessment data

Location of site: 382114 / 410335 (shown as easting and northing coordinates)

Document created on: 19 March 2024

This information was previously known as a product 4.

Customer reference number: DR7UAF5645TE

Map showing the location that flood risk assessment data has been requested for.



How to use this information

You can use this information as part of a flood risk assessment for a planning application. To do this, you should include it in the appendix of your flood risk assessment.

We recommend that you work with a flood risk consultant to get your flood risk assessment.

Included in this document

In this document you'll find:

- how to find information about surface water and other sources of flooding
- information on the models used
- definitions for the terminology used throughout
- flood map for planning (rivers and the sea)
- historic flooding
- flood defences and attributes
- information to help you assess if there is a reduced flood risk from rivers and the sea because of defences
- modelled data
- climate change modelled data
- information about strategic flood risk assessments
- information about this data
- information about flood risk activity permits
- help and advice

Surface water and other sources of flooding

Use the [long term flood risk service](#) to find out about the risk of flooding from:

- surface water
- ordinary watercourses
- reservoirs

For information about sewer flooding, contact the relevant water company for the area.

About the models used

Model name: Lower Roch 2017

Scenario(s): Defended fluvial, defences removed fluvial, defended climate change fluvial, defences removed climate change fluvial

Date: 23 March 2018

These models contain the most relevant data for your area of interest.

Terminology used

Annual exceedance probability (AEP)

This refers to the probability of a flood event occurring in any year. The probability is expressed as a percentage. For example, a large flood which is calculated to have a 1% chance of occurring in any one year, is described as 1% AEP.

Metres above ordnance datum (mAOD)

All flood levels are given in metres above ordnance datum which is defined as the mean sea level at Newlyn, Cornwall.

Flood map for planning (rivers and the sea)

Your selected location is in flood zone 3.

Flood zone 3 shows the area at risk of flooding for an undefended flood event with a:

- 0.5% or greater probability of occurring in any year for flooding from the sea
- 1% or greater probability of occurring in any year for fluvial (river) flooding

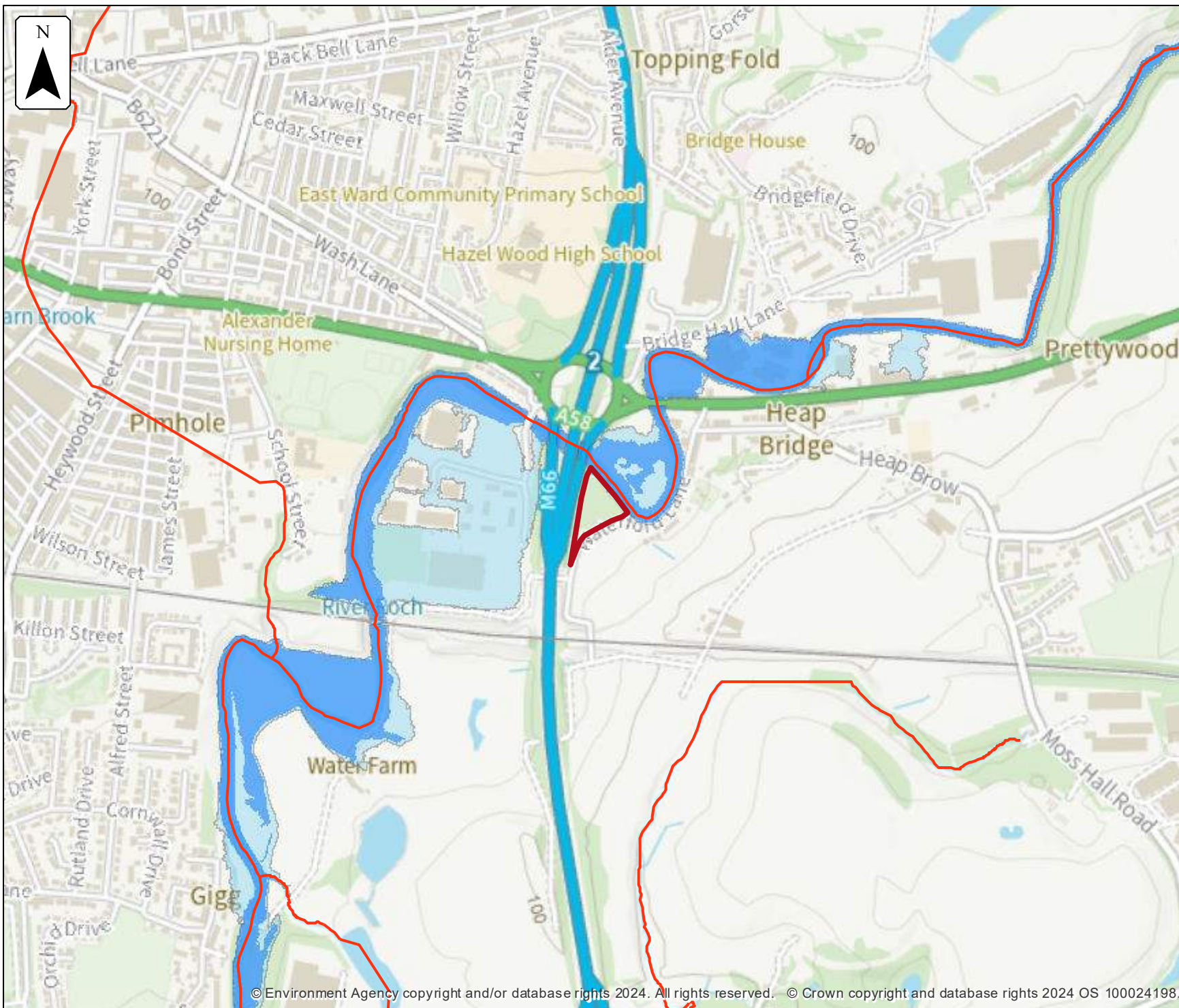
Flood zone 2 shows the area at risk of flooding for an undefended flood event with:

- between a 0.1% and 0.5% probability of occurring in any year for flooding from the sea
- between a 0.1% and 1% probability of occurring in any year for fluvial (river) flooding

It's important to remember that the flood zones on this map:

- refer to the land at risk of flooding and do not refer to individual properties
- refer to the probability of river and sea flooding, ignoring the presence of defences
- do not take into account potential impacts of climate change

The flood zones are not currently being updated. The last update was in November 2023. Some of the flood zones may have changed, however all source data is included in the models below.



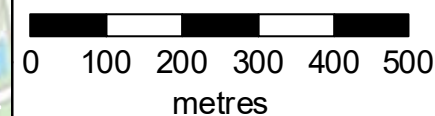
Flood map for planning

Location (easting/northing)
382114/410335

Scale
1:10,000

Created
19 Mar 2024

-  Selected area
-  Main river
-  Flood zone 3
-  Flood zone 2



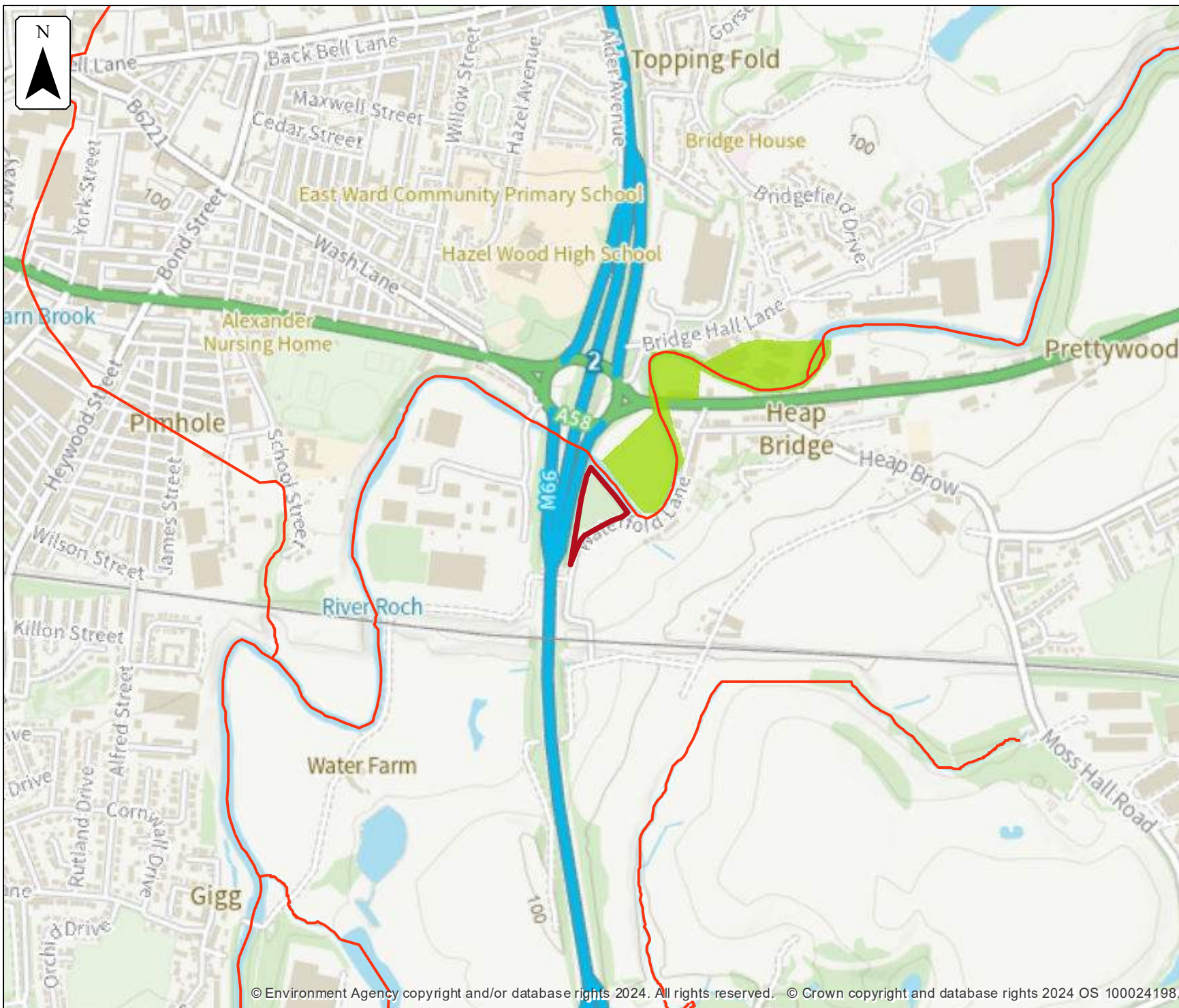
Historic flooding

This map is an indicative outline of areas that have previously flooded. Remember that:

- our records are incomplete, so the information here is based on the best available data
- it is possible not all properties within this area will have flooded
- other flooding may have occurred that we do not have records for
- flooding can come from a range of different sources - we can only supply flood risk data relating to flooding from rivers or the sea

You can also contact your Lead Local Flood Authority or Internal Drainage Board to see if they have other relevant local flood information. Please note that some areas do not have an Internal Drainage Board.

[Download recorded flood outlines in GIS format](#)



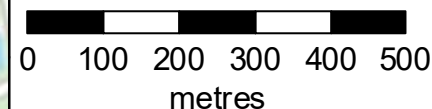
Historic flood map

Location (easting/northing)
382114/410335

Scale
1:10,000

Created
19 Mar 2024

-  Selected area
-  Main river
- Date of flood event
-  December, 2015



Historic flood event data

Start date	End date	Source of flood	Cause of flood	Affects location
26 December 2015	26 December 2015	main river	channel capacity exceeded (no raised defences)	No

Modelled data

This section provides details of different scenarios we have modelled and includes the following (where available):

- outline maps showing the area at risk from flooding in different modelled scenarios
- modelled node point map(s) showing the points used to get the data to model the scenarios and table(s) providing details of the flood risk for different return periods
- map(s) showing the approximate water levels for the return period with the largest flood extent for a scenario and table(s) of sample points providing details of the flood risk for different return periods

Climate change

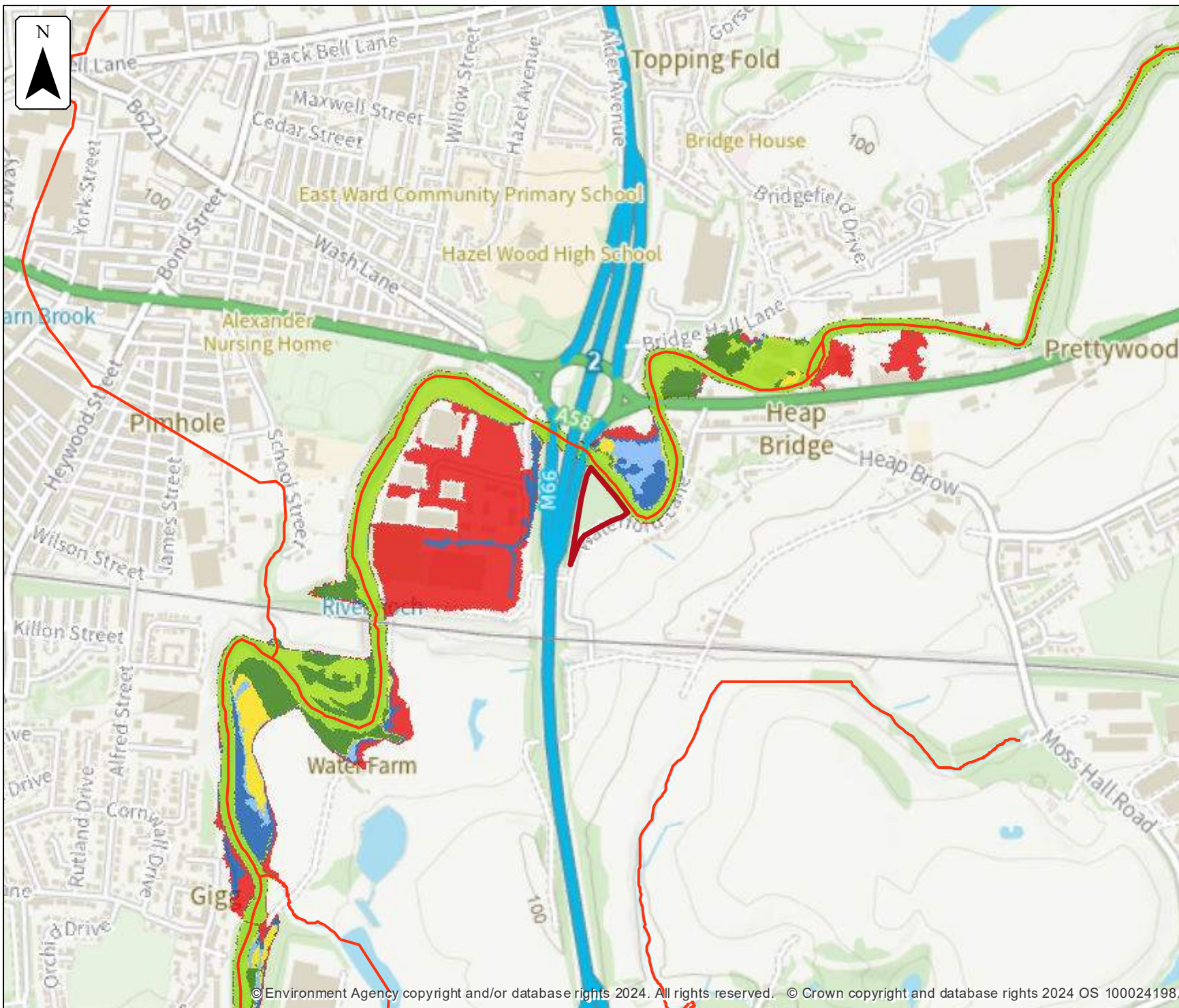
The climate change data included in the models may not include the latest [flood risk assessment climate change allowances](#). Where the new allowances are not available you will need to consider this data and factor in the new allowances to demonstrate the development will be safe from flooding.

The Environment Agency will incorporate the new allowances into future modelling studies. For now, it's your responsibility to demonstrate that new developments will be safe in flood risk terms for their lifetime.

Modelled scenarios

The following scenarios are included:

- Defended modelled fluvial: risk of flooding from rivers where there are flood defences
- Defences removed modelled fluvial: risk of flooding from rivers where flood defences have been removed
- No defences exist modelled fluvial: risk of flooding from rivers where there are no flood defences
- Defended climate change modelled fluvial: risk of flooding from rivers where there are flood defences, including estimated impact of climate change
- Defences removed climate change modelled fluvial: risk of flooding from rivers where flood defences have been removed, including estimated impact of climate change
- No defences exist climate change modelled fluvial: risk of flooding from rivers where there are no flood defences, including estimated impact of climate change



Defended modelled fluvial extent

Location (easting/northing)
382114/410335

Scale Created
1:10,000 19 Mar 2024

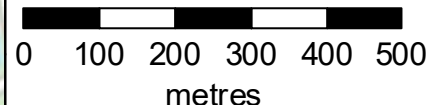
Model name
Lower Roch 2017

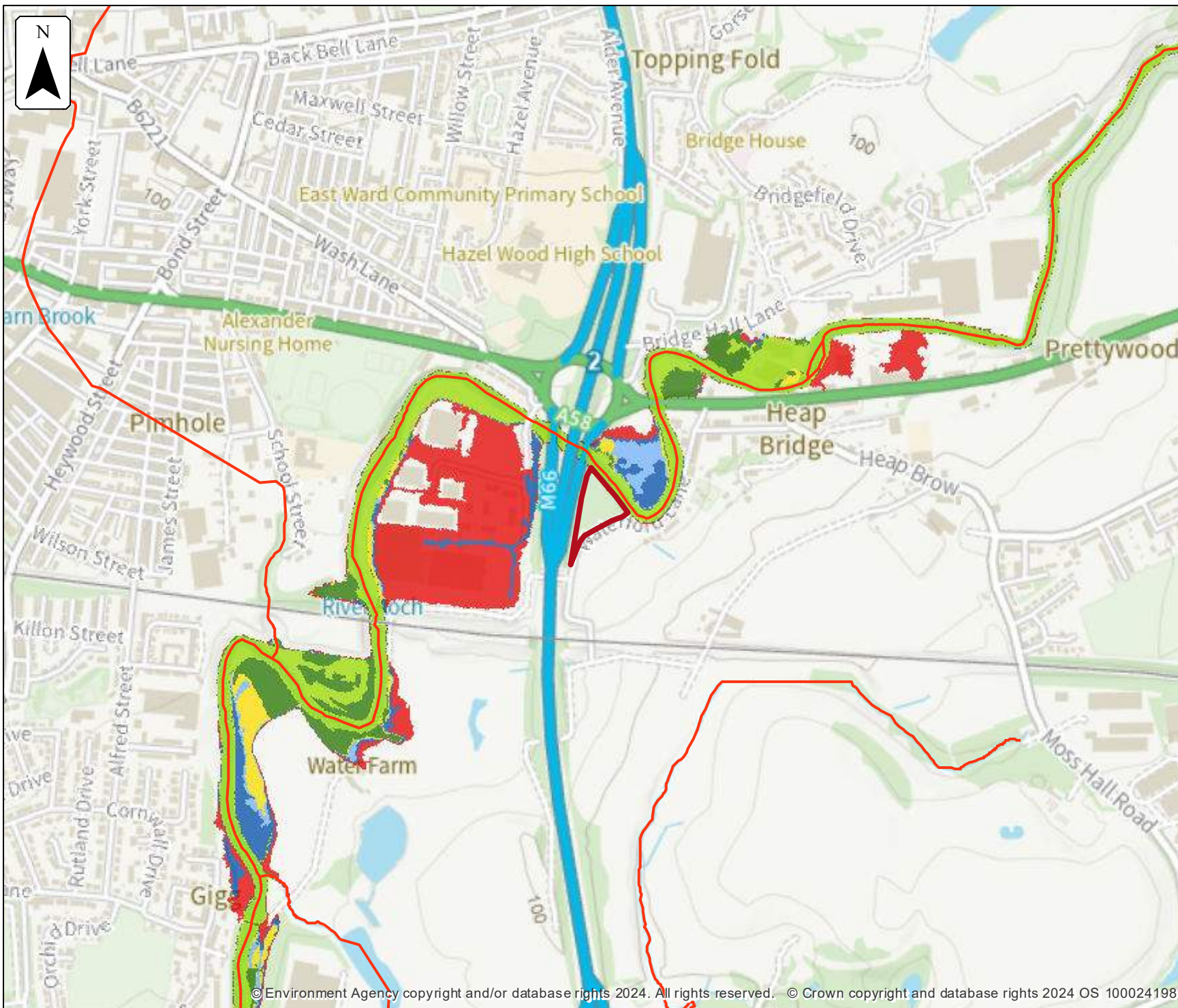
-  Selected area
-  Main river

Modelled flood extent

-  5% AEP
-  2% AEP
-  1.33% AEP
-  1% AEP
-  0.5% AEP
-  0.1% AEP

Flood extents may not be visible where they overlap other return periods





Defences removed modelled fluvial extent

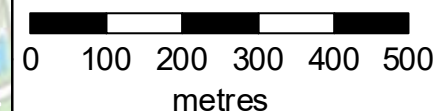
Location (easting/northing)
382114/410335

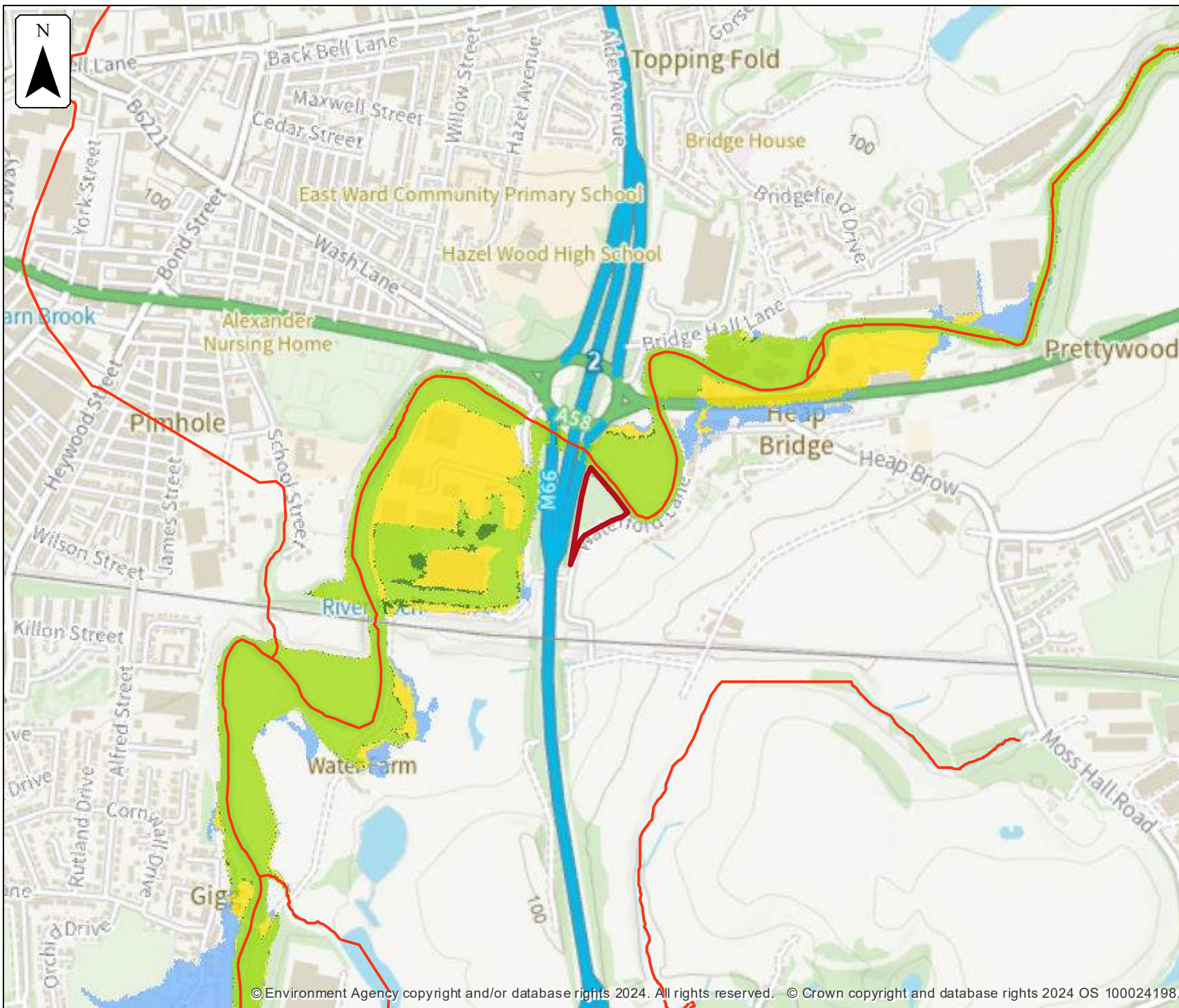
Scale Created
1:10,000 19 Mar 2024

Model name
Lower Roch 2017

- Selected area
- Main river
- Modelled flood extent
 - 5% AEP
 - 2% AEP
 - 1.33% AEP
 - 1% AEP
 - 0.5% AEP
 - 0.1% AEP

Flood extents may not be
visible where they overlap
other return periods





Defended climate change modelled fluvial extent

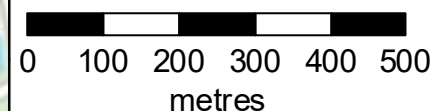
Location (easting/northing)
382114/410335

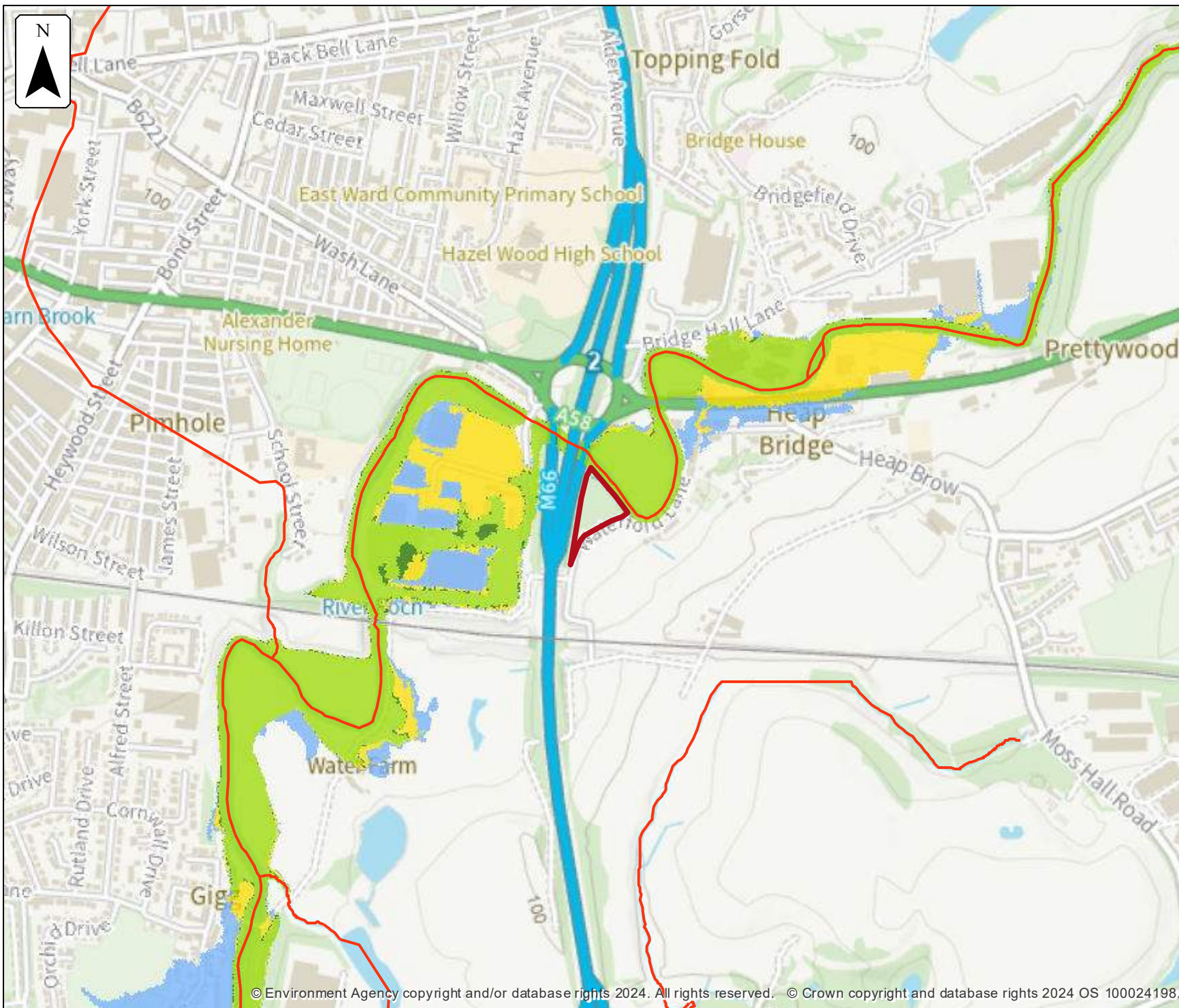
Scale Created
1:10,000 19 Mar 2024

Model name
Lower Roch 2017

-  Selected area
-  Main river
- Modelled flood extent
 -  1.0% AEP (+30%)
 -  1.0% AEP (+35%)
 -  1.0% AEP (+70%)
 -  0.1% AEP (+30%)

Flood extents may not be
visible where they overlap
other return periods





Defences removed climate change modelled fluvial extent

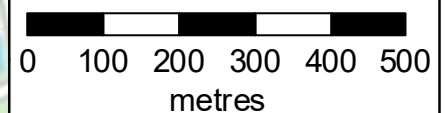
Location (easting/northing)
382114/410335

Scale Created
1:10,000 19 Mar 2024

Model name
Lower Roch 2017

- Selected area
- Main river
- Modelled flood extent
 - 1.0% AEP (+30%)
 - 1.0% AEP (+35%)
 - 1.0% AEP (+70%)
 - 0.1% AEP (+30%)

Flood extents may not be
visible where they overlap
other return periods





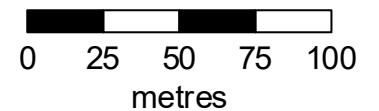
Defended modelled fluvial node locations

Location (easting/northing)
382114/410335

Scale Created
1:2,500 19 Mar 2024

Model name
Lower Roch 2017

-  Selected area
-  Modelled location
-  Main river



Modelled node locations data

Defended

Label	Modelled location ID	Easting	Northing	5% AEP		2% AEP		1.33% AEP		1% AEP		0.5% AEP		0.1% AEP	
				Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow
1	1444646	381996	410500	74.59	98.54	74.80	117.66	74.89	126.77	74.97	134.95	75.17	156.42	75.56	206.10
2	1444558	382019	410486	74.74	98.55	74.98	117.67	75.08	126.74	75.18	134.95	75.41	156.47	75.88	208.29
3	1444505	382046	410471	74.75	98.55	75.0	117.67	75.11	126.74	75.20	134.95	75.44	156.47	75.93	208.29
4	1444631	382081	410451	74.89	98.55	75.14	117.67	75.25	126.76	75.35	134.95	75.60	156.48	76.11	208.30
5	1444655	382102	410438	74.92	98.55	75.19	117.67	75.31	126.76	75.42	134.95	75.69	156.48	76.27	208.30
6	1444590	382154	410372	75.20	98.56	75.46	117.71	75.58	126.79	75.69	134.51	75.97	146.30	76.63	152.56
7	1444502	382197	410323	75.40	98.56	75.65	117.71	75.76	126.84	75.86	134.53	76.12	144.09	76.75	145.94
8	1444553	382208	410318	75.42	98.56	75.69	117.71	75.81	126.84	75.92	134.53	76.20	144.09	76.81	145.94
9	1444533	382240	410515	76.19	98.57	76.47	117.72	76.60	126.86	76.70	135.06	76.86	156.63	77.07	208.76
10	1444490	382270	410418	75.80	98.56	76.08	117.72	76.22	126.80	76.33	134.55	76.55	147.62	76.88	171.56

Data in this table comes from the Lower Roch 2017 model.

Level values are shown in mAOD, and flow values are shown in cubic metres per second.

Any blank cells show where a particular scenario has not been modelled for this location.



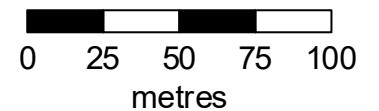
Defences removed modelled fluvial node locations

Location (easting/northing)
382114/410335

Scale Created
1:2,500 19 Mar 2024

Model name
Lower Roch 2017

-  Selected area
-  Modelled location
-  Main river



Modelled node locations data

Defences removed

Label	Modelled location ID	Easting	Northing	5% AEP		2% AEP		1.33% AEP		1% AEP		0.5% AEP		0.1% AEP	
				Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow
1	1444646	381996	410500	74.59	98.54	74.80	117.66	74.89	126.83	74.96	133.46	75.17	156.42	75.56	206.06
2	1444558	382019	410486	74.74	98.55	74.98	117.67	75.08	126.74	75.16	133.47	75.41	156.48	75.88	208.26
3	1444505	382046	410471	74.75	98.55	75.0	117.67	75.11	126.74	75.19	133.47	75.44	156.48	75.93	208.26
4	1444631	382081	410451	74.89	98.55	75.14	117.67	75.25	126.75	75.34	133.47	75.60	156.48	76.11	208.27
5	1444655	382102	410438	74.92	98.55	75.19	117.67	75.31	126.75	75.40	133.47	75.69	156.48	76.27	208.27
6	1444590	382154	410372	75.20	98.56	75.46	117.71	75.58	126.79	75.67	133.24	75.97	146.31	76.63	152.63
7	1444502	382197	410323	75.40	98.56	75.64	117.71	75.76	126.79	75.84	133.26	76.12	144.10	76.75	145.96
8	1444553	382208	410318	75.42	98.56	75.69	117.71	75.81	126.79	75.90	133.26	76.20	144.10	76.81	145.96
9	1444533	382240	410515	76.19	98.57	76.47	117.72	76.60	126.84	76.69	133.56	76.86	156.63	77.07	208.76
10	1444490	382270	410418	75.80	98.56	76.08	117.72	76.22	126.83	76.31	133.27	76.55	147.63	76.88	171.60

Data in this table comes from the Lower Roch 2017 model.

Level values are shown in mAOD, and flow values are shown in cubic metres per second.

Any blank cells show where a particular scenario has not been modelled for this location.



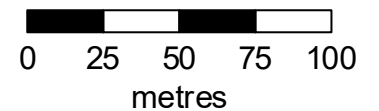
Defended climate change modelled fluvial node locations

Location (easting/northing)
382114/410335

Scale Created
1:2,500 19 Mar 2024

Model name
Lower Roch 2017

-  Selected area
-  Modelled location
-  Main river



Modelled node locations data

Defended climate change

Label	Modelled location ID	Easting	Northing	1.0% AEP (+30%)		1.0% AEP (+35%)		1.0% AEP (+70%)		0.1% AEP (+30%)	
				Level	Flow	Level	Flow	Level	Flow	Level	Flow
1	1444646	381996	410500	75.32	173.41	75.38	180.43	75.67	226.99	75.81	264.85
2	1444558	382019	410486	75.58	174.02	75.65	181.34	76.02	230.35	76.25	270.26
3	1444505	382046	410471	75.63	174.02	75.70	181.34	76.09	230.35	76.33	270.26
4	1444631	382081	410451	75.79	174.03	75.86	181.34	76.28	230.35	76.55	270.32
5	1444655	382102	410438	75.90	174.03	75.98	181.34	76.47	230.35	76.83	270.32
6	1444590	382154	410372	76.20	150.69	76.30	151.38	76.88	153.0	77.29	153.31
7	1444502	382197	410323	76.35	145.02	76.44	145.27	76.98	146.07	77.36	146.16
8	1444553	382208	410318	76.42	145.02	76.51	145.27	77.05	146.07	77.44	146.16
9	1444533	382240	410515	76.94	174.25	76.97	181.62	77.17	231.05	77.41	268.80
10	1444490	382270	410418	76.66	156.69	76.70	160.30	77.04	179.44	77.37	200.31

Data in this table comes from the Lower Roch 2017 model.

Level values are shown in mAOD, and flow values are shown in cubic metres per second.

Any blank cells show where a particular scenario has not been modelled for this location.



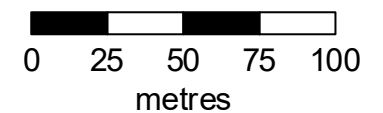
Defences removed climate change modelled fluvial node locations

Location (easting/northing)
382114/410335

Scale Created
1:2,500 19 Mar 2024

Model name
Lower Roch 2017

-  Selected area
-  Modelled location
-  Main river



Modelled node locations data

Defences removed climate change

Label	Modelled location ID	Easting	Northing	1.0% AEP (+30%)		1.0% AEP (+35%)		1.0% AEP (+70%)		0.1% AEP (+30%)	
				Level	Flow	Level	Flow	Level	Flow	Level	Flow
1	1444646	381996	410500	75.32	173.43	75.38	181.28	75.67	226.97	75.81	264.95
2	1444558	382019	410486	75.58	174.02	75.66	182.22	76.03	230.36	76.25	270.36
3	1444505	382046	410471	75.62	174.02	75.70	182.22	76.09	230.36	76.33	270.36
4	1444631	382081	410451	75.79	174.03	75.87	182.22	76.28	230.37	76.55	270.40
5	1444655	382102	410438	75.90	174.03	75.99	182.22	76.48	230.37	76.82	270.40
6	1444590	382154	410372	76.20	150.74	76.31	151.50	76.89	153.06	77.29	153.38
7	1444502	382197	410323	76.35	145.04	76.45	145.41	76.98	146.09	77.36	146.18
8	1444553	382208	410318	76.42	145.04	76.52	145.41	77.05	146.09	77.44	146.18
9	1444533	382240	410515	76.94	174.25	76.98	182.50	77.17	231.06	77.41	268.82
10	1444490	382270	410418	76.66	156.71	76.71	160.74	77.04	179.38	77.37	200.41

Data in this table comes from the Lower Roch 2017 model.

Level values are shown in mAOD, and flow values are shown in cubic metres per second.

Any blank cells show where a particular scenario has not been modelled for this location.

Strategic flood risk assessments

We recommend that you check the relevant local authority's strategic flood risk assessment (SFRA) as part of your work to prepare a site specific flood risk assessment.

This should give you information about:

- the potential impacts of climate change in this catchment
- areas defined as functional floodplain
- flooding from other sources, such as surface water, ground water and reservoirs

About this data

This data has been generated by strategic scale flood models and is not intended for use at the individual property scale. If you're intending to use this data as part of a flood risk assessment, please include an appropriate modelling tolerance as part of your assessment. The Environment Agency regularly updates its modelling. We recommend that you check the data provided is the most recent, before submitting your flood risk assessment.

Flood risk activity permits

Under the Environmental Permitting (England and Wales) Regulations 2016 some developments may require an environmental permit for flood risk activities from the Environment Agency. This includes any permanent or temporary works that are in, over, under, or nearby a designated main river or flood defence structure.

[Find out more about flood risk activity permits](#)

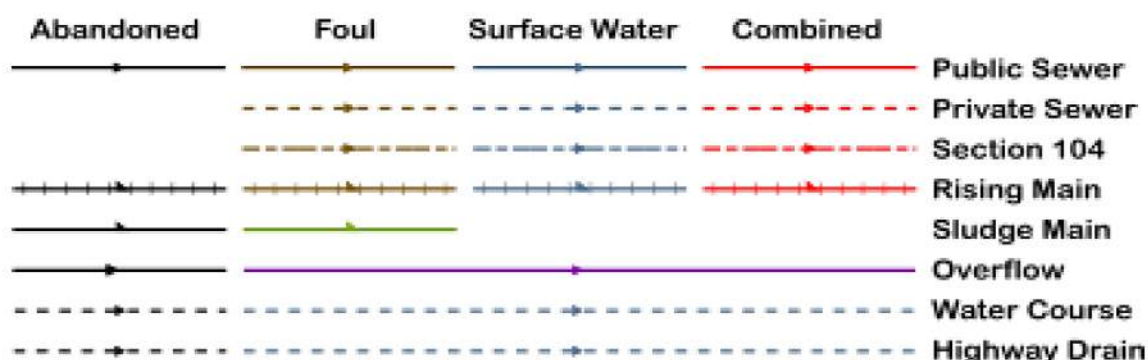
Help and advice

Contact the Greater Manchester Merseyside and Cheshire Environment Agency team at inforequests.gmmc@environment-agency.gov.uk for:

- [more information about getting a product 5, 6, 7 or 8](#)
- general help and advice about the site you're requesting data for

Appendix F – United Utilities Sewer Records

Wastewater Symbolology



All point assets follow the standard colour convention:

red – combined	brown - foul
blue – surface water	purple - overflow

Manhole	Side Entry Manhole
Head of System	Outfall
Extent of Survey	Screen Chamber
Rodding Eye	Inspection Chamber
Inlet	Bifurcation Chamber
Discharge Point	Lamp Hole
Vortex	T Junction / Saddle
Penstock	Catchpit
Washout Chamber	Valve Chamber
Valve	Vent Column
Air Valve	Vortex Chamber
Non Return Valve	Penstock Chamber
Soakaway	Network Storage Tank
Gully	Sewer Overflow
Cascade	Ww Treatment Works
Flow Meter	Ww Pumping Station
Hatch Box	Septic Tank
Oil Interceptor	Control Kiosk
Summit	
Drop Shaft	Change of Characteristic
Orifice Plate	



Scale: 1:1250
Date: 06/03/2024

SEWER RECORDS



Water for the North West

Address or Site Reference: A4301

Printed by: Property Searches

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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Appendix G – Soakaway Testing



PERCOLATION REPORT

LOCATION:

Land off M66, Bury

CLIENT:

Cornell Group Ltd

DOCUMENT REF:

26802-PR-001

DATE:

24/08/2026



DART
ENGINEERS LTD
CIVIL AND STRUCTURAL
ENGINEERING

CONTENTS & AMENDMENT HISTORY

1.0 TESTING REPORT 3

Revision	Description	Date	Author	Checked
A	First Issue	Aug 2026	O Mountain	R Thacker

TESTING REPORT

1.0 TESTING REPORT

The Percolation Testing was carried out on site on 24th August 2026 to establish if infiltration methods were going to be a suitable solution for draining the site.

2 Trial Holes were formed with the following dimensions;

Test Pit 1 1500mm x 1200mm x 1600mm deep

Test Pit 2 1300mm x 1200mm x 1500mm deep

The water level drop was monitored and recorded (see test sheets attached).

TEST PIT 1:

For Test 1 (Test Pit 1), water was filled to a depth of 600mm, the water level dropped 30mm after 1 hour 10 minutes of testing.

TEST PIT 2:

For Test 1 (Test Pit 2), water was filled to a depth of 630mm, the water level dropped 480mm after 4 hours 25 minutes of testing.

Calculation sheet 1 shows that the infiltration rates are not high enough and do not satisfy BRE 365 requirements. Therefore, Infiltration methods of drainage will not be viable for this site and strategy.

APPENDICES

Appendix A – Percolation Test Sheet

METHOD (from BRE Digest 365)

- Excavate a soakage trial pit to the required depth (typically 1.0m - 2.0m deep) using a minimum width (0.3m) and length (1.0m). Carefully trim sides and bottom.
- Carefully measure size of pit and note sizes below.
- Fill soakage hole briskly with water (from bowser) to at least three quarters full. Being careful not to wash away the sides. (Note: a 0.3m wide, 1m long, 1.5m deep trench needs at least 350 litres (80 gallons) of water)
- Place straight edge over top of soakage pit and measure (dip) to the top of the water.
- Record time versus dips in table below. Dip every 5 minutes for the first hour and every hour until pit is one quarter full. Repeat test 3 times in total on the same or consecutive days.

DETAILS

Site Location	Land off M66, Bury
Date of Test	24/08/2026
Weather Conditions	Dry – Summer
Engineer Name	Ollie Mountain

SIZE OF PIT 1

Length	Width	Depth
1.50m	1.20m	1.60m

Test 1 RESULTS

Time (mins)	Dip (mm)	Time (mins)	Dip (mm)
0	600	70	570
5	590		
10	580		
15	575		
20	570		
25	570		
30	570		
35	570		
40	570		
45	570		
50	570		
55	570		
60	570		
65	570		

Date: 24 August 2026
Ref: 26802/PR/001

Appendix A

Percolation Test Sheet Pit 2

SIZE OF PIT 2

Length	Width	Depth
1.30m	1.20m	1.50m

Test 1 RESULTS

Time (mins)	Dip (mm)	Time (mins)	Dip (mm)
0	630	200	150
5	608	240	150
10	586	265	150
15	564		
20	543		
25	523		
30	505		
35	490		
40	471		
45	452		
50	433		
55	415		
60	397		
90	300		
120	235		
150	190		
180	163		

Date: 24 August 2026
Ref: 26802/PR/001

Appendix A

Trial Pit 1



Date: 24 August 2026
Ref: 26802/PR/001

Trial Pit 1



Date: 24 August 2026
Ref: 26802/PR/001

Appendix B

Trial Pit 2



Date: 24 August 2026
Ref: 26802/PR/001

Trial Pit 2



Date: 24 August 2026
Ref: 26802/PR/001

Trial Pit Locations

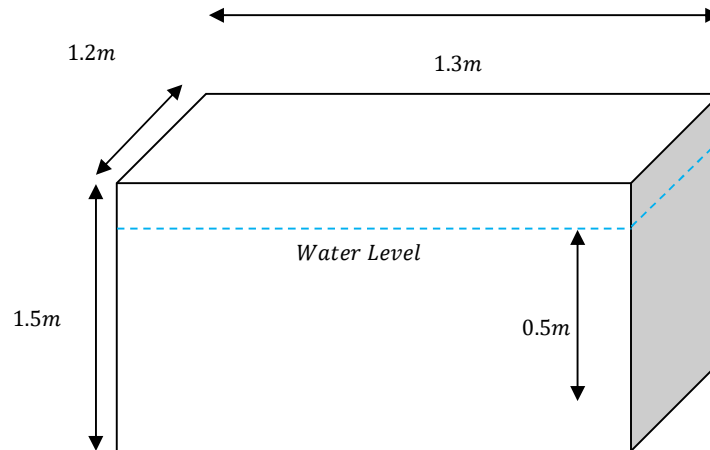


Trial Pit 1 was
formed here.

Trial Pit 2 was
formed here.

Project				Job Ref.	
Land off M66, Bury				26802	
Section				Sheet no./rev.	
				A	
Calc. by	Date	Chk'd by	Date	App'd by	Date
OM	24/08/26	RT	24/08/26		

Test 1, Test Pit 2)



Soil Infiltration rate(ms^{-1}): $\frac{V_{(P75-25)}}{t_{(P75-25)} \times a_{(P5)}}$

V = Effective storage volume between 75 – 25%

$a_{(P50)}$ = Surface area of the pit (50% effective depth) + box area

$t_{(P75-25)}$ = Time for water to fall from 75 – 25%

$$V_{(p75-25)} = (0.5 \times 0.5) \times 1.2 \times 1.3 = 0.390m^3$$

$$a_{(p50)} = 1.2 \times 1.3 + 2((0.5 \times 0.5) \times 1.2) + 2((0.5 \times 0.5) \times 1.3) = 2.81m^2$$

$$t_{(p75-25)} = 15900s$$

Soil Infiltration rate (m/s):

$$\frac{0.390}{15900 \times 2.81} = 8.728 \times 10^{-6}m/s$$

Soil Infiltration rate (m/hr):

$$8.728 \times 10^{-6} \times 3600 = 0.0314 m/hr$$