

Westlode Street, Spalding

Flood Risk Assessment and Drainage Strategy

Revision C

September 2026



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Report Reference

19906/FRA and DS/Rev B

Revision History

Rev	Amendments	Prepared By	Checked By	Date
First Issue	N/A	YT	GBR	29/09/2026
Rev A	Minor amendments	YT	GBR	02/10/2026
Rev B	Appendix A updated	YT	GBR	07/10/2026
Rev C	Minor amendments	YT	GBR	15/10/2026

Introduction



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Introduction

The following paragraphs state the purpose of this document, a summary of existing and future site details is also provided.

- 1.1 This Flood Risk Assessment (FRA) and Drainage Strategy has been prepared by Woods Hardwick Ltd (WH) on behalf of Broadgate Builders (Spalding) Ltd in support of a Full Planning Application for a proposed development on a site known as 'Westlode Street, Spalding'. A copy of the Existing Site Location Plan is provided in **Appendix A**.
- 1.2 The application boundary for the site covers an area of approximately 0.299ha and currently comprises an existing car park.
- 1.3 The development proposals are for a purpose-built indoor sports facility accommodating multiple padel and pickleball courts, plus reception and social space, changing facilities and landscaping. Car parking spaces for the padel facility will be allocated within the existing car park to the south of the development.
- 1.4 In terms of flood risk, the application site is situated in Flood Zone 3, indicating a 1 in 100 year or greater chance of chance of flooding from rivers and a 1 in 200 year or greater chance of flooding from seas each year. This is not unexpected given the low lying nature of the area and the existing town and surrounding area is of the same classification in terms of flood risk.
- 1.5 As the site lies within Flood Zone 3, the appropriate mitigation measures should be applied in accordance with the South East Lincolnshire (SEL) Standing Advice. This includes raising the finished floor levels of all buildings located within the hazard zones. Where this is not practicable, an area of safe refuge should be provided or an appropriate flood warning and evacuation plan to demonstrate how this risk will be managed.
- 1.6 This document has been written in accordance with the guidance contained within the Flood Risk and Coastal Change section of the Government's Planning Practice Guidance (FRCC, PPG).
- 1.7 This FRA concludes that the proposed development will not lead to the impedance of flood flows and will not increase the risk of flooding on the site itself, adjacent properties or to third parties situated either upstream or downstream of the site.
- 1.8 This document includes a Surface Water Drainage Strategy that identifies a suitable sustainable strategy for the disposal of surface water from the proposed development site that conforms with the guidance contained within the following documents and provides betterment on the existing site's surface water drainage strategy:
 - CIRIA C753 SuDS Manual (2015)
 - Lincolnshire County Council's (LCC) Sustainable Drainage Systems Design Evaluation Guide
 - National Standards for Sustainable Drainage Systems

- 1.9 The proposed Drainage Strategy is based on a maximum allowance of 40% climate change in accordance with the LCC's Lead Local Flood Authority (LLFA) guidance.
- 1.10 A suitable foul water outfall by way of a gravity connection to the existing foul network in Westlode Street to the south has been identified for the proposed development.
- 1.11 **From the findings of this report, the development proposals are considered appropriate for the site location; therefore, should be fully supported through the planning process in terms of Flood Risk, Foul and Surface Water Drainage.**

Existing Site and Proposed Development



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Existing Site and Proposed Development

The following paragraphs provide detail on the existing and proposed future residential development site; in relation to location, land uses and topography.

- 2.1 The application site currently forms part of Westlode Street Car Park which is located north of Westlode Street, Spalding.
- 2.2 The proposed development is located within the eastern extent of the existing car park and covers an area of approximately 0.299ha. The site is bounded by Spalding Police Station to the east and properties north of Westlode Street to the south. Spalding Bowl is located south west of the site, while The Castle Sports Complex & Swimming Pool is located to the north, beyond the existing car park.
- 2.3 The Topographical Survey of the site was carried out by Daniel Charles Surveys in July 2025. During the survey, information was recorded on the location and type of surface finishes, land boundaries, and vegetation. All surveyed elevations were recorded at heights in metres above Ordnance Datum (mAOD). Ground levels and spot levels are also indicated on the drawing where they were recorded onsite. A copy of the Topographical Survey is provided in **Appendix B**.
- 2.4 In terms of existing drainage utilities, the Anglian Water sewer records identify an existing foul sewer which runs within the car park to the west of the proposed development site. This foul sewer discharges into a combined foul sewer in Westlode Street to the south of the site. There are no existing public sewers within the application boundary.
- 2.5 The topographical survey indicates the presence of drainage gullies and manholes within the car park. It is considered likely that these discharge into the existing Anglian Water foul sewer unrestricted.
- 2.6 The development proposals are for a purpose-built indoor sports facility accommodating multiple padel and pickleball courts, plus reception and social space, changing facilities and landscaping. Car parking spaces for the padel facility will be allocated within the existing car park to the south of the development. A copy of the Proposed Site Plan is provided in **Appendix C**.

Flood Risk

Flood Risk

The following paragraphs will identify whether there are any flood risks associated with the future development which may affect the proposals impact on the surrounding environment.

- 3.1 This FRA has been prepared in accordance with the National Planning Policy Framework (NPPF) August 2026 version and accompanying Planning Practice Guidance (PPG) Flood Risk and Coastal Change published in March 2014 (last updated September 2025).
- 3.2 Table 1 of the NPPF Annex F seeks to define Flood Risk Zones. An extract of this table is shown in Figure 3.1 which follows.
- 3.3 Table 2 of the same document defines 'Flood Risk Vulnerability Classification'. Whilst Table 3 compares the suitability of a development within a particular Flood Zone based on its corresponding Flood Risk Vulnerability Classification.
- 3.4 As previously mentioned, the development proposals are for a purpose-built indoor sports facility accommodating multiple padel and pickleball courts, plus reception and social space, changing facilities and landscaping. Car parking spaces for the padel facility will be allocated within the existing car park to the south of the development.
- 3.5 The Environment Agency (EA) Flood Map demonstrates that the site lies within Flood Zone 3 and is therefore classified as having more than a 1 in 100 annual probability of flooding from rivers and 1 in 200 annual probability of flooding from seas. A copy of the EA Flood Map covering the immediate surrounding area for the proposed development is shown in **Appendix D**.
- 3.6 Based on Table 3: Flood risk vulnerability and flood zone 'incompatibility'; for development within Flood Zone 3a, an exception test is required.
- 3.7 According to Table 2 (NPPF Annex F), buildings used for cafes, non residential institutions not included in the 'more vulnerable' class and assembly and leisure are classified under the 'Less Vulnerable' category, which is considered to be appropriate for development within Flood Zone 3a (Table 3: Flood risk vulnerability and flood zone 'incompatibility'). Therefore, there is no need to carry out an Exception Test.

3.8 With regard to the application of the Sequential Test, Policy F5 of the NPPF states that;

The sequential test should be used in areas known to be at risk now or in the future from any form of flooding, other than for:

- a) *Sites allocated in the development plan which were subject to the sequential test during plan preparation;*
- b) *Sites where a site-specific flood risk assessment demonstrates clearly that:*
 - i. *No built development within the site boundary, including access or escape routes, land raising or other potentially vulnerable elements, would be located on an area that would be at risk of flooding from any source, now and in the future (having regard to potential changes in flood risk); or*
 - ii. *Where the site would be at risk of surface water flooding only, the proposed layout, design, and mitigation measures would ensure that occupiers and users would remain safe from current and future surface water flood risk for the lifetime of the development without increasing flood risk elsewhere in accordance with policy F7.*
- c) *For the following types of development:*
 - i. *Householder development;*
 - ii. *Small non-residential extensions (with a footprint of less than 250m²); and*
 - iii. *Changes of use, other than changes of use to a caravan, camping or chalet site, or to a mobile home or park home site.*

3.9 It should be noted that the site is currently used as a car park which is classified under the 'Less Vulnerable' category. Given that the development proposals comprise change of use (as described in point c (iii) above) and will not increase the flood risk vulnerability classification, it is therefore concluded that a sequential test is not required.

Table 1: Flood zones (risks from river and sea flooding)

Flood Zone	Definition
Zone 1 Low probability	Land having a less than 0.1% annual probability of river or sea flooding (all land outside Zones 2, 3a and 3b).
Zone 2 Medium probability	Land having between a 1% and 0.1% annual probability of river flooding; or land having between a 0.5% and 0.1% annual probability of sea flooding (land shown in light blue on the Flood Map for Planning).
Zone 3a High probability	Land having a 1% or greater annual probability of river flooding; or Land having a 0.5% or greater annual probability of sea flooding (land shown in dark blue on the Flood Map for Planning).
Zone 3b Functional floodplain	This zone comprises land where water from rivers or the sea has to flow or be stored in times of flood. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise: • Land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or • Land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding). Local planning authorities should identify in their strategic flood risk assessments areas of functional floodplain and their boundaries accordingly, in agreement with the Environment Agency (not separately distinguished from Zone 3a on the Flood Map).

Note: Flood Zones 2 and 3, shown on the Environment Agency's Flood Map for Planning, only account for river and sea flooding, and do not account for the benefits of flood defences or the possible effects of climate change. Reference should therefore also be made to the Environment Agency's other data on the Flood Map for Planning, and any current strategic flood risk assessment(s), when considering potential future flood risks to developments and land uses.

Figure 3.1: Flood Zone Definitions -NPPF (August 2026) Extract: Annex F

Risk of Flooding to the Development from Known Sources

- 3.11 Notwithstanding the above, presented below is a summary and analysis of the potential for the site to flood from known sources.

Flooding from Rivers and/ or Watercourses

- 3.12 The topographical survey did not identify any existing watercourse within or immediately adjacent to the site boundaries.
- 3.13 The nearest EA main rivers are the River Welland located approximately 170km south east of the site. Furthermore the Welland and Deepings Internal Drainage Board (IDB) Map shows an existing watercourse known as 'Cemetery Drain located approximately 240m north east of the site.
- 3.14 The Environment Agency (EA) Flood Map demonstrates that the site lies within Flood Zone 3 and is therefore classified as having more than a 1 in 100 annual probability of flooding from rivers and 1 in 200 annual probability of flooding from seas.
- 3.15 The EA Flood Map for Planning shown that the majority of Spalding and a large extent of South East Lincolnshire is in Flood Zone 3. Therefore, it is not possible to guide development entirely to Flood Zones 1 and 2. Instead, the suitability of the proposed development has been assessed with reference to the refined flood risk information (Hazard and Depth maps) from the SEL Strategic Flood Risk Assessment (SFRA), March 2017.
- 3.16 The hazard mapping shows modelled flooding consequences in the event of overtopping and breaching of flood defences. It also shows the likely flood depths, velocities and overall hazard to a proposed site. Two scenarios were modelled, the 1 in 200 (0.5%) and 1 in 1,000 (0.1%). This was undertaken for the 'present' day (2006 baseline) and 2115 (the year to which the final Defra sea level allowances related and allows for a lifetime of development).
- 3.17 The Residual Flood Hazard Map Overlay, which is provided in **Appendix E**, indicates that the hazard ratings across the site range between 'Danger for Most' in the northern part of the site to 'Low Hazard' in the central part of the site.

- 3.18 Additionally, the flood depths mapping, which is provided in **Appendix F**, indicates that the 2115 predicted flood depths on the site range from 0m to 1m. Court 1 and the southern part of Court 2 are located within the 0 - 0.25m range, whilst remainder of Court 2, Court 3 and northern part of Court 4 are situated within the 0.25m - 0.5 range. The northern part of Court 4 encroaches within the 0.5m - 1m range.
- 3.19 The proposed reception, social space and changing facilities building will be wholly outside of the affected zones and therefore does not require any mitigation measures.
- 3.20 In relation to the Padel Courts, SEL guidance notes that single storey buildings should be built with FFLs above the predicted flood depth. If this is not practicable an area of safe refuge will need to be provided or an appropriate flood warning and evacuation plan will need to demonstrate how this risk will be managed.
- 3.21 The proposed scheme will therefore incorporate flood resilient construction for the proposed padel courts to a minimum of 300mm above the predicted flood level. In addition, the southern part of the site, which is outside of the affected zones provides a safe refuge and also allows safe access and egress onto the site.

Flooding from the Sea

- 3.22 The nearest sea to the site is the North Sea, which is located approximately 25km to the north east, however, the site lies between 3.47m AOD and 4.15m AOD; and is situated within EA Flood Zone 3.
- 3.23 As previously mentioned, flood resilient construction will be implemented for the proposed padel courts to a minimum of 300mm above the predicted flood level.

Flooding from Land

- 3.24 The potential for overland flows needs to be considered to ensure that neither the development nor adjacent land and/ or property, including that which may be under the responsibility of a third party, is placed at an unacceptable risk of flooding.
- 3.25 The EA Surface Water Flood Map, which is enclosed in **Appendix G**, indicates that the northern extent of the site is at low risk of surface water flooding due to localised ponding in the vicinity of The Castle Sports Centre and Swimming Pool.

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- 3.26 It is anticipated that any surface water flows emanating from the proposed development site will be managed within the proposed drainage network following development of the site; thereby providing a betterment to the existing scenario.
- 3.27 At the detailed design stage, final external levels will be designed to ensure that surface water flows are routed away from any vulnerable areas and directed towards the proposed drainage network. The proposed mitigation measures incorporated to mitigate wider flood risk, will further assist in ensuring the development remains safe for its lifetime.

Flooding from Groundwater

- 3.28 Inspection of the British Geological Survey (BGS) website identified that the underlying superficial deposits comprise Tidal flat deposits - Clay and silt underlain by bedrock geology comprising Oxford Clay Formation - Mudstone. Copies of the BGS Maps are contained within **Appendix H**.
- 3.29 The SEL SFRA did not identify any groundwater flooding issues within the area.
- 3.30 On this basis, it is considered that the risk of groundwater flooding to the proposed development is very low. However, to avoid any potential groundwater ingress, the proposed drainage features will be lined.

Flooding from Sewers

- 3.31 A copy of the AW Wastewater Plan illustrating the site extents and the immediate surrounding areas on Ordnance Survey (OS) mapping; together with approximate locations of AW assets is enclosed in **Appendix I**.
- 3.32 The AW sewer records identify an existing foul sewer within the car park to the west of the site and a combined foul sewer in Westlode Street to the south of the site.
- 3.33 A sewer flooding history enquiry has been carried out with AW to confirm whether there have been flooding incidents in the area. In their response dated 25th August 2026, AW confirmed that they have no records of flooding in the vicinity that can be attributed to capacity limitations in the public sewerage system. A copy of the AW correspondence is provided in **Appendix J**.
- 3.34 Based on the above information, the proposed site is not considered to be at risk of flooding from this source.

Flooding from Reservoirs, Canals and Other Artificial Sources

- 3.35 The EA Reservoir Flood Map shows that is no part of the site or any immediately neighbouring land is identified to be at risk of flooding from reservoirs. A copy of this mapping is enclosed in **Appendix K**.
- 3.36 It should be noted that an occurrence of flooding from reservoirs is considered by the EA to be extremely rare. There has been no loss of life in the UK from reservoir flooding since 1925.

Risk of Flooding from the Proposed Development

- 3.37 Presented below is a summary and analysis of the potential for the site to exacerbate the risk of flooding to third parties both upstream and downstream.

Encroachment onto Floodplain

- 3.38 As outlined above, the EA Flood Map indicates that the site lies within Flood Zone 3.
- 3.39 However, the Residual Flood Hazard Map Overlay indicates that only the central and northern part of the site would be at risk of flooding. Additionally, the flood depths mapping indicates that the 2115 predicted flood depths on the site range from 0m to 1m and would only affect the proposed padel courts.
- 3.40 The proposed scheme will therefore incorporate flood resilient construction for the proposed padel courts to a minimum of 300mm above the predicted flood level. In addition, the southern part of the site, which is outside of the affected zones provides a safe refuge and also allows safe access and egress onto the site.

Impedance of Flood Flows

- 3.41 As previously mentioned, the EA Surface Water Flood map indicates that the northern extent of the site is at low - medium risk of surface water flooding due to localised ponding in the vicinity of the Castle Sports Centre and Swimming Pool.
- 3.42 It is anticipated that any surface water emanating on the site will be managed within the proposed drainage network following development of the site; thereby providing a betterment to the existing scenario.

Contribution of Flood Flows by Development Drainage

- 3.43 As previously mentioned, the application site covers an area of approximately 0.299ha.
- 3.44 The development proposals are for a purpose-built indoor sports facility accommodating multiple padel and pickleball courts, plus reception and social space, changing facilities and landscaping. Car parking spaces for the padel facility will be allocated within the existing car park to the south of the development. These elements will all contribute to the development's surface water discharge.
- 3.45 If considered appropriate at the detailed design stage, flood routing measures will be incorporated to ensure that flood waters in excess of those for which the site has been designed to accommodate, will be routed away from the more vulnerable areas of the site.
- 3.46 The surface and foul water disposal strategies for the site are described in greater detail in the following 'Chapter 4 - Proposed Development Drainage Strategy'.

Climate Change

- 3.47 The EA's guidance document 'Flood risk assessment: climate change allowances' (FRA:CC) sets out the requirements for accounting for climate change within flood risk assessments and drainage strategies.
- 3.48 The FRA:CC provides allowances for peak river flow and peak rainfall intensity as percentage uplifts that vary by management catchment. These allowances must be applied when assessing fluvial flood risk and in the design of site-wide drainage.
- 3.49 The peak rainfall allowances for the application site have been taken from the EA's published data for the 'Welland Management Catchment' and are as follows;

Epoch	Central allowance	Upper end allowance
3.3% annual exceedance rainfall event		
2050s	20%	35%
2070s	25%	35%
1% annual exceedance rainfall event		
2050s	20%	40%
2070s	25%	40%

Table 3.3: Welland Management Catchment peak rainfall allowances

- 3.50 It is advised to use '2050s' for development with a lifetime up to 2060 and the 2070s epoch for development with a lifetime between 2061 and 2125.
- 3.51 Considering the above, the climate change allowance that the proposed development's drainage strategy will be based on, is set at a value of +40% (Upper end allowance, representing the total potential change anticipated for 2061 - 2125).

Proposed Development Drainage Strategy



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Proposed Development Drainage Strategy

The following paragraphs will provide detail on the proposed site generated foul and surface water disposal methods, design criteria, maintenance regimes and potential third-party legal agreements.

- 4.1 In addition to ensuring that the development is not at risk of flooding from external sources, it is also important to ensure that the scheme itself does not exacerbate flood risk for others. It is therefore essential that the arrangements for storm and foul water disposal are fully assessed to guarantee that the effects are mitigated and that there will be no impact on the existing land drainage regime.

Surface Water Drainage Strategy

- 4.2 All of the recent guidance on the arrangements for surface water disposal from new developments encourages the application of a hierarchy for surface water disposal. This hierarchy is set out in the Building Regulations Part H and is consistent with the National Standards for SuDS and relevant LLFA guidance.
- 4.3 The first preference for surface water runoff is collection for non-potable use, such as rainwater harvesting or landscape irrigation. Rainwater harvesting will be utilised on site through the provision of water butts, however, at this stage, these measures are not included in the current drainage calculations. In terms of the formal drainage strategy, disposal will follow the hierarchy: first via infiltration into the ground, then to a ditch and/ or watercourse, followed by a surface water sewer or other piped drainage system. The last option to be considered is discharge to a combined sewer.

Method of Surface Water Discharge

Infiltration

- 4.4 The BGS maps indicate that the site is underlain by low permeability soils, and therefore, infiltration methods are unlikely to be suitable at the site.

Ditch and/or Watercourse

- 4.5 In light of the above and accordance with the hierarchy for surface water disposal, the next option to be considered is discharge to ditch/watercourse.
- 4.6 As previously mentioned, there are no existing watercourses on or immediately adjacent to the site, therefore, disposal via this method is not a feasible option.

Discharge to Public Sewer

- 4.7 In light of the above and accordance with the hierarchy for surface water disposal, the next option to be considered is discharge to public sewer.
- 4.8 As previously mentioned, the topographical survey indicates the presence of drainage gullies and manholes within the car park. It is considered likely that these discharge into the existing Anglian Water foul sewer or combined sewer unrestricted.
- 4.9 The current brownfield runoff rates have been calculated based on the modified rational method as follows;

$$Q = CiA$$

Q = Peak discharge

C - Dimensionless coefficient = 2.78

I = Rainfall intensity; 1 year = 50mm/hr; 30 year = 126mm/hr; 100 year = 152mm/hr

*A = Impermeable area = 0.15ha**

**Note - The impermeable area does not include the car parking spaces allocated for padel facility, which will continue to drain as existing.*

Therefore;

$$Q (1 \text{ in } 1 \text{ year}) = 20.85\text{l/s}$$

$$Q (1 \text{ in } 30 \text{ year}) = 52.54\text{l/s}$$

$$Q (1 \text{ in } 100 \text{ year}) = 63.38\text{l/s}$$

- 4.10 It is therefore proposed to discharge surface water runoff from the development site into the existing Anglian Water combined sewer to the south proposed development site. This network ultimately discharges to 900mm diameter existing combined sewer in Westlode Street.
- 4.11 Site runoff will be restricted to a maximum rate of 2l/s during all storm events up to and including the 1 in 100 year event plus 40% climate change allowance. This provides a significant betterment compared to the existing runoff rates; approximately 90% betterment during the 1 year storm event, 96% betterment during the 30 year event and 97% during the 100 year event.

Discharge Strategy

Rainfall Data

- 4.12 The Flood Estimation Handbook (FEH) methodology has been used in order to determine the requirements of the drainage network.

Runoff Rate

- 4.13 The impermeable area of the site has been calculated to be approximately 0.15ha.
- 4.14 The site's greenfield runoff rates have been calculated based on the IH124 Method. A copy of the calculation is provided in **Appendix L**, which gives flow rates as follows;

Q_{bar} = 0.2l/s

1 in 1 year - 0.2l/s

1 in 30 year - 0.4l/s

1 in 100 year - 0.5l/s

- 4.15 Given the above, the existing greenfield runoff rates are extremely low and may result in an increased risk of blockage. It is therefore proposed to discharge surface water runoff from the site at a maximum rate of 2 l/s which represents a significant betterment of approximately 90% during the 1-year storm event, 96% during the 30-year event and 97% during the 100-year event.

Attenuation Volume Requirement

- 4.16 The application site is currently 100% impermeable and therefore the proposed development will not increase the impermeable area.
- 4.17 Notwithstanding this, it is considered necessary to ensure that sufficient attenuation is provided on site to accommodate the runoff from the 0.15ha of impermeable surfacing within the developable area during the 1 in 100 (+40% climate change) storm event.
- 4.18 The impermeable area does not include the car parking spaces allocated for padel facility, which will continue to drain as existing. Any existing drainage infrastructure serving this area will be maintained or, where necessary, reinstated during construction.
- 4.19 Surface water storage will be provided within the proposed geocellular crates beneath the existing car park in the southern extent of the site.
- 4.20 A copy of the Proposed Drainage Strategy and associated drainage calculations can be found in **Appendix L and M**, respectively.
- 4.21 The drainage calculations demonstrate that the proposed attenuation features are capable of accepting flows from the 100 year rainfall events, including 40% allowance for climate change.

Method of Attenuation

- 4.22 In accordance with current guidelines and best practice, the Developer's best endeavours will be made to ensure that appropriate Sustainable Urban Drainage Systems (SuDS) are used wherever practicable. There are a number of primary methods available, the appropriateness of which has been considered and summarised in Table 4.1 below;

Table 4.1: SuDS Feasibility Consideration

SuDS System	Feasibility	Comments
Green Roofs	X	Cost is likely to adversely affect the scheme's viability.
Permeable Paving	X	Underlying ground conditions are not suitable for infiltration methods.
Soakaways	X	Underlying ground conditions are not suitable for infiltration methods.
Rainwater Harvesting	X	Will not be incorporated within the currently proposed Drainage Strategy.
Swales	X	Will not be incorporated within the currently proposed Drainage Strategy as surface water runoff from the site will ultimately discharge into an existing public foul sewer or combined sewer network.
Attenuation Basin	X	Will not be incorporated within the currently proposed Drainage Strategy as surface water runoff from the site will ultimately discharge into an existing public foul sewer or combined sewer network.
Geo-cellular Storage Crates	✓	Geocellular crates are proposed to provide surface water attenuation.

- 4.23 Based on the above assessment, which takes into account the underlying ground conditions, it is proposed to provide the site's surface water storage within the proposed geocellular crates which will be placed in the southern extent of the site.
- 4.24 The geocellular crates will be constructed to an approximate depth of 1.2m and will provide approximately 141m³ surface water storage.

Surface Water Conveyance

- 4.25 Surface water runoff from the proposed development will generally be routed towards the proposed geocellular crates in the southern extent of the site via gravity pipes. The crates will be sized to accommodate the site's surface water runoff during a 100 year storm with an additional 40% climate change allowance.
- 4.26 From the crates, surface water flows will be conveyed to the existing AW combined sewer which runs to the south of the proposed development site.
- 4.27 A flow control device will be installed downstream of the crates to restrict flows from the development site to 2l/s during all storms up to and including the 100 year event plus 40% climate change.
- 4.28 The proposed drainage network has been modelled using Causeway Flow software. The results demonstrate that the features are capable of accepting flows from the 100 year storm event, including 40% allowance for climate change. The proposed drainage strategy and associated calculations can be found in **Appendix L and M**, respectively.

Surface Water Drainage Maintenance

- 4.29 The arrangements for further maintenance of the surface water drainage system needs to be fully considered and, in that respect, it is anticipated that the onsite piped drainage network and geocellular crates would be maintained by a management company.
- 4.30 A summary of the likely maintenance requirements for the proposed geocellular crates is provided in Table 4.2 below.

Table 4.2: Recommended Maintenance for Geo-cellular Crates

Geo-cellular Crates	
Monitoring	Frequency
Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition operating as designed.	Annually
Survey inside the storage structure, where applicable to determine the extent of any sediment build up and remove if necessary.	Every 5 years or as required.
Regular Maintenance	
Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually
Remove debris from the catchment surface (where it may cause risk to performance)	Monthly
Occasional Maintenance	
Remove leaf accumulation	As required
Remove sediments from inlets and structures	As required
Remedial Work	
Repair/rehabilitate inlets, outlets, overflows and vents	As required

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- 4.31 It should be noted that the maintenance schedule described above should be considered indicative only. The frequency and type of maintenance tasks to be carried out should be reviewed as necessary to ensure that the schedule remains relevant to the nature and location of the proposed residential development.

Foul Water Drainage Strategy

- 4.32 The currently proposed foul drainage strategy is shown on the Proposed Drainage Strategy Drawing provided in **Appendix L**.
- 4.33 The proposed foul strategy is to discharge foul flows to the existing AW combined sewer to the south of the development site.
- 4.34 Given the relatively small scale of the proposed development, it is anticipated that sufficient capacity will be available within the existing drainage network to accommodate the proposed flows.
- 4.35 A suitable foul sewer network to discharge the proposed development, will be designed in accordance with AW adoptable standards, providing a direct point of connection between the development site and aforementioned AW foul sewer. Further details of this design will be provided at the detailed design stage.
- 4.36 In accordance with relevant drainage policy, AW are obliged to accept foul water flows from a proposed development, subject to the site receiving planning consent. In anticipation that such a consent will be granted for the proposed development scheme, it is expected that AW will make the necessary arrangements to ensure that the required provision within their public foul sewer network and treatment works will be available at the time that the Applicant wishes to connect the site's foul sewers to the public foul network.

Foul Water Drainage Maintenance

- 4.37 In anticipation that the proposed residential development will be connected to the AW public foul sewer network; it is considered reasonable to expect AW will act in their full capacity as the wastewater provider for the local area, to ensure that maintenance of their public sewers will be carried out as required from the point at which the private sewer outfalls connect to the public sewer network.

Summary and Conclusion



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Summary and Conclusions

The following paragraphs summarise the findings of this Flood Risk Assessment and Drainage Strategy. Details of foul and surface water outfalls and SuDS features are also provided.

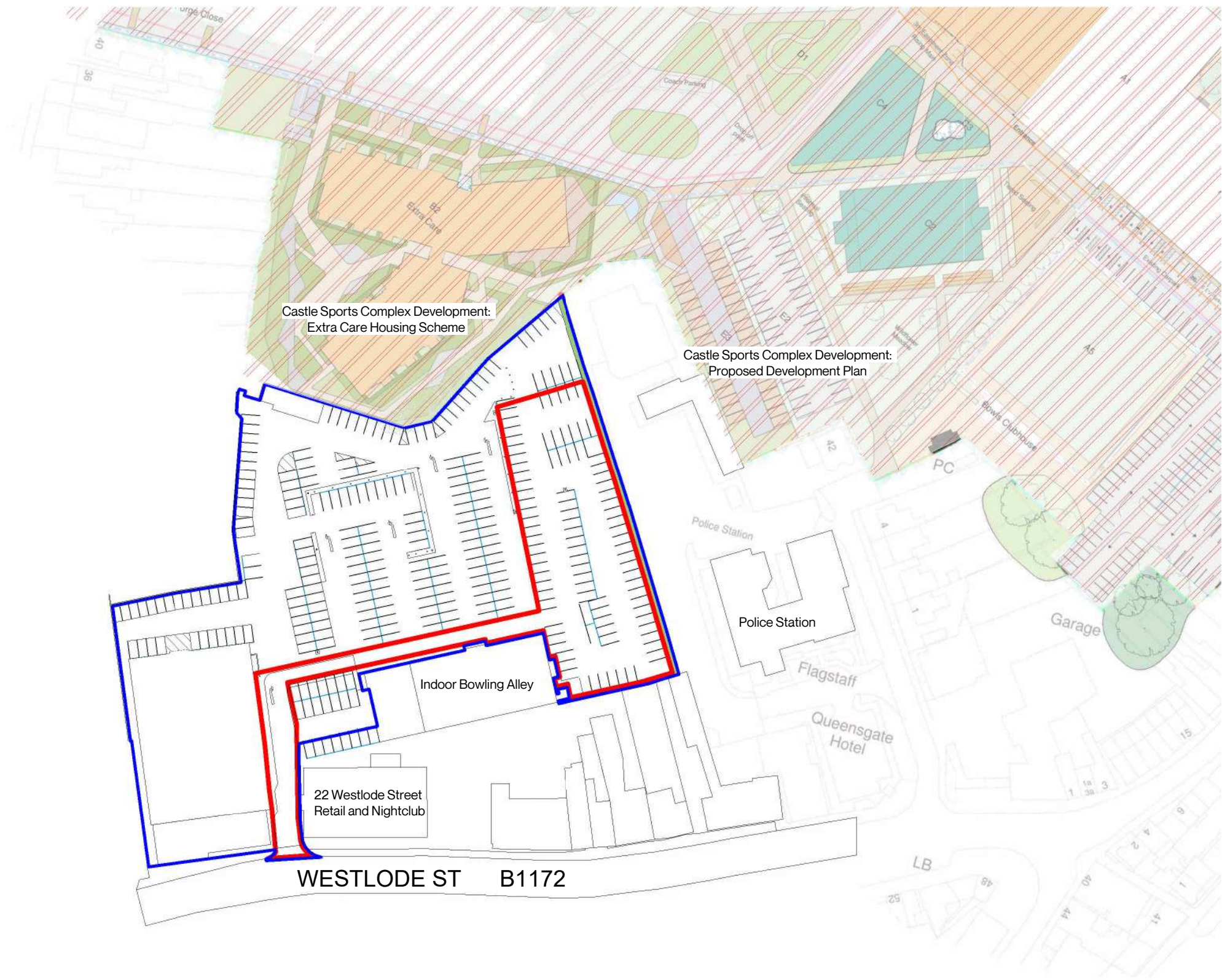
- 5.1 This Flood Risk Assessment (FRA) and Drainage Strategy has been prepared by Woods Hardwick Ltd (WH) on behalf of Broadgate Builders (Spalding) Ltd in support of a Full Planning Application for a proposed development on a site known as 'Westlode Street, Spalding'.
- 5.2 The development proposals are for a purpose-built indoor sports facility accommodating multiple padel and pickleball courts, plus reception and social space, changing facilities and landscaping. Car parking spaces for the padel facility will be allocated within the existing car park to the south of the development.
- 5.3 In terms of flood risk, the application site is situated in Flood Zone 3, indicating a 1 in 100 year or greater chance of flooding from rivers and a 1 in 200 year or greater chance of flooding from seas each year. However, the Residual Flood Hazard Mapping and Flood Depths Mapping contained within the SEL SFRA indicates that only the central and northern parts of the site would be at risk of flooding.
- 5.4 The proposed scheme will therefore incorporate flood resilient construction for the proposed padel courts to a minimum of 300mm above the predicted flood level. In addition, the southern part of the site, which is outside of the affected zones provides a safe refuge and also allows safe access and egress onto the site.
- 5.5 The EA Surface Water Flood Map indicates that the northern extent of the site is at low risk of surface water flooding due to localised ponding in the vicinity of The Castle Sports Centre and Swimming Pool. It is anticipated that any surface water flows emanating from the proposed development site will be managed within the proposed drainage network following development of the site. This will improve the existing situation.
- 5.6 All other potential sources of flooding to the proposed development have been considered and it has been demonstrated that the site will not be at any significant risk of flooding.
- 5.7 It has been demonstrated that the proposed development will not exacerbate the risk of flooding to third parties either upstream or downstream from the site.
- 5.8 The Surface Water Drainage Strategy has been developed in accordance with the hierarchy for sustainable surface water disposal.
- 5.9 The BGS maps indicate that the site is underlain by low permeability soils, and therefore, infiltration methods are unlikely to be suitable at the site. Furthermore, there are no existing watercourses on or immediately adjacent to the site, therefore, disposal via this method is not a feasible option.

- 5.10 The proposed strategy is to discharge surface water runoff from the development site into the existing Anglian Water combined sewer to the south of the development site. This network ultimately discharges to existing combined sewer in Westlode Street.
- 5.11 Site runoff will be restricted to a maximum rate of 2l/s during all storm events up to and including the 1 in 100 year event plus 40% climate change allowance. This provides a significant betterment compared to the existing brownfield runoff rates.
- 5.12 Surface water storage will be provided within the proposed geocellular crates beneath the existing car park in the southern extent of the site.
- 5.13 The proposed foul strategy is to discharge foul flows to the existing AW foul sewer, via manhole 8905, located within the car park to the west of the development site.
- 5.14 Given the relatively small scale of the proposed development, it is anticipated that sufficient capacity will be available within the existing drainage network to accommodate the proposed flows.
- 5.15 A suitable foul sewer network to discharge the proposed development, will be designed in accordance with AW adoptable standards, providing a direct point of connection between the development site and aforementioned AW foul sewer. Further details of this design will be provided at the detailed design stage.
- 5.16 In accordance with relevant drainage policy, AW are obliged to accept foul water flows from a proposed development, subject to the site receiving planning consent. In anticipation that such a consent will be granted for the proposed residential scheme, it is expected that AW will make the necessary arrangements to ensure that the required provision within their public foul sewer network and treatment works will be available at the time that the Applicant wishes to connect the site's foul sewers to the public foul network.
- 5.17 **From the information provided within this report, it is concluded that there is no reason in terms of drainage or flood risk why the proposed development on 'Westlode Street, Spalding', should not be fully supported through the planning process.**

Appendix A

Existing Site Location Plan

Rev	Date	By	Description
P01	11/09/2026	CH/JDS	First Issue
P02	01/10/2026	CH/JDS	Planning Application Issue



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Unit T64, Vulcan Works, 34-38 Guildhall Road, Northampton, NN1 1EW
01604272363 hello@24three.co.uk www.24three.co.uk

Client:
Broadgate Builders (Spalding) Ltd

Project Title:
Westlode Street
Spalding

Drawing Name:
Site Location Plan

Drawing Stage: Planning

Status: S2 - Suitable for Information

24/Three File Ref: 26041-243-XX-XX-M3-A-0001

26041	CH	JDS	As @ A2	P02
243 Project No:	Drawn:	Checked:	Indicated:	Rev:

Drawing Number:

26041 -243 -XX-XX -DR -A -1203

Project Code	Originator	Function	Spacial	Form	Discipline	Drawing Number
--------------	------------	----------	---------	------	------------	----------------

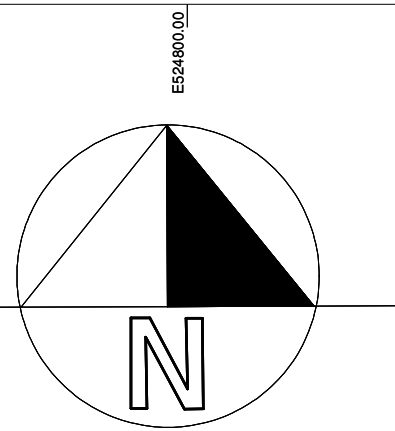


1 Existing Site Location Plan

1 : 1250

Appendix B

Topographic Survey

[illegible]

1. THE POSITION OF THIS SURVEY IS BASED ON GPS DOTS151 0110.
2. ALL LEVELS RELATE TO GPS DATA ACQUIRED WITH TRIMBLE V550.
3. THREE SPREADS ARE DRAWN TO SCALE AND SHOW THE GENERAL CONTOUR OF THE SITE.
4. ALL BELOW GROUND LEVEL INFORMATION INCLUDING VOIDS, DRAINAGE & SERVICES HAVE BEEN IDENTIFIED FROM THE SURFACE OF THE SITE. THEREFORE, THERE ARE NO EXTRACTORS NOTED. ALL CRITICAL DRAINAGES SHOULD BE CHECKED BY THE CLIENT.
5. EVERY EFFORT HAS BEEN MADE TO LOCATE AND SURVEY ALL VISIBLE FEATURES IF IT SHOULD BE NOTED THAT SOME ITEMS MAY NOT BE SHOWN AS THEY ARE NOT VISIBLY IDENTIFIED AND THEREFORE NOT SHOWN ON THIS DRAWING.
6. PHYSICAL BOUNDARY FEATURES SHOWN ON THIS DRAWING DO NOT REPRESENT THE EXACT BOUNDARIES OF THE SITE. THEREFORE THIS INFORMATION SHOULD BE CONFIRMED WITH THE RELEVANT AUTHORITIES.
7. THE CONTRACTOR MUST CHECK AND VERIFY ALL SITE LEVELS, DRAINAGE, UTILITIES AND DRAINAGE DATES PRIOR TO THE COMMENCEMENT OF ANY WORK. THE CLIENT'S SURVEY MUST BE NOTIFIED TO DANIEL CHARLES SURVEYS LTD.
8. ALL SURVEY STATION CONTROL POINTS MUST BE CHECKED BY THE CLIENT PRIOR TO THE SURVEY.

Point	Easting	Northing	Elevation
9000	524932.696	322887.780	5.274
9002	524908.395	322867.079	5.361
9003	524864.089	322861.437	5.463
9004	524878.098	322967.360	4.474
9005	524906.244	322977.456	4.447
9006	524931.016	322981.606	4.160

Rev	Amendments	Drn	Date

A	MANHOLE DETAILS ADDED	MDH	26/09/2026
---	-----------------------	-----	------------

Client:

BROADGATE BUILDERS (SPALDING)

Project Title:

WESTLCDE ST - SPALDING

Drawing Title:

TOPOGRAPHICAL SURVEY

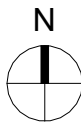
Scale @ A0:	1:250	Date:	02/09/2006
Drawing No:	26-87-01		Rev: A
C.A.D. Title:	"postbroadgate builders (spalling) - westside site - spalling". magnet master files\magnet\topo (25-87-01).img"		
Drawn By:	MDH	Checked By:	MJW



Appendix C

Site Layout Plan

Rev	Date	By	Description
P01	28/07/2026	LH/JDS	Initial issue for information
P02	29/07/2026	LH/JDS	Parking provisions updated
P03	30/07/2026	LH/JDS	Single padel courts added. Updated Pickleball court location.
P04	01/10/2026	CH/JDS	Planning Application Issue



Key

- Red line boundary
- Castle Sports Complex proposed development site

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24 THREE

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Unit T64, Vulcan Works, 34-38 Gullhall Road, Northampton, NN1 1EW
01604272363 hello@24three.co.uk www.24three.co.uk

Client:
Broadgate Builders (Spalding) Ltd

Project Title:
Westlode Street
Spalding

Drawing Name:
Proposed GF Site Plan

Drawing Stage: Planning

Status: A1 - Issued for Planning Approval

24/Three File Ref: 26041-243-XX-XX-M3-A-0001

26041	JDS	RM	1:500 @ A2	P04
243 Project No	Drawn	Checked	Scale	Rev

Drawing Number:

26041-243-XX-XX-DR -A -1200

Project Code	Originator	Function	Special	Form	Discipline	Drawing Number
--------------	------------	----------	---------	------	------------	----------------

1

Proposed Site Plan

1 : 500



Appendix D

Environment Agency - Flood Map for Planning

Flood map for planning

Your reference
Unspecified

Location (easting/northing)
524933/322974

Created
12 August 2026 14:08

Your selected location is in flood zone 3, an area with a high probability of flooding.

This means:

- you must complete a flood risk assessment for development in this area
- you should follow the Environment Agency's standing advice for carrying out a flood risk assessment (see <https://www.gov.uk/guidance/flood-risk-assessment-standing-advice>)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Flood risk data is covered by the Open Government Licence which sets out the terms and conditions for using government data. <https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3>

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2026 AC0000807064. <https://flood-map-for-planning.service.gov.uk/os-terms>



Flood map for planning

Your reference

Unspecified

Location (easting/northing)
524933/322974

Scale
1:2,500

Created
12 Aug 2026 14:08

-  Selected area
-  Flood zone 3
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Water storage area



0 20 40 60m

Appendix E

Residual Flood Hazard Map Overlay



- NOTES
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- SAFETY, HEALTH AND ENVIRONMENTAL
- There are no exceptional risks associated with these works. Refer to the designers risk assessment for the full assessment of risks.

KEY

Max Hazard (Flood Risk to People);

Less than 0.75 (Low Hazard)

Between 0.75 and 1.25 (Danger for Some)

Between 1.25 and 2.0 (Danger for Most)

*Max Hazard based on Residual Flood Hazard Map for Spalding - Year 2115 0.1% Event Probability (from SEL/SHDC SFRA)

A	Red line boundary amended	YT	GBR	15.10.2026
REV	DESCRIPTION	DRN	CHD	DATE
☒ PRELIMINARY	☐ INFORMATION	☐ TENDER		
☐ CONSTRUCTION	☐ AS BUILT			
SCALE	1:500 @ A4	DATE	SEPTEMBER 2026	
DRAWN	YT	CHK	GBR	
DRAWING NO.	19906-PADE-5-104	REV	A	
TITLE	WESTLODE STREET SPALDING			
DETAILS	RESIDUAL FLOOD HAZARD MAP OVERLAY			

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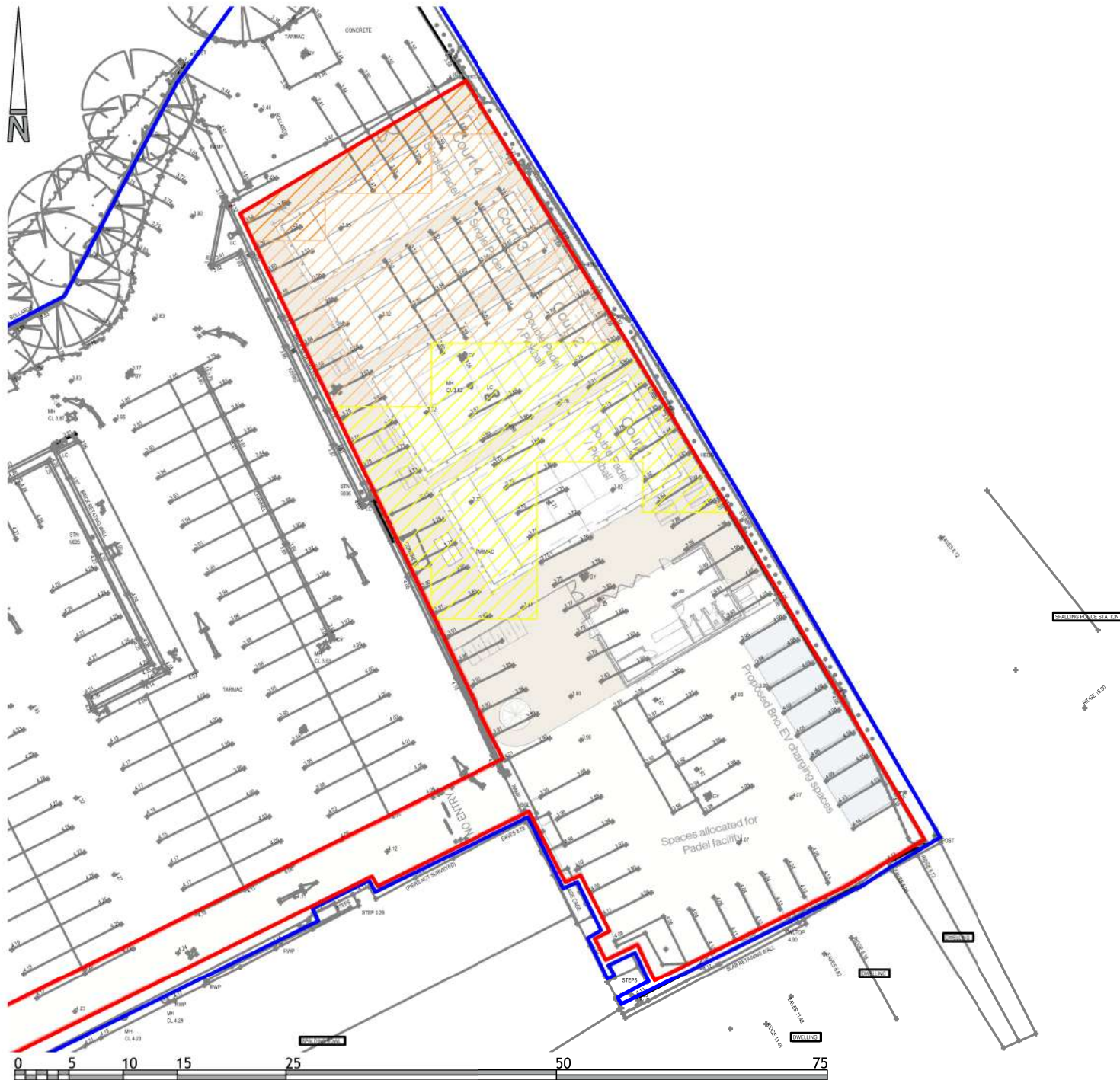
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Appendix F

Residual Flood Depth Map Overlay



NOTES

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SAFETY, HEALTH AND ENVIRONMENTAL

There are no exceptional risks associated with these works. Refer to the designers risk assessment for the full assessment of risks.

KEY

Peak Flood Depths;



0m - 0.25m



0.25m - 0.5m



0.5m - 1m

*Peak flood depths based on Residual Peak Depth Map for Spalding - Year 2115 0.1% Event Probability (from SEL/SHDC SFRA)

A	Red line boundary amended	YT	GBR	15.10.2026
REV	DESCRIPTION	DRN	CHD	DATE

☒ PRELIMINARY	☐ INFORMATION	☐ TENDER
☐ CONSTRUCTION	☐ AS BUILT	

SCALE 1:500 @ A4 DATE SEPTEMBER 2026

DRAWN YT CHK GBR

DRAWING NO. 19906-PADE-5-103 REV A

TITLE WESTLODE STREET
SPALDING

DETAILS RESIDUAL PEAK DEPTH MAP OVERLAY

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Appendix G

Environment Agency - Surface Water Flood Map

← Exit map

Rivers and the sea

Reservoirs

Surface water map

Yearly chance of flooding

Extent

Depth

Yearly chance of flooding between 2040 and 2060

Extent

High chance
More than 3.3% chance each year

Medium chance
Between 1% and 3.3% chance each year

Low chance
Between 0.1% and 1% chance each year

Depth

Map details

☒ Show flooding



Appendix H

British Geological Survey Maps

○ Superficial Geology

 About Opacity Legend

 Oxford Clay Formation-Mudstone

 Select Basemap Settings [Contact BGS](#)

 More data? Try BGS GeoIndex

Version 1.10.4

▼ 🔍 Search by placename, postcode...



Map Layers

☒ Superficial Geology

Layer Summary:

Superficial deposits are the youngest geological deposits formed during the most recent period of geological time, the Quaternary, which extends back about 2.6 million years from the present.

About

Opacity

Legend

Tidal flat deposits-Clay and silt

☐ Bedrock Geology☐ Combined Geology

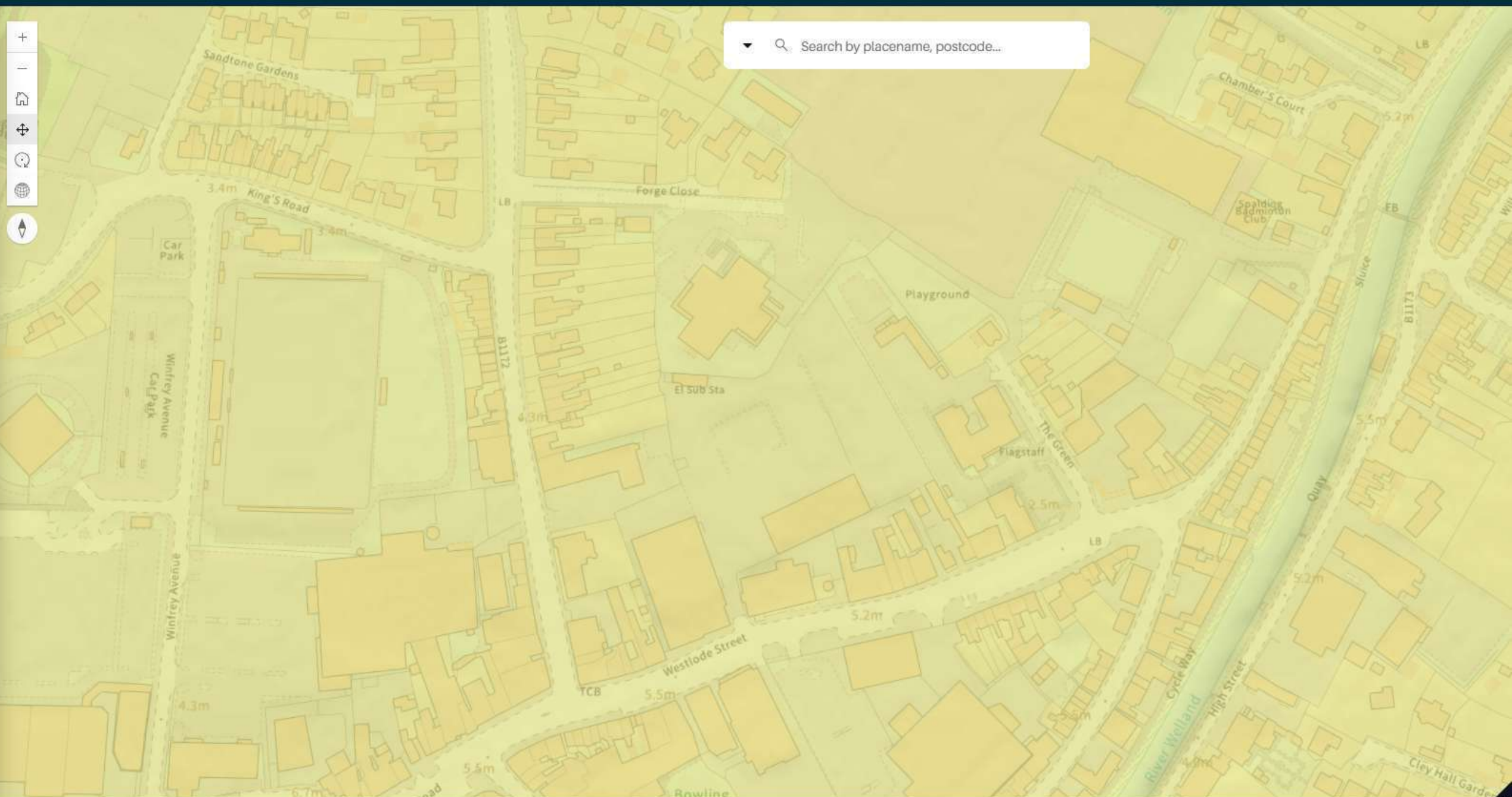
Options

Select Basemap

Settings

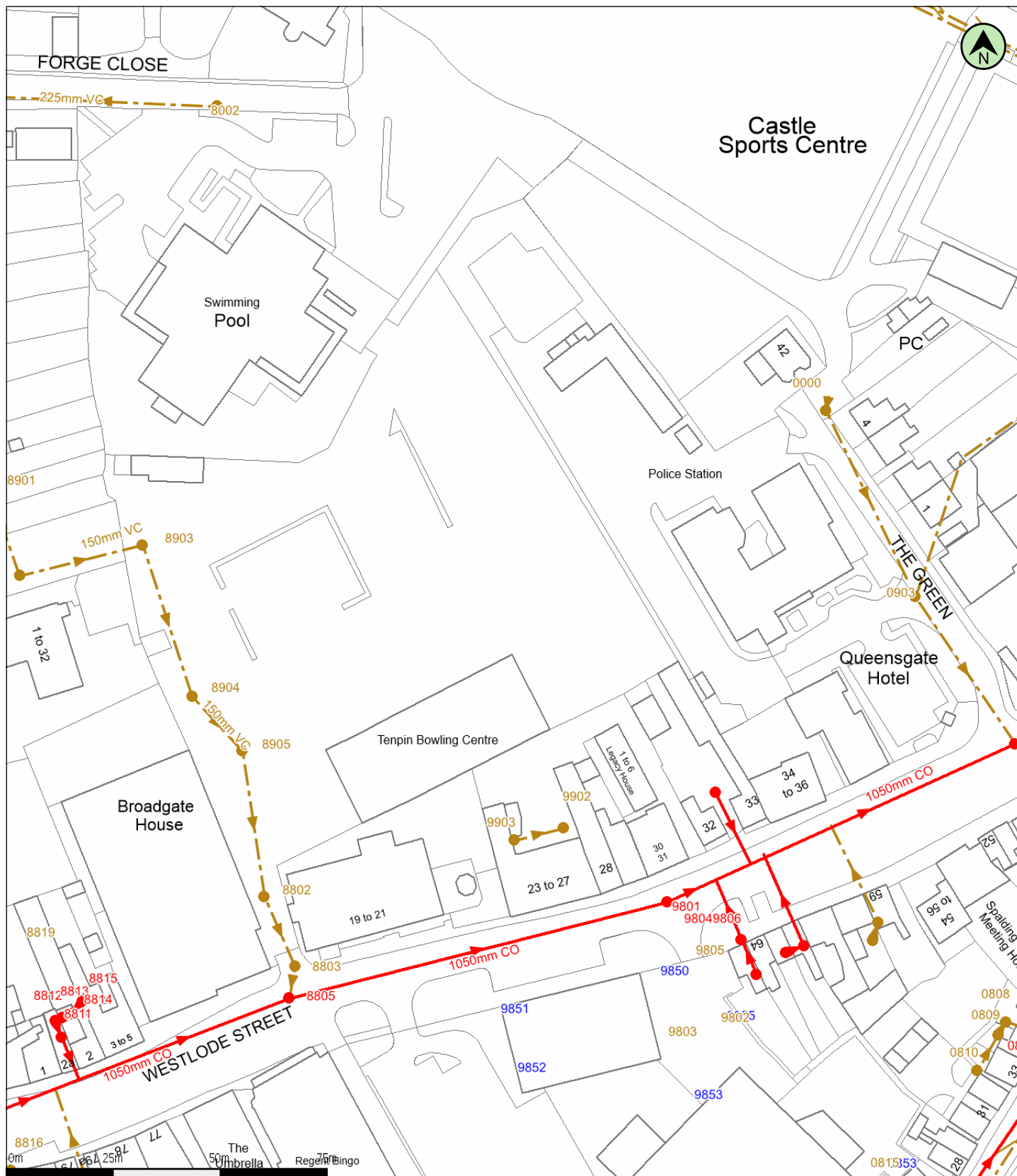
Contact BGS

More data? Try BGS GeoIndex



Appendix I

Anglian Water Sewer Records



(c) Crown copyright and database rights 2026 Ordnance Survey AC0000813445

Data updated: 31/07/26

Scale: 1:1250

Map Centre: 524947,322966

Date: 14/08/26

Our Ref: 2190925 - 2

Wastewater Plan A4

Powered by digdat

Foul Sewer
Surface Sewer
Combined Sewer

Final Effluent

Rising Main*

Private Sewer*

Decommissioned Sewer*

Outfall*
Inlet*
Manhole*



Sewage Treatment Works



Public Pumping Station



Decommissioned Pumping Station

*(Colour denotes effluent type)

i.ziecina@woodshardwick.com

19906 Padel Court



This plan is provided by Anglian Water pursuant its obligations under the Water Industry Act 1991 sections 198 or 199. It must be used in conjunction with any search results attached. The information on this plan is based on data currently recorded but position must be regarded as approximate. Service pipes, private sewers and drains are generally not shown. Users of this map are strongly advised to commission their own survey of the area shown on the plan before carrying out any works. The actual position of all apparatus MUST be established by trial holes. No liability whatsoever, including liability for negligence, is accepted by Anglian Water for any error or inaccuracy or omission, including the failure to accurately record, or record at all, the location of any water main, discharge pipe, sewer or disposal main or any item of apparatus. This information is valid for the date printed. This plan is produced by Anglian Water Services Limited (c) Crown copyright and database rights 2026 Ordnance Survey AC0000813445. This map is to be used for the purposes of viewing the location of Anglian Water plant only. Any other uses of the map data or further copies is not permitted. This notice is not intended to exclude or restrict liability for death or personal injury resulting from negligence.

Appendix J

Anglian Water Sewer Flooding History Enquiry

[Filed on 2026-09-02] RE: 19906 Westlode Street, Spalding

From Planning Liaison <planningliaison@anglianwater.co.uk>
Date Tue 25/08/2026 07:48
To Yolanda Tafirenyika <y.kwaramba@WoodsHardwick.com>

Good morning Yolanda,

Anglian Water is able to confirm that we have no records of flooding in the vicinity that can be attributed to capacity limitations in the public sewerage system. It is possible that other flooding may have occurred that we do not have records of, other organisations such as the Local Authority, Internal Drainage Board or the Environment Agency may have records.

Kind regards,
Charlotte



Growth, Planning and Capacity

For details on how to submit a pre-planning enquiry to the Growth, Planning and Capacity team, please visit the ["how to apply"](#) section on our website.
Growth, Planning and Capacity team contact number: 0345 026 3912

Anglian Water Services Limited



Delivering a 10/10 experience is our minimum standard

So whether we've fallen short or nailed it, we'd love to know.
We look at - **and act on** - every piece of feedback we receive.

Visit anglianwater.co.uk/dsfeedback or click [here](#)

From: Yolanda Tafirenyika <y.kwaramba@WoodsHardwick.com>
Sent: 24 August 2026 16:11
To: Planning Liaison <planningliaison@anglianwater.co.uk>
Subject: 19906 Westlode Street, Spalding

EXTERNAL MAIL - Please be aware this mail is from an external sender - THINK BEFORE YOU CLICK

Dear Sirs,

We are interested in the site at the site at the below address - see attached Site Location Plan showing the site boundary edged in red.

Westlode Street, Spalding
Nearest Postcode: PE11 2AF
OS Grid Ref: 524947, 322990

We would be grateful if you could confirm whether there has been any sewer flooding incidents in the vicinity of the site.

Many thanks.

The information contained in this message is likely to be confidential and may be legally privileged. The dissemination, distribution, copying or disclosure of this

message, or its contents, is strictly prohibited unless authorised by Anglian Water.

It is intended only for the person named as addressee.

Anglian Water cannot accept any responsibility for the accuracy or completeness of this message, and does not authorise any contract to be made using the Internet.

If you have received this message in error, please immediately return it to the sender at the above address and delete it from your computer.

Anglian Water Services Limited

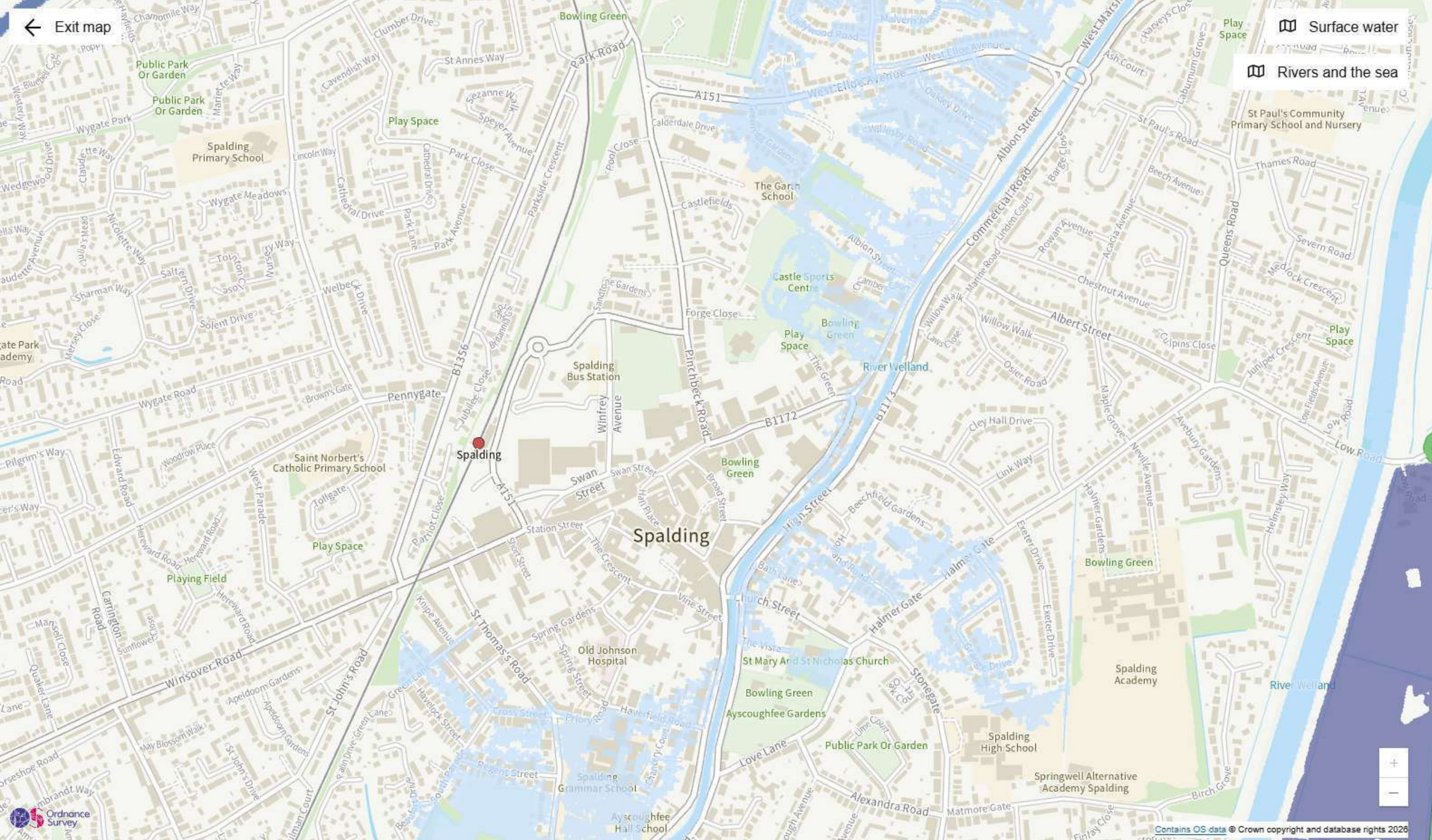
Registered Office: Lancaster House, Lancaster Way, Ermine Business Park, Huntingdon, Cambridgeshire, PE29 6XU

Registered in England No 2366656

Please consider the environment before printing this email.

Appendix K

Environment Agency - Reservoir Flood Map



Reservoirs map

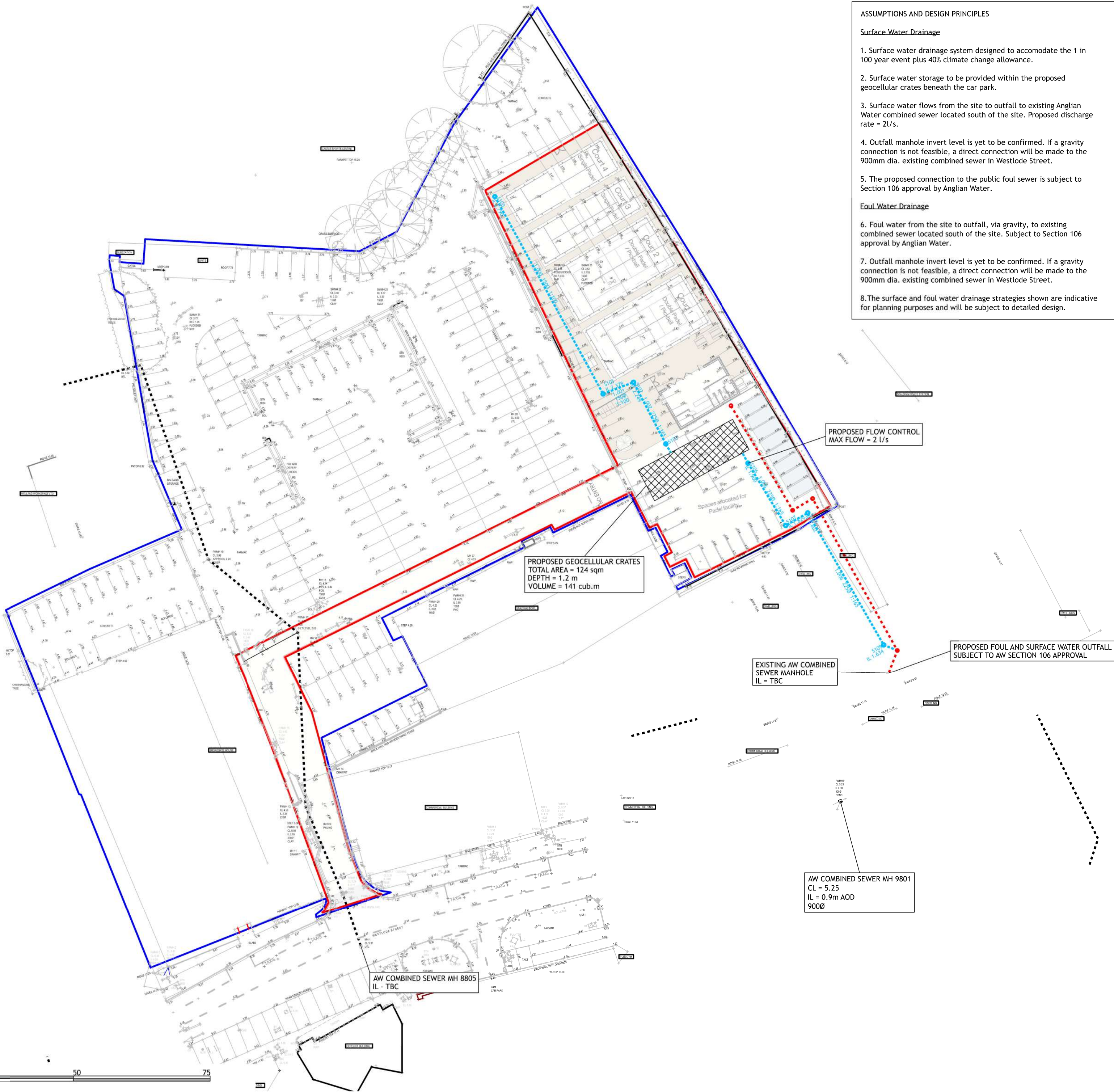
- ☒ Extent
 - When river levels are normal
 - When there is also flooding from rivers

Map details

- ☒ Show flooding

Appendix L

Drainage Calculations



- ASSUMPTIONS AND DESIGN PRINCIPLES**
- Surface Water Drainage**
- Surface water drainage system designed to accommodate the 1 in 100 year event plus 40% climate change allowance.
 - Surface water storage to be provided within the proposed geocellular crates beneath the car park.
 - Surface water flows from the site to outfall to existing Anglian Water combined sewer located south of the site. Proposed discharge rate = 2l/s.
 - Outfall manhole invert level is yet to be confirmed. If a gravity connection is not feasible, a direct connection will be made to the 900mm dia. existing combined sewer in Westlode Street.
 - The proposed connection to the public foul sewer is subject to Section 106 approval by Anglian Water.
- Foul Water Drainage**
- Foul water from the site to outfall, via gravity, to existing combined sewer located south of the site. Subject to Section 106 approval by Anglian Water.
 - Outfall manhole invert level is yet to be confirmed. If a gravity connection is not feasible, a direct connection will be made to the 900mm dia. existing combined sewer in Westlode Street.
 - The surface and foul water drainage strategies shown are indicative for planning purposes and will be subject to detailed design.

- NOTES**
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- SAFETY, HEALTH AND ENVIRONMENTAL**
- There are no exceptional risks associated with these works. Refer to the designers risk assessment for the full assessment of risks.

KEY	
—	Application Boundary
—	Ownership Boundary
- - - - -	Proposed surface water sewer
- - - - -	Proposed foul water sewer
	Proposed geo-cellular crates
- - - - -	Existing Anglian Water foul water sewer
—	Existing Anglian Water combined sewer

REV	DESCRIPTION	YTD	GBR	15.10.2026
1	Red line boundary amended			
2	PRELIMINARY			
3	INFORMATION			
4	TENDER			
5	CONSTRUCTION			
6	AS BUILT			
SCALE	1:500 @ A2	DATE	SEPTEMBER 2026	
DRAWN	YT	CHK	GBR	
DRAWING NO.	19906-PADE-5-102	REV	A	
TITLE	WESTLODE STREET SPALDING			
DETAILS	PROPOSED DRAINAGE STRATEGY			

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Appendix M

Proposed Drainage Strategy

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Node Type	Manhole Type	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
S100	0.024	5.00	3.540	Manhole	Adoptable	1200	524921.000	323006.000	0.900	2.640
S101	0.059	5.00	3.820	Manhole	Adoptable	1200	524941.000	322970.000	1.592	2.228
S102	0.036	5.00	3.780	Manhole	Adoptable	1200	524946.000	322972.000	1.681	2.099
S103	0.032	5.00	3.900	Manhole	Adoptable	1200	524952.000	322961.000	1.877	2.023
S104			3.900	Manhole	Adoptable	1	524952.000	322960.000	1.950	1.950
S105			3.985	Manhole	Adoptable	1	524966.000	322959.000	2.063	1.922
S106	0.000		4.015	Manhole	Adoptable	1200	524968.000	322956.000	2.115	1.900
S107	0.000		4.130	Manhole	Adoptable	1200	524974.000	322946.000	2.301	1.829
S108	0.000		4.130	Manhole	Adoptable	1200	524978.000	322948.000	2.328	1.802
S109			4.000	Manhole	Adoptable	1200	524992.000	322924.000	2.366	1.634
S110			4.000	Manhole	Adoptable	1200	524995.000	322923.000	2.385	1.615

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	T of C (mins)	Rain (mm/hr)
1.000	S100	S101	41.183	0.600	2.640	2.228	0.412	100.0	150	Circular	5.68	50.0
1.001	S101	S102	5.385	0.600	2.228	2.174	0.054	100.0	150	Circular	5.77	50.0
1.002	S102	S103	12.530	0.600	2.099	2.023	0.076	165.0	225	Circular	5.98	50.0
1.003	S103	S104	1.000	0.600	2.023	1.950	0.073	13.7	225	Circular	5.98	50.0
1.004	S104	S105	14.036	0.600	1.950	1.922	0.028	500.0	600	Circular	6.20	50.0
1.005	S105	S106	3.606	0.600	1.922	1.900	0.022	165.0	225	Circular	6.26	50.0
1.006	S106	S107	11.662	0.600	1.900	1.829	0.071	165.0	225	Circular	6.45	49.4
1.007	S107	S108	4.472	0.600	1.829	1.802	0.027	165.0	225	Circular	6.52	49.2
1.008	S108	S109	27.785	0.600	1.802	1.634	0.168	165.0	225	Circular	6.98	47.5
1.009	S109	S110	3.162	0.600	1.634	1.615	0.019	165.0	225	Circular	7.03	47.3

Name	US Node	DS Node	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Minimum Depth (m)	Maximum Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	S100	S101	1.005	17.8	4.3	0.750	1.442	0.750	1.442	0.024	0.0	51	0.833
1.001	S101	S102	1.005	17.8	15.0	1.442	1.456	1.442	1.456	0.083	0.0	106	1.124
1.002	S102	S103	1.015	40.4	21.5	1.456	1.652	1.456	1.652	0.119	0.0	116	1.029
1.003	S103	S104	3.554	141.3	27.3	1.652	1.725	1.652	1.725	0.151	0.0	66	2.756
1.004	S104	S105	1.082	305.9	27.3	1.350	1.463	1.350	1.463	0.151	0.0	120	0.680
1.005	S105	S106	1.015	40.4	27.3	1.838	1.890	1.838	1.890	0.151	0.0	136	1.088
1.006	S106	S107	1.015	40.4	27.0	1.890	2.076	1.890	2.076	0.151	0.0	135	1.086
1.007	S107	S108	1.015	40.4	26.8	2.076	2.103	2.076	2.103	0.151	0.0	134	1.083
1.008	S108	S109	1.015	40.4	25.9	2.103	2.141	2.103	2.141	0.151	0.0	131	1.076
1.009	S109	S110	1.015	40.4	25.8	2.141	2.160	2.141	2.160	0.151	0.0	131	1.076

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	x	1 year (l/s)	1.2
Rainfall Events	Singular	Drain Down Time (mins)	240	30 year (l/s)	3.6
Summer CV	1.000	Additional Storage (m³/ha)	20.0	100 year (l/s)	5.0
Winter CV	1.000	Starting Level (m)		Check Discharge Volume	x
Analysis Speed	Normal	Check Discharge Rate(s)	✓		

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	40	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)	1.000	Betterment (%)	0
SAAR (mm)	559	QBar	1.4
Soil Index	2	Q 1 year (l/s)	
SPR	0.30	Q 30 year (l/s)	
Region	5	Q 100 year (l/s)	
Growth Factor 1 year	0.85		

Node S106 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	1.900	Product Number	CTL-SHE-0067-2000-1000-2000
Design Depth (m)	1.000	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node S105 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	1.922
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	124.0	124.0	1.200	124.0	171.4	1.201	0.0	171.4

Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S100	11	2.689	0.049	4.3	0.0821	0.0000	OK
15 minute summer	S101	11	2.344	0.116	14.7	0.2166	0.0000	OK
15 minute summer	S102	11	2.219	0.120	20.4	0.1867	0.0000	OK
15 minute summer	S103	11	2.126	0.103	25.9	0.1509	0.0000	OK
240 minute summer	S104	172	2.096	0.146	9.8	0.0000	0.0000	OK
240 minute summer	S105	168	2.088	0.166	8.6	19.5808	0.0000	OK
240 minute summer	S106	172	2.088	0.188	2.2	0.2127	0.0000	OK
240 minute summer	S107	168	1.863	0.034	1.8	0.0387	0.0000	OK
240 minute summer	S108	168	1.834	0.032	1.8	0.0367	0.0000	OK
240 minute summer	S109	172	1.669	0.035	1.8	0.0392	0.0000	OK
240 minute summer	S110	172	1.647	0.032	1.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S100	1.000	S101	4.2	0.425	0.235	0.4040	
15 minute summer	S101	1.001	S102	14.3	1.049	0.807	0.0735	
15 minute summer	S102	1.002	S103	20.5	1.051	0.509	0.2447	
15 minute summer	S103	1.003	S104	26.0	1.420	0.184	0.0185	
240 minute summer	S104	1.004	S105	8.6	0.492	0.028	0.8179	
240 minute summer	S105	1.005	S106	2.2	0.176	0.054	0.1206	
240 minute summer	S106	1.006	S107	1.8	0.494	0.045	0.0431	
240 minute summer	S107	1.007	S108	1.8	0.500	0.045	0.0163	
240 minute summer	S108	1.008	S109	1.8	0.495	0.045	0.1025	
240 minute summer	S109	1.009	S110	1.8	0.495	0.045	0.0117	30.7

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.45%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S100	12	3.034	0.394	13.1	0.6560	0.0000	SURCHARGED
15 minute summer	S101	11	2.857	0.629	40.6	1.1769	0.0000	SURCHARGED
15 minute summer	S102	11	2.453	0.354	57.7	0.5512	0.0000	SURCHARGED
240 minute winter	S103	232	2.396	0.373	14.7	0.5487	0.0000	SURCHARGED
240 minute winter	S104	232	2.396	0.446	27.2	0.0000	0.0000	OK
240 minute winter	S105	232	2.396	0.474	14.0	55.8017	0.0000	SURCHARGED
240 minute winter	S106	232	2.396	0.496	2.1	0.5605	0.0000	SURCHARGED
30 minute winter	S107	27	1.864	0.035	2.0	0.0400	0.0000	OK
60 minute summer	S108	39	1.836	0.034	2.0	0.0380	0.0000	OK
30 minute summer	S109	28	1.670	0.036	2.0	0.0406	0.0000	OK
30 minute summer	S110	28	1.649	0.034	2.0	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 summer	S100	1.000	S101	12.3	0.700	0.694	0.7250	
15 minute summer	S101	1.001	S102	39.0	2.214	2.196	0.0948	
15 minute summer	S102	1.002	S103	57.2	1.438	1.417	0.4980	
240 minute winter	S103	1.003	S104	27.2	0.883	0.193	0.0398	
240 minute winter	S104	1.004	S105	14.0	0.630	0.046	3.2504	
240 minute winter	S105	1.005	S106	2.1	0.214	0.051	0.1434	
240 minute winter	S106	1.006	S107	2.0	0.503	0.048	0.0453	
30 minute winter	S107	1.007	S108	2.0	0.510	0.048	0.0172	
60 minute summer	S108	1.008	S109	2.0	0.505	0.048	0.1077	
30 minute summer	S109	1.009	S110	2.0	0.505	0.048	0.0123	29.1

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.59%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S100	10	3.540	0.900	30.6	1.4976	4.9859	FLOOD
15 minute summer	S101	10	3.661	1.433	63.2	2.6835	0.0000	FLOOD RISK
15 minute summer	S102	11	2.948	0.849	88.3	1.3242	0.0000	SURCHARGED
360 minute winter	S103	352	2.915	0.892	18.2	1.3132	0.0000	SURCHARGED
360 minute winter	S104	352	2.914	0.964	20.1	0.0000	0.0000	SURCHARGED
360 minute winter	S105	352	2.914	0.992	17.6	116.8950	0.0000	SURCHARGED
360 minute winter	S106	352	2.914	1.014	2.1	1.1473	0.0000	SURCHARGED
360 minute winter	S107	352	1.865	0.036	2.0	0.0403	0.0000	OK
360 minute winter	S108	352	1.836	0.034	2.0	0.0382	0.0000	OK
360 minute winter	S109	352	1.670	0.036	2.0	0.0409	0.0000	OK
360 minute winter	S110	352	1.649	0.034	2.0	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 summer	S100	1.000	S101	14.9	0.847	0.840	0.7250	
15 minute summer	S101	1.001	S102	52.3	2.973	2.947	0.0948	
15 minute summer	S102	1.002	S103	85.9	2.160	2.129	0.4983	
360 minute winter	S103	1.003	S104	20.1	0.833	0.142	0.0398	
360 minute winter	S104	1.004	S105	17.6	0.636	0.058	3.9536	
360 minute winter	S105	1.005	S106	2.1	0.167	0.051	0.1434	
360 minute winter	S106	1.006	S107	2.0	0.505	0.049	0.0458	
360 minute winter	S107	1.007	S108	2.0	0.512	0.049	0.0173	
360 minute winter	S108	1.008	S109	2.0	0.507	0.049	0.1089	
360 minute winter	S109	1.009	S110	2.0	0.507	0.049	0.0124	60.4

