FLOOD RISK ASSESSMENT

on:

Ferry Road, Rye

for:

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Structural Engineers Civil Engineers Building Surveyors

Canham Consulting

Ferry Road, Rye
Flood Risk Assessment
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1 INTRODUCTION

Canham Consulting Ltd have been commissioned by Plutus (Rye) Ltd to produce a Flood Risk Assessment in support of a planning application for 65 dwellings together with open space and amenity areas, located on the north side of Ferry Road, Rye, just to the west of the Hastings railway line. The centre of the site is located at 591765E 120515N. The purpose of this report is to provide information on the flood risks associated with the proposed development and present mitigation measures to the site, in order to ensure the proposed development is safe from flooding and that it does not increase the flood risk elsewhere to the design event stipulated in the National Planning Policy Framework (NPPF).

This report follows the guidance set out in the NPPF and the National Planning Policy Guidance (NPPG) alongside other national guidance such as the Environment Agency Flood Risk Assessments Climate Change guidance and the CIRIA SuDS Manual (C753 – 2015). The relevant local authority planning policies relating to flood risk management and sustainable drainage (SuDS) are set out in the Rother District Council Core Strategy and the Rye Neighbourhood Plan. The local flood risk context is set out in the Rother Council Level 1 SFRA and Level 2 SFRA (both 2008) which include risk and hazard mapping. Flood Management policies are set out in the East Sussex Local Flood Risk Management Strategy 2016-2026 (2016) and the Rye Stage 1 Surface Water Management Plan (2016). Earlier strategy policy information is set out in the Environment Agency Rother and Romney Catchment Flood Management Plan (2009). East Sussex County Council, as Lead Local Flood Authority, issued its Guide to Sustainable Drainage Systems East Sussex in 2015. Associated with the nearby nature reserve there is a Rye Harbour Nature Reserve Management Plan 2012 – 2021 which contains details relating to the management of water levels in the natural drainage system to the benefit of local wildlife.

The following data was collected as part of this assessment.

- Topographic Survey of the site.
- Sewer Records and Southern Water Capacity Check
- Environment Agency data.
- Infiltration tests

2 DEVELOPMENT DESCRIPTION & LOCATION

2.1 Type of Development with Location

The proposed development consists of 65 dwellings. The site is located to the north of Ferry Road just to the west of the road crossing over the railway line to Hastings. Figure 1 indicates the site location which is centred on Grid Reference 591765E 120515N.

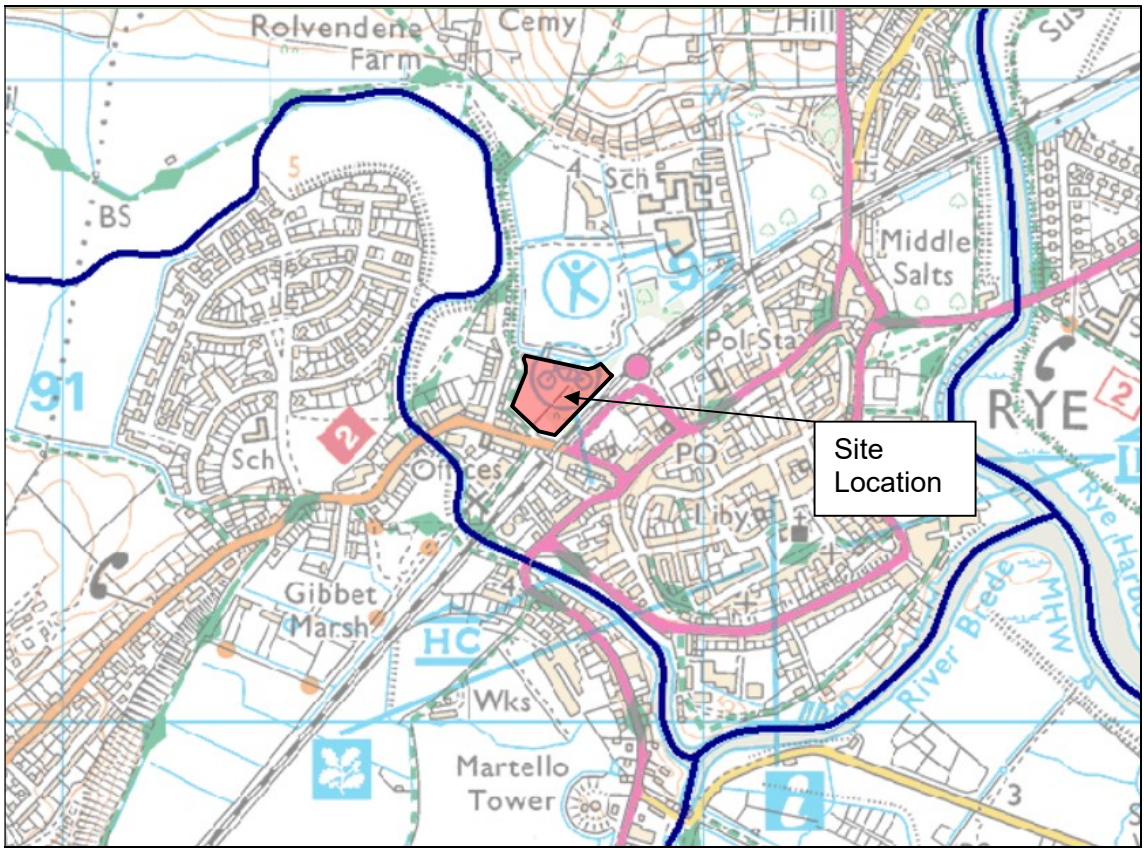


Figure 1: Site Location Plan

The brownfield site was formerly the Thomas Peacocke Lower School site and is now part cleared, with scrub/woodland adjacent to the railway line to the east. The site is just to the north of the Queen Adelaide public house site and the housing on Ferry Road, and includes some derelict remains of building foundations. To the north is Rye College and the Sports complex. To the west is Tillingham Avenue and the associated dwellings.

A Topographic Survey is provided within Appendix A. It indicates that the proposed development site has a shallow dished shape with a slight fall from north-east to south-

west. The perimeter ground levels vary from approximately 3.0m AOD to 3.25 m AOD with internal levels as low as 2.5m AOD. Ferry Road and Tillingham Avenue are set slightly higher than the general site level at approximately 3.3m AOD. To the north is a 1.5m deep drain flowing north west.

The site is allocated for housing (allocation RY04) in the Rother District Local Plan.

2.2 Flood Map for Planning and Vulnerability Classification

The EA Flood Map for Planning is shown in Figure 2.

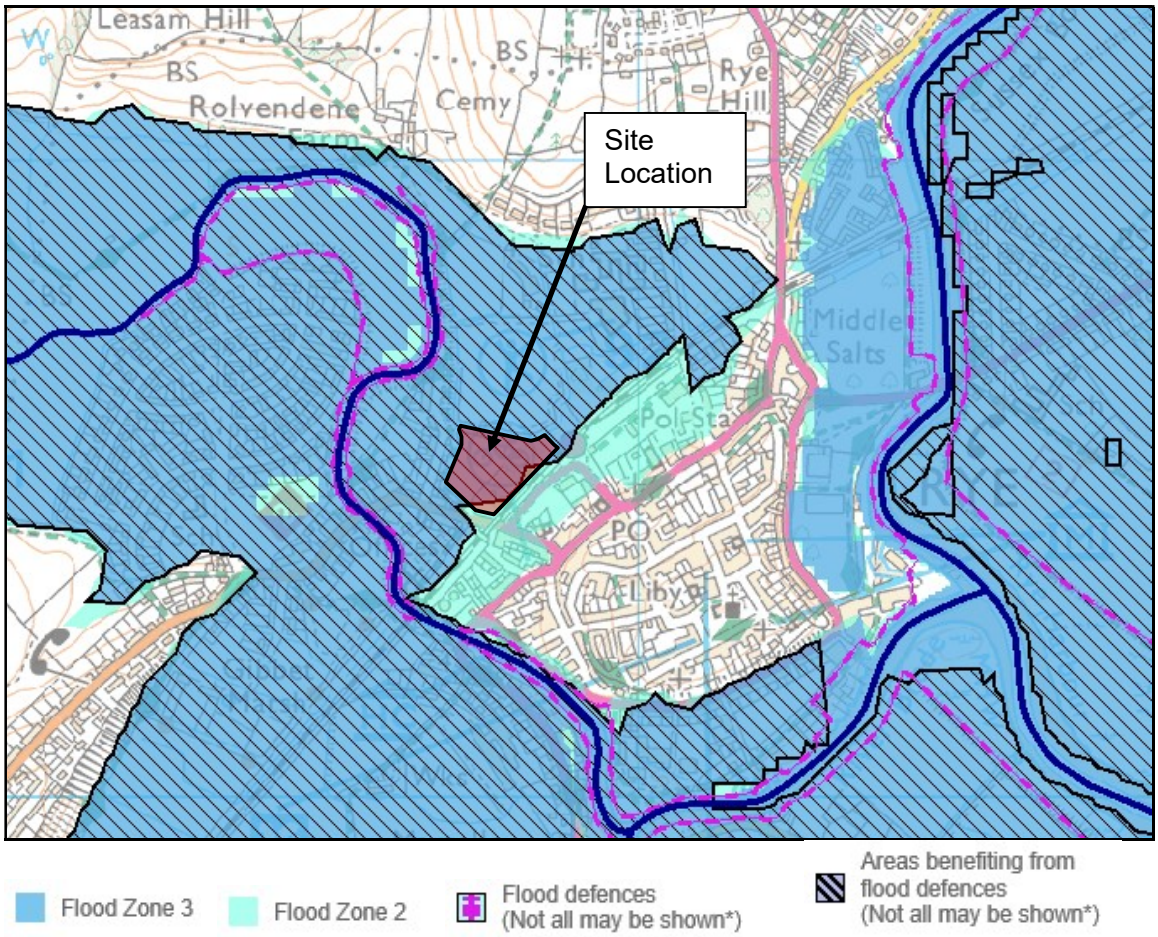


Figure 2: EA Flood Map for Planning

The site is located within a Flood Zone 3 area that benefits from defences. The guidance states that: "Land and property in this flood zone would have a high probability of flooding without the local flood defences. These protect the area against a river flood with a 1% chance of happening each year, or a flood from the sea with a 0.5% chance of happening each year."

For development proposals in this flood zone it is necessary to prepare a Flood Risk Assessment in accordance with the Environment Agency guidance.

The NPPG Table 2 provides a detailed list of which types of development fall into the vulnerability classifications described within NPPG. This list is recognised as not being exclusive and provides guidance on the various uses and their subsequent Flood Risk Vulnerability Classification.

The proposed development consists of a residential development, which falls into the **"More Vulnerable"** classification.

2.3 Sequential Test

The site is allocated for residential development. Therefore, the sequential test is deemed to have been met.

2.4 Local Policy Documents

The Rother Local Plan Core Strategy 2014

The following policies are considered to be pertinent to the scheme.

PC1: Presumption in Favour of Sustainable Development – flood risk mitigation can incorporate opportunities to improve the sustainability of this and neighbouring sites, and mitigate against the effects of climate change. The accompanying Drainage Strategy maximises the use of sustainable drainage elements.

Policy RY1: Policy Framework for Rye and Rye Harbour – the development will incorporate measures to minimise and manage flood risk.

Policy SRM1: Towards a Low Carbon Future – the flood risk management at the development will incorporate resilience to climate change.

Policy SRM2: Water Supply and Wastewater Management – the development will incorporate sustainable drainage systems.

Policy EN6: Flood Risk Management – the development will be designed to minimise and manage flood risk from fluvial sources and sea, allowing for the failure of existing defences and including an allowance for climate change, in accordance with all EA and local guidance.

Policy EN7: Flood Risk and Development – The development is supported by this FRA which demonstrates that the proposals will be safe, will not increase flooding elsewhere, and will minimise risk. Sustainable drainage systems will contribute to this.

Draft Rye Neighbourhood Plan 2016 version 8 - 2016 to 2028

The following policies are considered to be pertinent to the scheme.

Policy H8: The Former Lower School Site – Flood Risks from river and surface water are assessed in this FRA and minimised in the development proposals. The sewerage system is assessed to cope with the additional flows resulting from the development. Sustainable drainage systems are incorporated.

3 SOURCES OF FLOODING

The gov.uk website indicating "Long-term Flood Risk" shows the site to be at "high" risk of flooding from rivers and sea. With regard to surface water flooding, the gov.uk website indicates that there are small areas within the site with "low" or "medium" risk of flooding from surface water.

Flood risk in the Rye neighbourhood has been covered in the Rother Council 2008 Stage 1 and Stage 2 SFRA, which included hydraulic modelling. Risk and management policies are set out in the East Sussex Local Flood Risk Management Strategy 2016-2026 (2016) and the Rye Stage 1 Surface Water Management Plan (2015). Earlier strategy information was set out in the Environment Agency Rother and Romney Catchment Flood Management Plan (2009).

At a meeting with the Flood Management Team at ESCC (the LLFA) on 27th June 2017 the officers handed over their Drainage Report and this is included with the Meeting Record in Appendix I.

3.1 Flooding from Rivers

Fluvial flooding is flooding caused by rivers and occurs when the river channel capacity is exceeded by the flow. Most rivers have a natural floodplain which in built up areas is sometimes encroached upon by development.

The nearest watercourse is the River Tillingham, which has raised flood defences along its alignment to the west of the site. Fluvial flooding from the River Tillingham and the consequences of a defence breach are set out in the River Tillingham Flood Risk Mapping Study (2009). Based upon the Tillingham Study, the EA has provided the fluvial flood level information within Appendix B. The site does not flood under the defended scenario, but does flood in the undefended scenario. The present day undefended flood levels at the various locations on the site are summarised in Appendix B. There are defences, so the undefended levels are not realistic.

From the information above, flooding from the river can only occur in the residual risk event of defence failure and therefore can be considered as **low.**

3.2 Flooding from The Sea

Tidal flooding from the sea occurs when high tides and storm surges raise the level of tidal waters above the level of the shore or river bank. There are two ways in which the sea could potentially flood a site.

a) Open Coast Risk – the risk from the sea

The open coast is 2.4km to the south of the site. Substantial coastal defences exist along the coast at this location and the existing studies show that the site is not at risk from tides, up to the extreme 0.5% AEP event (includes extreme 0.5% AEP wave height). The EA flood data supplied includes flood levels taken from the 2009 Romney Marsh Flood Study which includes the residual risk undefended scenario. These residual risk flood levels are shown in Appendix B. There are defences, so the undefended levels are not realistic. There is only a residual risk from a breach/failure of defences to the site.

b) Tidal Influence affecting Rivers

At this location, the River Tillingham is influenced by the downstream tidal levels. The Tillingham joins the River Brede downstream at Rye Harbour and the Brede flows into the River Rother. The River Brede and River Rother are also tidal. Under normal circumstances the effect of high tides on upstream areas is reduced by the operation of the Tillingham sluice, which is closed during periods of extreme high tide in order to avoid backing up of tidal water upstream. Riverside embankments upstream of the Tillingham sluice are set at high defence levels in order to defend overbank areas from fluvial flow during the period of “tidelock” when the Tillingham sluice is closed.

From the information above, flooding from the sea can only occur in the residual risk event of defence failure and therefore can be considered as **low.**

3.3 Flooding from The Land

Within urban areas where there are large areas of impermeable surfacing e.g. roof areas, car parking and roads, it is possible for high intensity rainfall storms to not be able to soak into the ground or enter the man-made drainage system at a quick enough rate

to cope with the volume of water. Where this occurs, the excess water can flow across land and potentially cause flooding.

The topographical survey within Appendix A indicates that the site is slightly dished. There is a raised footpath along the western perimeter. There is a drainage channel at the northern boundary of the site (this has the status of an Ordinary Watercourse) which flows north westwards towards an IDB drain which outfalls to the River Tillingham to the west. It appears that the existing site, and the school buildings which formerly occupied the site, drained to this watercourse.

The gov.uk website map of long-term surface water flood risk (see Figure 3 below), and the 2015 Rye Stage 1 Surface Water Management Plan, both show that there are areas within the site which have low to medium risk of surface water flooding. This may be because of local overland flow or because of poor soakage into the soils.

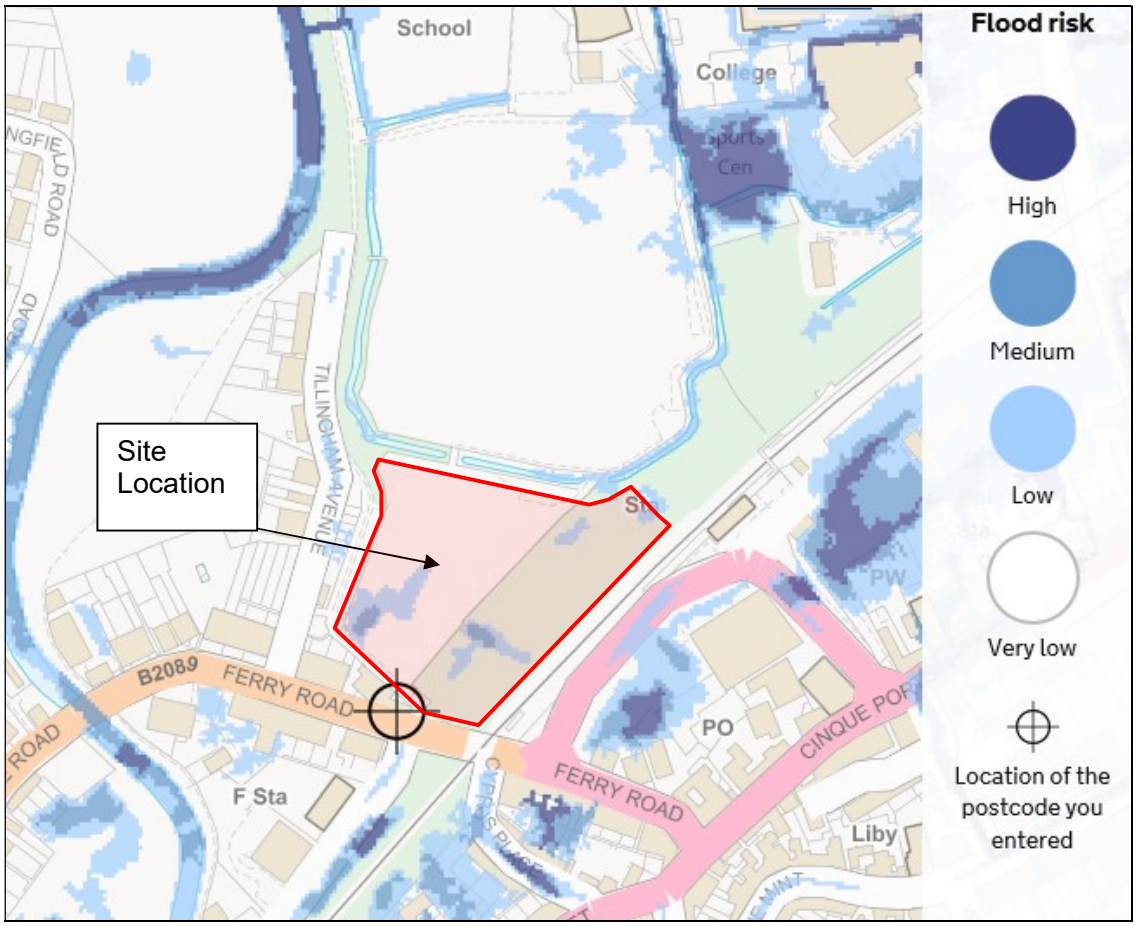


Figure 3: Long-Term Risk of Surface Water Flooding

The 2015 Rye Stage 1 Surface Water Management Plan does not identify any specific incidents or risks to the site which might require risk management. The SWMP does include a specific action plan for the area of The Grove, to the north of the site: that area has a history of surface water flooding incidents. The risk of flooding from the land is considered to be **low**.

3.4 Flooding from the Ground

In areas where the level of groundwater is high, rainfall that soaks into the ground can raise groundwater to a level where structures within the ground are at risk of flooding. Structures such as basements or detention ponds can be at risk, although this is dependent upon the ground conditions of the site.

Site soakage tests in accordance with BRE 365 have been carried out at the site with very poor results and these are included in Appendix C. The tests indicate that infiltration cannot be used at the development as any soakaway design would fail the required 24-hour half drain time. The 2m deep trial pit logs indicate 300mm – 600mm of made ground over clayey slightly gravelly sand.

The British Geological Society (BGS) maps indicate that the site has bedrock of Ashdown Formation – Sandstone, Siltstone and Mudstone. The superficial geology consists of Tidal Flat Deposits – Clay and Silt.

Within 100m to the south of the site there are three BGS borehole logs available. The borehole logs indicate ground water is at shallow depth (approximately 2m depth). The superficial deposits are variable and appear to extend to a depth of 10-16m.

According to the EA records the site is not within any Groundwater Source Protection Zone although it is designated within a Minor Aquifer High Vulnerability Zone.

The flood risk from groundwater is considered to be **low**.

3.5 Flooding from Artificial Sources

Infrastructure failure flooding includes that from sewers and also risks from reservoirs and canals. Sewer flooding occurs when the quantity of water flowing into the sewers exceeds the capacity of the sewer and backs up to an extent where it floods out of manholes or gullies. Alternatively, and more commonly, sewers flood when a blockage

occurs in a pipe. This is more likely in private sewers, but is usually less severe than flooding from larger public sewers which can cause extensive flooding due to the greater quantity of surface area which they drain.

Adopted Sewers: The Southern Water sewer record plans (see Appendix D), indicate foul sewers to the south of the site, along Ferry Road and along Tillingham Avenue. The Rye Stage 1 SWMP does not identify any flood risks from these adopted sewers or other surface water sewers. The flood risk from adopted drainage is considered to be **low**.

Private Drainage: There are likely to be existing private surface water drains in and around the site, associated with the historic use of the site which discharge into the Ordinary Watercourse to the north of the site. As part of the development any new private drainage will be designed in line with the Building Regulations Part H which will mitigate the overall risk, although the lack of maintenance remains as a residual risk. The flood risk from private drainage is considered to be **low**.

Flooding from Reservoirs: The EA online maps show that the site is not near to any reservoir.

3.6 Residual Risk Flood Modelling

Two Hydraulic Modelling Studies have been completed by the Environment Agency: the River Tillingham Flood Risk Mapping Study (2009) and the Romney Marsh Tidal Modelling and Mapping Study (2009). The Tillingham study included an examination of the consequences of failure of the fluvial defences, and the Romney Tidal Study included an analysis of the consequences of failure of the tidal defences. It should be noted that neither study examined the consequences of an extreme fluvial flood coinciding with an extreme tidal event.

The EA tidal and fluvial flood level information supplied in November 2016 and included in Appendix B is based upon these hydraulic models.

Subsequently, the EA requested further site-specific residual risk modelling. This was specified in order to examine the effects of a 0.5% AEP (2115) tidal flood at the downstream boundary of the River Tillingham together with the simultaneous failure of

the Tillingham Sluice (jammed in the open position), and a breach in the River Tillingham defences west of the Ferry Road site. The EA considered this to be the most onerous realistic scenario for the development site, and considered that the resulting modelled flood levels across the site could be considered the “design” flood levels.

The residual risk scenario parameters are therefore:

a) Failure of the Tillingham Sluice to operate – assumed jammed in the open position

b) Tidal event to be the 0.5% AEP event in 2115

c) 10m breach in the left bank of the River Tillingham (upstream of the sluice), to the west of the site. Otherwise fluvial and tidal defences in place.

d) River Tillingham fluvial ReFH baseflows only

The detailed Technical Note relating to this site-specific residual risk modelling is included in Appendix E and the most onerous results are set out in Table 1 and Figure 4 below.

Figure 4: Location of Flood Level Data Points

Site Data Point	0.5% AEP 2115 Tide Defended Peak Flood Levels Sluice Open with No Tillingham Breach (m AOD)	Water Depth (m)	0.5% AEP 2115 Tide Defended Peak Flood Levels Sluice Open with Western Tillingham Breach (m AOD)	Water Depth (m)	EA 0.5% AEP 2115 Tide Un-Defended Peak Flood Levels (m AOD)	Water Depth (m)
1	3.98	0.01	3.97	0.01	5.14	1.39
2	3.59	0.18	3.70	0.39	5.13	1.90
3	3.51	0.31	3.69	0.43	5.13	1.73
4	3.51	0.45	3.69	0.63	5.13	2.22
5	3.50	0.30	3.69	0.47	5.12	2.00
6	3.50	0.69	3.69	0.89	5.11	2.35
7	3.50	0.45	3.69	0.65	5.12	2.40
8	3.50	0.5	3.69	0.70	5.12	2.20
9	3.50	1.00	3.69	1.19	5.12	2.61
10	3.50	0.23	3.69	0.38	5.12	1.90
11	-	-	-	-	5.12	1.58
12	3.60	0.14	3.73	0.19	5.13	1.94
13	4.30	0.08	4.30	0.08	5.14	1.42
14	3.50	0.50	3.69	0.70	5.12	2.19
15	3.50	0.90	3.69	1.09	5.12	2.76
16	3.50	0.43	3.69	0.62	5.13	2.17
17	3.50	0.68	3.69	0.88	5.13	2.37
18	3.50	0.77	3.69	0.96	5.13	2.41

Table 1: Residual Risk Breach Modelling Results

It has been agreed with the Environment Agency that the 0.5% AEP 2115 tidal event, with the sluice open and with the Tillingham defence breach, is a realistic residual risk and that the resulting peak flood level of 3.69m AOD which occurs during the event at the central area of the site should be adopted as the “design” flood level (modelled flood levels at the perimeter areas are influenced by local topographical anomalies).

4 CLIMATE CHANGE

The factors for climate change, as defined in NPPF and NPPG, should be applied to the peak rainfall intensity, river flows or to the sea level increase, as appropriate, depending upon the dominant flood source. The dominant effect at the site within the residual risk scenario is the tidal influence. Consequently, the appropriate climate change allowance for sea level rise has been incorporated in the analysis. A 100-year lifespan for the development has been considered as the use is residential.

Table 3 of the 2017 Flood Risk Assessments: Climate Change Allowances Guidance advises the use of a cumulative sea level rise of 1.21m between the base year of 1990 and 2115 (assume the same level applies to 2117), and this has been incorporated in the residual risk hydraulic flood modelling.

For the purposes of the drainage strategy (see accompanying Drainage Strategy Report), Table 2 of the Guidance indicates that in small and urban catchments a central level of 20% and upper end of 40% peak rainfall intensity allowance should be used to assess the range of impact. NPPG only covers up to 2115, so it has been assumed the same level will apply for 2117. It is proposed that a conservative approach is considered and that a climate change factor of +40% is utilised on all drainage calculations.

5 DETAILED DEVELOPMENT PROPOSAL

The proposed residential development consists of the construction of 65 dwellings together with access roads and open landscaped areas. The access to the development will be from Ferry Road to the south of the site. The proposed development layout is shown in Appendix F.

5.1 On-Site Layout and Flood Risk

The development layout is designed to minimise the risk and consequences of flooding. The site-specific “design” flood level agreed with the Environment Agency, from the residual risk hydraulic modelling, is 3.69m AOD.

The finished dwelling ground floor levels will be set at 300mm above the design flood level of 3.69m AD, at 3.99m AOD. The development will be provided with a “dry escape route on foot” for the use of all residents during emergencies and under the conditions specified in the Flood Plan. This will be the footpath alongside the spine road, and other roads, set at 3.69m AOD. The spine road carriageway is to be set at 3.49m AOD. It is intended that the footpath routes are used if necessary when a Flood Alert is announced, before and until a Flood Warning is announced.

In order to determine the best alignment for the “dry escape route” we have carried out hazard mapping of the existing site in conjunction with the residual risk flood modelling, in accordance with the requirements of “Flood Risks to People Methodology” (FD/2321TR1), Framework and Guidance for Assessing and Managing Flood Risk for New Development (FD2320/TR2), and the “Supplementary Note on Flood Hazard Ratings and Thresholds for Development Planning and Control Purposes” (Clarification of Table 13.1 of FD2320/TR2 and table 3.2 of FD2321/TR1).

An animation of the spread of the residual risk flood, represented by the “Flood Hazard Rating” (a function of water depth, water velocity, and a debris factor) has been prepared. There are four thresholds of this value, Low (Caution), Moderate (Dangerous for Some - i.e. Children), Significant (Dangerous for most People) and Extreme (Dangerous for All).

Details of the hazard mapping are shown in Appendix H. The hazard mapping based on the existing site topography indicates that during the residual risk event, the site is encroached from the west, from the embankment breach position, approximately 2 hours after the breach initiation, and during this time the site remains at “Very Low Hazard – Caution”, coloured blue on the plans. At 3 hours after the breach, some of the areas of the site are inundated to the next lowest threshold “Danger for Some – includes children, the elderly and the infirm”, coloured yellow on the plans. However, reviewing the analysis with the proposed raised levels of the new development, it can be demonstrated that the spine road and “dry escape route” will remain dry or “Very Low Hazard – Caution” through the event. At approximately five hours after the first inundation, the water begins to recede from the site.

The Hazard Mapping has been carried out with a debris factor of 0.5 when the water depth is below 0.25m, a debris factor of 1 when the water depth is between 0.25 and 0.5m, and a debris factor of 1 when the depth is greater than 0.75m and/or the velocity is greater than 2m/sec. The velocities during the flood, after the initial inundation, are generally very low, of the order of 0.1m/sec. However, during the initial inundation, between 2 hours and 3 hours after the breach, flows can reach 1m/sec in certain areas.

When a Flood Warning is announced, the Flood Plan instructs residents to evacuate if safe to do so, or to take refuge on the upper floor of the dwellings until it is announced that the situation has returned to normal. The “dry escape route” utilises the raised road/footpath surface and will exit the site at the south-east corner to Ferry Road. This will permit a further onward dry route all the way to one of the expected Council Rest Centres at Rye Community Centre located at Conduit Hill, Rye TN31 7LE, as shown on the drawings associated with the Flood Plan included in Appendix G. (The location of all of Council Rest Centres will be announced by the authorities during any Flood Alert period).

The Hazard Rating analysis demonstrates that the arrangement of “dry escape route on foot”, within and outside the site, corresponds well with the aspiration to locate these routes within the least hazardous areas which remain during the various stages of the flood encroachment.

6 FLOOD RISK MANAGEMENT MEASURES

6.1 Level Strategy

In order to mitigate the flood risk from any overland flow, the external levels will fall away from the entrances to the buildings. This will ensure that should any drainage systems become blocked, that the flood flow paths flow away from the buildings. This is a function of the detailed design.

Ground floor level within and at the thresholds of dwellings will be set at 3.99m AOD, 300mm above the residual risk flood level of 3.69m AOD. The “dry escape route on foot” is aligned appropriately, and set at 3.69m AOD, ensuring that the degree of flood hazard to people using it remains at or below the Low Flood Hazard Rating for several hours during the early stages of the residual risk flood event.

6.2 Compensatory Storage

As this proposal is on land which is defended against fluvial and tidal flooding, the site is ordinarily neither a flood storage area in times of flood, nor on a flood flow path, and the new development footprint will not cause loss of flood storage volume.

Under the residual risk defence failure flood event, it is possible that the new development may have an effect upon the risk to neighbouring areas. An increase in the quantity of flood water displaced may increase flood levels at neighbouring properties. The area of the former Thomas Peacocke School buildings totalled approximately 1,720m². The impermeable area of the proposed residential development (buildings footprints, roads and hard surfacing) amounts to approximately 3,501 m². This is an increase of approximately 100%.

However, the Flood Hazard Animation attached to this FRA indicates that the site area is small in comparison with the area of the entire flood storage cell encroached by the residual risk flood. This indicates that any loss of storage represented by the increase in displaced flood water is insignificant compared with the total within the cell, and that any increase in flood level over the entire cell would be negligible.

The animation also shows that the residual risk flood event encroaches upon areas to the west, south and north of the site before it reaches the development site itself. This

suggests that there would be minimal effect to the risk at the neighbouring areas and neighbouring dwellings are unlikely to be at greater risk because of the new development.

Furthermore, the provision of compensation storage volume within the site itself, to compensate for the increase in the building footprint (together with the raised “dry escape route”), is impossible to arrange on a “level for level basis” as there is no ground within the site which is above the residual risk flood level. National guidance suggests that in sites where there is no ground above the floodplain, simply “digging holes in the floodplain” is not recommended.

With regard to the areas indicated on the long-term surface water flood risk maps as storing surface water, the development site will be profiled suitably to ensure that this water is not displaced from the site.

6.3 Flood Warning

The EA operates a flood information service.

It is possible to sign up for flood warnings. The EA flood warnings are delivered direct to the household occupier, although the occupier does need to sign up to the flood warning system via the EA website www.environment-agency.gov.uk or via telephone 0345 988 1188.

The flood warnings are delivered either via telephone, text, email or fax under a free service and come in one of three categories as shown within Table 2.

Flood Warning Code	Description/ Action
	Flooding is possible. Be prepared. Issued 2 hours to 2 days before an event. • Be prepared to act on your flood plan. • Prepare a flood kit of essential items. • Monitor local water levels and the flood forecast on our website.
	Flooding is expected, immediate action required. Issued half an hour to one day before an event. • Move family, pets and valuables to a safe place. • Turn off gas, electricity and water supplies if safe to do so. • Put flood protection equipment in place.
	Severe flooding. Danger to life. Issued when flooding poses a significant threat to life. • Stay in a safe place with a means of escape. • Be ready should you need to evacuate from your home. • Co-operate with the emergency services. • Call 999 if you are in immediate danger.

Table 2: Flood Warning Codes

The owners and occupiers of the properties will join the Flood Warning scheme which will provide them with 24 hours prior to the site flooding to act, which is sufficient time to evacuate the site.

6.4 Emergency Access and Egress

In the event of a severe flood event, if a Flood Alert is received prior to flooding occurring in the local area, then the access/egress to the site will be via the dry escape route as shown in the Flood Plan (Appendix G).

Lidar ground model surveys and Hazard Mapping have been used to establish a “dry” and “Low Hazard” route from the site exit all the way to the Rye Community Centre in Conduit Hill, during the residual risk event.

Depending upon any announcements which may be issued by the emergency services, it is likely that the Council Rest Centre will be at the Rye Community Centre at Conduit

Hill. The route to this Centre will be to exit the site at the southern corner on to Ferry Road, then turn left across the railway line and proceed 150m along Ferry Road until Cinque Ports Street is reached. It is then necessary to turn left and proceed 300m along Cinque Ports Street north-eastwards, and turn right into Conduit Hill. The Centre is approximately 40m along Conduit Hill on the left, just past Turkey Cock Lane.

6.5 Safe Refuge

In the event that a flood event occurs suddenly without any flood warning, it is considered that the first and/or second floors will provide a safe refuge for the likely 12 to 18-hour duration of flooding.

It is unlikely that there will be a power supply during this time and therefore a suitable flood kit should be prepared which will include water, food, torch and additional blankets as well as some form of communication such as a mobile phone so that the authorities/ emergency services can be notified. The flood kit should be kept at first floor level.

6.6 Flood Plan

Given the above it is proposed that a full Flood Plan based upon the above information is prepared by each property owner(s) or developer to ensure that there is an understanding of the likely risks and actions associated with any flood warning. A preliminary Flood Plan is included within Appendix G. This will be completed by the owner of each property and included within the sales documents for any future owner. Useful information is given on the www.rother.gov.uk website and the Sussex Resilience Forum website at SussexResilienceForum@sussex.pnn.police.uk

The Flood Plan will emphasise that the residential properties can be evacuated during the period of a “Flood Alert”. If a “Flood Warning” is received before it has been possible to evacuate the dwelling, then it is safe to remain in the dwelling at the upstairs refuge with the flood kit, phone and supplies as set out in the Flood Plan, for the expected 12 to 18-hour duration of the flood.

Rother District Council, Rye Council and the emergency services have in place a Multi-Agency Emergency Flood Plan, and the Flood Plan prepared for the new residences will allow them to coordinate their emergency procedures to include the Ferry Road development.

6.7 Foul Water Drainage

Foul drainage from the development will connect to the Southern Water system to the south of the site. The foul water strategy is set out in the Drainage Strategy which accompanies this FRA.

The designs will meet the adoption requirements of Southern Water.

6.8 Surface Water Drainage (SuDS)

The surface water drainage proposals for the development are set out in the Drainage Strategy which accompanies this FRA. Preliminary discussions with the IDB suggest that the historic site formerly discharged to the Ordinary Watercourse to the north of the site. As set out in the Rye Surface Water Management Plan, the Ordinary Watercourse drains to an IDB drain and outfalls to the River Tillingham. The IDB agree in principle to the new development continuing to discharge surface water to the watercourse.

In accordance with national guidance, there will be the maximum implementation of SuDS in the form of attenuation pipe storage and restriction of outflow rates to the pre-existing values.

6.9 Maintenance

It is important that all drainage elements at the site are properly maintained during the life of the development, in order to prevent flooding caused by blockages or failure of drainage systems. It is proposed that the minimum requirements for maintenance are set out in an operation and maintenance manual which should be completed before the site is occupied. In terms of the responsibility for the maintenance of the surface water and foul drainage, at properties and in public areas, this will be a mixture of the adopting authority (Southern Water), individual householders or a maintenance company employed on their behalf which will be controlled through the deeds of the property, or the Local Authority in their capacity as the highway authority.

SuDS schemes require much more maintenance than traditional drainage piped systems and as such it is imperative that a suitable maintenance regime is established to ensure that they function in the way they are designed to.

The exact maintenance requirements of the SuDS will depend upon the product or SuDS provided as a function of detailed design. However, it is proposed that the minimum requirements for maintenance are recommended to follow that set out in 'The SuDS Manual' (C753), Chapter 32. In terms of the responsibility for the maintenance of the SuDS, it will rest with a maintenance management company.

7 RESIDUAL RISKS

The residual risks to the development are considered as:

7.1 Lack of Maintenance

As discussed above, SuDS drainage systems are more susceptible to failure due to lack of maintenance. In order to mitigate this, the proposed SuDS (catchpits, attenuation tanks etc) will be managed by a management company and adopted where possible.

7.2 Flood Warning Not Received

Should the residents of the properties not receive the flood warning then they could be at risk. The provision of a safe refuge on the ground and upper floors, along with a flood kit which provides emergency supplies for 48 hours will mitigate the risk.

8 OFF SITE IMPACTS

8.1 Impact of Surface Water Drainage

The site will continue to discharge to the watercourse at the restricted pre-existing rate and the implementation of SuDS will bring an **improvement** to water quality.

8.2 Impact of Development on Hydrological Morphology

The proposed development will not displace any flood water under the ordinarily defended conditions and therefore will not impinge on the hydrological morphology of the area. Under the residual risk flood scenario, because of the new buildings and raised roads on the site, compared with the earlier existing buildings and surfacing on the site, the new development may have a small overall effect on displacing flood water. However as set out in Section 6.2 above, under the residual risk scenario, because of the large size of the flood cell compared with the site, the effect upon flood levels across the entire flood cell will be negligible.

The residual risk modelling also indicates that large areas to the south, west and north of the site, which include the surrounding residential areas, are inundated before the site itself is reached by the flood. This also will minimise any effects on hydrological morphology.

Therefore, the new development, compared with the former development, will have a largely **neutral** effect upon hydrological morphology.

8.3 Impact on Groundwater

The proposed development will not negatively impact on the groundwater in the local area and therefore the site is considered as **neutral**.

9 SUMMARY

The proposed development consists of 65 dwellings together with access roads and landscaped public open space. The site is allocated for housing in the Local Plan. The gov.uk website Flood Map for Planning shows the site to be mostly within defended Flood Zone 3. This FRA demonstrates that the site can be designed to be safe against the residual flood risk associated with defence failure. The greater sustainability benefits which outweigh the residual flood risk, as required by the Sequential Test, are set out in information accompanying the planning application. It is therefore demonstrated that the site is suitable for residential development.

Substantial hydraulic modelling and risk mapping of the Rye area has been carried out for the EA in earlier years (the 2009 River Tillingham Fluvial Study and the 2009 Romney Marsh Tidal Study). In connection with this FRA, and as requested by the EA, further site specific tidal residual risk modelling has been carried out, in order to explore the consequences of a defence failure together with the failure of the Tillingham Sluice. This modelling has produced a “design” residual risk flood level of 3.69m AOD which has been agreed with the EA.

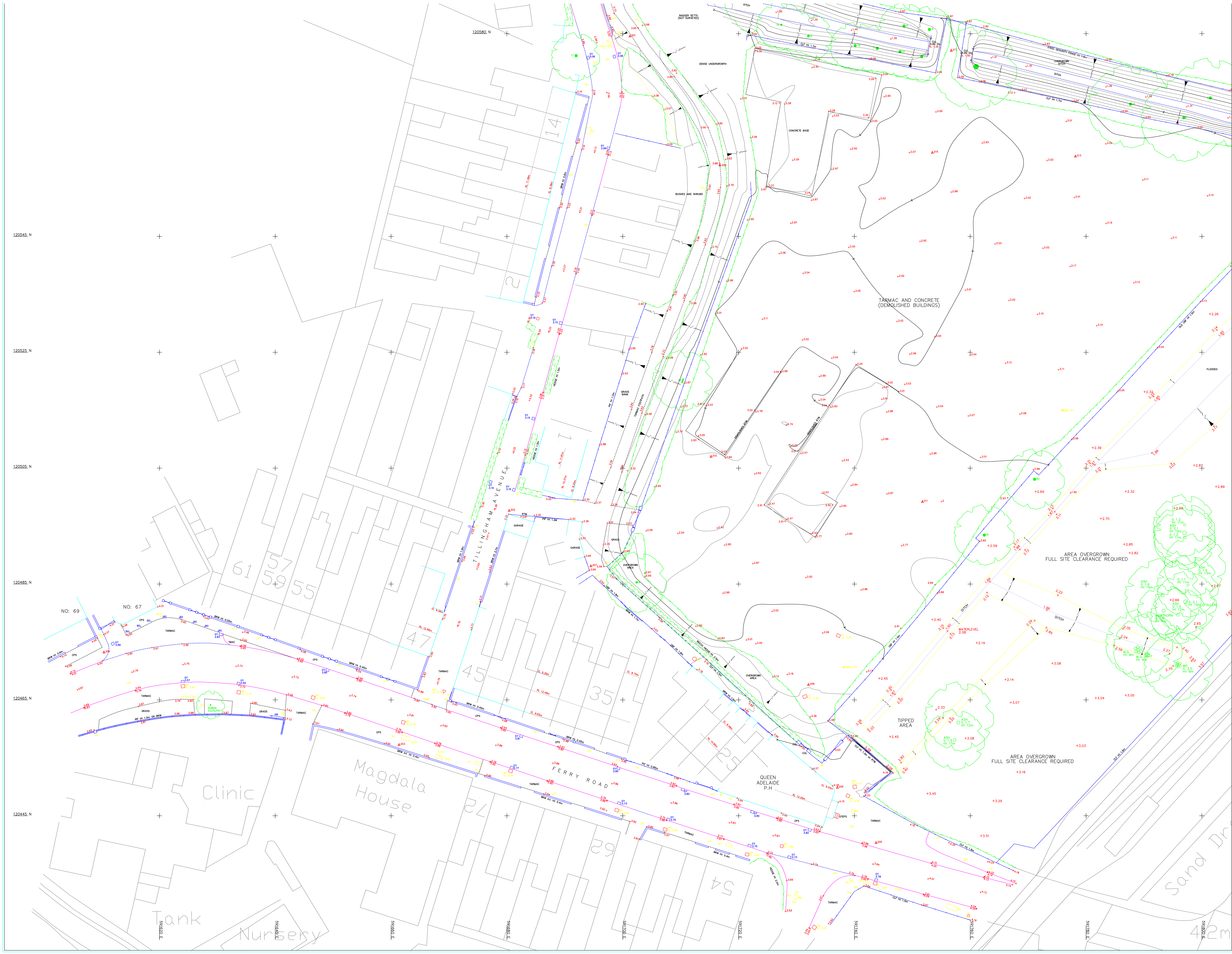
A safe “dry escape route” within and outside the site has been designed into the scheme, intended to be used in accordance with the circumstances set out in the Flood Plan. Lidar ground model surveys and Hazard Mapping have been used to establish that there will be a “dry” and “Low Hazard” route from the site exit all the way to the Rye Community Centre in Conduit Hill, during the residual risk event.

If these mitigation measures are included within the detailed design the site will have a neutral impact on the flood risk to the area.

Overall the proposed development addresses and mitigates the risk from flooding in line with the policies set out in NPPF.

APPENDIX A

Topographic Survey



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Grid related to best fit on OS Data.
Levels related to OSBM situated on 83 High Street, Rye. Value 14.57m.

Some detail may be omitted due to been obscured.

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ALL STATIONS ARE PK NAILS

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REVISIONS

Issue	Details	By	Date
	Site extended		

INDICATIVE ONLY

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SG7 6BE

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Ferry Road Rye

TOPOGRAPHICAL SURVEY

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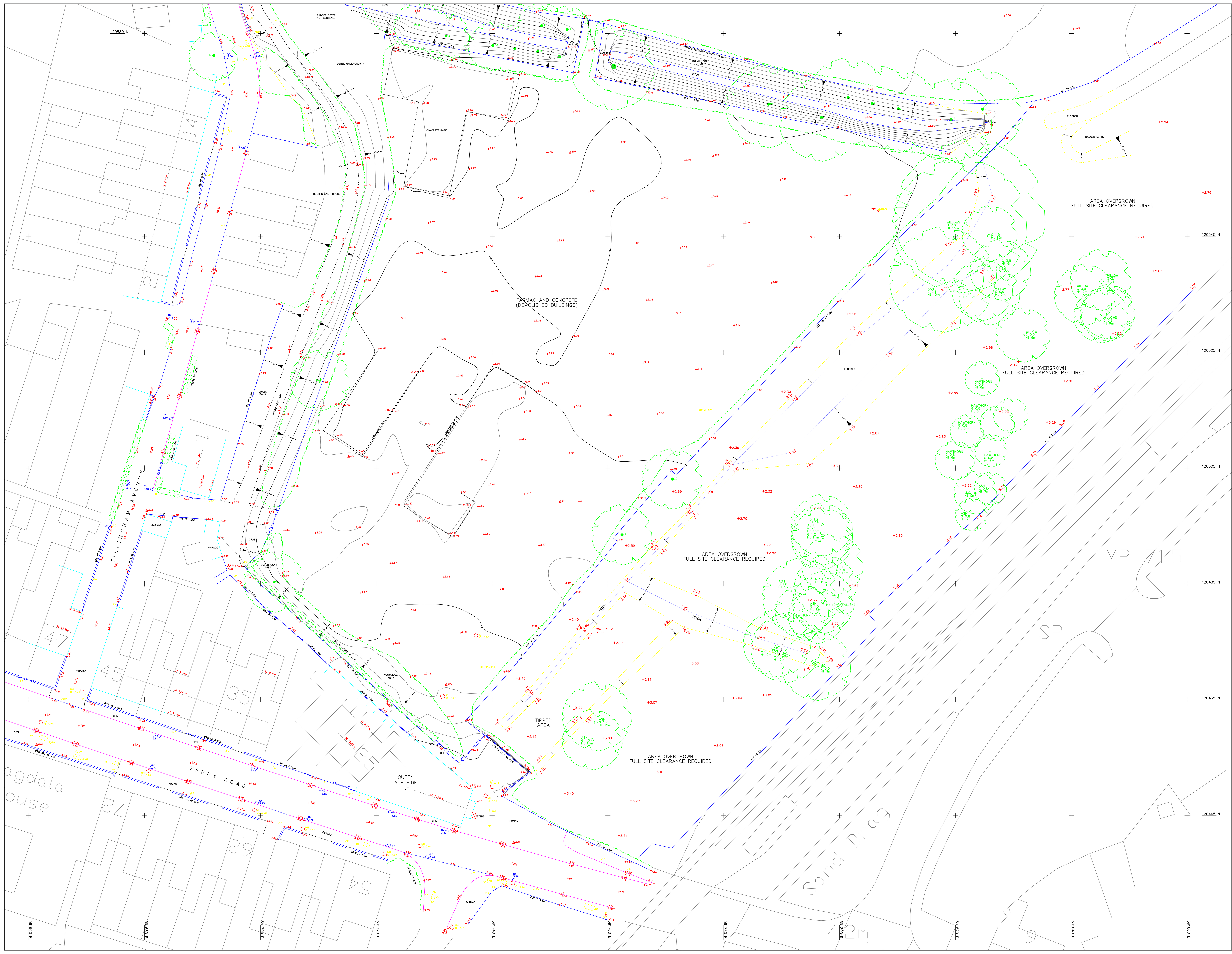

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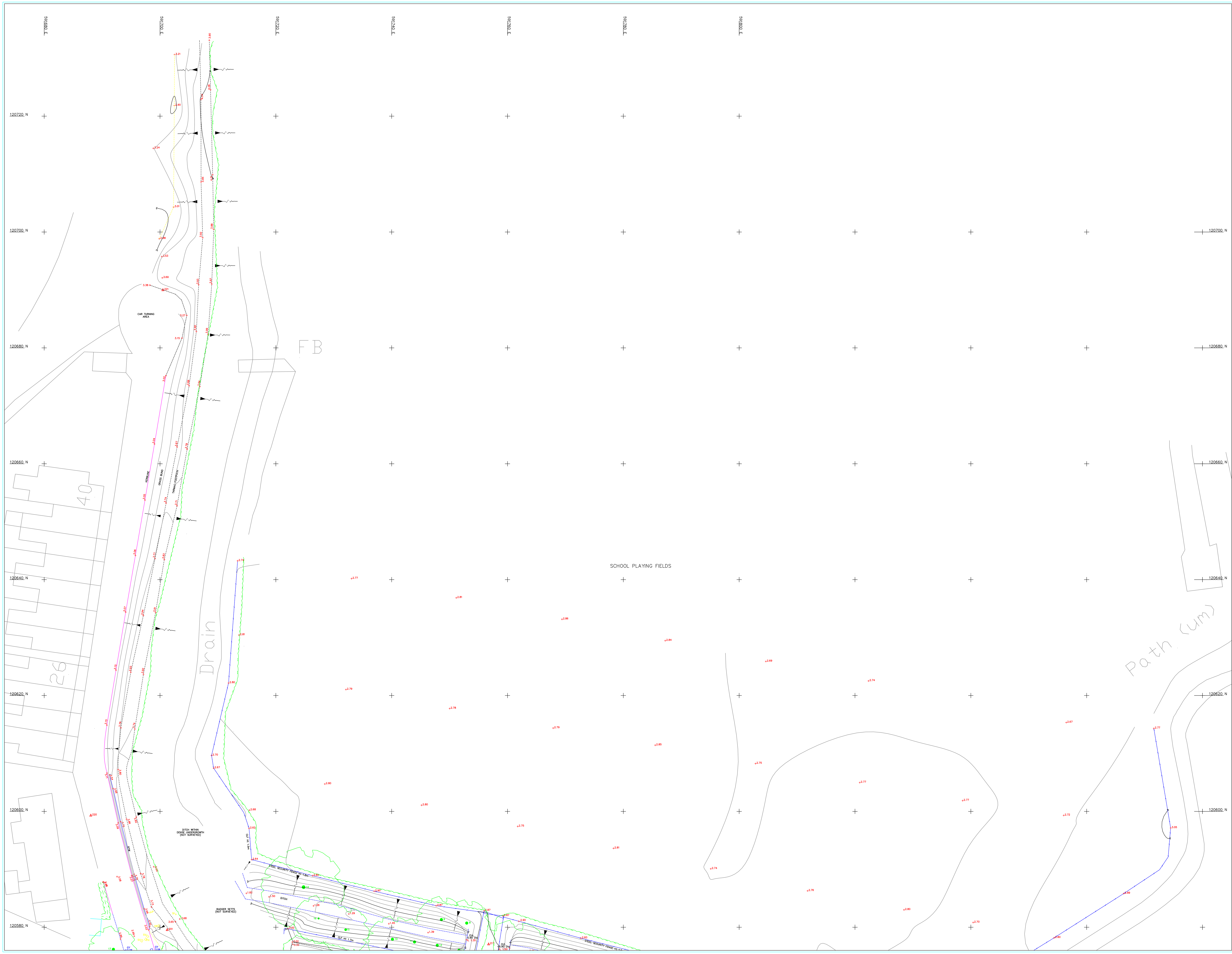

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Appendix B

Environment Agency Data

Environment Agency

Table 1: Modelled Fluvial Flood Levels for various Annual Exceedance Probability (AEP) events, shown in metres above ordnance datum (mAOD)

	National Grid Reference		Modelled Fluvial Flood Levels for Annual Exceedance Probabily (AEP) events shown (metres AOD)								
			Defended						Undefended		
Node ID	Easting	Northing	20% AEP	5% AEP	2% AEP	1.3% AEP	1% AEP + CC	0.4% AEP	1% AEP	0.4% AEP	0.1% AEP
1	591728	120451	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	591719	120472	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	591701	120486	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.10
4	591717	120522	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.10
5	591725	120551	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	591724	120576	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	591758	120569	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	591798	120562	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	591841	120564	0.00	0.00	0.00	0.00	0.00	0.00	2.87	2.91	3.10
10	591868	120545	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.10
11	591830	120506	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	591802	120474	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	591773	120441	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	591754	120544	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.10
15	591811	120536	0.00	0.00	0.00	0.00	0.00	0.00	2.87	2.91	3.10
16	591767	120512	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.10
17	591730	120492	0.00	0.00	0.00	0.00	0.00	0.00	2.82	2.86	3.10
18	591771	120477	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.10

Data taken from the River Tillingham Flood Risk Mapping Study, completed by a PBA/Atkins/Jacobs consortium in 2009.

Please be aware that this model was completed in 2009. Whilst this is currently the best available data, flood risk in this area may have changed since the completion of this modelling study. The model provides flood levels above ordnance datum for a variety of AEP flood events. Flood level data for the 1% AEP and 0.1% AEP defended scenarios are unavailable for this model. Flood depth data is also unavailable.

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Email: kslenquiries@environment-agency.gov.uk

It should be noted that the Environment Agency specified that this study should consider the risk of flooding from extreme fluvial flood events only. The study does not take into account the joint probability of an extreme fluvial event occurring during an extreme tidal event, neither does it account for tidal flooding or sea level rise. The consideration of the flood risk from these additional factors was beyond the scope of this study but it is recommended that they be considered.

Table 2: Modelled Tidal Flood Levels for various Annual Exceedance Probability (AEP) events, shown in metres above ordnance datum (mAOD)

	National Grid Reference		Modelled Tidal Flood Levels for Annual Exceedance Probability (AEP) events shown (metres AOD)									
			Defended					Undefended				
Node ID	Easting	Northing	5% Tide 5% Wave	1.3% Tide 1.3% Wave	0.5% Tide 100% Wave	0.5% Tide 0.5% Wave	0.1% Tide 0.5% Wave	0.5% AEP (2010)	0.5% AEP (2070)	0.5% AEP (2115)	0.1% AEP (2010)	0.1% AEP (2115)
1	591728	120451	0.00	0.00	0.00	0.00	0.00	0.00	4.20	5.14	4.00	5.50
2	591719	120472	0.00	0.00	0.00	0.00	0.00	3.61	4.07	5.13	3.85	5.50
3	591701	120486	0.00	0.00	0.00	0.00	0.00	3.58	4.05	5.13	3.83	5.50
4	591717	120522	0.00	0.00	0.00	0.00	0.00	0.00	4.01	5.13	0.00	5.50
5	591725	120551	0.00	0.00	0.00	0.00	0.00	3.47	4.00	5.12	3.71	5.49
6	591724	120576	0.00	0.00	0.00	0.00	0.00	3.47	3.99	5.11	3.71	5.49
7	591758	120569	0.00	0.00	0.00	0.00	0.00	3.47	3.99	5.12	3.71	5.49
8	591798	120562	0.00	0.00	0.00	0.00	0.00	3.47	3.99	5.12	3.71	5.49
9	591841	120564	0.00	0.00	0.00	0.00	0.00	3.47	3.99	5.12	3.71	5.49
10	591868	120545	0.00	0.00	0.00	0.00	0.00	3.47	3.99	5.12	3.71	5.49
11	591830	120506	0.00	0.00	0.00	0.00	0.00	0.00	4.00	5.12	0.00	5.49
12	591802	120474	0.00	0.00	0.00	0.00	0.00	0.00	4.00	5.13	3.71	5.50
13	591773	120441	0.00	0.00	0.00	0.00	0.00	0.00	4.22	5.14	0.00	5.50
14	591754	120544	0.00	0.00	0.00	0.00	0.00	3.47	4.00	5.12	3.71	5.49
15	591811	120536	0.00	0.00	0.00	0.00	0.00	3.47	3.99	5.12	3.71	5.49
16	591767	120512	0.00	0.00	0.00	0.00	0.00	3.47	4.00	5.13	3.71	5.50
17	591730	120492	0.00	0.00	0.00	0.00	0.00	3.48	4.01	5.13	3.71	5.50
18	591771	120477	0.00	0.00	0.00	0.00	0.00	3.47	4.03	5.13	3.72	5.50

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Table 3: Modelled Tidal Flood Depths for various Annual Exceedance Probability (AEP) events, shown in metres (m)

	National Grid Reference		Modelled Tidal Flood Depths for Annual Exceedance Probability (AEP) events shown (metres)											
			Defended					Undefended						
Node ID	Easting	Northing	5% Tide 5% Wave	1.3% Tide 1.3% Wave	0.5% Tide 100% Wave	0.5% Tide 0.5% Wave	0.1% Tide 0.5% Wave	0.5% AEP (2010)	0.5% AEP (2070)	0.5% AEP (2115)	0.1% AEP (2010)	0.1% AEP (2070)	0.1% AEP (2115)
1	591728	120451	0.00	0.00	0.00	0.00	0.00	0.00	0.44	1.39	0.36	0.76	1.75
2	591719	120472	0.00	0.00	0.00	0.00	0.00	0.40	0.84	1.90	0.73	1.24	2.26
3	591701	120486	0.00	0.00	0.00	0.00	0.00	0.25	0.65	1.73	0.54	1.06	2.09
4	591717	120522	0.00	0.00	0.00	0.00	0.00	0.00	1.10	2.22	0.96	1.55	2.59
5	591725	120551	0.00	0.00	0.00	0.00	0.00	0.37	0.88	2.00	0.76	1.33	2.38
6	591724	120576	0.00	0.00	0.00	0.00	0.00	0.72	1.24	2.35	1.11	1.68	2.73
7	591758	120569	0.00	0.00	0.00	0.00	0.00	0.76	1.27	2.40	1.15	1.72	2.77
8	591798	120562	0.00	0.00	0.00	0.00	0.00	0.56	1.08	2.20	0.95	1.53	2.58
9	591841	120564	0.00	0.00	0.00	0.00	0.00	0.97	1.48	2.61	1.36	1.93	2.98
10	591868	120545	0.00	0.00	0.00	0.00	0.00	0.26	0.77	1.90	0.65	1.22	2.27
11	591830	120506	0.00	0.00	0.00	0.00	0.00	0.00	0.48	1.58	0.00	0.91	1.95
12	591802	120474	0.00	0.00	0.00	0.00	0.00	0.00	0.82	1.94	0.68	1.27	2.31
13	591773	120441	0.00	0.00	0.00	0.00	0.00	0.00	0.50	1.42	0.00	0.77	1.78
14	591754	120544	0.00	0.00	0.00	0.00	0.00	0.56	1.07	2.19	0.94	1.52	2.57
15	591811	120536	0.00	0.00	0.00	0.00	0.00	1.11	1.63	2.76	1.50	2.08	3.13
16	591767	120512	0.00	0.00	0.00	0.00	0.00	0.53	1.05	2.17	0.92	1.50	2.54
17	591730	120492	0.00	0.00	0.00	0.00	0.00	0.73	1.25	2.37	1.11	1.70	2.74
18	591771	120477	0.00	0.00	0.00	0.00	0.00	0.76	1.31	2.41	1.16	1.74	2.78

Data taken from the Romney Marsh Tidal Flood Risk Mapping Study, completed by Mott MacDonald in 2009.

A 0.00 figure indicates that the site in question is outside the flood extent for a particular return period, at this location.

There is no additional information or health warnings for these depths and levels, or the model from which they were produced.

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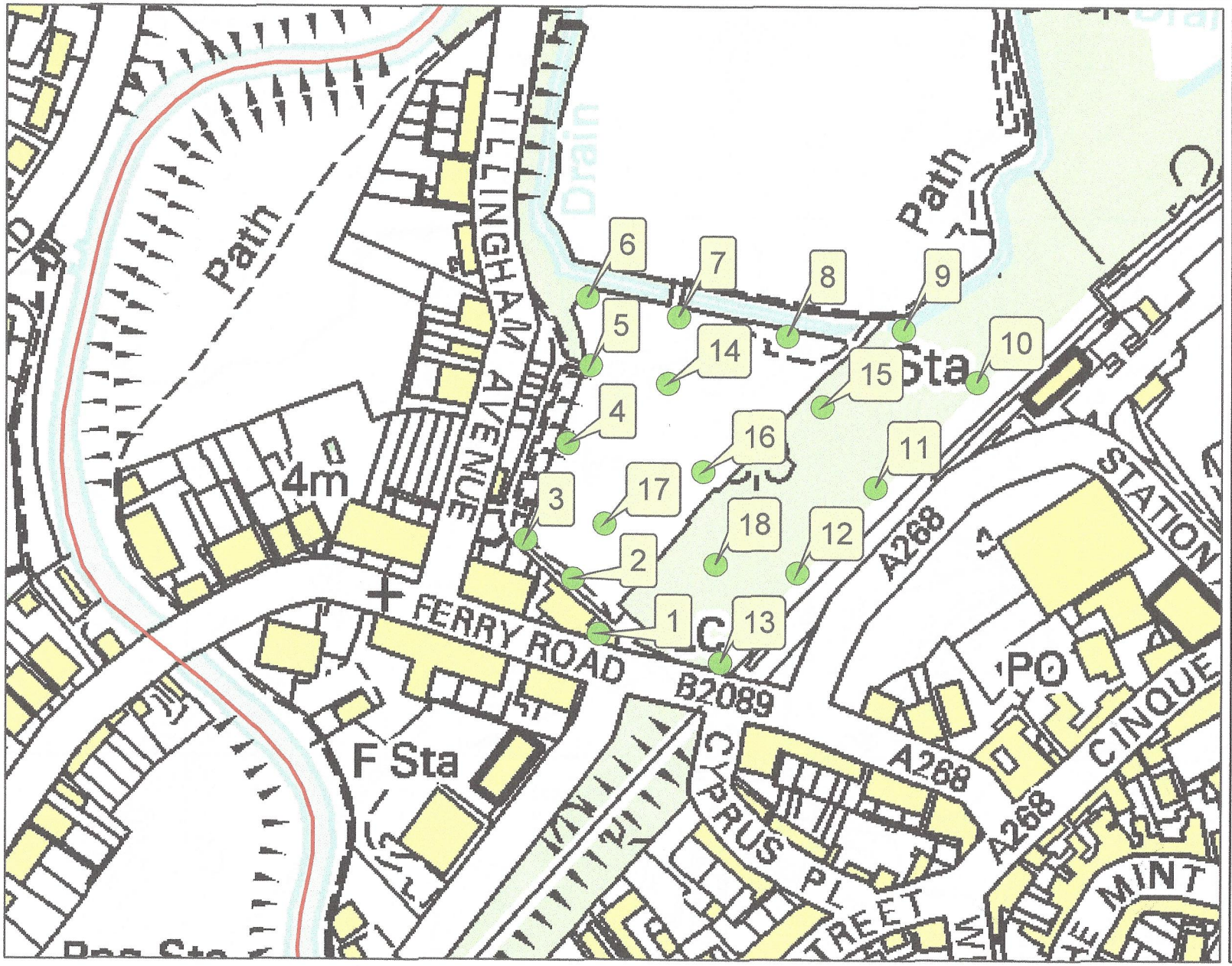
Data points map centred on land north of Ferry Road, Rye, TN31 7DJ.
Created 03/11/2016 [Ref: KSL 27445 SD]



Environment Agency

Scale 1:2,000

N W E S

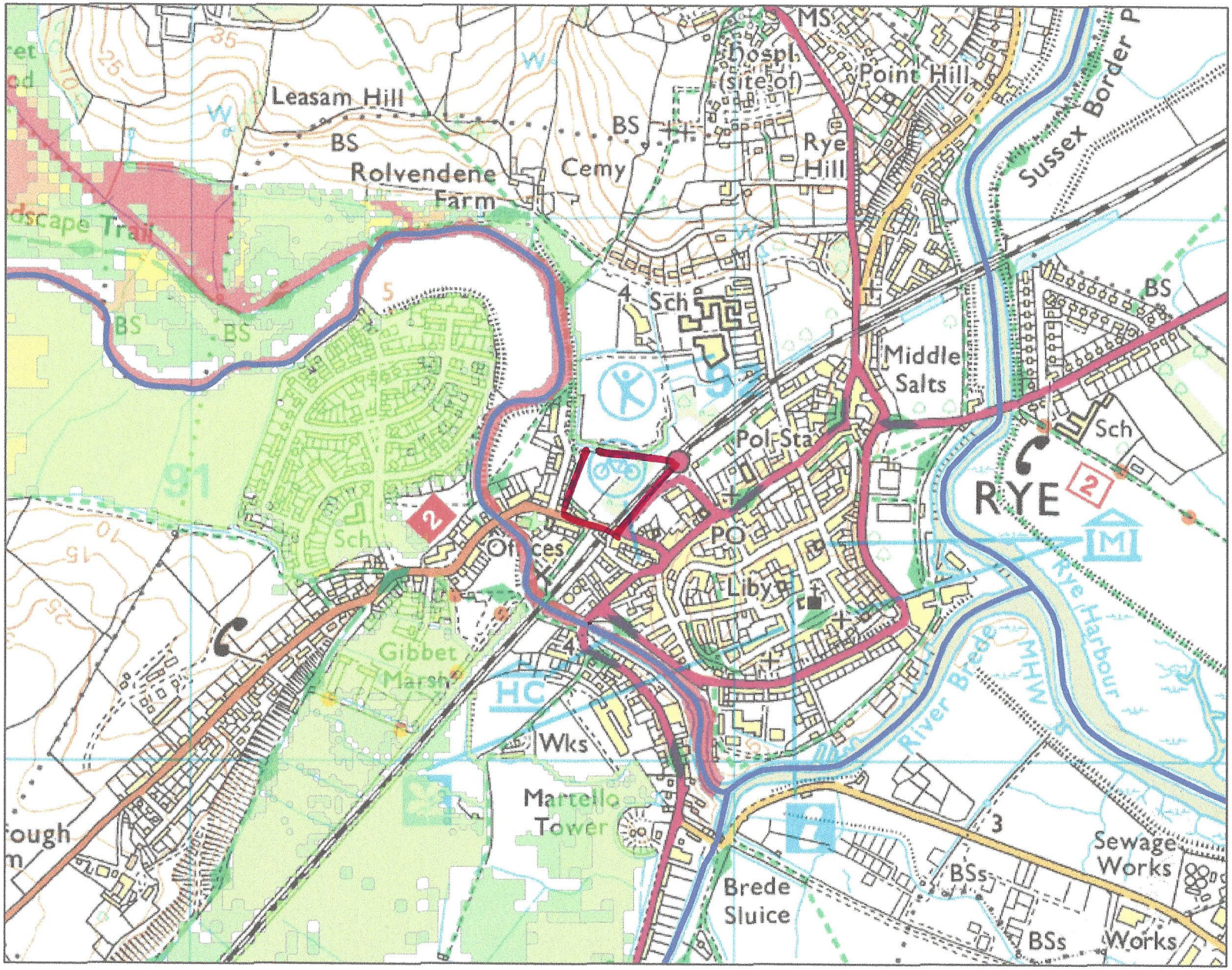
Legend

- Data points
- Main River

0 50 100
Meters

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Defended Fluvial Flood Outlines Map centred on land north of Ferry Road, Rye, TN31 7DJ.
Created 03/11/2016 [Ref: KSL 27445 SD]



Environment Agency

Scale 1:10,000

N W E S

Legend

- Main River
- 20% AEP
- 5% AEP
- 2% AEP
- 1.3% AEP
- 1% AEP
- 1% AEP + CC
- 0.4% AEP
- 0.1% AEP

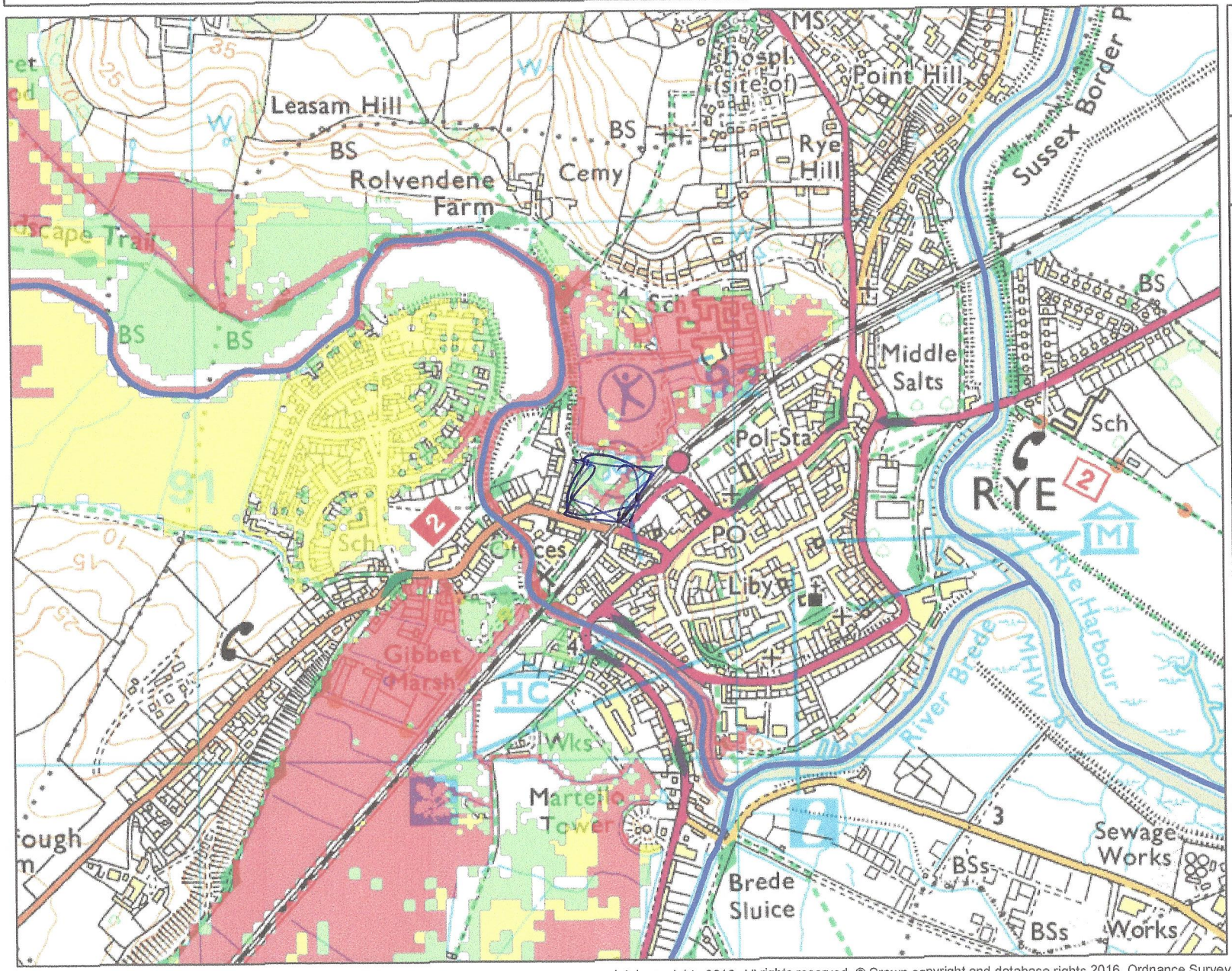
1% + CC = 1% Climate Change extent. This is the 1% AEP event with an allowance for climate change (+20% on river flows).

AEP = Annual Exceedance Probability. The probability of a flood of a particular magnitude, or greater, occuring in any given year.

0 250 500
Meters

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Undefended Fluvial Flood Outlines Map centred on land north of Ferry Road, Rye, TN31 7DJ.
Created 03/11/2016 [Ref: KSL 27445 SD]



Environment Agency

Scale 1:10,000

N W E S

Legend

- Main River
- 1.0% AEP
- 0.4% AEP
- 0.1% AEP

AEP = Annual Exceedance Probability. The probability of a flood of a particular magnitude, or greater, occuring in any given year.

0 250 500
Meters

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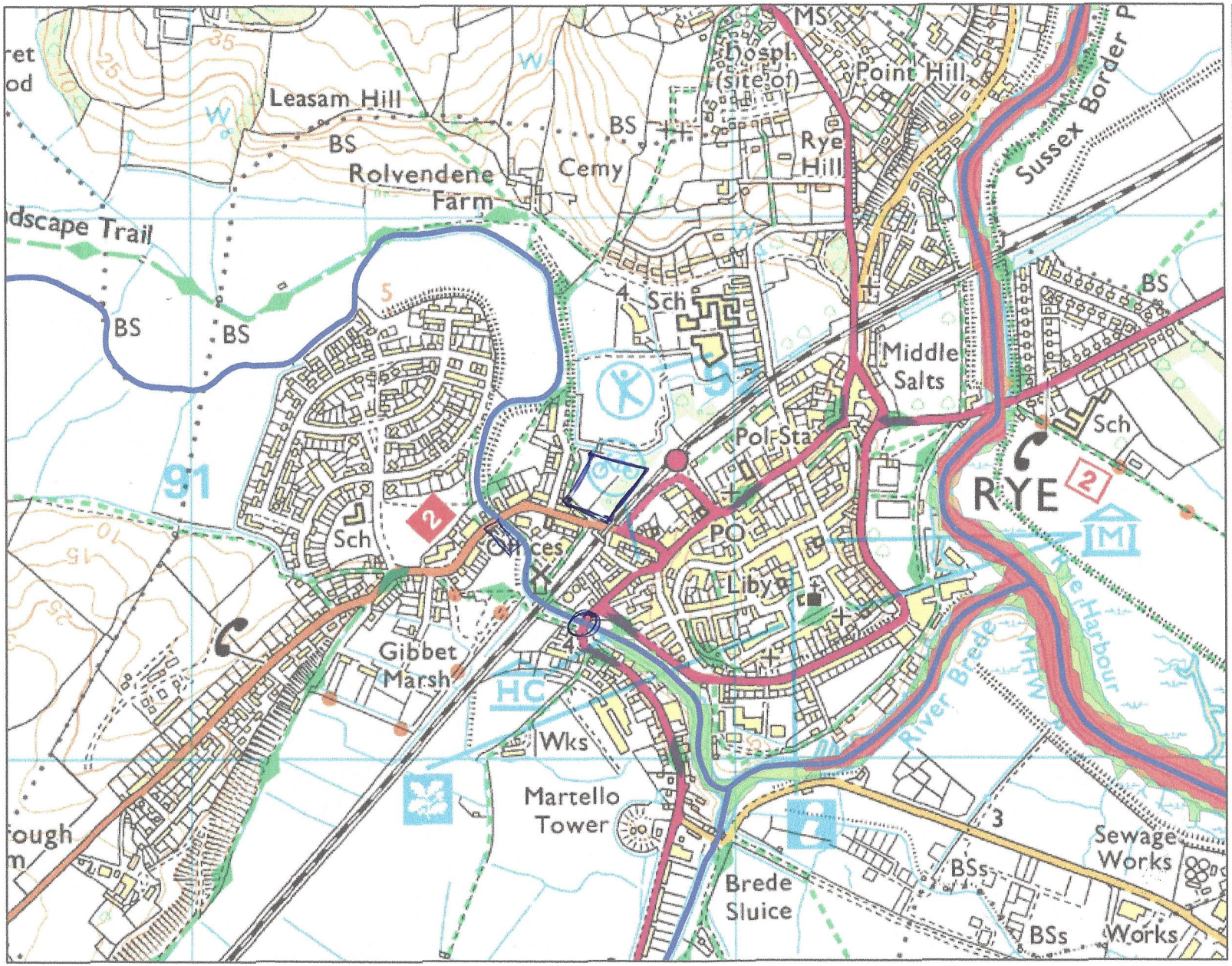
Defended Tidal Flood Outlines Map centred on land north of Ferry Road, Rye, TN31 7DJ.
Created 03/11/2016 [Ref: KSL 27445 SD]



Environment Agency

Scale 1:10,000

N W E S

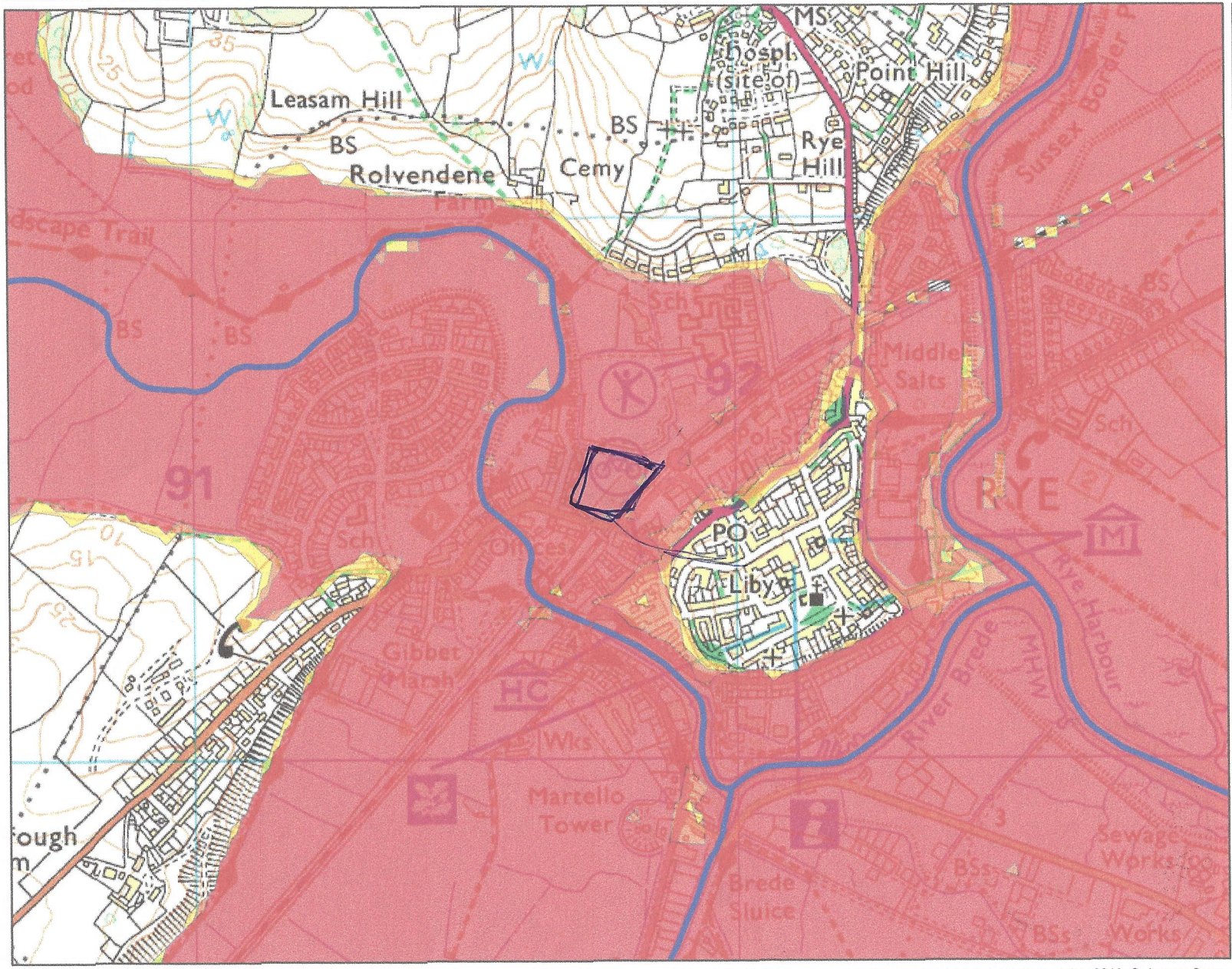
Legend

- Main River
- 5% Tide 5% Wave
- 1.3% Tide 1.3% Wave
- 0.5% Tide 100% Wave
- 0.5% Tide 0.5% Wave
- 0.1% Tide 0.5% Wave

0 250 500
Meters

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Undefended Tidal Flood Outlines Map centred on land north of Ferry Road, Rye, TN31 7DJ.
Created 03/11/2016 [Ref: KSL 27445 SD]



Environment Agency

Scale 1:10,000

N W E S

Legend

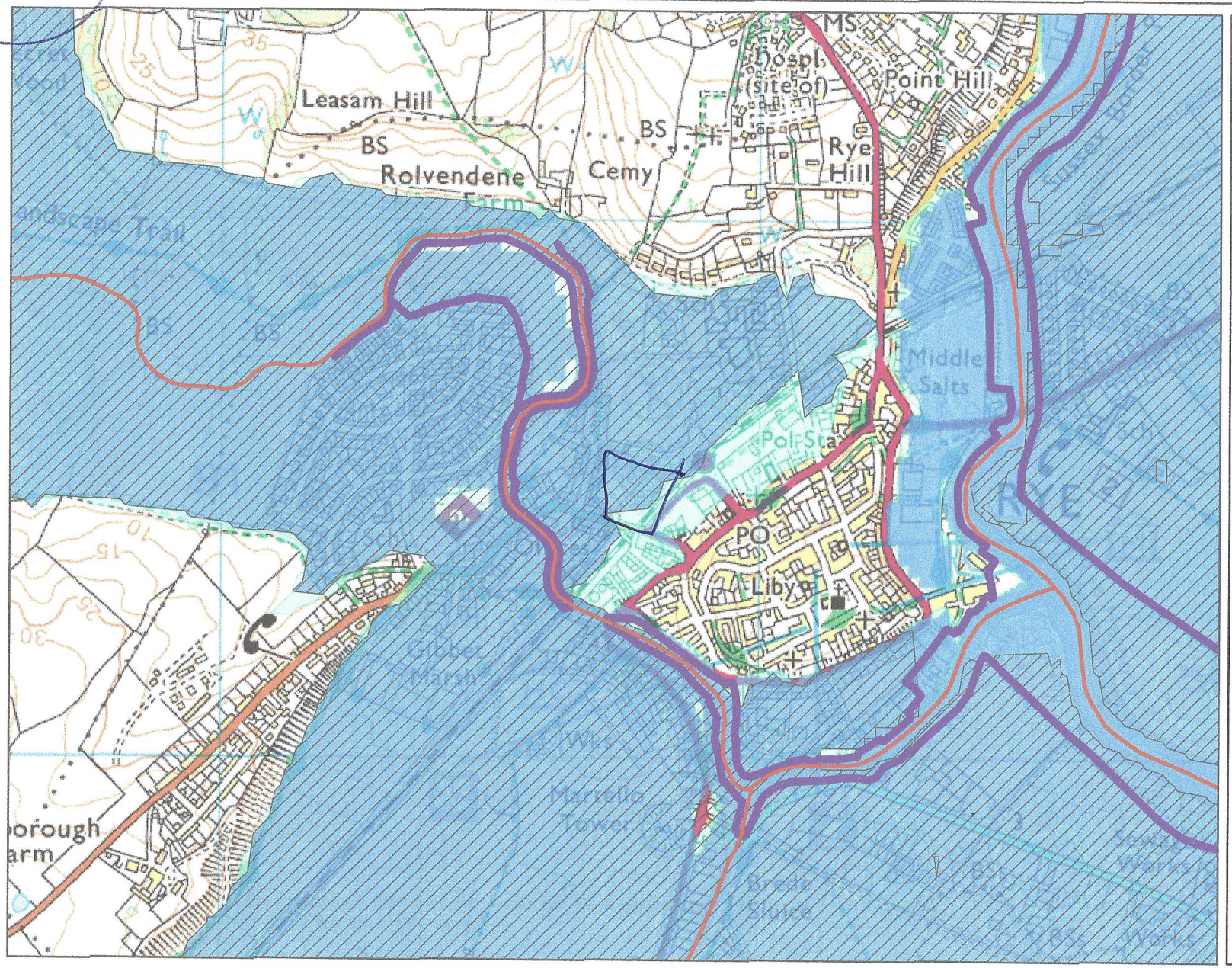
- Main River
- 0.1% AEP (2010)
- 0.1% AEP (2070)
- 0.1% AEP (2115)
- 0.5% AEP (2010)
- 0.5% AEP (2070)
- 0.5% AEP (2115)

AEP = Annual Exceedance Probability. The probability of a flood of a particular magnitude, or greater, occuring in any given year.

0 250 500
Meters

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Flood map centred on land north of Ferry Road, Rye, TN31 7DJ.
Created 03/11/2016 [Ref: KSL 27445 SD]



Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

APPENDIX C

Site Infiltration Tests

Specialists in the investigation & reclamation of brownfield sites

Jomas Associates Ltd

1 Furzeground Way
Lakeside House
Stockley Park
UB11 1BD

Tel: 0843 289 2187
Fax: 0872 115 4505

www.jomasassociates.com
info@jomasassociates.com

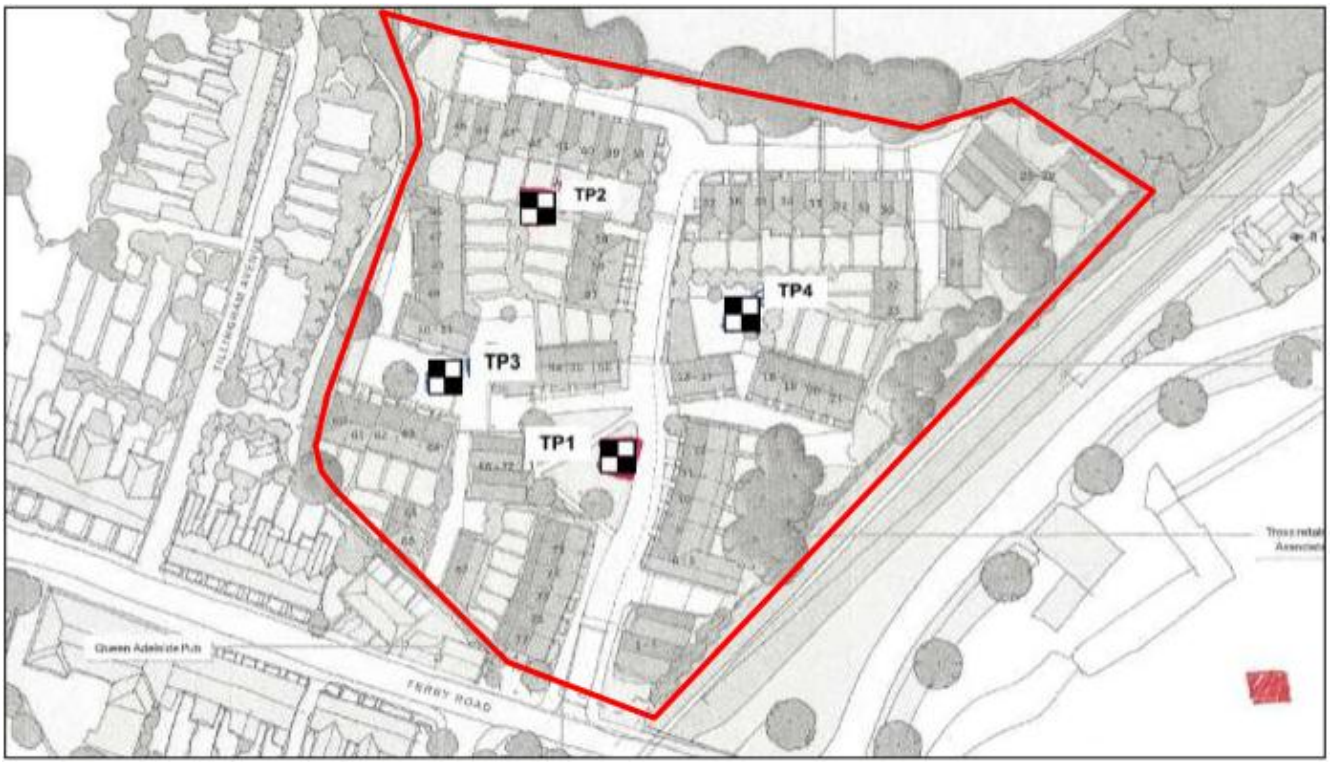
Dr Nick Davey
Entran
7 Greenway Farm
Bath Road
Wick
Bristol
BS30 5RL

02 March 2017
Our Ref: P9687J1026/src

Dear Mr Raveendran,

Ferry Road, Rye, TN31 7DN – SOAKAGE TESTING IN TRIAL PITS - FACTUAL RECORDS

On 23rd February 2017, the site at Ferry Road, Rye, was attended by a Jomas engineer to carry out soakage testing in accordance with BRE 365. Tests were carried out at 4No positions across the site as shown on the plan of the plan below:



The ground conditions observed across the 4 trial pits were broadly consistent Brown gravelly clayey sand with brick and concrete fragments (Made Ground) was encountered to depth of approximately 0.5mbgl. This is underlain by brown very sandy Clay and clayey Sand to the base of all trial pits. TP1 and TP2 were excavated to a depth of 2mbgl. TP3 and TP4 were excavated to depths of 0.8mbgl and 1mbgl respectively. The pits were then filled with water and allowed to drain over time, with the water level measured at reguar intervals. The four pits were monitored for between 50 and 108 minutes.

None of the pits showed significant infiltration.

The raw soakage testing data and calculation is attached to this letter.

Yours sincerely,

Shaw Carter BSc (Hons) FGS
Geotechnical Engineer

Enc:

Exploratory Hole Logs
Infiltration Test Results and Calculations

TRIAL PIT RECORD

Exploratory Hole No:	TP1		
Site Address:	Ferry Road, Rye, TN31 7DN	Project No:	P9687J1026
Client:	Plutus (Rye) Ltd	Ground Level:	
Logged By:	Michael	Date Commenced:	23/02/2017
Checked By:		Date Completed:	23/02/2017
Type and diameter of equipment:	Mini digger	Sheet No:	1 Of 1

Pit Dimension:	Length:	1.00	Width:	0.40	Depth:	2.00

Remarks

1: Soakage test (BRE 365) undertaken

2:

3:

4:

Sample or Tests			Strata			
Type	Depth (mbgl)	Result	Legend	Depth (mbgl)	Water Strikes (mbgl)	Strata Description
				0.35		Asphalt over sandy gravel. Gravel consists of fine to coarse flint fill. (MADE GROUND).
P+J	0.40			0.40		Asphalt layer. (MADE GROUND).
P+J	0.60			0.60		Concrete slab. (MADE GROUND).
D	1.00			1.40		Soft to firm consistency grey clayey SAND.
D	2.00			2.00		Soft to firm consistency grey clayey slightly gravelly SAND. Gravel consists of coarse rounded flint.

0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample

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TRIAL PIT RECORD

				Exploratory Hole No:		TP2	
Site Address:	Ferry Road, Rye, TN31 7DN			Project No:		P9687J1026	
Client:	Plutus (Rye) Ltd			Ground Level:			
Logged By:	Michael			Date Commenced:		23/02/2017	
Checked By:				Date Completed:		23/02/2017	
Type and diameter of equipment:	Mini digger			Sheet No:		1 Of 1	
Pit Dimension:	Length:	1.30	Width:	0.40	Depth:	2.00	

Remarks

1: Soakage test (BRE 365) undertaken

2:

3:

4:

Sample or Tests				Strata			
Type	Depth (mbgl)	Result		Legend	Depth (mbgl)	Water Strikes (mbgl)	Strata Description
			0.00				
P+J	0.30				0.30		Asphalt over soft consistency brown sandy gravelly clay. Gravel consists of fine to coarse brick and concrete. (MADE GROUND).
			0.50				Soft to firm consistency grey clayey SAND.
D	1.00		1.00				
			1.50				
D	2.00		2.00		2.00		
			2.50				
			3.00				
			3.50				
			4.00				
			4.50				
			5.00				

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample

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TRIAL PIT RECORD

Exploratory Hole No:	TP3		
Site Address:	Ferry Road, Rye, TN31 7DN	Project No:	P9687J1026
Client:	Plutus (Rye) Ltd	Ground Level:	
Logged By:	Michael	Date Commenced:	23/02/2017
Checked By:		Date Completed:	23/02/2017
Type and diameter of equipment:	Mini digger	Sheet No:	1 Of 1

Pit Dimension:	Length:	1.20	Width:	0.40	Depth:	0.80

Remarks

1: Soakage test (BRE 365) undertaken

2:

3:

4:

Sample or Tests			Strata			
Type	Depth (mbgl)	Result	Legend	Depth (mbgl)	Water Strikes (mbgl)	Strata Description
				0.10		Asphalt over concrete. (MADE GROUND).
				0.40		Soft consistency brown gravelly clayey sand. Gravel consists of fine to coarse brick and concrete. (MADE GROUND).
P+J	0.40					
				0.80		Soft consistency brown clayey SAND.
D	0.80					

0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample

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TRIAL PIT RECORD

Exploratory Hole No:	TP4		
Site Address:	Ferry Road, Rye, TN31 7DN	Project No:	P9687J1026
Client:	Plutus (Rye) Ltd	Ground Level:	
Logged By:		Date Commenced:	23/02/2017
Checked By:		Date Completed:	23/02/2017
Type and diameter of equipment:	Mini digger	Sheet No:	1 Of 1

Pit Dimension:	Length:	1.00	Width:	0.40	Depth:	1.00	

Remarks

1: Soakage test (BRE 365) undertaken

2:

3:

4:

Sample or Tests			Strata			
Type	Depth (mbgl)	Result	Legend	Depth (mbgl)	Water Strikes (mbgl)	Strata Description
P+J	0.40			0.50		Asphalt over soft consistency brown sandy gravelly clay. Gravel consists of fine to coarse brick and concrete. (MADE GROUND).
D	1.00			1.00		Soft to firm consistency grey clayey SAND.

0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample

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SOAKAGE TEST RECORD

Client	Plutus (Rye) Ltd	**Ground Level**		**Trial Pit Nr**	TP1
Site	Ferry Road	**Nat Grid Co-ord**		**Project Nr**	P9687J1026
Date	23/02/2017	**Engineer**			

JOMAS
Specialists in the investigation & reclamation of brownfield sites

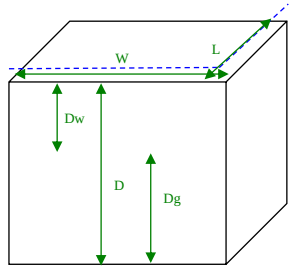
Pit Dimensions
Length - L (m): 1.0
Width - W (m): 0.40
Depth - D (m): 2.00

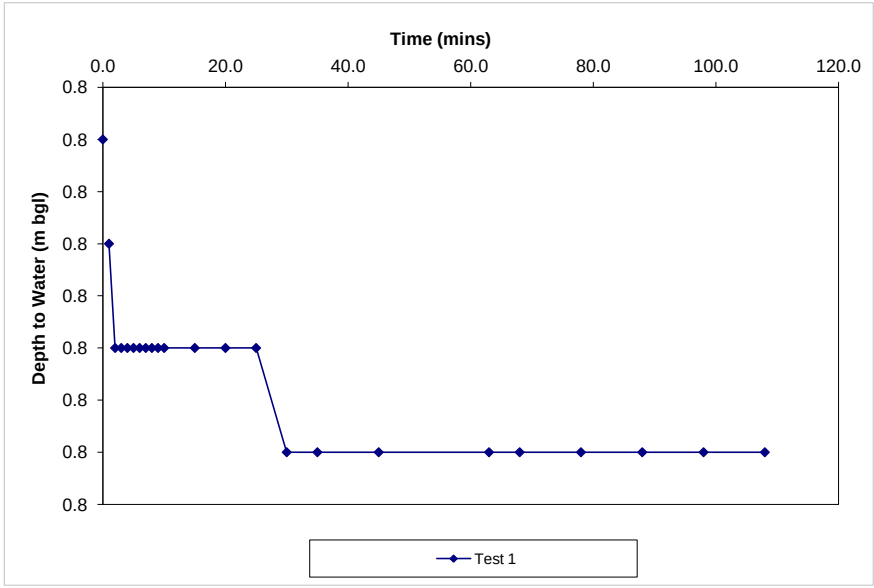
Ground Conditions
0.00 -0.6m Made Ground

0.6 - 2.0 Soft to firm very sandy Clay / very clayey Sand

	TEST 1		TEST 2		TEST 3	
Elapsed time	**Depth to Water**	**Height of Water**	**Depth to Water**	**Height of Water**	**Depth to Water**	**Height of Water**
Minutes	**(Dw) mbgl**	**(Dg) m**	**(Dw) mbgl**	**(Dg) m**	**(Dw) mbgl**	**(Dg) m**
0.0	0.80	1.20				
0.5						
1	0.81	1.19				
2	0.82	1.18				
3	0.82	1.18				
4	0.82	1.18				
5	0.82	1.18				
6	0.82	1.18				
7	0.82	1.18				
8	0.82	1.18				
9	0.82	1.18				
10	0.82	1.18				
15	0.82	1.18				
20	0.82	1.18				
25	0.82	1.18				
30	0.83	1.17				
35	0.83	1.17				
45	0.83	1.17				
63	0.83	1.17				
68	0.83	1.17				
78	0.83	1.17				
88	0.83	1.17				
98	0.83	1.17				
108	0.83	1.17				

	TEST 1	TEST 2	TEST 3
75%	0.6		
25%	0.2		
50%	0.4		
Vp75-25 (m^3)			
ap50 (m^2)			
tp75-25 (min)			
Soil infiltration rate (m/sec)	**No Significant Drainage**		





Water Depths - strike(s): N/A

Type of Excavator: Mini digger

Remarks: Insufficient drop in water level

Approved By:
PSW

SOAKAGE TEST RECORD

Client	Plutus (Rye) Ltd	**Ground Level**		**Trial Pit Nr**	TP2
Site	Ferry Road	**Nat Grid Co-ord**		**Project Nr**	P9687J1026
Date	23/02/2017	**Engineer**	AJH		

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Specialists in the investigation & reclamation of brownfield sites

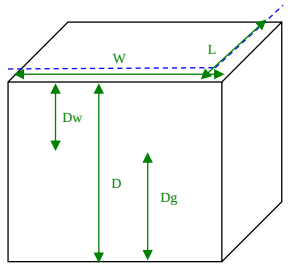
Pit Dimensions
Length - L (m): 1.3
Width - W (m): 0.40
Depth - D (m): 2.00

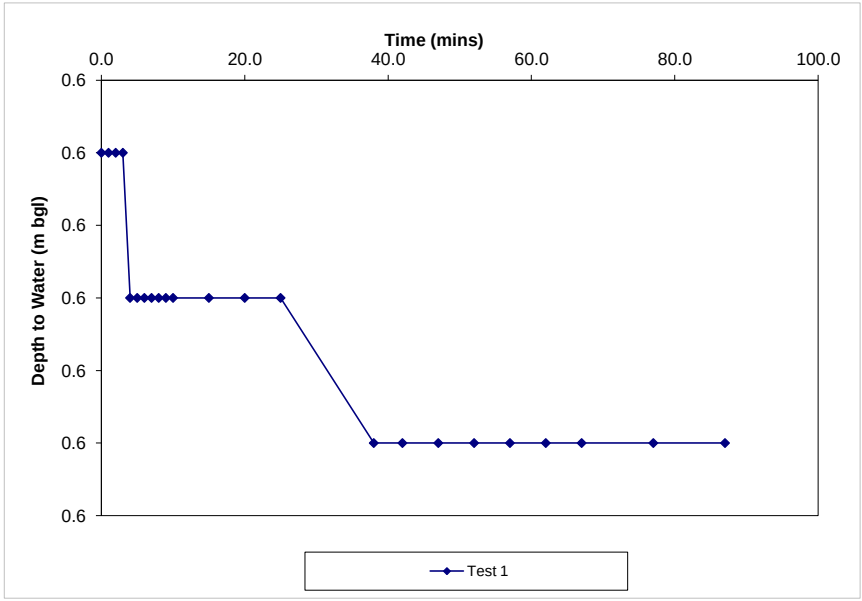
Ground Conditions
0.00 -0.3m Made Ground

0.3 - 2.0 Soft to firm very sandy Clay / very clayey Sand

	TEST 1		TEST 2		TEST 3	
Elapsed time	**Depth to Water**	**Height of Water**	**Depth to Water**	**Height of Water**	**Depth to Water**	**Height of Water**
Minutes	**(Dw) mbgl**	**(Dg) m**	**(Dw) mbgl**	**(Dg) m**	**(Dw) mbgl**	**(Dg) m**
0.0	0.60	1.40				
0.5						
1	0.60	1.40				
2	0.60	1.40				
3	0.60	1.40				
4	0.61	1.39				
5	0.61	1.39				
6	0.61	1.39				
7	0.61	1.39				
8	0.61	1.39				
9	0.61	1.39				
10	0.61	1.39				
15	0.61	1.39				
20	0.61	1.39				
25	0.61	1.39				
38	0.62	1.38				
42	0.62	1.38				
47	0.62	1.38				
52	0.62	1.38				
57	0.62	1.38				
62	0.62	1.38				
67	0.62	1.38				
77	0.62	1.38				
87	0.62	1.38				

	TEST 1	TEST 2	TEST 3
75%	0.45		
25%	0.15		
50%	0.3		
Vp75-25 (m^3)			
ap50 (m^2)			
tp75-25 (min)			
Soil infiltration rate (m/sec)	**No Significant Drainage**		





Water Depths - strike(s): N/A

Type of Excavator: Mini digger

Remarks: Insufficient drop in water level

Approved By:
PSw

SOAKAGE TEST RECORD

Client	Plutus (Rye) Ltd	**Ground Level**		**Trial Pit Nr**	TP3
Site	Ferry Road	**Nat Grid Co-ord**		**Project Nr**	P9687J1026
Date	23/02/2017	**Engineer**			

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Pit Dimensions

Length - L (m): 1.2

Width - W (m): 0.40

Depth - D (m): 0.80

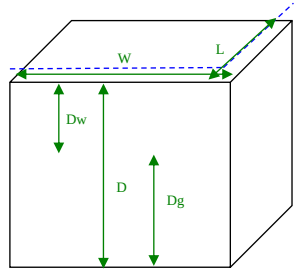
Ground Conditions

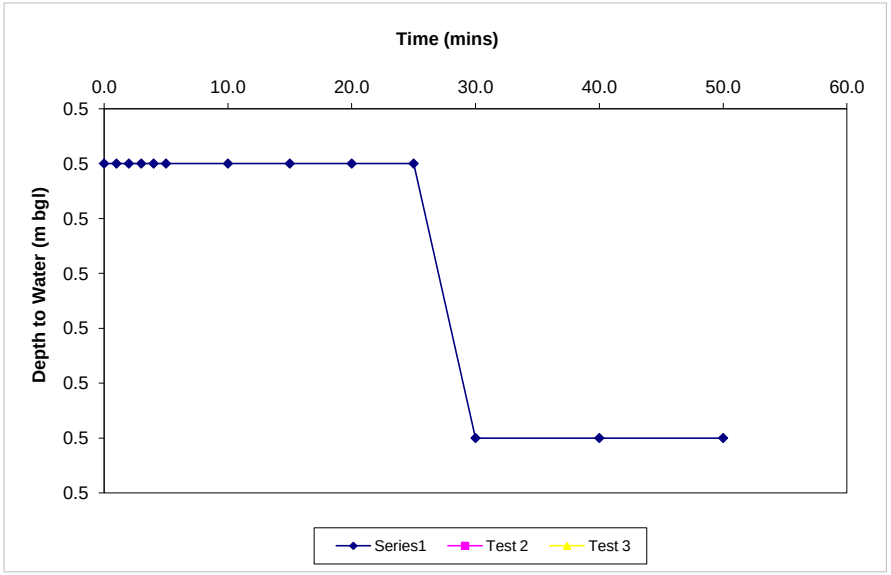
0.00 -0.4m Made Ground

0.4 - 0.8 Soft to firm very sandy Clay / very clayey Sand

	TEST 1		TEST 2		TEST 3	
Elapsed time	**Depth to Water**	**Height of Water**	**Depth to Water**	**Height of Water**	**Depth to Water**	**Height of Water**
Minutes	**(Dw) mbgl**	**(Dg) m**	**(Dw) mbgl**	**(Dg) m**	**(Dw) mbgl**	**(Dg) m**
0.0	0.50	0.30				
1	0.50	0.30				
2	0.50	0.30				
3	0.50	0.30				
4	0.50	0.30				
5	0.50	0.30				
10	0.50	0.30				
15	0.50	0.30				
20	0.50	0.30				
25	0.50	0.30				
30	0.51	0.29				
40	0.51	0.29				
50	0.51	0.29				

	TEST 1	TEST 2	TEST 3
75%	0.375		
25%	0.125		
50%	0.25		
Vp75-25 (m^3)			
ap50 (m^2)			
tp75-25 (min)			
Soil infiltration rate (m/sec)	**No Significant Drainage**		





Water Depths - strike(s): N/A

Type of Excavator: Mini digger

Remarks: Insufficient drop in water level

Approved By: PSw

SOAKAGE TEST RECORD

Client	Plutus (Rye) Ltd	**Ground Level**		**Trial Pit Nr**	TP4
Site	Ferry Road	**Nat Grid Co-ord**		**Project Nr**	P9687J1026
Date	23/02/2017	**Engineer**			

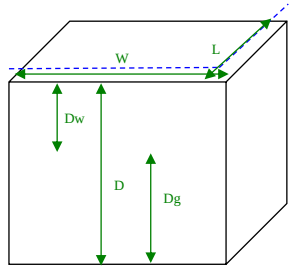
JOMAS
Specialists in the investigation & reclamation of brownfield sites

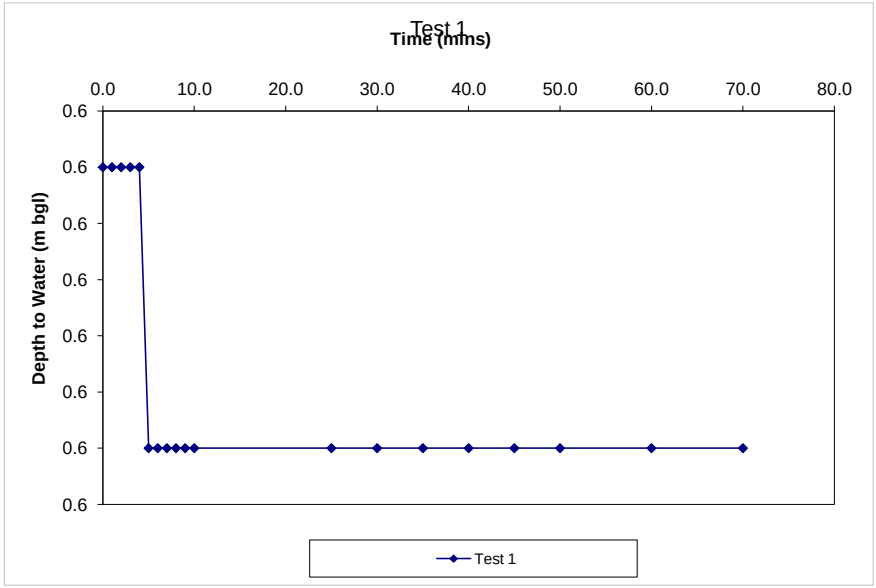
Pit Dimensions
Length - L (m): 1.0
Width - W (m): 0.40
Depth - D (m): 1.00

Ground Conditions
0.00 -0.5m Made Ground
0.5 - 1.0m Soft to firm very sandy Clay / very clayey Sand

	TEST 1		TEST 2		TEST 3	
Elapsed time	**Depth to Water**	**Height of Water**	**Depth to Water**	**Height of Water**	**Depth to Water**	**Height of Water**
Minutes	**(Dw) mbgl**	**(Dg) m**	**(Dw) mbgl**	**(Dg) m**	**(Dw) mbgl**	**(Dg) m**
0.0	0.600	0.400				
1	0.600	0.400				
2	0.600	0.400				
3	0.600	0.400				
4	0.600	0.400				
5	0.610	0.390				
6	0.610	0.390				
7	0.610	0.390				
8	0.610	0.390				
9	0.610	0.390				
10	0.610	0.390				
25	0.610	0.390				
30	0.610	0.390				
35	0.610	0.390				
40	0.610	0.390				
45	0.610	0.390				
50	0.610	0.390				
60	0.610	0.390				
70	0.610	0.390				

	TEST 1	TEST 2	TEST 3
75%	0.45		
25%	0.15		
50%	0.3		
Vp75-25 (m^3)			
ap50 (m^2)			
tp75-25 (min)			
Soil infiltration rate (m/sec)	**No Significant Drainage**		





Water Depths - strike(s): N/A

Type of Excavator: Mini digger

Remarks: Insufficient drop in water level

Approved By: PSw

APPENDIX D

Southern Water Sewer Records and Capacity Check

Southern Water

Canham Consulting
The Old School
School lane
Thorpe st Andrew
Norwich
Norfolk
NR7 0EP

Developer Services
Southern Water
Sparrowgrove House
Sparrowgrove
Otterbourne
Hampshire
SO21 2SW

Tel: **0330 303 0119**
Email: ***developerservices@southernwater.co.uk***

Your Ref:

Our Ref:
CC/003394

Date:
06 June 2017

Site: Land North Of Ferry Road, Rye, East Sussex, TN31 7DJ.

Dear Mr. Hughes,

We have completed the capacity check for the above development site and the results are as follows:-

Foul capacity check:

There is currently inadequate capacity within the foul sewerage network to accommodate a foul flow for the above development at manhole reference TQ91207410. The proposed development would increase flows to the public sewerage system, and existing properties and land may be subject to a greater risk of flooding as a result. Additional off-site sewers, or improvements to existing sewers, will be required to provide sufficient capacity to service the development.

The nearest point where capacity is currently available is at Newbury Lane Rye WTW which is located approximately 1.3 km South East of the proposed development site.

Section 98 of the Water Industry Act 1991 provides a legal mechanism through which the appropriate infrastructure can be requested (by the developer) and provided to drain a specific location.

Unfortunately, it may be several years before adequate infrastructure is provided via a prioritised capital expenditure programme. Therefore, this proposed development would be considered premature until such time adequate sewerage infrastructure could be provided.

It should be noted that Southern Water has recently undertaken a review of their modelling criteria, processes and solutions for Level 2 capacity assessments (sewerage and surface water). This review has indicated concerns with inconsistencies moving through the various processes. Southern Water are not satisfied that we are fully delivering a service that meets the expectations and needs of our Customers and hence the Foul and Surface Water Level 2 capacity assessments will not be available for the foreseeable future.

Southern Water are currently developing a new process/application, which will aim to deliver a more comprehensive and robust solution in providing capacity for your proposed development site. This will appear on Southern Water's website on completion of the review process.

Southern Water will still accept **Fresh Water** Level 2 capacity assessment applications.

Before any connections are made to foul and surface sewerage network, an application form needs to be completed and approved by Southern Water Services.

Should you require any further information, please contact us at the above mentioned phone number or address.

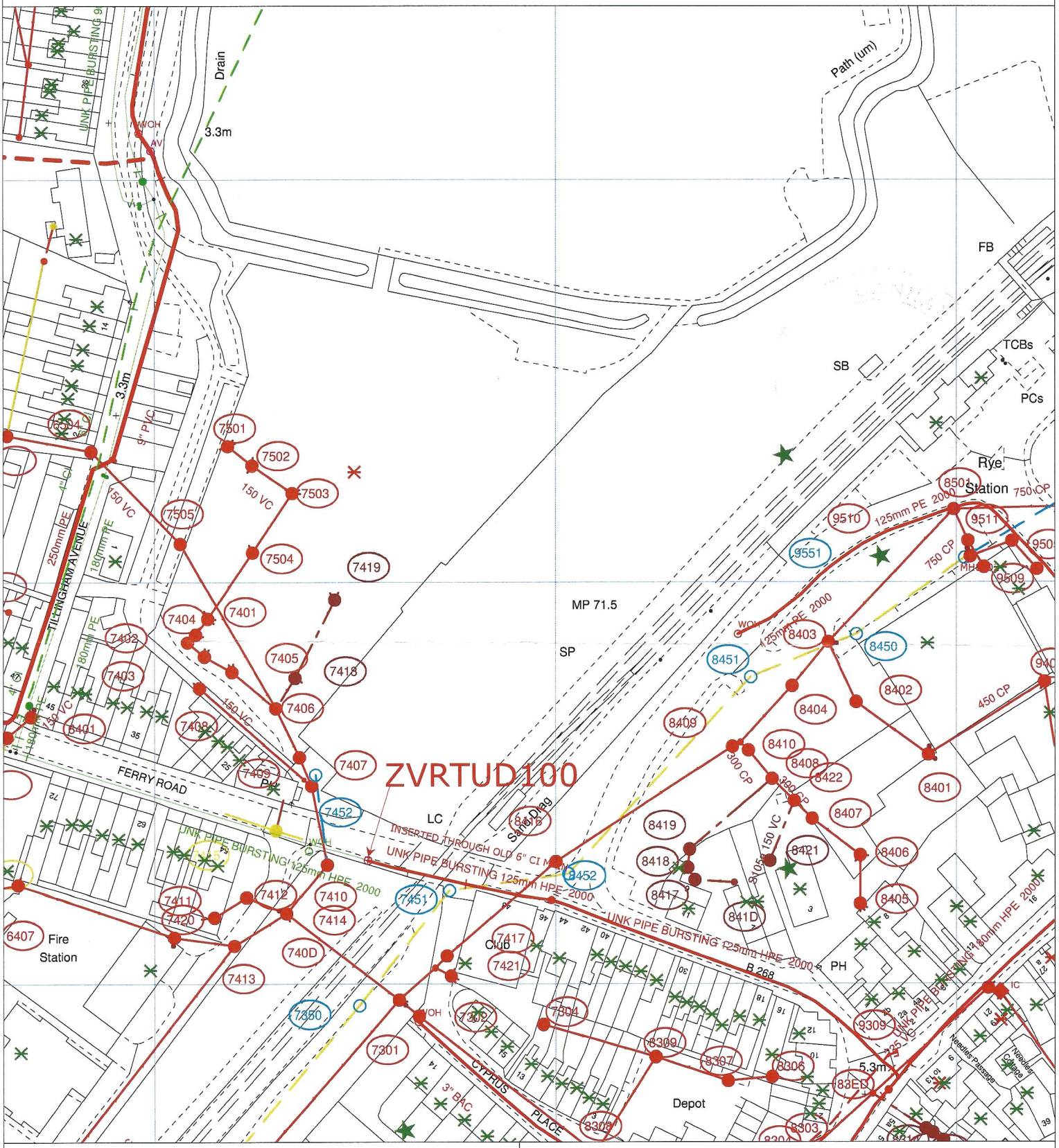
Yours faithfully

David Akehurst
Developer Services

Please note: -

The information provided above does not grant approval for any designs/drawings submitted for the capacity analysis. The results quoted above are only valid for 12 months from the date of issue of this letter.

SOUTHERN WATER



The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site.

Southern Water

O.S. REF: TQ9120SE	Scale: 1:1250	Printed By: Giri	Date: 19-5-2017
Screen Print		Site Plan	
WARNING: BAC pipes are constructed of Bonded Asbestos Cement		Requested By:	
WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement			

APPENDIX E

Residual Risk Hydraulic Modelling Technical Note

TECHNICAL NOTE

Job Name: Ferry Rd, Rye

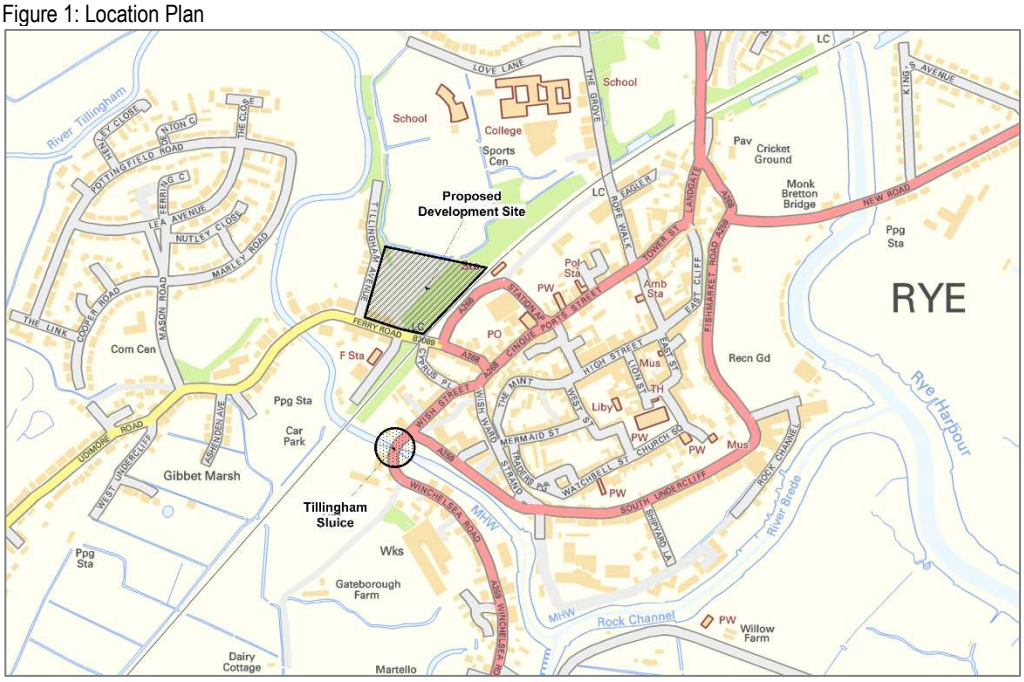
Job No: 40806_4001

Note No: TN01

Date: 12th May 2017

Prepared By: Hazel Fielding

Subject: **Residual Risk Modelling**

Item	Subject
1.	Peter Brett Associates LLP (PBA) has been commissioned to undertake hydraulic modelling to assess the residual risk of tidal flooding to a proposed development site on Ferry Rd in Rye, East Sussex. Figure 1 below shows the location of the proposed development site and Tillingham Sluice on the River Tillingham. Figure 1: Location Plan 

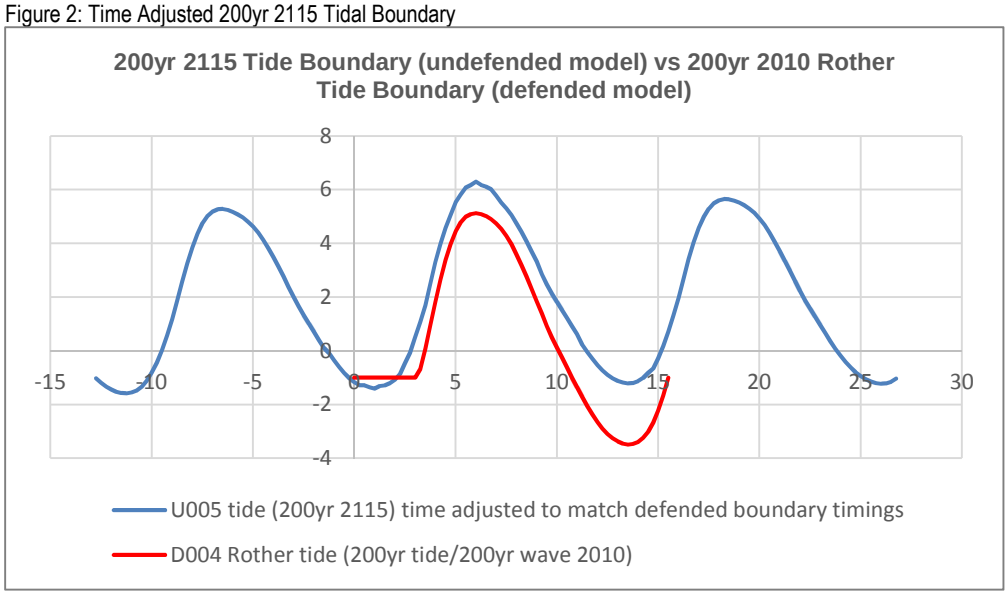
DOCUMENT ISSUE RECORD

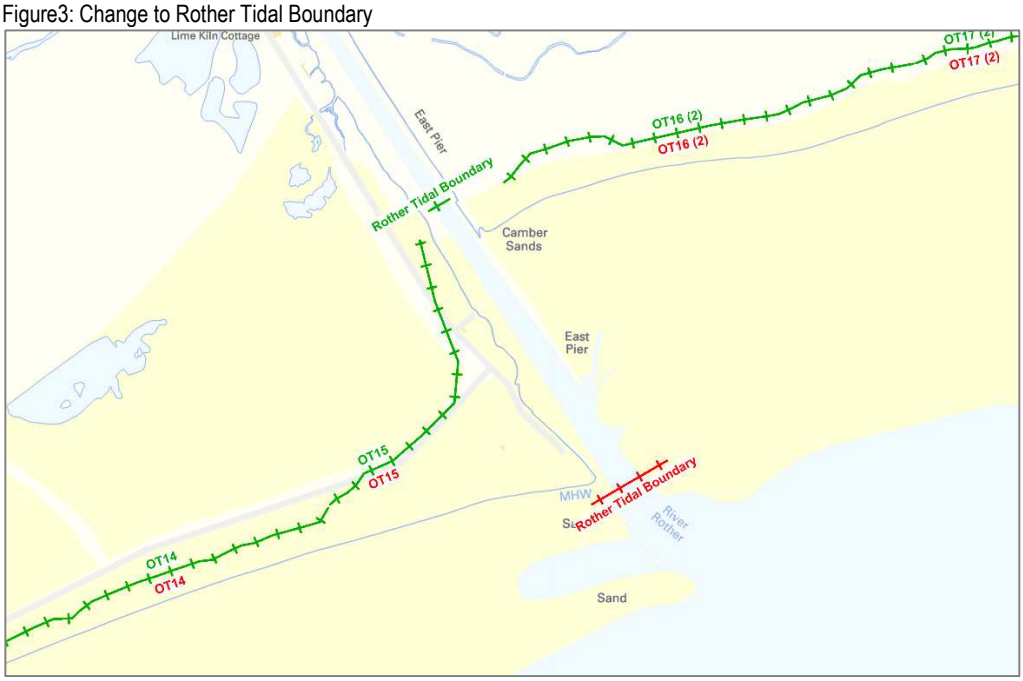
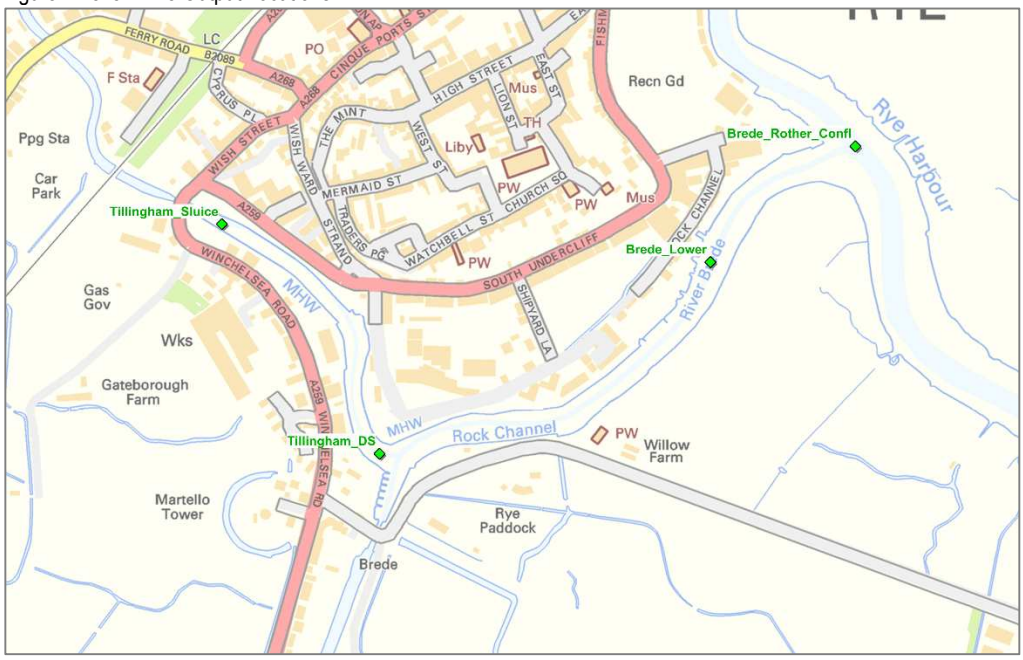
Technical Note No	Rev	Date	Prepared	Checked	Reviewed (Discipline Lead)	Approved (Project Director)
40806/4001/TN01	-	12.05.17	HF	AH	AH	PJ

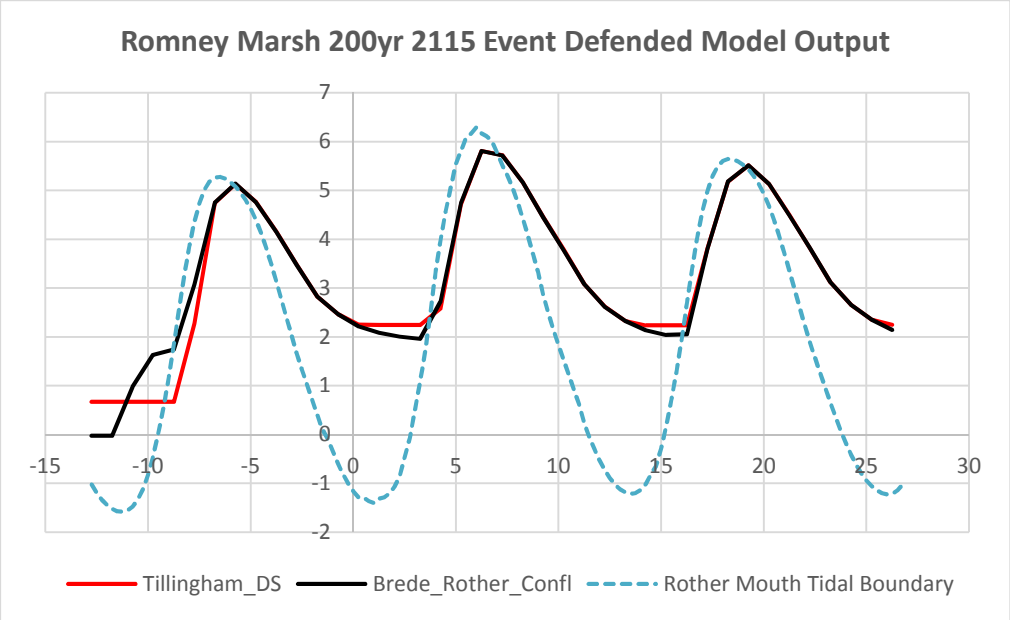
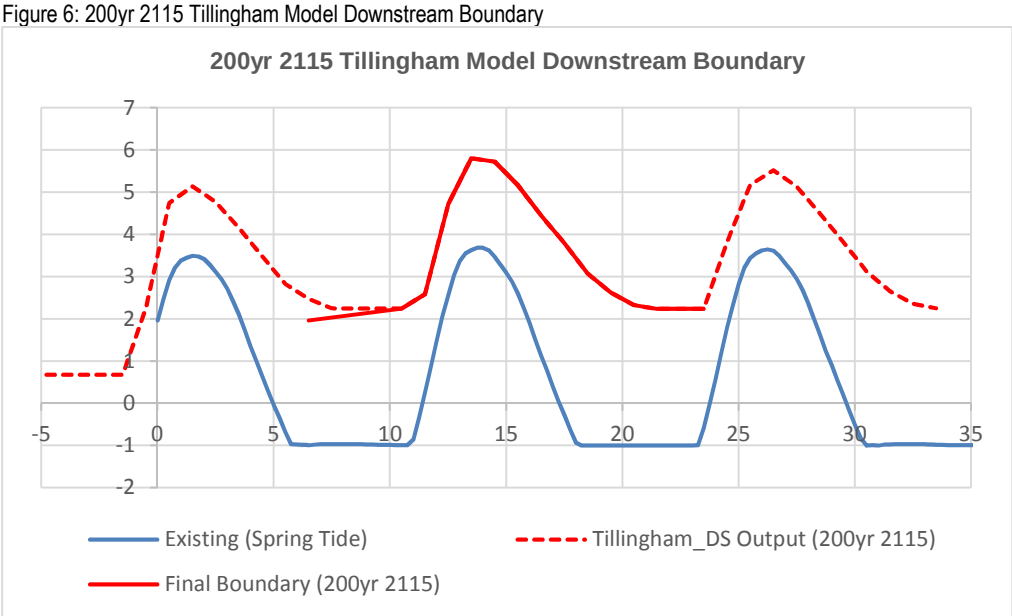
Peter Brett Associates LLP Caversham Bridge House Waterman Place, Reading Berkshire RG1 8DN
T: +44 (0)118 950 0761 +44 (0)118 959 7498 E: reading@peterbrett.com

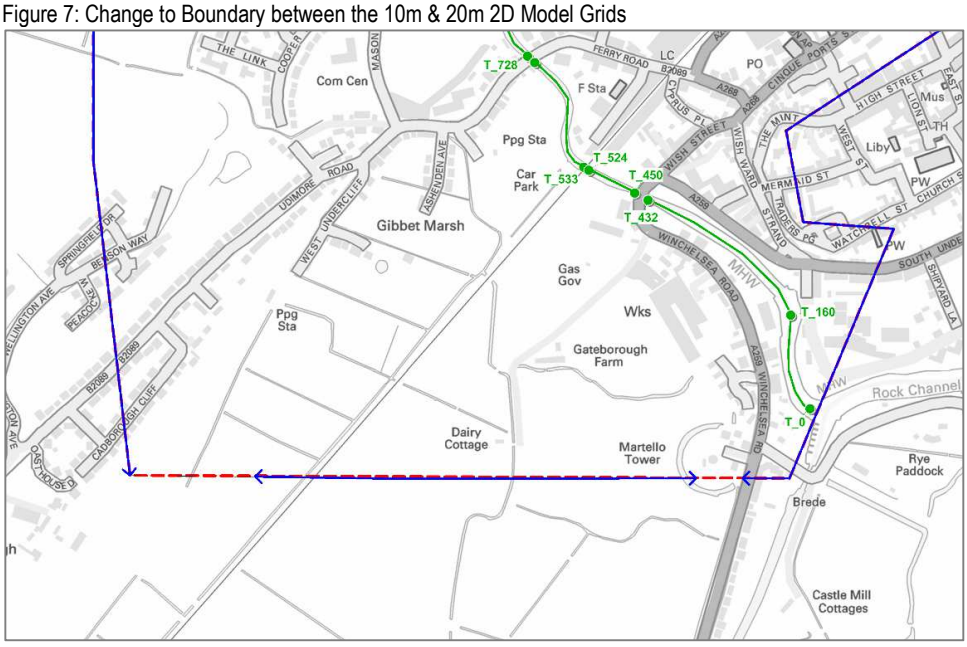
Item	Subject
2.	The Environment Agency (EA) provided modelled peak tidal flood levels at 18 no. locations within the proposed development site for various return period events and for both defended and undefended scenarios. These model results were obtained from the Romney Marsh Tidal Flood Risk Mapping Study completed by Mott MacDonald in 2009. The results for the defended scenario include wave overtopping and are only for the year 2010, which was the present day when the modelling study was undertaken. For the undefended scenario, results are provided for the years 2010, 2070 and 2115 (ie. present day and two future dates which include an allowance for climate change due to sea level rise). The defended scenario results indicate that there is no tidal flooding within the proposed development site for any of the return period events for the present day (2010). However, the are no defended scenario results which include an allowance for the impact of climate change.
3.	The EA has requested that the residual risk of tidal flooding to the proposed development site be assessed for the 1 in 200yr tidal event in the year 2115 with the Tillingham Sluice gate remaining open for one tide cycle (ie. failure to close) combined with a 10m breach in the left bank of the River Tillingham (upstream of the sluice) occurring at the peak of the tide. The EA has confirmed that they are not concerned with fluvial flooding at the site since the tidal flood event will have a higher impact on the site.
4.	The EA has supplied two hydraulic models for use in this assessment; the Romney Marsh Model and the River Tillingham Model.
5.	The Romney Marsh model was constructed as part of the Romney Marsh Tidal Modelling and Mapping Study (Mott MacDonald, 2009). It is a very large model encompassing the coastline between Cliff End and the Royal Military Canal at Hythe, Romney Marsh and the lower reaches of the Rivers Rother, Tillingham and Brede. The model is a hydrodynamic 2-Dimensional model using the TUFLOW software and has a grid size of 20m. The main purpose of the model is to assess tidal flood risk, so the river channels are only coarsely represented using gully lines within the 2D model. Both undefended and defended models were constructed as part of the Romney Marsh Tidal Modelling and Mapping Study. <u>*Undefended Model*</u> The Romney Marsh undefended model did not need to take into account any wave overtopping since there are no defences to be overtopped. Therefore, it is assumed that the tidal boundary (level-time) has been applied to one boundary line within the model (along the whole modelled coastline). The undefended model boundary line file was not supplied with the other model data, therefore, this assumption could not be verified absolutely, although it is mentioned in the modelling report (Mott MacDonald, June 2009). A constant (fixed) low flow boundary was applied to the upstream modelled extent of the River Rother (gully line) to account for baseflow in the River Rother. The following scenarios have been run using the undefended model: • 1 in 200yr Tidal event for the years 2010 (present day), 2070 & 2115 • 1 in 1000yr Tidal event for the years 2010 (present day), 2070 & 2115

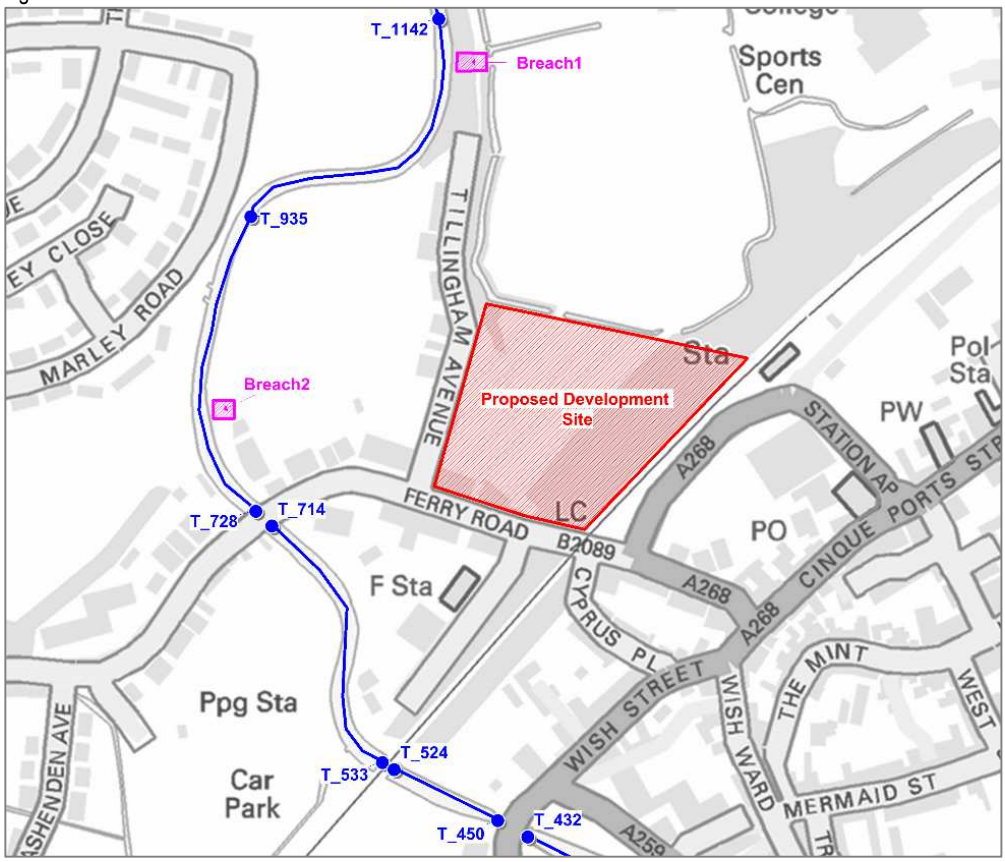
Item	Subject
	Defended Model The Romney Marsh defended model included 60 no. separate wave overtopping boundaries (flow-time) applied along the length of the modelled coastline on the landward side of the defences. These represent the volume of water overtopping the coastal defences during each modelled event. In addition, a tidal boundary (level-time) was applied to the mouth of the River Rother and a constant (fixed) low flow boundary was applied to the upstream modelled extent of the River Rother (gully line) to account for baseflow in the River Rother. The following scenarios have been run using the defended model, all for the year 2010 (present day): • 1 in 20yr tidal/1 in 20yr wave overtopping • 1 in 75yr tidal/1 in 75yr wave overtopping • 1 in 200yr/1 in 1yr wave overtopping • 1 in 200yr/1 in 200yr wave overtopping • 1 in 1000yr/1 in 200yr wave overtopping
6.	The Tillingham model was constructed as part of the Tillingham Flood Risk Mapping Study (Peter Brett Associates, 2009). The Tillingham model consists of a 1D ISIS model dynamically linked to a 2D multiple domain TUFLOW model. The 1D ISIS model represents the river channels with the 2D TUFLOW model representing the floodplain. The 2D model has been divided into domains; one a coarse resolution 20m grid to represent the rural part of the catchment, the other a more detailed 10m grid to represent the urban part of the catchment. The upstream limit of this model is approximately 0.5km upstream of Furnace Lane near the village of Broad Oak and the downstream limit is at the confluence of the Rivers Tillingham and Brede (approx. 12km of river). The main purpose of this model is to assess fluvial flood risk, so all the fluvial return period runs utilise a spring tide cycle set to a MHWS tide level as the downstream boundary. The following scenarios have been modelled: • 1 in 5yr, 20yr, 50yr, 75yr, 100yr & 1000yr fluvial (defended) • 1 in 100yr fluvial +20% climate change allowance (defended) • 1 in 100yr, 250yr & 1000yr (undefended*) *NB. For the undefended scenario only the fluvial flood defences along the River Tillingham through Rye (upstream of Tillingham Sluice) have been removed. Tillingham Sluice and the tidal defences remain in the model since the aim of this study was to establish fluvial flood risk not tidal flood risk.
7.	In order to obtain a tide cycle for the 1 in 200yr tidal event in the year 2115 at the downstream end of the River Tillingham model, the Romney Marsh defended model was run using the 200yr 2115 tide cycle obtained from the undefended model (model run ref: U005) but applied to the mouth of the River Rother (2D boundary ref: Rother Tidal Boundary). The fixed inflow boundary remained unchanged. The overtopping boundaries also remained unchanged (the 200yr wave overtopping boundaries were used). Due to the fact that the undefended and defended models were run for different time periods, it was necessary to adjust the time base on the 200yr 2115 tide cycle obtained from the undefended model to match the timings used within the defended model, as shown in the Figure 2 overleaf.

Item	Subject
	Figure 2: Time Adjusted 200yr 2115 Tidal Boundary 
8.	The original EA Romney Marsh model was run using Version 2008-08-AG-iSP of TUFLOW. This version was also used to re-run the defended model with the 200yr 2115 tidal boundary. (NB. Actual version number used for latest modelling is 2008-08-DB-iSP due to the use of a WIBU dongle).
9.	It was discovered that an error had been made in the original EA Romney Marsh Defended model. The Rother Tidal Boundary had been mistakenly attributed as a flow-time (QT) boundary, rather than a level-time (HT) boundary. This error means that instead of a high tidal level being applied to the downstream end of the Rother, a very small flow was applied instead. This error has been corrected prior to running the Romney Marsh Defended model with the 200yr 2115 tidal boundary. In addition, it was necessary to change the location and length of the boundary line at the mouth of the River Rother to prevent model instabilities (2D boundary ref: Rother Tidal Boundary). It was considered that this would not result in any impact on water levels at the downstream end of the River Tillingham. No other changes were made to the 2D boundaries. The change made to the Rother Tidal boundary line is shown in the Figure 3 overleaf. The green boundary lines are from the original EA Romney Marsh model and the red lines are from the PBA amended Romney Marsh model.

Item	Subject
	Figure3: Change to Rother Tidal Boundary  Green = original EA Romney Marsh Model boundaries; Red = PBA amended Romney Marsh Model boundaries
10.	Level-time (HT) output was obtained during the 200yr 2115 defended model run at 4 no. locations along the River Tillingham and River Brede downstream of Tillingham Sluice. These model output locations are shown in Figure 4 below and the resulting model output for two of these locations compared to the tidal boundary applied at the mouth of the Rother are shown in Figure 5 overleaf. Figure4: Level-Time Output Locations 

Item	Subject
	Figure 5: Romney Marsh 200yr 2115 Defended Model Level-Time Output 
11.	The level-time output data from the Tillingham_DS location were selected for use in the 200yr 2115 downstream boundary of the EA Tillingham model (model node T_0d). This output location was selected as it is situated at the confluence of the Rivers Tillingham and Brede, which is the location of the downstream node of the Tillingham model. Figure 6 below shows the final data used in the Tillingham model. Figure 6: 200yr 2115 Tillingham Model Downstream Boundary  As can be seen from Figure 6 above, only one tide cycle was used in the 200yr 2115 Tillingham Model runs. This is in line with the EA's request that the residual risk to the proposed development site be assessed with the Tillingham Sluice gate remaining open for one tide cycle (ie. failure to close) combined with a 10m breach in the left bank of the River Tillingham (upstream of the sluice) occurring at the peak of the tide.

Item	Subject
12.	The original EA Tillingham model was run using Version 3.1.0.65 of ISIS and Version 2008-08-AE-iSP of TUFLOW (with the 2D multiple domains option enabled). Unfortunately, it was not possible to re-run the model using this combination of software versions. Therefore, the updated runs were undertaken using Version 3.7.0 (single precision, 32-bit, with appropriate backwards compatibility options checked) of ISIS and Version 2013-12-AE-iSP-w32 (with PRE 2010 defaults specified) of TUFLOW.
13.	The new 200yr 2115 downstream boundary was imported into the Tillingham model and the Tillingham Sluice gate was set to the maximum opening from the start of the model run. In addition, the inflow ReFH boundaries were set to remain at minimum flows (ie. baseflow only) throughout the run. This is in line with the EA's focus on the residual risk to the proposed development site being from tidal sources only. New start conditions for the 1D ISIS element of the model were developed using these model settings. No other changes were made to the 1D ISIS element of the model.
14.	Initially, there were some stability issues along the boundary between the 10m and 20m 2D model grids to the south of the River Tillingham within the 2D TUFLOW element of the model. This was thought to be due to the large amount of water passing across this boundary during the 200yr 2115 tidal event, which is much more extreme than any of the events previously run using this model. The model runs indicated that the largest instabilities were occurring at the western and eastern ends of the boundary line between the two 2D model grids where the ground levels were more variable compared to the generally flat nature of the ground in this area. Therefore, this boundary line was shortened to move it away from these areas which solved the stability issues. This was not considered to have any significant impact on the resulting modelled peak water levels at the proposed development site. The change made to the boundary line between the two 2D model grids is shown in Figure 7 below. The red dashed line is the original boundary line and the blue arrow line is the revised boundary line. No other changes were made to the baseline 2D element of the model. Figure 7: Change to Boundary between the 10m & 20m 2D Model Grids  Red dashed line = original boundary line; Blue arrow line = modified boundary line; Green circles = 1D model nodes

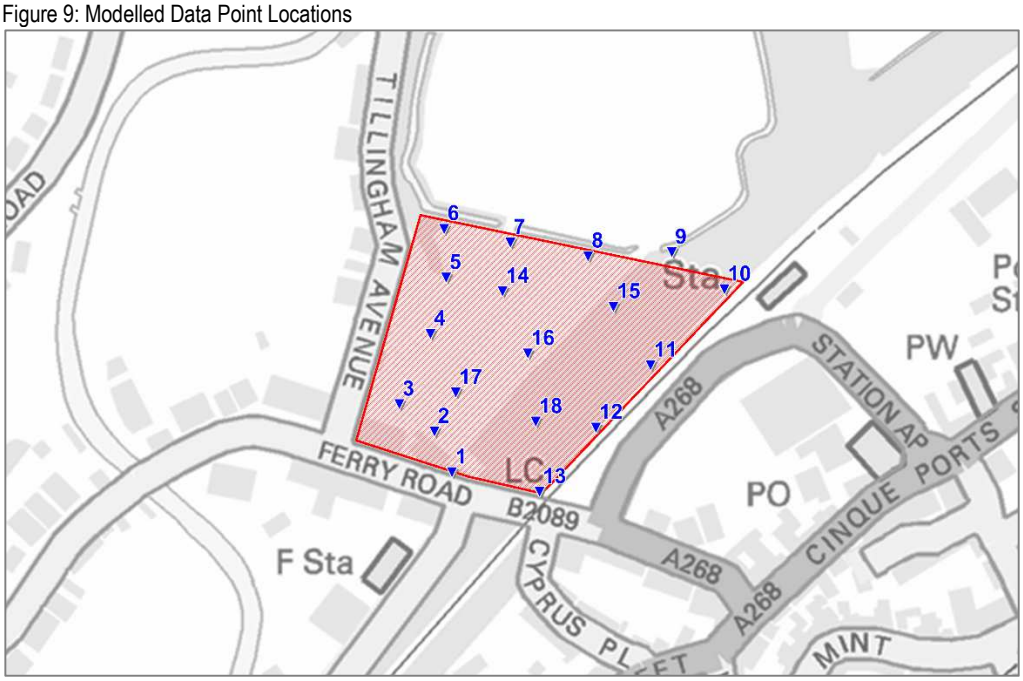
Item	Subject
15.	The model was run with the sluice gate open from the beginning for the one tide cycle developed from the results of the Romney Marsh defended model (as shown in Figure 6 above). The results of this model run provided the time of the peak water level in the River Tillingham adjacent to the proposed site of the breach in the left bank of the river. Based on the results of the initial run with the sluice gate open, it was observed that flood water can reach the proposed development site from more than one direction. Therefore, two breach locations were selected to ensure that the worst case scenario has been assessed. Figure 8 below shows the two breach locations used in the modelling. Figure 8: Breach Locations  The location of Breach1 was selected because there is a low point in the flood bank and the ground levels are low on the landward side of the defence. The location of Breach2 was selected because there is a low point in the flood bank.
16.	The variable z-shape option was used in the 2D TUFLOW element of the model to simulate a 10m wide breach occurring in the left bank of the river at the peak water level in the River Tillingham (as specified by the EA). Two separate scenarios were run, one for each of the beach locations. The base level of the breach was selected based on the ground levels behind the river bank. The following base levels were selected for each breach: • Breach1 = 1.5m aOD (bed level of drainage channel) • Breach2 = 3.4m aOD

Item	Subject
	Both breaches were set to occur over a period of 0.25hrs, so they were set to start occurring 0.25hrs before the peak water level in the river, to ensure that the breach was fully open when the peak water level in the river occurred.
17.	The results of the tidal residual risk breach modelling are shown in Table 1 below. As mentioned in Point 2 of this Technical Note, the EA have provided existing peak modelled flood levels at 18 no. data point locations within the proposed development site (Product 4 data produced on 03/11/16). The modelled peak levels (taken from the Product 4 data provided by the EA) for the 200yr 2115 Undefended Romney Marsh Model are included in Table 1 below for comparison purposes.

Table 1: Residual Risk Breach Modelling Results

Data Point	200yr 2115 Tide Defended Peak Flood Levels (m aOD)			EA 200yr 2115 Tide Undefended Peak Flood Levels (m aOD)
	sluice open (no breach)	peak breach1 (sluice open)	peak breach2 (sluice open)	
1	3.98	3.97	3.98	5.14
2	3.59	3.70	3.61	5.13
3	3.51	3.69	3.54	5.13
4	3.51	3.69	3.54	5.13
5	3.50	3.69	3.53	5.12
6	3.50	3.69	3.53	5.11
7	3.50	3.69	3.53	5.12
8	3.50	3.69	3.53	5.12
9	3.50	3.69	3.53	5.12
10	3.50	3.69	3.53	5.12
11	no flooding	no flooding	no flooding	5.12
12	3.60	3.73	3.61	5.13
13	4.30	4.30	4.30	5.14
14	3.50	3.69	3.53	5.12
15	3.50	3.69	3.53	5.12
16	3.50	3.69	3.53	5.13
17	3.50	3.69	3.53	5.13
18	3.50	3.69	3.53	5.13

The locations of the data points listed in Table 1 are shown in Figure 9 overleaf.

Item	Subject
	Figure 9: Modelled Data Point Locations  It can be seen from Table 1 that Breach1 (in combination with the open sluice gate) results in the highest modelled peak water levels at the proposed development site.
18.	Table 1 shows that the peak modelled tidal residual risk flood level for the majority of the site is 3.69m aOD. There are a few modelled peak levels along Ferry Road and the railway line which are higher than 3.69m aOD but that is as a result of the higher ground levels in these locations. The flood water is flowing over Ferry Road and the railway line (which are higher than the site) and then dropping down into the site.
19.	In conclusion, the modelled residual risk peak flood level for the proposed development site is **3.69m aOD**. This level is based on the 1 in 200yr tidal event in the year 2115 with the Tillingham Sluice gate remaining open for one tide cycle (ie. failure to close) combined with a 10m breach in the left bank of the River Tillingham (upstream of the sluice) occurring at the peak of the tide. The EA have confirmed that they are not concerned with fluvial flooding at the site since the tidal flood event will have a higher impact on the site.

APPENDIX F

Proposed Development

Plutus Estates (Rye) Ltd

N

0 5 10 15 20 25 50m

Scale 1:500

Proposed Residential Development

NOTES:

Report all discrepancies, errors and omissions.

Verify all dimensions on site before commencing any work on site or preparing shop drawings.

All materials, components and workmanship are to comply with the relevant British Standards, Codes of Practice, and appropriate manufacturers recommendations that from time to time shall apply.

For all specialist work, see relevant drawings.

Rev	Date	Description

Project Title

Residential Development
Land North of Ferry Road
Rye
East Sussex

Drawing Description

Proposed Site Plan

Scale	Drawn by
1:500@A1	MH
Date	Checked by
June 2017	TWM

CLAGUE ARCHITECTS

62 Burgate, Canterbury
Kent CT1 2BH 01227 762060

1 Kinsbourne Court, Luton Road,
Harpenden, Hertfordshire AL5 3BL 01582 765102

4th Floor, 99 Charterhouse Street
London EC1M 6HR 0203 597 6112

CANTERBURY LONDON HARPENDEN

Drawing Number	Revision
22876A_10	B

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6. THE PROPOSED SITE LAYOUT SHOWN ON THIS DRAWING IS BASED UPON THE CLAGUE ARCHITECTS DRAWING 22876A-50-D, RECEIVED 12TH MAY 2017.
7. THE INFORMATION SHOWN DOES NOT CONSTITUTE TECHNICAL APPROVAL FROM THE RELEVANT AUTHORITIES AND COULD BE SUBJECT TO CHANGE POST PLANNING.

LEGEND

- ROOF AREA ($3,425m^2$)
- ADOPTABLE ROAD ($1215m^2$)
- ADOPTABLE FOOTPATH ($280m^2$)
- PRIVATE ROAD ($1,165m^2$)
- PRIVATE PARKING ($990m^2$)
- PRIVATE FOOTPATH ($690m^2$)
- PUMPING STATION ROOF AREA ($80m^2$)
- PROPOSED SITE ($14,170m^2$)

SCALE 1:750m

0m 10m 20m 30m 40m 50m 60m 70m

PRELIMINARY DRAWING:
THIS DRAWING IS FOR PRELIMINARY PURPOSES ONLY AND MUST NOT BE READ AS A CONSTRUCTION ISSUE.
IT INDICATES DESIGN INTENT ONLY AND IS SUBJECT TO AMENDMENT DURING FINAL DESIGN DEVELOPMENT.

rev	date	details	by	check
P1	23.11.18	PRELIMINARY ISSUE ONLY	AW	MR

client: PLUTUS (IPSWICH) LIMITED

architect: CLAGUE ARCHITECTS

project: FERRY ROAD, RYE
EAST SUSSEX

title: PROPOSED
IMPERMEABLE AREAS

CCL A3 1213: CAD DRAWING NOT TO BE HAND MODIFIED OR SCALED IF IN DOUBT ASK

drawn	design	checked	scales	date
AW	CW	MR	1:750@A3	21.11.18

drawing number: 208805-SK350-P1

Canham Consulting
Structural Engineers | Civil Engineers | Building Surveyors
Canham Consulting Ltd The Old School School Lane Norwich Norfolk NR7 0EP Tel: +44 (0)1603 430650 Fax: +44 (0)1603 430651
Email: mail@canhamconsulting.co.uk www.canhamconsulting.co.uk

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APPENDIX G

Flood Plan

FLOOD RESPONSE PLAN

for:

Ferry Road, Rye

for:

Plutus (Rye) Ltd
c/o Scott Hill
5 Dene Lodge
38 Western Road
Poole
Dorset
BH13 6EU

Structural Engineers Civil Engineers Building Surveyors

Canham Consulting

Ferry Road, Rye
Flood Response Plan
208805

Version number: 1.1

Date of plan version: 23/07/18

Normal review period: three years

(or following a flood event or as flood warnings or circumstances change)

Date for revision: 23/11/2021

Canham Consulting Ltd
The Old School
School Lane
Thorpe St. Andrew
Norwich
NR7 0EP

T: 01603 430650
office@canhamconsulting.co.uk

F: 01603 430672
www.canhamconsulting.co.uk

CONTENTS

1. DISTRIBUTION LIST

The following should receive a copy of the plan:

Name	Contact details
Occupier	
Owner / landlord	
Letting Agent	
Insurer (It is suggested you send a copy of this document to your insurance company)	
Tenant 1	
Tenant 2	
Other	

2. DOCUMENT HISTORY

Version	Revision date	Revisions
1.0	17/05/2017	Preliminary Issue
1.1	23/11/2018	Figures 2 & 3 updated with latest layout.

Note:

Keeping this plan up-to-date and keeping a record of changes may be important as it could affect your property insurance. If you require help in maintaining this plan, see the contacts page for details of organisations that can provide assistance.

3. PURPOSE AND SCOPE OF THE PLAN

This plan is to ensure there are appropriate measures in place that complement the Rye Community Multi-Agency Emergency Plan to protect life and property in the event of a flood.

The scope of the plan covers the owners/occupiers of those residential properties which form the development at Ferry Road, Rye.

4. LOCATION

This property is located in an Environment Agency (EA) designated flood zone due to tidal flooding. For the EA flood map see:

https://flood-warning-information.service.gov.uk/long-term-flood-risk

The site does benefit from flood defences, including the River Tillingham walls and embankments, the Tillingham tidal sluice and the coastal tidal defences. The risk to the site is therefore a residual risk of the defences failing.

This mode of failure can be sudden and severe and as such it is important that residents take note of this flood plan so that they are aware of how to react in the event of a flood.

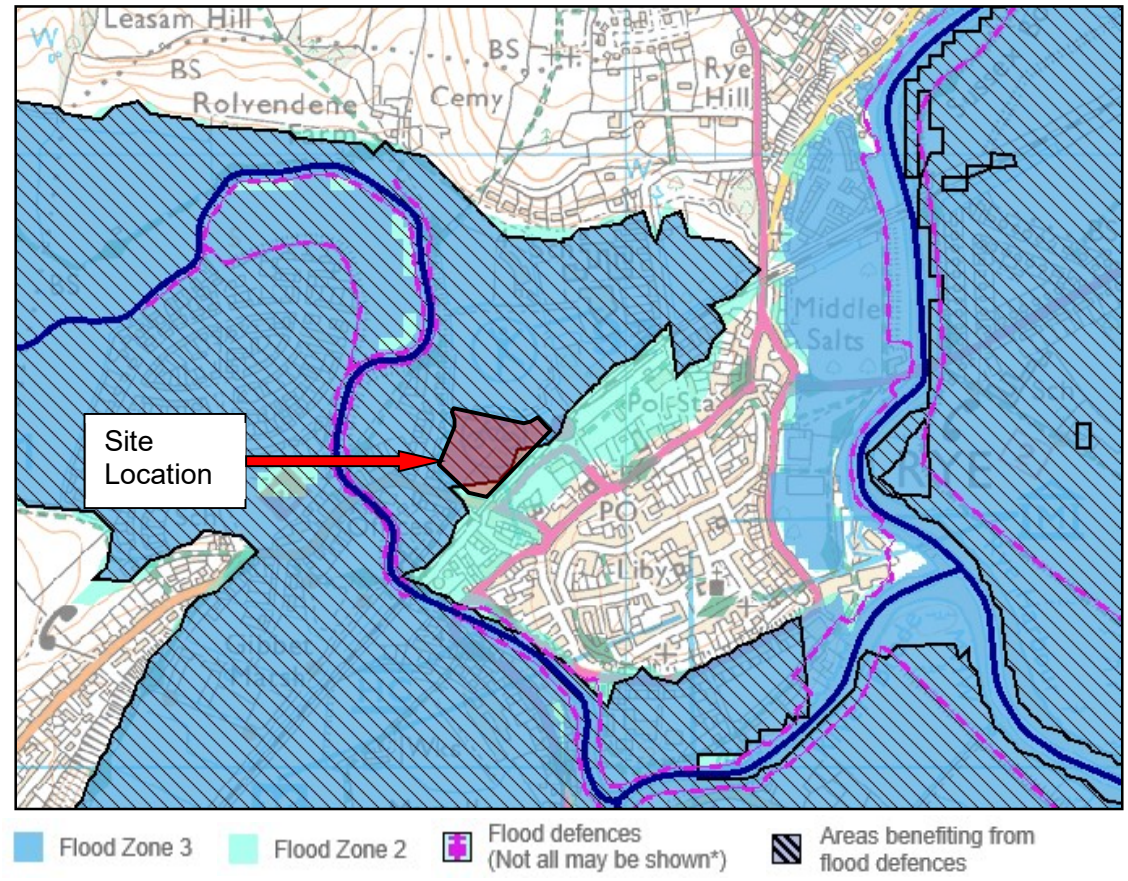


Figure 1: Flood Map

The recommended exit route prior to a flood occurring is along the raised “dry escape routes” arranged within the development towards Ferry Road and then across the railway line along Ferry Road to higher ground within Rye town centre to the south-east of the site. This is shown in Figures 2 and 3 below.

Residents are advised to seek temporary shelter during a flood event with friends or relatives out of the flood zone. Alternatively, they can seek temporary accommodation at Emergency Rest Centres which the local authority will advise upon. It is likely that the Rye Community Centre in Conduit Hill will be one of the Emergency Rest Centres, and this can be reached via the high ground along Cinque Ports Street.

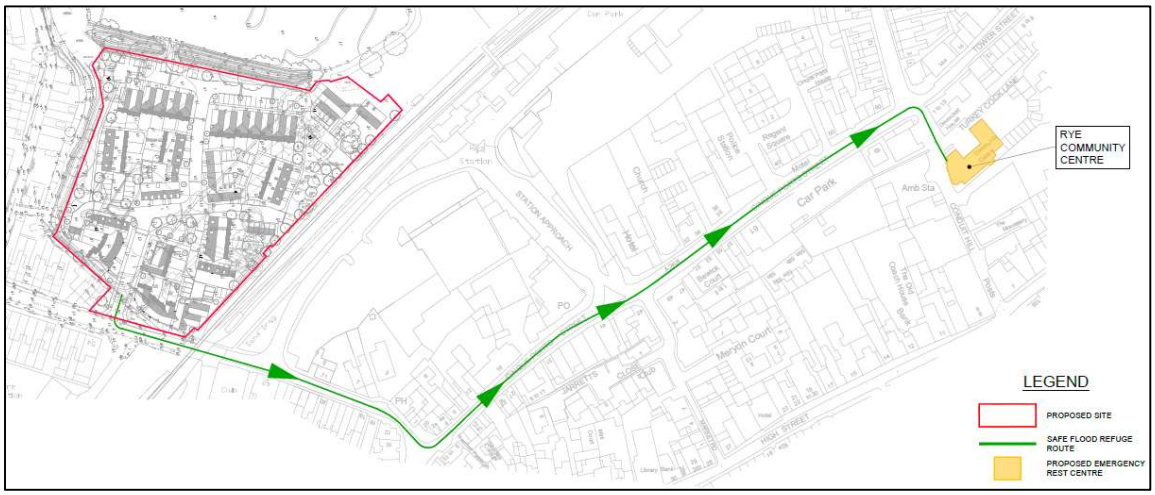


Figure 2: “Dry” Escape Route to Emergency Rest Centre

Figure 3: "Dry" Escape Routes within Development towards Ferry Road

5. FLOOD THREAT

The main risk of flooding comes from the sea to the south which is susceptible to tidal surges such as the one which occurred in 1953. The tidal surge can cause river levels to rise and overtop or breach the defence walls and embankments. In a flood event at the Ferry Road development flood water is most likely to arrive from the west but may advance from any direction depending on the type and location of overtopping or defence failure.

6. ENVIRONMENT AGENCY FLOOD INFORMATION SERVICE

Floodline: 0345 988 1188

The owner (and occupier) of the property will sign up to the Flood Warning Service.

(*Any landline phone will be automatically registered for flood warnings if located in a designated EA flood warning area. However, it is the responsibility of the owner/occupier to register mobile phone numbers to receive flood warnings from the EA by voice and/or SMS text).*

The following procedure should be followed to ensure all occupants of the premises receive warnings directly or are made aware of any Flood Warnings issued:

As an owner/occupier of the property it is your responsibility to register with the Environment Agency's Flood Warning Service. They will either phone or text you, subject to your chosen option.

For an explanation and description of the flood codes see:

https://flood-warning-information.service.gov.uk

The flood information service has three types of warnings that will help you prepare for flooding and take action. You should not normally need to take action on the announcement of a "Flood Alert" unless you are in a particularly vulnerable low-lying area or have livestock on a river or near the coast. Therefore, you will not receive a "Flood Alert" unless you require an early warning or request a "Flood Alert". You should take action if you receive a "Flood Warning" or "Severe Flood Warning".

Flood alert

What it means

Flooding is possible. Be prepared.

When it's used

Two hours to two days in advance of flooding.

What to do

- Be prepared to act on your flood plan
- Prepare a flood kit of essential items
- Monitor local water levels and the flood forecast on the EA website

Flood warning

What it means

Flooding is expected. Immediate action required.

When it's used

Half an hour to one day in advance of flooding.

What to do

- Move family, pets and valuables to a safe place.
- Turn off gas, electricity and water supplies if safe to do so.
- Put flood protection equipment in place.

Severe flood warning

What it means

Severe flooding. Danger to life.

When it's used

When flooding poses a significant threat to life.

What to do

- Stay in a safe place with a means of escape.
- Be ready should you need to evacuate from your home.
- Co- operate with the emergency services.
- Call 999 if you are in immediate danger.

Warnings no longer in force

What it means

No further flooding is currently expected in your area.

When it's used

When river or sea conditions begin to return to normal.

What to do

- Be careful. Flood water may still be around for several days.
- If you've been flooded, ring your insurance company as soon as possible.

7. FLOOD ALERT NOTICE

A Flood Alert Notice should be displayed in a prominent, clearly visible place on the premises as shown below.

Flood Alert Notice

This building is located in an area at risk of tidal flooding. Flooding may occur when a combination of weather conditions and/or high tides coincide. This is more likely during the winter months but could occur at any time of the year.

Up-to-date flood warning information and advice can be obtained from:

Floodline on 0345 988 1188 (24 hours a day, called charged at local rate)

Or visit their website:

www.flood-warning-information.service.gov.uk

8. PROCEDURES

The procedures listed below should be followed:

- The owner/occupant will sign up to Floodline Warnings Direct. Include both landline and mobile phone numbers.
- The owner/occupant should follow the advice below.
- The owner/occupier should join the local Community Resilience Group

Note that for tidal flooding the EA undertakes to issue a Flood Warning several hours before the predicted event. The technology is available to predict a tidal surge well in advance of the event (usually at least 24 hours). This is why, in most cases, there is no reason to take hasty measures and a “Flood Response Plan” allows organisations and individuals to take appropriate precautions in a measured and unhurried way.

Actions to take during ‘close down’ of the premises can include:

- shut off your gas/electric/water supplies – indicate in the plan where and how to shut off
- store furniture and belongings, fittings and valuable items above flood level (upstairs if possible)
- ensure any hazardous materials are safe and secure and that they do not create any additional risks by coming in contact with flood waters
- tie or anchor down equipment that could potentially float and cause an additional hazard or remove to a safe location.

If there is time, fit flood protection products you might have available such as:

- Flood boards
- Airbrick covers
- Toilet bungs (only for ground floor toilets)

Sandbags can be obtained from local builder's merchants. A guide to the effective use of sandbags can be downloaded from the Environment Agency website by clicking here.

Advice on preparing for flood and other emergencies is available at the Sussex Resilience Forum website at:

SussexResilienceForum@sussex.pnn.police.uk

https://sussex.police.uk/advice/protect-yourself-and-others/preparing-for-an-emergency-sussex-resilience-forum/how-you-can-help-yourself/

The leaflets "Advice to Residents in an Emergency", and "Precautions to take following Flooding" are available on the Rother District Council website at:

www.rother.gov.uk

9. ON-SITE REFUGE

If the worst happens and you are at home when flooding occurs then you must take on-site refuge upstairs. The first floor of the property is above the expected extreme flood levels and is considered a safe refuge that can be used as a **last resort** only if evacuation is not possible.

10. FLOOD KIT

A Flood Kit of essential items should be kept upstairs at the first-floor safe refuge as an easily accessible “grab bag”. The Flood Kit might include the following:

- Copies of insurance documents
- A torch with spare batteries or wind up
- A wind-up or battery radio (to receive latest updates on the situation)
- Warm, waterproof clothing and blankets
- First Aid kit
- Bottled water & high energy food snacks
- Flood Response Plan including list of important contact numbers.

11. RE-OCCUPATION OF PREMISES AFTER A FLOOD

Owing to potential residual hazards following major flooding, re-occupation of your premises should only be carried out following consultation with the emergency services and appropriate authorities. Utility companies will advise on the state of drinking water, sewerage, gas and electricity supplies. Do not switch the electricity supply back on until deemed safe to do so.

12. LIST OF KEY CONTACTS

Owner/landlord telephone numbers (landline & mobile)	
Floodline	0345 988 1188
Sussex Resilience Forum	01273 470101
East Sussex Resilience & Emergencies Partnership (ESREP)	01323 747090
Rother D C Joint Emergency Planning Unit	01424 787000
Rother D C out of office hours	01424 787868
Rye Emergency Action Community Team (REACT) *www.facebook.com/pages/Rye-Emergency-Action-Community-Team-REACT*	
Rye Community Help Point, 30a High Street, Rye, TN31 7JG (for sandbag collection)	01424787000
Electricity Provider	
Electricty (UK Power 24hr Fault Line)	0800 783 8838
Water (Southern Water)	0330 303 1263
Sewerage (Southern Water)	0330 303 0368
Gas (National Grid Gas Emergency Service)	0800 111 999
Telephone Provider	
Telephone Network, BT	0800 0850 654
NHS - urgent medical help needed but not an emergency	111
Local public transport, buses	
Local public transport, taxis:	
Insurance company	

13. DANGERS OF FLOOD WATER

REMEMBER!

- Don't walk through flowing water – Currents can be deceptive, and shallow, fast moving water can knock you off your feet!
- Don't swim through fast flowing water – You may get swept away or struck by an object in the water!
- If you have to walk in standing water, use a pole or stick to ensure that you do not step into deep water, open manholes or ditches!
- Don't drive through a flooded area – You may not be able to see abrupt drop-offs and only half a metre of flood water can carry a car away!
- Avoid contact with flood water – It may be contaminated with sewage, oil, chemicals or other substances!

See also the EA web page:

http://www.environment-agency.gov.uk/homeandleisure/floods/31632.aspx

APPENDIX H

Flood Hazard Mapping

Hazard To People Classification from EA/Wallingford "Supplementary Note on Flood Hazard Ratings and Thresholds for Development Planning and Control Purposes – Clarification of Table 13.1 of FD/2320TR2 and Figure 3.2 of FD2321/TR1".

This table is recommended for development planning and control use.

Table 4 – Hazard to People Classification using Hazard Rating *(HR= d x (v + 0.5) + DF)* for (Source Table 13.1 of FD2320/TR2 - Extended version)

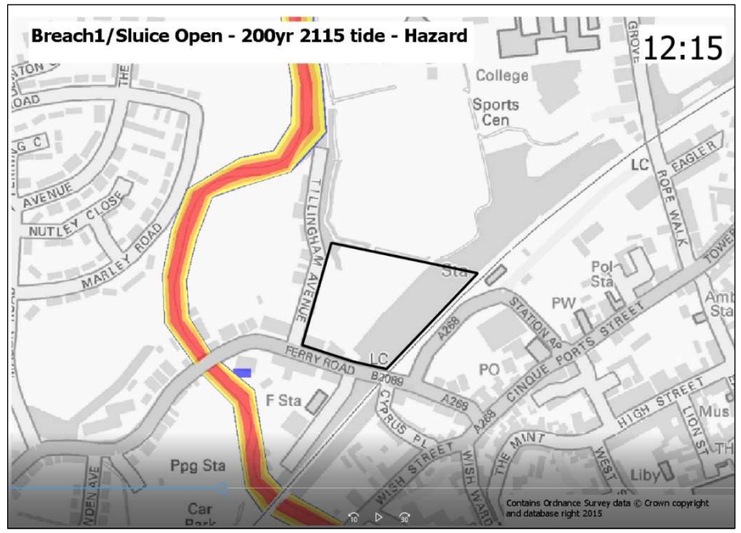
HR	Depth of flooding - d (m)												
	DF = 0.5				DF = 1								
Velocity v (m/s)	0.05	0.10	0.20	0.25	0.30	0.40	0.50	0.60	0.80	1.00	1.50	2.00	2.50
0.0	0.03 + 0.5 = 0.53	0.05 + 0.5 = 0.55	0.10 + 0.5 = 0.60	0.13 + 0.5 = 0.63	0.15 + 1.0 = 1.15	0.20 + 1.0 = 1.20	0.25 + 1.0 = 1.25	0.30 + 1.0 = 1.30	0.40 + 1.0 = 1.40	0.50 + 1.0 = 1.50	0.75 + 1.0 = 1.75	1.00 + 1.0 = 2.00	1.25 + 1.0 = 2.25
0.1	0.03 + 0.5 = 0.53	0.06 + 0.5 = 0.56	0.12 + 0.5 = 0.62	0.15 + 0.5 = 0.65	0.18 + 1.0 = 1.18	0.24 + 1.0 = 1.24	0.30 + 1.0 = 1.30	0.36 + 1.0 = 1.36	0.48 + 1.0 = 1.48	0.60 + 1.0 = 1.60	0.90 + 1.0 = 1.90	1.20 + 1.0 = 2.20	1.50 + 1.0 = 2.50
0.3	0.04 + 0.5 = 0.54	0.08 + 0.5 = 0.58	0.15 + 0.5 = 0.65	0.19 + 0.5 = 0.69	0.23 + 1.0 = 1.23	0.30 + 1.0 = 1.30	0.38 + 1.0 = 1.38	0.45 + 1.0 = 1.45	0.60 + 1.0 = 1.60	0.75 + 1.0 = 1.75	1.13 + 1.0 = 2.13	1.50 + 1.0 = 2.50	1.88 + 1.0 = 2.88
0.5	0.05 + 0.5 = 0.55	0.10 + 0.5 = 0.60	0.20 + 0.5 = 0.70	0.25 + 0.5 = 0.75	0.30 + 1.0 = 1.30	0.40 + 1.0 = 1.40	0.50 + 1.0 = 1.50	0.60 + 1.0 = 1.60	0.80 + 1.0 = 1.80	1.00 + 1.0 = 2.00	1.50 + 1.0 = 2.50	2.00 + 1.0 = 3.00	2.50 + 1.0 = 3.50
1.0	0.08 + 0.5 = 0.58	0.15 + 0.5 = 0.65	0.30 + 0.5 = 0.80	0.38 + 0.5 = 0.88	0.45 + 1.0 = 1.45	0.60 + 1.0 = 1.60	0.75 + 1.0 = 1.75	0.90 + 1.0 = 1.90	1.20 + 1.0 = 2.20	1.50 + 1.0 = 2.50	2.25 + 1.0 = 3.25	3.00 + 1.0 = 4.00	3.75 + 1.0 = 4.75
1.5	0.10 + 0.5 = 0.60	0.20 + 0.5 = 0.70	0.40 + 0.5 = 0.90	0.50 + 0.5 = 1.00	0.60 + 1.0 = 1.60	0.80 + 1.0 = 1.80	1.00 + 1.0 = 2.00	1.20 + 1.0 = 2.20	1.60 + 1.0 = 2.60	2.00 + 1.0 = 3.00	3.00 + 1.0 = 4.00	4.00 + 1.0 = 5.00	5.00 + 1.0 = 6.00
2.0	0.13 + 0.5 = 0.63	0.25 + 0.5 = 0.75	0.50 + 0.5 = 1.00	0.63 + 0.5 = 1.13	0.75 + 1.0 = 1.75	1.00 + 1.0 = 2.00	1.25 + 1.0 = 2.25	1.50 + 1.0 = 2.50	2.00 + 1.0 = 3.00	3.50	4.75	6.00	7.25
2.5	0.15 + 0.5 = 0.65	0.30 + 0.5 = 0.80	0.60 + 0.5 = 1.10	0.75 + 0.5 = 1.25	0.90 + 1.0 = 1.90	1.20 + 1.0 = 2.20	1.50 + 1.0 = 2.50	1.80 + 1.0 = 2.80	3.40	4.00	5.50	7.00	8.50
3.0	0.18 + 0.5 = 0.68	0.35 + 0.5 = 0.85	0.70 + 0.5 = 1.20	0.88 + 0.5 = 1.38	1.05 + 1.0 = 2.05	1.40 + 1.0 = 2.40	1.75 + 1.0 = 2.75	3.10	3.80	4.50	6.25	8.00	9.75
3.5	0.20 + 0.5 = 0.70	0.40 + 0.5 = 0.90	0.80 + 0.5 = 1.30	1.00 + 0.5 = 1.50	1.20 + 1.0 = 2.20	1.60 + 1.0 = 2.60	3.00	3.40	4.20	5.00	7.00	9.00	11.00
4.0	0.23 + 0.5 = 0.73	0.45 + 0.5 = 0.95	0.90 + 0.5 = 1.40	1.13 + 0.5 = 1.63	1.35 + 1.0 = 2.35	1.80 + 1.0 = 2.80	3.25	3.70	4.60	5.50	7.75	10.00	12.25
4.5	0.25 + 0.5 = 0.75	0.50 + 0.5 = 1.00	1.00 + 0.5 = 1.50	1.25 + 0.5 = 1.75	1.50 + 1.0 = 2.50	2.00 + 1.0 = 3.00	3.50	4.00	5.00	6.00	8.50	11.00	13.50
5.0	0.28 + 0.5 = 0.78	0.60 + 0.5 = 1.10	1.10 + 0.5 = 1.60	1.38 + 0.5 = 1.88	1.65 + 1.0 = 2.65	3.20	3.75	4.30	5.40	6.50	9.25	12.00	14.75

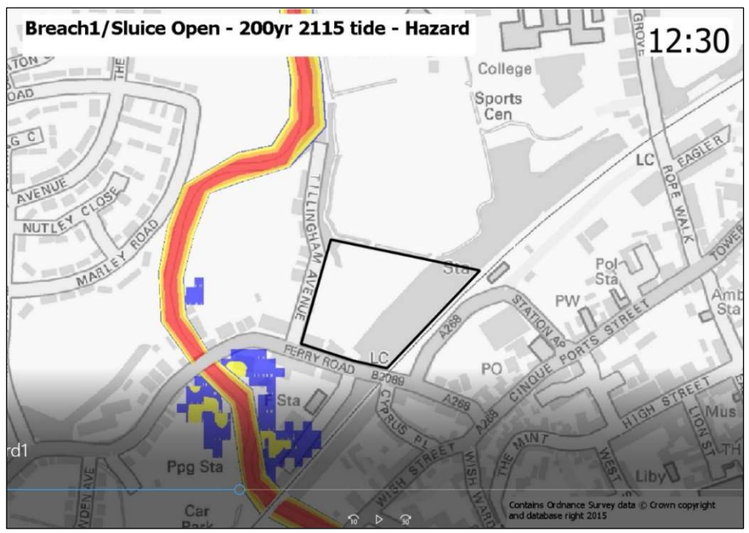
Flood Hazard Rating (HR)	Colour Code	Hazard to People Classification
Less than 0.75		Very low hazard - Caution
0.75 to 1.25		Danger for some – includes children, the elderly and the infirm
1.25 to 2.0		Danger for most – includes the general public
More than 2.0		Danger for all – includes the emergency services

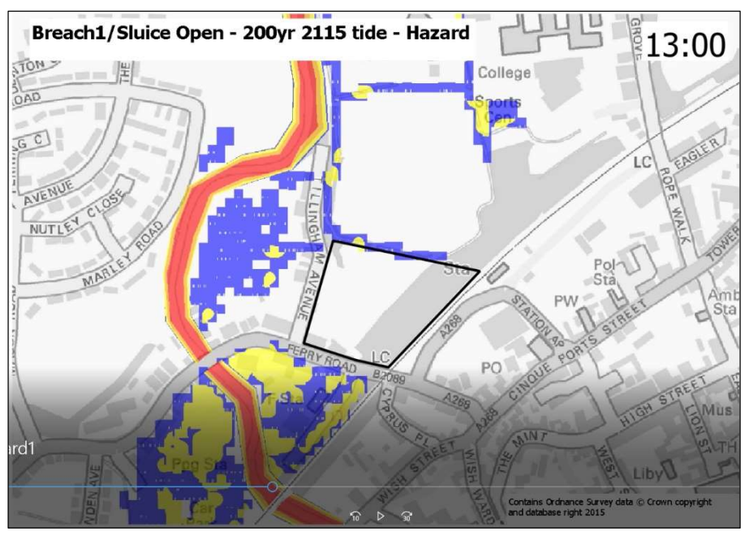
200805 Ferry Road: Residual Risk Modelling - Hazard Animation based upon Existing Topography - Sheet 1

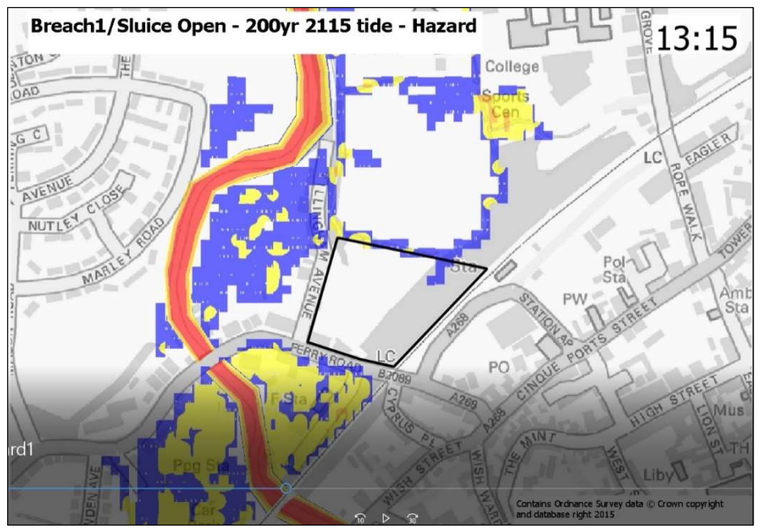
Canham Consulting - June 2017

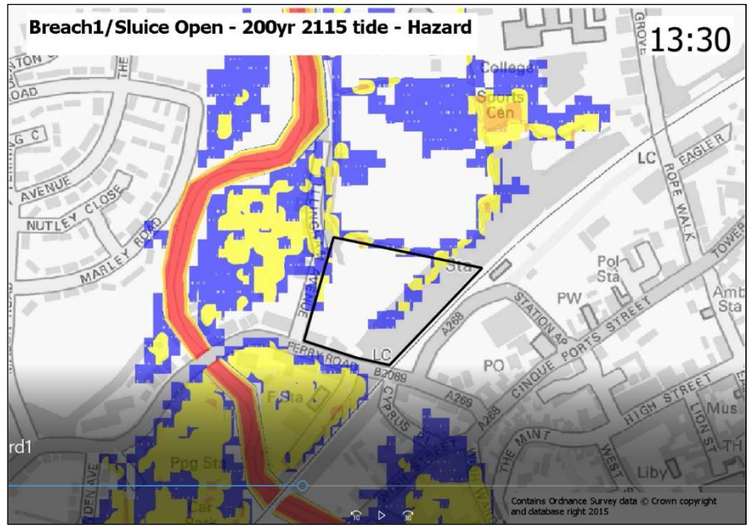
Elapsed Time in Hrs:Mins

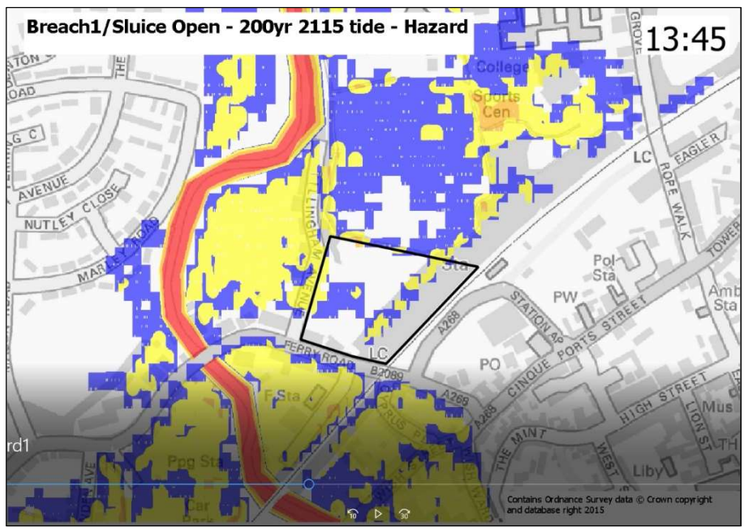








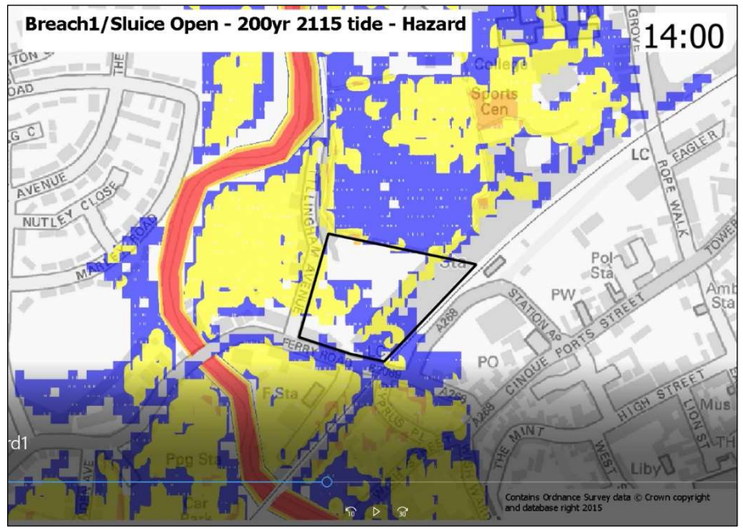


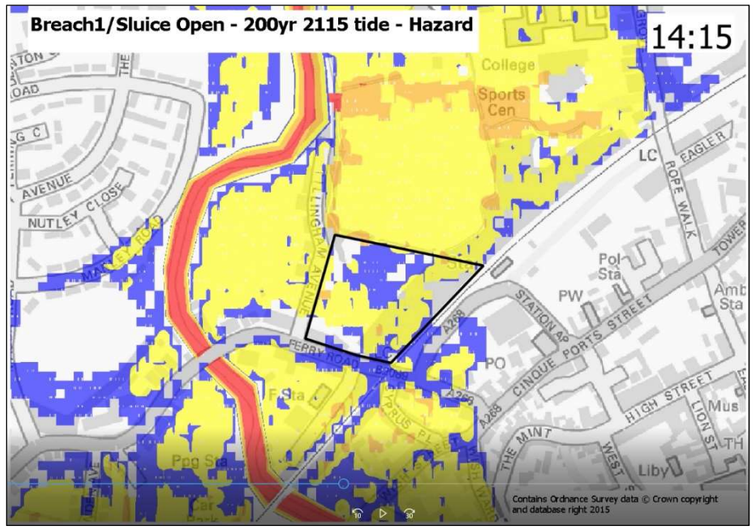


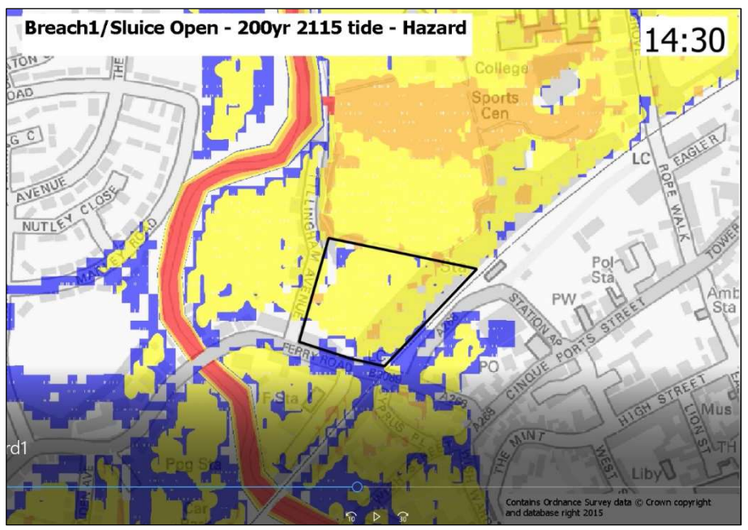
200805 Ferry Road: Residual Risk Modelling - Hazard Animation based upon Existing Topography - Sheet 2

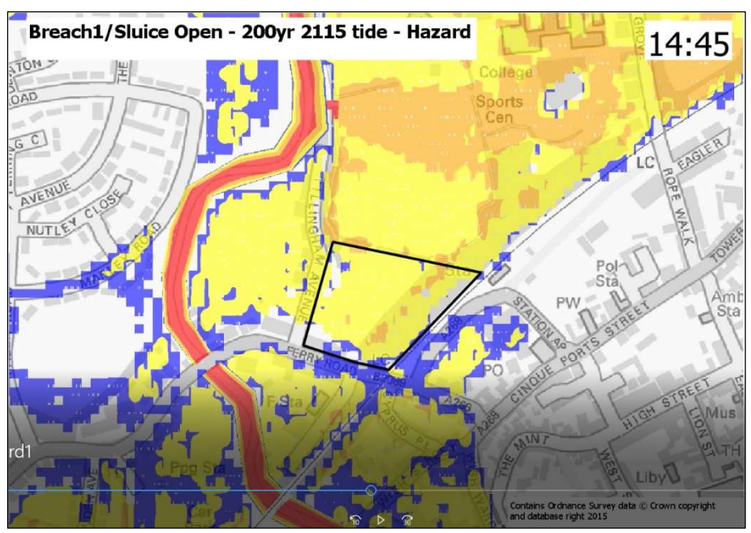
Canham Consulting - June 2017

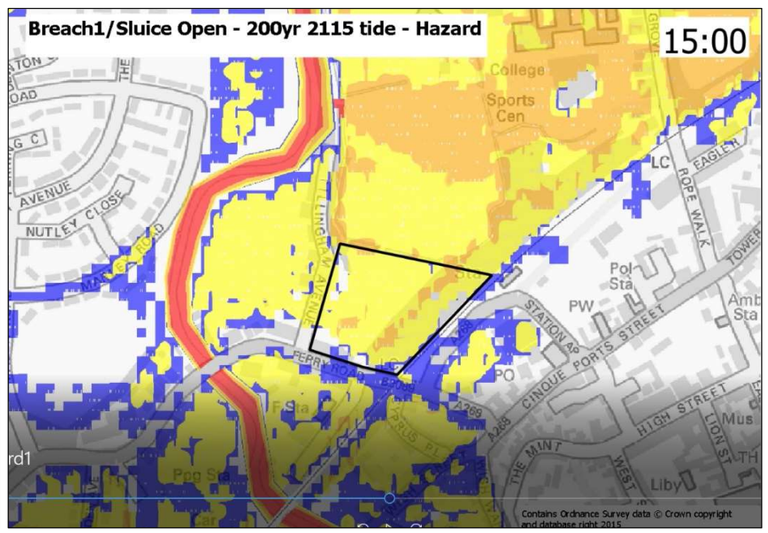
Elapsed Time in Hrs:Mins

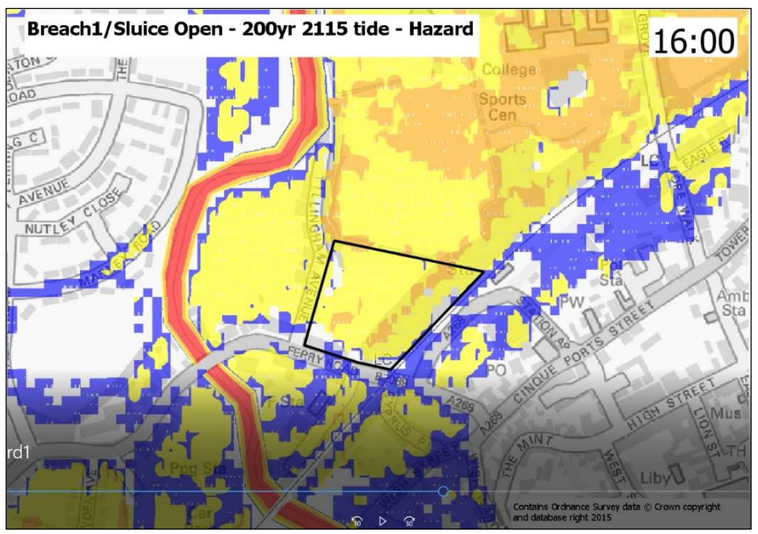












200805 Ferry Road: Residual Risk Modelling - Hazard Animation based upon Existing Topography - Sheet 3

Canham Consulting - June 2017

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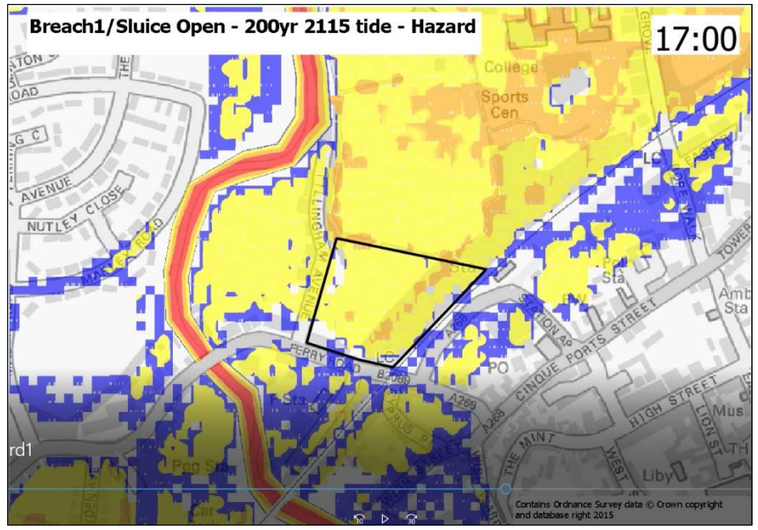
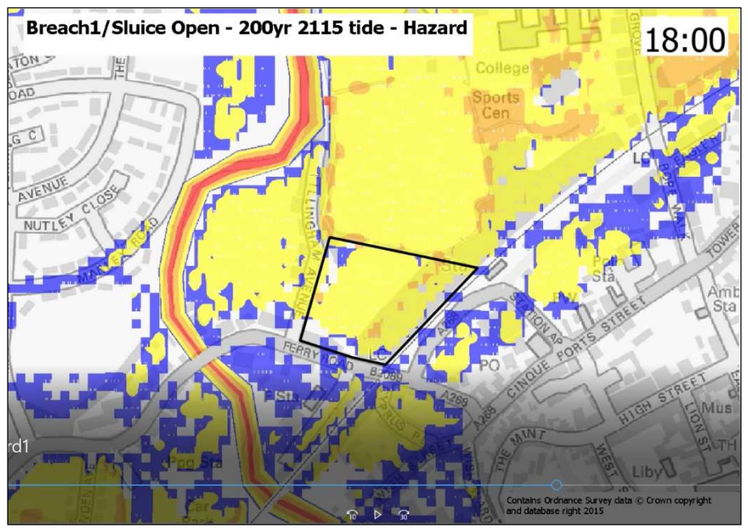
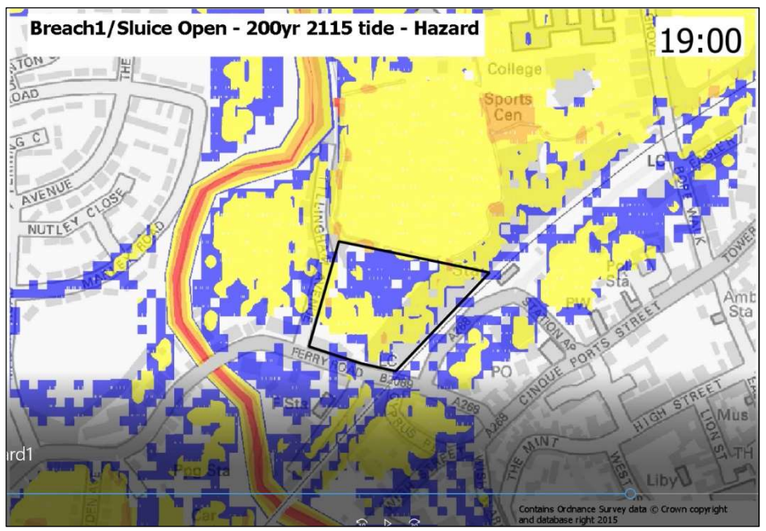
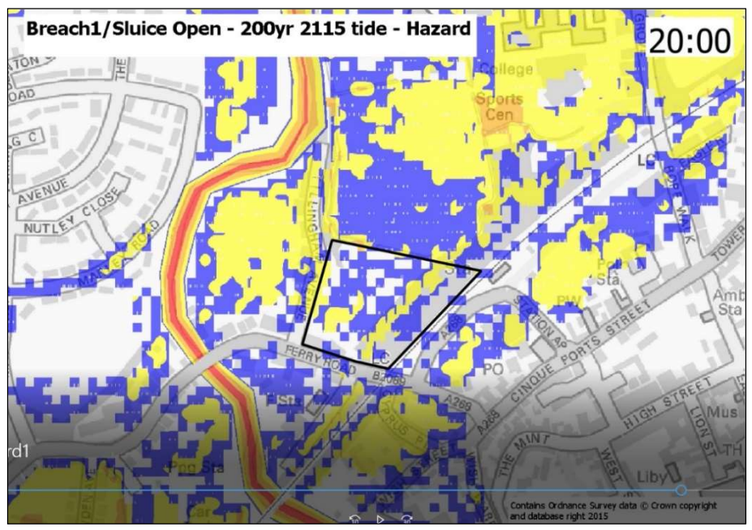
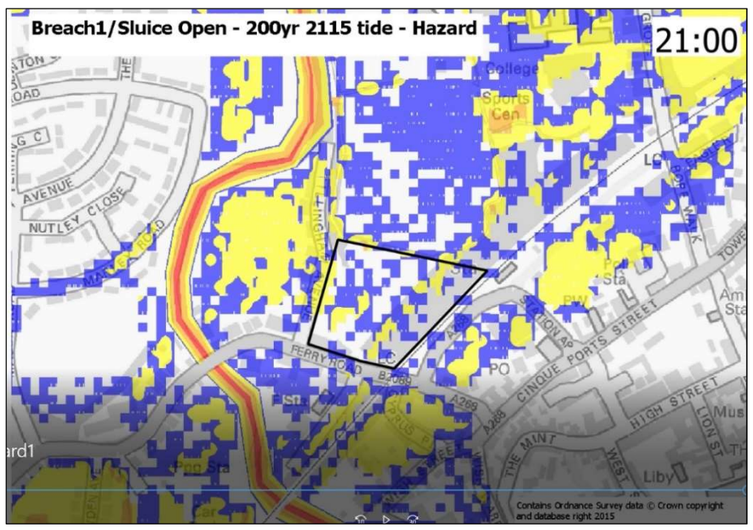
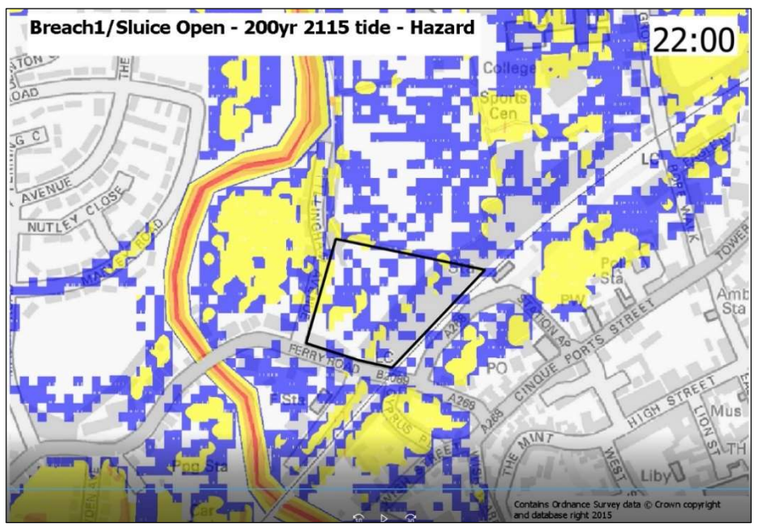












APPENDIX I

ESCC (LLFA) Meeting Record and Drainage Report

MEETING REPORT

208805 Ferry Road, Rye

Meeting at East Sussex County Council (as LLFA) on Tuesday 27th June 2017

Present:

Nick Claxton – Team Manager, Flood Risk Management – ESCC

Ms Revai Kinsella – Flood Risk Management Engineer – ESCC

Tim Wolfe Murray – Architect – Clague Architects

Michelle Hughes – Head of Pre-planning – Canham Consulting (CC)

Chris Ward – Pre-planning Engineer – Canham Consulting (CC)

Introduction:

1. The meeting had been requested by CC in order to discuss the surface water drainage proposals and flood risk management strategy for the project.
2. ESCC handed to CC their "Drainage Report" dated 27/06/2017 ESCC Ref: SUD/PRE/RR/2017/006 which sets out the status of several factors influencing the surface water regime and flood risk at the site location.
3. CC noted that they wished to discuss the flood levels, the need for a freeboard, the escape route, and the proposed arrangements for discharging the surface water runoff to the Ordinary Watercourse to the north of the site. The general proposal had been forwarded to ESCC with the CC letter of 11th May 2017 and email of 12th June 2017. CC tabled the latest Site Layout of 72 dwellings and noted that the FRA, the Drainage Strategy and the Flood Plan were in draft ready for issue.

Flood Level:

4. CC noted that the report and Tuflow data covering the residual risk modelling on which the flood level was based had been sent to the EA but the EA said it would take several months lead-in for this to be checked and approved by the EA. The modelling exercise was exactly what the EA had asked for: it included the failed sluice gate and a River Tillingham embankment breach positioned at an agreed location to produce the most onerous result. CC noted that the site did not flood under the defended condition. The planning application would be submitted on the basis of the residual risk modelling flood level of 3.69mAOD.
5. ESCC said that the modelling seemed to be a sensible basis for the determination of the "design" flood level. ESCC said that it would be useful to confirm the embankment conditions in the site vicinity in order to confirm that the modelled scenario was the most likely (i.e. that the breach position was realistic).

Freeboard:

6. CC asked if it was necessary to provide a freeboard to internal residential floors above the flood level. CC noted that the Rother Level 2 SFRA (2008) had said that if breach analysis of a defended residential site had been carried out by the applicant then no freeboard was required, as the procedure was considered conservative enough.
7. ESCC said that they considered the Rother SFRA to be an old document probably being superseded soon. It was good policy to provide a 300mm freeboard to the dwelling floor levels. This would also be required by the EA.

Escape Procedures Within and Outside the Site:

8. CC noted that the footway adjacent to the main spine road located within the development was to be set at the 3.69mAOD residual risk flood level and this would form the "dry escape route on foot" for the residents. There would be steps up to the ground floor of the dwellings, to accommodate the 300mm "freeboard".
9. TWM tabled a site plan showing all the proposed site levels and noted that the arrangement of raising the spine road benefitted the general appearance of the resident street view.
10. TWM noted however that there were certain areas of the site perimeter, especially at the north west of the site, where it was difficult to graduate to the adjacent ground levels. In general dwellings would have a raised deck level at the rear at the 3.69mAOD level but the gardens would be left at existing level where possible in order not to displace flood storage.
11. ESCC said it was acceptable to leave gardens at the existing level. With regard to the possibility of having to walk through flood water in an emergency, CC should identify where this might be likely on the site, and set this out in the Flood Management Plan as appropriate, for those dwellings which might be affected.
12. CC said that they had made some progress on this already in that "Hazard Mapping" had been carried out for the "residual risk" flood in accordance with current guidance ("Flood Risks to People" Phase 2 FD 2321/TR2). CC tabled some plans showing the succession of stills from the Tuflow Hazard Animation, which had been used to determine the best escape route within and outside the site (using the current topography). The residual risk flood encroached upon the site from the west, and it was approximately two hours after the initiation of the breach before the site was inundated with some areas of Low Hazard to People – Caution, and Moderate Hazard to People – Dangerous for Some.
13. ESCC said this was useful and should be highlighted in the FRA and in the Flood Management Plan especially to identify which particular dwellings might be at most Hazard and what depth of water the occupants were likely to have to negotiate.
14. CC said that it was intended that the dry escape route was provided in order that when an evacuation announcement was made, i.e. ahead of any flood, it could be used, but the intention was that upstairs refuge should be used after the initial warning period and this remained the backup. ESCC said this should be made clear in the householder's Flood Plan documentation and should be agreed with the Emergency Planners at Rother District Council (Nigel Ray – Emergency Planning Officer – Rother District Council).
15. ESCC also suggested that the hazard modelling should be re-run with the proposed site levels as this would show an improvement over the existing topographical levels. It was likely that the "dry escape route" and other raised areas would remain at "Low Hazard to People – Caution" for a longer period and possibly for the whole residual risk flood event. ESCC suggested that this might be done by hand as an overlay on the 1:500 scale site layout plan. CC commented that at this stage no further hydraulic modelling was likely to be undertaken.
16. CC tabled the plan showing the offsite escape route and the analysis which indicated that this was the optimum route likely to remain dry all the way to the Rye Community Centre (earlier

identified by the Rother District Council Emergency Planning Officer as one of the several Emergency Rest Centres).

Surface Water Drainage Strategy:

17. CC noted that the surface water drainage strategy was intended to maintain the pre-existing runoff rate into the Ordinary Watercourse at the north of the site and calculations had been included in the planning documentation. It may be possible to use the existing pipe outfall and headwalls, subject to condition. Soakage testing on site indicated that infiltration was not possible. CC asked whether the ESCC as LLFC would approve this arrangement. There would be attenuation in the form of oversized pipes, possibly under the main spine road. In terms of water quality treatment, CC noted that private driveways and private hardstanding would be of permeable construction with a storage/treatment layer underneath, designed to take driveway and hardstanding runoff, outfalling to the main surface water drainage system. CC noted that there was very limited space to provide any SuDS "Suitable Level of Water Quality Treatment" to the runoff from the main spine road, although there would be gullies and catchpits, but it may be possible to include a proprietary treatment system.
18. ESCC asked whether it was intended that the spine road be offered for adoption, and if so, the surface water drainage system would need to be adopted by Southern Water and they would be unlikely to accept an oversized pipe. This would influence what could be incorporated in or under the highway, for example attenuation storage for the 1 in 100-year event including climate change would not be adopted by Southern Water, only a 1 in 30-year drainage system. If the spine road were to be adopted therefore, any attenuation storage would need to be elsewhere.
19. TWM confirmed that the decision whether or not to offer the road for adoption would be clarified with the Highway Engineer.
20. ESCC noted that if and where permeable paving was used along the spine road, there should be a designated utilities services corridor.

Ordinary Watercourse Consent

21. ESCC noted that any application for Ordinary Watercourse Consent submitted to ESCC would go anyway to the RMAIDB (Romney Marshes Area Internal Drainage Board) as the Ordinary Watercourse flowed into their Drain further to the north. ESCC said it was essential to discuss the proposals now with Nick Botting at the RMAIDB to incorporate his comments and get his approval. CC noted that they had spoken earlier to Nick Botting and he had been generally agreeable to the proposals.
22. ESCC said that CC should ensure that the system operated correctly under surcharge conditions at high water and that the attenuation storage was sufficient for that. Also ESCC noted that the discharge orifice should not be too small (ESCC limit 75mm diameter) because of maintenance and operation problems.
23. There was some discussion concerning the condition of the Ordinary Watercourse which was observed to be overgrown and generally in a poor state of maintenance. ESCC noted that the IDB were probably agreeable to adopting the Watercourse and this would suit the ESCC. This would probably involve contributions and/or committed sums for 20 years.
24. CC noted that the Watercourse was outside the site boundary and the Client was not immediately in a position to do anything about its condition.

Foul Sewerage:

25. CC noted that the foul sewerage system would be offered for adoption to Southern Water. The proposals included a pumping station at the northern end of the site (the lowest end) which was intended to pump back southwards to the Southern Water foul sewer in Ferry Road. However the recent capacity check carried out by Southern Water (letter 6th June 2017) has declared that there is no capacity in the SW network "for several years" and their recommendation is that the sewage should be pumped all the way to a connection point adjacent to the Newbury Lane, Rye WTW, at approximately 1.3km from the site, through an agreement using Section 98 of the Water Industry Act 1991. The SW letter does say that their analysis may have "inconsistencies" and that accurate capacity assessments are not immediately available. Notwithstanding this, it is deemed there is satisfactory foul drainage solution.

General:

26. ESCC recommended that the submitted Flood Plan should include all the information discussed in a not-too technical format which was well illustrated and was readily understandable by non-specialist planning staff.
27. CC asked whether it was necessary to have a separate Maintenance Plan associated with the Drainage Strategy. ESCC confirmed that this was not necessary at the moment and that there will subsequently be a suitably worded condition in regards to the provision of a Maintenance Strategy for the proposed detailed scheme.

End.

CDW: Canham Consulting 27th June 2017

27/06/2017

Drainage Report

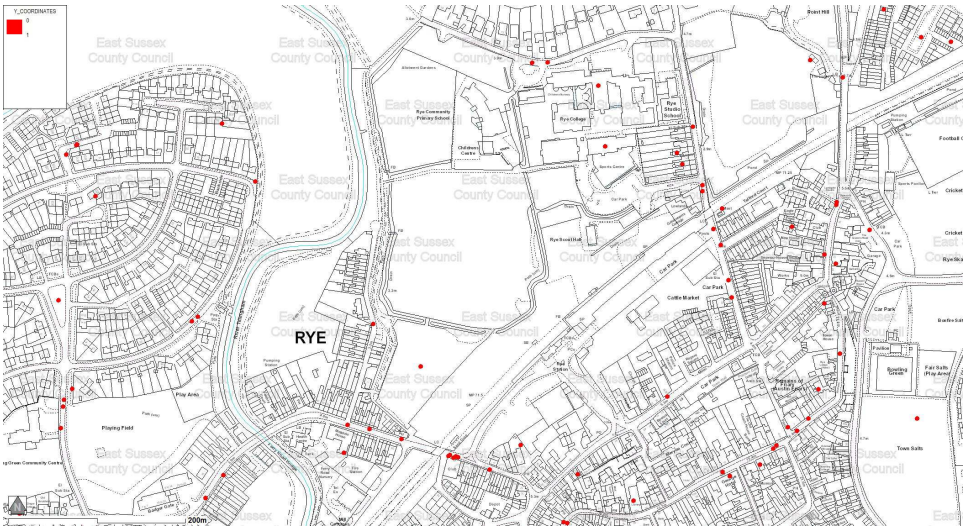
Site name: Development at Ferry Road, Rye

ESCC Reference: SUD/PRE/RR/2017/006

Flood Risk

Flood Risk	Is any part of the site at risk?	Where to obtain additional information
Fluvial/Coastal	Yes	Environment Agency
Surface water	Yes	Environment Agency
Groundwater	No	British Geological Survey

The map below shows the flood incidents recorded in our database in the vicinity of the development site.



Recorded flooding incident

Figure 1: Recorded Flood Incidents

The table below provides details of the recorded flood incidents within the vicinity of the site.

Date	Source of flooding	Description
12/07/2010	Surface water	Drains blocked and flooding to property
14/06/2006	Combined	Curtilage and highways flooding
17/09/2014	Surface water	Localised flooding of road outside property. Rain drain is blocked.
31/12/1988	Combined	internal flooding
26/01/1995	Foul	Curtilage flooding
20/08/2006	Combined	Curtilage flooding
20/11/2013	Surface water	Flooding to curtilage due to road camber
31/01/2014	Surface water	Outside 2 Mason Road, Rye footpath is flooded
18/07/2014	Surface water	Gullies blocked and causing road to flood
27/08/2014	Surface water	surface water flooding on pavement
17/09/2014	Surface water	flooding on Cooper Road, Rye
06/12/2011	Surface water - Pluvial runoff	There has been a drainage issue in the past here the drains were cleared as the area flooded after heavy rain
12/04/2013	Surface water	drains outside these properties have become blocked with tarmac and are beginning to flood the road
08/05/2013	Surface water	Blocked drain next to property, and is becoming flooded in heavy rain
12/04/2016	Surface water	Road damage from recent flooding on Mason Road
24/03/2016	Surface water - pluvial runoff	Flooding of pavement and road during heavy rain
07/12/2015	Surface water	extensive quantities of mud in the road, which blocks drainage system causing flooding
22/09/2015	Surface water	Flooding o/s property, thinks the drain is blocked as there is surface water drive even when it is lightly raining
13/08/2015	Surface water	Flooding to property here

Please note that our records only provide a snapshot of the flood history in the area, as the majority of incidents were compiled after the County Council was established as the Lead Local Flood Authority in 2010. Therefore, other risk management authorities, such as the Environment Agency, Wealden and Southern Water may hold additional records.

The surface water management strategy should include information on how the potential impacts of local flood risk sources on the proposed drainage arrangements have been considered and mitigated where necessary. Local flood risk sources include surface water, groundwater, sewer and ordinary watercourse flood risk.

Surface Water Flood Risk

The Environment Agency's surface water flood mapping shows the predicted surface water flood risk at the development site, and the table below gives the corresponding maximum flood depth:

Table 1: Surface Water Flood Depths

Flood Event	Maximum Depth
3.33% AEP (1 in 30 year)	N/A
1% AEP (1 in 100 year)	N/A
0.1% AEP (1 in 1000 year)	0.15-0.30

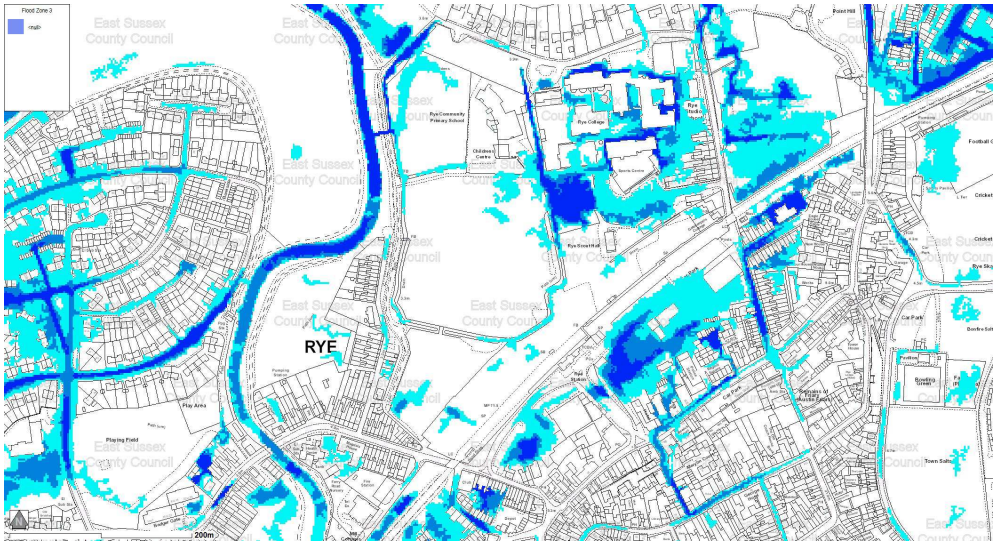
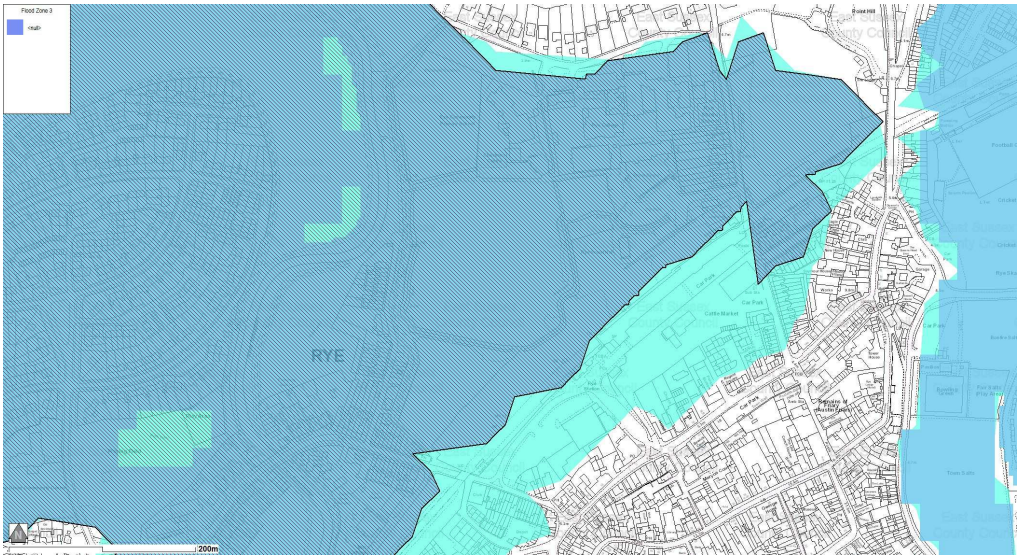


Figure 2: Surface Water Flood Risk

Further information can be viewed online on at the Environment Agency's pages on the GOV.UK website.

Fluvial and Coastal Flood Risk

The Environment Agency's mapping shows that the property is within Flood Zone 2 and Flood Zone 3



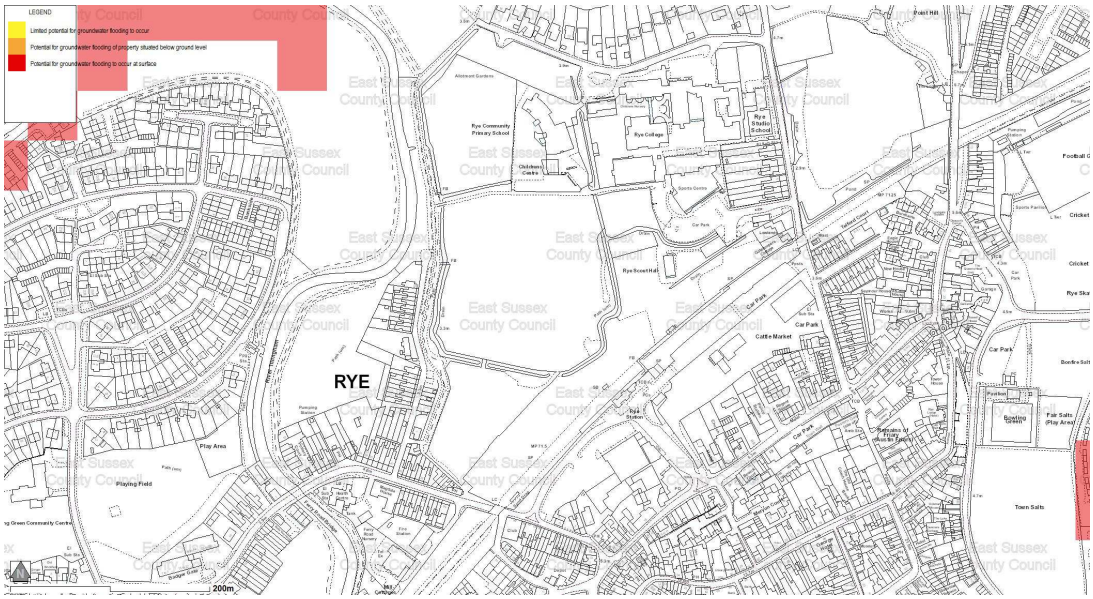
Flood Zone 3	Flood Zone 2

Figure 3: Fluvial and Coastal Flood Risk

Further information can be viewed online at the Environment Agency's pages on the GOV.UK website.

Groundwater Flood Risk

Mapping from the British Geological Survey shows that there is negligible risk to the site from Groundwater flooding

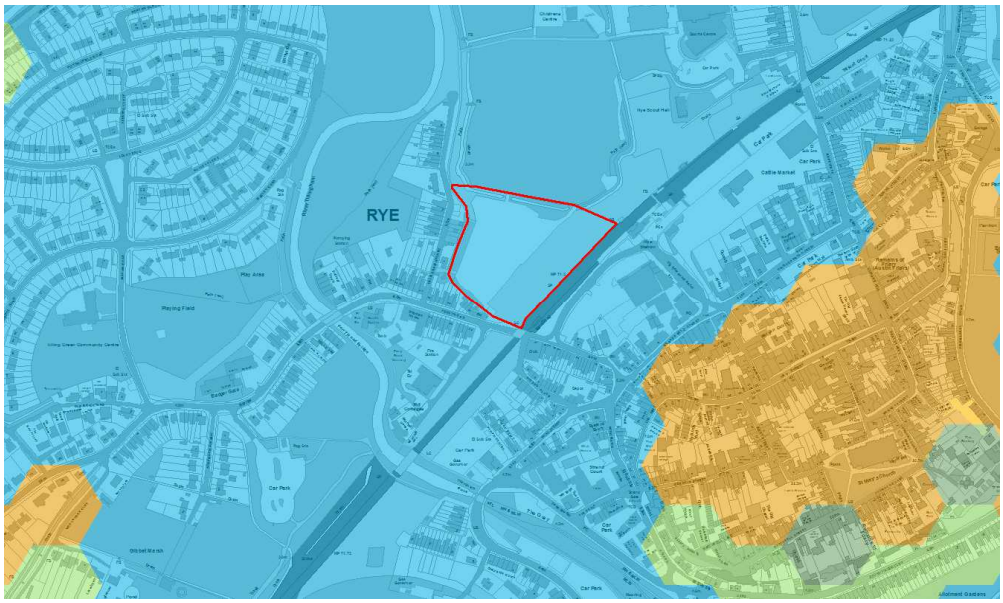


Limited potential for groundwater flooding to occur	Potential for groundwater flooding of property situated below ground level	Potential for groundwater flooding to occur at surface

Figure 4: Groundwater Flood Risk

Drainage Considerations

The council has carried out county wide analysis to classify East Sussex into four areas of broad drainage characteristics or Drainage Risk Areas (DRA). These spatial groupings are intended to inform the preparation of drainage strategies with development proposals, so that appropriate SuDS techniques are implemented in the county.



Risk area 1	Risk area 2	Risk area 3	Risk area 4

Figure 5: Drainage Risk areas

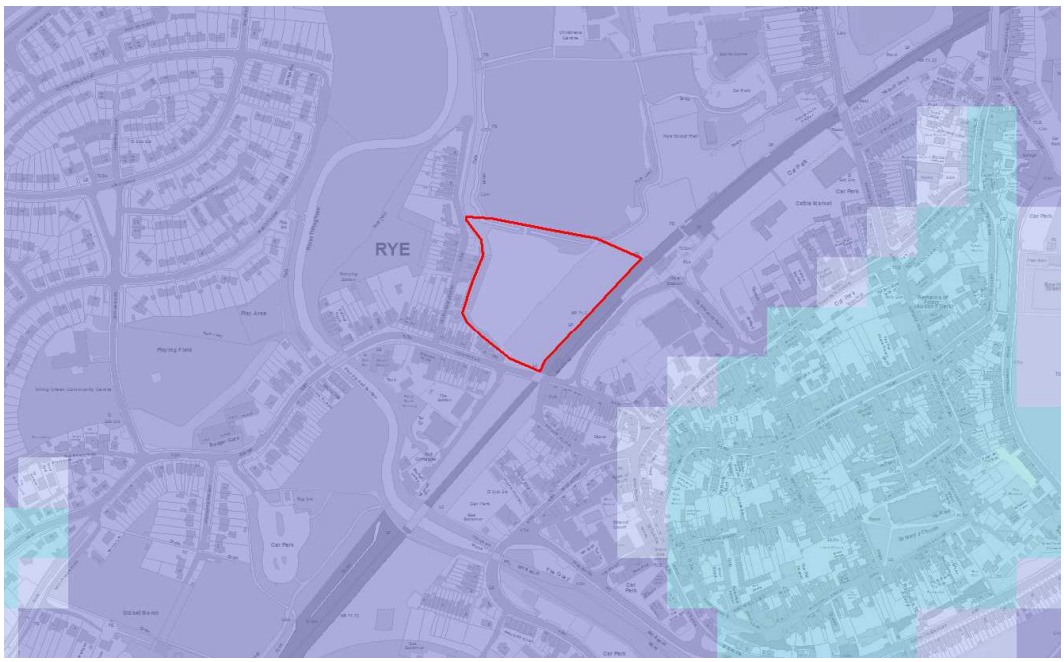
The site is shown to be within risk area 3. The site may also the contain aspects of other DRA categories.

The LLFA requirements for each DRA are provided in Table 2 below.

Table 2: Drainage Risk Area Guidance

DRA Number	Colour	Guidance
1		Improvements upon greenfield runoff rates should be discussed with LLFA
2		Proposed infiltration methods should use sensitive techniques
3		Infiltration techniques are likely to be inappropriate
4		Robust evidence is required to show the applicability of infiltration on site

Figure 6 below outlines the estimated water table depth for the site, based on data from the British Geological Survey. The legend contains the British Geological Survey advice for each groundwater depth band.



	>5m below surface	Observations of seasonal variations in groundwater level recommended
	3m – 5m below surface	Determine seasonal variations in groundwater level
	<3m below surface	Determine seasonal variations in groundwater level

Figure 6: Depth to Groundwater

The site is shown to have groundwater at depths less than 3m below ground level, however the seasonal variation of groundwater should be determined and inform design of any infiltration systems.

Figure 7 below outlines the estimated ground stability for the site, based on data from the British Geological Survey. The legend contains the British Geological Survey advice for each ground stability band. Geohazards are unlikely at this site.

The BGS data shows that there it is unlikely that geohazards will occur at this site

	Potential for Geohazard	Before installing infiltration SuDS consider the potential for or consequences of infiltration or ground stabilty
	Significant potential for Geohazard	Only install infiltration SuDS if the potential for or consequences of infiltration are considered no to be considerate
	Very significant constraints are indicated	Only install infiltration SuDS if the potential for or consequences of infiltration are considered no to be considerate

Figure 7: Ground Stability

The information provided is guidance only. All development proposals must undertake the necessary site surveys to confirm the drainage constraints or opportunities. For further information on drainage strategy requirements, please refer to the ESCC Guide to Sustainable Drainage Systems in East Sussex and the Local Flood Risk Management Strategy. The 'surface water drainage checklist' available on our website lists the information we expect to be submitted in support of a planning application

Watercourses and Drainage Assets

Watercourses and drainage assets in the vicinity of the property are shown below.

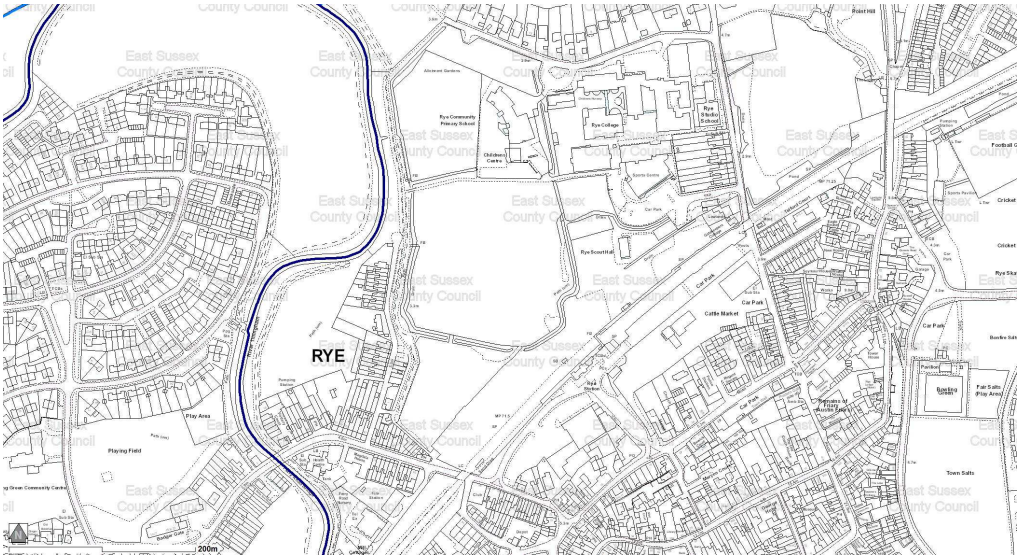


Figure 8: Watercourses

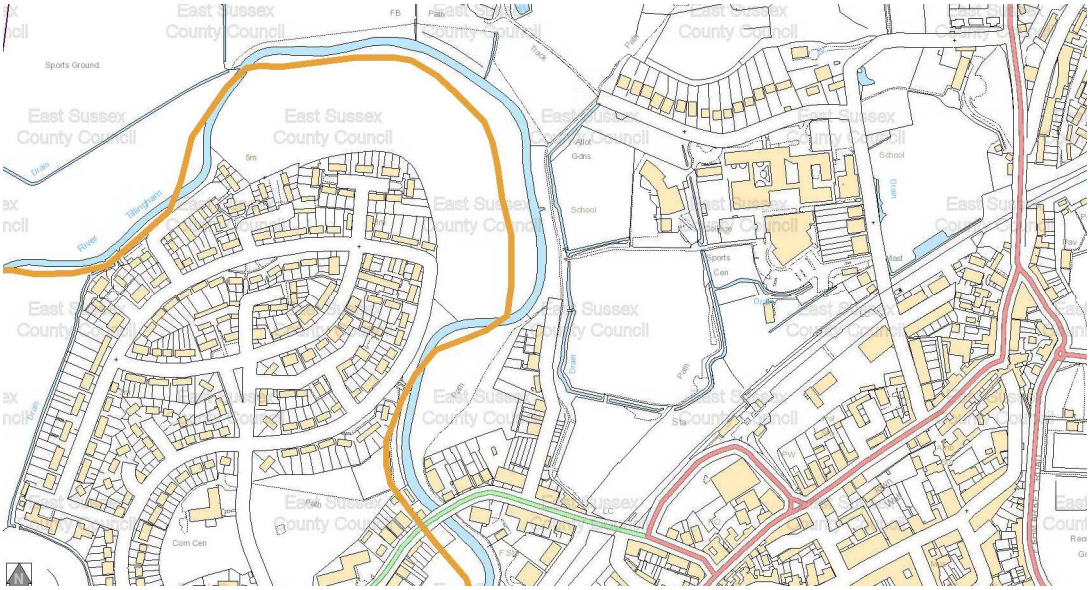
If any ordinary watercourses lie within the site boundary, any planned works to the watercourse map require a separate Ordinary Watercourse Consent from ESCC. There is an ordinary watercourse on the Northern boundary of this site.

If a main rives lies within the site boundary, any planned works to this watercourse may require an Environmental Permit (formerly Flood Defence Consent) from the Environment Agency. Contact the EA for enquiries at enquiries@environment-agency.co.uk. The River Tillingham is within the vicinity of the site.

To connect into existing surface water and foul water systems, agreement must be obtained from Southern Water. Please refer to Southern Water for details on the capacity of the existing sewer system and applications for a new connection to the existing sewer system.

Water Quality and Landfill

Figure 9 below shows the ecological status of adjacent waterbodies, as defined by the Water Framework Directive and any historic landfill sites. The adjacent watercourse, the River Tillingham is a Water Framework Directive water body.



High Ecological Status	Good Ecological Status	Moderate Ecological Status
Poor Ecological Status	Bad Ecological Status	Historic Landfill Site

Figure 9: Water Quality and Landfill

If the site is adjacent to a sensitive waterbody, as defined by the Water Framework Directive, the Quality of water discharged from the site is likely to be a key consideration. Contact the EA for enquiries at enquiries@environment-agency.co.uk for further information.

If the site is in the vicinity of a historic landfill the EA may have additional comments on the associated water quality risks.

Investigations

ESCC has undertaken a broad range of investigations into historic flooding and drainage issues including section 19 reports, Land Drainage Investigations and Surface Water Management Plans. Figure 10 below illustrates the location of these investigations.

Where a significant flood event has occurred and the responsibility for managing the risk is unclear; ESCC may undertake a formal investigation under Section 19 of the Flood and Water Management Act 2010. The published report aims to identify the responsible party and proposed response to the incident. To address less severe, localised flooding, ESCC may undertake a Land Drainage investigation.

The Surface Water Management Plans (SWMP) in ESCC identified several risk 'hotspots'. If the site is adjacent to a hotspot, please refer to the full SWMP document for more information. This site is within a SWMP hotspot.

Land Drainage Investigation	SWMP Hotspot	Section 19 Investigation

Figure 10: Previous investigations

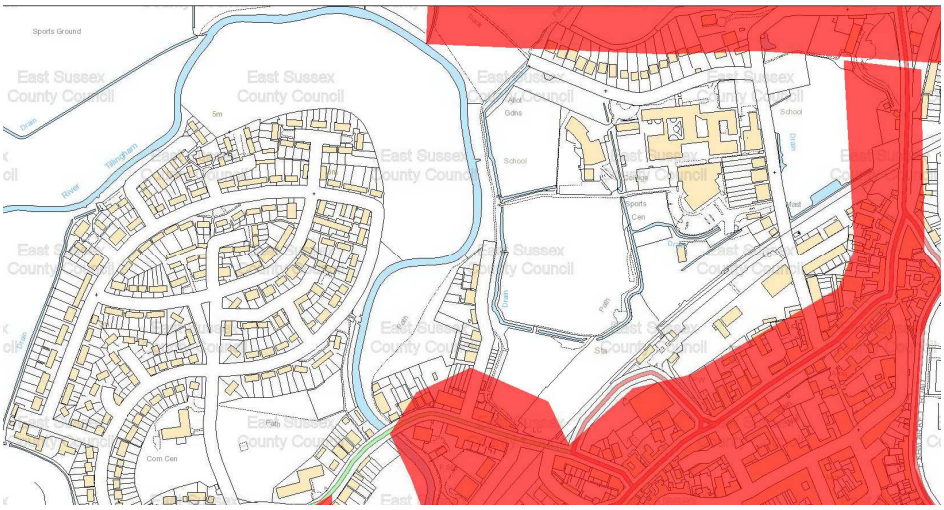
If the site is adjacent to any Section 19 Reports, Land Drainage Investigations or SWMP hotspots, please contact the Flood Risk Management Team at watercourse.consenting@eastsussex.co.uk

Other Information

The site lies with administrative area of the East Sussex County Council Internal Drainage Board. Additional requirements may need to be taken into consideration. Please contact the below relevant authority for further information. This site falls within the Romney Marsh IDB.

Upper Medway Internal Drainage Board	enquiries@medwayidb.co.uk
Romney Marshes Area Internal Drainage Board	info@rmaidb@co.uk
Cuckmere and Pevensey Water Level Management Board	info@wlma.org.uk
East Sussex County Council LLFA	Watercourse.consenting@eastsussex.gov.uk

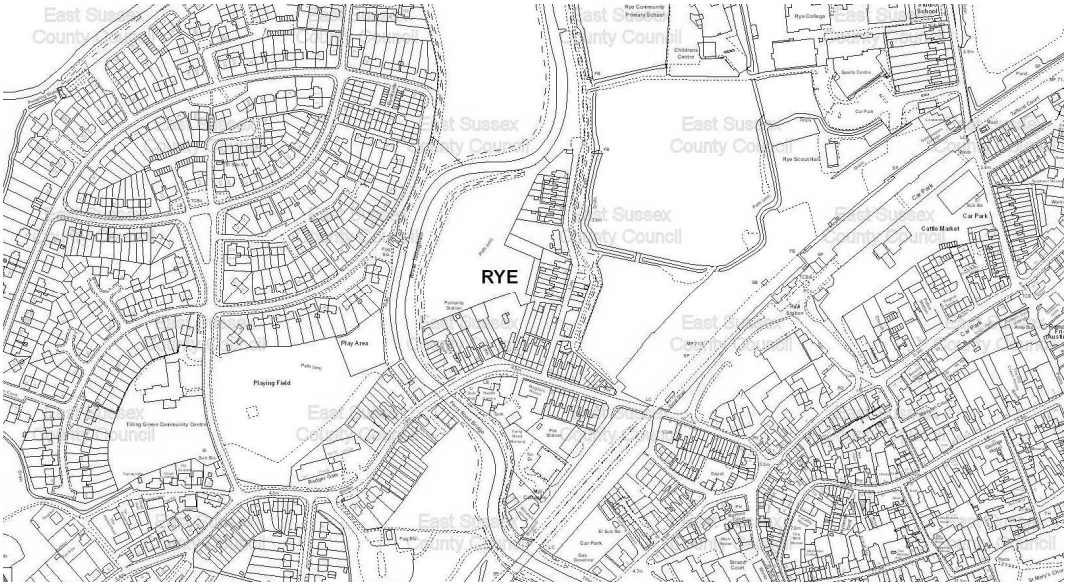
Figure 11 below shows any known archaeological sites adjacent to the site. If there is an adjacent site, it is highly likely that information on the location and extent of heritage assets will be required, as well as the archaeological potential of the area. It is recommended to investigate the level of information required by contacting East Sussex Historic Environment Record (HER) at country.HER@eastsussex.gov.uk



Archaeological Site

Figure 11: Archaeology

East Sussex contains area of international, national and local importance for biodiversity. The below Figure 12 illustrates the location of RAMSAR sites, Sites of Specific Scientific Interest (SSSI), Special Areas of Conservation (SAC) and Special Protection Areas (SPA). There are no ecological sites within the vicinity of this site.



RAMSAR	SSSI	SAC	SPA

Figure 12: Biodiversity

ESCC policy states that the development should provide net gain in biodiversity where possible. Therefor Sustainable Drainage Systems (SuDS) should be designated as multifunctional features, which ensure that biodiversity can be compensated and/or enhanced.

Further information can be found in the Guide to Sustainable Drainage Systems in East Sussex.