FLOOD RISK ASSESSMENT

Site Address

163 Lower Road

Belvedere

Kent

DA17 6DG

Client

[redacted]

Date

13/07/2021

1 Document Control

FLOOD RISK ASSESSMENT

Site Address:	163 Lower Road Belvedere Kent DA17 6DG
National Grid Reference:	550217, 179043
STM Reference:	FRA – 2021 – 000091
Version No:	1.0
Prepared for:	[redacted]
Date:	13/07/2021
Report Author:	Francesca Caggiano (MSc, BSc) **Environmental Consultant**
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Contents

2 Abbreviations

Abbreviation	Description
STM	STM Environmental Consultants Limited
BGS	British Geological Survey
EA	Environment Agency
OS	Ordnance Survey of Great Britain
FRA	Flood Risk Assessment
NPPF	National Planning Policy Framework
FWD	Floodline Warning Direct
FRMS	Flood Risk Management Strategy
LBB	London Borough of Bexley
SWMP	Surface Water Management Plan
SFRA	Strategic Flood Risk Assessment
CDA	Critical Drainage Area
SuDS	Sustainable Drainage Systems
GWSPZ	Groundwater Source Protection Zone
LLFA	Lead Local Flood Authority
mbgl	metres below ground level
DCLG	Department for Communities and Local Government
PPGPS	Planning practice guidance and Planning system

3 Disclaimer

This report and any information or advice which it contains, is provided by STM Environmental Consultants Ltd (STM) and can only be used and relied upon by Mr [redacted] (Client).

STM has exercised such professional skill, care and diligence as may reasonably be expected of a properly qualified and competent consultant when undertaking works of this nature. However, STM gives no warranty, representation or assurance as to the accuracy or completeness of any information, assessments or evaluations presented within this report. Furthermore, STM accepts no liability whatsoever for any loss or damage arising from the interpretation or use of the information contained within this report. Any party other than the Client using or placing reliance upon any information contained in this report, do so at their own risk.

4 Executive Summary

Location	163 Lower Road Belvedere Kent DA17 5DG Grid reference: 550001, 178992
Proposed Development	Single storey rear extension for A3/A5 (fish and chips) to provide storage space.
Flood Zone	Flood Zone 3.
Topography	1mAOD (N) to 2.4mAOD (SE); ~1.5mAOD at proposed location of the extension.
Main Sources of Flooding	River Thames.
Flood Defences	Yes, along the river Thames.
Records of Historic Flooding	One in 1953.
Fluvial (River) and Tidal (Sea) Flood Risk	Low to Medium – Site benefits from flood defences; One fluvial/tidal flooding incidents identified in 1953. Flood depths would reach 1m at the proposed location of the extension during the 1 in 200-year (2115) modelled scenario. The front of the site would remain dry during this event.
Pluvial (Surface Water) Flood Risk	Low – Site will remain dry during all modelled events. No significant surface water flooding incidents identified. Only 3 recorded surface water/sewer flooding incidents in the vicinity.
Flood Risk from Artificial (Canals and Reservoirs) Sources	Low – No significant artificial sources identified.
Groundwater Flood Risk	Low – Site has potential to groundwater flooding below ground level, no recorded incidents have been identified.
Development Impacts on Local Flood Risk	The development will increase the site impermeable area. As such it may impact on surface water runoff rates if unmitigated.
Proposed Flood Risk Mitigation Measures	• Finished floor levels will be set to 300mm above general ground levels; • Construction will utilise flood resistant materials and services will be placed as high as practicable to reduce impact of flooding; • Occupants will sign up for EA Emergency Flood Warning Direct Service; • Safe egress to flood zone 1 is available by a 2-minute walk to the south of the site.
Surface Water Management (SuDS)	SuDS would reduce current surface water runoff. Consideration should be given to rainwater harvesting and/or permeable paving where possible.
Conclusions	Based on the information reviewed and taking into account the proposed mitigation measures, it is considered that overall flood risk to the proposed development is medium. With a suitable SuDS strategy in place, the proposal is unlikely to have a significant impact on local flood risk.

Flood Risk Assessment (FRA) Checklist	
This document should be attached to the front of the Floor Risk Assessment (FRA) issued to Local Planning Authorities (LPA) in support of a development proposal which may be at risk of flooding. This document is not a substitute for a FRA. Please note, under our responsibilities as a statutory consultee we will review any submitted FRA only in respect to fluvial and tidal risk. Your FRA should also consider other sources of flooding such as surface water, drainage, and ground water flooding.	
1.Development Proposal	
Site name	163 Lower Road Belvedere Kent DA17 5DG
National Grid Reference (NGR)	550217, 179043
Flood Risk Assessment	Reference/Title: FRA – 2021 – 000091 Date: July - 2021
Existing site use & vulnerability classification	Commercial / less vulnerable
Proposed site use & vulnerability classification	Commercial / Less vulnerable
2. Flood Risk	
Flood Zone(s) affecting the site/property	Flood Zone 3.
Sources of flooding affecting the site	River Thames
Have you considered flood storage compensation?	No as the site is at risk from tidal flooding only.
3. Please provide a node map and accompanying table in the Flood Risk Assessment similar to the example given (see Appendix A). You should clearly demonstrate the highest and most representative flood levels for your proposed development. For example, if it is a small extension (< 250 square metres) then approximately 5-10 nodes would be sufficient. For larger sites, approximately 10 to 20 nodes would be appropriate.	
4. Mitigation	
Finished floor levels (in mAOD) for each proposed floor. Have you considered a freeboard for these Finished Floor Levels?***	To match existing.
Drawing reference showing Finished Floor Levels for proposed development	
Have you considered suitable internal and external access for safe refuge above the flood level?	Not considered to be required (less vulnerable development)
5.Proximity to the watercourse/ flood defence/ culvert	
Are the proposed developments on, over, under or within 8 metres of a fluvial main river or 16 metres of a tidal main river or flood defence?	No
Map Many of our flood datasets are available online: Flood Map For Planning (Flood Zone 2, Flood Zone 3 ,Flood Storage Areas, Flood Defences, Areas Benefiting from Defences, , Risk of Flooding from Rivers and Sea, Historic Flood Map, Current Flood Warnings	

**** Please be aware floodplain compensation may be required for your site. Floodplain compensation is normally required when the proposed site use has an increased built footprint in relation to the existing site use and lies primarily in Flood Zone 3, which is considered the fluvial floodplain. This is normally demarked in the modelled data by the 1 in 100 + Climate Change flood return period.**

***** Please refer to the Local Authority's SFRA for further guidance on freeboard requirements for each type of development**

Environment Agency, Orchard House, Endeavour Park, London Road, West Malling, ME19 5SH
Customer services line: 03708 506 506
Email: enquiries@environment-agency.gov.uk
www.environment-agency.gov.uk

Planning advice and guidance

The Environment Agency are keen to work with partners to enable development which is resilient to flooding for its lifetime and provides wider benefits to communities. If you have requested this information to help inform a development proposal, then we recommend engaging with us as early as possible by using the pre-application form available from our website:
https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion

Complete the form in the link and email back to kslplanning@environment-agency.gov.uk

We recognise the value of early engagement in development planning decisions. This allows complex issues to be discussed, innovative solutions to be developed that both enables new development and protects existing communities. Such engagement can often avoid delays in the planning process following planning application submission, by reaching agreements up-front. We offer a charged pre-application advice service for applicants who wish to discuss a development proposal.

We can also provide a preliminary opinion for free which will identify environmental constraints related to our responsibilities including flooding, waste, land contamination, water quality, biodiversity, navigation, pollution, water resources, foul drainage or Environmental Impact Assessment.

Flood Risk Assessments guidance

In preparing your planning application submission, you should refer to the Environment Agency's Flood Risk Standing Advice and the Planning Practice Guidance for information about what flood risk assessment is needed for new development in the different Flood Zones. This information can be accessed via:
https://www.gov.uk/flood-risk-assessment-standing-advice
http://planningguidance.planningportal.gov.uk/
https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications
https://www.gov.uk/guidance/flood-risk-and-coastal-change

You should also consult the Strategic Flood Risk Assessment and flood risk local plan policies produced by your local planning authority.

You should note that:

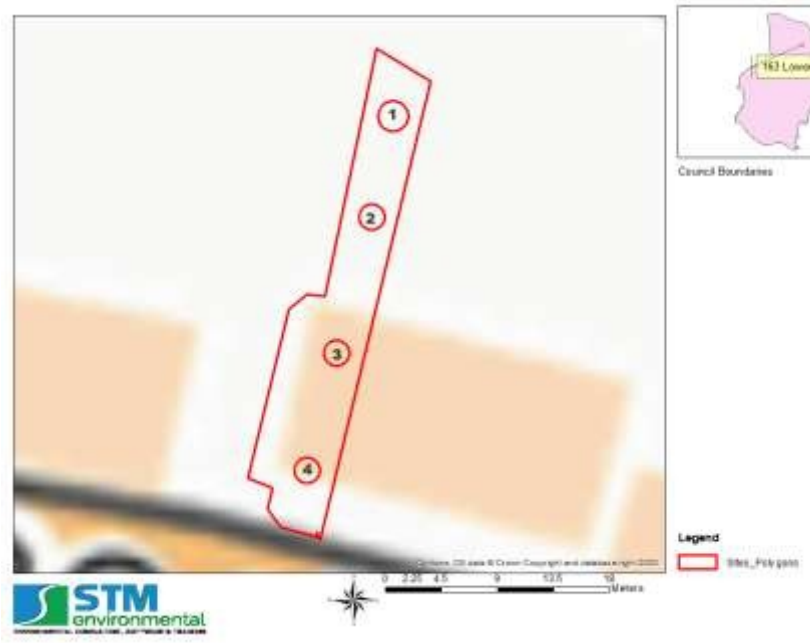
1. Information supplied by the Environment Agency may be used to assist in producing a Flood Risk Assessment where one is required, but does not constitute such an assessment on its own.
2. This information covers flood risk from main rivers and the sea, and you will need to consider other potential sources of flooding, such as groundwater or overland runoff. You should discuss surface water management with your Lead Local Flood Authority.
3. Where a planning application requires a FRA and this is not submitted or deficient, the Environment Agency may well raise an objection due to insufficient information

Advice to Consultants

The data provided in the checklist and FRA will be checked against our records as we review the FRAs when consulted on by the Local Planning Authority in our remit as statutory consultee for flood risk from tidal and fluvial sources. We require you to get in touch with us to check for the most up to date model information and FRA checklist. Having the latest data is important as not having the data will possibly delay us in reviewing your application at planning stage.

Environment Agency, Orchard House, Endeavour Park, London Road, West Malling, ME19 5SH
Customer services line: 03708 506 506
Email: enquiries@environment-agency.gov.uk
www.environment-agency.gov.uk

Appendix A:



1. Outline your site boundary clearly

2. Clearly mark the node points where you are extracting data from

3. Select node points that cover the site, around the site itself, and along the access route to the site to give a representative sample

	National Grid Reference		Modelled Levels	
Node	Easting	Northing	1 in 200 (2005)	1 in 200 (2115)
1	550223	179063	2.21	2.49
2	550220	179055	2.21	2.49
3	550218	179044	-	2.49
4	550216	179035	-	2.49

5 Introduction

STM Environmental Consultants Limited (STM) has been appointed by [redacted] (Client) to provide a Flood Risk Assessment (FRA) at a site located at 163 Lower Road, Belvedere, Kent, DA17 6DG.

6 Development Proposal

The FRA is required to support a planning application for a single storey rear extension for A3/A5 (fish and chips) to provide storage space.

Further details including drawings of the development plans are available in Appendix 2.

7 Report Aims and Objectives

The purpose of this report is to establish the flood risk to the site from all potential sources and, where possible, to propose suitable mitigation methods to reduce any risks to an acceptable level. It aims to make an assessment of whether the development will be safe for its lifetime, taking into account climate change and the vulnerability of its users, without increasing flood risk elsewhere.

The FRA assesses flood risk to the site from tidal, fluvial, surface water, groundwater, sewers and artificial sources. The FRA has been produced in accordance with the National Planning Policy Framework (NPPF) and its supporting guidance.

8 Summary of Data Review Undertaken

The following research has been undertaken as part of the FRA:

- Desktop assessment of topographical, hydrological and hydrogeological settings through review of the information sourced from the British Geological Survey (BGS), the Environment Agency (EA) and the Ordnance Survey (OS);
- Review of publicly available flood risk mapping provided by the EA;
- Review of the Preliminary Flood Risk Assessment (PFRA) and Level 1 Strategic Flood Risk Assessment (SFRA) produced by the LLFA outlining flood risk from various sources within the borough.

9 Legislative and Policy Context

9.1 Legislative Context

The Flood and Water Management Act was introduced in 2010. The Act defines the role of lead local flood authority (LLFA) for an area. All LLFA are required to develop, maintain, apply and monitor a strategy for local flood risk management in its area, called “local flood risk management strategy”.

Alongside the Act, Flood Risk Regulations (2009) outline the roles and responsibilities of the various authorities, which include preparing Flood Risk Management Plans and identifying how significant flood risks are to be mitigated.

9.2 Policy Context

9.2.1 National Planning Policy Framework (NPPF)

The NPPF sets out the government’s planning policies for England and how these are expected to be applied. It also provides a set of guidelines and philosophy with which local planning authorities (LPAs) can build their own unique policies to appropriately regulate development within their jurisdictions.

Section 14 entitled “Meeting the challenge of climate change, flooding and coastal change” deals specifically with flood risk. Among other things it states that LPAs should try to ensure that “Inappropriate development in areas at risk of flooding should

be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere". It further states that when determining planning application, LPAs should "ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment50. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

- within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;
- development is appropriately flood resilient and resistant;
- it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;
- any residual risk can be safely managed; and
- safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

Applications for minor development and changes of use should not be subject to the Sequential or Exception Tests but should still meet the requirements for site-specific flood risk assessments set out in footnote 50.

Footnote 50 states: "A site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use."

The NPPF also lays out requirements for how LPAs should deal with planning applications in coastal areas. They should ensure that should they "reduce risk from

coastal change by avoiding inappropriate development in vulnerable areas or adding to the impacts of physical changes to the coast."

Developments in Coastal Change Management Areas should only be considered appropriate where it is demonstrated that:

- it will be safe over its planned lifetime and will not have an unacceptable impact on coastal change;
- the character of the coast including designations is not compromised;
- the development provides wider sustainability benefits;
- the development does not hinder the creation and maintenance of a continuous signed and managed route around the coast.

9.2.2 Local Planning Policy

Policy CS08 of the Bexley Core Strategy (2012) addresses adaptation and mitigation to the effects of climate change, including flood risk management.

All development should contribute to the delivery of sustainable development by planning for, adapting to, and mitigating the impacts of climate change, by reducing the carbon emissions related to the construction and operation of all development.

The Council will achieve this by applying the requirements and targets outlined in national and regional planning policy and guidance to new development. In particular, this will encompass the requirements of the Mayor's London Plan with regard to environment policies such as: reducing CO2 emissions; the Mayor's energy hierarchy; integrating energy efficiency; decentralised energy (in particular district heating where appropriate); site-wide communal heat networks supported by CHP; adopting on-site renewable energy technologies; sustainable transport (in particular public transport, cycling and walking); green infrastructure; flood risk management; and sustainable urban drainage systems (SUDS), including supporting the Mayor's drainage hierarchy. In addition, this will comprise:

- working with local organisations such as schools to invest in energy efficient improvements;
- monitoring and setting improvement targets for the energy efficiency of Council buildings and developments;
- improving the efficiency of Bexley's housing stock by educating residents in methods to reduce energy use in the home and actively engaging with relevant retrofitting programmes;
- requiring the use of sustainable design and construction techniques in new built development, including exceeding current Building Regulations requirements through energy efficiency alone, and sustainably retrofitting existing building stock where possible;
- investigating opportunities within the borough for the location of zero carbon developments, prioritising those areas being investigated for decentralised energy networks;
- investigating opportunities for the funding and development of decentralised energy networks in Bexleyheath town centre, Crayford town centre, Belvedere town centre and Employment Area and Erith town centre;
- following the sequential approach to flood risk management advocated in national planning policy and its associated practice guidance;
- applying the recommendations of Bexley's Strategic Flood Risk Assessment;
- supporting green infrastructure (e.g. green and brown roofs) and the contribution it can make, to managing flood risk and surface water, and to the mitigation of the urban heat island effect;
- supporting the protection of key infrastructure assets, such as Crossness Sewage Treatment Works, from the risks of flooding; and
- working with partners to prepare a joint urban drainage strategy for London, as well as a local Surface Water Management Plan (SWMP) for Bexley, to address surface water and drainage flooding, including sewer flooding.

9.3 EA Standing Advice on Flood Risk

The Environment Agency's standing advice lays out the process that must be followed when carrying out flood risk assessments for developments.

Flood risk assessments are required for developments within one of the flood zones. This includes developments:

- in flood zone 2 or 3 including minor development and change of use more than 1 hectare (ha) in flood zone 1;
- less than 1 ha in flood zone 1, including a change of use in development type to a more vulnerable class (for example from commercial to residential), where they could be affected by sources of flooding other than rivers and the sea (for example surface water drains, reservoirs);
- in an area within flood zone 1 which has critical drainage problems as notified by the Environment Agency.

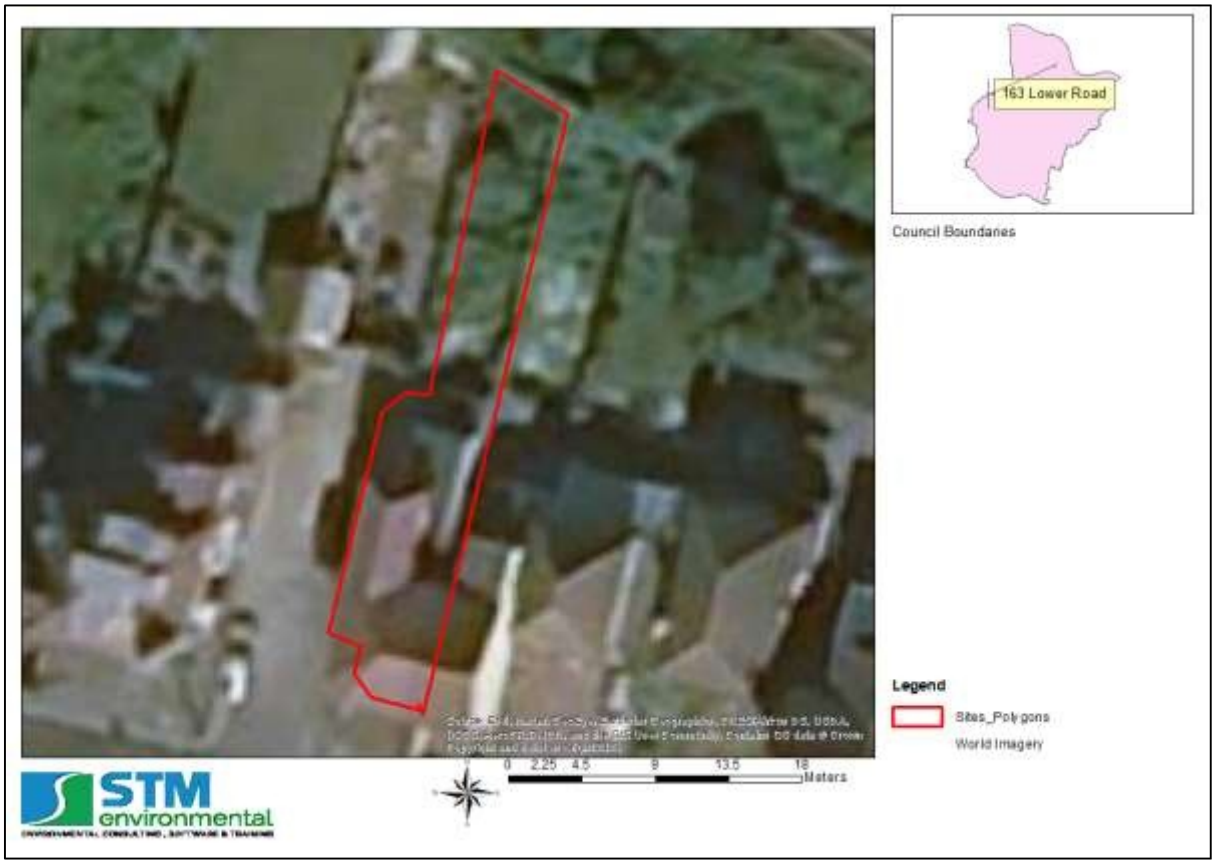
10 Site Description and Environmental Characteristics

10.1 Site Location and Area

The site is located at 163 Lower Road, Belvedere, Kent, DA17 6DG. It is centred at national grid reference 550217, 179043. The site has an area of approximately 210m^2.

A site location map and aerial photo are shown below. Photographs of the site are available in Appendix 1.


CULLING ROAD
LOWER ROAD
B213
ROAD
PO
163 Lower Road
Council Boundaries
Legend
Sites_Polygons
0 5 10 20 30 40
Meters
STM environmental


163 Lower Road
Council Boundaries
Legend
Sites_Polygons
World Imagery
0 2.25 4.5 9 13.5 18
Meters
STM environmental

10.2 Site Access

The site will be accessed via Lower Road.

10.3 Local Planning Authority

The site falls within the jurisdiction of London Borough of Bexley (LBB) in terms of the planning process.

10.4 Lead Local Flood Authority

LBB is also the Lead Local Flood Authority (LLFA).

10.5 Flood Zone

For planning purposes, the site is located in Flood Zone 3 as defined by the EA and LLFA.

10.6 Site and Surrounding Land Uses

10.6.1 Site Current Land Use

The site is currently used as a fish and chips shop (commercial).

10.6.2 Surrounding Land Uses

The land use surrounding the site is mainly residential and commercial. The railway line runs to the north of the site.

10.7 Hydrology

The nearest main watercourse is the River Thames which is located at approximately 720m.

10.8 Geology

Data from the British Geological Survey indicates that the underlying superficial geology is classified as Alluvium and the bedrock geology is characterized as Seaford Chalk Formation.

10.9 Hydrogeology

The site lies upon a principal bedrock aquifer and a secondary (undifferentiated) superficial aquifer.

Appendix 3 provides BGS mapping showing the hydrogeology at the site location.

10.10 Topography

A LIDAR map showing the topology of the site and surrounding area is available in Appendix 3. The ground level at the site ranges from 1mAOD in the north to 2.4mAOD in the south. At the proposed location of the extension, the ground sits at approximately 1.5mAOD.

A topographic survey has not been conducted.

11 The Sequential and Exception Tests

11.1 The Sequential Test

The Sequential Test aims to steer developments and redevelopments to areas of lower flood risk. The test compares the proposed development site with other available sites, in terms of flood risk, to aid the steering process. The Sequential Test is not required if the proposed development is a minor development or if it involves a change of use unless the development is a caravan, camping chalet, mobile home or park home site.

Minor development means:

- minor non-residential extensions: industrial/commercial/leisure etc extensions with a footprint less than 250 square metre.
- alterations: development that does not increase the size of buildings eg alterations to external appearance.

- householder development: For example; sheds, garages, games rooms etc within the curtilage of the existing dwelling, in addition to physical extensions to the existing dwelling itself. This definition excludes any proposed development that would create a separate dwelling within the curtilage of the existing dwelling eg subdivision of houses into flats.

With regard to residential and commercial developments, major development means one or more of the following:

- c(i) - the number of dwelling houses to be provided is 10 or more; or
- c(ii) - the development is to be carried out on a site having an area of 0.5 hectares or more and it is not known whether the development falls within sub-paragraph (c)(i);
- the provision of a building or buildings where the floor space to be created by the development is 1,000 square metres or more;
- or development carried out on a site having an area of 1 hectare or more.

The development is considered to be minor and as such the Sequential Test should not be required by the LLFA.

11.2 The Exception Test

If alternative sites of lower flood risk are not available then the proposed development may require an Exception Test to be granted planning permission. Where the exception test is required, it should be applied as soon as possible to all local development document allocations for developments and all planning applications other than for minor developments. All three elements of the exception test have to be passed before development is allocated or permitted. For the exception test to be passed:

- It must demonstrate that the development provides wider sustainability benefits to the community that outweigh the flood risk, informed by an SFRA, where one has been prepared;
- The development should be on developed land or on previously developed land;
- A flood risk assessment must demonstrate that the development will be safe without increasing flood risk elsewhere, and where possible will reduce the overall flood risk.

The requirements for an Exception Test are given in Table 1 and are defined in terms of Flood Zone and development vulnerability classification.

Table 1: NPPF flood zone vulnerability compatibility (source: NPPF).

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a	Exception Test required	X	Exception Test required	✓	✓
Zone 3b	Exception Test required	X	X	X	✓

Key:

✓ Development is appropriate

✗ Development should not be permitted.

Based on its scale and nature, the development is considered to be “less vulnerable”. As such the Exception Test should not be required by the LLFA.

12 Site Specific Flood Risk Analysis

The PFRA and Level 1 SFRA produced by the LLFA and maps from the EA provide information regarding historic flooding events and incidents as well as predictions of flood extents and depths during extreme rainfall events.

12.1 Fluvial (River) and Tidal (Sea) Flood Risk

12.1.1 Mechanisms for Fluvial Flooding

Fluvial, or river flooding, occurs when excessive rainfall over an extended period of time or heavy snow melt causes a river to exceed its capacity. The damage from a fluvial flood can be widespread as the overflow may affect downstream tributaries, overtopping defences and flooding nearby inhabited areas. Fluvial flooding consists of two main types:

- Overbank flooding – this occurs when water rises steadily and overflows over the edges of a river or stream;
- Flash flooding – this is characterized by an intense, high velocity torrent of water that occurs in an existing river channel with little to no notice. Flash floods are very dangerous and destructive not only because of the force of the water, but also the hurtling debris that is often swept up in the flow.

12.1.2 Definition of EA Modelled Fluvial Flood Risk Zones

Fluvial flood risk is assessed using flooding maps produced by the Environment Agency. These maps use available historic data and hydraulic modelling to define zones of flood risk. The maps allow a site to be defined in terms of its flood zone (e.g. 1, 2, 3) and in terms of the overall flood risk (very low, low, medium or high). It is important to note that existing flood defences are not taken into account within the models or the maps. The EA fluvial flood zones are defined as follows:

- Flood zone 1: Less than 1 in 1000 (0.1%) annual probability of flooding;

- Flood zone 2: Between 1 in 100 (1%) and 1 in 1000 (0.1%) annual probability of flooding;
- Flood zone 3: Greater than 1 in 100 (1%) annual probability of fluvial flooding.

Flood zone 3 is split into two sub-categories (3a and 3b) by LLFAs depending on whether the land is considered to be a functional flood plain (i.e. an important storage area for flood waters in extreme events).

- Flood zone 3a: Greater than 1 in 100 (1%) annual probability of fluvial flooding and/or greater than 1 in 200 (0.5%) annual probability of tidal flooding;
- Flood zone 3b: Functional flood plain (definition specific to the LLFA). Less than a 1 in 20 (5%) annual probability of fluvial and/or tidal flooding.

12.1.3 Mechanisms for Tidal Flooding

Tidal flooding may be described simply as the inundation of low-lying coastal areas by the sea, or the overtopping or breaching of sea defences. Tidal flooding may be caused by seasonal high tides, storm surges and where increase in water level above the astronomical tide level is created by strong on shore winds or by storm driven wave action.

12.1.4 Definition of EA Tidal Flood Risk Zones

As with fluvial flood risk, tidal flood risk is assessed using flooding maps produced by the Environment Agency. The difference is in the probability return periods used to define tidal flood zones. The EA tidal flood zones are defined as:

- Flood zone 1: Less than 1 in 1000 (0.1%) annual probability of flooding;
- Flood zone 2: Between 1 in 200 (0.5%) and 1 in 1000 (0.1%) annual probability of tidal flooding;
- Flood zone 3: Greater 1 in 200 (0.5%) annual probability of tidal flooding.

12.1.5 Main Potential Sources of Local Fluvial/Tidal Flooding

The nearest potential source of fluvial/tidal flooding to the site is considered to be the River Thames.

12.1.6 Records of Historic Fluvial/Tidal Flooding Incidents

The EA's historic and recorded flood outline maps show the locations and extents of historic flooding. These maps indicate that there has been historic flooding at the site in 1953. Copies of the maps at the site location are available in Appendix 4.

12.1.7 Designated Fluvial/Tidal Flood Risk Zone for the Site

The site is considered to be located within flood zone 3 as defined by the Environment Agency and the LLFA indicating that it has greater than 1 in 100 annual probability of fluvial flooding and/or greater than 1 in 200 annual probability of tidal flooding.

12.1.8 Flood Defences

The EA's Areas benefitting from flood defences and current flood defences map which is available in Appendix 7 shows that the site benefits from flood defences.

12.1.9 Climate Change – EA/SFRA Modelled Predictions of Fluvial and Tidal Flood Levels and Extents

The EA Product 6 dataset which is presented in Appendix 11 provides modelled flood levels and extents close to the site.

The site will flood during the 1 in 200 and 1 in 1000 (2115) year scenarios.

A table summarising the flood levels at the site is available below.

Table 2 - Modelled flood levels during different AEP

	National Grid Reference		Modelled Levels	
Node	Easting	Northing	1 in 200 (2005)	1 in 200 (2115)
1	550223	179063	2.21	2.49
2	550220	179055	2.21	2.49

3	550218	179044	-	2.49
4	550216	179035	-	2.49

Mapping from the SFRA Level 2 is also available in Appendix 11. During the 1 in 200-year plus climate change tidal breach event, the flood level at the site would reach 4.4mAOD. As the ground level at the site ranges from 1mAOD to 2.4mAOD, flood depths would potentially reach 2 to 3.4m.

12.1.10 Long Term Fluvial Flood Risk Considering Flood Defences

The EA's long term flood risk maps give an indication of the actual risk associated with flooding after taking into account the effect of any flood defences in the area. Copies of maps for the site which are available in Appendix 9 indicate that the long-term risk from fluvial flooding to the site is very low.

12.2 Pluvial (Surface Water) Flood Risk

A pluvial, or surface water flood, is caused when heavy rainfall creates a flood event independent of an overflowing water body. Surface water flooding occurs when high intensity rainfall leads to run-off which flows over the ground surface, causing ponding in low-lying areas when the precipitation rate or overland flow rate is greater than the rate of infiltration, or return into watercourses. Surface water flooding can be exacerbated when the underlying soil and geology is saturated (as a result of prolonged precipitation or a high-water table) or when the drainage network has insufficient capacity.

12.2.1 Mechanisms of Pluvial Flooding

The chief mechanisms for surface water flooding can be divided into the following categories:

- Runoff from higher topography;
- Localised surface water runoff – as a result of localised ponding of surface water;

- Sewer Flooding – areas where extensive and deep surface water flooding is likely to be influenced by sewer flooding. Where the sewer network has reached capacity, and surcharged, this will exacerbate the flood risk in these areas;
- Low Lying Areas – areas such as underpasses, subways and lowered roads beneath railway lines are more susceptible to surface water flooding;
- Railway Cuttings –railway infrastructure cut into the natural geological formations can cause extra surface run off and pooling disrupting service and potentially affecting adjacent structures;
- Railway Embankments – discrete surface water flooding locations along the up-stream side of the raised network rail embankments where water flows are interrupted and ponding can occur;
- Failure of artificial sources (i.e., man-made structures) such as such as canals and reservoirs.

12.2.2 Main Potential Sources of Local Pluvial Flooding

The main potential source of pluvial flooding to the site is considered to be surface water ponding and flooding associated with heavy rainfall.

12.2.3 Records of Historic Pluvial / Sewer Flooding Incidents

Examination of the LLFA's Level 1 SFRA revealed three drainage incidents in the vicinity of the site on Lower Road. Two from highway (surface water) and one from domestic receptors (sewer).

A map showing the location of surface water flooding incidents is available in Appendix 4 .

12.2.4 Surface Water Flood Risk from Artificial Sources (Reservoirs and Canals)

An examination of OS mapping and the EA's mapping revealed no indications of significant reservoirs or canals in the area of the site.

The EA's reservoir flood risk map indicates that the site does not lie within an area that is at risk of reservoir flooding.

12.2.5 Climate Change - Modelled Predictions of Surface Water Run-off Flooding

Mapping of the predicted extent and depth of surface water flooding for the 1 in 30-year, 1 in 100-year and 1 in 1000-year rainfall return periods provided by the EA are available in Appendix 6.

The maps show that the site would remain dry during both the 1 in 30-year and the 1 in 100-year precipitation events. Only a very small area along the northern boundary, away from the proposed development, would potentially witness some ponding during these events up to 600mm in depth. During the 1 in 1000-year event, the northern half of the site would flood at average depths of 600mm, slightly increasing to 900mm along the northern boundary.

12.2.6 Long Term Surface Water Flood Risk

The EA's long term flood risk maps which are available in Appendix 9 indicate that the long-term risk of flooding from surface water is also considered to be very low to low at the majority of the site including at the location of the extension, increasing to high along the northern boundary.

12.3 Risk of Flooding from Multiple Sources (ROFMS)

The Environment Agency provides a map which gives an indication the overall flood risk from fluvial, tidal and surface water sources considering the presence of river defences. This map indicates that there is between 0.1% and 1% chance of flooding at the site in any year. A copy of the map is presented in Appendix 8.

12.4 Groundwater Flood Risk

Groundwater flooding occurs when water rises from the underlying aquifer at the location of a spring – where the underlying impermeable geology meets the ground surface. This tends to occur after much longer periods of intense precipitation, in often low-lying areas where the water table is likely to be at a shallow depth. Groundwater

flooding is known to occur in areas underlain by principal aquifers, although increasingly it is also being associated with more localised floodplain sands and gravels. A high groundwater table also has the potential to exacerbate the risk of surface water and fluvial flooding by reducing rainfall infiltration capacity, and to increase the risk of sewer flooding through sewer/groundwater interactions.

12.4.1 Historic Records of Groundwater Flooding

A map showing the locations of historic groundwater flooding incidents is not available as part of the SFRA.

12.4.2 Susceptibility to Groundwater Flooding

The Groundwater Flood Susceptibility Map provided by BGS, which is available in Appendix 10 indicates that the potential for groundwater flooding to occur at the surface exists below surface. The Groundwater Depth map also provided by BGS indicates that the groundwater level may be at less than 3mbgl.

12.5 Critical Drainage Area

A Critical Drainage Area (CDA) may be defined as “a discrete geographic area (usually a hydrological catchment) where multiple and interlinked sources of flood risk (surface water, groundwater, sewer, main river and/or tidal) cause flooding in one or more Local Flood Risk Zones during severe weather thereby affecting people, property or local infrastructure”. A CDA is defined in the Town and Country Planning (General Development Procedure) (Amendment) (No. 2) (England) Order 2006 as “an area within Flood Zone 1 which has critical drainage problems and which has been notified… [to]…the local planning authority by the Environment Agency”.

The SFRA does not detail information on CDAs within the Council.

13 Potential Impacts of the Development on Local Flood Risk

13.1 Impacts on Flood Storage

13.1.1 Changes to Impermeable Area and Building Footprint

The proposed development will increase the built-up area at the site by 77.6m^2. This would be partially built on existing hardstanding. As such, it is considered possible that it will impact upon surface water runoff rates and flood storage capacity. Flood compensatory storage is discussed in section 14.2.2 below.

13.2 Impacts on Flood Flow Routes

The development does involve the addition of an extension at the site, however, its impact on flood flow paths is not considered to be significant.

14 Flood Risk Mitigation Measures

14.1 SuDS

Planning practice guidance (PPG) which is prepared by the Ministry of Housing, Communities and Local Government (DCLG) states that developers and Local Authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage techniques.

As such, the developer has to implement a SuDS strategy in line with the drainage hierarchy as outlined in Table 2 below to reduce surface water discharges from the site.

Table 3: SuDs Options

Store rainwater for later use;
Use infiltration techniques, such as porous surfaces in non-clay areas;
Attenuate rainwater in ponds or open water features for gradual release;

- Attenuate rainwater by storing in tanks or sealed water features for gradual release;
- Discharge directly to a water course;
- Discharge rainwater directly to a surface water sewer/drain;
- Discharge to a combined sewer.

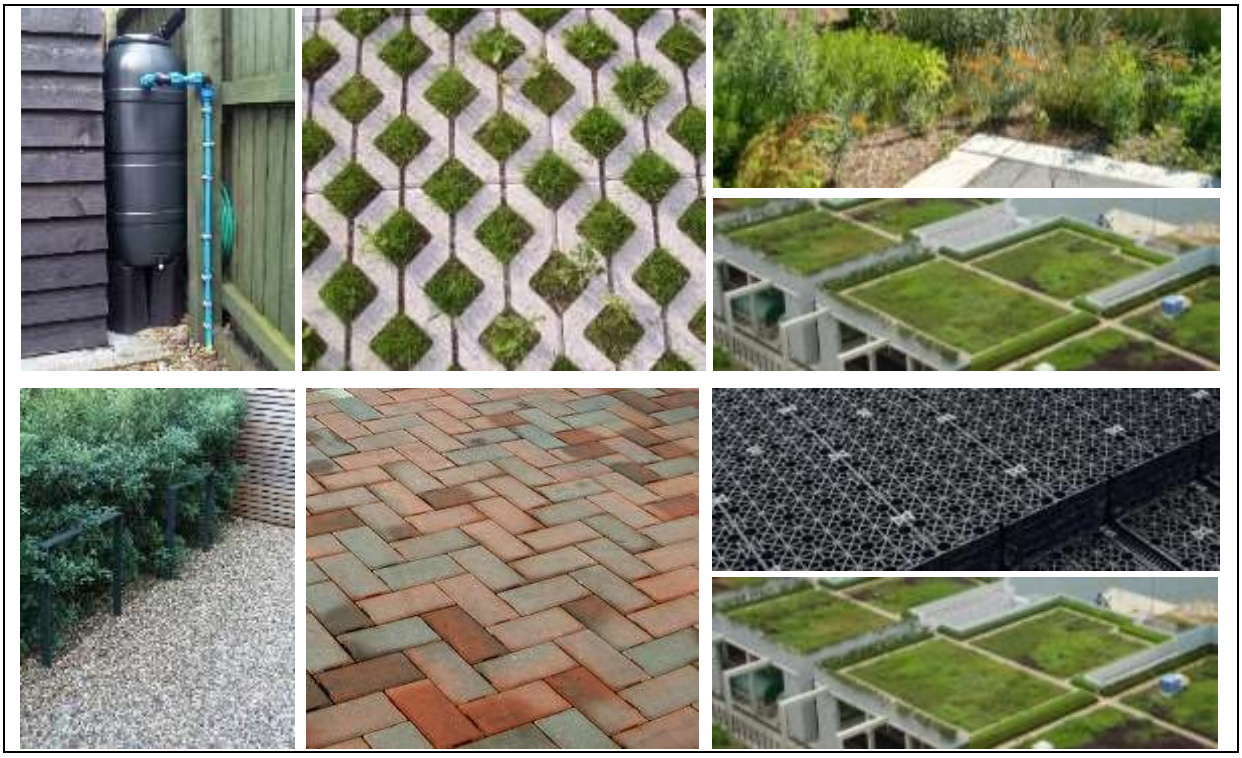


Figure 1: Surface water storage facilities and potential SuDS features - rainwater harvesting, on-site tank storage, rain garden soak-away and green roofs. (Source: UK SuDS Manual)

Given the nature of the development and the size of the site, it is considered that there are opportunities for implementing SuDS. Measures such as green roofs, rainwater harvesting, infiltration (soakaways, permeable paving, rain gardens) or attenuation storage tanks should be considered. When required, the SuDS strategy will be detailed in a separate report as is outside the scope of works of this FRA.

14.2 Flood Resilience

Flood resilient construction uses methods and materials that reduce the impact from a flood, ensuring that structural integrity is maintained, and the drying out and cleaning required, following inundation and before reoccupation, is minimised.

14.2.1 Finished Floor Levels

The average ground level at the proposed location of the extension is 1.5mAOD.

For minor extensions EA Standing Advice states that finished floor levels are either no lower than existing floor levels or 300 millimetres (mm) above the estimated flood level. Where floor levels cannot be set to 300mm above existing flood levels, applicants should check with the LPA if they need to take flood resistance and resilience measures.

As it is not feasibly possible to raise finished floor levels above predicted flood levels, finished floor levels would be set no lower than existing and additional mitigation measures will be implemented. These are discussed in section 14.2.3 below.

14.2.2 Flood displacement storage

All new development within Flood Zone 3 must not result in a net loss of flood storage capacity. Where possible, opportunities should be sought to achieve an increase in the provision of floodplain storage.

Where proposed development results in a change in building footprint, the developer must ensure that it does not impact upon the ability of the floodplain to store water, and should seek opportunities to provide a betterment with respect to floodplain storage.

As the site is at risk from tidal flooding only, compensatory flood storage is not considered to be required in this instance.

14.2.3 Flood Resilience Measures

In terms of achieving resilience, there are two main strategies, whose applicability is dependent on the water depth the property is subjected to. These are:

- Water exclusion strategy - where emphasis is placed on minimising water entry whilst maintaining structural integrity, and on using materials and construction

techniques to facilitate drying and cleaning. This strategy is favoured when low flood water depths are involved (not more than 0.3m);

- Water entry strategy - buildings are at significant risk of structural damage if there is a water level difference between outside and inside of about 0.6m or more. This strategy is therefore favoured when high flood water depths are involved (greater than 0.6m).

Given that flood depths greater than 0.6m are predicted in extreme scenarios, the water entry strategy is considered most applicable for this site.

Flood resilience design and measures that will be implemented are outlined below. Water-resistant and resilient materials will be utilized through the construction to minimize the flood risk and potential impacts.

Floor construction:

- Use of a concrete slab 150mm thick;
- Use of ceramic tiles or stone floor finishes is recommended;
- Maintain existing under floor ventilation by UPVC telescopic vents above 400 mm to external face of extension;
- Damp proof membrane of impermeable polythene at least 1200 gauge;
- Avoid the use of MDF carpentry.

Wall construction:

- Include in the external face of the extension a damp – proof course, 1m above ground level, to prevent damp rising through the wall;
- Use rigid closed – cell material for insulation above the DPC.

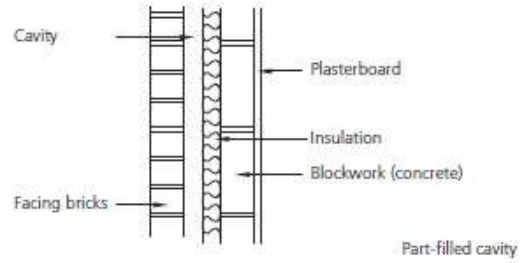
Doors:

- Seal doors around edges and openings. UPVC or composite material will be used with passive protection meaning that minimal intervention will be required in the event of flooding.

Underground drainage:

- Avoid use of metal for any underground piping;
- Use closed cell insulation for pipes that are below the predicted flood level;
- Provide non – return valves for the drainage system to prevent back water flow;
- Use UPVC or clay pipework for fouls and surface water drainage.

Figure 6.10 Cavity External Walls – Part-filled cavity with sacrificial plasterboard



Part-filled cavity

- External face consisting of engineering bricks up to required level for flood protection (up to d.p.c.). Other external facing materials can be used above this level, but ensure transition is watertight.
- Rigid insulation
- Internal cement based render, preferably with lime content. Composition depends on masonry; the following mix is effective:

  1 cement : 6 sand: 1 lime on concrete blocks.
- Stainless steel wall ties should be used to minimise corrosion and consequent staining.
- Sacrificial plasterboard can be used, but it needs to be removed between ground floor to flood level. The board should be laid horizontally to make removal easier.

As well as the above the following flood resilience features should be applied as part of the development:

- Electrical sockets should be installed above flood level for the ground floor;
- Utility services such as fuse boxes, meters, main cables, gas pipes, phone lines and sockets will be positioned as high as practicable;
- All external openings for pipes or vents below 400mm to be sealed around pipe or vent with expanding foam and mastic.

14.3 Emergency Plan

The dangers associated with flood water to people are possible injury and/or death. This can occur as a result of drowning or being carried along by the waters into hard objects or vice versa.

The risk to life is largely a function of the depth and velocity of the floodwater as it crosses the floodplain. Fast flowing deep water that contains debris would represent the greatest hazard.

The assessment of danger to people from walking in floodwater is described in the Flood Risks to People guidance documents (FD2321_TR1 and FD2321_TR2) by DEFRA/EA. Danger can be estimated by the simple formula:

$$HR = d \times (v + 0.5) + DF$$

where, HR = (flood) hazard rating; d = depth of flooding (m); v = velocity of floodwaters (m/sec); and DF = debris factor. The scoring methodology and calculation matrix for this is summarised in Appendix 13.

The EA provides hazard mapping at the proposed location of the development and along the evacuation route. The flood hazard score ranges from 0.5 to the front of the site on Lower Road to 0.5 at the beginning of Mayfield Road indicating that the hazard is classified as being Low to Moderate.

A copy of the flood hazard map during the 1 in 200-year (2115) flood event is available in Appendix 13 as well.

The use of a flood emergency plan is therefore sufficient for the proposed development. The key elements of the emergency plan are described below.

14.3.1 EA Flood Warnings Direct Service Subscription

The occupants will subscribe to the EA Flood Warnings Direct Service which is a free service offered by the EA providing flood warnings direct to people by telephone, mobile, email, SMS text message and fax. The EA aims to provide 2 hours' notice of flood, day or night, allowing timely evacuation of the site.

The agency operates a 24-hour telephone service on 0345 988 1188 that provides frequently updated flood warnings and associated floodplain information. In addition, this information can also be found at https://fwd.environment-agency.gov.uk/app/olr/home along with recommendations on what steps should be taken to prepare for floods, what to do when warnings are issued, and how best to cope with the aftermath of floods.

14.3.2 Access and Safe Egress

Safe egress to Flood Zone 1 is available by a 2-minute walk to the south direction on Mayfield Road. A map showing the evacuation route is available in Appendix 12.

14.3.3 Safe Refuge

The proposed development does not have internal connections to upper floors in the property which will act to provide sufficient safe refuge in the event of an extreme flood event. However, given that the development is classified as less vulnerable, safe refuge is not considered to be required.

15 Conclusions and Recommendations

This assessment has considered the potential risks to the application site associated with flooding from fluvial, tidal, surface water, artificial and groundwater sources and the potential impacts of climate change.

A review of LLFA's PFRA and SFRA as well as data provided by the EA was undertaken. The main findings of the review and assessment are provided below:

- The main source of potential flooding to the site is the River Thames;
- The EA define the site as being within flood zone 3;
- EA mapping indicates that the site is in an area that benefits from flood defences;
- One record of fluvial/tidal flooding incidents was identified at the site;
- Three records of surface water/sewers flooding incidents were identified in the vicinity of the site;
- The development will result in a change in the impermeable area of the site and therefore may impact on surface water runoff rates if unmitigated;
- There is opportunity for implementing SuDS mitigation measures. Consideration should be given to use of permeable paving and/or rainwater harvesting;
- Flood resilient materials and construction methods will be used so as to ensure that the impacts of any potential flooding are minimised as much as possible;
- Occupants will subscribe to the EA Flood Warnings Direct Service;
- Safe egress routes to flood zone 1 are easily available.

Based on the information reviewed and taking into account the proposed mitigation measures, it is considered that overall flood risk to the proposed development is medium. With a suitable SuDS strategy in place, the proposal is unlikely to have a significant impact on local flood risk.

16 References

1. Communities and Local Government - National Planning Policy Framework NPPF, March 2019.
2. Communities and Local Government - Planning Practice Guidance: Flood Risk and Coastal Change, Updated 06 March 2014.
3. Strategic Flood Risk Assessment – London Borough of Bexley, 2008.
4. Core Strategy – London Borough of Bexley, 2012.
5. CIRIA, Defra, Environment Agency – UK SuDS Manual, 2015.

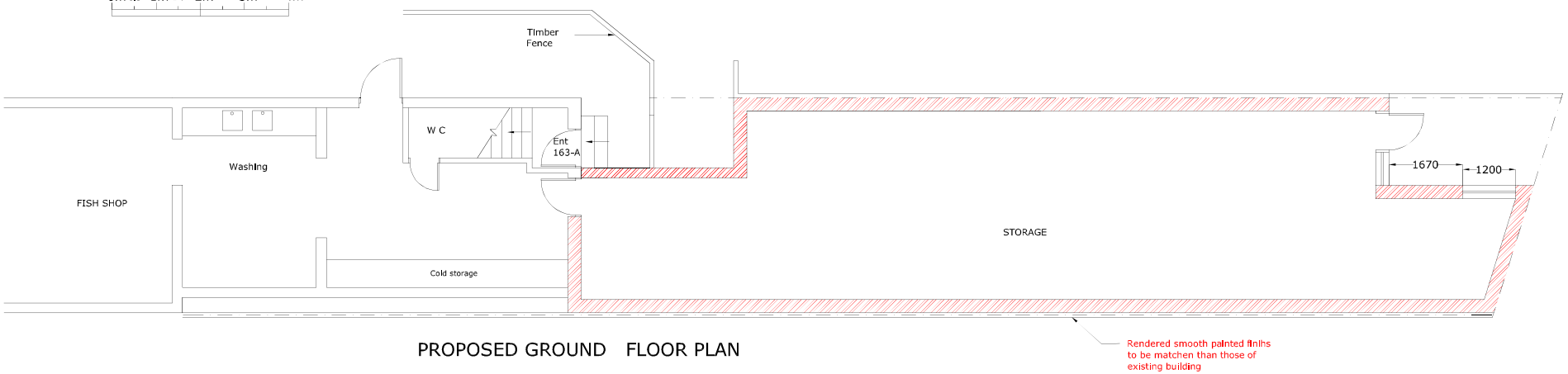
17 Appendices

17.1 Appendix 1 – Site Photographs

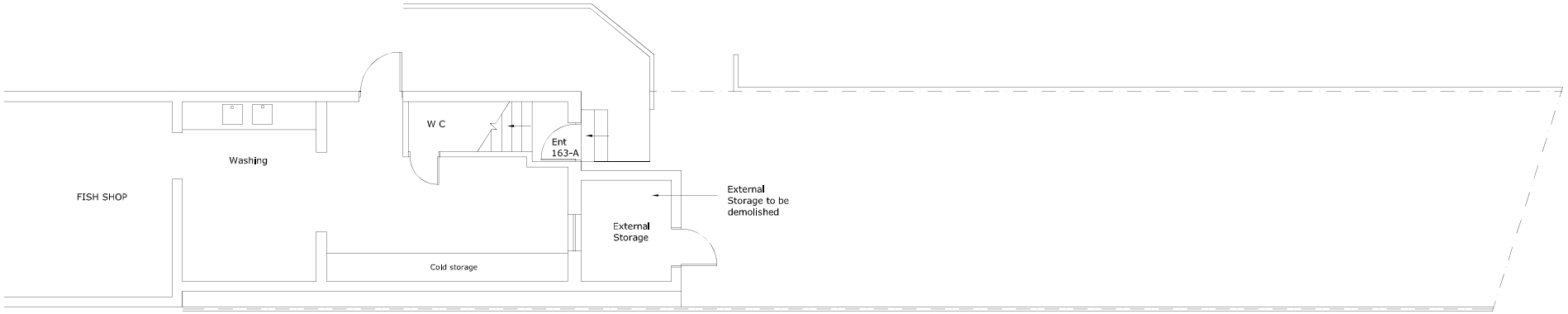
17.2 Appendix 2 – Development Plans

SCALE BAR

0m 0.5 1m 1.5 2m 3m 4m



PROPOSED GROUND FLOOR PLAN



EXISTING GROUND FLOOR PLAN

Future Vision
Planning & Development consultants

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27 A, Romford Road ,
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CLIENT

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Kent , DA176DQ

JOB TITLE

Proposal for the single storey rear extension to form storage for the ground floor A3/A5 use site at 163- Lower road , Belvedere , Kent , DA17 6DQ

DRAWING TITLE

Existing Plans /Proposed Plans

SCALE

1-100@A3

DATE

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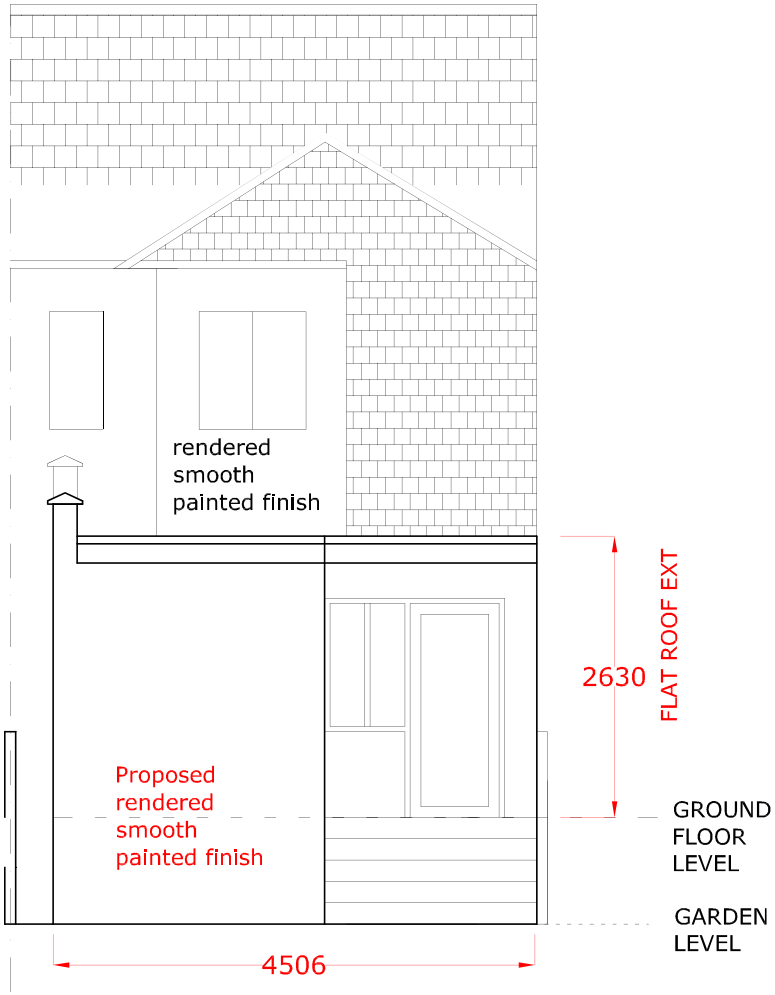
DRAWING NO.

FV-2021-01

REVISION



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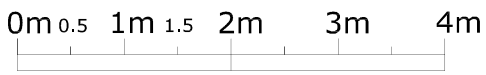

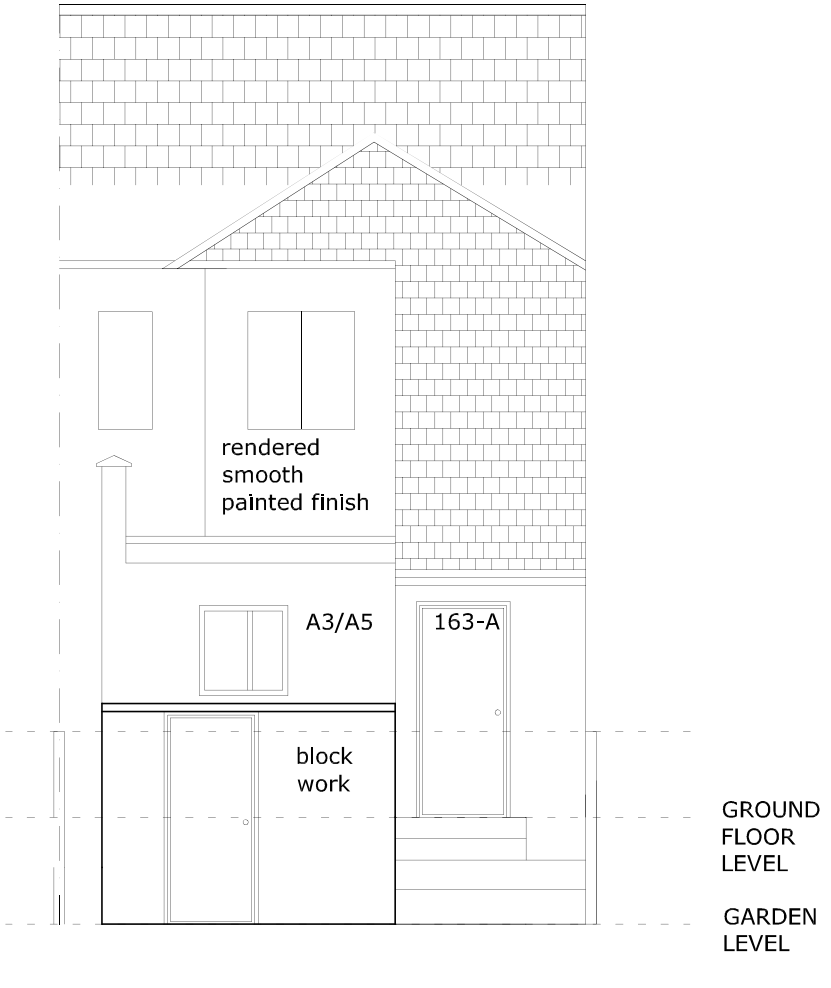

EXISTING REAR ELEVATION

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to form storage for the ground floor A3/A5 use
site at 163- Lower road , Belvedere , Kent , DA17 6DQ

DRAWING TITLE
Existing /Proposed
Elevations

SCALE
1-50@A3

DATE
18-03-2021

DRAWING NO.
FV-2021-02

REVISION

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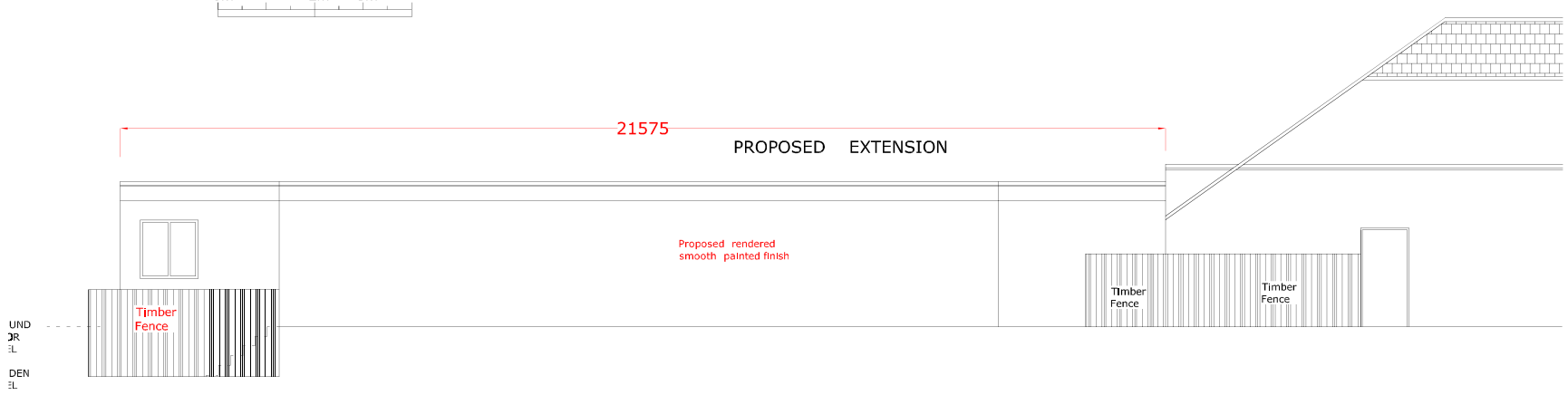
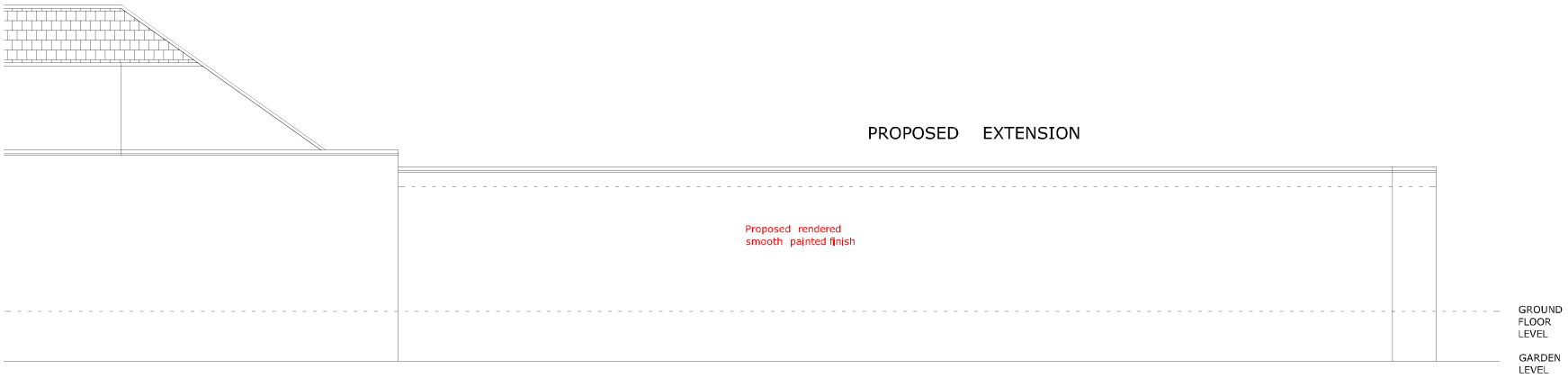


PROPOSED WEST ELEVATION



PROPOSED EAST ELEVATION

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JOB TITLE

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DRAWING TITLE

Existing Plans /Proposed Elevations

SCALE

1-100@A3

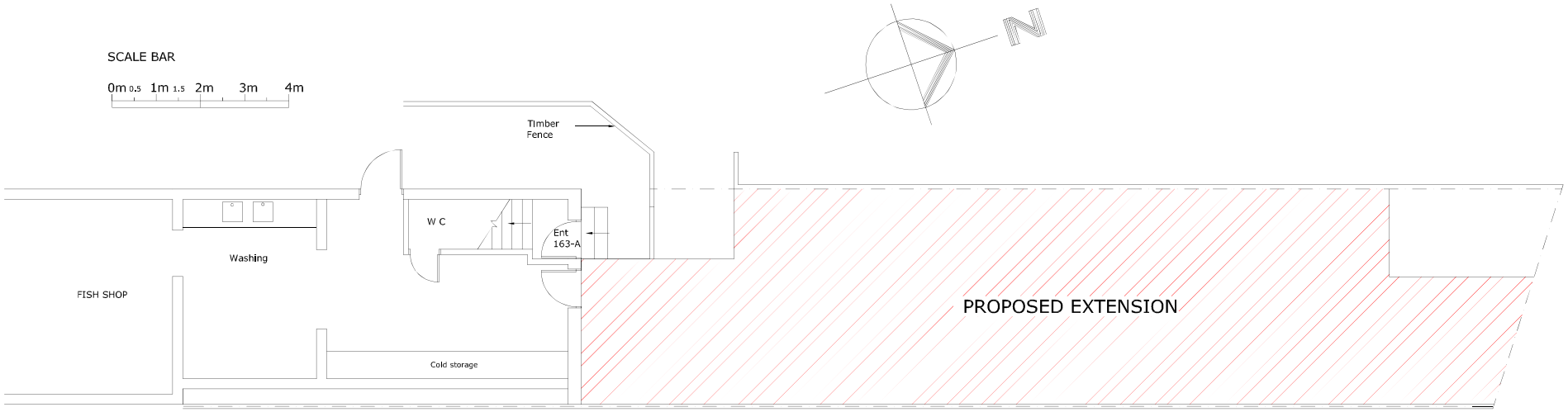
DATE

18-03-2021

DRAWING NO.

FV-2021-03

REVISION



PROPOSED SITE PLAN

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DRAWING TITLE

Proposed Plans

SCALE

1-100@A3

DATE

18-03-2021

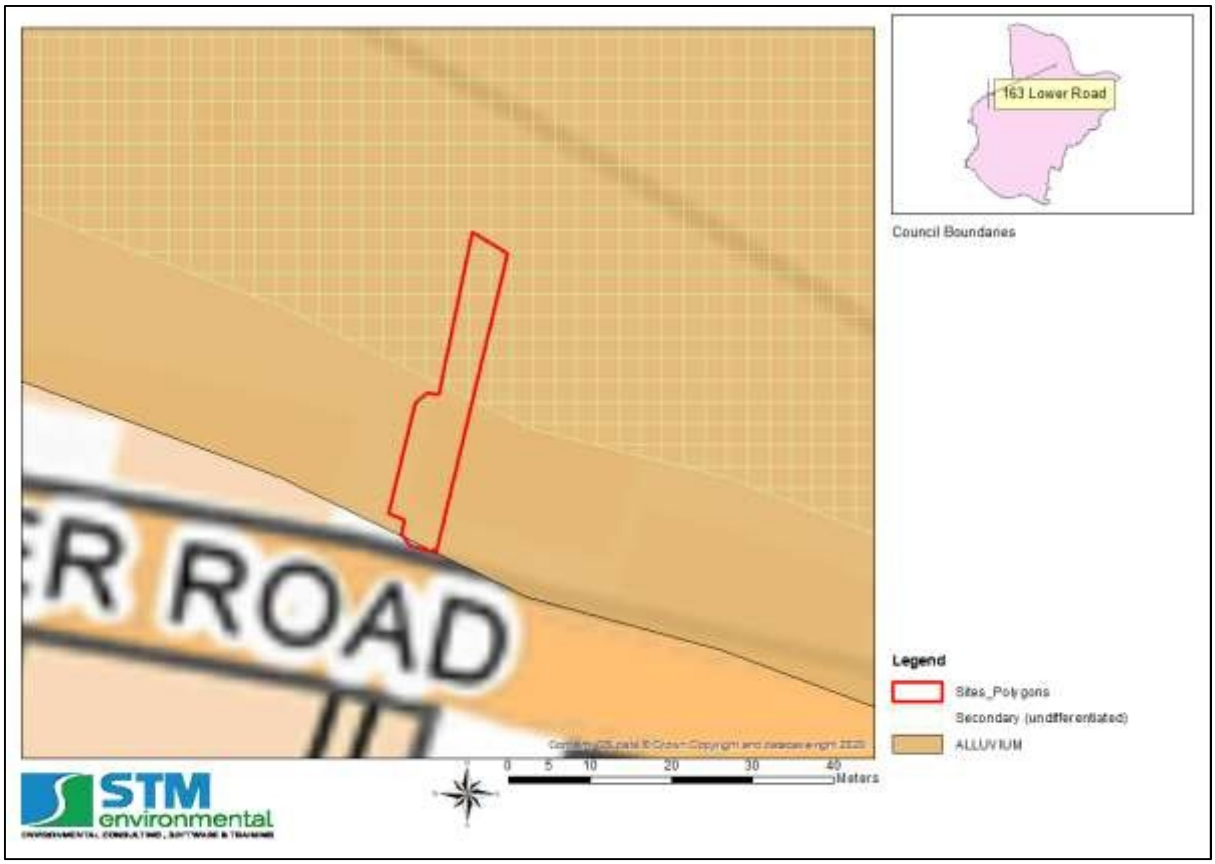
DRAWING NO.

FV-2021-04

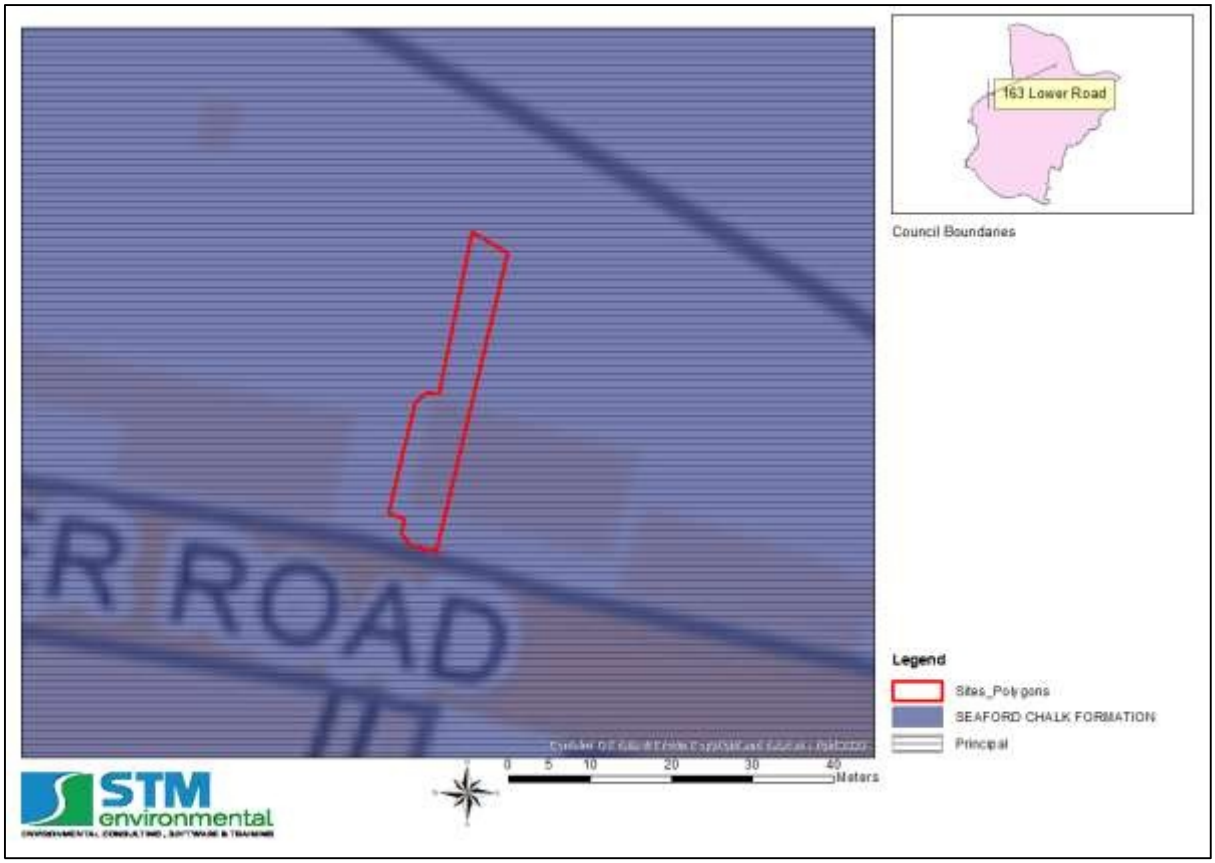
REVISION

17.3 Appendix 3 – Environmental Characteristics

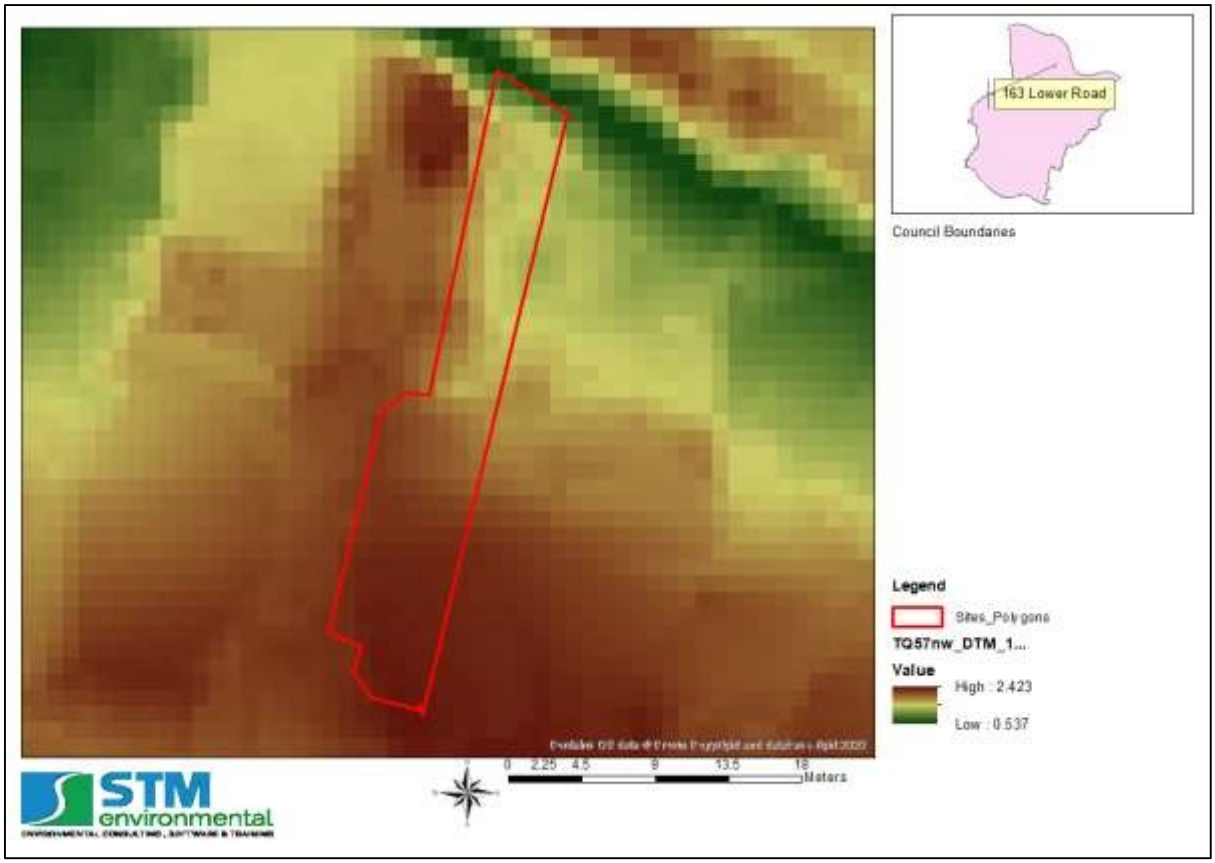
17.3.1 Superficial Hydrogeology Map



17.3.2 Bedrock Hydrogeology Map

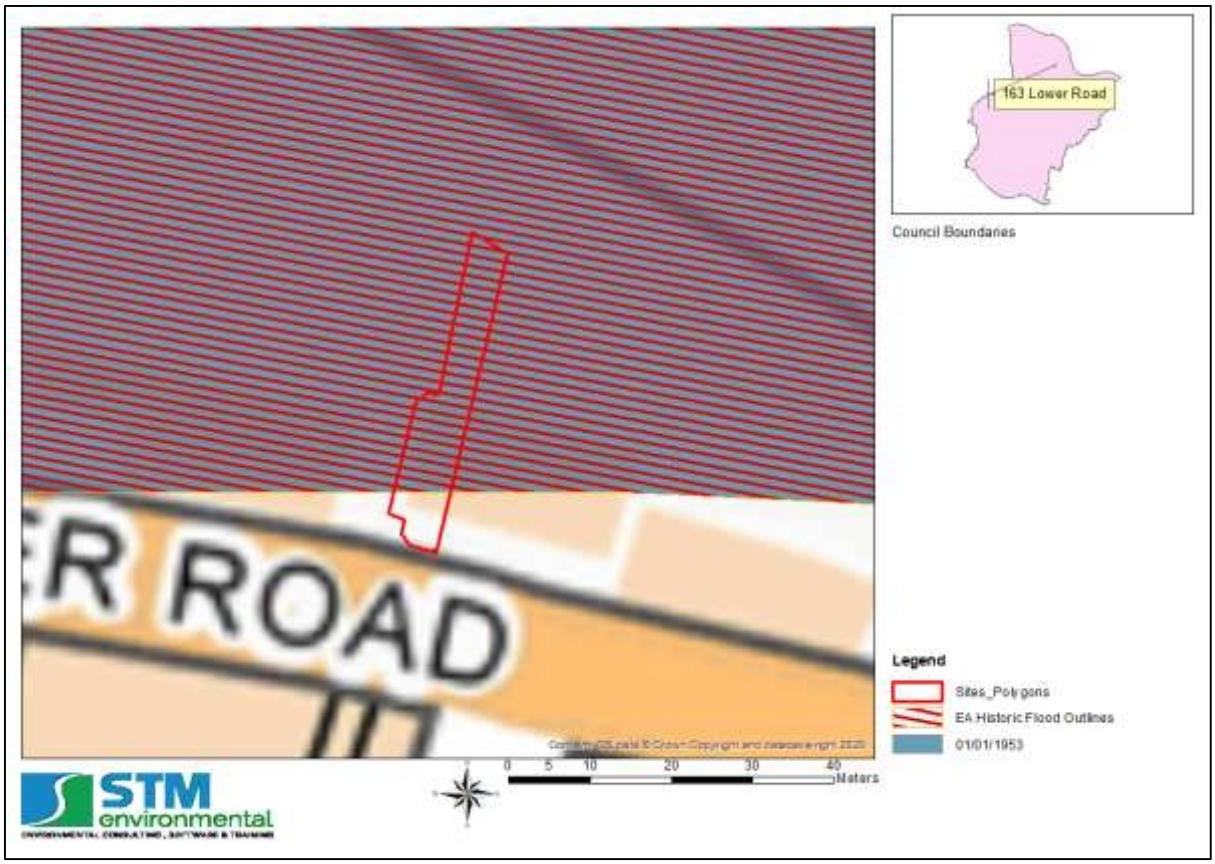


17.3.3 Topology Map

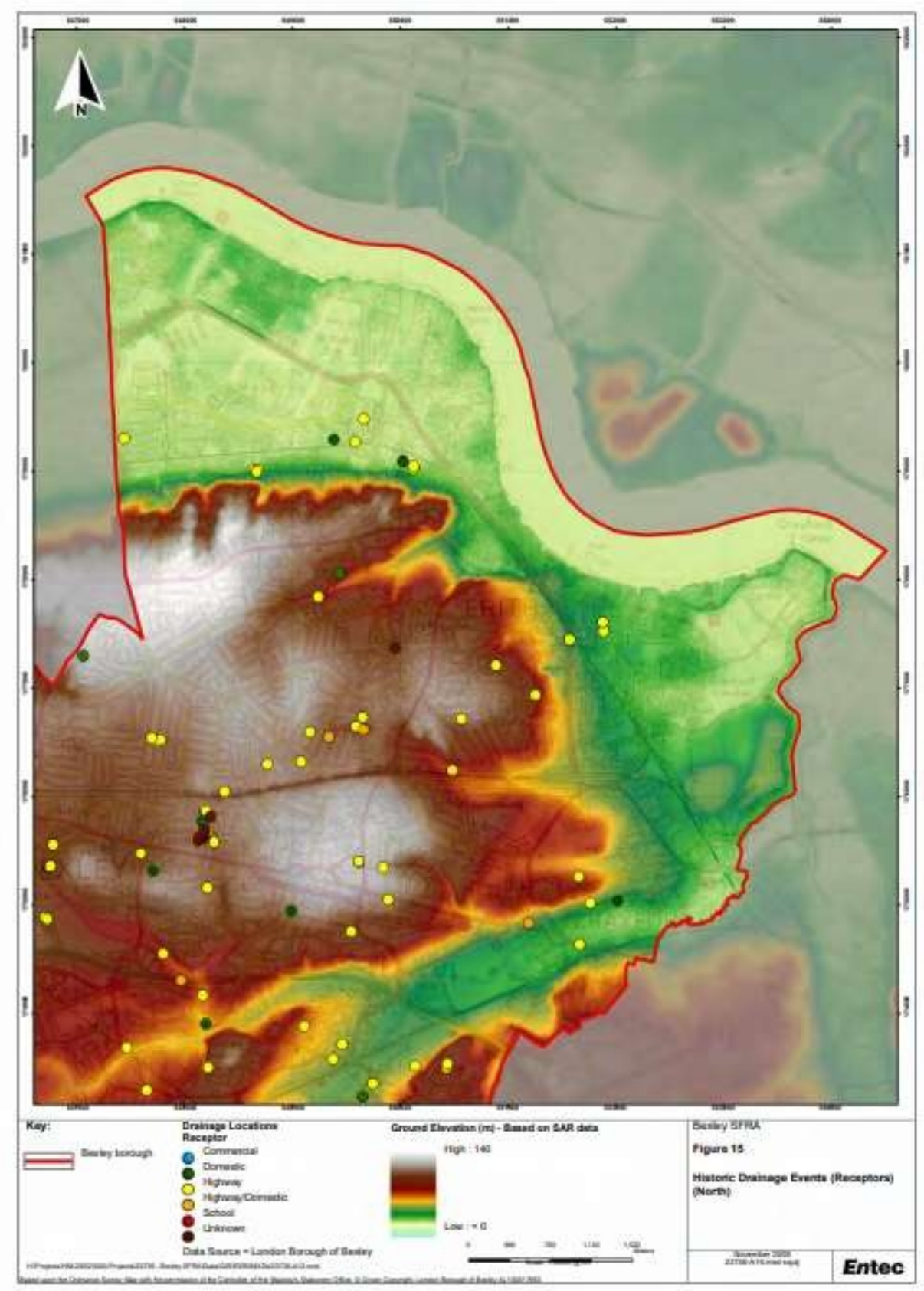


17.4 Appendix 4 – Historical Flood Incident Maps

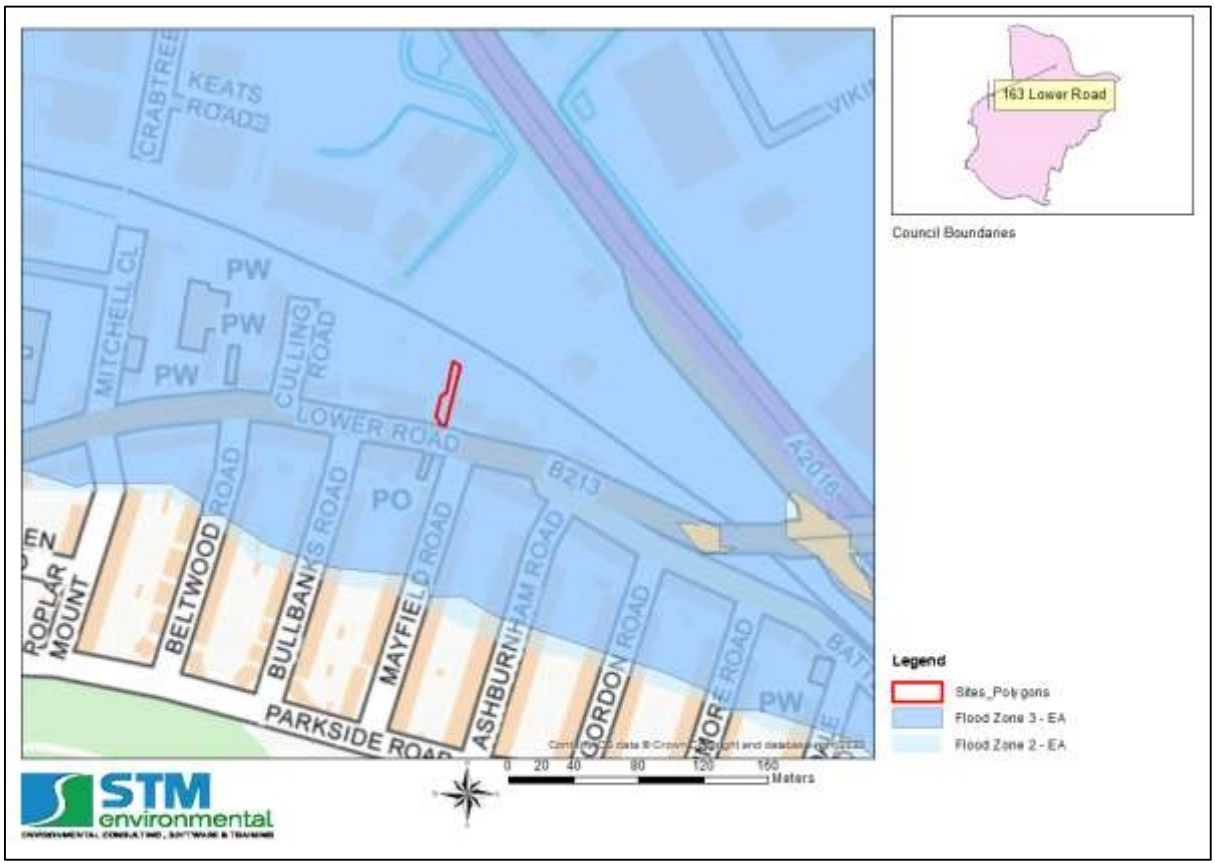
17.4.1 EA Historic Flood Outlines



17.4.2 SFRA Historic Drainage Incidents Map

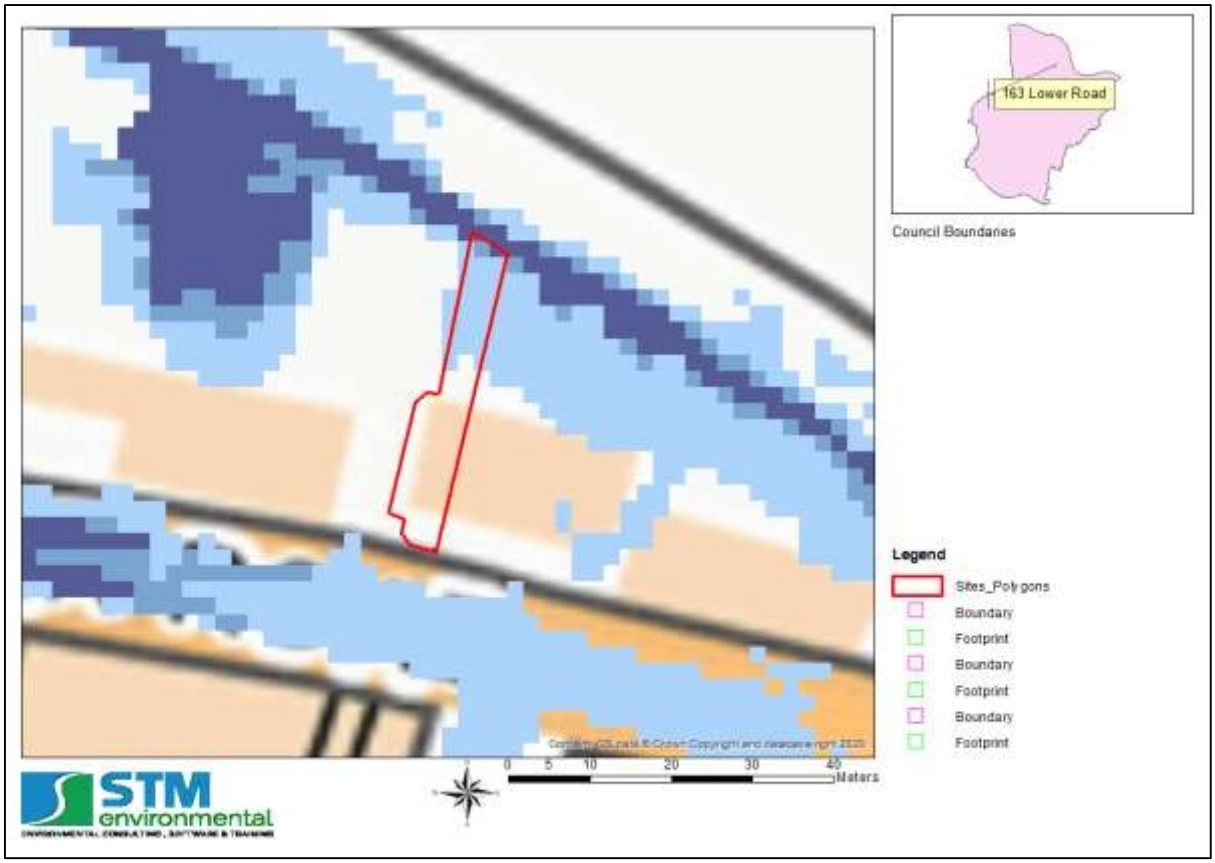


17.5 Appendix 5 - EA Flood Zone Map

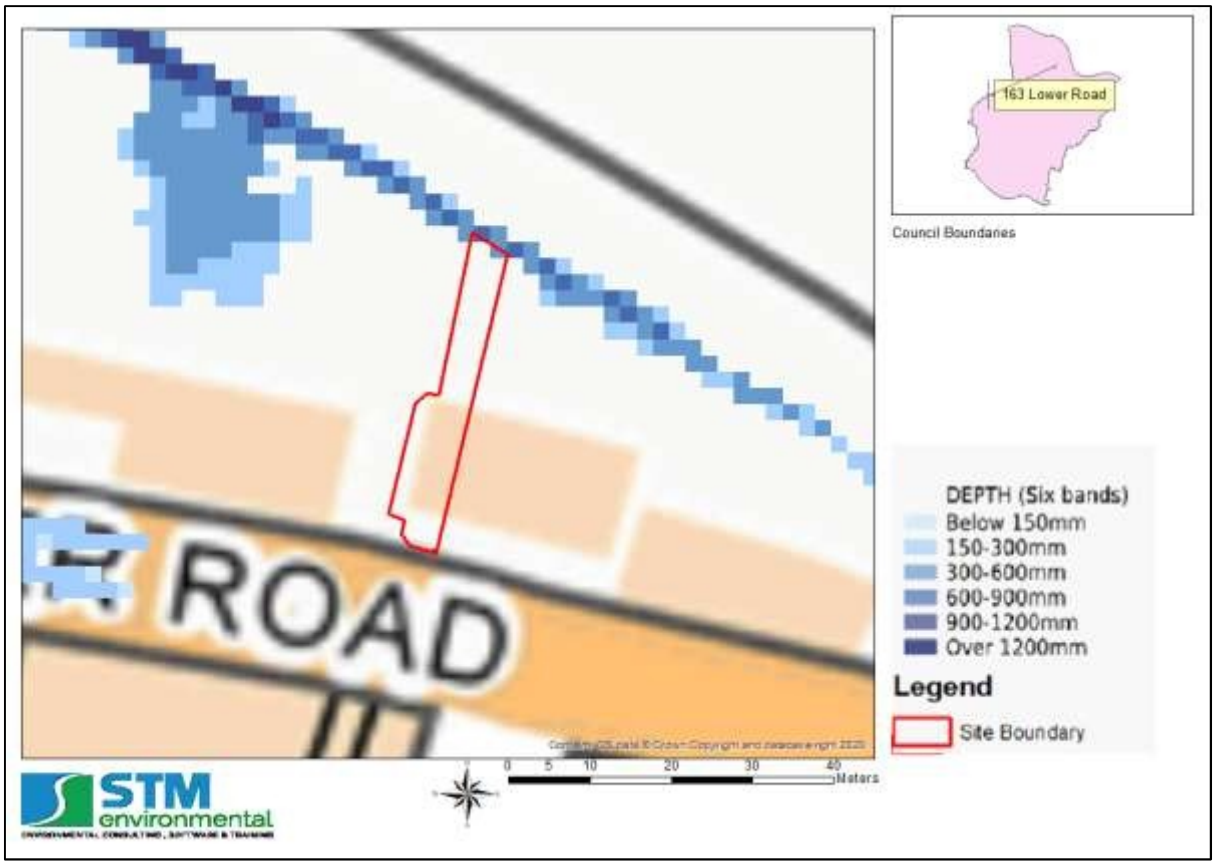


17.6 Appendix 6 – Surface Water Flood Extent and Depth Maps

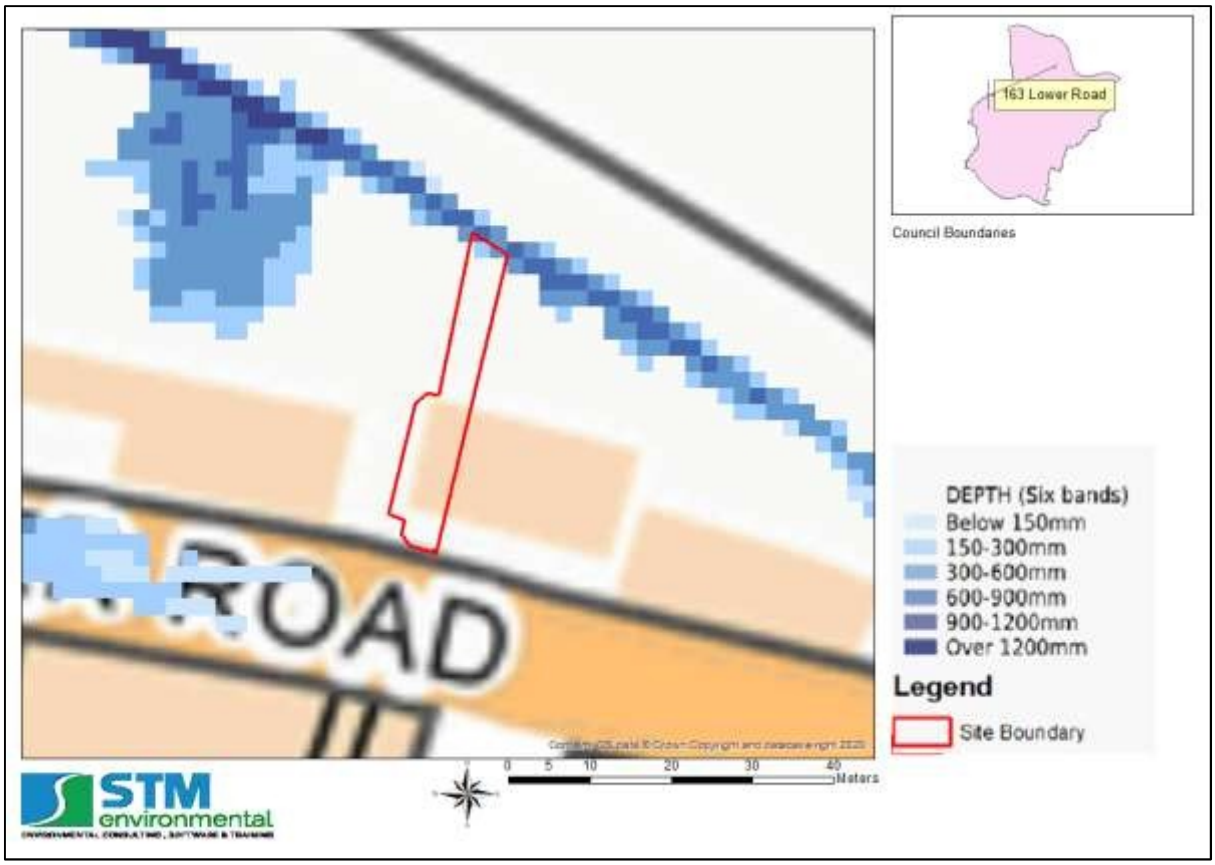
17.6.1 Map showing surface water flood extents for the 1 in 30-year, 100-year and 1 n 1000-year rainfall return period (Source: EA, 2016).



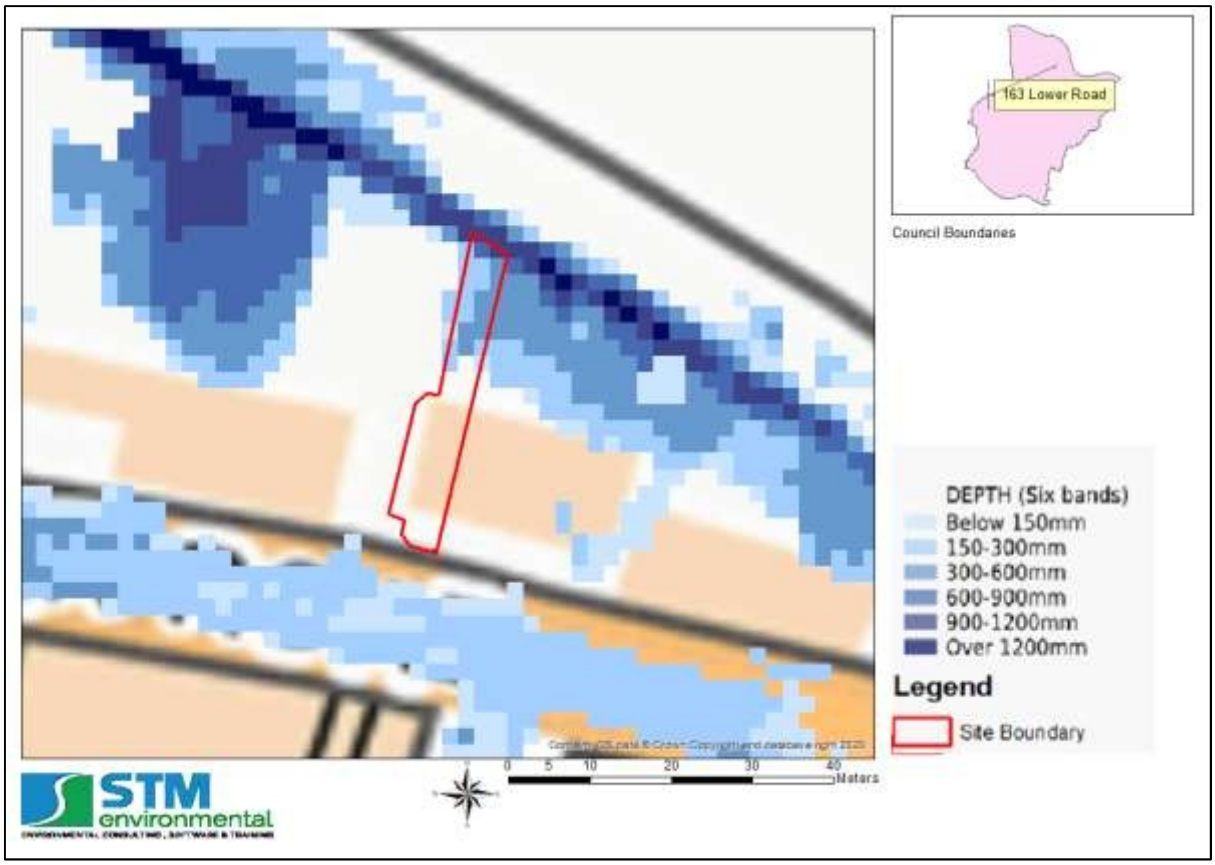
17.6.2 Map showing surface water flood depths for the 1 in 30-year rainfall return period (Source: EA, 2016).



17.6.3 Map showing surface water flood depths for the 1 in 100-year rainfall return period (Source: EA, 2016).

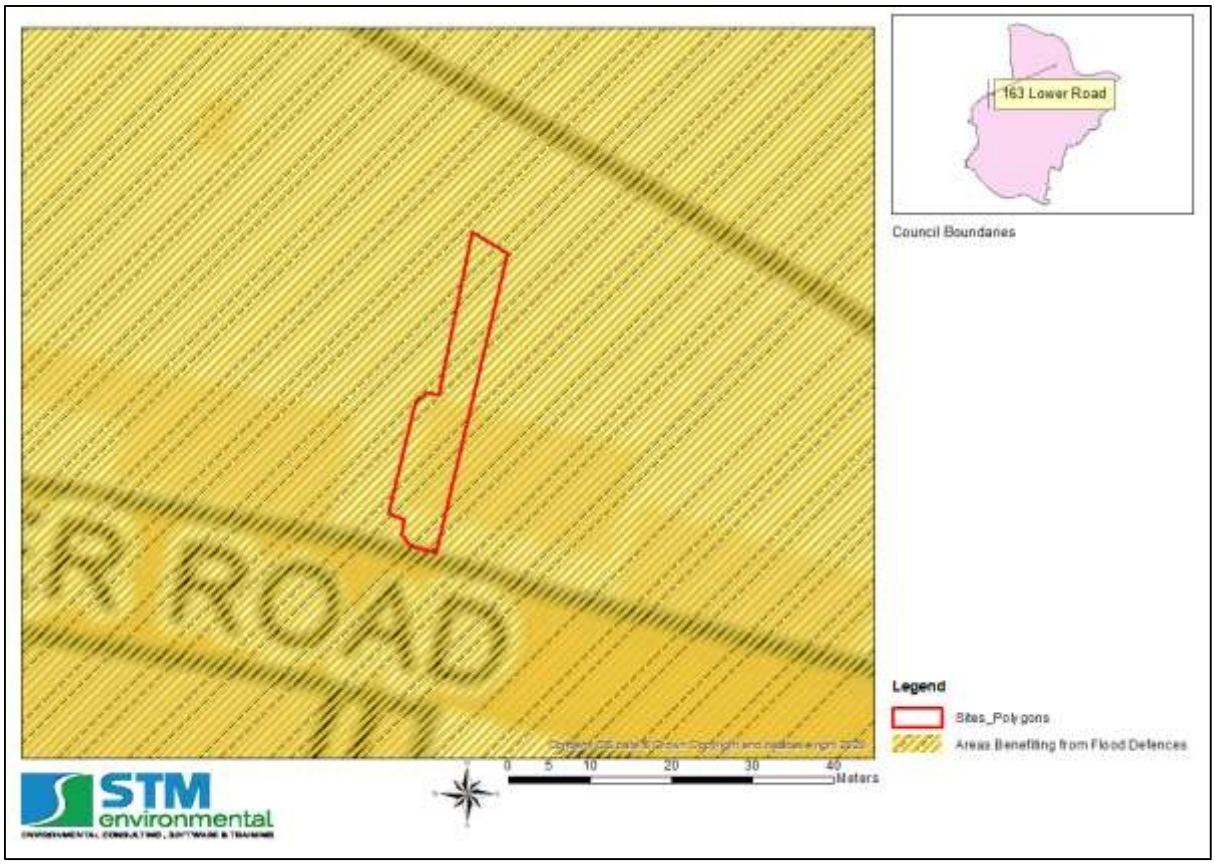


17.6.4 Map showing surface water flood depths for the 1 in 1000-year rainfall return period (Source: EA, 2016).



17.7 Appendix 7 –Flood Defence and Reservoir Flood Risk Maps

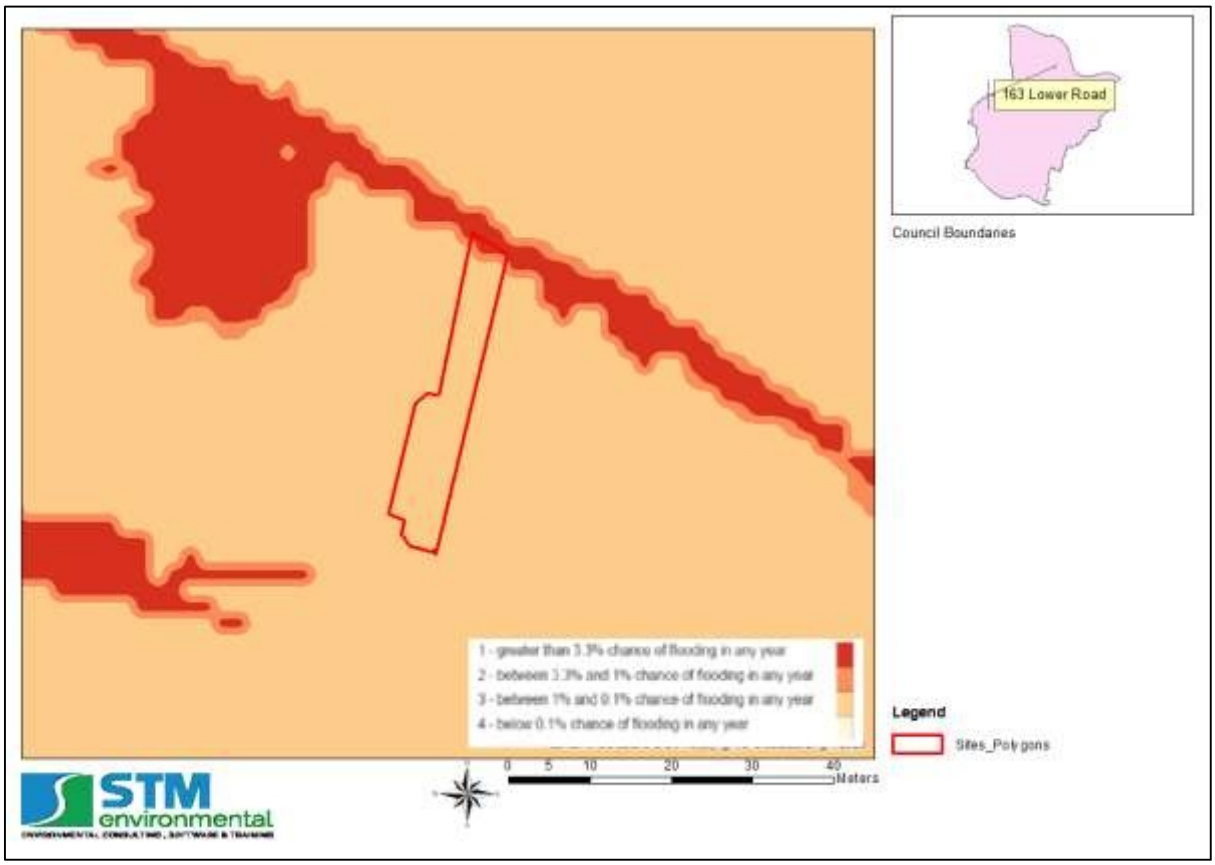
17.7.1 EA Map showing areas benefitting from flood defences



17.7.2 Reservoir Flood Risk Map

N/A

17.8 Appendix 8 – Risk of Flooding from Multiple Sources Map



17.9 Appendix 9 - Long Term Flood Risk Maps

Extent of flooding from rivers or the sea

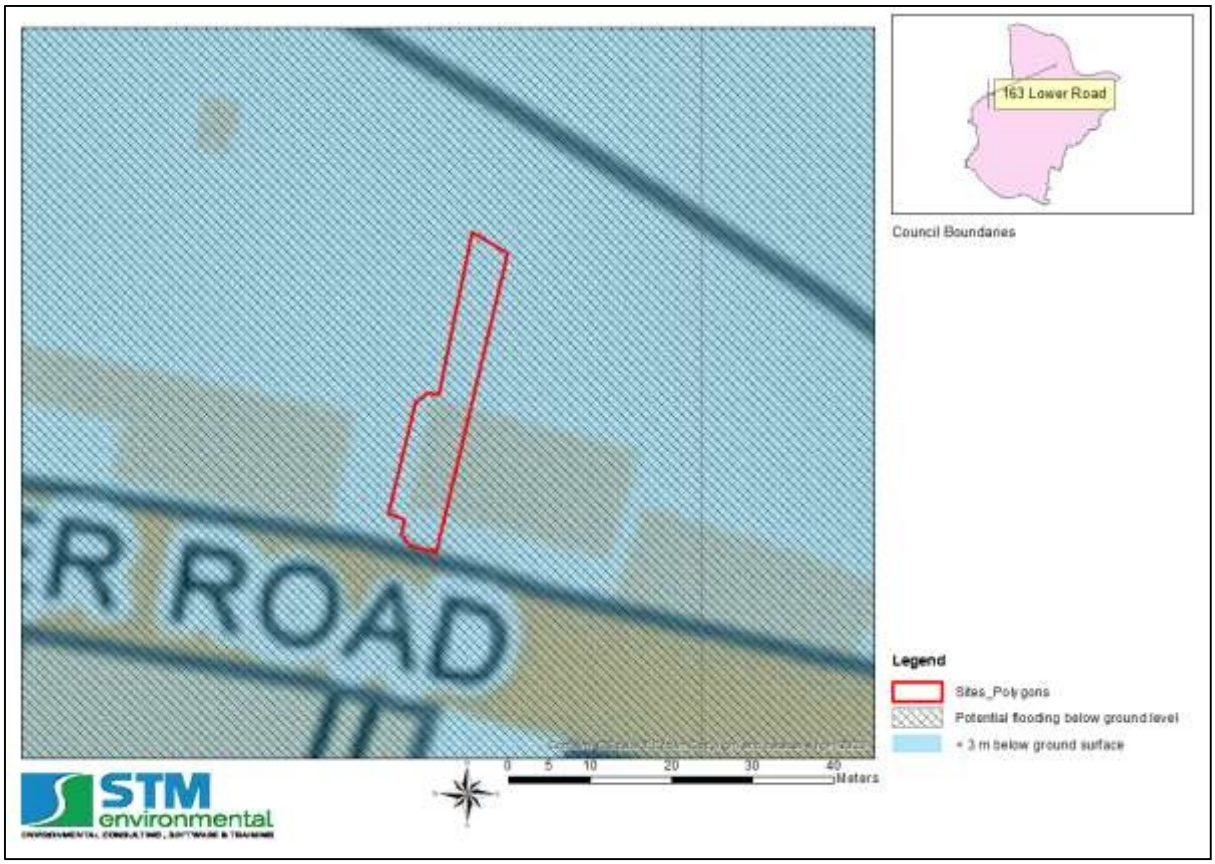
High Medium Low Very low Location you selected

Extent of flooding from surface water

High Medium Low Very low Location you selected

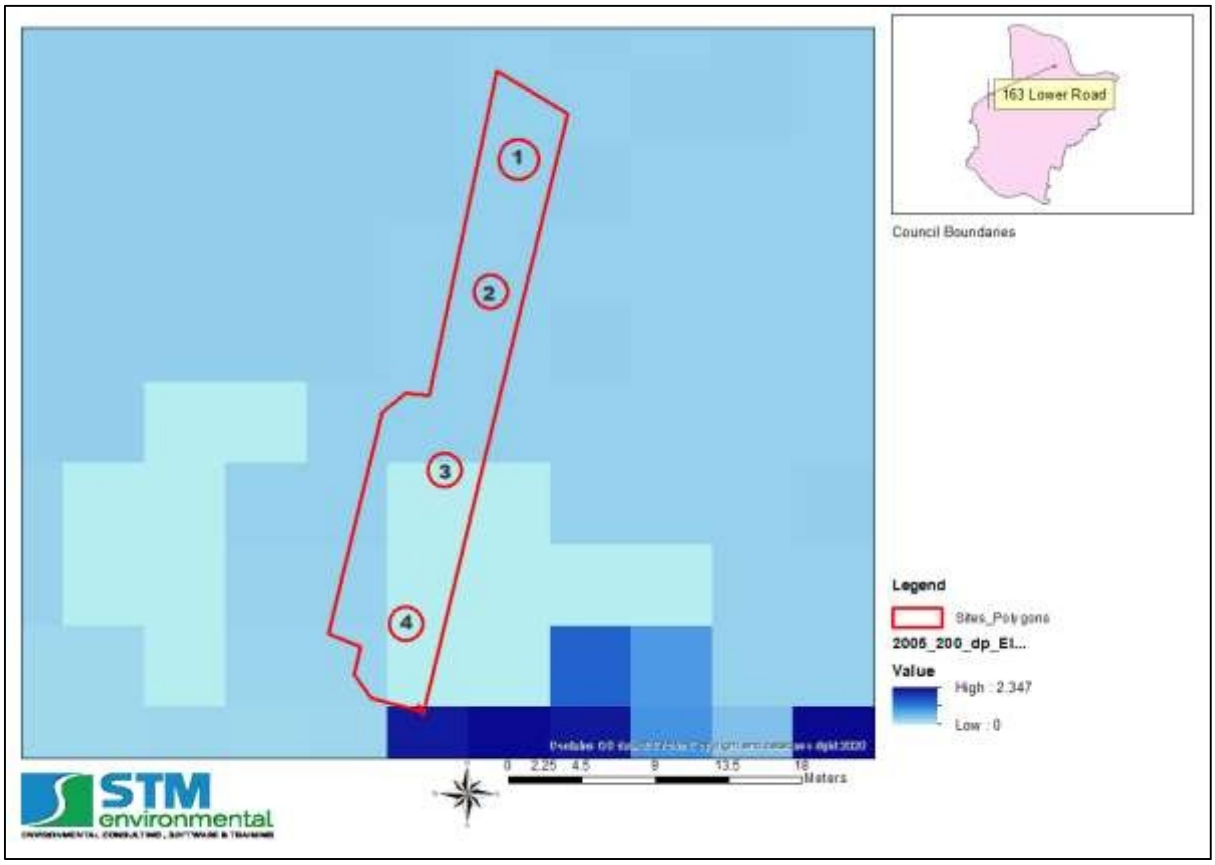
17.10 Appendix 10 – Groundwater Flood Maps

17.10.1 Groundwater Flooding (Susceptibility) Map (BGS)

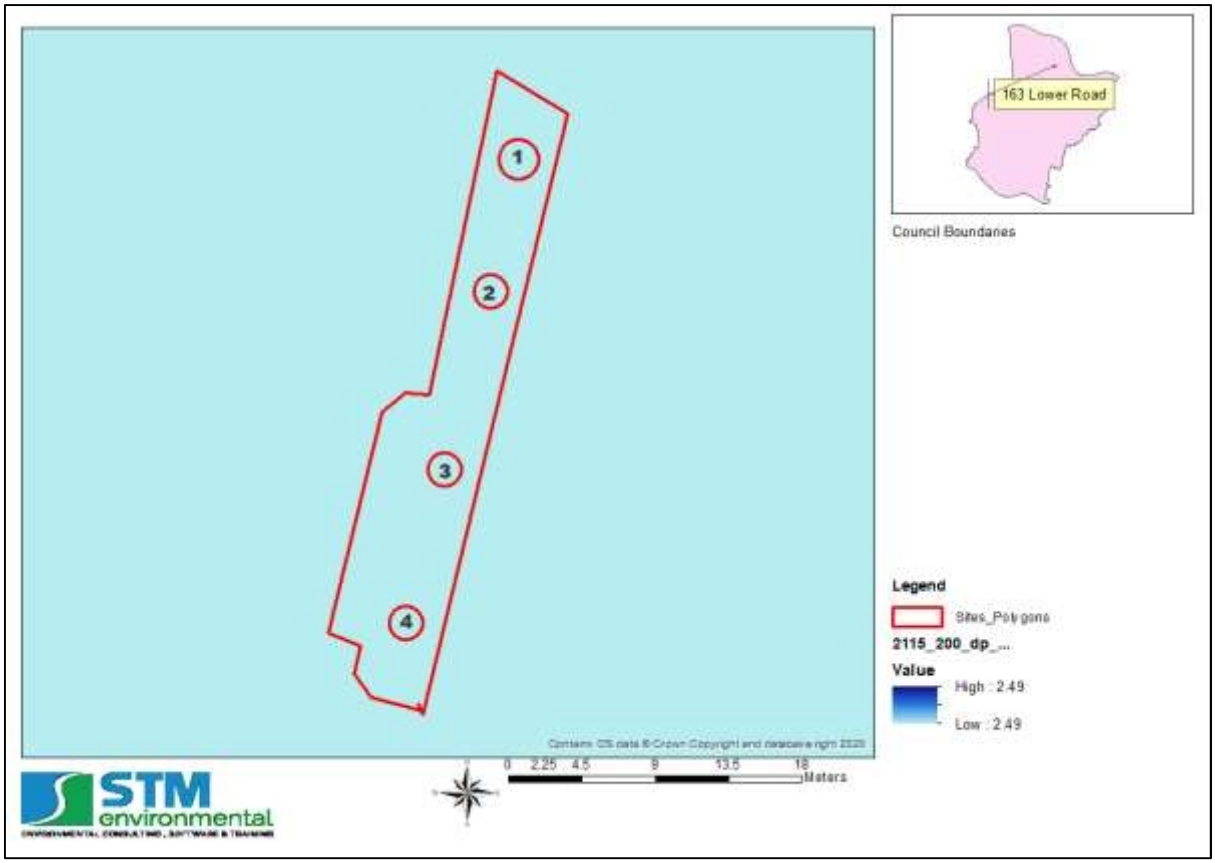


17.11 Appendix 11 - EA Product 6 (Detailed Flood Risk) Data / SFRA Level 2 Mapping

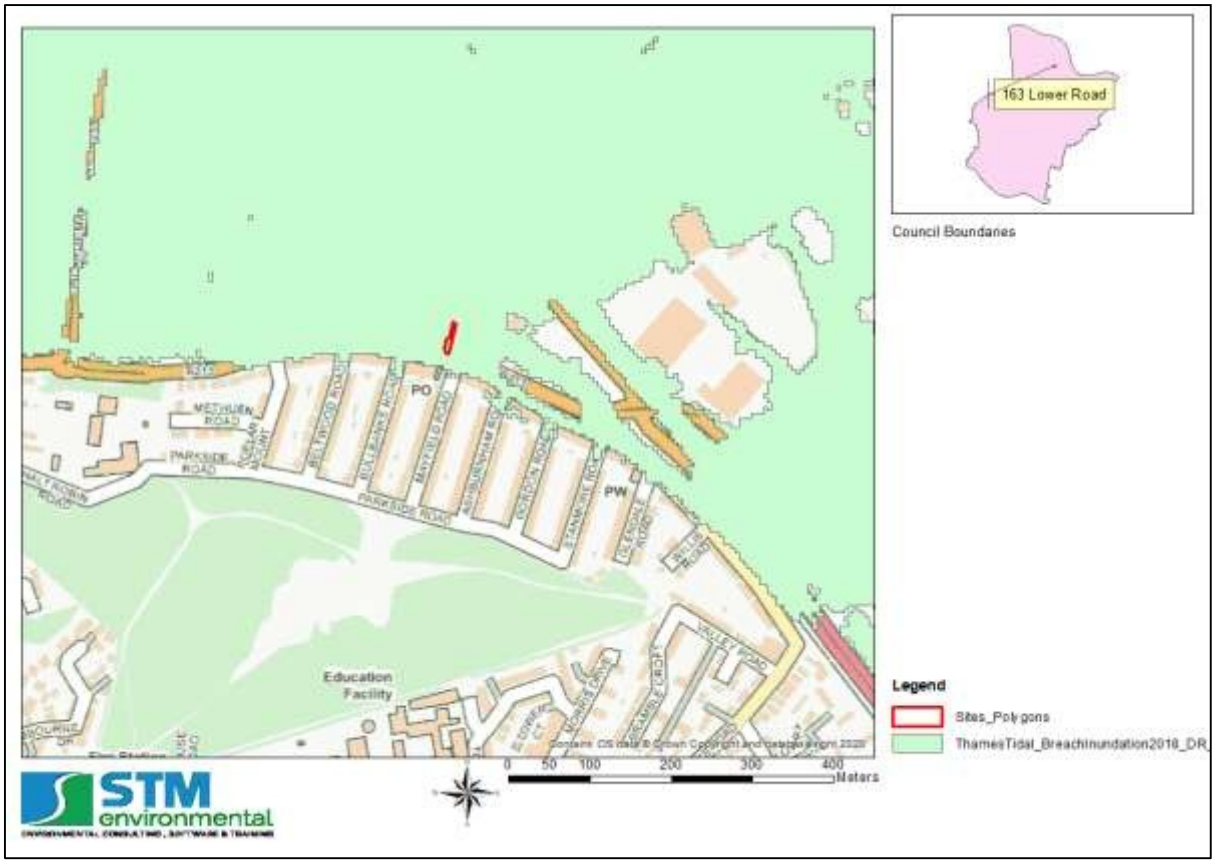
17.11.1 Food levels during the 1 in 200 (2005) event



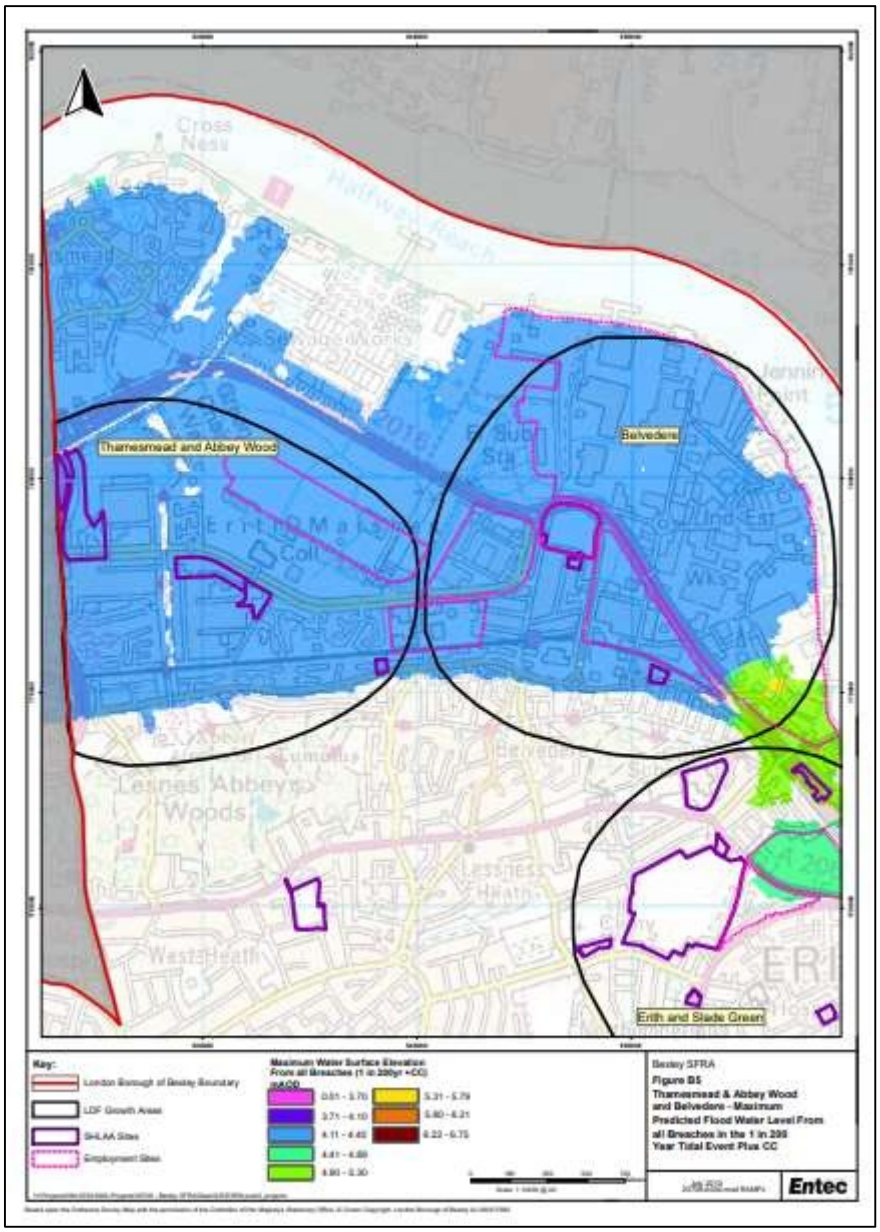
17.11.2 Food levels during the 1 in 200 (2115) event



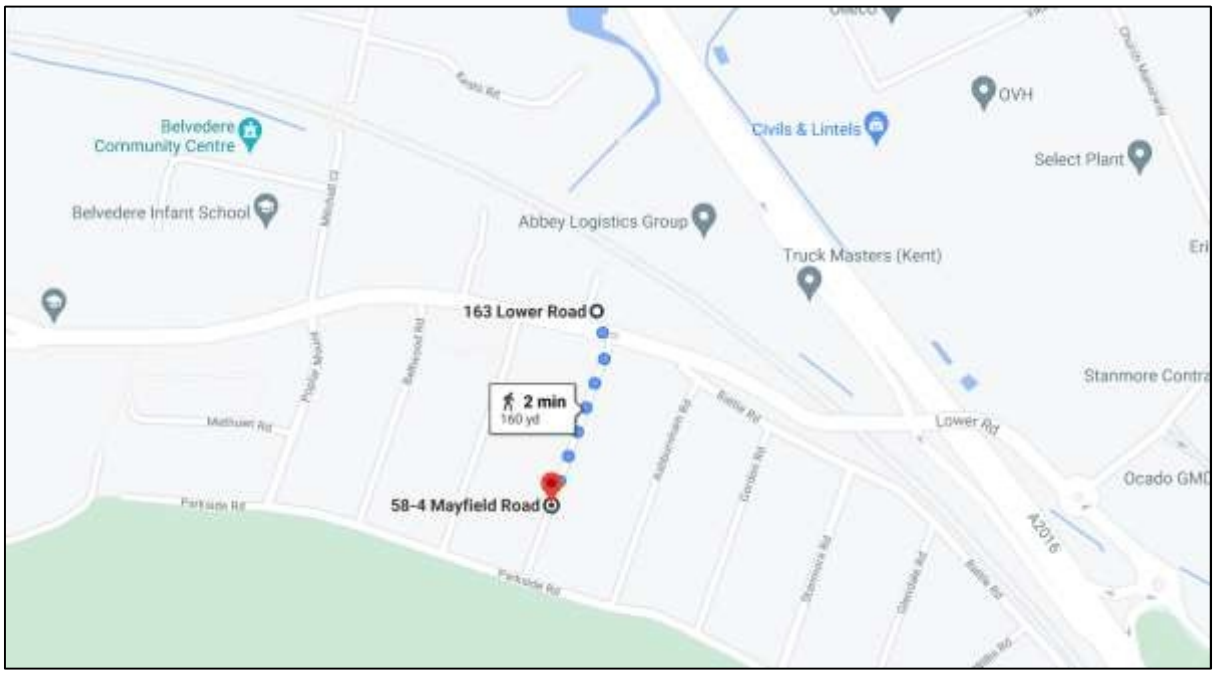
17.11.3 Flood extent during the 1 in 200 breach event



17.11.4 SFRA 1 in 200 + cc breach tidal event flood level in mAOD



17.12 Appendix 12 – Safe egress to flood zone 1



17.13 Appendix 13 – Flood Hazard

17.13.1 Calculation of Flood Hazard Rating

Table 4: Flood Hazard Rating Scores – based on DF score of 0

Velocity	Depth									
	0.25	**0.50**	**0.75**	**1.00**	**1.25**	**1.50**	**1.75**	**2.0**	**2.25**	**2.50**
0.0	0.13	0.25	0.38	0.50	0.63	0.75	0.88	1.00	1.13	1.25
0.5	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50
1.0	0.38	0.75	1.13	1.50	1.88	2.25	2.63	3.00	3.38	3.75
1.5	0.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00
2.0	0.63	1.25	1.88	2.50	3.13	3.75	4.38	5.00	5.63	6.25
2.5	0.75	1.50	2.25	3.00	3.75	4.50	5.25	6.00	6.75	7.50
3.0	0.88	1.75	2.63	3.50	4.38	5.25	6.13	7.00	7.88	8.75
3.5	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00
4.0	1.13	2.25	3.38	4.50	5.63	6.75	7.88	9.00	10.13	11.25
4.5	1.25	2.50	3.75	5.00	6.25	7.50	8.75	10.00	11.25	12.50
5.0	1.38	2.75	4.13	5.50	6.88	8.25	9.63	11.00	12.38	13.75

Table 5: Summary of Scores

	Score From	Score To	Flood Hazard	Description
	<0.75	0.75	Low	Exercise Caution
Class 1	0.75	1.5	Moderate	Danger for some
Class 2	1.5	2.5	Significant	Danger for most
Class 3	2.5	20.0	Extreme	Danger for all

Table 6: Values for Debris Factor for different flood depths

Depths	Pasture/Arable Land	Woodland	Urban
0 to 0.25	0	0	0
0.25 to 0.75	0.5	1	1
d>0.75 and/or v > 2	0.5	1	1

- The “danger to some” category includes vulnerable groups such as children, the elderly and infirm. “Danger: Flood zone with deep or fast
- flowing water”

- The “danger to most” category includes the general public.
- The danger to all category includes the emergency services.

A flood emergency plan is considered to be an acceptable way of managing flood risk where the flood hazard has been given a “very low hazard” rating. In some instances, flood emergency plans may also be acceptable where the rating is “danger for some”. However, it is unlikely to be an acceptable way of managing residual flood risk where the hazard to people classification is “danger for most” or “danger for all”.

17.13.2 Flood Hazard Map along evacuation route during the 1 in 200-year (2115) event