

**Flood Risk Assessment &
Surface Water Drainage
Strategy**

June 2023



Former Bull & Monkie Pub

Churchgate, Spalding

PE11 2RA

Abbey Healthcare

Document History

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The content of this report is based on information available as of June 2023, the validity of the statements made may therefore vary over time as planning guidance / policies and the evidence base change.

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1 Introduction

- 1.1 This Flood Risk Assessment and SuDS Statement has been prepared by EAS Transport Planning on behalf of Abbey Healthcare (hereinafter referred to as the 'applicant'), regarding the proposed redevelopment of the former Bull and Monkie Pub, Churchgate, Spalding PE11 2RA (hereinafter, the 'site').
- 1.2 A location plan is contained at **Appendix A**.
- 1.3 The site is located within the administrative planning boundaries of South Holland District Council ('SHDC'), while Lincolnshire County Council ('LCC') act as the Lead Local Flood Authority (LLFA).
- 1.4 The site currently consists the former Bull and Monkie Public House, and it is proposed that this will be demolished and redeveloped to contain an 88 bedroom elderly residential care home, spread across four floors.
- 1.5 The care home will offer 17 x bedrooms on the ground floor, 25 x bedrooms on the first floor, 27 x bedrooms on the second floor and 19 x bedrooms on the third floor. The proposals will also offer Lounge and Dining areas across all floors, as well as a quiet and activity room on the third floor. There is a kitchen and staff areas in a semi-basement floor.
- 1.6 The proposed site layouts are included within **Appendix B**.
- 1.7 The site falls within Flood Zone 3 of the Environment Agency (EA) Flood Map for Planning, which would indicate a high risk of flooding. However, when defences are taken into account the site is protected up to a 0.1% annual probability flood event.
- 1.8 The content of this report is based on the advice set out in the National Planning Policy Framework (NPPF) published in July 2021, Annex 3: Flood risk vulnerability classification, also from the NPPF and PPG 'Guidance for Flood Risk and Coastal Change', updated in August 2022.
- 1.9 This report is based on a site-specific topographic survey, BGS geological maps, Environment Agency (EA) flood maps and consultation, local flood risk policy, Thames Water sewer records and OS mapping.
- 1.10 This document includes:
 - Section 2 - sets out the relevant flood risk and drainage policy background;
 - Section 3 - provides background information on the site;
 - Section 4 - reviews and discusses the flood risk to the development;
 - Section 5 - outlines any mitigation measures;
 - Section 6 - sets out the SuDS proposals;
 - Section 7 - discusses the SuDS maintenance and management requirements; and
 - Section 8 - summarises and concludes the report.

2 Policy Context

Introduction

- 2.1 This section sets out the policy context. This report is based on the advice set out in the National Planning Policy Framework (NPPF) published in July 2021 and the Planning Practice Guidance (PPG) updated in August 2022.

National Policy

- 2.2 Paragraph 167 footnote 55 of the NPPF states:

“A site-specific flood risk assessment should be provided for all developments in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.”

- 2.3 The flood risk zones are defined as:

- Flood Zone 1- This zone comprises land assessed as having a less than 1 in 1,000 annual probability of river flooding (<0.1%)
- Flood Zone 2- This zone comprises land assessed as having between a 1 in a 100 and 1 in 1,000 annual probability of river flooding.
- Flood Zone 3a- This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), and for tidal flooding at least a 0.5% annual probability of flooding from tidal sources.
- Flood Zone 3b- This zone comprises land where water has to flow or be stored in times of flood.

- 2.4 Paragraph 155 discusses the suitability of development location, particularly with regard to future risks induced by climate change:

“Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere”.

- 2.5 Paragraph 159 of the National Planning Policy Framework (NPPF) states:

“Strategic policies should be informed by a strategic flood risk assessment, and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards”.

2.6 Paragraph 165 of the NPPF discusses the application of sustainable drainage systems:

“Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:

- *Take account of advice from the lead local flood authority;*
- *Have appropriate proposed minimum operational standards;*
- *Have maintenance arrangements in place to ensure an acceptable standard of operation of the lifetime of the development; and*
- *Where possible, provide multifunctional benefits.”*

2.7 The Flood Map for Planning shows the site to be mostly located in Flood Zone 3, at a ‘high’ risk of flooding from fluvial or tidal sources. However, when defences are taken into account the site is protected up to a 0.1% annual probability flood event. The EA Flood Map as well as the Product 4 flood mapping and data, are enclosed in **Appendix C**.

2.8 The fluvial flood risks at the site are assessed in detail in Section 4 of this report.

Local Policy

South East Lincolnshire Local Plan

2.9 South Holland District Council prepared a new Local Plan jointly with Boston Borough Council and Lincolnshire County Council. The Plan was adopted on 8 March 2019.

2.10 Policy 4: ‘Approach to Flood Risk below, provides guidance on how the Council’s will approach flood risk taking account of the location specific risks.

Development proposed within an area at risk of flooding (Flood Zones 2 and 3 of the Environment Agency’s flood map or at risk during a breach or overtopping scenario as shown on the flood hazard and depths maps in the Strategic Flood Risk Assessment) will be permitted, where:

1. It can be demonstrated that there are no other sites available at a lower risk of flooding (i.e., that the sequential test is passed). The sequential test will be based on a Borough or District wide search area of alternative sites within the defined settlement boundaries, unless local circumstances relating to the catchment area for the development justify a reduced search area, i.e., there is a specific need for the development in that location. The sequential test is not required for sites allocated in the Local Plan, minor development1 or change of use (except for a change of use to a caravan, camping or chalet site, or to a mobile home or park home site).

2. It can be demonstrated that essential infrastructure in FZ3a & FZ3b, highly vulnerable development in FZ2 and more vulnerable development in FZ3 provide wider sustainability benefits to the community that outweigh flood risk.

3. The application is supported with a site-specific flood risk assessment, covering risk from all sources of flooding including the impacts of climate change and which:

a. demonstrate that the vulnerability of the proposed use is compatible with the flood zone;

- b. identify the relevant predicted flood risk (breach/overtopping) level, and mitigation measures that demonstrate how the development will be made safe and that occupants will be protected from flooding from any source;*
- c. propose appropriate flood resistance and resilience measures (following the guidance outlined in the Strategic Flood Risk Assessment), maximising the use of passive resistance measures (measures that do not require human intervention to be deployed), to ensure the development maintains an appropriate level of safety for its lifetime;*
- d. include appropriate flood warning and evacuation procedures where necessary (referring to the County's evacuation routes plan), which have been undertaken in consultation with the authority's emergency planning staff;*
- e. incorporates the use of Sustainable Drainage Systems (SuDS) (unless it is demonstrated that this is not technically feasible) and confirms how these will be maintained/managed for the lifetime of development (surface water connections to the public sewerage network will only be permitted in exceptional circumstances where it is demonstrated that there are no feasible alternatives);*
- f. demonstrates that the proposal will not increase risk elsewhere and that opportunities through layout, form of development and green infrastructure have been considered as a way of providing flood betterment and reducing flood risk overall;*
- g. demonstrates that adequate foul water treatment and disposal already exists or can be provided in time to serve the development;*
- h. ensures suitable access is safeguarded for the maintenance of water resources, drainage and flood risk management infrastructure.*

Development in all flood zones, and development over 1 hectare in size in Flood Zone 1, will need to demonstrate that surface water from the development can be managed and will not increase the risk of flooding to third parties.

Change of use of existing buildings will be supported providing they do not pose an increase in risk to people. Change of use that would result in self-contained ground floor residential accommodation in areas of hazard rating danger for some', 'danger for most' and 'danger for all' will not be supported. In these areas unrestricted access to a habitable room above the flood level and an emergency evacuation plan will be required.

Caravans, mobile homes and park homes intended for permanent residential use will not be permitted in areas at risk of flooding. Caravan, chalet, log cabin, camping and touring sites at risk of fluvial flooding where there is a 'danger for most' and 'danger for all' will not be permitted.

Occupancy of caravan, chalet, log cabin, camping and touring sites at risk of tidal flooding will not be permitted to open between 1st November in any one year and the 14th March in the succeeding year.

No development will be permitted within a 50m buffer from the toe of the raised Witham Haven Banks (flood defences), as shown on the indicative Plan contained in Appendix 10, to allow access for construction and maintenance.

Flood risk management infrastructure shall be provided at the strategic level, where development opportunities allow, to reduce the hazard and probability of flooding.

South East Lincolnshire Strategic Flood Risk Assessment (March 2017)

- 2.11 The SFRA notes that around 74% of South Holland lies within the floodplain with 68% in Flood Zone 3. The SFRA includes modelling of the combined fluvial and tidal risks including an allowance for climate change.
- 2.12 The hazard and depth mapping produced indicates the results of defences being overtopped or breached.
- 2.13 A 2006 baseline and 2115 future year scenario were modelled, the latter being the year the DEFRA sea level allowances relate to and allows for the lifetime of development.
- 2.14 The breach locations are shown to be located along the Coronation Channel which runs along the eastern boundary of the main urban area of Spalding and the River Glen located circa 4km to the west of Spalding.
- 2.15 The model results have been reviewed and used to assess the flood risk within Section 4 of this report.

3 Existing Site Assessment

Site Description

- 3.1 The site currently consists the former Bull and Monkie Public House and it is proposed that this will be demolished and redeveloped to contain an 88 bedroom elderly residential care home, spread across four floors.
- 3.2 The site currently contains a number of buildings, paved parking areas and landscaping/scrub land.
- 3.3 The care home will offer 17 x bedrooms on the ground floor, 25 x bedrooms on the first floor, 27 x bedrooms on the second floor and 19 x bedrooms on the third floor. The proposals will also offer Lounge and Dining areas across all floors, as well as a quiet and activity room on the third floor. There is a kitchen and staff areas in a semi-basement floor.
- 3.4 A location plan is contained in **Appendix A** and the proposals are contained in **Appendix B**.

Local Watercourses

- 3.5 Spalding is located in the fens and was at one time Marshland. As a result, there are a number of local watercourses and drains, a combination of natural and engineered channels. The main watercourses are identified below.
- 3.6 Running parallel with the site to the west of Churchgate is the River Welland, which flows from south to north through Spalding. 800m to the south of the site the Coronation Channel commences, diverting water from the main River Welland channel offering protection preventing flooding within the town. The channel re-joins the River Welland at the Marsh Lane Sluice, 2km to the north of the site. The sluice is understood to protect the town against rises in the level of the tidal section of the River Welland to the north.
- 3.7 Circa 4km to the west of Spalding is the River Glen which joins the River Welland 6km to the north of Spalding.
- 3.8 The Vernatt's Drain located 2km to the east of the site was formed as part of the draining of the local area in the 17th Century and also joins the River Welland 6km to the north of the town.

Geology

- 3.9 With reference to the BGS Geology Viewer (<https://geologyviewer.bgs.ac.uk/>) the site is in a location with a bedrock of Oxford Clay Formation – mudstone with superficial deposits of Tidal Flat Deposits - clay and silt. The local geology is not considered conducive to infiltration.
- 3.10 There are no borehole records within the site or within close proximity of the site.

Site Levels

- 3.11 A topographic survey is enclosed at **Appendix D**. Site levels range between 4.5mAOD in the south-eastern corner of the site to 6.88mAOD in the south-western corner of the site. The existing building has a threshold level of approximately 6.41mAOD. Analysis undertaken in Civils3d identified a mean site level of 5.752mAOD.

Existing Drainage

- 3.12 A formal surface water drainage system is currently in place at the existing site. A CCTV drainage survey identifies a private surface water sewer serving the existing roof area with a series of gullies serving the areas of hardstanding.
- 3.13 A CCTV drainage survey confirmed the presence of an existing surface water manhole located in the south eastern corner of the site. A 150dia surface water sewer is then shown to outfall a surface water sewer located within The Vista via a two stage interceptor. This section of surface water sewer is not mapped as an adopted sewer on the Anglian Water records however the CCTV survey confirmed this surface water sewer ultimately outfalls to the Anglian Water sewer network to the south of the site at the approximate location of MH 9451.
- 3.14 The existing surface water drainage infrastructure will be removed as part of the works however it is proposed to reuse the existing surface water outfall.
- 3.15 The existing surface water drainage plan as informed by the CCTV drainage survey can be viewed in **Appendix E**.

Sewer Records

- 3.16 Anglian Water sewer records are enclosed at **Appendix F**.
- 3.17 There is an adopted 150mm Anglian Water foul sewer and manhole shown to commence within the site, which continues across Church Street to the north. It is assumed that the sewer connection and manhole (ref.9507) which falls within the proposed access road, will be retained to serve the proposed development.

4 Potential Sources of Flooding

Fluvial

- 4.1 A copy of the Flood Map for Planning is included in **Appendix C**. The site falls within Flood Zone 3 of the Environment Agency (EA) Flood Map for Planning, which would indicate a high risk of flooding. However, when defences are taken into account the site is protected up to a 0.1% annual probability flood event.
- 4.2 The received EA Product 4 flood mapping and level information is also contained in **Appendix C**. The provided Flood Map indicates the site is at risk of flooding, assuming no flood defences exist, for a flood with a 0.5% chance of occurring in any year for flooding from the sea, or a 1% chance of occurring for fluvial (river) flooding.
- 4.3 However, it was noted in the provided notes that:
- “...in some locations, such as around the fens and the large coastal floodplains, showing the area at risk of flooding assuming no defences may give a slightly misleading picture in that if there were no flood defences, water would spread out across these large floodplains. This flooding could cover large areas of land but to relatively shallow depths and could leave pockets of locally slightly higher land as isolated dry islands. It is important to understand the actual risk of the flooding to these dry islands, particularly in the event of defence failure.....The Flood Map also shows the location of formal raised flood defences and flood storage reservoirs. It represents areas at risk of flooding for present day only and does not take account of climate change...”*
- 4.4 Hence, the provided defended flood map indicates that the site and the town area shown would be entirely free of flooding in a defended scenario; and there is no evidence of any historic flood events.

Flood Defences

- 4.5 The EA Product 4 identified that the existing fluvial defences reducing the risk of flooding to this site consist of Crowland & Cowbit Washes and embankment. They are identified to be in fair condition and provide protection against a flood event with a 1% chance of occurring in any year (1 in 100).

Fluvial Modelled Levels and Flows

- 4.6 The Product 4 included modelled fluvial flood levels and flows for “in-channel” levels within the Welland River. In-channel levels do not represent the flood level experienced outside of the channel and therefore should be treated with caution. The closest node to the site ‘SPALDING_CHANNEL 2068.5’ has a maximum 0.1% plus 20% climate change flood level of 4.67mAOD. Based on this level a very small area in the south-eastern corner of the site could be at risk of flooding, however this would not occur due to the available flood defences; as illustrated on the defended flood map provided.

South East Lincolnshire Strategic Flood Risk Assessment (March 2017) Flood Modelling

- 4.7 As identified in section 2 of this report, the SFRA notes that around 74% of South Holland lies within the floodplain with 68% in Flood Zone 3. The SFRA includes modelling of the combined

fluvial and tidal risks including an allowance for climate change. The hazard and depth mapping produced indicates the results of defences being overtopped or breached. A 2006 baseline and 2115 future year scenario were modelled, the latter being the year the DEFRA sea level allowances relate to and allows for the lifetime of development. The breach locations are shown to be located along the Coronation Channel which runs along the eastern boundary of the main urban area of Spalding and the River Glen located circa 4km to the west of Spalding.

4.8 The model results contained within Appendices A, B, C and D of the SFRA have been reviewed and a summary of the results for the site included below.

4.9 In summary, the site has a:

- maximum hazard rating of 'Danger for Most' in the 2115 1% fluvial and 0.5% tidal combined scenario and the 0.1% fluvial scenario;
- potential flood depths of between 0 to 2m in the 2115 1% fluvial and 0.5% tidal combined scenario and the 0.1% fluvial scenario. It should be noted that the average flood level shown on the site in both scenarios falls within the 0.5-1m category; and
- potential velocities of 0 to 0.3m/s in the 2115 1% fluvial and 0.5% tidal combined scenario and the 0.1% fluvial scenario.

4.10 Also, within Appendix C of the SFRA is a standing advice table. Cell C9 provides the site specific requirements for a Major development and an extract of the advice is provided below.

The Environment Agency requires direct consultation on proposals in this hazard zone. The NPPF requires that proposals are accompanied by a Flood Risk Assessment which contains evidence that appropriate mitigation measures/flood resilience techniques have been incorporated into the development. The Environment Agency also wish to be consulted on the Sequential Test evidence. Applicants will need to demonstrate that housing proposals are required to meet an identified local housing need.

The applicant is advised to refer to the following document for information on flood resilience and resistance techniques to be included: 'Improving Flood Performance of New Buildings - Flood Resilient Construction' (DCLG 2007). Finished floor levels (FFL) should be informed by the predicted flood depth maps (refer to the relevant 2115 1% fluvial or 0.5% tidal Max Depth Map) and set as required below (single storey proposals must use the 0.1% event, 2115 scenario, for setting FFLs):

depths of >1.6m

It is unlikely that mitigation measures would prevent flood water from entering the building at ground floor level. Therefore, proposals must have a minimum of 2 storeys with no ground floor habitable accommodation. The first floor living accommodation must be above the highest predicted flood depth. *

depths of 1-1.6m

Proposals must have a minimum of 2 storeys, with FFL set a minimum of 1m above existing ground level, flood resilient construction to a height 300mm above the predicted flood depth, and demountable defences to 600mm above FFL.

depths 0.5 - 1m

FFL must be set 1m above ground level, with flood resilient construction to a height of 300mm above the predicted flood depth.

depths of 0.25 - 0.5

FFL must be set 500mm above ground level, with flood resilient construction to a height 300mm above the predicted flood depth.

depths 0 - 0.25

FFL must be set 300mm above ground level.

* Where there is to be no ground floor habitable accommodation, the Environment Agency requires the imposition of the following conditions in order to ensure this space is not subsequently developed:

CONDITION

The ground floor[s] of the [property][properties][plot nos. *] hereby approved shall be used as [garage][WC][utility][bath/shower room] only and as annotated on approved drawings ***, and for no other habitable accommodation.

- 4.11 On the basis of the average flood level on the site of 0.5-1m, the advice set out in these cells require that proposals require finished floor levels (FFL) set a minimum of 1m above existing ground level and flood resilient construction to a height 300mm above the predicted flood depth.
- 4.12 As per the requirements of the standing advice table the EA have been consulted regarding the proposed application and as a result have provided further detail on the requirements mitigation measures based on the SFRA modelling. Correspondence between the EA and EAS is contained in **Appendix C**.
- 4.13 The EA requested that the following mitigation measures be included as part of the development:
- Proposals must have a minimum of 2 storeys, with FFL set a minimum of 1m above existing ground level (**6.752mAOD**),
 - Flood resilient construction to a height 300mm above the predicted flood depth, and demountable defences to 600mm above FFL.
 - We would accept the basement to be used as ancillary use only, with no habitable accommodation on this level.
- 4.14 Mitigation measures are detailed in the next section of this report.

Surface Water

- 4.15 Surface water flooding refers to flooding caused when the intensity of rainfall, particularly in urban areas, can create runoff which temporarily overwhelms the capacity of the local drainage systems or does not infiltrate into the ground. The water ponds on the ground and flows towards low-lying land. This source of flood risk is also known as 'pluvial'.
- 4.16 The surface water flood map provided as part of the Product 4 pack is included in **Appendix G**. The site and adjacent public highway is shown to be entirely at a very low risk of surface water flooding; less than a 0.1% annual probability.

Groundwater

- 4.17 It is recommended groundwater levels are confirmed via site specific ground investigations. It is anticipated a suitably worded condition could allow for such site investigation post-planning. Any mitigation measures concluded from the site investigation would need to be facilitated, particularly with reference to the semi-basement level.

Reservoir

- 4.18 The Long Term Flood Risk map shows the western and southern parts of the site to be in a reservoir flood risk area, when there is also flooding from rivers (<https://flood-warning-information.service.gov.uk/long-term-flood-risk/map>). A copy of the reservoir flood map is included in **Appendix H**.
- 4.19 The source of flooding appears to be from Rutland Water, located around 25km to the south west. The risk of a reservoir failing is extremely low due to the rigorous inspections and management that take place to maintain these features. The risk of a reservoir flooding is therefore considered to be residual.

- 4.20 Given the risk is limited to when there is also flooding from rivers and the site is defended from a fluvial event the flood risk is likely to be extremely low. However, the proposed mitigation measures set out in the next section of this report would offer some protection.

Sewer Flooding

- 4.21 Sewer flooding generally results from localised short-term intense rainfall events overloading the capacity of the private and public drainage or due to failures within the public sewer.
- 4.22 The adopted sewers in the local area appear to be limited to the foul sewer which commences from within the site boundary. The risk of the foul sewer surcharging are anticipated to be low; however, should this occur the effluent is unlikely to enter the proposed building due to the proposed raised FFL.

5 Mitigation Measures and Required Consents

5.1 As identified in Section 4, the EA have provided pre-application advice and requested that the following mitigation measures be included as part of the development:

- Proposals must have a minimum of 2 storeys, with FFL set a minimum of 1m above existing ground level (6.752mAOD).
- Flood resilient construction to a height 300mm above the predicted flood depth, and demountable defences to 600mm above FFL.
- We would accept the basement to be used as ancillary use only, with no habitable accommodation on this level.

5.2 Each of these measures are described in more detail below.

Finished Floor Levels

5.3 Analysis undertaken in Civils3d identified a mean site level of 5.752mAOD. On this basis a minimum FFL of 6.752mAOD is proposed.

Sleeping Accommodation

5.4 The EA have confirmed that ground floor sleeping accommodation at a FFL of 6.752mAOD is acceptable.

Safe Refuge

5.5 A first, second and third floor is available should a refuge area be required.

Flood Resilience Construction

5.6 On the basis of the EA advice and a FFL of 6.752mAOD, flood resilient design is required to 7.052mAOD and demountable defences to 7.352mAOD.

5.7 It is recommended that flood resilience measures within the “Improving the Flood Performance of New Buildings” document published by DEFRA are reviewed by the project architect and structural engineer. Some potential measures are included below.

Floors-

- The use of suspended floors.
- A suitable DPM.
- Floor insulation of a closed cell type.
- Floor types of either water resistant or easily replaceable materials.

Walls-

- Ensure high quality workmanship at all stages of construction

- Where possible, use engineering bricks up to predicted flood level plus one course of bricks to provide freeboard
- Aircrete blocks allow less leakage than typical concrete blocks but concrete blocks dry more quickly
- Do not use highly porous bricks such as hand- made clay bricks.
- Raise air vents/bricks (if required).

Services-

- Pipework: Closed cell insulation should be used for pipes.
- Drainage services: non-return valves are recommended in the drainage system to prevent back-flow.
- Water, electricity and gas meters: should be located above predicted flood level.
- Electrical services: electrical sockets should be installed above flood level.
- Electric ring mains should be installed at first floor level with drops to ground floor sockets and switches.
- Heating systems: boiler units and ancillary devices should be installed above predicted flood level.
- Communications wiring: wiring for telephone, TV, Internet and other services should be protected by suitable insulation agreed with relevant service.

Flood Warning and Evacuation

- 5.8 The site is located within the '*Eastern areas of Spalding on the right bank of the river Welland and surrounding areas, including Deeping St Nicholas, Crowland, Cowbit, Moulton and Whaplode*' Flood Warning Area. A warning cannot be given for a breach however such an event is likely to occur when river levels are also high.
- 5.9 It is recommended that the care home management subscribe to the EA flood warning service by using the link: <https://www.fws.environment-agency.gov.uk/app/olr/home>. Alternatively, registration can be completed by telephone via the EA Floodline on 0345 988 1188 or Typetalk 0345 602 6340.
- 5.10 For information on EA Flood Information in the local area, the GOV.UK website can be used: <https://flood-warning-information.service.gov.uk/>
- 5.11 It is also recommended that the care home management sign up to MET Office which can be found here: <https://www.metoffice.gov.uk/weather/warnings-and-advice/uk-warnings#?date=2023-04-12>.
- 5.12 It is proposed that the managers of the care home will be provided with guidance in the form of a Flood Warning and Evacuation Plan. A Flood Warning and Evacuation Plan sets out the flood risks and how best to manage them, including what to expect in a flood event and how to react at different levels of flood warnings, including before and after a flood event.

- 5.13 A separate Flood Warning and Evacuation Plan document will be provided post planning via a suitably worded
- 5.14 condition.

Main River Easement & EA Permit

- 5.15 All built development is located outside the 8m easement from The River Welland therefore a Flood Risk Activity is not considered to be required.

6 Surface Water Drainage Assessment

Relevant SuDS Policy

- 6.1 SuDS mimic the natural drainage system and provide a method of surface water drainage which can decrease the quantity of water discharged, and hence reduce the risk of flooding. In addition to reducing flood risk, these features can improve water quality and provide biodiversity and amenity benefits.
- 6.2 The SuDS management train incorporates a hierarchy of techniques and considers all three SuDS criteria of flood reduction, pollution reduction, and landscape and wildlife benefit. In decreasing order of preference, the preferred means of disposal of surface water runoff is:
- Discharge to ground.
 - Discharge to a surface water body.
 - Discharge to a surface water sewer.
 - Discharge to a combined sewer.
- 6.3 The philosophy of SUDS is to replicate as closely as possible the natural drainage from a site pre-development and to treat runoff to remove pollutants, resulting in a reduced impact on the receiving watercourses. The benefits of this approach are as follows:
- Reducing runoff rates, thus reducing the flood risk downstream.
 - Reducing pollutant concentrations, thus protecting the quality of the receiving water body.
 - Groundwater recharge.
 - Contributing to the enhanced amenity and aesthetic value of development areas.
 - Providing habitats for wildlife in developed areas, and opportunity for biodiversity enhancement.

Site-Specific SuDS

- 6.4 The various SuDS methods need to be considered in relation to site-specific constraints. Several SuDS options are available to reduce or temporarily hold back the discharge of surface water runoff. Table 6.1 outlines the constraints and opportunities to each of the SuDS devices in accordance with the hierarchical approach outlined in The SuDS Manual CIRIA C753. It also indicates what could and could not be incorporated within the development, based upon site-specific criteria.

Device	Description	Constraints / Comments	Appropriate
Living roofs (source control)	Provide soft landscaping at roof level which reduces surface water runoff.	Extent of plant and PV requirement leaves no area available for green roof. The sensitive nature of site and thus the architecture including the	No

		scale / heights would not be suitable in this instance for the implementation of green roof	
Infiltration devices & Soakaways (source control)	Store runoff and allow water to percolate into the ground via natural infiltration.	Local geology not considered conducive to infiltration	No
Pervious surfaces (source control)	Storm water is allowed to infiltrate through the surface into a storage layer, from which it can either infiltrate and/or slowly release to sewers.	Lined permeable paving is proposed	Yes
Rainwater harvesting (source control)	Reduces the annual average rate of runoff from the Site by reusing water for non-potable uses e.g., toilet flushing, recycling processes.	Not currently proposed. Spatial constraints mean below ground tanks for rainwater harvesting could be facilitated. Water saving design within the building could be implemented e.g., reduced flush devices	Possibly
Swales (permeable conveyance)	Broad shallow channels that convey / store runoff, and allow infiltration (ground conditions permitting).	No suitable location on site for this feature	No
Filter drains & perforated pipes (permeable conveyance)	Trenches filled with granular materials (to take flows from adjacent impermeable areas) that convey runoff while allowing infiltration.	Infiltration not being pursued	No
Filter Strips (permeable conveyance)	Wide gently sloping areas of grass or dense vegetation that remove pollutants from run-off from adjacent areas.	Not proposed	No
Infiltration basins (end of pipe treatment)	Depressions in the surface designed to store runoff and allow infiltration.	Infiltration not being pursued.	No
Wet ponds & constructed wetlands (end of pipe treatment)	Provide water quality treatment & temporary storage above the permanent water level.	Not proposed- no suitable location for such a feature on site.	No
Attenuation Underground (end of pipe treatment)	Oversized pipes or geo-cellular tanks designed to store water below ground level.	Attenuation tanks have been proposed to provide additional storage where required	Yes.

Table 6.1: Site Specific Sustainable Drainage

Rainfall Allowances

- 6.5 Utilising the peak rainfall allowances as published on the gov.uk website (<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#peak-rainfall-intensity-allowance>) a climate change allowance of 40% is applicable here (2070s upper end allowance).

Proposed Surface Water Drainage Strategy

- 6.6 The surface water drainage design has been designed using FEH 22 rainfall data for the 100yr +40% climate change event.
- 6.7 The local geology is not considered conducive to infiltration and infiltration tests are not going to be pursued. The CCTV drainage survey confirms there is an existing surface water drainage connection that can be re-utilised and as such an attenuation strategy with a restricted outfall has been proposed. Causeway Flow calculations are enclosed in **Appendix I** and the Surface Water Drainage Sketch is enclosed in **Appendix J**.
- 6.8 Post planning an indirect connection S106 application will need to be agreed with Anglian Water.
- 6.9 The site is spatially constrained and the presence of root protection zones along the eastern boundary further restricts the ability to implement above ground SuDS features. A green roof is not possible as the extent of plant and PV requirement leaves no area available for green roof.
- 6.10 The sensitive nature of site and thus the architecture including the scale / heights would not be suitable in this instance for the implementation of green roof.
- 6.11 A green roof has however been proposed for the bin store. The chosen product specification will be detailed at a detailed design stage.

Lined Permeable Paving

- 6.12 At total of 440m² lined permeable paving manages itself and has a restricted outfall to a cellular storage tank at a maximum of 0.9l/s for all events up to and including the 100yr+40% climate change event via a 20mm orifice plate. Causeway Flow estimated that to restrict the permeable paving to a maximum of 0.9l/s, a minimum sub-base depth of 248mm is required.
- 6.13 The permeable paving has a porosity of 30% therefore the permeable paving provides a total of 33.7m³.

Cellular Storage Tank

- 6.14 Roof runoff, runoff associated with impermeable areas and outfall from the permeable paving are to be directed to two cellular storage tanks sized at 25m² and 125m² both with a depth of 0.66m deep. The smaller of the two tanks is located beneath the proposed access into the site and manages runoff collected from the higher point of the site. The second tank has been positioned lower within the ground in order to collect runoff from the lower points of the site along with the runoff from the first cellular storage tank. The second tank is located at the centre of the site.
- 6.15 The cellular storage tanks have a porosity of 95% therefore providing a total of 94.05m³ of attenuation volume.
- 6.16 The outfall rate from the first cellular storage tank is restricted to 7.4 l/s via a 53mm orifice plate before discharging to the second storage tank. The runoff from the second tank is directed to the surface water network at a maximum of 5.0l/s in the 100yr+40% climate change storm event, restricted by a 55mm orifice plate.

Existing and Proposed Outfall Rates

- 6.17 The site is a brownfield site and is 100% impermeable comprised of roof area and hardstanding. The red line boundary covers an area of 2563m² (0.25ha).
- 6.18 The rainfall intensity for the modelled critical storm for each return period and been used to estimate the existing runoff rates.
- 6.19 Table 6.2 below demonstrates that a significant betterment, as much as 50l/s in the 100yr storm event is achieved by the proposed SuDS scheme.

Return Period (yr)	Existing Runoff Rate (l/s)	Proposed Runoff Rate (l/s)	Achieved Reduction in Site Runoff (l/s)
2	15.85	2	13.85
30	41.88	3.4	38.48
100	54.50	4.1	50.4
100 + 40% Climate Change	-	5	-

Table 6.2 Existing & Proposed Runoff Rates

Exceedance Event

- 6.20 In an exceedance event, in the areas of permeable paving surface water would pool within the area of paving; in all other parts of the site manholes may surcharge, resulting in surface water runoff towards the low point in the south eastern corner of the site.

Water Quality

- 6.21 The drainage system has been designed in order to meet the water quality requirements set out by Table 26.2 of the CIRIA SuDS Manual C753 which sets out the specific pollution hazard indices for low traffic roads in Table 6.3 below. Table 6.4 demonstrates that the proposed SuDS strategy exceeds the required treatment stages.

Land Use	Hazard Level	Pollution Hazard Indices		
		Suspended Solids	Metals	Hydrocarbons
Individual property driveways and low traffic roads	Low	0.5	0.4	0.4
Pollution Mitigation Required		0.5	0.4	0.4

Table 6.3 Land Use Pollution Hazard Ratings. Extracted from the CIRIA SuDS Manual C753 Simple Index Approach Tool

- 6.22 The roof runoff will pass through a downstream defender prior to discharging into the surface water sewer. Residential roof runoff has a 'very low' hazard level and therefore the downstream defender will provide a sufficient treatment stage.

SuDS Component	Pollution Mitigation Indices		
	Suspended Solids	Metals	Hydrocarbons
Permeable Paving	0.7	0.6	0.7

Table 6.4 SuDS Component Pollution Mitigation for Permeable Paving and adapted from the CIRIA SuDS Manual C753 Simple Index Approach Tool

7 Maintenance of Development Drainage

- 7.1 The maintenance of the SuDS features will remain private and it is recommended a maintenance company be appointed to manage the drainage features.
- 7.2 Regular inspections and maintenance should be carried out for each of these elements, particularly after periods of heavy rainfall. Maintenance tasks and frequency are detailed in the CIRIA SuDS Manual (C753), and some of these have been summarised below in Tables 7.1 – 7.3.

Maintenance Schedule	Required Action	Frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually.
	Remove debris from the catchment surface (where it may cause risks to performance).	Monthly
	Remove sediment from pre-treatment structures and/or internal forebays.	Annually or as required.
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents.	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed.	Annually
	Survey inside of tank/crate system for sediment build-up and remove if necessary.	Every 5 years or as required.

Table 7.1: Maintenance tasks for cellular storage tank (Source: CIRIA C753, The SUDS Manual)

Maintenance Schedule	Required Action	Frequency
Regular maintenance	Brushing and vacuuming.	Three times per year at end of winter, mid-summer, after autumn leaf fall, or as required based on site specific observations of clogging or manufacturer's recommendations.
Occasional maintenance	Stabilise and mow contributing and adjacent areas.	As required.
	Removal of weeds.	As required.
Remedial actions	Remediate any landscaping which, through vegetation maintenance of soil slip, has been raised to within 50mm of the level of the paving.	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance of a hazard to the user.	As required
	Rehabilitation of surface and upper sub-surface.	As required (if infiltration performance is reduced as a result of significant clogging.)
Monitoring	Initial inspection	Monthly for 3 months after installation. 3 monthly, 48 hours after large storms.
	Inspect for evidence of poor operation and/or weed growth. If required, take remedial action.	Annually.
	Inspect silt accumulation rates and establish appropriate brushing frequencies.	Annually.
	Monitor inspection chambers.	Annually.

Table 7.2: Maintenance tasks for permeable paving (Source: CIRIA C753, The SUDS Manual)

- 7.3 It is recommended that during the first 12 months of operation all SuDS and drainage features are visually inspected on a monthly basis to determine any seasonal patterns this includes all SuDS features, inspection chambers, inlets and outlets. This will determine whether or not the recommended service intervals set out by CIRIA in the figures above will be sufficient for maintenance beyond the first year.
- 7.4 After the first 12 months, the maintenance schedule should be designed to at least meet the requirements set out by CIRIA based on the outcome of the monitoring.
- 7.5 The filters should be maintained in accordance with the manufacturer's recommendations. After the first 12 months, the flow controls should be inspected quarterly and following large storm events.
- 7.6 All inspection chambers and silt traps should be inspected on a bi-annual basis with further visual checks carried out throughout the year.

8 Summary and Conclusion

- 8.1 This Flood Risk Assessment and SuDS Statement has been prepared by EAS Transport Planning on behalf of Abbey Healthcare, regarding the proposed redevelopment of the former Bull and Monkie Pub, Churchgate, Spalding PE11 2RA.

Flood Risk Summary

- 8.2 The site falls within Flood Zone 3 of the Environment Agency (EA) Flood Map for Planning, which would indicate a high risk of flooding. However, when defences are taken into account the site is protected up to a 0.1% annual probability flood event. The EA Product 4 identified that the existing fluvial defences reducing the risk of flooding to this site consist of Crowland & Cowbit Washes and embankment. They are identified to be in fair condition and provide protection against a flood event with a 1% chance of occurring in any year (1 in 100).
- 8.3 The risk from the breach of these defences poses a residual risk to the site that nonetheless needs to be adequately mitigated.
- 8.4 The South East Lincolnshire SFRA includes modelling of the combined fluvial and tidal risks including an allowance for climate change. The hazard and depth mapping produced indicates the results of defences being overtopped or breached. A 2006 baseline and 2115 future year scenario were modelled, the latter being the year the DEFRA sea level allowances relate to and allows for the lifetime of development.
- 8.5 In summary, the site has a:
- maximum hazard rating of 'Danger for Most' in the 2115 1% fluvial and 0.5% tidal combined scenario and the 0.1% fluvial scenario;
 - potential flood depths of between 0 to 2m in the 2115 1% fluvial and 0.5% tidal combined scenario and the 0.1% fluvial scenario. It should be noted that the average flood level shown on the site in both scenarios falls within the 0.5-1m category; and
 - potential velocities of 0 to 0.3m/s in the 2115 1% fluvial and 0.5% tidal combined scenario and the 0.1% fluvial scenario.
- 8.6 The site is at very low risk of surface water flooding and is located in a reservoir flood extent.
- 8.7 Mitigation measures in line with the SFRA Standing Advice have been discussed and agreed via pre-planning advice with the EA and include:
- A FFL set a minimum of 1m above existing ground level (6.752mAOD) and a 3 storey building providing first floor and above refuge area;
 - Flood resilient construction to a height 300mm above the predicted flood depth, and demountable defences to 600mm above FFL.
 - No habitable accommodation in the basement level.
- 8.8 Additionally, a stand-alone Flood Warning and Evacuation plan would be provided post-planning.

Surface Water Drainage Strategy

- 8.9 An attenuation strategy with a restricted outfall to the existing surface water drainage outfall is proposed. The SuDS strategy comprises of lined permeable paving and two cellular storage crates with a maximum outfall of 5.0l/s in the 100yr+40% climate change event. The proposed surface water drainage strategy provides a significant reduction in runoff rates when compared to the existing situation, as much as 50l/s in the 100yr return period storm.
- 8.10 The proposed SuDS strategy exceeds the required treatment stages required by the CIRIA SuDS Manual C753.
- 8.11 Maintenance tasks for the permeable paving and cellular storage tank has been discussed, which have been taken from the CIRIA SuDS Manual (C753). It is also important that the proposed SuDS devices are regularly inspected and any debris is removed to prevent a fluvial or surface water flood risk.
- 8.12 Post planning an indirect connection/S106 application will need to be made to Anglian Water.

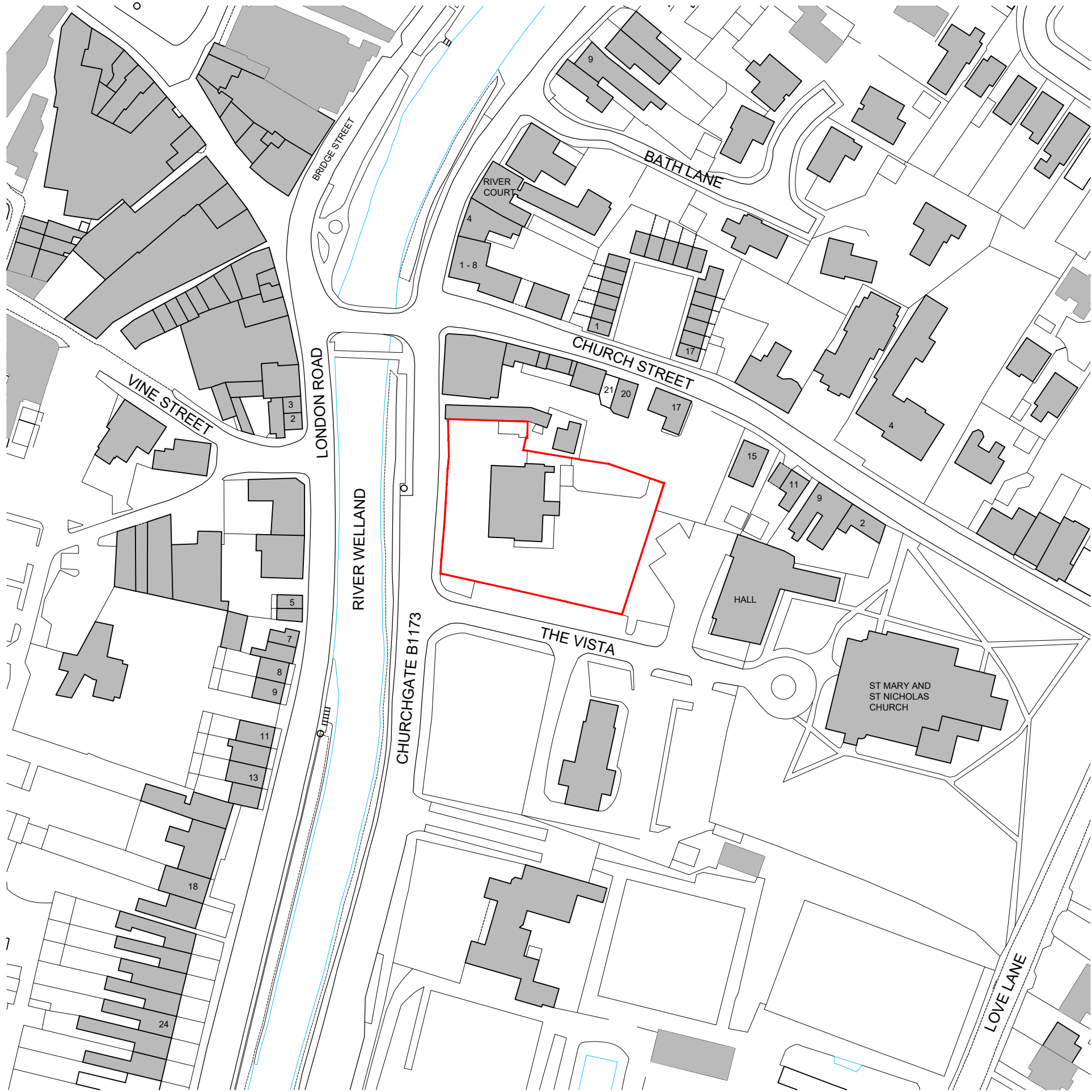
Conclusion

- 8.13 This FRA has assessed all sources of flooding and the appropriate mitigation measures have been detailed to manage the identified risks in line with local policy.

9 Appendices

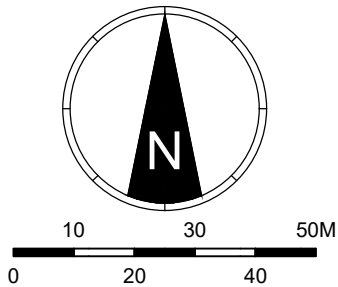
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Appendix: A – Location Plan



SITE LOCATION PLAN

- GENERAL NOTES:
1. ALL DIMENSIONS TO BE VERIFIED ON SITE AND ANY DISCREPANCIES REPORTED BACK TO RDT ARCHITECTS.
 2. COPYRIGHT OF THIS DRAWING IS RESERVED BY RDT ARCHITECTS.
 3. THIS DRAWING IS FOR PLANNING PURPOSES ONLY.



KEY:	
—	SITE BOUNDARY SITE AREA = 0.63 ACRES / 0.25 HECTARE

NOTES:	
1.	ORDNANCE SURVEY INFORMATION TAKEN FROM ORDNANCE SURVEY, (C) CROWN COPYRIGHT 2008 .

P1	PRELIMINARY ISSUE	CMY	14.12.22
REV	DESCRIPTION	BY	DATE
PROJECT WORK STAGE			

PLANNING

CLIENT	CRISPEN HOLDINGS LTD
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PROJECT	PROPOSED NEW CARE HOME FORMER BULL & MONKIE PUBLIC HOUSE CHURCHGATE SPALDING, PE11 2RA
DRWG TITLE	SITE LOCATION PLAN

PROJECT	ORIGINATOR	ZONE	LEVEL	TYPE	DIS	NUMBER
1315PL	RDT	ZZ	XX	DR	A	0001

STATUS	SUITABILITY DESCRIPTION
-	-

DRAWN BY	DATE	SCALE	CHECKED BY
NS	OCT 2021	1:1250	CC

RDT PROJECT REF.	PAPER SIZE	REVISION
1315	A3	P1



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www.rdtarchitects.co.uk

Appendix: B – Proposed Development Layout

Appendix: C – Flood Map for Planning, EA Data & EA Charged Advice Correspondance

Rose Cargill
rose.cargill@eastp.co.uk

Our ref: CCN-2022-258424

Date: 25/04/2022

Dear Rose,

Provision of Flood Risk Information for Churchgate

Thank you for your request to use our flood risk information for the above site. The information is set out below and attached. It is important you read any contextual notes on the maps provided.

If you are preparing a Flood Risk Assessment (FRA) for this site, please note this information may not be sufficient by itself to produce an adequate FRA to demonstrate the development is safe over its lifetime. Additional information may be required to carry out an appropriate assessment of all risk, such as consequence of a breach in defences.

We aim to review our information on a regular basis, so if you are using this data more than twelve months from the date of this letter, please contact us again to check it is still valid.

1. Flood Map

The attached map includes the current Flood Map for your area. The Flood Map indicates the area at risk of flooding, **assuming no flood defences exist**, for a flood with a 0.5% chance of occurring in any year for flooding from the sea, or a 1% chance of occurring for fluvial (river) flooding. It also shows the extent of the Extreme Flood Outline which represents the extent of a flood with a 0.1% chance of occurring in any year, or the highest recorded historic extent if greater.

In some locations, such as around the fens and the large coastal floodplains, showing the area at risk of flooding assuming no defences may give a slightly misleading picture in that if there were no flood defences, water would spread out across these large floodplains. This flooding could cover large areas of land but to relatively shallow depths and could leave pockets of locally slightly higher land as isolated dry islands. It is important to understand the actual risk of the flooding to these dry islands, particularly in the event of defence failure.

The Flood Map also shows the location of formal raised flood defences and flood storage reservoirs. It represents areas at risk of flooding for present day only and does not take account of climate change.

The Flood Map only indicates the extent and likelihood of flooding from rivers or the sea. It should also be remembered flooding may occur from other sources such as surface water sewers, road drainage, etc.

2. Historic Flood Event Outlines

With regards to the history of flooding I can advise we do not have any records of flooding in this area. It is possible recent flooding may have occurred which we are currently investigating, therefore this information may be subject to change. It is possible other flooding may have occurred which other risk management authorities, such as the Lead Local Flood Authority (i.e. top tier council) or Internal Drainage Board (where they exist) have responsibility.

3. Schemes in the area

There are no ongoing capital projects to reduce or sustain the current flood risk to this site.

4. Fluvial Flood Risk Information

4.1 Fluvial Defence Information

The existing fluvial defences reducing the risk of flooding to this site consist of Crowland-Cowbit Washes and embankment. They are in fair condition and provide protection against a flood event with a 1% chance of occurring in any year (1 in 100). We inspect these defences regularly to ensure that any potential defects are identified early.

4.2 Fluvial Modelled Levels and Flows

Available modelled fluvial flood levels and flows for the model nodes shown on the attached map are set out in the data table attached. This data is taken from the model named on the data table, which is the most up-to-date model currently available.

Please note these levels are “in-channel” levels and therefore may not represent the flood level on the floodplain, particularly where the channel is embanked or has raised defences.

Our models may not have the most up to date climate change allowances. In time we will update our models for the latest allowances. You should refer to '[Flood risk assessments: climate change allowances](#)' to check if the allowances modelled are appropriate for the type of development you are proposing and its location. You may need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence.

4.3 Fluvial Modelled Flood Extents

Please find attached a map showing available modelled flood extents, taking into account flood defences, for your area. This data is taken from the model named on the map, which is the most up-to-date model currently available.

4.4 Fluvial Hazard Mapping

For certain locations we have carried out modelling to map the maximum values of flood depth, velocity and hazard rating (danger to people) resulting from overtopping and/or breaching of defences at specific locations for a number of scenarios.

At present this information is available for fluvial flood risk in Northampton, Lincoln, Wainfleet and some isolated rural locations.

The number of locations we have this information for is expected to increase in time.

At present this site is not covered by any Environment Agency hazard mapping.

Detailed Hazard Mapping is available within the 2017 Update of South Holland Strategic Flood Risk Assessment. This can be downloaded via the following link:

<http://www.southeastlincslocalplan.org/water/>

5. Tidal Flood Risk Information

This site is not considered to be at risk from tidal flooding.

6. Development Planning

If you would like local guidance on preparing a flood risk assessment for a planning application, please contact our Sustainable Places team at LNplanning@environment-agency.gov.uk. It will help if you mention this data request and attach your site location plan.

We provide free preliminary advice; additional/detailed advice, review of draft FRAs and meetings are chargeable at a rate set to cover our costs, currently £100 (plus VAT) per hour of staff time. Further details are available on our website at <https://www.gov.uk/guidance/developers-get-environmental-advice-on-your-planning-proposals>.

General advice on flood risk assessment for planning applications can be found on GOV.UK at <https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications>

Climate change will increase flood risk due to overtopping of defences. Please note, unless specified otherwise, the climate change data included has an allowance for 20% increase in flow. Updated guidance on how climate change could affect flood risk to new development - 'Flood risk assessments: climate change allowances' was published on GOV.UK in **July 2021**. The appropriate updated climate change allowance should be applied in a Flood Risk Assessment.

You should also consult the Strategic Flood Risk Assessment produced by your local planning authority.

7. Data Licence and Other Supporting Information

We respond to requests for recorded information we hold under the Freedom of Information Act 2000 (FOIA) and the associated Environmental Information Regulations 2004 (EIR).

This information is provided in accordance with the Open Government Licence which can be found here: <http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>

Further information on flood risk can be found on the GOV.UK website at: <https://www.gov.uk/browse/environment-countryside/flooding-extreme-weather>

8. Other Flood Risk Management Authorities

The information provided with this letter relates to flood risk from main river or the sea. Additional information may be available from other risk management authorities, such as the Lead Local Flood Authority (i.e. top tier council) or Internal Drainage Board (where they exist).

I hope we have correctly interpreted your request. If you have any queries or would like to discuss the content of this letter further please contact Alexander Tan using the email address below.

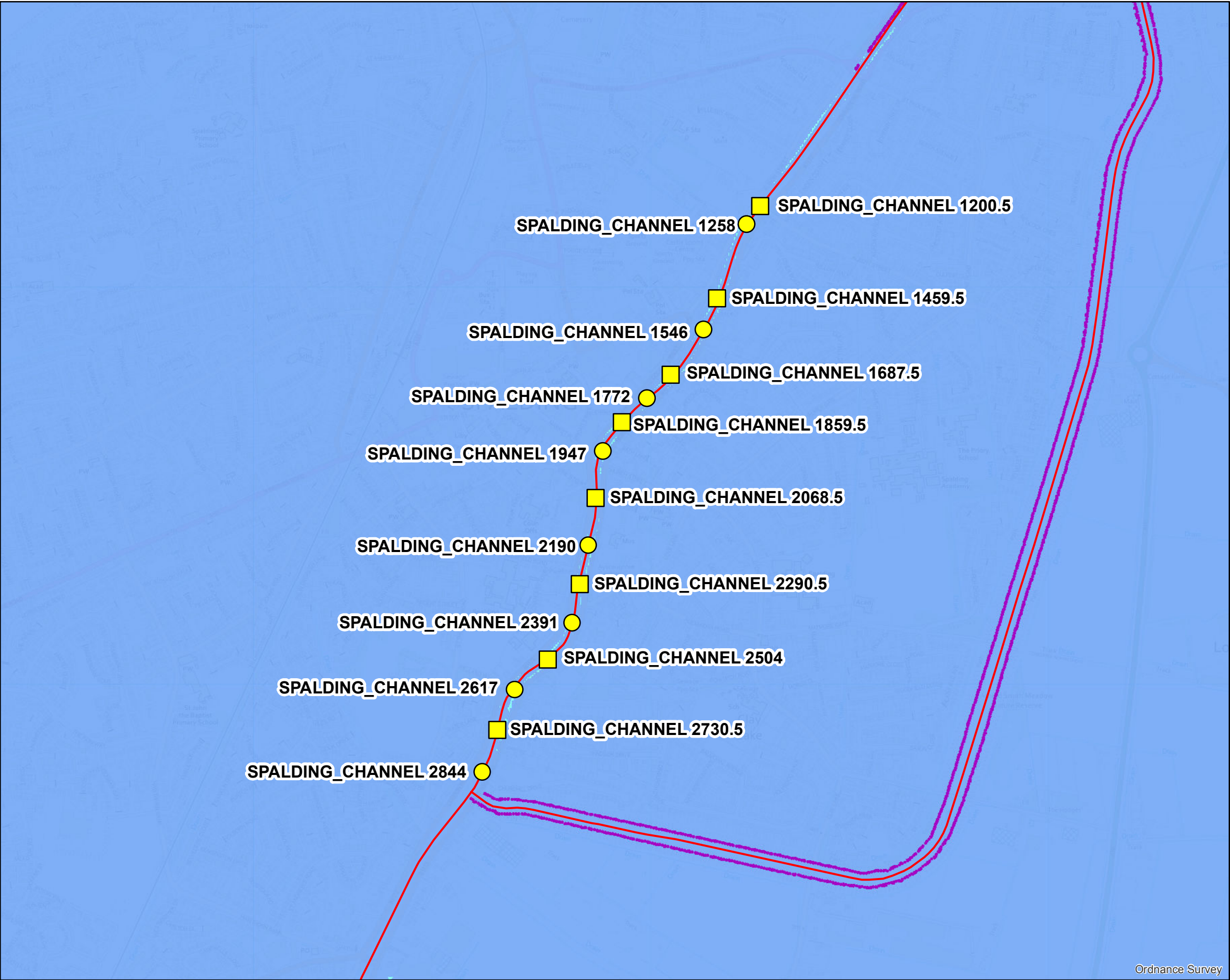
Yours sincerely,

A handwritten signature in black ink, appearing to read 'Alexander Tan', written in a cursive style.

for Alastair Windler
Welland and Nene Partnerships and Strategic Overview Team Leader
e-mail PSOWN@environment-agency.gov.uk

Enc.
Flood Map with Modelled Nodes
Modelled Fluvial Levels and Flows Data Sheet
Modelled Flood Extent Maps

Flood Map centred on TF 24909 22486 - created April 2022 [Ref: CCN-2022-258424]



Scale 1:10,000



Legend

- Modelled Levels
- Modelled Flows
- Main River
- Raised Defences
- Flood Storage Areas
- Area at Risk of Flooding from Rivers or The Sea
- Extreme Flood Outline

Dark blue shows the area that could be affected by flooding, either from rivers or the sea, if there were no flood defences. This area could be flooded:

- from the sea by a flood that has a 0.5% (1 in 200) or greater chance of happening each year.
- or from a river by a flood that has a 1% (1 in 100) or greater chance of happening each year.

Light blue shows the extent of the Extreme Flood Outline, which represents the extent of a flood event with a 0.1% chance of occurring in any year, or the highest recorded historic extent if greater.

These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements. Sites outside the two extents, but behind raised defences, may be affected by flooding if the defences are overtopped or fail.

Created by the Partnerships and Strategic Overview Team, Kettering

Fluvial Flood Levels (mODN)

The fluvial flood levels for the model nodes shown on the attached map are set out in the table below. They are measured in metres above Ordnance Datum Newlyn (mODN).

Node Label	Easting	Northing	Annual Exceedance Probability - Maximum Water Levels (mODN)										
			50% (1 in 2)	20% (1 in 5)	10% (1 in 10)	5% (1 in 20)	2% (1 in 50)	1.33% (1 in 75)	1% (1 in 100)	1% (1 in 100) inc 20% Climate Change	0.5% (1 in 200)	0.1% (1 in 1000)	0.1% (1 in 1000) inc 20% Climate Change
SPALDING_CHANNEL 1258	525242	323157	3.70	3.99	4.17	4.45	4.51	4.52	4.52	4.67	4.53	4.55	4.68
SPALDING_CHANNEL 1546	525133	322892	3.70	3.98	4.17	4.44	4.51	4.52	4.52	4.67	4.53	4.55	4.67
SPALDING_CHANNEL 1772	524991	322719	3.69	3.98	4.17	4.44	4.51	4.51	4.51	4.67	4.53	4.55	4.67
SPALDING_CHANNEL 1947	524880	322587	3.69	3.98	4.17	4.44	4.50	4.51	4.51	4.67	4.53	4.55	4.67
SPALDING_CHANNEL 2190	524844	322350	3.69	3.97	4.17	4.43	4.50	4.51	4.51	4.67	4.52	4.54	4.67
SPALDING_CHANNEL 2391	524803	322154	3.68	3.96	4.17	4.43	4.50	4.51	4.51	4.67	4.52	4.54	4.67
SPALDING_CHANNEL 2617	524658	321986	3.68	3.96	4.17	4.42	4.49	4.50	4.50	4.67	4.52	4.54	4.67
SPALDING_CHANNEL 2844	524577	321779	3.68	3.96	4.17	4.42	4.49	4.50	4.50	4.67	4.51	4.54	4.67

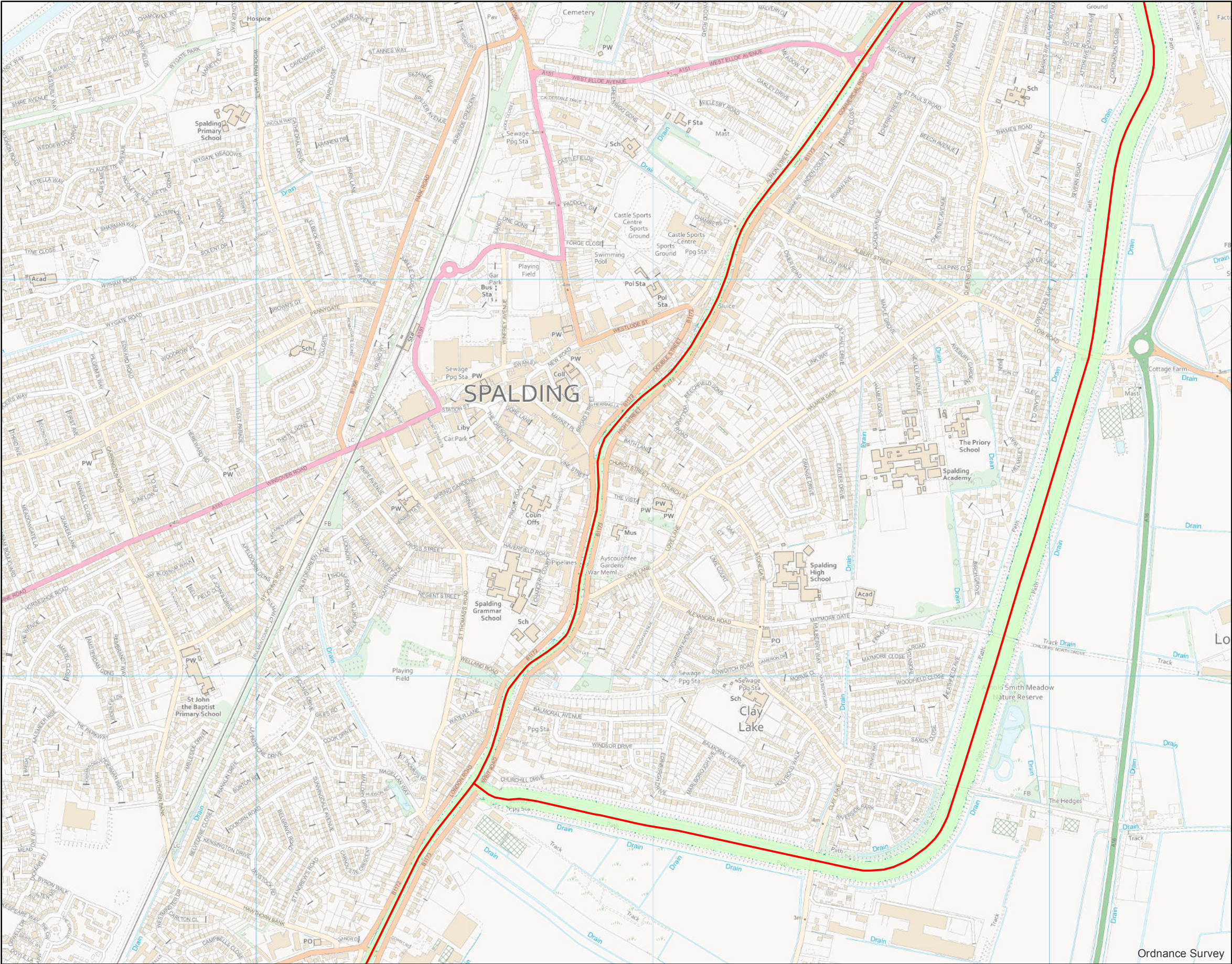
Fluvial Flood Flows (m³/s)

The fluvial flood flows for the model nodes shown on the attached map are set out in the table below. They are measured in metres cubed per second (m³/s).

Node Label	Easting	Northing	Annual Exceedance Probability - Maximum Flows (m³/s)										
			50% (1 in 2)	20% (1 in 5)	10% (1 in 10)	5% (1 in 20)	2% (1 in 50)	1.33% (1 in 75)	1% (1 in 100)	1% (1 in 100) inc 20% Climate Change	0.5% (1 in 200)	0.1% (1 in 1000)	0.1% (1 in 1000) inc 20% Climate Change
SPALDING_CHANNEL 1200.5	525276	323203	2.52	3.75	3.69	4.26	4.03	4.59	4.81	6.58	4.63	4.25	6.88
SPALDING_CHANNEL 1459.5	525167	322971	3.04	4.34	4.55	5.22	4.98	5.59	5.90	7.95	5.74	5.27	8.01
SPALDING_CHANNEL 1687.5	525050	322779	3.43	4.74	5.30	6.05	5.81	6.42	6.80	9.07	6.70	6.21	8.87
SPALDING_CHANNEL 1859.5	524928	322659	3.69	4.97	5.86	6.68	6.45	7.03	7.47	9.83	7.43	6.90	9.44
SPALDING_CHANNEL 2068.5	524861	322469	3.93	5.64	6.49	7.42	7.22	7.75	8.23	10.68	8.30	7.75	10.13
SPALDING_CHANNEL 2290.5	524821	322252	4.23	6.27	7.07	8.10	7.91	8.39	8.89	11.36	9.07	8.52	11.11
SPALDING_CHANNEL 2504	524741	322062	4.52	6.70	7.54	8.64	8.47	8.88	9.38	11.84	9.66	9.13	11.85
SPALDING_CHANNEL 2730.5	524614	321886	4.97	7.09	8.12	9.23	9.08	9.39	9.88	12.30	10.25	9.75	12.55

Modelled Flood Extents (with defences)

Map centred on TF 24909 22486 - created April 2022 [Ref: CCN-2022-258424]



Scale 1:10,000



Modelled Flood Extents (with defences)

- Main River
- 5% (1 in 20) Fluvial Event
- 1% (1 in 100) Fluvial Event
- 1% (1 in 100) Fluvial Event inc Climate Change
- 0.1% (1 in 1000) Fluvial Event
- 0.1% (1 in 1000) Fluvial Event inc Climate Change

Created by the Partnerships & Strategic Overview Team, Kettering



Rose Cargill
EAS
The Maltings Roydon Road
Stanstead Abbots
WARE
SG12 8HG

Our ref: AN/2023/133964/02-L01

Date: 01 February 2023

Dear Rose

**Proposed care home, Churchgate, Spalding
Former Bull & Monkie Public House, Churchgate, Spalding, PE11 2RA**

Thank you for accepting our offer to provide advice on the above application.

We are providing our planning advice under our agreement number ENVPA/1/LNA/00169 and an invoice for £400 plus VAT will be issued shortly.

Please note that due to the way invoices are automatically generated you may receive multiple invoices.

Having reviewed the above, we would like to make the following comments:

We have examined the South Hollands Strategic Flood Risk Assessment (SFRA) Breach Hazard Mapping and potential breach flood depths. The 2115 1% and 2115 0.1% hazard rating for the site is Danger to All (red). This category includes potential flood depths of between 0.3m to >2.5m; and potential velocities of 0 to 5m/s.

We can confirm that the site could potentially have flood depths of 1-1.6m for the 0.1% 2115 breach scenario and for the 1% fluvial /0.5% tidal 2115 breach scenario. For ground floor sleeping we would expect the 0.1% scenario flood depth to be used. Therefore, if the application is to include habitable accommodation with ground floor sleeping, and to be within the More Vulnerable classification, as in line with South East Lincolnshire standing advice we would require the Finished Floor Level (FFL) to be in line with either Cell C8 or Cell C9 of the South East Lincolnshire standing advice dependent on if the development is classed as Major or Non Major development (depending on number of units and size of development area).

If the average site level is approx. 6.2mAOD we would expect the worst case scenario flood depth to be used of 1 – 1.6mAOD. Proposals must have a minimum of 2 storeys, with FFL set a minimum of 1m above existing ground level, flood resilient construction to a height 300mm above the predicted flood depth, and demountable defences to 600mm above FFL. The proposed FFL of 6.6mAOD is only 0.4m above ground levels, it would need to be 1m above the average ground level.

Ceres House, Searby Road, Lincoln, LN2 4DW
Customer services line: 03708 506 506
Email: LNplanning@environment-agency.gov.uk
www.gov.uk/environment-agency

Calls to 03 numbers cost no more than national rate calls to 01 or 02 numbers and count towards any inclusive minutes in the same way. This applies to calls from any type of line including mobile.

Cont/d..

We would accept the basement to be used as ancillary use only, with no habitable accommodation on this level.

We would expect a full flood risk assessment (FRA) to be submitted with floor plans and elevations. The NPPF requires that proposals are accompanied by a FRA which contains evidence that appropriate mitigation measures/flood resilience techniques have been incorporated into the development.

Please note this response is based on the information you have made available and our best available datasets at the time of this response. It is based on current national planning policy, associated legislation and environmental data / information. If any of these elements change we may need to reconsider our position.

Should you require any additional information, or wish to discuss these matters further, please do not hesitate to contact Amelia Crawford by email at amelia.crawford@environment-agency.gov.uk

Yours sincerely

Amelia Crawford

Sustainable Places Planning Advisor



07387 134115 (mobile)



amelia.crawford@environment-agency.gov.uk



www.gov.uk/environment-agency

Rose Cargill
EAS
The Maltings Roydon Road
Stanstead Abbots
WARE
SG12 8HG

Our ref: AN/2023/133964/03-L01

Date: 15 February 2023

Dear Rose

**Proposed Care Home, Churchgate, Spalding
Former Bull & Monkie Public House, Churchgate, Spalding, PE11 2RA**

In response to your email of 07 February 2023, I have now looked into this with our Flood Risk Officer.

We have reviewed your email dated, 07 February 2023 and submitted data/topography survey.

We can confirm we would find the suggested Finished Floor Levels (FFLs) methodology and levels acceptable with ground floor sleeping at the ground floor FFL, 6.752mAOD, with a minimum of 2 storeys/ access to higher floors for safe refuge, as in line with South East Lincolnshire standing advice matrix.

However we would like to note that our response is based on South East Lincolnshire standing advice and we can condition these mitigation measures and highlight the potential breach depths/levels to the Local Planning Authority (LPA), however the final decision is down to the LPA.

Should you require any additional information, or wish to discuss these matters further, please do not hesitate to contact me using the details below.

Yours sincerely

Amelia Crawford
Sustainable Places Planning Advisor
 07387 134115 (mobile)
 amelia.crawford@environment-agency.gov.uk
 www.gov.uk/environment-agency

End

Flood map for planning

Your reference
<Unspecified>

Location (easting/northing)
524918/322484

Created
20 Apr 2023 9:22

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

This means:

- you may need to complete a flood risk assessment for development in this area
- you should ask the Environment Agency about the level of flood protection at your location and request a Flood Defence Breach Hazard Map (You can email the Environment Agency at: enquiries@environment-agency.gov.uk)
- you should follow the Environment Agency's standing advice for carrying out a flood risk assessment (find out more at 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 2022 OS 100024198. <https://flood-map-for-planning.service.gov.uk/os-terms>

Flood map for planning

Your reference
<Unspecified>

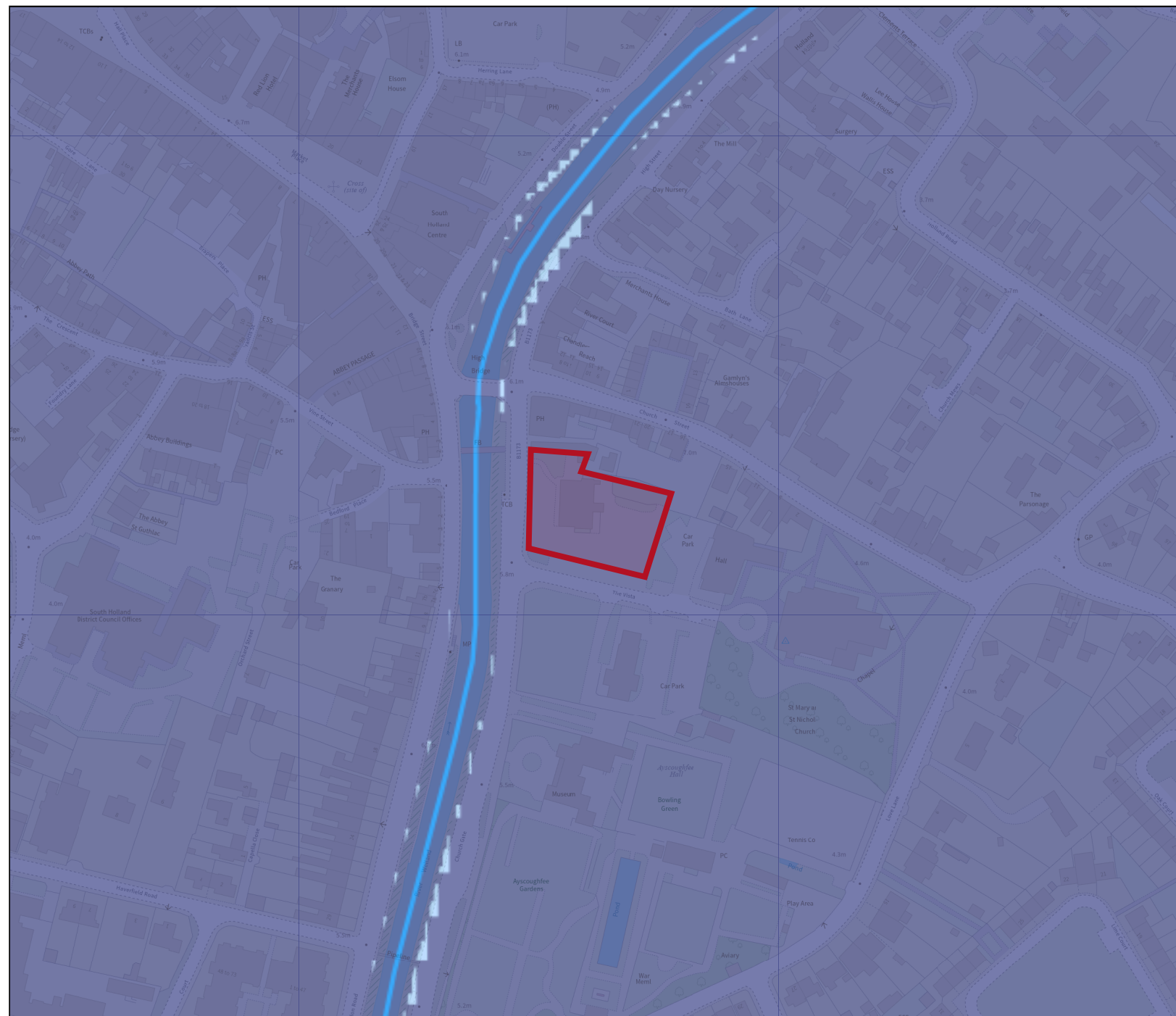
Location (easting/northing)
524918/322484

Scale
1:2500

Created
20 Apr 2023 9:22

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

0 20 40 60m



Appendix: D – Topographical Survey



Every effort has been made to confirm drainage run, type and size on site, yet it is advised to check these details against statutory authority records before proceeding with any design.

L E G E N D

Survey control station Banking Gate (single) Gate (double) Tree Spread and Girth shown to scale	Building Fence Contour 22.50 Wall Ordnance Survey Value 15.73
---	---

Ballard	BH	Post	P
Borehole	BD	Pipe	PE
British Telecom Box	BTB	Road Sign	RS
BT Inspection Cover	BT	Roading Eye	RE
Concrete Paving Slabs	CPS	Service Marker	MK
Cable Television Cover	CTV	Sign Post	SP
Electricity Cable Pit	EC	Sluice Valve	SV
Electricity Pole	EP	Stop Top	ST
Earth Road	ER	Stop Cock	SC
Fire Hydrant	FH	Telegraph Pole	TP
Flag Staff	FS	Telephone Call Box	TCB
Gas Valve	GV	Traffic Light	TL
Gate Post	GP	Unsurfaced	U
Gully	GY	Vent Pipe	VP
Inspection Cover	IC	Water Meter	WM
Kerb Outlet	KO	Eaves Level	EL
Lamp Post	LP	Ridge Level	RL
Manhole	MH	Roof Level	RFL
Marker Post	MP	Soffit Level	SL
Parking Meter	PM	Threshold Level	THL
Retaining Wall	RTW	Cover Level	CL
Barbed Wire Fence	BWF	Invert Level	IL
Cable Boreased Fence	CBF	No Visible Connection	NVC
Chain Link Fence	CLF	Unable to Lift	UTL
Chestnut Paling Fence	CPF		
Post and Chain Fence	PCF		
Post and Rail Fence	PRF		
Post and Wire Fence	PWF		



RDT DESIGN

Project

THE BULL & MONKIE PUBLIC
HOUSE
SPALDING

Title

TOPOGRAPHICAL SURVEY

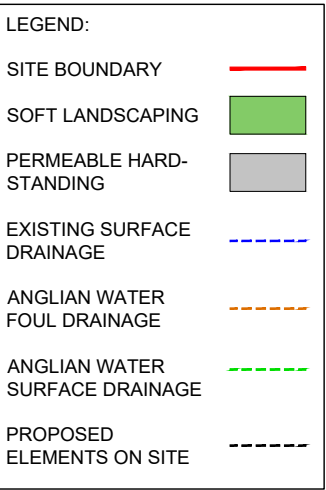
Scale 1:200	Date SEP 08
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Drawing Number TS08-191P\1

All levels related to OSBM located on the east face boundary between no's 11 & 15 Church Street.

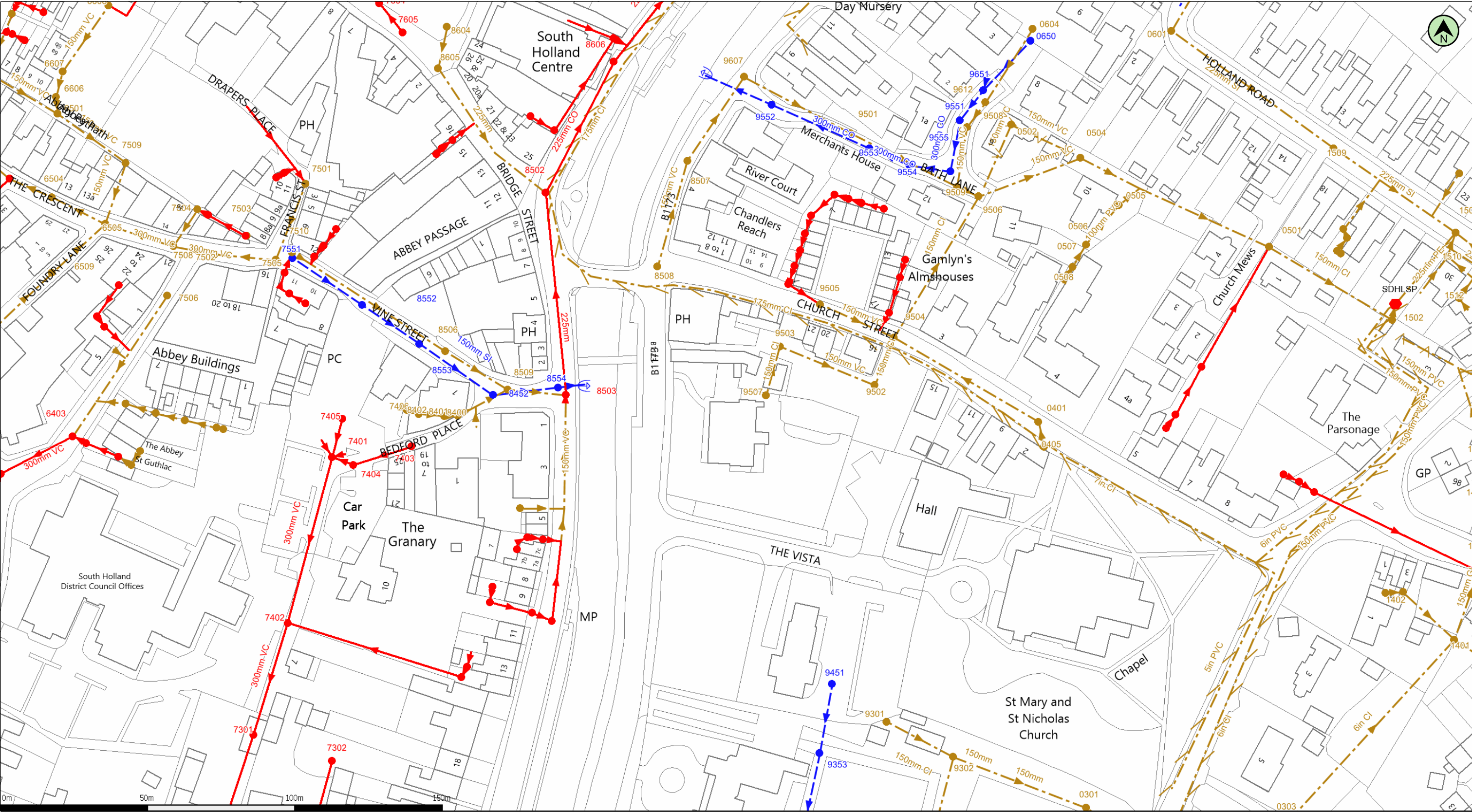
Value 6.54m

Appendix: E – CCTV Drainage Survey



P2	MM	Issued for Comment		17/03/23
P2	MM	Issued for Comment		14/03/23
Rev	Drawn by	Description		Date
			Unit 1, Oakington Business Park Dry Drayton Road, Oakington Cambridge, CB24 3DQ	
www.gawnassociates.com			info@gawnassociates.com	
Status:			01223 233888	
PRELIMINARY ISSUE				
Client:				
CRISPEN HOLDINGS LTD				
Project:				
PROPOSED CARE HOME, FORMER BULL & MONKIE PUBLIC HOUSE, CHURCHGATE, SPALDING PE11 2RA				
Drawing Title:				
EXISTING FOUL & SURFACE WATER DRAINAGE ROUTE BEYOND EXTENT OF SITE BOUNDARY				
Drawn by:	Ck'd by:	Revision:	Drawing No:	
MM	LJG	P2	221/1811/SK01	
Date:	Scale:			
MAR 2023	1:500		@ A1	
DO NOT SCALE FROM THIS DRAWING - either manually or electronically. All drawings to be read in conjunction with attached contract notes.				

Appendix: F – Sewer Mapping



(c) Crown copyright and database rights 2023 Ordnance Survey 100022432 Date: 25/01/23 Scale: 1:1250 Map Centre: 524909,322497 Data updated: 31/12/22 Our Ref: 1066837 - 1 Wastewater Plan A3

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 2023 Ordnance Survey 100022432. 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.

Foul Sewer		Outfall*		Sewage Treatment Works	
Surface Sewer		Inlet*		Public Pumping Station	
Combined Sewer		Manhole*		Decommissioned Pumping Station	
Final Effluent					
Rising Main*					
Private Sewer*					
Decommissioned Sewer*					

*(Colour denotes effluent type)

tom.short@eastp.co.uk
Spalding

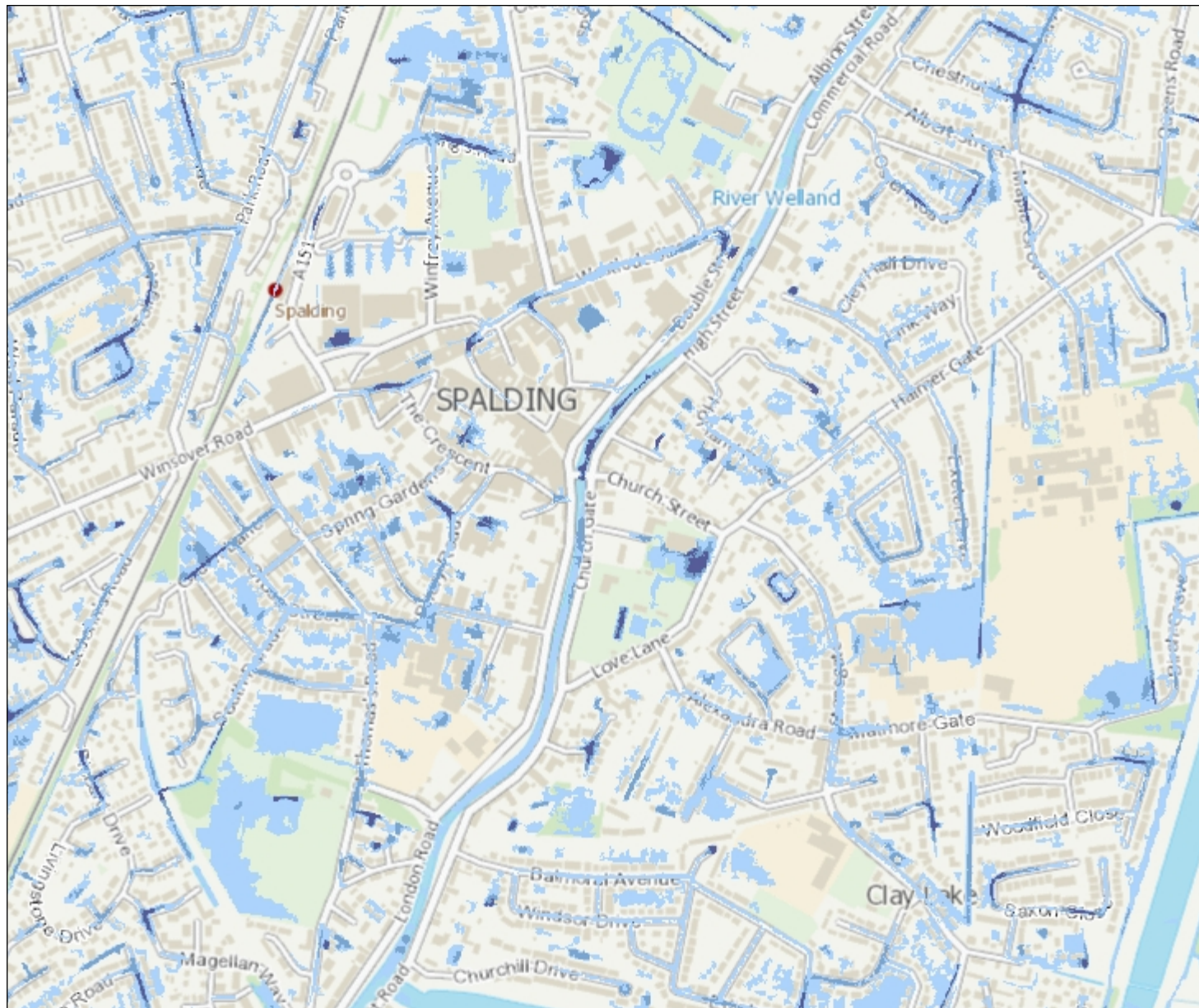


Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
6402	C	3.925	2	1.925
6403	C	4.141	2.52	1.621
6503	C	4.741	2.552	2.189
7301	C	4.761	2.838	1.923
7302	C	4.47	3.062	1.408
7401	C	5.308	3.646	1.662
7402	C	4.785	3.169	1.616
7403	C	-	-	-
7404	C	-	-	-
7405	C	-	-	-
7604	C	6.84	4.62	2.22
7605	C	6.79	5.41	1.38
8502	C	6.02	3.25	2.77
8503	C	-	-	-
8606	C	5.13	3.13	2
0301	F	-	-	1.931
0401	F	-	-	1.525
0405	F	-	-	-
0501	F	3.577	1.85	1.727
0502	F	-	-	1.982
0504	F	4.521	2.392	2.129
0505	F	-	-	-
0506	F	-	-	-
0507	F	-	-	-
0508	F	-	-	-
0601	F	3.686	2.426	1.26
0604	F	-	-	-
1401	F	3.2	1.06	2.14
1402	F	-	-	0.991
1502	F	-	-	3.355
1508	F	3.432	2.032	1.4
1509	F	3.497	2.177	1.32
1510	F	-	-	-
1512	F	-	-	-
6501	F	4.146	3.196	0.95
6504	F	4.745	2.834	1.911
6505	F	4.826	2.9	1.926
6509	F	-	-	-
6606	F	4.239	3.329	0.91
6607	F	4.206	-	-
6608	F	4.606	3.566	1.04
6614	F	4.533	3.733	0.8
7406	F	-	-	-
7501	F	-	-	-
7502	F	5.54	3.89	1.65
7503	F	-	-	-
7504	F	5.041	4.141	0.9
7505	F	5.295	4.085	1.21

[illegible][illegible]

Appendix: G – Surface Water Mapping

Risk of flooding from Surface Water



1: 10,000

0 Metres 250



Likelihood of flooding from Surface Water

- High ($\geq 3.3\%$)
- Medium (3.3% - 1%)
- Low (1% - 0.1%)
- Very Low

Likelihood of flooding from Surface Water

- High: Greater than or equal to 3.3% (1 in 30) chance in any given year
- Medium: Less than 3.3% (1 in 30) but greater than or equal to 1% (1 in 100) chance in any given year
- Low: Less than 1% (1 in 100) but greater than or equal to 0.1% (1 in 1,000) chance in any given year
- Very Low: Less than 0.1% (1 in 1,000) chance in any given year

This information is shown on the Risk of Flooding from Surface Water map on GOV.UK.

Appendix: H- Reservoir Mapping

Flood risk

Location

Extent of flooding

Enter a place or postcode



Maximum extent of flooding from reservoirs:

- when river levels are normal
- when there is also flooding from rivers
- Location you selected

Appendix I – CausewayFlow Results

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	40	Minimum Backdrop Height (m)	0.200
CV	0.750	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	x
Maximum Rainfall (mm/hr)	50.0		

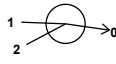
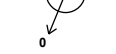
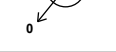
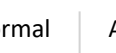
Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
SIC01	0.013	5.00	6.750	600	35.630	35.117	0.850
SIC02	0.009	5.00	6.750	600	24.900	39.659	0.910
SIC03	0.010	5.00	6.750	600	4.526	39.465	0.980
SIC04	0.015	5.00	6.750	600	6.834	85.886	1.180
Carpark 1	0.046	5.00	6.300		8.526	106.304	1.200
Depth/Area 1	0.005	5.00	6.300	600	42.915	104.994	1.760
SIC05	0.023	5.00	4.780	600	61.282	59.582	0.570
SIC06	0.007	5.00	6.710	600	67.168	77.425	2.560
SIC07	0.008	5.00	6.600	600	53.556	79.264	2.560
SIC08	0.017	5.00	6.600	600	43.991	61.054	2.640
SIC09	0.023	5.00	6.600	600	26.332	64.916	2.780
Depth/Area 2			6.300		61.654	102.310	2.500
SIC10			6.300	600	74.484	100.033	2.530
SIC11			6.300	600	103.569	67.956	2.640
SIC12			4.460	600	87.217	28.099	0.940
SIC13			4.480	600	69.856	6.732	1.020

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SIC01	35.630	35.117	6.750	0.850	600				
						0	1.000	5.900	150
SIC02	24.900	39.659	6.750	0.910	600		1	1.000	5.840
						0	1.001	5.840	150
SIC03	4.526	39.465	6.750	0.980	600		1	1.001	5.770
						0	1.002	5.770	150
SIC04	6.834	85.886	6.750	1.180	600		1	1.002	5.570
						0	1.003	5.570	150
Carpark 1	8.526	106.304	6.300	1.200					
						0	2.000	5.100	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
Depth/Area 1	42.915	104.994	6.300	1.760	600		1 2.000 2 1.003 0 1.004	5.050 5.050 4.540	150 150 150
SIC05	61.282	59.582	4.780	0.570	600		0 3.000	4.210	225
SIC06	67.168	77.425	6.710	2.560	600		1 3.000	4.150	225
SIC07	53.556	79.264	6.600	2.560	600		0 3.001	4.150	225
SIC08	43.991	61.054	6.600	2.640	600		1 3.001	4.040	225
SIC09	26.332	64.916	6.600	2.780	600		0 3.002	4.040	225
SIC10	61.654	102.310	6.300	2.500	600		1 3.002	3.960	225
SIC11	74.484	100.033	6.300	2.530	600		0 3.003	3.960	225
SIC12	103.569	67.956	6.300	2.640	600		1 3.003	3.820	225
SIC13	87.217	28.099	4.460	0.940	600		0 3.004	3.820	225
SIC14	69.856	6.732	4.480	1.020	600		1 3.004	3.800	225
SIC15	74.484	100.033	6.300	2.530	600		2 1.004	4.310	150
SIC16	74.484	100.033	6.300	2.530	600		0 1.005	3.800	225
SIC17	103.569	67.956	6.300	2.640	600		1 1.005	3.770	225
SIC18	87.217	28.099	4.460	0.940	600		0 1.006	3.770	225
SIC19	69.856	6.732	4.480	1.020	600		1 1.006	3.660	225
SIC20	69.856	6.732	4.480	1.020	600		0 1.007	3.660	225
SIC21	69.856	6.732	4.480	1.020	600		1 1.007	3.520	225
SIC22	69.856	6.732	4.480	1.020	600		0 1.008	3.520	225
SIC23	69.856	6.732	4.480	1.020	600		1 1.008	3.460	225

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.840	Drain Down Time (mins)	240	Check Discharge Volume	x

Storm Durations

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

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

Node Carpark 1 Online Orifice Control

Flap Valve	x	Replaces Downstream Link	✓	Diameter (m)	0.020
Downstream Link	2.000	Invert Level (m)	5.100	Discharge Coefficient	0.600

Node Depth/Area 2 Online Orifice Control

Flap Valve	x	Design Depth (m)	0.660	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	5.0		
Invert Level (m)	3.800	Diameter (m)	0.055		

Node Depth/Area 1 Online Orifice Control

Flap Valve	x	Replaces Downstream Link	✓	Diameter (m)	0.053
Downstream Link	1.004	Invert Level (m)	4.540	Discharge Coefficient	0.600

Node Carpark 1 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	6.000	Slope (1:X)	1000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	
Safety Factor	2.0	Width (m)	21.040	Inf Depth (m)	
Porosity	0.30	Length (m)	21.040		

Node Depth/Area 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	4.540
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	94

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	25.0	0.0	0.660	25.0	0.0	0.661	0.0	0.0

Node Depth/Area 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	3.800
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	256

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	125.0	0.0	0.660	125.0	0.0	0.661	0.0	0.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.53%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SIC01	10	5.935	0.035	1.9	0.0207	0.0000	OK
15 minute winter	SIC02	10	5.888	0.048	3.2	0.0229	0.0000	OK
15 minute winter	SIC03	11	5.830	0.060	4.5	0.0291	0.0000	OK
15 minute winter	SIC04	11	5.617	0.047	6.6	0.0252	0.0000	OK
120 minute winter	Carpark 1	88	6.026	0.926	2.3	2.7758	0.0000	FLOOD RISK
120 minute winter	Depth/Area 1	84	4.701	0.161	3.6	3.8736	0.0000	SURCHARGED
15 minute winter	SIC05	10	4.254	0.044	3.3	0.0484	0.0000	OK
15 minute winter	SIC06	10	4.199	0.049	4.3	0.0164	0.0000	OK
15 minute winter	SIC07	11	4.097	0.057	5.3	0.0197	0.0000	OK
15 minute winter	SIC08	11	4.019	0.059	7.6	0.0244	0.0000	OK
240 minute winter	SIC09	196	3.929	0.109	2.5	0.0486	0.0000	OK
240 minute winter	Depth/Area 2	196	3.929	0.129	4.2	15.2668	0.0000	OK
240 minute winter	SIC10	196	3.805	0.035	2.0	0.0099	0.0000	OK
240 minute winter	SIC11	196	3.694	0.034	2.0	0.0097	0.0000	OK
240 minute winter	SIC12	200	3.554	0.034	2.0	0.0098	0.0000	OK
240 minute winter	SIC13	200	3.493	0.033	2.0	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SIC01	1.000	SIC02	1.9	0.477	0.120	0.0305	
15 minute winter	SIC02	1.001	SIC03	3.1	0.557	0.208	0.0551	
15 minute winter	SIC03	1.002	SIC04	4.5	0.807	0.311	0.1663	
15 minute winter	SIC04	1.003	Depth/Area 1	6.6	1.427	0.199	0.0704	
120 minute winter	Carpark 1	Orifice	Depth/Area 1	0.8				
120 minute winter	Depth/Area 1	Orifice	Depth/Area 2	2.1				
15 minute winter	SIC05	3.000	SIC06	3.3	0.551	0.079	0.0567	
15 minute winter	SIC06	3.001	SIC07	4.2	0.593	0.100	0.1207	
15 minute winter	SIC07	3.002	SIC08	5.3	0.655	0.133	0.1087	
15 minute winter	SIC08	3.003	SIC09	7.6	0.756	0.146	0.1396	
15 minute winter	SIC09	3.004	Depth/Area 2	10.7	1.871	0.254	0.0210	
240 minute winter	Depth/Area 2	Orifice	SIC10	2.0				
240 minute winter	SIC10	1.006	SIC11	2.0	0.522	0.051	0.0739	
240 minute winter	SIC11	1.007	SIC12	2.0	0.527	0.049	0.0860	
240 minute winter	SIC12	1.008	SIC13	2.0	0.535	0.048	0.0349	29.8

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.53%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SIC01	10	5.962	0.062	5.2	0.0365	0.0000	OK
15 minute winter	SIC02	10	5.929	0.089	8.7	0.0427	0.0000	OK
15 minute winter	SIC03	11	5.882	0.112	12.6	0.0544	0.0000	OK
15 minute winter	SIC04	11	5.655	0.085	18.2	0.0457	0.0000	OK
180 minute winter	Carpark 1	152	6.095	0.995	4.6	12.0262	0.0000	FLOOD RISK
120 minute winter	Depth/Area 1	86	4.972	0.432	7.7	10.4135	0.0000	SURCHARGED
15 minute winter	SIC05	10	4.288	0.078	9.2	0.0849	0.0000	OK
15 minute winter	SIC06	10	4.235	0.085	11.9	0.0286	0.0000	OK
15 minute winter	SIC07	11	4.142	0.102	14.9	0.0351	0.0000	OK
360 minute winter	SIC08	288	4.112	0.152	3.3	0.0626	0.0000	OK
360 minute winter	SIC09	288	4.112	0.292	4.7	0.1308	0.0000	SURCHARGED
360 minute winter	Depth/Area 2	288	4.112	0.312	7.5	37.0352	0.0000	SURCHARGED
360 minute winter	SIC10	288	3.815	0.045	3.4	0.0128	0.0000	OK
360 minute winter	SIC11	288	3.704	0.044	3.4	0.0125	0.0000	OK
360 minute winter	SIC12	288	3.565	0.045	3.4	0.0127	0.0000	OK
360 minute winter	SIC13	288	3.503	0.043	3.4	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SIC01	1.000	SIC02	5.1	0.580	0.329	0.0683	
15 minute winter	SIC02	1.001	SIC03	8.6	0.691	0.574	0.1215	
15 minute winter	SIC03	1.002	SIC04	12.5	1.022	0.859	0.3605	
15 minute winter	SIC04	1.003	Depth/Area 1	18.3	1.846	0.556	0.1518	
180 minute winter	Carpark 1	Orifice	Depth/Area 1	0.8				
120 minute winter	Depth/Area 1	Orifice	Depth/Area 2	3.7				
15 minute winter	SIC05	3.000	SIC06	9.1	0.704	0.222	0.1243	
15 minute winter	SIC06	3.001	SIC07	11.7	0.757	0.282	0.2656	
15 minute winter	SIC07	3.002	SIC08	14.8	0.816	0.371	0.2438	
15 minute winter	SIC08	3.003	SIC09	21.4	0.957	0.409	0.3088	
15 minute winter	SIC09	3.004	Depth/Area 2	30.3	2.109	0.715	0.0704	
360 minute winter	Depth/Area 2	Orifice	SIC10	3.4				
360 minute winter	SIC10	1.006	SIC11	3.4	0.604	0.086	0.1072	
360 minute winter	SIC11	1.007	SIC12	3.4	0.609	0.083	0.1251	
360 minute winter	SIC12	1.008	SIC13	3.4	0.620	0.081	0.0506	79.4

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.53%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SIC01	11	5.994	0.094	7.1	0.0553	0.0000	OK
15 minute winter	SIC02	11	5.986	0.146	11.9	0.0700	0.0000	OK
15 minute winter	SIC03	11	5.939	0.169	16.3	0.0825	0.0000	SURCHARGED
15 minute winter	SIC04	11	5.671	0.101	23.5	0.0543	0.0000	OK
240 minute winter	Carpark 1	224	6.155	1.055	5.4	19.9385	0.0000	FLOOD RISK
120 minute winter	Depth/Area 1	88	5.169	0.629	10.4	15.1488	0.0000	SURCHARGED
15 minute winter	SIC05	10	4.304	0.094	12.6	0.1023	0.0000	OK
360 minute winter	SIC06	320	4.254	0.104	2.6	0.0349	0.0000	OK
360 minute winter	SIC07	320	4.252	0.212	3.3	0.0730	0.0000	OK
360 minute winter	SIC08	304	4.252	0.292	4.8	0.1204	0.0000	SURCHARGED
360 minute winter	SIC09	312	4.252	0.432	6.6	0.1935	0.0000	SURCHARGED
360 minute winter	Depth/Area 2	312	4.252	0.452	9.9	53.6286	0.0000	SURCHARGED
360 minute winter	SIC10	312	3.820	0.050	4.1	0.0142	0.0000	OK
360 minute winter	SIC11	304	3.709	0.049	4.1	0.0138	0.0000	OK
360 minute winter	SIC12	304	3.570	0.050	4.1	0.0140	0.0000	OK
360 minute winter	SIC13	304	3.507	0.047	4.1	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SIC01	1.000	SIC02	7.0	0.597	0.445	0.1119	
15 minute summer	SIC02	1.001	SIC03	11.0	0.713	0.736	0.1651	
15 minute winter	SIC03	1.002	SIC04	15.7	1.064	1.080	0.4476	
15 minute winter	SIC04	1.003	Depth/Area 1	23.5	1.942	0.714	0.1852	
240 minute winter	Carpark 1	Orifice	Depth/Area 1	0.9				
120 minute winter	Depth/Area 1	Orifice	Depth/Area 2	4.6				
15 minute winter	SIC05	3.000	SIC06	12.5	0.753	0.305	0.1591	
15 minute winter	SIC06	3.001	SIC07	16.1	0.806	0.387	0.3413	
15 minute winter	SIC07	3.002	SIC08	20.3	0.867	0.507	0.3137	
15 minute winter	SIC08	3.003	SIC09	29.4	1.006	0.561	0.3999	
15 minute winter	SIC09	3.004	Depth/Area 2	41.5	2.158	0.980	0.0999	
360 minute winter	Depth/Area 2	Orifice	SIC10	4.1				
360 minute winter	SIC10	1.006	SIC11	4.1	0.638	0.105	0.1238	
360 minute winter	SIC11	1.007	SIC12	4.1	0.643	0.101	0.1447	
360 minute winter	SIC12	1.008	SIC13	4.1	0.655	0.099	0.0584	101.4

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.53%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SIC01	12	6.239	0.339	10.0	0.1999	0.0000	SURCHARGED
120 minute winter	SIC02	80	6.229	0.389	5.7	0.1872	0.0000	SURCHARGED
120 minute winter	SIC03	80	6.225	0.455	8.3	0.2216	0.0000	SURCHARGED
120 minute winter	SIC04	80	6.202	0.632	12.2	0.3396	0.0000	SURCHARGED
240 minute winter	Carpark 1	236	6.248	1.148	7.5	32.4108	0.0000	FLOOD RISK
120 minute winter	Depth/Area 1	80	6.175	1.635	14.3	16.2429	0.0000	FLOOD RISK
360 minute winter	SIC05	328	4.449	0.239	2.8	0.2604	0.0000	SURCHARGED
360 minute winter	SIC06	328	4.449	0.299	3.7	0.1007	0.0000	SURCHARGED
360 minute winter	SIC07	328	4.449	0.409	4.7	0.1411	0.0000	SURCHARGED
360 minute winter	SIC08	328	4.449	0.489	6.4	0.2013	0.0000	SURCHARGED
360 minute winter	SIC09	328	4.449	0.629	9.0	0.2817	0.0000	SURCHARGED
360 minute winter	Depth/Area 2	328	4.449	0.649	13.1	77.0325	0.0000	SURCHARGED
360 minute winter	SIC10	328	3.825	0.055	5.0	0.0156	0.0000	OK
360 minute winter	SIC11	328	3.714	0.054	5.0	0.0152	0.0000	OK
360 minute winter	SIC12	328	3.575	0.055	5.0	0.0155	0.0000	OK
360 minute winter	SIC13	328	3.512	0.052	5.0	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SIC01	1.000	SIC02	8.6	0.600	0.549	0.1356	
15 minute winter	SIC02	1.001	SIC03	14.5	0.821	0.966	0.1725	
15 minute winter	SIC03	1.002	SIC04	21.1	1.202	1.447	0.5061	
15 minute winter	SIC04	1.003	Depth/Area 1	31.3	2.002	0.951	0.2395	
240 minute winter	Carpark 1	Orifice	Depth/Area 1	0.9				
120 minute winter	Depth/Area 1	Orifice	Depth/Area 2	7.4				
15 minute winter	SIC05	3.000	SIC06	17.4	0.800	0.426	0.2093	
15 minute winter	SIC06	3.001	SIC07	22.5	0.849	0.542	0.4526	
15 minute winter	SIC07	3.002	SIC08	28.4	0.898	0.710	0.4239	
15 minute winter	SIC08	3.003	SIC09	41.3	1.142	0.788	0.4945	
15 minute winter	SIC09	3.004	Depth/Area 2	59.2	2.210	1.397	0.1193	
360 minute winter	Depth/Area 2	Orifice	SIC10	5.0				
360 minute winter	SIC10	1.006	SIC11	5.0	0.672	0.127	0.1423	
360 minute winter	SIC11	1.007	SIC12	5.0	0.676	0.122	0.1665	
360 minute winter	SIC12	1.008	SIC13	5.0	0.690	0.120	0.0671	126.0

Appendix: J – SuDS Sketch

