

FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY

for

CRJ DEVELOPMENTS LTD

PROPOSED RESIDENTIAL DEVELOPMENT

on

LAND AT SPRINGWOOD DRIVE

WHALLEY

JUNE 2026 – Revision B

REFORD

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1. INTRODUCTION

- 1.1 This flood risk assessment and drainage strategy has been produced on behalf of CRJ Developments Ltd in support of a planning application for a proposed residential development on land at Springwood Drive, Whalley. A location plan is included within Appendix A.
- 1.2 The Flood Risk Assessment (FRA) is compliant with the requirements set out in the National Planning Policy Framework (NPPF) and the Planning Practice Guidance (NPPG) in relation to Flood Risk and Coastal Change, and describes the existing site conditions and proposed development. It assesses the potential sources of flooding to the site from tidal, fluvial, groundwater, surface water and other sources, taking a risk based approach in accordance with National Policy.
- 1.3 The drainage strategy describes the existing site conditions and proposed development. It assesses the potential impact of proposals on existing drainage and includes a proposed strategy for the provision of new drainage to serve the proposed development.

Site summary

Site Name	Land at Springwood Drive
Location	Whalley
NGR (approx.)	SD735365
Application site area	Approx. 0.7ha
Development type	Residential
Vulnerability	More Vulnerable
Environment Agency flood mapping	Mainly Flood Zone 1
Local Planning Authority	Ribble Valley Borough Council

2. DESCRIPTION OF THE SITE

Existing site

- 2.1 The development site lies to the southern side of Springwood Drive, Whalley, which forms the northern and eastern boundaries of the site.
- 2.2 The development site comprises an area of greenfield land that was previously used as the construction compound for the adjoining new housing estate that lies on the northern side of Springwood Drive to the northeast of the site. The area of the site is approx. 0.7ha.
- 2.3 The Wiswell Brook ordinary watercourse lies along the eastern boundary of the site. The watercourse flows from the north from Wiswell along Wiswell Shay and Wiswell Lane. On leaving the site the watercourse flows to the south and then west along Brookside Close before flowing south in a 1200mm diameter culvert under King Street, to discharge into the River Calder that lies approx. 720m to the south of the site.

Proposed development

- 2.4 The proposal is for the construction of six residential dwellings with associated car parking and landscaping.
- 2.5 Access to the site will be from Springwood Drive.

3. SCOPE OF THE ASSESSMENT

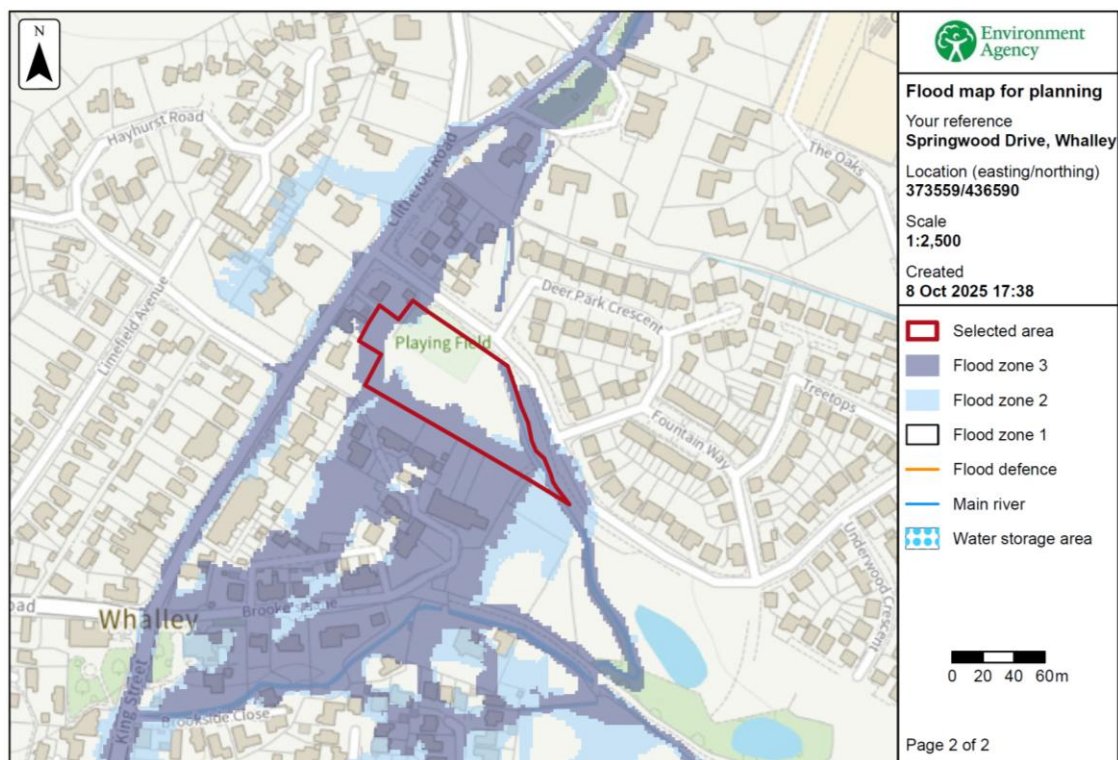
Flood risk planning policy

- 3.1 The National Planning Policy Framework (NPPF) sets out the Government's national policies on different aspects of land use planning in England in relation to flood risk. Supporting Planning Practice Guidance is also available.
- 3.2 The NPPF sets out the vulnerability to flooding of different land uses. It encourages development to be located away from areas at highest risk (whether existing or future), and states that where development is necessary in such areas, the development should be made safe for its lifetime. It also stresses the importance of preventing increases in flood risk offsite to the wider catchment area.
- 3.3 The NPPF also states that alternative sources of flooding, other than fluvial (river flooding), should also be considered when preparing a Flood Risk Assessment.
- 3.4 As set out in the NPPF, local planning authorities should only consider development in flood risk areas appropriate where informed by a site specific Flood Risk Assessment. This document will identify and assess the risk associated with all forms of flooding to and from the development. Where necessary it will demonstrate how these flood risks will be managed so that the development remains safe throughout its lifetime, taking climate change into account.
- 3.5 This Flood Risk Assessment is written in accordance with the NPPF and the Planning Practice Guidance in relation to Flood Risk and Coastal Change.

Flood zones

- 3.6 In investigating the flood risk relating to the site, the Environment Agency flood mapping has been reviewed and has identified that the majority of the site lies within Flood Zone 1. The flood mapping also shows areas of Flood Zone 3 lying within the confines of the Wiswell Brook along the eastern boundary of the site and within the site close to and along the western and southern boundaries of the site.

- 3.7 Flood Zone 1 is identified as land assessed as having a low probability of flooding, that is in any year has less than a 0.1% chance of flooding from rivers or the sea. Flood Zone 3 is identified as land assessed as having a high probability of flooding, that is in any year has a 1% or more chance of flooding from rivers, or a 0.5% or more chance of flooding from the sea. The flood zones categorisation refers to the probability of river and sea flooding, ignoring the presence of defences.
- 3.8 The main risk of flooding is fluvial from the Wiswell Brook ordinary watercourse.
- 3.9 An extract from the Environment Agency's flood zone map for planning is shown below.



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Strategic Flood Risk Assessment

- 3.10 The site is within the area covered by the Ribble Valley Borough Council Revised Strategic Flood Risk Level 1 Assessment, April 2017.

4. CONSULTATIONS AND DATA ACQUISITIONS

Environment Agency

- 4.1 The Environment Agency flood mapping has been reviewed and has identified that the majority of the site lies within Flood Zone 1. The flood mapping also shows areas of Flood Zone 3 lying within the confines of the Wiswell Brook along the eastern boundary of the site and within the site close to and along the western and southern boundaries of the site.
- 4.2 Product 4 information has been obtained from the Environment Agency and is included within Appendix B. The model provided containing the most relevant data for the area of interest was:
- Model name: Whalley 2017
- Scenario(s): Defended fluvial, defences removed fluvial, defended climate change fluvial, defences removed climate change fluvial
- Date: 11 August 2017
- 4.3 The information gave modelled flood levels within the Wiswell Brook and within the southern part of the site for the 1%, 1% plus climate change (15%) and 0.1% fluvial events. The site is unaffected by tidal events.
- 4.4 The Environment Agency also stated that the site is also partially affected by flood risk within the western part of the site produced from the New National Model at the North of the site, sourced from the Wiswell Brook ordinary watercourse which runs alongside Wiswell Lane. The flood levels or depth data are not currently available for the New National Model from the New National Flood Risk Assessment system.
- 4.5 The Environment Agency information identifies that there are no flood defences local to the site. A short length of flood defence lies on the northern bank of the River Calder to the south of the site.
- 4.6 Areas of the site that lie along the eastern and southern boundaries are in an area benefitting from the Environment Agency's flood alert service, which warn people of

the possibility of flooding and encourage them to be alert, stay vigilant and make early / low impact preparations for flooding.

United Utilities

- 4.7 United Utilities sewer records have been obtained and identify the following sewers local to the development site. The sewer records are included within Appendix C.
- 4.8 A 225mm diameter public combined sewer runs north south through the western part of the site. The sewer serves the residential properties that lie to the west and north of the site.
- 4.9 A 225mm diameter public surface water sewer runs southwards along Clitheroe Road that lies to the west of the site. The sewer takes a restricted discharge, controlled by a Hydrobrake, from attenuation storage that lies under Springwood Drive located immediately outside of the development site access. This system serves the residential development to the north of Springwood Drive.

Site Investigation

- 4.10 Site investigations have not been carried out on the site. The Soilsmap Viewer has identified that the geology encountered will be slowly permeable seasonally wet acid loamy and clayey soils with impeded drainage.

Topographical survey

- 4.11 A topographical survey has been carried out for the site and is included within Appendix D.
- 4.12 The site and the Wiswell Brook watercourse fall from the north to the south, the lowest point of the site being the southwestern corner of the site.

Historic flooding

- 4.13 The Environment Agency Historical Flood Mapping on the GOV.UK website shows that the site has not previously flooded. An extract from the Recorded Flood Outlines on the gov.uk website is shown below. It can be seen that the proposed development site was unaffected.



- 4.14 However, the Environment Agency has stated that it is aware and has evidence that an area of Springwood Drive directly north of the site flooded on the 31st December 2024 and the 1st January 2025 originating from the culvert inlet north of Springwood Drive, caused by a blockage of a debris screen. They understand that flood flows then travelled north-west before joining Clitheroe Road. The site was unaffected and the debris screen has since been removed.

5. SOURCES OF FLOOD RISK

Potential Sources of Flood Risk

- 5.1 Potential sources of flood risk to the site are identified below. The significance of these sources is investigated further into Section 6.

Tidal flooding

- 5.2 The site is not at risk from tidal flooding.

Fluvial flooding

- 5.3 The Environment Agency flood mapping identifies that the majority of the site lies within Flood Zone 1. The flood mapping also shows areas of Flood Zone 3 lying within the confines of the Wiswell Brook along the eastern boundary of the site and within the site close to and along the western and southern boundaries of the site.
- 5.4 Product 4 information has been obtained from the Environment Agency. Modelled flood levels have been provided within the Wiswell Brook that lies along the eastern boundary of the site for the fluvial events. Defended and undefended levels are the same.

<u>Reference Point</u>	<u>Fluvial Return Period</u>		
	1%	1% plus 15% cc	0.1%
931695	58.50m AOD	58.55m AOD	58.65m AOD
931649	58.42m AOD	58.46m AOD	58.48m AOD
931696	58.30m AOD	58.34m AOD	58.44m AOD
931627	58.03m AOD	58.05m AOD	58.10m AOD
931611	57.92m AOD	57.95m AOD	58.00m AOD
931669	57.77m AOD	57.81m AOD	57.87m AOD
931620	57.66m AOD	57.70m AOD	57.78m AOD

- 5.5 Modelled flood levels have also been provided for the area of flooding close to and along the southern boundary of the site. The maximum depth of the flooding has been identified as 80mm for the 1% storm event and 130mm for the 0.1% storm event.

5.6 The flood risk within the western part of the site is identified from the New National Model at the North of the site, sourced from the Wiswell Brook ordinary watercourse which runs alongside Wiswell Lane and the flood levels or depth data are not currently available from the Environment Agency.

5.7 Areas of the site that lie along the eastern and southern boundaries are in an area benefitting from the Environment Agency's flood alert service, which warn people of the possibility of flooding and encourage them to be alert, stay vigilant and make early / low impact preparations for flooding.

Canals, reservoirs and other artificial sources

5.8 There are no canals, reservoirs or other artificial sources local to the area.

5.9 The Environment Agency risk of flooding from reservoirs map identifies the site is not at risk of flooding from reservoirs when river levels are normal or when there is also flooding from rivers.

Groundwater

5.10 Groundwater flooding tends to occur after much longer periods of sustained high rainfall. The areas that are at risk tend to be those low-lying areas where the water table is shallow. Flooding tends to occur in areas that are underlain by major aquifers, although groundwater flooding is also noted in localised floodplain sands and gravels. The main causes of groundwater flooding are:

- Natural groundwater rising due to tidal influence, or exceptionally wet periods leading to rapid recharge;
- Groundwater rebound due to cessation of abstraction and mine dewatering;
- Existence of confined aquifers and springs.

Pluvial runoff

5.11 The Environment Agency Risk of Flooding from Surface Water map identifies a small area along the southern boundary of the site that has a high yearly chance of surface water flooding between 2040 and 2060.

- 5.12 It should be noted that surface water flooding can be difficult to predict, much more so than river or sea flooding as it is hard to forecast exactly where or how much rain will fall in any storm. In addition, local features can greatly affect the chance and severity of flooding.

Sewers

- 5.13 United Utilities sewer records identify a 225mm diameter public combined sewer that runs north south through the western part of the site and a 225mm diameter public surface water sewer that runs southwards along Clitheroe Road and takes a restricted discharge, controlled by a Hydrobrake, from attenuation storage that lies under Springwood Drive located immediately outside of the development site access that serves the residential development to the north of Springwood Drive.
- 5.14 Sewer flooding occurs when the sewer network cannot cope with the volume of water that is entering it. It is often experienced during times of heavy rainfall when large amounts of surface water overwhelm the sewer network causing flooding. Temporary problems such as blockages, siltation, collapses and equipment or operational failures can also result in sewer flooding.

Development drainage

- 5.15 Surface water (including the risk of sewers and culverted watercourses surcharging) poses the highest risk of more frequent flooding. Surface water drainage from new developments is critical in reducing the risk of localised flooding.
- 5.16 If surface water runoff is not managed appropriately, there may be an increased risk presented elsewhere from development drainage, and the aim should be to implement appropriate sustainable drainage systems (SuDS) to treat and contain flows and mimic the existing conditions.
- 5.17 Where possible the preference for dealing with surface water runoff from the developed site is for it to infiltrate back into the ground or alternatively to a waterbody or watercourse. Only if it is not possible for either of these options is surface water from the development to be allowed into the public sewers.

6. FLOOD RISK ASSESSMENT

- 6.1 This section of the Flood Risk Assessment looks at the flood risk to the site before any mitigation measures are put into place and hence identifies where mitigation will be required. Section 7 continues to explain the mitigation measures proposed and the residual risk following implementation of any proposed mitigation.
- 6.2 The proposal is for the construction of six residential dwellings with associated car parking and landscaping.

Risk of Flooding to Proposed Development

Tidal flooding

- 6.3 The site is not at risk from tidal flooding.

Fluvial Flood Risk

- 6.4 The Environment Agency flood mapping identifies that the majority of the site lies within Flood Zone 1. The flood mapping also shows areas of Flood Zone 3 lying within the confines of the Wiswell Brook along the eastern boundary of the site and within the site close to and along the western and southern boundaries of the site.
- 6.5 Modelled flood levels have been provided within the Wiswell Brook that lies along the eastern boundary of the site for the fluvial events. Defended and undefended levels are the same.

<u>Reference Point</u>	<u>Fluvial Return Period</u>		
	1%	1% plus 15% cc	0.1%
931695	58.50m AOD	58.55m AOD	58.65m AOD
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931669	57.77m AOD	57.81m AOD	57.87m AOD
931620	57.66m AOD	57.70m AOD	57.78m AOD

- 6.6 Modelled flood levels have also been provided for the area of flooding close to and along the southern boundary of the site. The maximum depth of the flooding has been identified as 80mm for the 1% storm event and 130mm for the 0.1% storm event.
- 6.7 The Environment Agency Flood Zone map shows floodwater overtopping the western bank of the Wiswell Brook near to the site's southeastern corner and creating the Flood Zone 3 area within the site close to and along the southern boundary of the site before flowing overland to the south away from the site, to rejoin the Wiswell Brook ordinary watercourse where it lies along Brookside Close.
- 6.8 A topographical survey has been carried out for the site and shows that the site and the Wiswell Brook fall from the north to the south. The modelled flood levels within the Wiswell Brook for the fluvial events have been plotted onto the topographical survey and proposed site layout along with the ground levels that are along the top of the western bank of the Wiswell Brook.
- 6.9 At the request of the Environment Agency, in addition to what was already a detailed topographical survey, a more intense grid of levels has also been provided, to the stretch of the western bank of the Wiswell Brook where overtopping is alleged to occur on the Whalley 2017 model, i.e., the south-east of the site. The topographical survey and proposed site layout have been included within Appendix D.
- 6.10 For the Ribble Management Catchment, the design flood level for the site is the 1% AEP plus 36% added for climate change. Only the 1% AEP plus 15% added for climate change was provided by the Environment Agency within the Product 4 information. Based upon recent past experiences within North West England, the 1% AEP plus 36% flood water level will be below the 0.1% AEP flood level.
- 6.11 The information from the survey demonstrates, in unequivocal terms, that there is no low spot within the western bank of the Wiswell Brook which would cause flooding from the Wiswell Brook into the development site. The water within the Wiswell Brook for all events up to the 0.1% AEP event are below the existing ground levels that are along the top of the western bank of the Wiswell Brook. As such, any water within the Wiswell Brook stays within the channel and does not overtop the western bank into

the development site even when the 0.1% AEP event is considered, (i.e. during the design flood event – the 0.1% AEP event being used as a ‘proxy’ for the 1% AEP plus climate change event), and which has always been the situation.

- 6.12 However, approx. 5m to the south of Node Reference 931620 in the extreme south eastern corner of the development site, the additional topographical survey has identified a low spot within the western bank where there may be a plausible flow path for floodwaters to overtop the western bank of the Wiswell Brook during the 0.1% AEP event.
- 6.13 The detailed topographical survey included within Appendix D, has been marked up to show that any potential overtopped floodwaters, should they occur at the location approx. 5m to the south of Node Reference 931620, i.e., in the very extreme south eastern corner of the development site, will not ‘fan out’ into the Flood Zone 2 extent at the south of the site where ground level raising is proposed. When correctly interpreting the existing ground levels it can be seen from the marked up survey that the potential for any overtopped floodwaters will flow away from the development site (the limit of the southern site boundary is defined / confirmed by the red line on the topographical survey). The downward gradient of the natural slope of the land away from the proposed development is very evident and therefore any potential flood routing will not be routed back to the south of the development site. As such the Flood Zone 3 area within the development site close to and along the southern boundary of the site should be identified as being Flood Zone 1.
- 6.14 This conclusion was the same as for the 2018 FRA and the additional topographical survey carried out at the request of the Environment Agency has also concluded that for the design flood event the water within the Wiswell Brook, where it flows adjacent the development site, stays within the channel and does not overtop the western bank into the proposed development.
- 6.15 Existing ground levels along the western bank of the Wiswell Brook where it lies along and within the eastern boundary of the site are to be maintained and are not to be reduced in order to ensure that the water remains within channel of the Wiswell Brook for the 0.1% AEP storm event.

- 6.16 The flood risk within the western part of the site is identified from the New National Model at the North of the site, sourced from the Wiswell Brook ordinary watercourse which runs alongside Wiswell Lane and the flood levels or depth data are not currently available from the Environment Agency.
- 6.17 The Wiswell Brook ordinary watercourse lies to the north, east and south of the development site, flowing from the north from Wiswell along Wiswell Shay and Wiswell Lane and then adjacent the eastern boundary of the site. Thereafter, the watercourse flows to the south and then west along Brookside Close before flowing south in a 1200mm diameter culvert under King Street, to eventually discharge into the River Calder approx. 720m to the south of the site.
- 6.18 The flood map for planning shows a Flood Zone 3 area within the western part of the site that is overland flow from water allegedly overspilling from the section of Wiswell Brook which runs alongside Wiswell Lane and then overland down the hill supposedly through the development site and beyond, to rejoin the Wiswell Brook where it lies along Brookside Close. This area, defined as Flood Zone 3 was originally as a consequence of surface water flooding, as depicted on the surface water flood maps prior to March 2025. The route of this overland flow will not be impeded by the proposed development, ground levels within this area of the site being maintained and any boundary fences to be erected being raised a minimum 225mm above the ground.
- 6.19 Referring to the Environment Agency's Flood Map for Planning, the overland flow does not encroach within the areas of the site where residential dwellings are planned. In addition, there will be no interference of the overland flow, water will not accumulate within the site and will not be displaced as the land continues to fall away from the development site's southern boundary.
- 6.20 From the above, it has been demonstrated:
- That for the design flood event the water within the Wiswell Brook stays within the channel where it flows adjacent to the development site and does not overtop the western bank into the development site. As such the southern part of the development site should be identified as being Flood Zone 1.

- The Flood Zone 3 area within the western part of the site is likely to be overland flow from water overspilling from the section of Wiswell Brook which runs alongside Wiswell Lane and then overland down the hill, potentially through the development site and beyond, to rejoin the Wiswell Brook where it lies along Brookside Close.

6.21 As such, there will be no interference of flow, water will not accumulate within the site and will not be displaced. There will no increase in fluvial flood risk elsewhere as a result of the development both now and for the 1% plus climate change event. Flood storage compensation will, therefore, not be required to be provided.

6.22 It is, however, recommended that mitigation measures are undertaken to take account of any residual flood risk should it occur.

- Floor levels of the proposed residential dwellings where they are shown to lie within the Flood Zone 3 areas on the Environment Agency's flood mapping, Plots 3 and 6, will be set at a minimum 600mm above the average existing ground levels adjacent to each dwelling. There will be no sunken floor levels within the development site, the floor levels being set above the highest finished ground levels immediately adjacent to the dwellings, thus providing a freeboard on the uphill elevations immediately adjacent to the dwellings. As such, proposed (raised) floor levels of the dwellings should be more than sufficient to deal with any residual flooding should it remotely occur, in particular as any overspill from the Wiswell Brook will be overland flow rather than impounded accumulation.
- It is not proposed to lift the proposed finished floor levels of Plots 1, 2, 4 and 5 as they are located within the Flood Zone 1 area of the site identified on the Flood Map for Planning, although the floor levels being set above the highest finished ground levels immediately adjacent to the dwellings will provide a degree of freeboard on the uphill elevations immediately adjacent to the dwellings. It should be noted that floor levels also have to be set to comply with access requirements to the dwellings on a sloping site – ref AD 'M' of the Building Regulations.
- The fall in the ground levels from the north to the south outside of the dwellings in the area of the identified overland flow within the western part of the site is to remain so as not to impede or divert the overland flow, should it occur.

- A retaining wall is to be installed inside the development site parallel to the western bank of the Wiswell Brook. The retaining structure will play no part in preventing flood waters from entering the site but is for bank stability as it is proposed to reduce the levels within the development site. The acceptance of the structure being termed a 'flood defence structure' is purely based on the fact that the structure will support the bank of Wiswell Brook. There will be no influence / impact on flood flow, velocity or flood risk from the Wiswell Brook and no increase in flood risk elsewhere.

6.23 The proposed floor levels of the dwellings and existing / proposed external ground levels are shown on the proposed site layout included within Appendix D.

Canals, reservoirs and other artificial sources

6.24 There are no canals, reservoirs or other artificial sources local to the area.

6.25 The Environment Agency risk of flooding from reservoirs map identifies the site is not at risk of flooding from reservoirs when river levels are normal or when there is also flooding from rivers.

Groundwater

6.26 No information has been identified to suggest that the site is susceptible to groundwater flooding.

Pluvial Runoff

6.27 The Environment Agency Risk of Flooding from Surface Water map identifies a small area along the southern boundary of the site that has a high yearly chance of surface water flooding between 2040 and 2060.

6.28 Floor levels of the dwellings are being set above the highest finished ground levels immediately adjacent to the dwellings and this will provide a degree of freeboard on the uphill elevations immediately adjacent to the dwellings and mitigation against surface water flooding should it occur.

Sewers

- 6.29 United Utilities sewer records identify a 225mm diameter public combined sewer that runs north south through the western part of the site and a 225mm diameter public surface water sewer that runs southwards along Clitheroe Road and takes a restricted discharge, controlled by a Hydrobrake, from attenuation storage that lies under Springwood Drive located immediately outside of the development site access that serves the residential development to the north of Springwood Drive.
- 6.30 United utilities has the responsibility of maintaining public sewers and would deal with a problem were it to arise.

Effect of the Development on the Wider Catchment

Development Drainage

- 6.31 The proposal is for the construction of six residential dwellings with associated car parking and landscaping.
- 6.32 The proposed development will introduce an area of impermeable hardstanding on site which has the potential to significantly alter the surface water runoff regime of the site and have an adverse effect on flood risk elsewhere in the wider catchment.
- 6.33 Surface water runoff from the site will therefore be controlled such that there will be no change to the flood risk upstream or downstream of this location.
- 6.34 Surface water requirements have been prepared and are discussed in Section 8 of this document. As a result of the mitigation measures, the risk of flooding from the development drainage is low.

7. PREDICTED IMPACTS AND MITIGATION

- 7.1 This section of the FRA sets out the mitigation measures recommended to reduce the risk of flooding to the proposed development and outlines any residual impacts.

Site arrangements

Safe access and egress

- 7.2 Areas of the site that lie along the eastern and southern boundaries are in an area benefitting from the Environment Agency's flood alert service, which warn people of the possibility of flooding and encourage them to be alert, stay vigilant and make early / low impact preparations for flooding.
- 7.3 It has been determined that the areas of the site where the residential dwellings are planned lie within Flood Zone 1. However, should evacuation be necessary, a safe route is available onto Springwood Drive and then to the east as it is noted that Springwood Drive at its eastern end, is currently being connected to the A671. The whole of this route lies within Flood Zone 1.
- 7.4 If it is not possible to evacuate safely from the dwellings, or If during evacuation flood waters are confronted, then refuge shall be taken within the first floor of the dwellings where occupants will be safe above predicted flood water levels and may remain until rescued or flooding has subsided or Environment Agency Flood Warnings are no longer active.

Finished levels

- 7.5 The proposed floor levels of the dwellings and existing / proposed external ground levels are shown on the proposed site layout included within Appendix D.
- 7.6 Floor levels of the proposed residential dwellings where they are shown to lie within the Flood Zone 3 areas on the Environment Agency's flood mapping, Plots 3 and 6, will be set at a minimum 600mm above the average existing ground levels adjacent to each dwelling. There will be no sunken floor levels within the development site, the floor levels being set above the highest finished ground levels immediately adjacent

to the dwellings, thus providing a freeboard on the uphill elevations immediately adjacent to the dwellings. As such, proposed (raised) floor levels of the dwellings should be more than sufficient to deal with any residual flooding should it remotely occur, in particular as any overspill from the Wiswell Brook will be overland flow rather than impounded accumulation.

- 7.7 It is not proposed to lift the proposed finished floor levels of Plots 1, 2, 4 and 5 as they are located within the Flood Zone 1 area of the site identified on the Flood Map for Planning, although the floor levels being set above the highest finished ground levels immediately adjacent to the dwellings will provide a degree of freeboard on the uphill elevations immediately adjacent to the dwellings. It should be noted that floor levels also have to be set to comply with access requirements to the dwellings on a sloping site – ref AD ‘M’ of the Building Regulations.
- 7.8 The fall in the ground levels from the north to the south outside of the dwellings in the area of the identified overland flow within the western part of the site is to remain so as not to impede or divert the overland flow, should it occur.
- 7.9 The above measures will also provide mitigation against surface water flooding should it occur.

Upstream and downstream effects

- 7.10 There is no material effect on the floodplain due to the proposed development.
- 7.11 Surface water runoff from the site will be controlled. As such the potential to alter the surface water runoff regime of the site and to have an adverse effect on flood risk elsewhere in the wider catchment is therefore low.

8. DRAINAGE STRATEGY

Surface water drainage

- 8.1 In accordance with the National Standards for Sustainable Drainage, the drainage strategy should incorporate the use of Sustainable Drainage (SUDS) where possible. The approach promotes the use infiltration features in the first instance. If drainage cannot be achieved solely through infiltration due to site conditions or contamination risks, the preferred options are (in order of preference):
- (i) a controlled discharge to a local waterbody or watercourse, or
 - (ii) a controlled discharge into the public sewer network (depending on availability and capacity).
- 8.2 The rate and volume of discharge should strive to provide betterment and be restricted to the pre-development values as far as practicable.
- 8.3 The Soilsmap Viewer has identified that the geology encountered will be slowly permeable seasonally wet acid loamy and clayey soils with impeded drainage. As such infiltration is unlikely to provide a viable drainage solution for surface water runoff generated by the site. In addition, as the site slopes from the north to the south, locating soakaways for individual dwellings within the higher parts of the development site may result in water leaching from the lower parts of the site, increasing the risk of flooding to those dwellings that lie below them.
- 8.4 As the Wiswell Brook ordinary watercourse that lies along the eastern boundary of the site lies higher than the rest of the site, it is not possible for a gravity connection to be made for surface water runoff from the proposed development to discharge into it. In addition, if a restricted discharge of surface water from the developed site was to be made into the Wiswell Brook, there is the possibility of the increased risk of flooding onto third party property from the Wiswell Brook downstream from the site.

- 8.5 United Utilities sewer records identify a 225mm diameter public surface water sewer that runs southwards along Clitheroe Road and takes a restricted discharge, controlled by a Hydrobrake, from the surface water drainage system and attenuation storage that lies under Springwood Drive located immediately outside of the development site access. It is not possible to connect into the 225mm diameter public surface water sewer that runs southwards along Clitheroe Road without having to cross third party land. Nor is it possible to connect to the surface water drainage system and attenuation storage that lies under Springwood Drive located immediately outside of the development site access without the possibility of increasing the risk of flooding from that drainage system.
- 8.6 United Utilities sewer records identify a 225mm diameter public combined sewer running north south through the western part of the site. The sewer serves the residential properties that lie to the west and north of the site.
- 8.7 The proposal is for a residential development to comprise six residential properties. It is therefore intended that surface water runoff from the developed site will be controlled to the existing pre-development Greenfield runoff rate, Q_{bar} , or 2.0 l/s whichever is the greater, allowing surface water runoff generated by all rainfall events up to the 100 year critical rain storm plus 50% on stored volumes to discharge into the 225mm diameter public combined sewer running north south through the western part of the site. The additional 50% is to allow for climate change and has been included in the surface water volume.
- 8.8 To determine the restricted surface water discharge rate from the developed site, the pre-development Greenfield runoff rates have been calculated using the 'Causeway Flow' programme. The calculations are based upon the area of the site in which development will occur and this has been measured as 0.6ha. The existing pre-development Greenfield runoff rates have been calculated as below:

Pre-development discharge

Site Makeup	Greenfield ▾
Greenfield Method	IH124 ▾
Positively Drained Area (ha)	0.600
SAAR (mm)	1139
Soil Index	4 ▾
SPR	0.47
Region	10 ▾
Betterment (%)	0
	Calc
QBar (l/s)	5.1

Return Period (years)	Growth Factor	Q (l/s)
1	0.87	4.5
30	1.70	8.7
100	2.08	10.7

- 8.9 As the existing pre-development Greenfield runoff rate, Qbar, has been calculated as 5.1 l/s, new surface water drainage will therefore be constructed, appropriately sized to take surface water runoff from the proposed development and be attenuated to 5.1 l/s prior to a controlled discharge into the 225mm diameter public combined sewer running north south through the western part of the site.
- 8.10 The proposed surface water drainage for the development will take runoff from the roofs of the properties and the access road.
- 8.11 The private drives and parking areas are to comprise permeable paving allowing surface water runoff to pass into the construction matrix or to run off at its edges where it will either infiltrate into the upper soil layers, evaporate or be taken up by the vegetation, thus dealing with the surface water at source. It has been determined that in order to cater for the 100 year critical rain storm plus 50% added for climate change, the depth of the sub-base under the private drive and parking areas comprising open graded crushed rock shall be a minimum thickness of 270mm.

- 8.12 Similarly, surface water from the paths and patios within the developed site will runoff to channel drains or to adjacent areas of gravel filter strips or planted beds where it will be allowed to infiltrate into the upper strata and will be either taken up by plants or evaporated thus also dealing with the surface water at source.
- 8.13 A surface water drainage design has been carried out for the proposed development for all events up to the 100 year critical rain storm plus 50% for climate change on stored volumes. Attenuation is provided within the network of pipes and manholes and sealed underground storage beneath the access road. The surface water drainage design is included within Appendix E.

Foul water drainage

- 8.14 United Utilities sewer records identify a 225mm diameter public combined sewer running north south through the western part of the site. The sewer serves the residential properties that lie to the west and north of the site.
- 8.15 It is therefore intended that foul water from the proposed residential dwellings will discharge into the 225mm diameter public combined sewer running north south through the western part of the site.

9. CONCLUSIONS

- 9.1 This flood risk assessment and drainage strategy has been produced on behalf of CRJ Developments Ltd in support of a planning application for a proposed residential development on land at Springwood Drive, Whalley.
- 9.2 The Environment Agency flood mapping identifies that the majority of the site lies within Flood Zone 1. The flood mapping also shows areas of Flood Zone 3 lying within the confines of the Wiswell Brook along the eastern boundary of the site and within the site close to and along the western and southern boundaries of the site.
- 9.3 It has been demonstrated:
- That for the design flood event the water within the Wiswell Brook stays within the channel where it flows adjacent to the development site and does not overtop the western bank into the development site. As such the southern part of the development site should be identified as being Flood Zone 1.
 - The Flood Zone 3 area within the western part of the site is likely to be overland flow from water overspilling from the section of Wiswell Brook which runs alongside Wiswell Lane and then overland down the hill, potentially through the development site and beyond, to rejoin the Wiswell Brook where it lies along Brookside Close.
- 9.4 There will be no interference of flow, water will not accumulate within the site and will not be displaced. There will no increase in fluvial flood risk elsewhere as a result of the development both now and for the 1% plus climate change event. Flood storage compensation will, therefore, not be required to be provided.
- 9.5 The areas of the site where residential dwellings are planned lie within Flood Zone 1.
- 9.6 There are no canals, reservoirs or other artificial sources local to the area.
- 9.7 The Environment Agency risk of flooding from reservoirs map identifies the site is not at risk of flooding from reservoirs when river levels are normal or when there is also flooding from rivers.

- 9.8 No information has been identified to suggest that the site is susceptible to groundwater flooding.
- 9.9 The Environment Agency Risk of Flooding from Surface Water map identifies a small area along the southern boundary of the site that has a high yearly chance of surface water flooding between 2040 and 2060.
- 9.10 Floor levels of the proposed residential dwellings where they are shown to lie within the Flood Zone 3 areas on the Environment Agency's flood mapping, Plots 3 and 6, will be set at a minimum 600mm above the average existing ground levels adjacent to each dwelling. There will be no sunken floor levels within the development site, the floor levels being set above the highest finished ground levels immediately adjacent to the dwellings, thus providing a freeboard on the uphill elevations immediately adjacent to the dwellings. As such, proposed (raised) floor levels of the dwellings should be more than sufficient to deal with any residual flooding should it remotely occur, in particular as any overspill from the Wiswell Brook will be overland flow rather than impounded accumulation.
- 9.11 It is not proposed to lift the proposed finished floor levels of Plots 1, 2, 4 and 5 as they are located within the Flood Zone 1 area of the site identified on the Flood Map for Planning, although the floor levels being set above the highest finished ground levels immediately adjacent to the dwellings will provide a degree of freeboard on the uphill elevations immediately adjacent to the dwellings. It should be noted that floor levels also have to be set to comply with access requirements to the dwellings on a sloping site – ref AD 'M' of the Building Regulations.
- 9.12 The fall in the ground levels from the north to the south outside of the dwellings in the area of the identified overland flow within the western part of the site is to remain so as not to impede or divert the overland flow, should it occur.
- 9.13 The above measures will also provide mitigation against surface water flooding should it occur.
- 9.14 The potential to alter the surface water runoff regime of the site and to have an adverse effect on flood risk elsewhere in the wider catchment is low.

- 9.15 New surface water drainage will be constructed, appropriately sized to take surface water runoff from the roofs of the properties and the access road and be attenuated to 5.1 l/s prior to a controlled discharge into the 225mm diameter public combined sewer running north south through the western part of the site.
- 9.16 Foul water from the proposed residential dwellings will discharge into the 225mm diameter public combined sewer running north south through the western part of the site.000

APPENDIX A



LOCATION PLAN

APPENDIX B



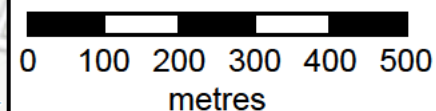
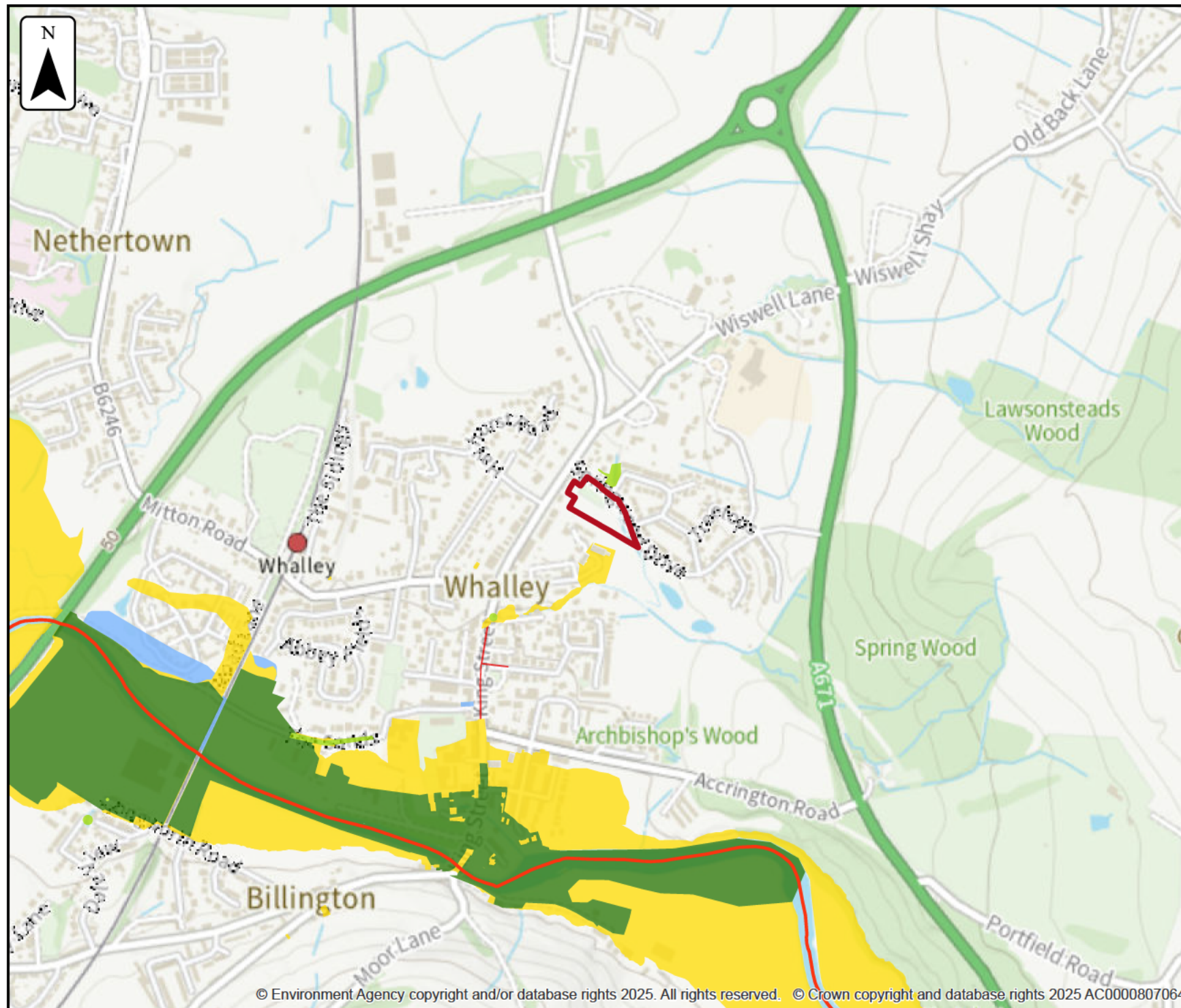
Past floods

Location (easting/northing)
373563/436589

Scale
1:10,000

Created
17 Dec 2025

-  Selected area
-  Main river
- Date of flood event
 -  December, 2024
 -  February, 2020
 -  December, 2015
 -  June, 2012
 -  October, 2000
 -  December, 1999



Data on past flood events

Start date	End date	Source of flood	Cause of flood	Affects location
31 December 2024	1 January 2025	unknown	unknown	No
9 February 2020	10 February 2020	main river	overtopping of defences	No
26 December 2015	27 December 2015	main river	channel capacity exceeded (no raised defences)	No
22 June 2012	23 June 2012	unknown	local drainage/surface water	No
26 October 2000	27 October 2000	main river	channel capacity exceeded (no raised defences)	No
11 December 1999	12 December 1999	ordinary watercourse	obstruction/blockage - debris screen	No



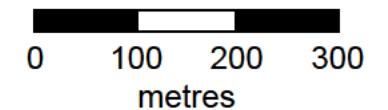
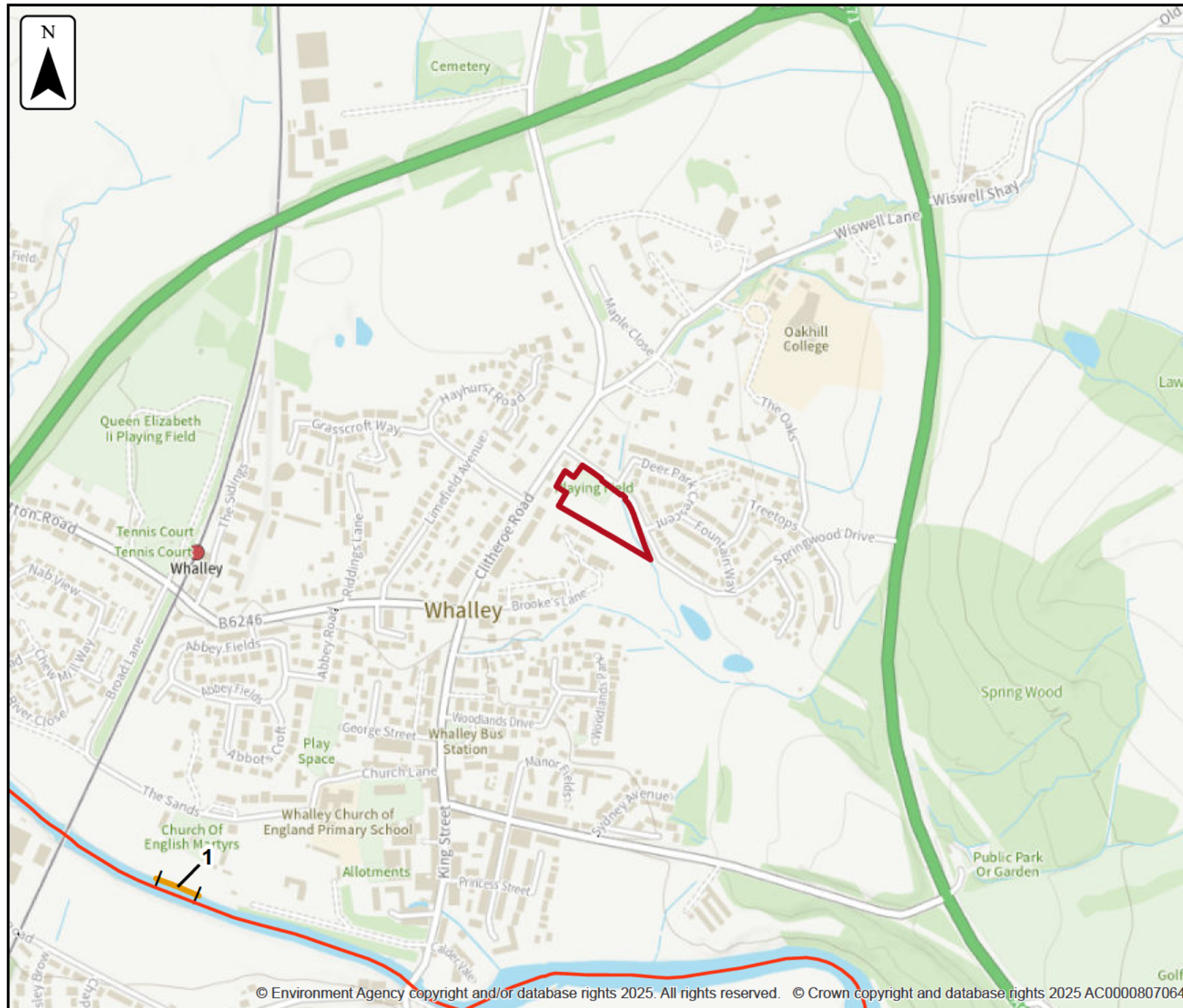
Flood defences

Location (easting/northing)
373563/436589

Scale
1:7,500

Created
17 Dec 2025

-  Selected area
-  Main river
-  Flood defence



Flood defences data

Label	Asset ID	Asset Type	Standard of protection (years)	Current condition	Downstream actual crest level (mAOD)	Upstream actual crest level (mAOD)	Effective crest level (mAOD)
1	64827	Embankment	5	Poor	43.90	43.90	43.90

Any blank cells show where a particular value has not been recorded for an asset.



Defences removed modelled fluvial extent

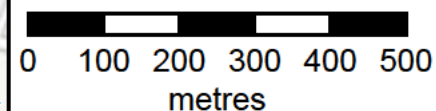
Location (easting/northing)
373563/436589

Scale Created
1:10,000 17 Dec 2025

Model name
Whalley 2017

-  Selected area
-  Main river
- Modelled flood extent
 -  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 climate change modelled fluvial extent

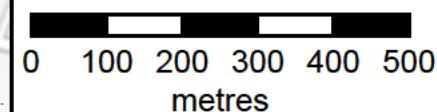
Location (easting/northing)
373563/436589

Scale Created
1:10,000 17 Dec 2025

Model name
Whalley 2017

-  Selected area
-  Main river
- Modelled flood extent
-  1% AEP (+15%)

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





Defended modelled fluvial extent

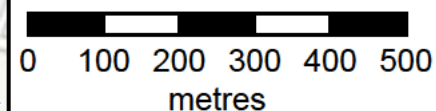
Location (easting/northing)
373563/436589

Scale Created
1:10,000 17 Dec 2025

Model name
Whalley 2017

-  Selected area
-  Main river
- Modelled flood extent
-  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

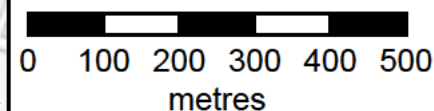
Location (easting/northing)
373563/436589

Scale Created
1:10,000 17 Dec 2025

Model name
Whalley 2017

-  Selected area
-  Main river
- Modelled flood extent
-  1% AEP (+15%)

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





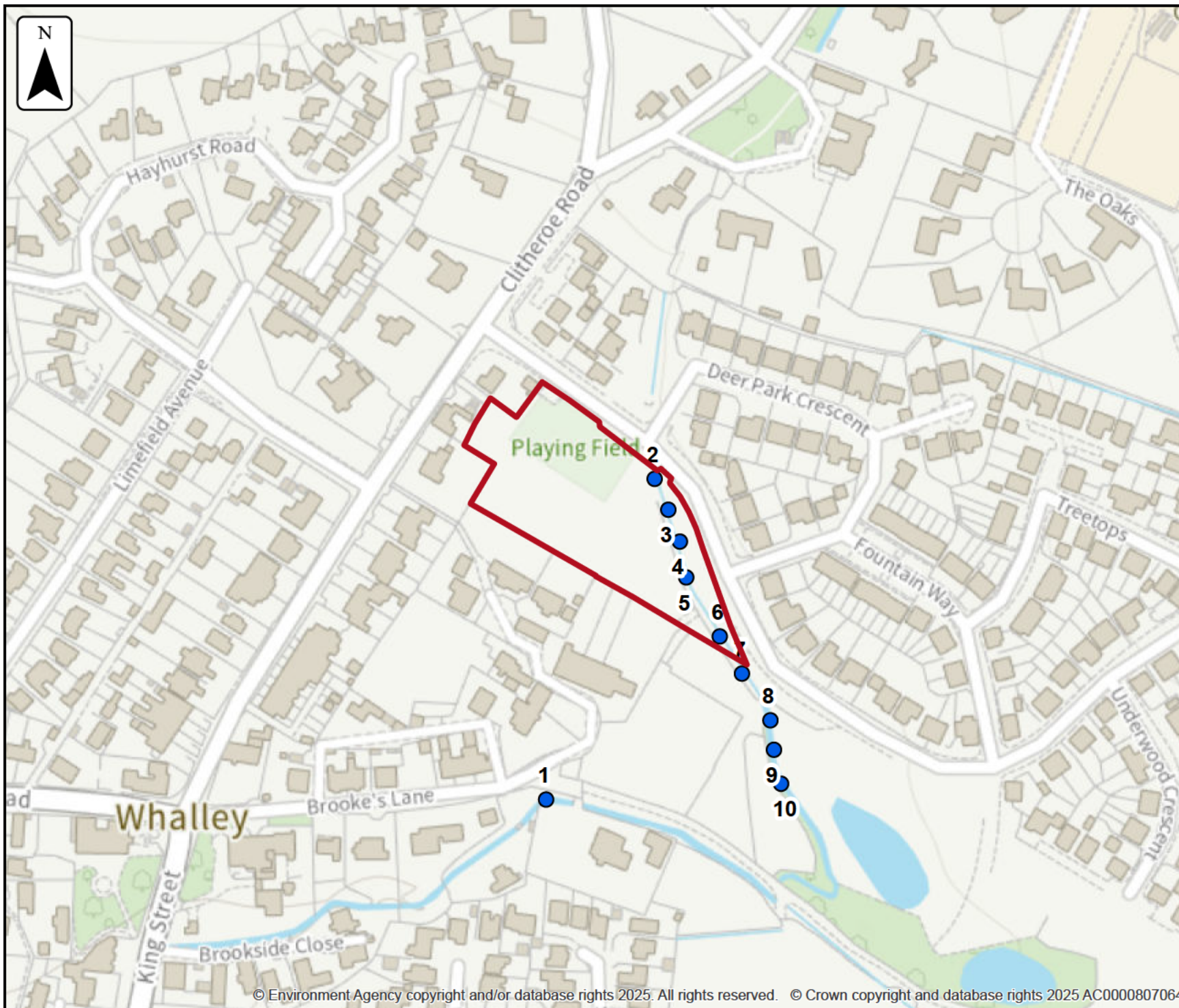
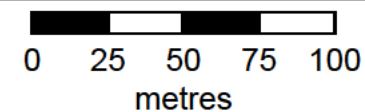
Defences removed modelled fluvial node locations

Location (easting/northing)
373563/436589

Scale Created
1:2,500 17 Dec 2025

Model name
Whalley 2017

-  Selected area
-  Modelled location
-  Main river



Modelled node locations data

Defences removed

Label	Modelled location ID	Easting	Northing	50% AEP	10% AEP	4% AEP	1.33% AEP	1% AEP	0.5% AEP	0.1% AEP
				Level	Level	Level	Level	Level	Level	Level
1	931671	373538	436449	51.96	52.11	52.17	52.27	52.29	52.37	52.56
2	931695	373590	436604	58.19	58.32	58.40	58.47	58.50	58.55	58.65
3	931649	373597	436589	58.12	58.26	58.33	58.39	58.42	58.46	58.48
4	931696	373602	436574	58.01	58.13	58.19	58.26	58.30	58.35	58.44
5	931627	373605	436556	57.87	57.97	57.98	58.01	58.03	58.05	58.10
6	931620	373622	436528	57.39	57.57	57.59	57.63	57.66	57.71	57.78
7	931659	373632	436510	57.14	57.34	57.37	57.43	57.49	57.55	57.75
8	931609	373646	436487	56.62	56.77	56.80	56.85	56.89	56.94	57.06
9	931652	373648	436473	55.99	56.13	56.14	56.18	56.22	56.26	56.35
10	931638	373651	436456	55.52	55.66	55.68	55.72	55.75	55.79	55.89

Data in this table comes from the Whalley 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

Label	Modelled location ID	Easting	Northing	50% AEP	10% AEP	4% AEP	1.33% AEP	1% AEP	0.5% AEP	0.1% AEP
				Flow	Flow	Flow	Flow	Flow	Flow	Flow
1	931671	373538	436449	1.10	1.70	1.97	2.41	2.54	2.89	4.19
2	931695	373590	436604	0.60	1.0	1.30	1.60	1.80	2.10	3.0
3	931649	373597	436589	0.60	1.0	1.30	1.60	1.80	2.10	3.0
4	931696	373602	436574	0.60	1.0	1.30	1.56	1.73	1.97	2.16
5	931627	373605	436556	0.60	1.0	1.30	1.57	1.76	2.04	2.66
6	931620	373622	436528	0.60	1.0	1.07	1.21	1.31	1.44	1.69
7	931659	373632	436510	0.60	1.0	1.07	1.21	1.31	1.40	1.43
8	931609	373646	436487	0.60	1.0	1.07	1.21	1.33	1.49	1.94
9	931652	373648	436473	0.60	1.0	1.07	1.21	1.33	1.49	1.94
10	931638	373651	436456	0.60	1.0	1.07	1.21	1.33	1.49	1.93

Data in this table comes from the Whalley 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.



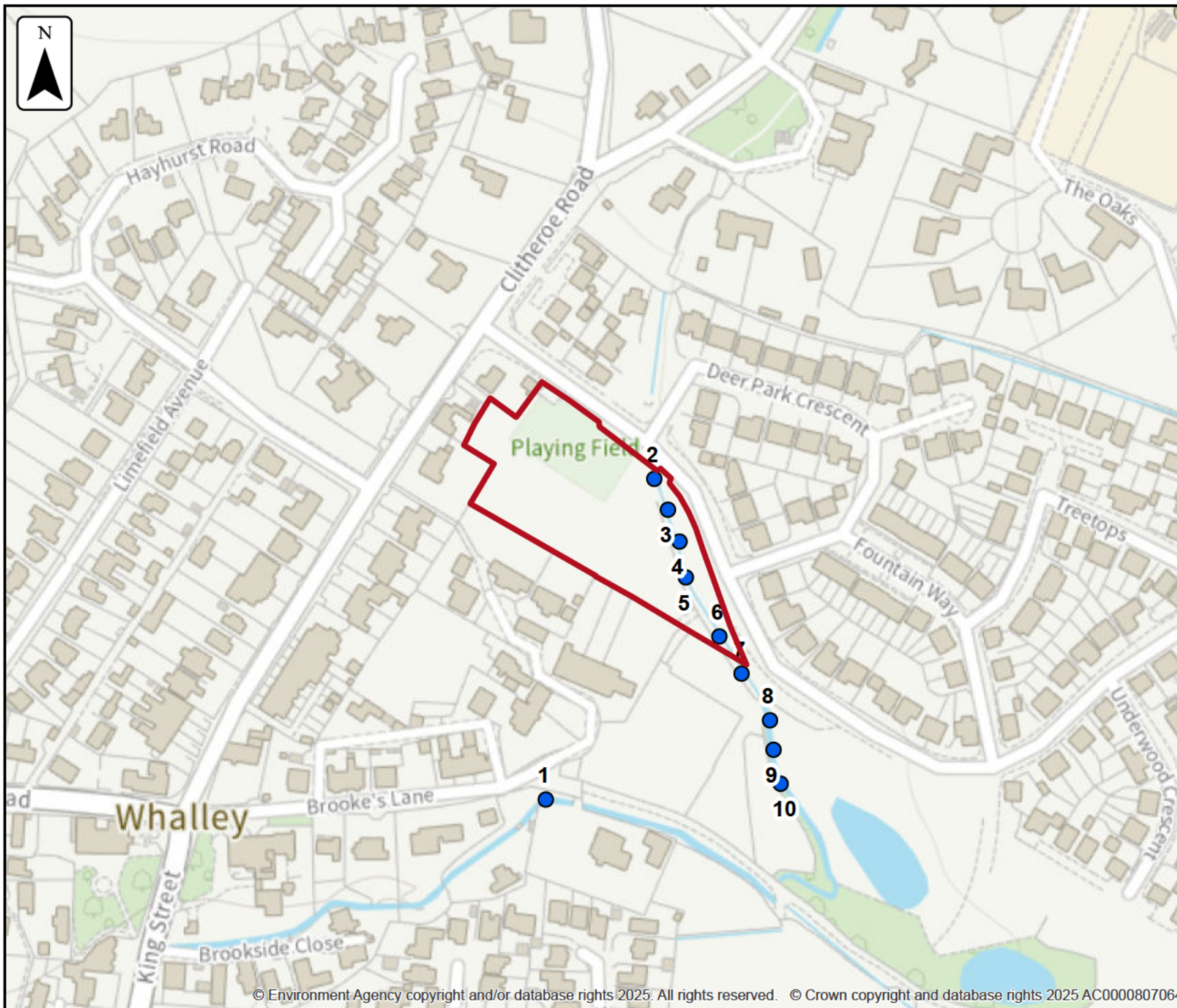
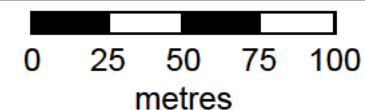
Defences removed climate change modelled fluvial node locations

Location (easting/northing)
373563/436589

Scale Created
1:2,500 17 Dec 2025

Model name
Whalley 2017

-  Selected area
-  Modelled location
-  Main river



Modelled node locations data

Defences removed climate change

Label	Modelled location ID	Easting	Northing	1% AEP (+15%)	1% AEP (+15%)
				Level	Flow
1	931671	373538	436449	52.36	2.85
2	931695	373590	436604	58.55	2.07
3	931649	373597	436589	58.46	2.07
4	931696	373602	436574	58.34	1.95
5	931627	373605	436556	58.05	2.01
6	931620	373622	436528	57.70	1.43
7	931659	373632	436510	57.54	1.40
8	931609	373646	436487	56.94	1.48
9	931652	373648	436473	56.25	1.48
10	931638	373651	436456	55.79	1.48

Data in this table comes from the Whalley 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.



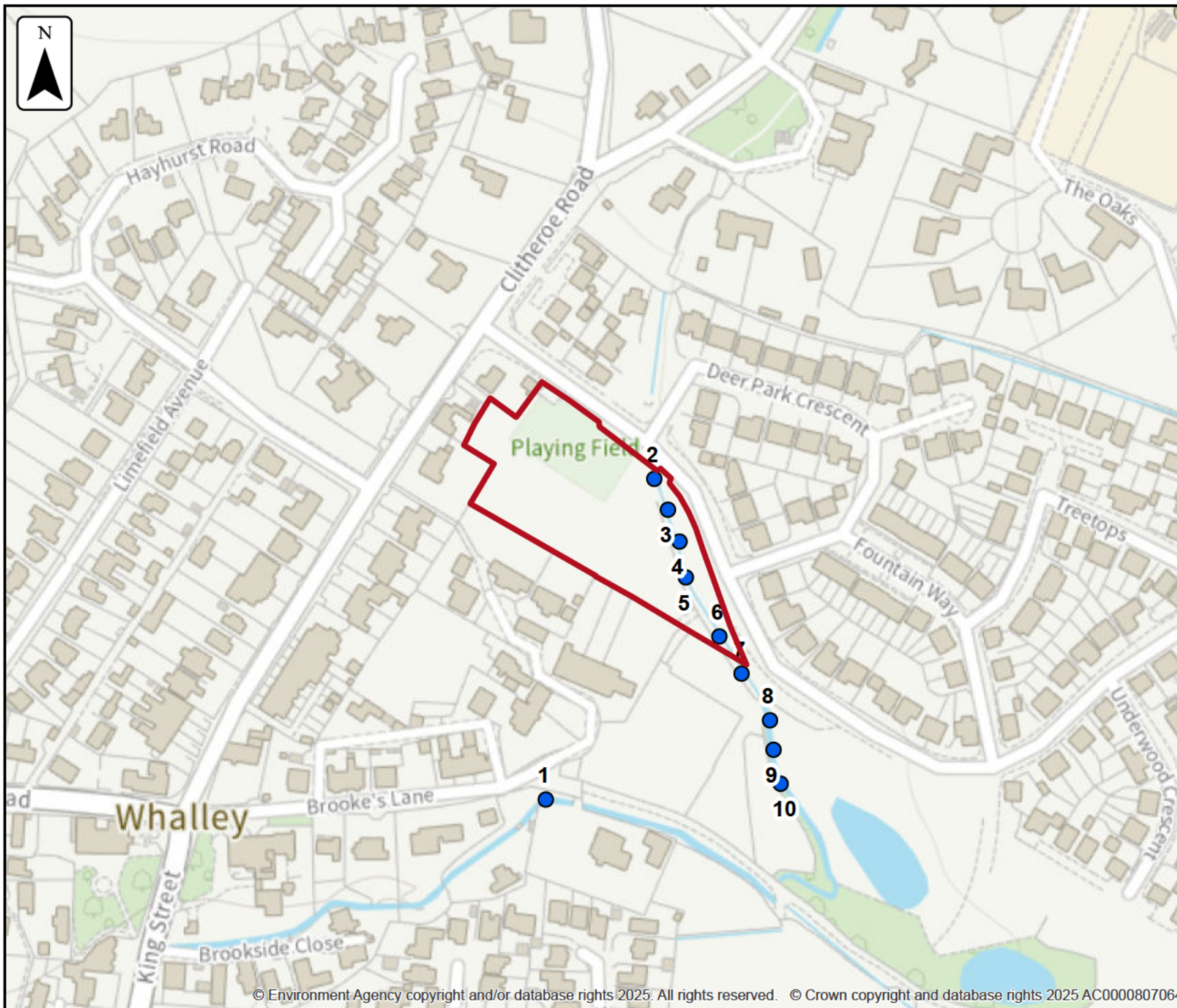
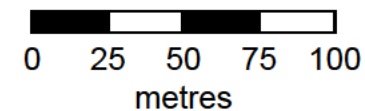
Defended modelled fluvial node locations

Location (easting/northing)
373563/436589

Scale Created
1:2,500 17 Dec 2025

Model name
Whalley 2017

-  Selected area
-  Modelled location
-  Main river



Modelled node locations data

Defended

Label	Modelled location ID	Easting	Northing	50% AEP	10% AEP	4% AEP	1.33% AEP	1% AEP	0.5% AEP	0.1% AEP
				Level	Level	Level	Level	Level	Level	Level
1	931671	373538	436449	51.96	52.09	52.17	52.27	52.29	52.37	52.56
2	931695	373590	436604	58.19	58.32	58.40	58.47	58.50	58.55	58.65
3	931649	373597	436589	58.12	58.26	58.33	58.39	58.42	58.46	58.48
4	931696	373602	436574	58.01	58.12	58.19	58.26	58.30	58.35	58.44
5	931627	373605	436556	57.87	57.95	57.98	58.01	58.03	58.05	58.10
6	931620	373622	436528	57.39	57.52	57.59	57.63	57.66	57.71	57.78
7	931659	373632	436510	57.14	57.29	57.37	57.43	57.49	57.55	57.75
8	931609	373646	436487	56.62	56.74	56.80	56.85	56.89	56.94	57.06
9	931652	373648	436473	55.99	56.10	56.14	56.18	56.22	56.26	56.35
10	931638	373651	436456	55.52	55.63	55.68	55.72	55.75	55.79	55.89

Data in this table comes from the Whalley 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

Label	Modelled location ID	Easting	Northing	50% AEP	10% AEP	4% AEP	1.33% AEP	1% AEP	0.5% AEP	0.1% AEP
				Flow	Flow	Flow	Flow	Flow	Flow	Flow
1	931671	373538	436449	1.10	1.60	1.97	2.41	2.54	2.89	4.19
2	931695	373590	436604	0.60	1.0	1.30	1.60	1.80	2.10	3.0
3	931649	373597	436589	0.60	1.0	1.30	1.60	1.80	2.10	3.0
4	931696	373602	436574	0.60	1.0	1.30	1.56	1.73	1.97	2.16
5	931627	373605	436556	0.60	1.0	1.30	1.57	1.76	2.04	2.66
6	931620	373622	436528	0.60	0.91	1.07	1.21	1.31	1.44	1.69
7	931659	373632	436510	0.60	0.91	1.07	1.21	1.31	1.40	1.43
8	931609	373646	436487	0.60	0.91	1.07	1.21	1.33	1.49	1.94
9	931652	373648	436473	0.60	0.91	1.07	1.21	1.33	1.49	1.94
10	931638	373651	436456	0.60	0.91	1.07	1.21	1.33	1.49	1.93

Data in this table comes from the Whalley 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.



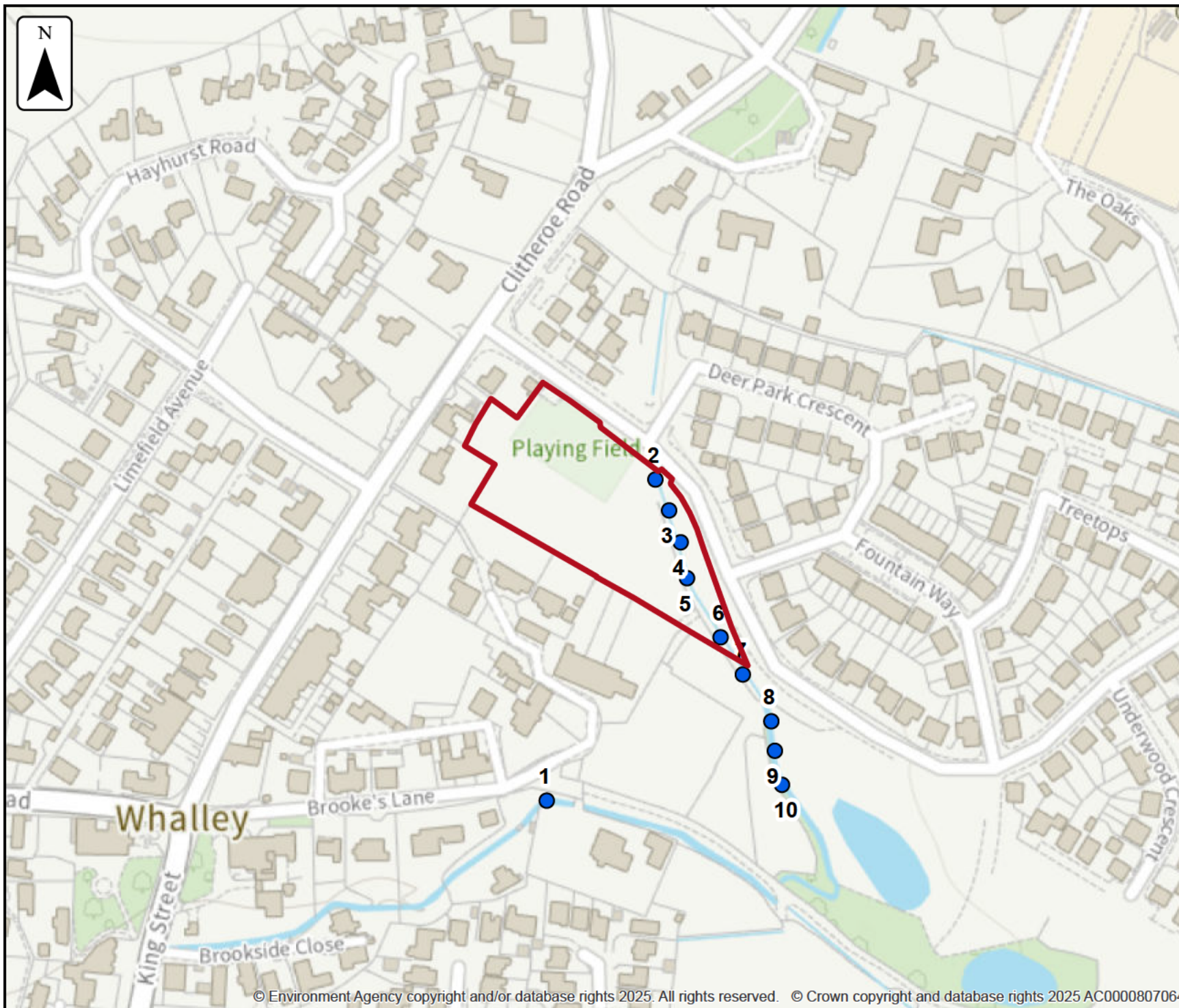
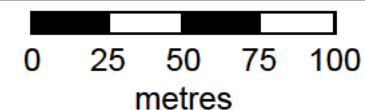
Defended climate change modelled fluvial node locations

Location (easting/northing)
373563/436589

Scale Created
1:2,500 17 Dec 2025

Model name
Whalley 2017

-  Selected area
-  Modelled location
-  Main river



Modelled node locations data

Defended climate change

Label	Modelled location ID	Easting	Northing	1% AEP (+15%)	1% AEP (+15%)
				Level	Flow
1	931671	373538	436449	52.36	2.85
2	931695	373590	436604	58.55	2.07
3	931649	373597	436589	58.46	2.07
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5	931627	373605	436556	58.05	2.01
6	931620	373622	436528	57.70	1.43
7	931659	373632	436510	57.54	1.40
8	931609	373646	436487	56.94	1.48
9	931652	373648	436473	56.25	1.48
10	931638	373651	436456	55.79	1.48

Data in this table comes from the Whalley 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 extent and height

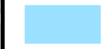
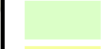
Location (easting/northing)
373563/436589

Scale Created
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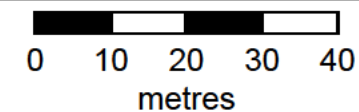
Model name
Whalley 2017

-  Selected area
-  Main river

Modelled 2D grid
Water level in mAOD

-  51 - 52.0
-  52.0 - 53.0
-  53.0 - 54.0
-  54.0 - 55.0
-  55.0 - 56.0
-  56.0 - 57.0
-  57.0 - 58.0
-  58.0 - 59.0
-  59.0 - 60.0

This map shows the
0.1% AEP height data



Label	Easting	Northing	50% AEP	10% AEP	4% AEP	1.33% AEP	1% AEP	0.5% AEP	0.1% AEP
			Height	Height	Height	Height	Height	Height	Height
25	373519	436655	NoData	NoData	NoData	NoData	NoData	NoData	NoData
26	373543	436655	NoData	NoData	NoData	NoData	NoData	NoData	NoData
Max value in selected area:			NoData	57.82	58.19	58.33	58.36	58.40	58.45

Data in this table comes from the Whalley 2017 model. Height values are shown in mAOD, and depth values are shown in metres.

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

Cells which contain text 'NoData' for a scenario show that return period has been modelled but there is no flood risk for that return period for that location.

'Max value in selected area' is the deepest depth or highest height at any location within your drawn boundary.

Label	Easting	Northing	50% AEP	10% AEP	4% AEP	1.33% AEP	1% AEP	0.5% AEP	0.1% AEP
			Depth	Depth	Depth	Depth	Depth	Depth	Depth
25	373519	436655	NoData	NoData	NoData	NoData	NoData	NoData	NoData
26	373543	436655	NoData	NoData	NoData	NoData	NoData	NoData	NoData
Max value in selected area:			NoData	0.13	0.16	0.18	0.22	0.23	0.32

Data in this table comes from the Whalley 2017 model. Height values are shown in mAOD, and depth values are shown in metres.

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

Cells which contain text 'NoData' for a scenario show that return period has been modelled but there is no flood risk for that return period for that location.

'Max value in selected area' is the deepest depth or highest height at any location within your drawn boundary.



**Defences removed
climate change
modelled fluvial
extent and height**

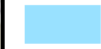
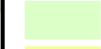
Location (easting/northing)
373563/436589

Scale Created
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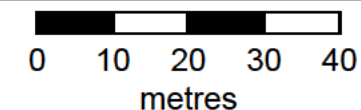
Model name
Whalley 2017

-  Selected area
-  Main river

Modelled 2D grid
Water level in mAOD

-  51 - 52.0
-  52.0 - 53.0
-  53.0 - 54.0
-  54.0 - 55.0
-  55.0 - 56.0
-  56.0 - 57.0
-  57.0 - 58.0
-  58.0 - 59.0
-  59.0 - 60.0

This map shows the
1% AEP +15% height data



Sample point data

Defences removed climate change

Label	Easting	Northing	1% AEP (+15%)	1% AEP (+15%)
			Height	Depth
1	373615	436511	NoData	NoData
2	373639	436511	57.52	0.12
3	373591	436535	56.25	0.08
4	373615	436535	NoData	NoData
5	373639	436535	NoData	NoData
6	373543	436559	55.35	0.03
7	373567	436559	55.90	0.17
8	373591	436559	NoData	NoData
9	373615	436559	58.16	0.15
10	373495	436583	NoData	NoData
11	373519	436583	55.13	0.06
12	373543	436583	NoData	NoData

Label	Easting	Northing	1% AEP (+15%)	1% AEP (+15%)
			Height	Depth
13	373567	436583	NoData	NoData
14	373591	436583	NoData	NoData
15	373615	436583	NoData	NoData
16	373495	436607	NoData	NoData
17	373519	436607	NoData	NoData
18	373543	436607	NoData	NoData
19	373567	436607	NoData	NoData
20	373591	436607	NoData	NoData
21	373495	436631	NoData	NoData
22	373519	436631	NoData	NoData
23	373543	436631	NoData	NoData
24	373567	436631	NoData	NoData

Label	Easting	Northing	1% AEP (+15%)	1% AEP (+15%)
			Height	Depth
25	373519	436655	NoData	NoData
26	373543	436655	NoData	NoData
Max value in selected area:			58.40	0.22

Data in this table comes from the Whalley 2017 model. Height values are shown in mAOD, and depth values are shown in metres.

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

Cells which contain text 'NoData' for a scenario show that return period has been modelled but there is no flood risk for that return period for that location.

'Max value in selected area' is the deepest depth or highest height at any location within your drawn boundary.



Defended modelled fluvial extent and height

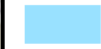
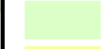
Location (easting/northing)
373563/436589

Scale Created
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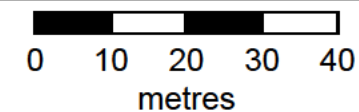
Model name
Whalley 2017

-  Selected area
-  Main river

Modelled 2D grid
Water level in mAOD

-  51 - 52.0
-  52.0 - 53.0
-  53.0 - 54.0
-  54.0 - 55.0
-  55.0 - 56.0
-  56.0 - 57.0
-  57.0 - 58.0
-  58.0 - 59.0
-  59.0 - 60.0

This map shows the
0.1% AEP height data



Label	Easting	Northing	50% AEP	10% AEP	4% AEP	1.33% AEP	1% AEP	0.5% AEP	0.1% AEP
			Height	Height	Height	Height	Height	Height	Height
25	373519	436655	NoData	NoData	NoData	NoData	NoData	NoData	NoData
26	373543	436655	NoData	NoData	NoData	NoData	NoData	NoData	NoData
Max value in selected area:			NoData	57.82	58.19	58.33	58.36	58.40	58.45

Data in this table comes from the Whalley 2017 model. Height values are shown in mAOD, and depth values are shown in metres.

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

Cells which contain text 'NoData' for a scenario show that return period has been modelled but there is no flood risk for that return period for that location.

'Max value in selected area' is the deepest depth or highest height at any location within your drawn boundary.

Label	Easting	Northing	50% AEP	10% AEP	4% AEP	1.33% AEP	1% AEP	0.5% AEP	0.1% AEP
			Depth	Depth	Depth	Depth	Depth	Depth	Depth
25	373519	436655	NoData	NoData	NoData	NoData	NoData	NoData	NoData
26	373543	436655	NoData	NoData	NoData	NoData	NoData	NoData	NoData
Max value in selected area:			NoData	0.12	0.16	0.18	0.22	0.23	0.32

Data in this table comes from the Whalley 2017 model. Height values are shown in mAOD, and depth values are shown in metres.

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

Cells which contain text 'NoData' for a scenario show that return period has been modelled but there is no flood risk for that return period for that location.

'Max value in selected area' is the deepest depth or highest height at any location within your drawn boundary.



Defended climate change modelled fluvial extent and height

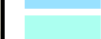
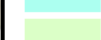
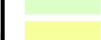
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373563/436589

Scale Created
1:1,000 17 Dec 2025

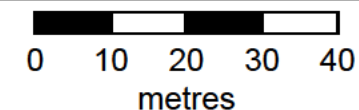
Model name
Whalley 2017

-  Selected area
-  Main river

Modelled 2D grid
Water level in mAOD

-  51 - 52.0
-  52.0 - 53.0
-  53.0 - 54.0
-  54.0 - 55.0
-  55.0 - 56.0
-  56.0 - 57.0
-  57.0 - 58.0
-  58.0 - 59.0
-  59.0 - 60.0

This map shows the
1% AEP +15% height data



Sample point data

Defended climate change

Label	Easting	Northing	1% AEP (+15%)	1% AEP (+15%)
			Height	Depth
1	373615	436511	NoData	NoData
2	373639	436511	57.52	0.12
3	373591	436535	56.25	0.08
4	373615	436535	NoData	NoData
5	373639	436535	NoData	NoData
6	373543	436559	55.35	0.03
7	373567	436559	55.90	0.17
8	373591	436559	NoData	NoData
9	373615	436559	58.16	0.15
10	373495	436583	NoData	NoData
11	373519	436583	55.13	0.06
12	373543	436583	NoData	NoData

Label	Easting	Northing	1% AEP (+15%)	1% AEP (+15%)
			Height	Depth
13	373567	436583	NoData	NoData
14	373591	436583	NoData	NoData
15	373615	436583	NoData	NoData
16	373495	436607	NoData	NoData
17	373519	436607	NoData	NoData
18	373543	436607	NoData	NoData
19	373567	436607	NoData	NoData
20	373591	436607	NoData	NoData
21	373495	436631	NoData	NoData
22	373519	436631	NoData	NoData
23	373543	436631	NoData	NoData
24	373567	436631	NoData	NoData

Label	Easting	Northing	1% AEP (+15%)	1% AEP (+15%)
			Height	Depth
25	373519	436655	NoData	NoData
26	373543	436655	NoData	NoData
Max value in selected area:			58.40	0.22

Data in this table comes from the Whalley 2017 model. Height values are shown in mAOD, and depth values are shown in metres.

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

Cells which contain text 'NoData' for a scenario show that return period has been modelled but there is no flood risk for that return period for that location.

'Max value in selected area' is the deepest depth or highest height at any location within your drawn boundary.

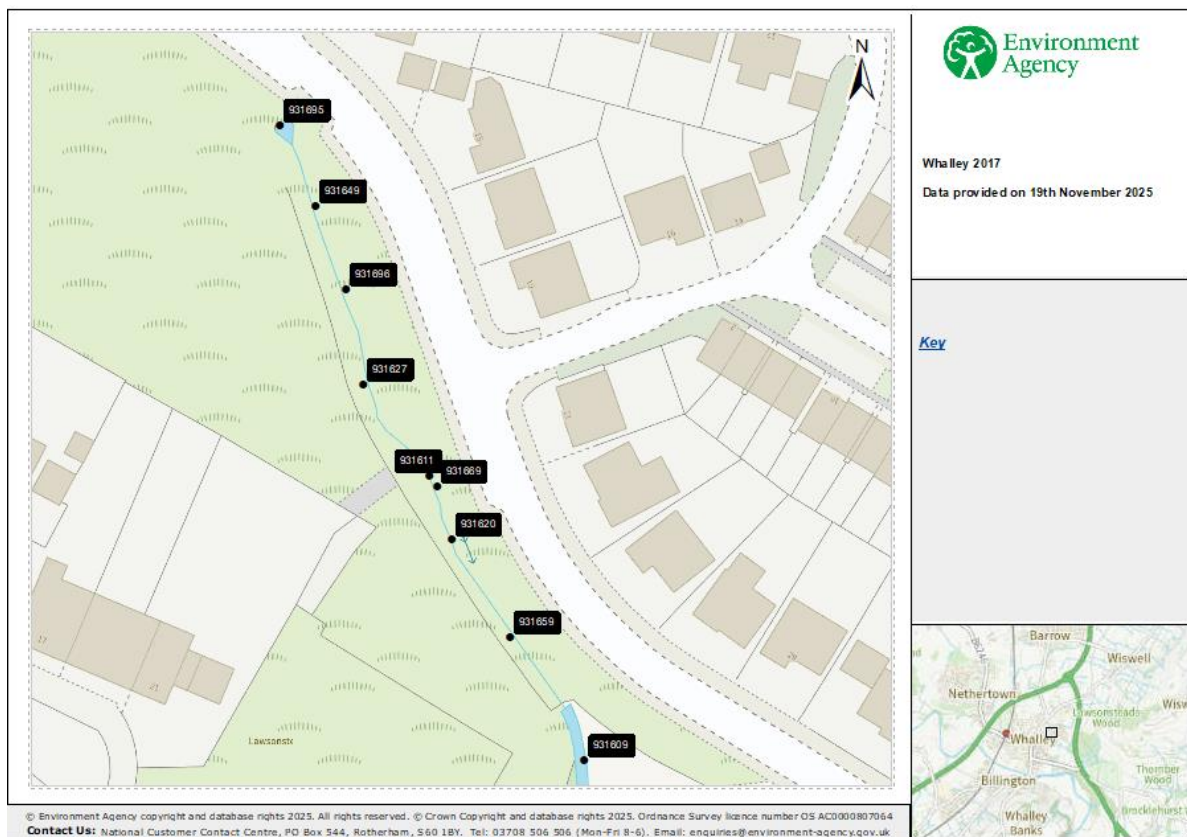


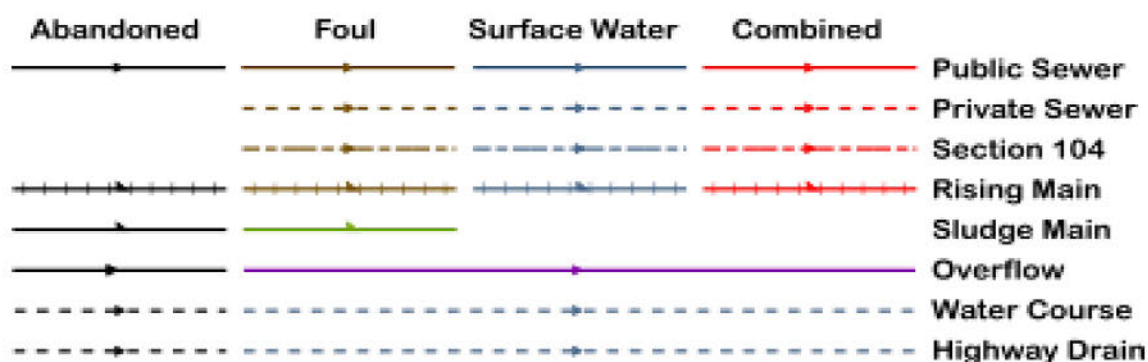
Figure 1: Whalley 2017 modelled information locations

Table 1: 1d hydraulic modelling information at relevant nodes

Flood Location ID	Node Point ID	Model Flood Group ID (D = Defended, UD = Undefended, CC = Climate Change)	Annual Exceedance Probability (AEP %)	Water Level (mAO D)	Flow (m³/s⁻¹)
931627	WISW01_I002	Whalley2017_D	0.1	58.1	2.66
931627	WISW01_I002	Whalley2017_D_15%CC	1	58.05	2.01
931627	WISW01_I002	Whalley2017_D	1	58.03	1.76
931627	WISW01_I002	Whalley2017_U	0.1	58.1	2.66
931627	WISW01_I002	Whalley2017_U_15%CC	1	58.05	2.01
931627	WISW01_I002	Whalley2017_U	1	58.03	1.76
931611	WISW01_01019	Whalley2017_D	0.1	58	1.71
931611	WISW01_01019	Whalley2017_D_15%CC	1	57.95	1.43
931611	WISW01_01019	Whalley2017_D	1	57.92	1.31
931611	WISW01_01019	Whalley2017_U	0.1	58	1.71
931611	WISW01_01019	Whalley2017_U_15%CC	1	57.95	1.43
931611	WISW01_01019	Whalley2017_U	1	57.92	1.31
931669	WISW01d01019	Whalley2017_D	0.1	57.87	1.71
931669	WISW01d01019	Whalley2017_D_15%CC	1	57.81	1.43
931669	WISW01d01019	Whalley2017_D	1	57.77	1.31
931669	WISW01d01019	Whalley2017_U	0.1	57.87	1.71
931669	WISW01d01019	Whalley2017_U_15%CC	1	57.81	1.43
931669	WISW01d01019	Whalley2017_U	1	57.77	1.31
931620	WISW01_01006	Whalley2017_D	0.1	57.78	1.69
931620	WISW01_01006	Whalley2017_D_15%CC	1	57.7	1.43
931620	WISW01_01006	Whalley2017_D	1	57.66	1.31
931620	WISW01_01006	Whalley2017_U	0.1	57.78	1.69
931620	WISW01_01006	Whalley2017_U_15%CC	1	57.7	1.43
931620	WISW01_01006	Whalley2017_U	1	57.66	1.31

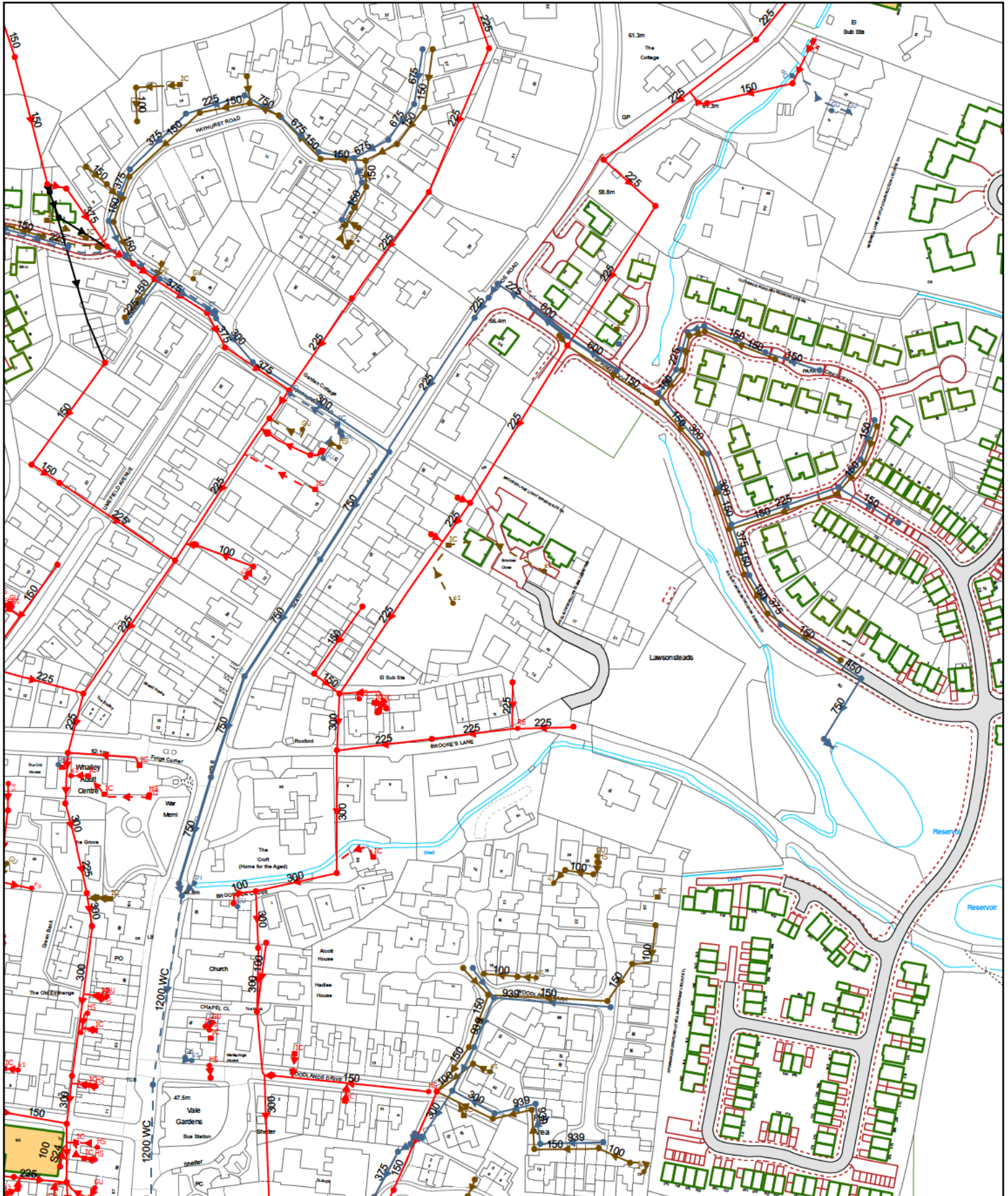
APPENDIX C

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	DNM Network Monitoring Point
Drop Shaft	Change of Characteristic
Orifice Plate	



Date: 25/09/2024

Extract from Map of Public Sewers

Printed By:
Property Searches

springwood drive

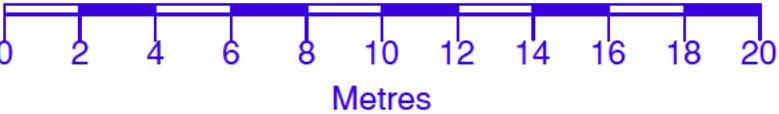
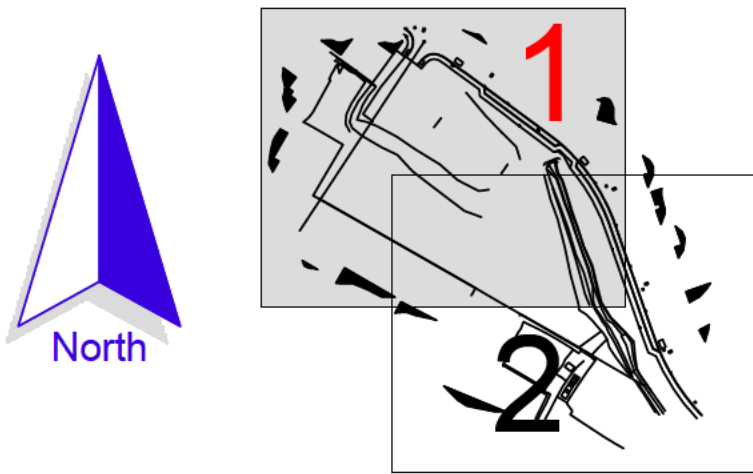


The position of underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. The actual positions may be different from those shown on the plan and private pipes, sewers or drains may not be recorded. United Utilities Water PLC will not accept any liability for any damage caused by the actual positions being different from those shown.

APPENDIX D

Notes

All Dimensions to be checked on site. Walls shown on plans are not to be assumed to be solid & should be checked for thickness, construction, load bearing capacity & stability.



ABBREVIATIONS

- BT BT Cover
CL Cover Level
DK Drop Kerb
EH Eaves Height
GU Gully
LP Lamp Post
MH Man Hole
RH Ridge/Roof Height
TF Top of Fence
TH Top of Hedge
TW Top of Wall

NOTE

All levels and coordinates relate to OSG83(15) using GNSS data.
Levels defining edge of carriageway are observed at channel (bottom of kerb).

Rev.A Description. Additional Survey Data



2 Berkshire Close | Wilpshire | Blackburn | Lancashire | BB1 9NG
tel 01254 614055 fax 01254 209754 e-mail sales@tricadsolutions.co.uk

Site Address

Springwood Drive
Whalley
BB7 9XL

Project Description
Site Survey

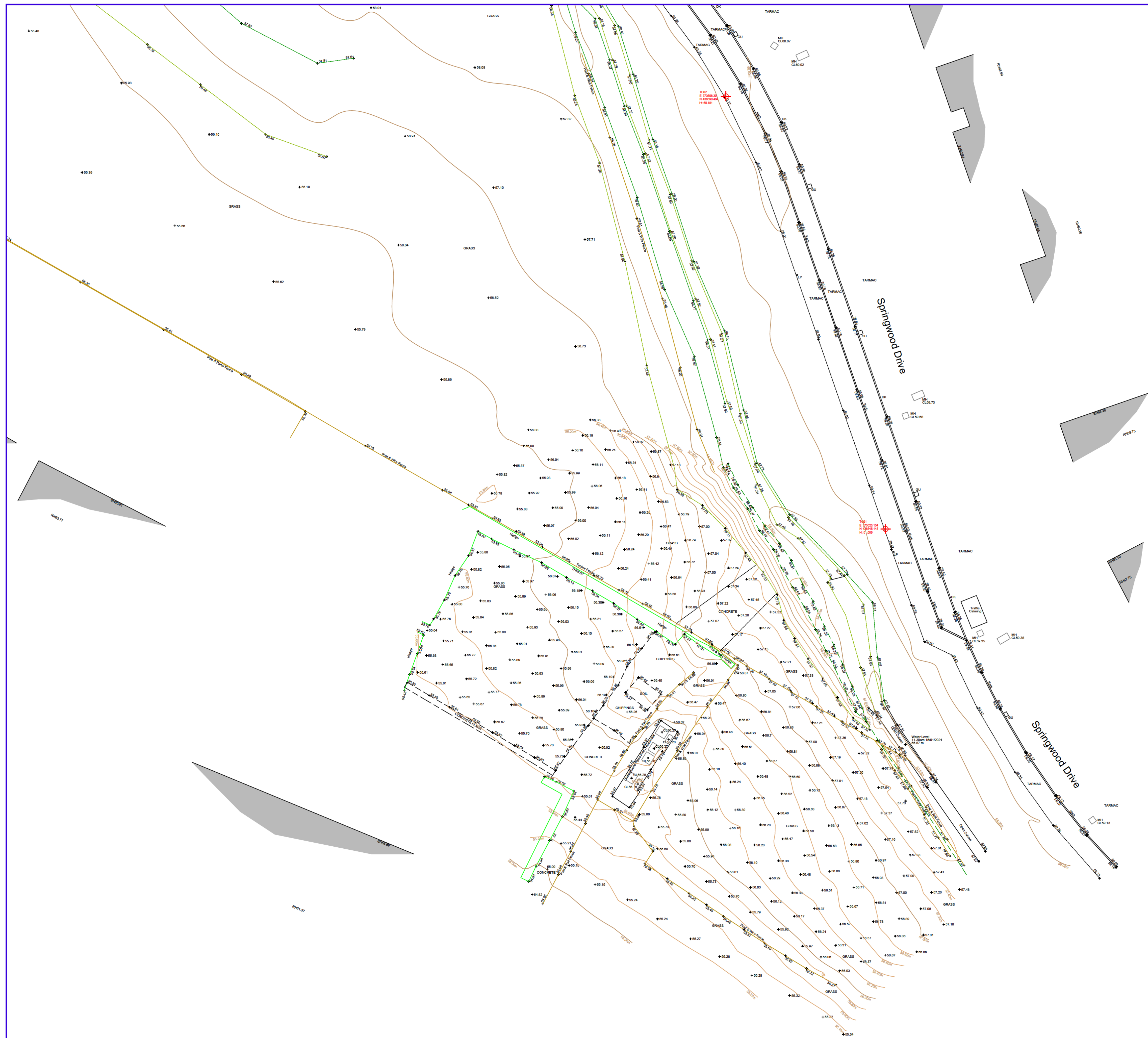
Drawing Title

Existing
Site Layout

Scale Date Drawn By
1:200@A1 15/01/2024 MW

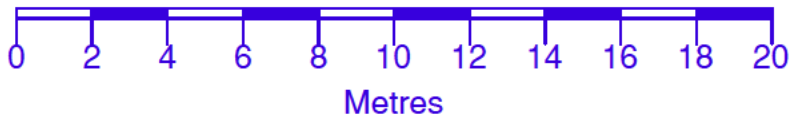
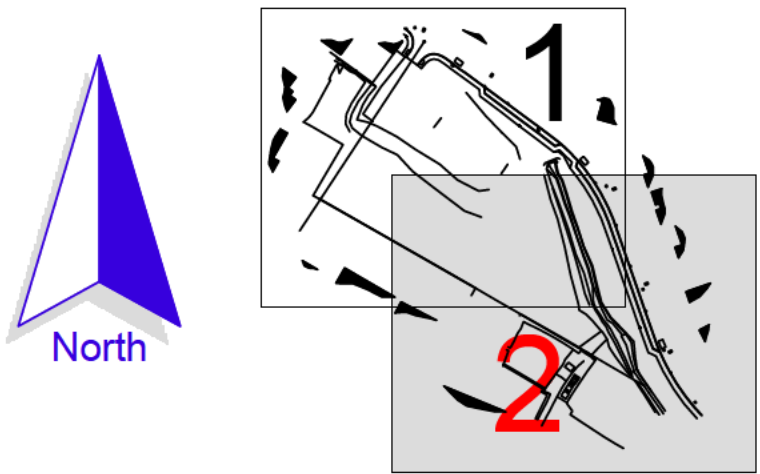
Drawing Number

TRI-4353-01



Notes

All Dimensions to be checked on site. Walls shown on plans are not to be assumed to be solid & should be checked for thickness, construction, load bearing capacity & stability.



ABBREVIATIONS

- BT BT Cover
- CL Cover Level
- DK Drop Kerb
- EH Eaves Height
- GU Gully
- LP Lamp Post
- MH Man Hole
- RH Ridge/Roof Height
- TF Top of Fence
- TH Top of Hedge
- TW Top of Wall

NOTE

All levels and coordinates relate to OSGB36(15) using GNSS data.
Levels defining edge of carriageway are observed at channel (bottom of kerb).

Rev.A Description. Additional Survey Data



2 Berkshire Close | Wilpshire | Blackburn | Lancashire | BB1 9NG
tel 01254 614055 fax 01254 209754 e-mail sales@tricadsolutions.co.uk

Site Address

Springwood Drive
Whalley
BB7 9XL

Project Description

Site Survey

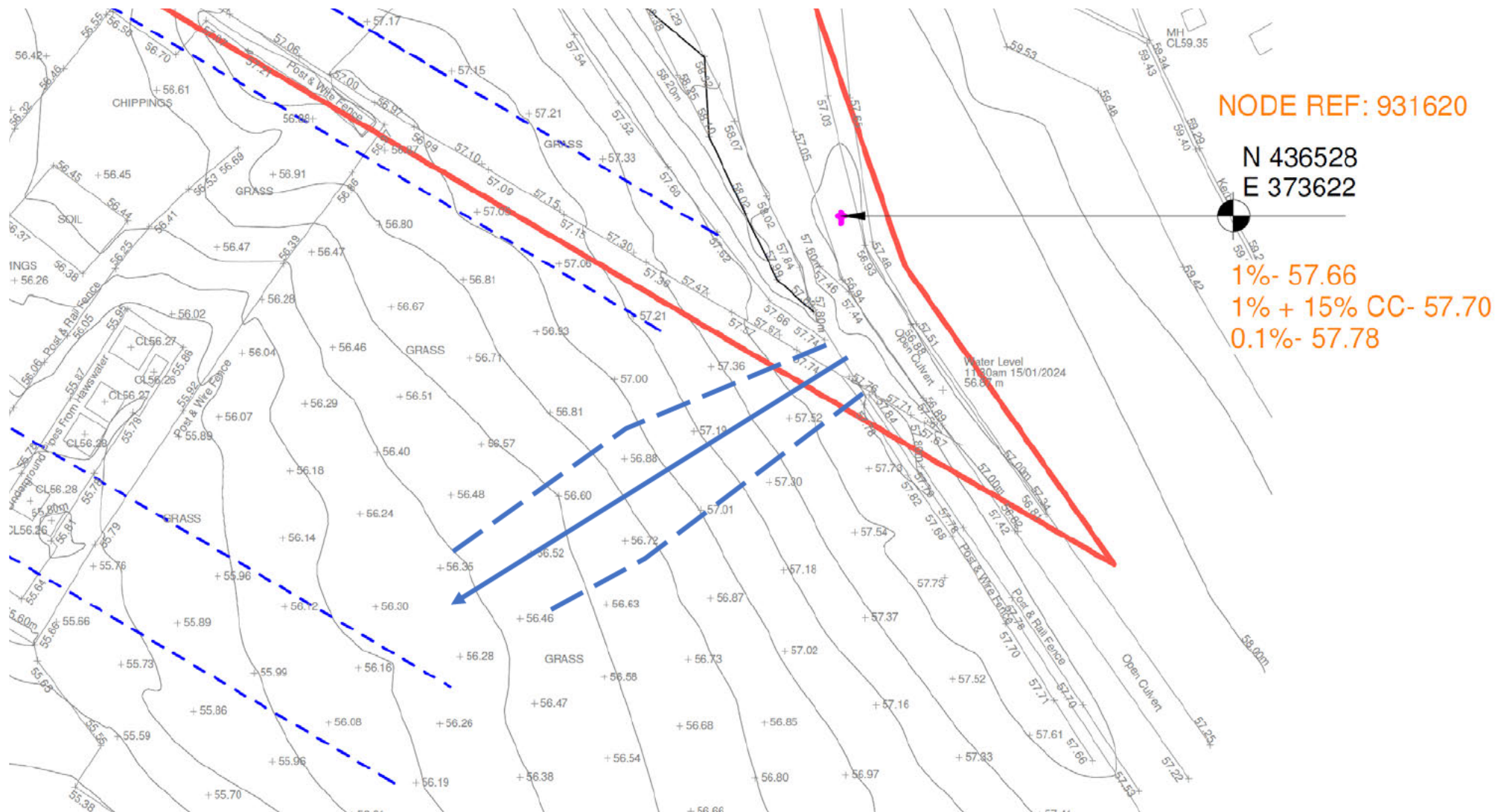
Drawing Title

Existing
Site Layout

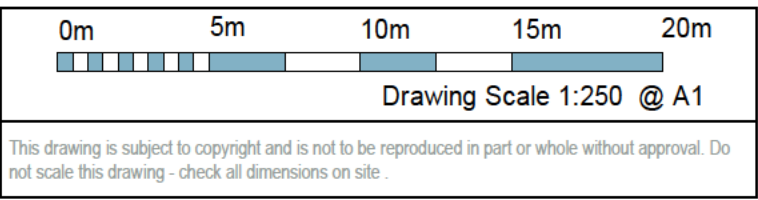
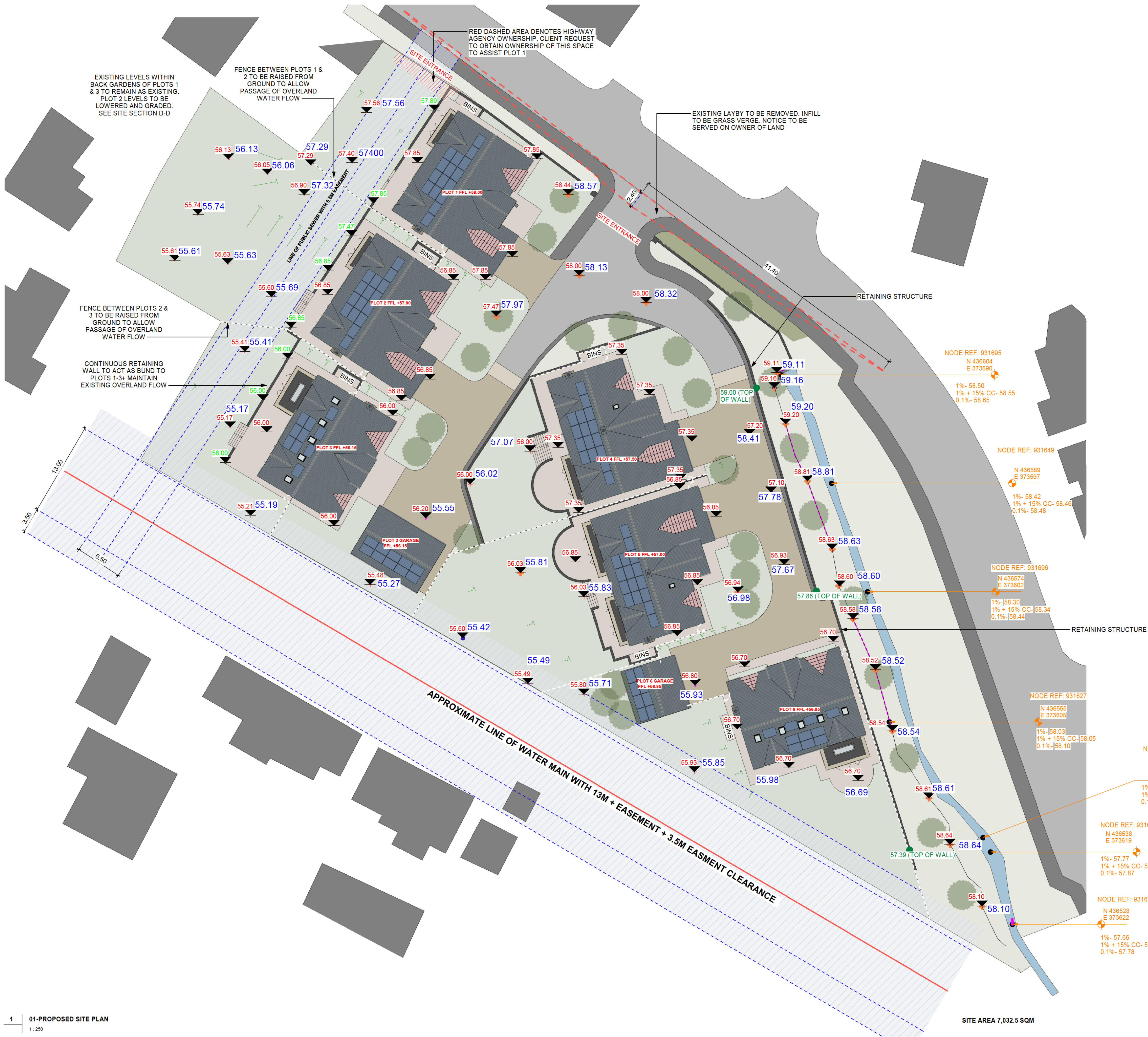
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Drawing Number

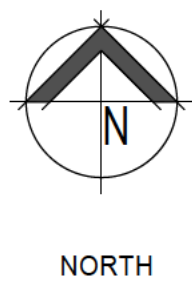
TRI-4353-02



**PLAUSIBLE FLOW PATH FOR FLOODWATERS TO OVERTOP THE WESTERN BANK OF THE WISWELL BROOK
DURING THE 0.1% AEP EVENT**



- LEGEND**
- SITE BOUNDARY
 - ROAD
 - PAVEMENT
 - TREE
 - PRIVATE SOFT LANDSCAPE
 - PUBLIC SOFT LANDSCAPE
 - TOPOGRAPHIC SLOPE
 - DWELLING PATH/ PATIO SPACE
 - EXISTING SITE LEVELS 58520
 - PROPOSED SITE LEVELS 58520
 - PROPOSED TOP OF EXTERNAL WALL 58520



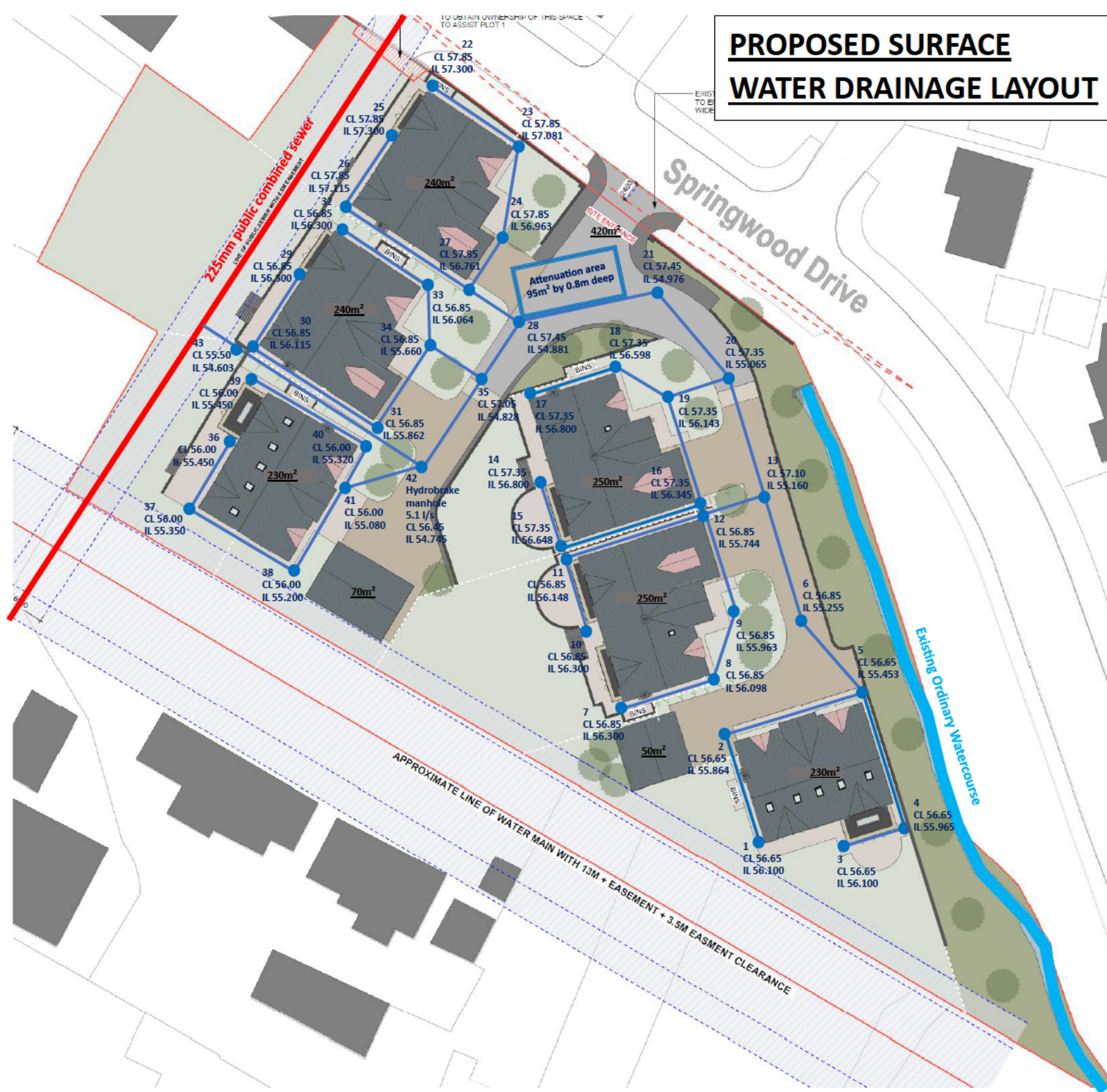
P11	ADDITIONAL LEVELS SHOWN	PD	02.06.26
P10	ALL UNITS CHANGED TO METRES	PD	30.04.25
P9	BOUNDARY TREATMENT ADJUSTED FOR PLOT 1 ALONG SPRINGWOOD DRIVE	PD	29.04.26
P8	ADDITIONAL TOPOGRAPHIC INFORMATION MODELLED	PD	15.04.26
P7	SITE PLAN UPDATED WITH SITE SECTION S-B TO SHOW NEW PROPOSED LEVELS TO ASSIST WITH FLOODING STRATEGY	PD	08.01.25
P6	SITE LEVELS REVISED TO ASSIST WITH FLOODING STRATEGY	PD	22.12.25
P5	EXISTING & PROPOSED LAND HEIGHTS PLOTTED	PD	11.12.25
P4	AMENDMENT TO DRAWING	PD	07.10.25
P3	SITE PLAN AMENDED IN ACCORDANCE WITH CLIENT COMMENTS	PD	22.09.25
P2	CLIENT COMMENTS INCORPORATED	PD	19.02.25
P1	REVISED PLOT LAYOUTS	PD	31.01.25
Rev	Description	By	Date

Cassidy+Ashton
www.cassidyashton.co.uk
Architecture + Building Surveying + Town Planning
7 East Cliff, Preston, Lancashire, PR1 3JE
10 Hunters Walk, Canal Street, Chester, CH1 4EB
St Andrews Business Centre, Mold, Flintshire, CH7 1XB
T: 01772 258 356
T: 01244 402 950
T: 01352 706 244

Client			
CRJ DEVELOPMENTS LTD.			
Project			
SPRINGWOOD DRIVE			
Drawing Title			
PROPOSED SITE & ROOF PLAN			
Drawn by	PD	Checked by	DP
Suitability	S3	Scale @ A1	As indicated
12477	SWD-CAA-XX-XX-D-A-1002	P11	
C+A JOB NO.	PROJECT - ORIGINATOR - VOL. - LEVEL - TYPE - ROLE - NUMBER	REV.	

APPENDIX E

PROPOSED SURFACE WATER DRAINAGE LAYOUT



Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	75.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	18.800	Minimum Backdrop Height (m)	3.000
Ratio-R	0.300	Preferred Cover Depth (m)	0.450
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
1	0.005	5.00	56.650	100	0.550
2	0.010	5.00	56.650	450	0.786
3	0.003	5.00	56.650	100	0.550
4	0.005	5.00	56.650	450	0.685
5	0.005	5.00	56.650	450	1.197
6			56.850	1200	1.595
7	0.004	5.00	56.850	100	0.550
8	0.004	5.00	56.850	450	0.752
9	0.003	5.00	56.850	450	0.887
10	0.004	5.00	56.850	100	0.550
11	0.004	5.00	56.850	450	0.702
12	0.006	5.00	56.850	450	1.106
13			57.100	1200	1.940
14	0.004	5.00	57.350	100	0.550
15	0.004	5.00	57.350	450	0.702
16	0.006	5.00	57.350	450	1.005
17	0.004	5.00	57.350	100	0.550
18	0.004	5.00	57.350	450	0.752
19	0.003	5.00	57.350	450	1.207
20	0.014	5.00	57.350	1200	2.285
21	0.014	5.00	57.450	1200	2.474

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
22	0.003	5.00	57.850	100	0.550
23	0.003	5.00	57.850	450	0.769
24	0.004	5.00	57.850	450	0.971
25	0.004	5.00	57.850	100	0.550
26	0.004	5.00	57.850	450	0.735
27	0.006	5.00	57.850	450	1.089
28	0.014	5.00	57.450	1200	2.569
29	0.004	5.00	56.850	100	0.550
30	0.004	5.00	56.850	450	0.735
31	0.006	5.00	56.850	450	0.988
32	0.003	5.00	56.850	100	0.550
33	0.003	5.00	56.850	450	0.769
34	0.004	5.00	56.850	450	1.190
35			57.050	1200	2.222
36	0.005	5.00	56.000	100	0.550
37	0.005	5.00	56.000	450	0.650
38	0.010	5.00	56.000	450	0.800
39	0.005	5.00	56.000	100	0.550
40	0.003	5.00	56.000	450	0.680
41	0.002	5.00	56.000	450	0.920
42			56.450	1200	1.705
43			55.500	1200	0.897
44			55.500	1200	0.933

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	1	2	14.000	0.600	56.100	55.864	0.236	59.3	100	5.23	56.0
1.001	2	5	17.000	0.600	55.864	55.578	0.286	59.4	100	5.52	54.8
2.000	3	4	8.000	0.600	56.100	55.965	0.135	59.3	100	5.13	56.4
2.001	4	5	17.000	0.600	55.965	55.578	0.387	43.9	100	5.38	55.4
1.002	5	6	11.000	0.600	55.453	55.255	0.198	55.6	225	5.62	54.4
1.003	6	13	16.000	0.600	55.255	55.160	0.095	168.4	225	5.89	53.4
3.000	7	8	12.000	0.600	56.300	56.098	0.202	59.4	100	5.20	56.1
3.001	8	9	8.000	0.600	56.098	55.963	0.135	59.3	100	5.33	55.5
3.002	9	12	13.000	0.600	55.963	55.744	0.219	59.4	100	5.55	54.7
4.000	10	11	9.000	0.600	56.300	56.148	0.152	59.2	100	5.15	56.3
4.001	11	12	18.000	0.600	56.148	55.744	0.404	44.6	100	5.41	55.2
3.003	12	13	8.000	0.600	55.744	55.285	0.459	17.4	100	5.62	54.4
1.004	13	20	16.000	0.600	55.160	55.065	0.095	168.4	225	6.15	52.4
5.000	14	15	9.000	0.600	56.800	56.648	0.152	59.2	100	5.15	56.3

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	1.002	7.9	0.8	0.450	0.686	0.005	0.0	21	0.625
1.001	1.001	7.9	2.2	0.686	0.972	0.015	0.0	36	0.860
2.000	1.002	7.9	0.5	0.450	0.585	0.003	0.0	17	0.549
2.001	1.166	9.2	1.2	0.585	0.972	0.008	0.0	25	0.808
1.002	1.758	69.9	4.1	0.972	1.370	0.028	0.0	36	0.964
1.003	1.004	39.9	4.1	1.370	1.715	0.028	0.0	48	0.646
3.000	1.001	7.9	0.6	0.450	0.652	0.004	0.0	19	0.595
3.001	1.002	7.9	1.2	0.652	0.787	0.008	0.0	26	0.719
3.002	1.001	7.9	1.6	0.787	1.006	0.011	0.0	31	0.788
4.000	1.003	7.9	0.6	0.450	0.602	0.004	0.0	19	0.596
4.001	1.158	9.1	1.2	0.602	1.006	0.008	0.0	25	0.802
3.003	1.859	14.6	3.7	1.006	1.715	0.025	0.0	34	1.544
1.004	1.004	39.9	7.5	1.715	2.060	0.053	0.0	66	0.777
5.000	1.003	7.9	0.6	0.450	0.602	0.004	0.0	19	0.596

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)
5.001	15	16	18.000	0.600	56.648	56.345	0.303	59.4	100	5.45	55.1
5.002	16	19	12.000	0.600	56.345	56.143	0.202	59.4	100	5.65	54.3
6.000	17	18	12.000	0.600	56.800	56.598	0.202	59.4	100	5.20	56.1
6.001	18	19	8.000	0.600	56.598	56.143	0.455	17.6	100	5.27	55.8
5.003	19	20	8.000	0.600	56.143	55.190	0.953	8.4	100	5.70	54.1
1.005	20	21	15.000	0.600	55.065	54.976	0.089	168.5	225	6.40	51.6
1.006	21	28	16.000	0.600	54.976	54.881	0.095	168.4	225	6.67	50.7
7.000	22	23	13.000	0.600	57.300	57.081	0.219	59.4	100	5.22	56.0
7.001	23	24	12.000	0.600	57.081	56.879	0.202	59.4	100	5.42	55.2
7.002	24	27	7.000	0.600	56.879	56.761	0.118	59.3	100	5.53	54.7
8.000	25	26	11.000	0.600	57.300	57.115	0.185	59.5	100	5.18	56.2
8.001	26	27	15.000	0.600	57.115	56.761	0.354	42.4	100	5.39	55.3
7.003	27	28	7.000	0.600	56.761	55.006	1.755	4.0	100	5.56	54.6
1.007	28	35	9.000	0.600	54.881	54.828	0.053	169.8	225	6.82	50.2

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)
5.001	1.001	7.9	1.2	0.602	0.905	0.008	0.0	26	0.718
5.002	1.001	7.9	2.1	0.905	1.107	0.014	0.0	35	0.841
6.000	1.001	7.9	0.6	0.450	0.652	0.004	0.0	19	0.595
6.001	1.851	14.5	1.2	0.652	1.107	0.008	0.0	20	1.132
5.003	2.684	21.1	3.7	1.107	2.060	0.025	0.0	29	2.027
1.005	1.004	39.9	12.9	2.060	2.249	0.092	0.0	87	0.896
1.006	1.004	39.9	14.6	2.249	2.344	0.106	0.0	94	0.926
7.000	1.001	7.9	0.5	0.450	0.669	0.003	0.0	17	0.549
7.001	1.001	7.9	0.9	0.669	0.871	0.006	0.0	23	0.666
7.002	1.002	7.9	1.5	0.871	0.989	0.010	0.0	29	0.766
8.000	1.001	7.9	0.6	0.450	0.635	0.004	0.0	19	0.595
8.001	1.187	9.3	1.2	0.635	0.989	0.008	0.0	25	0.823
7.003	3.900	30.6	3.6	0.989	2.344	0.024	0.0	23	2.608
1.007	1.000	39.8	19.6	2.344	1.997	0.144	0.0	111	0.995

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)
9.000	29	30	11.000	0.600	56.300	56.115	0.185	59.5	100	5.18	56.2
9.001	30	31	15.000	0.600	56.115	55.862	0.253	59.3	100	5.43	55.1
9.002	31	34	12.000	0.600	55.862	55.660	0.202	59.4	100	5.63	54.4
10.000	32	33	13.000	0.600	56.300	56.081	0.219	59.4	100	5.22	56.0
10.001	33	34	7.000	0.600	56.081	55.660	0.421	16.6	100	5.28	55.8
9.003	34	35	8.000	0.600	55.660	54.953	0.707	11.3	100	5.69	54.1
1.008	35	42	14.000	0.600	54.828	54.745	0.083	168.7	225	7.05	49.5
11.000	36	37	10.000	0.600	55.450	55.350	0.100	100.0	100	5.22	56.0
11.001	37	38	13.000	0.600	55.350	55.200	0.150	86.7	100	5.48	55.0
11.002	38	41	12.000	0.600	55.200	55.080	0.120	100.0	100	5.74	53.9
12.000	39	40	13.000	0.600	55.450	55.320	0.130	100.0	100	5.28	55.8
12.001	40	41	6.000	0.600	55.320	55.080	0.240	25.0	100	5.35	55.5
11.003	41	42	8.000	0.600	55.080	54.870	0.210	38.1	100	5.85	53.5
1.009	42	43	24.000	0.600	54.745	54.603	0.142	169.0	225	7.45	48.3

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)
9.000	1.001	7.9	0.6	0.450	0.635	0.004	0.0	19	0.595
9.001	1.002	7.9	1.2	0.635	0.888	0.008	0.0	26	0.719
9.002	1.001	7.9	2.1	0.888	1.090	0.014	0.0	35	0.841
10.000	1.001	7.9	0.5	0.450	0.669	0.003	0.0	17	0.549
10.001	1.903	14.9	0.9	0.669	1.090	0.006	0.0	17	1.048
9.003	2.310	18.1	3.5	1.090	1.997	0.024	0.0	30	1.797
1.008	1.004	39.9	22.5	1.997	1.480	0.168	0.0	121	1.033
11.000	0.769	6.0	0.8	0.450	0.550	0.005	0.0	24	0.521
11.001	0.827	6.5	1.5	0.550	0.700	0.010	0.0	32	0.668
11.002	0.769	6.0	2.9	0.700	0.820	0.020	0.0	49	0.761
12.000	0.769	6.0	0.8	0.450	0.580	0.005	0.0	24	0.521
12.001	1.550	12.2	1.2	0.580	0.820	0.008	0.0	21	0.991
11.003	1.253	9.8	4.4	0.820	1.480	0.030	0.0	46	1.214
1.009	1.003	39.9	25.9	1.480	0.672	0.198	0.0	132	1.066

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)
1.010	43	44	6.000	0.600	54.603	54.567	0.036	166.7	225	7.55	48.0

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)
1.010	1.010	40.1	25.8	0.672	0.708	0.198	0.0	131	1.071

Simulation Settings

Rainfall Methodology	FSR	Summer CV	0.750	Additional Storage (m³/ha)	20.0
Rainfall Events	Singular	Winter CV	0.840	Starting Level (m)	
FSR Region	England and Wales	Analysis Speed	Normal	Check Discharge Rate(s)	x
M5-60 (mm)	18.800	Skip Steady State	x	Check Discharge Volume	x
Ratio-R	0.300	Drain Down Time (mins)	240		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440
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Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0	100	0	0	0
30	45	0	0	100	50	0	0

Node 42 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	54.745	Product Number	CTL-SHE-0103-5100-1250-5100
Design Depth (m)	1.250	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.1	Min Node Diameter (mm)	1200

Node 28 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	54.881
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	168

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	95.0	0.0	0.800	95.0	0.0	0.801	0.0	0.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.72%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	56.121	0.021	0.8	0.0040	0.0000	OK
15 minute winter	2	11	55.902	0.038	2.4	0.0156	0.0000	OK
15 minute winter	3	10	56.117	0.017	0.5	0.0019	0.0000	OK
15 minute winter	4	11	55.990	0.025	1.3	0.0075	0.0000	OK
15 minute winter	5	11	55.490	0.037	4.2	0.0091	0.0000	OK
15 minute winter	6	11	55.304	0.049	4.2	0.0556	0.0000	OK
15 minute summer	7	11	56.319	0.019	0.6	0.0029	0.0000	OK
15 minute summer	8	11	56.125	0.027	1.2	0.0070	0.0000	OK
15 minute winter	9	10	55.994	0.031	1.7	0.0070	0.0000	OK
15 minute summer	10	11	56.319	0.019	0.6	0.0029	0.0000	OK
15 minute winter	11	11	56.173	0.025	1.2	0.0067	0.0000	OK
15 minute winter	12	11	55.780	0.036	3.7	0.0097	0.0000	OK
15 minute winter	13	11	55.227	0.067	8.0	0.0762	0.0000	OK
15 minute summer	14	11	56.819	0.019	0.6	0.0029	0.0000	OK
15 minute winter	15	11	56.674	0.026	1.2	0.0072	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 winter	1	1.000	2	0.8	0.400	0.097	0.0271	
15 minute winter	2	1.001	5	2.3	0.859	0.292	0.0453	
15 minute winter	3	2.000	4	0.5	0.400	0.059	0.0094	
15 minute winter	4	2.001	5	1.2	0.800	0.130	0.0253	
15 minute winter	5	1.002	6	4.2	0.806	0.060	0.0589	
15 minute winter	6	1.003	13	4.2	0.521	0.106	0.1310	
15 minute summer	7	3.000	8	0.6	0.452	0.076	0.0161	
15 minute summer	8	3.001	9	1.2	0.651	0.152	0.0148	
15 minute winter	9	3.002	12	1.6	0.717	0.208	0.0299	
15 minute summer	10	4.000	11	0.6	0.483	0.076	0.0113	
15 minute winter	11	4.001	12	1.2	0.600	0.132	0.0363	
15 minute winter	12	3.003	13	3.7	1.511	0.256	0.0198	
15 minute winter	13	1.004	20	7.9	0.608	0.198	0.2094	
15 minute summer	14	5.000	15	0.6	0.456	0.076	0.0120	
15 minute winter	15	5.001	16	1.2	0.560	0.152	0.0387	

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.72%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	16	11	56.382	0.037	2.1	0.0104	0.0000	OK
15 minute summer	17	11	56.819	0.019	0.6	0.0029	0.0000	OK
15 minute summer	18	11	56.618	0.020	1.2	0.0052	0.0000	OK
15 minute winter	19	11	56.172	0.029	3.7	0.0062	0.0000	OK
15 minute winter	20	11	55.161	0.096	13.7	0.1207	0.0000	OK
15 minute winter	21	11	55.081	0.105	15.7	0.1308	0.0000	OK
15 minute winter	22	10	57.316	0.016	0.5	0.0019	0.0000	OK
15 minute winter	23	10	57.104	0.023	1.0	0.0054	0.0000	OK
15 minute winter	24	11	56.911	0.032	1.5	0.0076	0.0000	OK
15 minute summer	25	11	57.319	0.019	0.6	0.0029	0.0000	OK
15 minute summer	26	11	57.140	0.025	1.2	0.0067	0.0000	OK
15 minute winter	27	11	56.785	0.024	3.6	0.0065	0.0000	OK
60 minute winter	28	48	55.013	0.132	12.1	12.1075	0.0000	OK
15 minute summer	29	11	56.319	0.019	0.6	0.0029	0.0000	OK
15 minute winter	30	11	56.141	0.026	1.2	0.0071	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 winter	16	5.002	19	2.1	0.915	0.266	0.0275	
15 minute summer	17	6.000	18	0.6	0.574	0.076	0.0126	
15 minute summer	18	6.001	19	1.2	0.830	0.083	0.0119	
15 minute winter	19	5.003	20	3.7	1.971	0.176	0.0150	
15 minute winter	20	1.005	21	13.6	0.804	0.341	0.2578	
15 minute winter	21	1.006	28	15.8	1.422	0.396	0.2139	
15 minute winter	22	7.000	23	0.5	0.426	0.058	0.0141	
15 minute winter	23	7.001	24	0.9	0.526	0.113	0.0208	
15 minute winter	24	7.002	27	1.5	0.847	0.192	0.0125	
15 minute summer	25	8.000	26	0.6	0.478	0.076	0.0139	
15 minute summer	26	8.001	27	1.2	0.828	0.128	0.0217	
15 minute winter	27	7.003	28	3.6	2.564	0.118	0.0099	
60 minute winter	28	1.007	35	4.6	0.527	0.116	0.2669	
15 minute summer	29	9.000	30	0.6	0.455	0.076	0.0146	
15 minute winter	30	9.001	31	1.2	0.564	0.152	0.0320	

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.72%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	31	11	55.899	0.037	2.1	0.0104	0.0000	OK
15 minute winter	32	10	56.317	0.017	0.5	0.0019	0.0000	OK
15 minute winter	33	10	56.098	0.017	1.0	0.0040	0.0000	OK
15 minute winter	34	11	55.691	0.031	3.6	0.0071	0.0000	OK
60 minute winter	35	49	55.014	0.186	5.4	0.2099	0.0000	OK
15 minute winter	36	10	55.474	0.024	0.8	0.0046	0.0000	OK
15 minute winter	37	11	55.383	0.033	1.6	0.0102	0.0000	OK
15 minute winter	38	11	55.252	0.052	3.1	0.0213	0.0000	OK
15 minute winter	39	10	55.475	0.025	0.8	0.0047	0.0000	OK
15 minute winter	40	10	55.341	0.021	1.3	0.0053	0.0000	OK
15 minute winter	41	10	55.129	0.049	4.5	0.0099	0.0000	OK
60 minute winter	42	49	55.013	0.268	5.7	0.3031	0.0000	SURCHARGED
60 minute winter	43	48	54.660	0.057	5.0	0.0644	0.0000	OK
60 minute winter	44	48	54.620	0.053	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)
15 minute winter	31	9.002	34	2.1	0.887	0.266	0.0283	
15 minute winter	32	10.000	33	0.5	0.534	0.058	0.0112	
15 minute winter	33	10.001	34	0.9	0.635	0.061	0.0103	
15 minute winter	34	9.003	35	3.6	1.753	0.198	0.0164	
60 minute winter	35	1.008	42	4.8	0.285	0.121	0.5237	
15 minute winter	36	11.000	37	0.8	0.420	0.126	0.0182	
15 minute winter	37	11.001	38	1.5	0.475	0.229	0.0411	
15 minute winter	38	11.002	41	3.0	0.771	0.503	0.0473	
15 minute winter	39	12.000	40	0.8	0.556	0.125	0.0177	
15 minute winter	40	12.001	41	1.2	0.490	0.099	0.0151	
15 minute winter	41	11.003	42	4.6	1.164	0.468	0.0400	
60 minute winter	42	Hydro-Brake®	43	5.0				
60 minute winter	43	1.010	44	5.0	0.666	0.125	0.0452	24.7

Results for 30 year +45% CC Critical Storm Duration. Lowest mass balance: 99.72%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	56.135	0.035	2.1	0.0067	0.0000	OK
15 minute winter	2	10	55.934	0.070	6.4	0.0289	0.0000	OK
15 minute winter	3	10	56.127	0.027	1.3	0.0032	0.0000	OK
15 minute winter	4	10	56.008	0.043	3.4	0.0130	0.0000	OK
15 minute winter	5	10	55.516	0.063	11.5	0.0154	0.0000	OK
180 minute winter	6	152	55.448	0.193	3.4	0.2183	0.0000	OK
15 minute winter	7	10	56.331	0.031	1.7	0.0048	0.0000	OK
15 minute winter	8	10	56.145	0.047	3.4	0.0125	0.0000	OK
15 minute winter	9	10	56.018	0.055	4.6	0.0126	0.0000	OK
15 minute winter	10	10	56.331	0.031	1.7	0.0048	0.0000	OK
15 minute winter	11	10	56.190	0.042	3.4	0.0114	0.0000	OK
15 minute winter	12	11	55.812	0.068	10.4	0.0182	0.0000	OK
180 minute winter	13	152	55.448	0.288	6.5	0.3257	0.0000	SURCHARGED
15 minute winter	14	10	56.831	0.031	1.7	0.0048	0.0000	OK
15 minute winter	15	10	56.693	0.045	3.4	0.0124	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 winter	1	1.000	2	2.1	0.504	0.264	0.0581	
15 minute winter	2	1.001	5	6.2	1.085	0.785	0.0968	
15 minute winter	3	2.000	4	1.3	0.524	0.162	0.0196	
15 minute winter	4	2.001	5	3.3	1.056	0.359	0.0531	
15 minute winter	5	1.002	6	11.5	1.045	0.165	0.1224	
180 minute winter	6	1.003	13	3.4	0.484	0.085	0.6083	
15 minute winter	7	3.000	8	1.7	0.589	0.213	0.0343	
15 minute winter	8	3.001	9	3.3	0.821	0.421	0.0323	
15 minute winter	9	3.002	12	4.5	0.897	0.578	0.0657	
15 minute winter	10	4.000	11	1.7	0.646	0.213	0.0234	
15 minute winter	11	4.001	12	3.3	0.758	0.365	0.0787	
15 minute winter	12	3.003	13	10.3	1.914	0.708	0.0432	
180 minute winter	13	1.004	20	6.5	0.590	0.163	0.6363	
15 minute winter	14	5.000	15	1.7	0.607	0.213	0.0249	
15 minute winter	15	5.001	16	3.3	0.717	0.421	0.0828	

Results for 30 year +45% CC Critical Storm Duration. Lowest mass balance: 99.72%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	16	11	56.414	0.069	5.9	0.0193	0.0000	OK
15 minute winter	17	10	56.832	0.032	1.7	0.0049	0.0000	OK
15 minute winter	18	10	56.631	0.033	3.4	0.0087	0.0000	OK
15 minute winter	19	10	56.194	0.051	10.3	0.0106	0.0000	OK
180 minute winter	20	152	55.448	0.383	11.2	0.4801	0.0000	SURCHARGED
180 minute winter	21	152	55.448	0.472	11.9	0.5866	0.0000	SURCHARGED
15 minute winter	22	10	57.327	0.027	1.3	0.0032	0.0000	OK
15 minute winter	23	10	57.120	0.039	2.6	0.0092	0.0000	OK
15 minute winter	24	11	56.935	0.056	4.2	0.0135	0.0000	OK
15 minute winter	25	10	57.331	0.031	1.7	0.0048	0.0000	OK
15 minute winter	26	10	57.157	0.042	3.4	0.0114	0.0000	OK
15 minute winter	27	10	56.803	0.042	10.0	0.0112	0.0000	OK
180 minute winter	28	148	55.447	0.566	17.0	51.7940	0.0000	SURCHARGED
15 minute winter	29	10	56.331	0.031	1.7	0.0048	0.0000	OK
15 minute winter	30	10	56.160	0.045	3.4	0.0121	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 winter	16	5.002	19	5.8	1.193	0.734	0.0584	
15 minute winter	17	6.000	18	1.7	0.765	0.213	0.0263	
15 minute winter	18	6.001	19	3.3	1.084	0.230	0.0248	
15 minute winter	19	5.003	20	10.4	2.465	0.494	0.0410	
180 minute winter	20	1.005	21	10.3	0.746	0.259	0.5966	
180 minute winter	21	1.006	28	11.6	0.880	0.290	0.6363	
15 minute winter	22	7.000	23	1.3	0.564	0.162	0.0294	
15 minute winter	23	7.001	24	2.5	0.685	0.318	0.0439	
15 minute winter	24	7.002	27	4.1	1.098	0.526	0.0266	
15 minute winter	25	8.000	26	1.7	0.639	0.213	0.0289	
15 minute winter	26	8.001	27	3.3	1.061	0.356	0.0469	
15 minute winter	27	7.003	28	9.9	3.352	0.324	0.0349	
180 minute winter	28	1.007	35	4.9	0.539	0.124	0.3579	
15 minute winter	29	9.000	30	1.7	0.607	0.213	0.0305	
15 minute winter	30	9.001	31	3.3	0.721	0.420	0.0686	

Results for 30 year +45% CC Critical Storm Duration. Lowest mass balance: 99.72%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	31	11	55.931	0.069	5.9	0.0193	0.0000	OK
15 minute winter	32	10	56.328	0.028	1.3	0.0032	0.0000	OK
15 minute winter	33	10	56.109	0.028	2.6	0.0066	0.0000	OK
15 minute winter	34	10	55.715	0.055	10.0	0.0124	0.0000	OK
180 minute winter	35	152	55.447	0.619	4.9	0.6996	0.0000	SURCHARGED
15 minute winter	36	13	55.509	0.059	2.1	0.0112	0.0000	OK
15 minute winter	37	12	55.503	0.153	4.2	0.0480	0.0000	SURCHARGED
15 minute winter	38	12	55.470	0.270	7.7	0.1103	0.0000	SURCHARGED
15 minute winter	39	10	55.492	0.042	2.1	0.0080	0.0000	OK
180 minute winter	40	152	55.447	0.127	1.0	0.0313	0.0000	SURCHARGED
180 minute winter	41	152	55.446	0.366	3.6	0.0744	0.0000	SURCHARGED
180 minute winter	42	152	55.445	0.700	5.4	0.7922	0.0000	SURCHARGED
60 minute winter	43	32	54.661	0.058	5.1	0.0650	0.0000	OK
60 minute winter	44	32	54.621	0.054	5.1	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 winter	31	9.002	34	5.8	1.160	0.734	0.0606	
15 minute winter	32	10.000	33	1.3	0.716	0.161	0.0231	
15 minute winter	33	10.001	34	2.5	0.838	0.169	0.0217	
15 minute winter	34	9.003	35	10.1	2.177	0.554	0.0480	
180 minute winter	35	1.008	42	5.0	0.279	0.126	0.5568	
15 minute winter	36	11.000	37	2.1	0.538	0.343	0.0631	
15 minute winter	37	11.001	38	3.7	0.555	0.573	0.1017	
15 minute winter	38	11.002	41	6.1	0.841	1.006	0.0939	
15 minute winter	39	12.000	40	2.1	0.733	0.343	0.0367	
180 minute winter	40	12.001	41	1.0	0.453	0.082	0.0469	
180 minute winter	41	11.003	42	3.3	0.774	0.338	0.0626	
180 minute winter	42	Hydro-Brake®	43	5.1				
60 minute winter	43	1.010	44	5.1	0.669	0.127	0.0457	68.7

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.72%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	56.133	0.033	1.9	0.0063	0.0000	OK
15 minute winter	2	10	55.928	0.064	5.7	0.0266	0.0000	OK
15 minute winter	3	11	56.125	0.025	1.1	0.0030	0.0000	OK
15 minute winter	4	10	56.005	0.040	3.0	0.0122	0.0000	OK
15 minute winter	5	10	55.513	0.060	10.3	0.0145	0.0000	OK
120 minute winter	6	112	55.370	0.115	3.9	0.1300	0.0000	OK
15 minute winter	7	10	56.329	0.029	1.5	0.0045	0.0000	OK
15 minute winter	8	10	56.141	0.043	3.0	0.0115	0.0000	OK
15 minute winter	9	11	56.014	0.051	4.0	0.0116	0.0000	OK
15 minute winter	10	10	56.329	0.029	1.5	0.0045	0.0000	OK
15 minute winter	11	10	56.187	0.039	3.0	0.0106	0.0000	OK
15 minute winter	12	11	55.806	0.062	9.2	0.0166	0.0000	OK
120 minute winter	13	108	55.370	0.210	7.5	0.2374	0.0000	OK
15 minute winter	14	10	56.829	0.029	1.5	0.0045	0.0000	OK
15 minute winter	15	10	56.690	0.042	3.0	0.0115	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 winter	1	1.000	2	1.9	0.494	0.238	0.0532	
15 minute winter	2	1.001	5	5.5	1.063	0.704	0.0884	
15 minute winter	3	2.000	4	1.1	0.501	0.140	0.0179	
15 minute winter	4	2.001	5	2.9	1.025	0.321	0.0489	
15 minute winter	5	1.002	6	10.3	1.017	0.147	0.1127	
120 minute winter	6	1.003	13	3.9	0.511	0.098	0.4718	
15 minute winter	7	3.000	8	1.5	0.572	0.187	0.0311	
15 minute winter	8	3.001	9	2.9	0.802	0.370	0.0290	
15 minute winter	9	3.002	12	4.0	0.880	0.511	0.0593	
15 minute winter	10	4.000	11	1.5	0.625	0.187	0.0213	
15 minute winter	11	4.001	12	2.9	0.740	0.321	0.0709	
15 minute winter	12	3.003	13	9.1	1.867	0.623	0.0389	
120 minute winter	13	1.004	20	7.5	0.622	0.187	0.6269	
15 minute winter	14	5.000	15	1.5	0.587	0.187	0.0227	
15 minute winter	15	5.001	16	2.9	0.699	0.370	0.0748	

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.72%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	16	11	56.408	0.063	5.2	0.0175	0.0000	OK
15 minute winter	17	10	56.830	0.030	1.5	0.0046	0.0000	OK
15 minute winter	18	10	56.629	0.031	3.0	0.0081	0.0000	OK
15 minute winter	19	10	56.192	0.049	9.1	0.0102	0.0000	OK
120 minute winter	20	110	55.370	0.305	13.1	0.3822	0.0000	SURCHARGED
120 minute winter	21	110	55.370	0.394	14.5	0.4895	0.0000	SURCHARGED
15 minute winter	22	11	57.325	0.025	1.1	0.0030	0.0000	OK
15 minute winter	23	11	57.117	0.036	2.2	0.0086	0.0000	OK
15 minute winter	24	10	56.931	0.052	3.7	0.0125	0.0000	OK
15 minute winter	25	10	57.329	0.029	1.5	0.0045	0.0000	OK
15 minute winter	26	10	57.154	0.039	3.0	0.0106	0.0000	OK
15 minute winter	27	10	56.800	0.039	8.8	0.0105	0.0000	OK
120 minute winter	28	110	55.369	0.488	20.3	44.6617	0.0000	SURCHARGED
15 minute winter	29	10	56.329	0.029	1.5	0.0045	0.0000	OK
15 minute winter	30	10	56.157	0.042	3.0	0.0113	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 winter	16	5.002	19	5.1	1.144	0.645	0.0538	
15 minute winter	17	6.000	18	1.5	0.739	0.187	0.0239	
15 minute winter	18	6.001	19	2.9	1.018	0.202	0.0232	
15 minute winter	19	5.003	20	9.1	2.472	0.433	0.0316	
120 minute winter	20	1.005	21	12.5	0.797	0.314	0.5966	
120 minute winter	21	1.006	28	13.5	0.919	0.338	0.6363	
15 minute winter	22	7.000	23	1.1	0.540	0.140	0.0267	
15 minute winter	23	7.001	24	2.2	0.664	0.280	0.0398	
15 minute winter	24	7.002	27	3.6	1.071	0.462	0.0242	
15 minute winter	25	8.000	26	1.5	0.618	0.188	0.0263	
15 minute winter	26	8.001	27	2.9	1.026	0.313	0.0426	
15 minute winter	27	7.003	28	8.8	3.250	0.286	0.0331	
120 minute winter	28	1.007	35	4.9	0.526	0.124	0.3579	
15 minute winter	29	9.000	30	1.5	0.587	0.188	0.0278	
15 minute winter	30	9.001	31	2.9	0.702	0.369	0.0620	

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.72%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	31	11	55.925	0.063	5.2	0.0176	0.0000	OK
15 minute winter	32	11	56.326	0.026	1.1	0.0030	0.0000	OK
15 minute winter	33	11	56.107	0.026	2.2	0.0062	0.0000	OK
15 minute winter	34	10	55.712	0.052	8.8	0.0118	0.0000	OK
120 minute winter	35	110	55.369	0.540	5.1	0.6113	0.0000	SURCHARGED
15 minute winter	36	10	55.488	0.038	1.9	0.0073	0.0000	OK
15 minute winter	37	12	55.440	0.090	3.8	0.0280	0.0000	OK
15 minute winter	38	12	55.410	0.210	7.5	0.0861	0.0000	SURCHARGED
15 minute winter	39	10	55.490	0.040	1.9	0.0076	0.0000	OK
120 minute winter	40	108	55.369	0.049	1.1	0.0120	0.0000	OK
120 minute winter	41	108	55.369	0.289	4.2	0.0586	0.0000	SURCHARGED
120 minute winter	42	110	55.367	0.622	5.8	0.7038	0.0000	SURCHARGED
60 minute winter	43	33	54.661	0.058	5.1	0.0650	0.0000	OK
15 minute summer	44	15	54.621	0.054	5.1	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 winter	31	9.002	34	5.1	1.128	0.644	0.0555	
15 minute winter	32	10.000	33	1.1	0.688	0.140	0.0208	
15 minute winter	33	10.001	34	2.2	0.821	0.147	0.0201	
15 minute winter	34	9.003	35	8.7	2.137	0.482	0.0454	
120 minute winter	35	1.008	42	5.0	0.283	0.126	0.5568	
15 minute winter	36	11.000	37	1.9	0.531	0.310	0.0491	
15 minute winter	37	11.001	38	3.7	0.545	0.570	0.0989	
15 minute winter	38	11.002	41	6.1	0.833	1.015	0.0939	
15 minute winter	39	12.000	40	1.9	0.717	0.309	0.0339	
120 minute winter	40	12.001	41	1.1	0.494	0.090	0.0348	
120 minute winter	41	11.003	42	3.9	0.835	0.400	0.0626	
120 minute winter	42	Hydro-Brake®	43	5.1				
60 minute winter	43	1.010	44	5.1	0.669	0.127	0.0457	62.6

Results for 100 year +50% CC Critical Storm Duration. Lowest mass balance: 99.72%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	56.141	0.041	2.8	0.0078	0.0000	OK
180 minute winter	2	168	55.983	0.119	2.4	0.0490	0.0000	SURCHARGED
15 minute winter	3	10	56.131	0.031	1.7	0.0037	0.0000	OK
15 minute winter	4	10	56.015	0.050	4.5	0.0154	0.0000	OK
180 minute winter	5	168	55.982	0.529	4.5	0.1285	0.0000	SURCHARGED
180 minute winter	6	168	55.982	0.727	4.5	0.8222	0.0000	SURCHARGED
15 minute winter	7	10	56.337	0.037	2.3	0.0056	0.0000	OK
15 minute winter	8	10	56.155	0.057	4.6	0.0150	0.0000	OK
15 minute winter	9	10	56.031	0.068	6.1	0.0154	0.0000	OK
15 minute winter	10	10	56.337	0.037	2.3	0.0056	0.0000	OK
15 minute winter	11	10	56.198	0.050	4.6	0.0135	0.0000	OK
180 minute winter	12	168	55.983	0.239	3.9	0.0641	0.0000	SURCHARGED
180 minute winter	13	168	55.982	0.822	8.1	0.9296	0.0000	SURCHARGED
15 minute winter	14	10	56.837	0.037	2.3	0.0056	0.0000	OK
15 minute winter	15	10	56.702	0.054	4.6	0.0147	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 winter	1	1.000	2	2.8	0.525	0.353	0.0756	
180 minute winter	2	1.001	5	2.4	0.869	0.305	0.1330	
15 minute winter	3	2.000	4	1.7	0.557	0.213	0.0242	
15 minute winter	4	2.001	5	4.4	1.135	0.480	0.0659	
180 minute winter	5	1.002	6	4.5	0.802	0.064	0.4375	
180 minute winter	6	1.003	13	4.3	0.503	0.107	0.6363	
15 minute winter	7	3.000	8	2.3	0.628	0.287	0.0431	
15 minute winter	8	3.001	9	4.4	0.867	0.564	0.0409	
15 minute winter	9	3.002	12	6.2	0.920	0.790	0.0874	
15 minute winter	10	4.000	11	2.3	0.699	0.287	0.0291	
15 minute winter	11	4.001	12	4.5	0.788	0.490	0.1044	
180 minute winter	12	3.003	13	3.9	1.527	0.267	0.0626	
180 minute winter	13	1.004	20	7.4	0.616	0.186	0.6363	
15 minute winter	14	5.000	15	2.3	0.656	0.287	0.0310	
15 minute winter	15	5.001	16	4.4	0.746	0.565	0.1053	

Results for 100 year +50% CC Critical Storm Duration. Lowest mass balance: 99.72%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	16	11	56.436	0.091	7.8	0.0253	0.0000	OK
15 minute winter	17	10	56.838	0.038	2.3	0.0057	0.0000	OK
15 minute winter	18	10	56.636	0.038	4.5	0.0102	0.0000	OK
15 minute winter	19	11	56.202	0.059	13.7	0.0123	0.0000	OK
180 minute winter	20	168	55.982	0.917	13.0	1.1497	0.0000	SURCHARGED
180 minute winter	21	168	55.981	1.005	14.7	1.2507	0.0000	SURCHARGED
15 minute winter	22	10	57.331	0.031	1.7	0.0037	0.0000	OK
15 minute winter	23	10	57.126	0.045	3.4	0.0107	0.0000	OK
15 minute winter	24	10	56.947	0.068	5.6	0.0163	0.0000	OK
15 minute winter	25	10	57.337	0.037	2.3	0.0056	0.0000	OK
15 minute winter	26	10	57.165	0.050	4.6	0.0135	0.0000	OK
15 minute winter	27	10	56.811	0.050	13.3	0.0133	0.0000	OK
180 minute winter	28	168	55.981	1.100	22.4	73.6089	0.0000	SURCHARGED
15 minute winter	29	10	56.337	0.037	2.3	0.0056	0.0000	OK
15 minute winter	30	10	56.169	0.054	4.6	0.0144	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 winter	16	5.002	19	7.7	1.232	0.977	0.0738	
15 minute winter	17	6.000	18	2.3	0.827	0.286	0.0327	
15 minute winter	18	6.001	19	4.5	1.195	0.309	0.0301	
15 minute winter	19	5.003	20	13.6	2.495	0.644	0.0505	
180 minute winter	20	1.005	21	12.6	0.754	0.315	0.5966	
180 minute winter	21	1.006	28	14.4	0.907	0.360	0.6363	
15 minute winter	22	7.000	23	1.7	0.606	0.213	0.0360	
15 minute winter	23	7.001	24	3.3	0.726	0.421	0.0545	
15 minute winter	24	7.002	27	5.5	1.196	0.696	0.0333	
15 minute winter	25	8.000	26	2.3	0.690	0.287	0.0360	
15 minute winter	26	8.001	27	4.4	1.177	0.477	0.0587	
15 minute winter	27	7.003	28	13.2	3.590	0.431	0.0387	
180 minute winter	28	1.007	35	4.9	0.521	0.123	0.3579	
15 minute winter	29	9.000	30	2.3	0.656	0.287	0.0379	
15 minute winter	30	9.001	31	4.4	0.750	0.564	0.0873	

Results for 100 year +50% CC Critical Storm Duration. Lowest mass balance: 99.72%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	31	168	55.982	0.120	2.2	0.0337	0.0000	SURCHARGED
15 minute winter	32	10	56.332	0.032	1.7	0.0037	0.0000	OK
15 minute winter	33	10	56.113	0.032	3.4	0.0076	0.0000	OK
180 minute winter	34	168	55.981	0.321	3.8	0.0726	0.0000	SURCHARGED
180 minute winter	35	168	55.980	1.152	5.9	1.3031	0.0000	SURCHARGED
180 minute winter	36	168	55.981	0.531	0.8	0.1009	0.0000	FLOOD RISK
180 minute winter	37	168	55.981	0.631	1.6	0.1975	0.0000	FLOOD RISK
180 minute winter	38	168	55.981	0.781	3.2	0.3194	0.0000	FLOOD RISK
180 minute winter	39	168	55.980	0.530	0.8	0.1007	0.0000	FLOOD RISK
180 minute winter	40	168	55.980	0.660	1.3	0.1631	0.0000	FLOOD RISK
180 minute winter	41	168	55.980	0.900	4.4	0.1827	0.0000	FLOOD RISK
180 minute winter	42	168	55.979	1.234	5.6	1.3954	0.0000	SURCHARGED
120 minute summer	43	58	54.661	0.058	5.1	0.0650	0.0000	OK
120 minute summer	44	58	54.621	0.054	5.1	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)
180 minute winter	31	9.002	34	2.2	0.914	0.280	0.0939	
15 minute winter	32	10.000	33	1.7	0.772	0.213	0.0282	
15 minute winter	33	10.001	34	3.3	0.907	0.223	0.0262	
180 minute winter	34	9.003	35	3.8	1.399	0.209	0.0626	
180 minute winter	35	1.008	42	5.6	0.266	0.140	0.5568	
180 minute winter	36	11.000	37	0.8	0.421	0.133	0.0782	
180 minute winter	37	11.001	38	1.6	0.489	0.246	0.1017	
180 minute winter	38	11.002	41	2.8	0.726	0.472	0.0939	
180 minute winter	39	12.000	40	0.8	0.563	0.133	0.1017	
180 minute winter	40	12.001	41	1.3	0.491	0.107	0.0469	
180 minute winter	41	11.003	42	4.1	0.781	0.422	0.0626	
180 minute winter	42	Hydro-Brake®	43	5.1				
120 minute summer	43	1.010	44	5.1	0.669	0.127	0.0457	96.2