

FLOOD RISK ASSESSMENT

Site Address

23 Meadow Close
Ruislip
HA4 8AP

Client

Mr Mark Pottle

Date

20/05/2019



**CONSULTING GEO-ENVIRONMENTAL
ENGINEERS AND SCIENTISTS**

Phase 1 Contaminated Land Desk Studies, Geo-Environmental Site Investigations, Environmental Due Diligence, Flood Risk Assessments, Surface Water Management Strategies (SuDS), Ecology, Noise and Air Quality Assessments, Environmental Management Systems, GIS & Data Management Systems

1 Document Control



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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
LBH	London Borough of Hillingdon
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 is solely for use by Mr Mark Pottle (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 using or placing reliance upon any information contained in this report, do so at their own risk.

4 Executive Summary

Location	23 Meadow Close, Ruislip, HA4 8AP Grid reference: 509955, 188196
Proposed Development	Rear Extension.
Flood Zone	Flood Zone 2.
Sequential and Exception Tests	Development is minor and more vulnerable so Sequential and Exception Tests should not be required.
Main Sources of Flooding	River Pinn.
Flood Defences	High Ground along the River Pinn.
Records of Historic Flooding	One record in 1977.
Fluvial (River) and Tidal (Sea) Flood Risk	Low – The site will not flood up to the 1 in 1000-year scenario.
Pluvial (Surface Water) Flood Risk	Low – The site will partially flood during the 1 in 100 year with shallow flood depths. No historic incidents identified in the vicinity.
Flood Risk from Artificial (Canals and Reservoirs) Sources	Low – The site does not lie within the extent of flooding from artificial sources.
Groundwater Flood Risk	Low – Although site is potentially susceptible to groundwater flooding, no recorded incidents have been identified.
Development Impacts on Local Flood Risk	The development will not increase the site impermeable area as the extension will be built on existing hardstanding. Therefore, it is considered unlikely that the proposal will have an adverse impact on local flood risk.
Proposed Flood Risk Mitigation Measures	- Finished floor levels will be no lower than existing ground floor 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 a 2-minute walk away and safe refuge is available on upper floors.
Surface Water Management (SuDS)	SuDS would reduce current surface water run off rates however given the small size of the site (500m ²), there is limited potential for implementation. Consideration should be given to rainwater harvesting, soakaway and permeable paving where possible.
Conclusions	The site is considered to be at low overall risk of flooding. The site did not experience flooding since 1977. No previous records of groundwater or surface water flooding incidents were found and the proposed development will not increase local flood risk.

5 Introduction

STM Environmental Consultants Limited (STM) has been appointed by Mr Mark Pottle (Client) to provide a Flood Risk Assessment (FRA) at a site located at 23 Meadow Close, Ruislip, HA4 8AP.

6 Development Proposal

The FRA is required to support a planning application to erect a rear extension. 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 10 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 is

avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere". It further states that when determining planning applications, LPAs should "only consider development appropriate in areas at risk of flooding where, informed by a site-specific flood risk assessment following the Sequential Test, and if required the Exception Test, 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, including safe access and escape routes where required, and that any residual risk can be safely managed, including by emergency planning; and it gives priority to the use of sustainable drainage systems.

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.

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

The Hillingdon Council's aim is to ensure that flood risk is managed appropriately across the Borough by using the best available information on flood risk to inform a flood risk management strategy and working in a coordinated way with relevant parties.

All development proposals in flood risk zones 2, 3a, and 3b will be required to submit a Flood Risk Assessment (FRA) to demonstrate that the development is resistant and resilient to all relevant sources of flooding including surface water flooding. Critical Drainage Areas (CDAs) will be treated the same as flood zone 3.

Developments may be required to make contributions to addressing surface water flood risk, where offsite mitigation measures are required.

Proposals that fails to make appropriate provision for flood risk mitigation, or which would increase the risk or consequences of flooding will be refused.

Hillingdon Council's Policy EM6 on Flood Risk Management states that sites will only be allocated within Flood Zones 2 or 3 where there are overriding issues that outweigh flood risk. In these instances, policy criteria will be set requiring future applicants of these sites to demonstrate that flood risk can be suitably mitigated.

The Council will require all development across the borough to use sustainable urban drainage systems (SUDS) unless demonstrated that it is not viable. The Council will encourage SUDS to be linked to water efficiency methods. The Council may require developer contributions to guarantee the long-term maintenance and performance of SUDS is to an appropriate standard.

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:

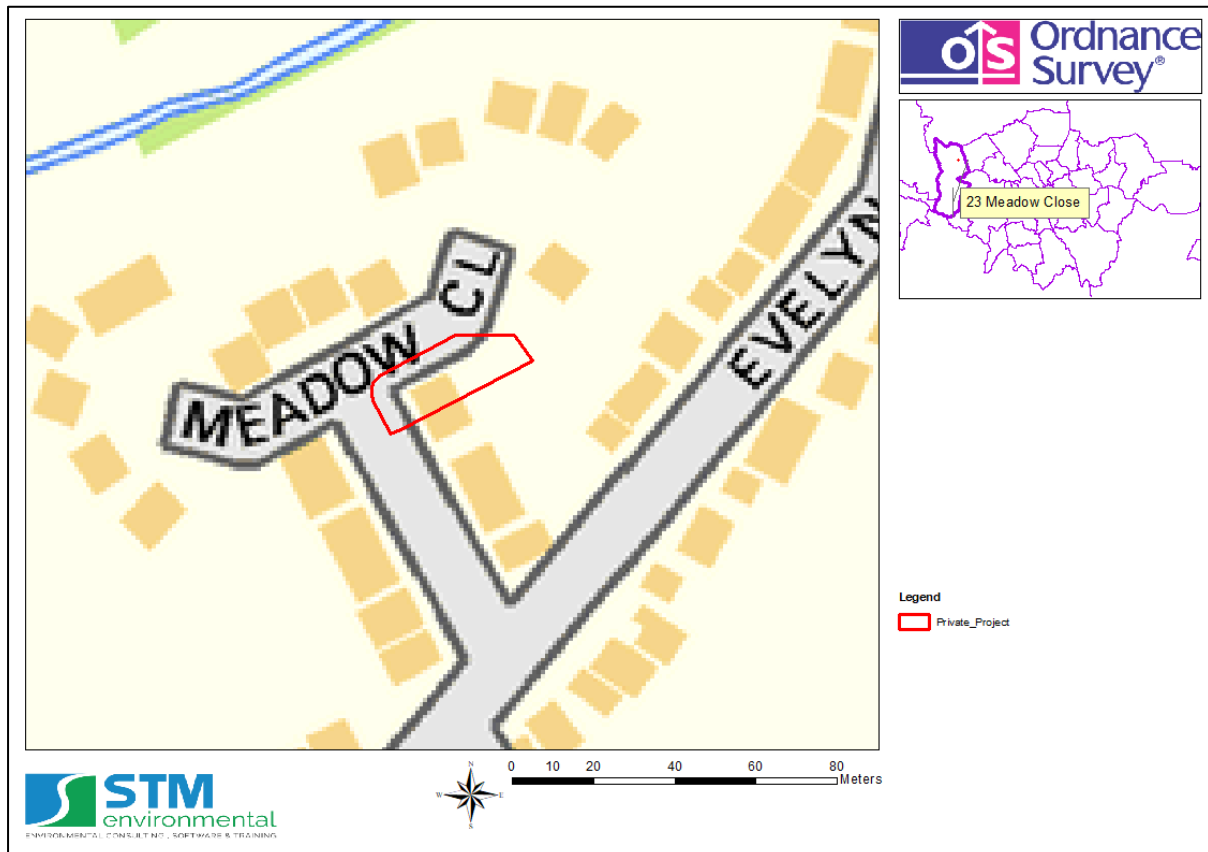
- in flood zone 2 or 3 including minor development and change of use more than 1 hectare (ha) in flood zone 1;
- less than 1 ha in flood zone 1, including a change of use in development type to a more vulnerable class (for example from commercial to residential), where they could be affected by sources 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 23 Meadow Close, Ruislip, HA4 8AP. It is centred at national grid reference 509955, 188196. The site has an area of approximately 500m².

A site location map and aerial photo are shown below. Photographs of the site are available in [Appendix 1](#).



10.2 Site Access

The site is accessed via Meadow Close.

10.3 Local Planning Authority

The site falls within the jurisdiction of London Borough of Hillingdon in terms of the planning process.

10.4 Lead Local Flood Authority

The London Borough of Hillingdon is also the Lead Local Flood Authority (LLFA).

10.5 Flood Zone

For planning purposes, the site is located in Flood Zone 2 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 residential.

10.6.2 Surrounding Land Uses

A description of current land uses surrounding the boundaries of the site is given below in Table 1 below.

Table 1: Summary of surrounding land uses

Boundary	Land Use Description	
	Immediately Adjacent (within 0 – 25m)	General Local Area (i.e. within 25 - 250m)
Northern	Residential	River Pinn / Open field
Eastern	Residential	Residential
Southern	Residential	Residential / Tennis Courts
Western	Residential	Residential

10.7 Hydrology

The nearest main watercourse is the River Pinn which is located approximately 80m to the north of the site.

10.8 Geology

Data from the British Geological Survey indicates that the underlying superficial geology is characterised as Alluvium. The underlying bedrock geology is characterized as Lambeth Group.

10.9 Hydrogeology

The site lies upon a Secondary A superficial aquifer and a Secondary bedrock 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 site is mainly flat with levels ranging from 42.1mAOD to 42.5mAOD. The proposed location of the extension is located at approximately 42.4mAOD.

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.

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 2 and are defined in terms of Flood Zone and development vulnerability classification.

Table 2: 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

X Development should not be permitted.

Based on its scale and nature, the development is considered to be “more 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 Main Potential Sources of Local Fluvial Flooding

The nearest potential source of fluvial flooding to the site is considered to be the River Pinn.

12.1.4 Records of Historic Fluvial 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. Copies of the maps at the site location are available in [Appendix 4](#).

The Product 4 Data provided by the EA and available in [Appendix 10](#) has confirmed that the site has been impacted by one event in 1977.

12.1.5 Designated Fluvial Flood Risk Zone for the Site

The site is considered to be located within flood zone 2 as defined by the Environment Agency and the LLFA indicating that it has between 1 in 100 and 1 in 1000 annual probability of fluvial flooding.

12.1.6 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.

12.1.7 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.

12.1.8 Potential Sources of Tidal Flooding

The area in which the site is located is considered unlikely to be affected by tidal flooding.

12.1.9 Flood Defences

The Product 4 Data identifies flood defences in the form of high ground along the River Pinn. Details on their condition and design standard of protection are available in [Appendix 10](#).

12.1.10 Climate Change - EA Modelled Predictions of Fluvial and Tidal Flood Levels and Extents

The EA Product 4 dataset which is presented in [Appendix 10](#) provides modelled flood levels and flows for model node points close to the site. These are summarised in Table 3 below. The following information has been extracted from the River Pinn Mapping Study (JBA, 2015).

Table 3: EA modelled flood levels and expected flood depths for different return periods and scenarios.

	Flood Levels (mAOD)						
	1 in 5	1 in 20	1 in 100	1 in 100 + 20%	1 in 100 + 35%	1 in 100 + 70%	1 in 1000
2D-Node	41.9	42.02	42.08	42.11	42.14	42.38	42.47

The proposed location of the extension sits on an elevation of 42.4mAOD. As such, it will remain dry during all modelled scenarios up to the 1 in 1000-year event when it would potentially flood to depths lower than 100mm.

12.1.11 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 8](#) indicate that the long-term risk from fluvial flooding to the site is 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 Flooding Incidents

Examination of the LLFA's Level 1 SFRA revealed no evidence of records of pluvial flooding on or in the vicinity of the site.

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)

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 Sewer Flooding

A map showing recorded incidents of sewer flooding is available in [Appendix 4](#).

The site lies within an area that has witness between 6 to 10 incidents.

12.2.6 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 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 the 1 in 30-year event. It will witness shallow flooding in the rear garden of approximately 300mm during the 1 in 100-year scenario.

During the 1 in 1000-year event. The flood will extent to the whole site with depths up to 900mm in the rear garden.

12.2.7 Long Term Surface Water Flood Risk

The EA's [long term flood risk maps](#) which are available in [Appendix 8](#) indicate that the long term risk of flooding from surface water is also considered to be low.

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 less than 0.1% chance of flooding at the

centre of the site in any year. The chance increases towards the east and the west of the site up to greater than 3.3% in some areas. 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 available in [Appendix 4](#). The map indicates that there have been no recorded incidents of groundwater flooding at or within 500m of the site.

12.4.2 Susceptibility to Groundwater Flooding

The Groundwater Flood Susceptibility Map provided by BGS, which is available in [Appendix 9](#) indicates that the potential for groundwater flooding to occur at the surface does exist. The Groundwater Depth map also provided by BGS indicates that the groundwater level may be at approximately 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 site is not located within a Critical Drainage Area.

12.6 Potential Impacts of the Development on Local Flood Risk

12.6.1 Impacts on Flood Storage and Changes to Impermeable Area and Building Footprint

The change to the impermeable area of the site is considered to be insignificant as the extension will be built on existing hardstanding areas. The proposal will increase the building footprint of approximately 20m² within flood zone 2. As such, floodplain storage will not be affected and surface water runoff rates will not increase.

12.6.2 Impacts on Flood Flow Routes

As the development does not involve the significant redesign of buildings at the site, it is considered to be unlikely that it will alter flood flow paths.

13 Flood Risk Mitigation Measures

13.1 SuDS

The Department for Communities and Local Government 's (DCLG) Planning practice guidance and Planning system (PPGPS) 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 the option to implement a SuDS strategy in line with the drainage hierarchy as outlined in Table 4 below to reduce surface water discharges from the site.

Table 4: 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.

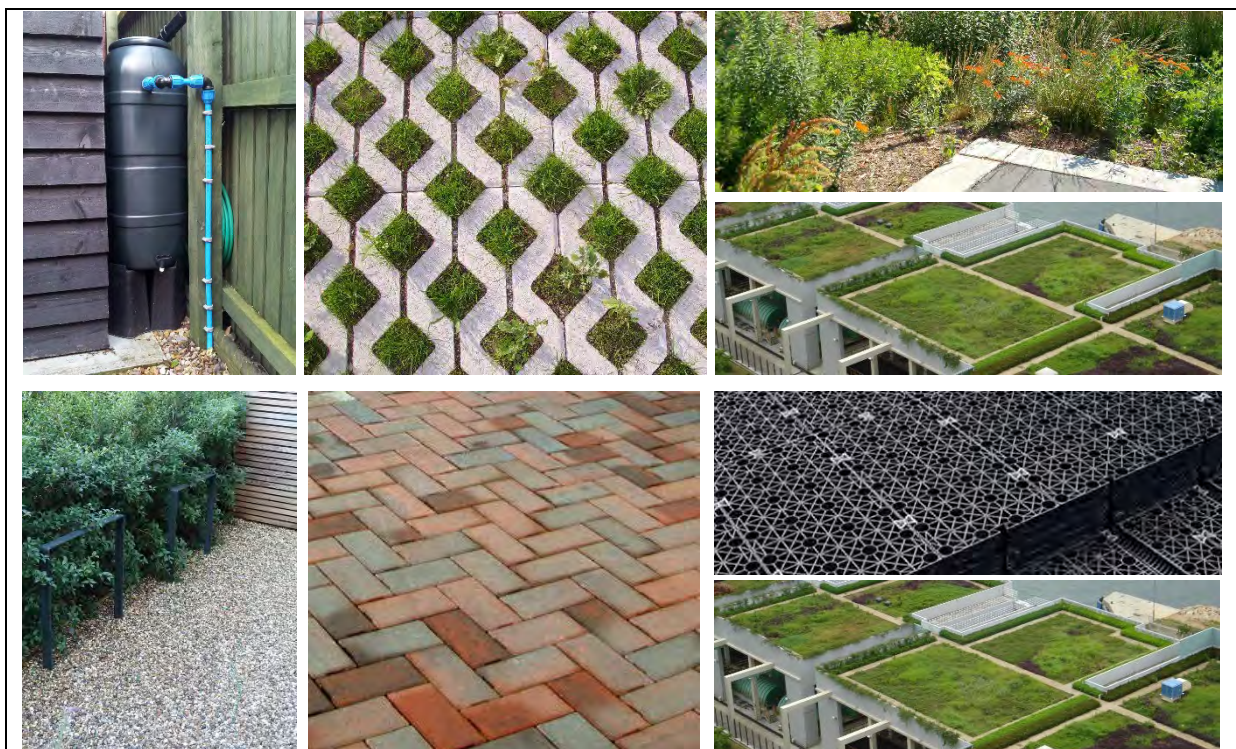


Figure 1: Surface water storage facilities and potential SuDs features - rainwater harvesting, on-site tank storage, rain garden soak-away and green roofs. (Source: UK SuDS Manual)

Additionally, the relevant schedules from Policy CC4 – Minimizing Surface Water Run-off with Sustainable Drainage Systems are:

- Developments must maximize attenuation levels, achieving greenfield rates where possible;

- All new car parks and hard standing areas should be rainwater permeable with no run-off directed in to the sewer network;
- All flat roofs should be green or brown roofs to contribute to reducing surface water run-off.

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. If required, the SuDS strategy will be detailed in a separate report as is outside the scope of works of this FRA.

13.2 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.

13.2.1 Finished Floor Levels

The average ground level at the proposed location of the extension is 42.4mAOD.

For minor extensions, EA Standing Advice states that finished floor levels are to be set 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 the proposed location of the extension will remain dry during all modelled scenarios up to the 1 in 1000-year event, it is considered to be reasonable to set finished floor levels to match existing.

13.2.2 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.

As the site lies within flood zone 2, flood displacement storage is not considered to be required.

13.2.3 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).

As the site will remain dry during all modelled scenarios up to the 1 in 1000-year event, the water exclusion strategy is considered to be the most appropriate for the development.

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 ceramic tiles or stone floor finishes is recommended;

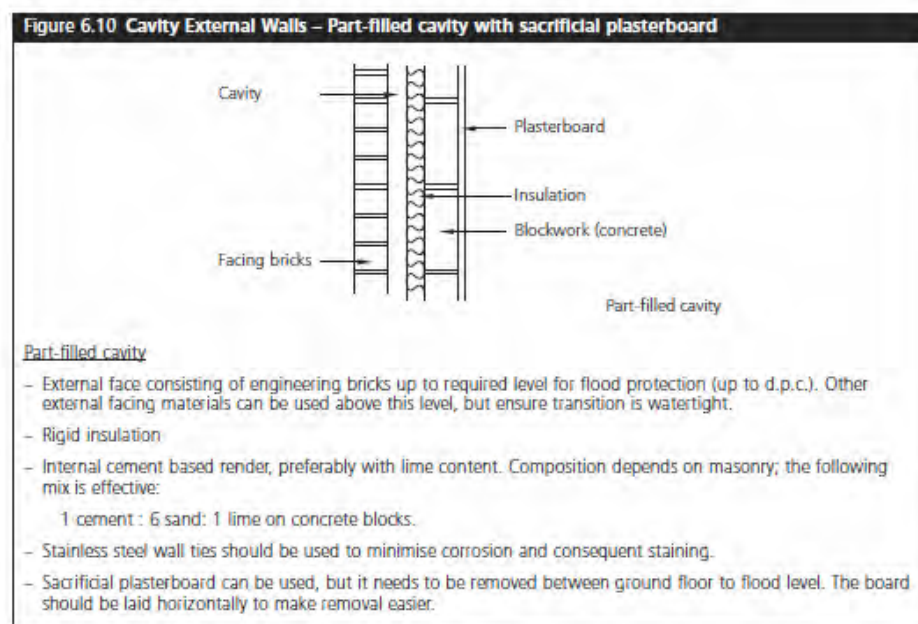
Doors:

- 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 fouds and surface water drainage.

Improving the flood performance of new buildings



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.

13.3 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.

As the site will not flood up to the 1 in 1000-year fluvial event, the flood hazard score is considered to be very low.

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

13.3.1 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.

13.3.2 Access and Safe Egress

Safe egress to Flood Zone 1 is a 2-min walk to Evelyn Avenue. Directions of this route are presented in [Appendix 11](#).

13.3.3 Safe Refuge

The proposed development will 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.

14 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 EA define the site as being within flood zone 2; |
|  | The site is classified as a more vulnerable minor development and is therefore unlikely to require sequential and exception tests to be undertaken; |
|  | The main source of potential flooding to the site is the River Pinn; |

-  No records of groundwater, surface water or artificial flooding incidents were identified at or in the vicinity of the site;
-  The site is within a CDA. It is not in an area that has had a significant number of sewage flooding incidents;
-  The EA considers the sites overall flood risk to be low;
-  The development will not result in a change in the impermeable area of the site and therefore it is unlikely to have an adverse impact on local flood risk;
-  There is opportunity for implementing SuDS mitigation measures. Consideration should be given to use of rainwater harvesting, soakaways and/or permeable paving. If required, the SuDS strategy will be detailed in a separate report as it is outside the scope of this FRA;
-  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 accessible;
-  In the event that evacuation is not possible, safe refuge is available in the upper floors of the building which are accessible via an internal staircase.

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 low. The proposal will not impact flood storage and it will not have an adverse impact on local flood risk.

15 References

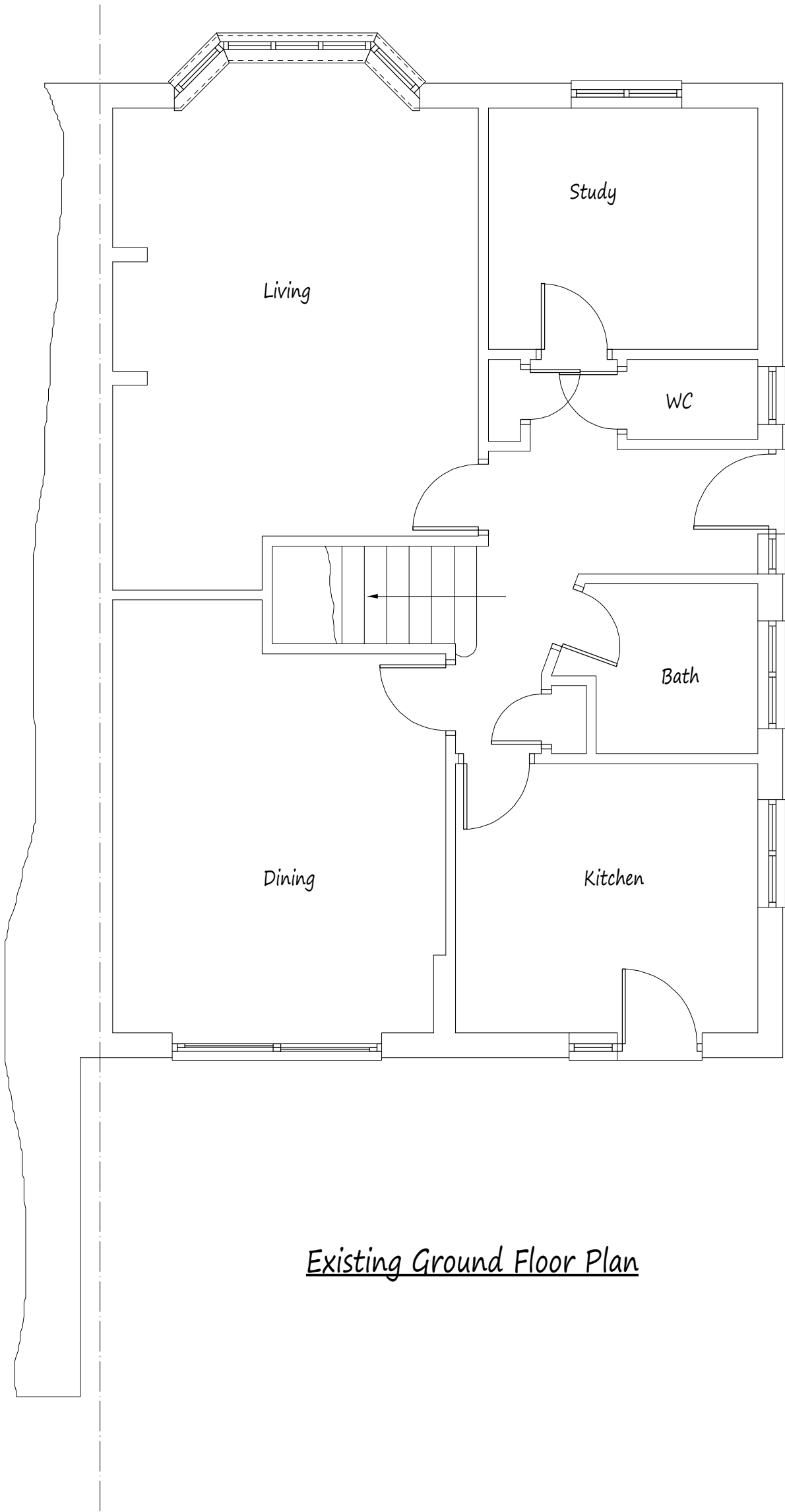
1. Communities and Local Government - National Planning Policy Framework NPPF, March 2012.
2. Communities and Local Government - Planning Practice Guidance: Flood Risk and Coastal Change, Updated 06 March 2014.
3. Strategic Flood Risk Assessment - Hillingdon Council - Feb 2016
4. CIRIA, Defra, Environment Agency – UK SuDS Manual, 2015.
5. Greater London Authority – London Sustainable Drainage Action Plan, 2015.
6. Google Maps accessed May 19.

16 Appendices

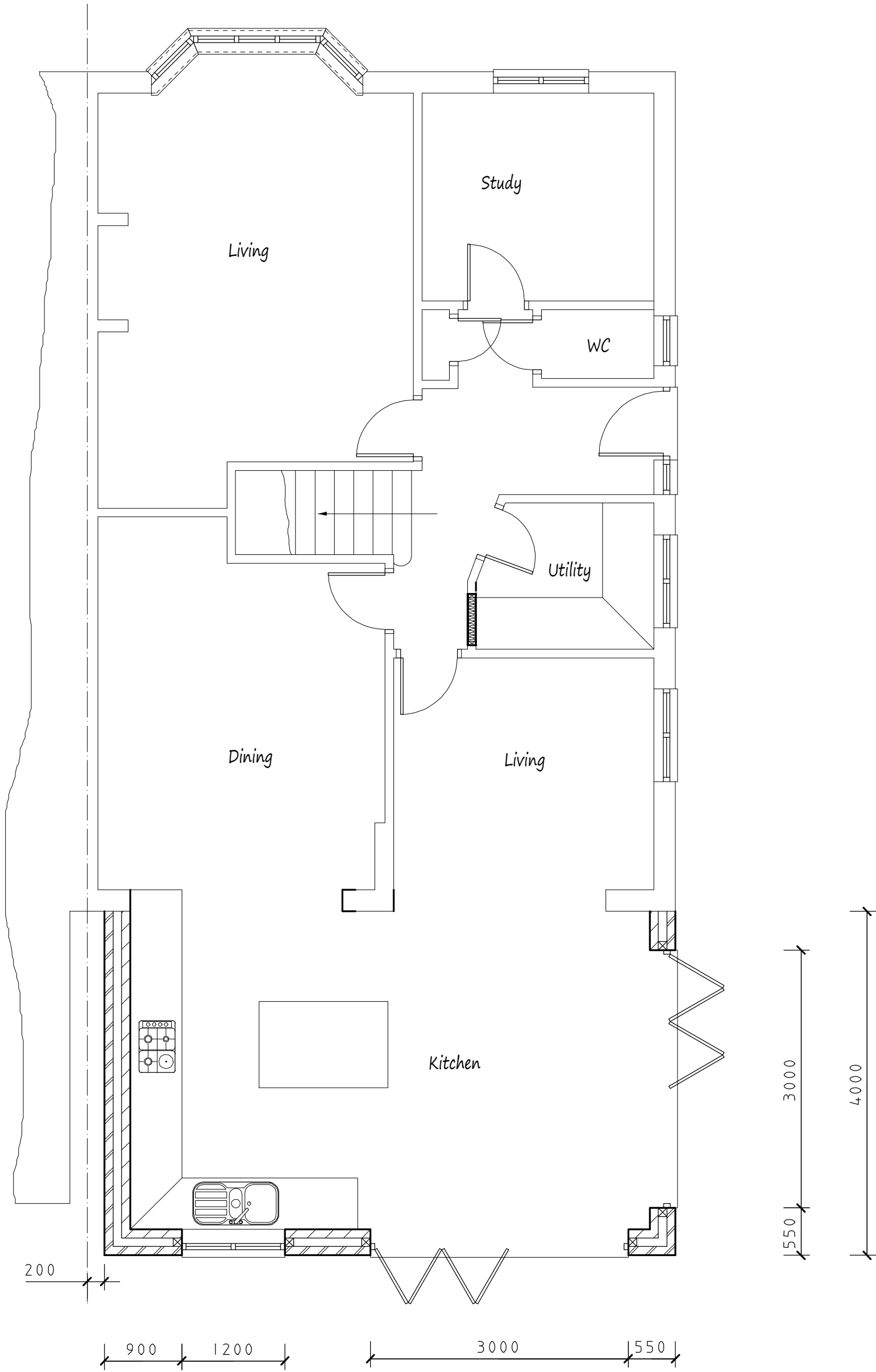
16.1 Appendix 1 – Site Photographs



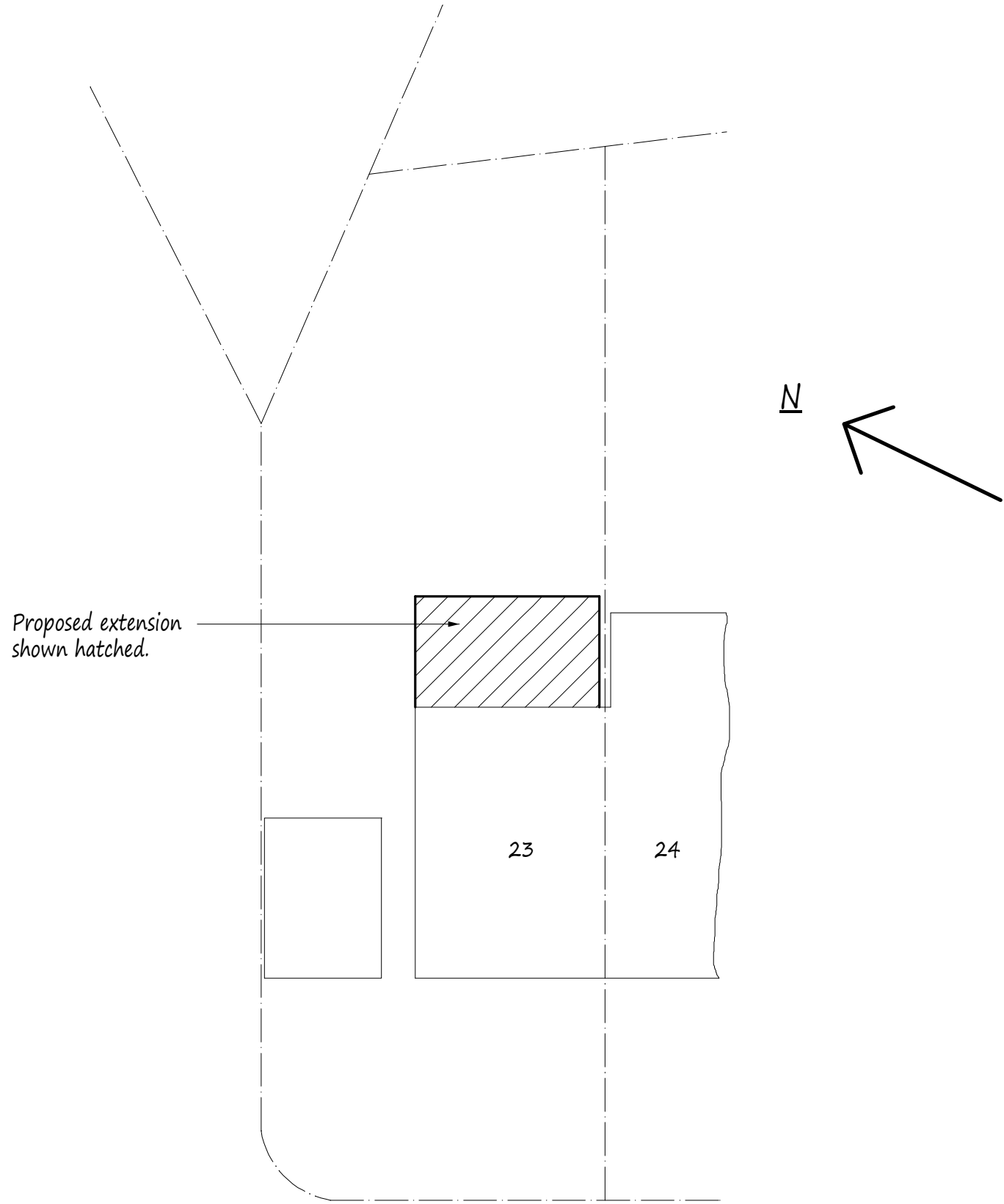
16.2 Appendix 2 – Development Plans



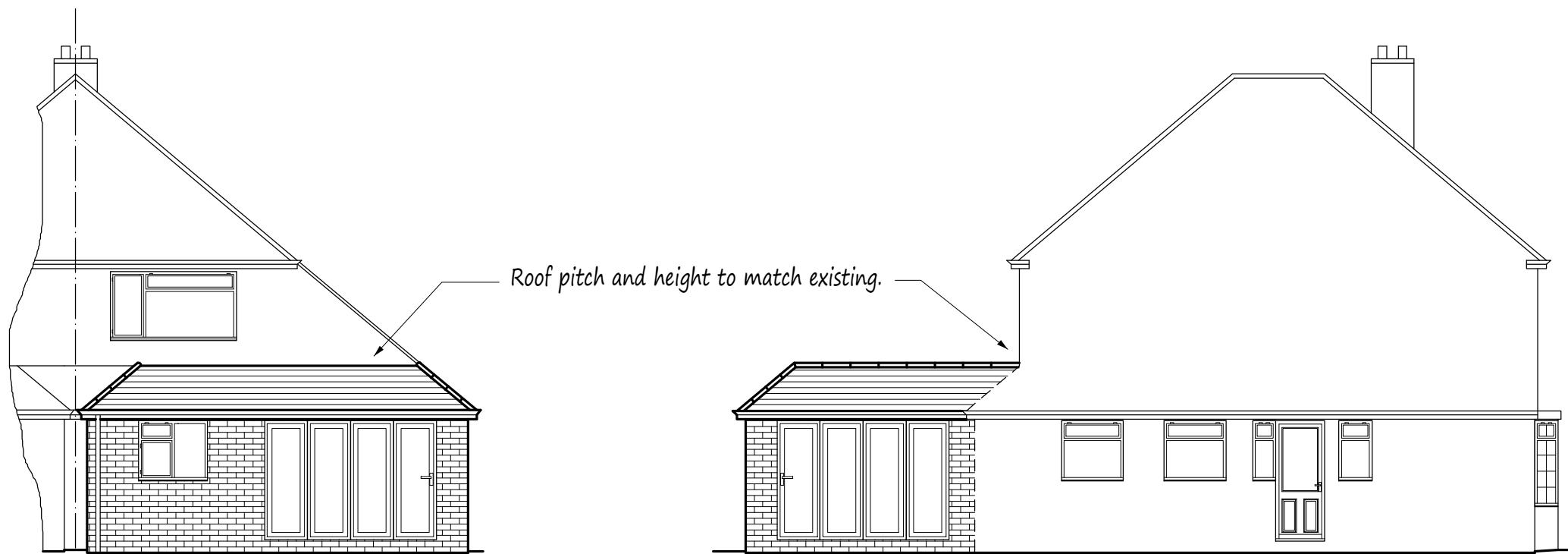
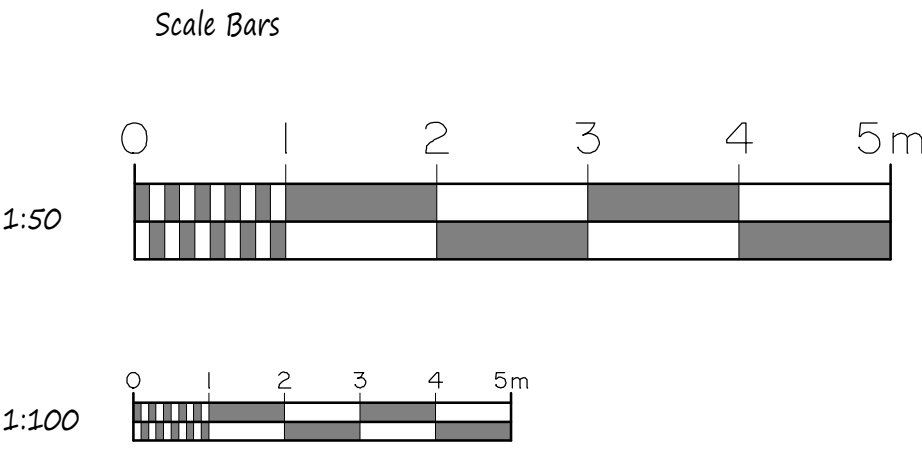
Existing Ground Floor Plan



Proposed Ground Floor Plan

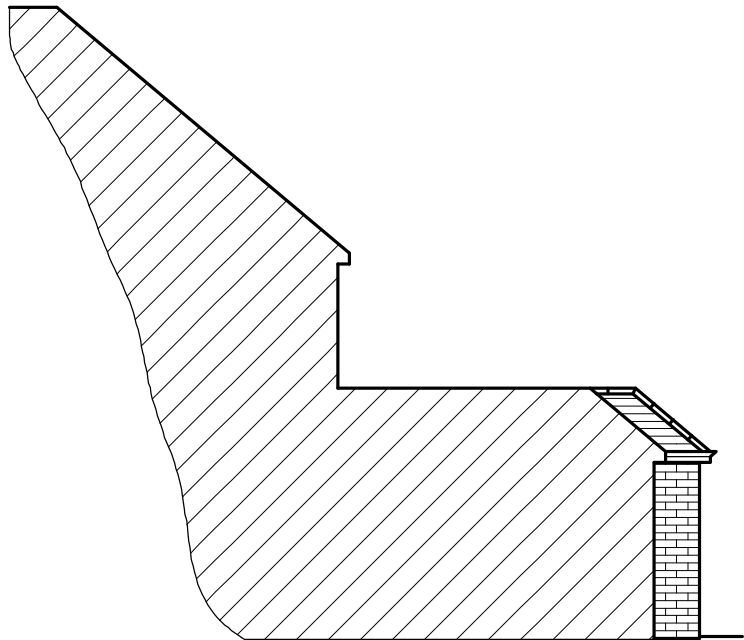


Site Plan scale 1:200



Rear Elevation

Side Elevation



Side Elevation

NOTES:
All dimensions must be checked on site and not scaled from this drawing.

A	Date	Revisions

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Client
Mr. M. Milmoe

Job Title

23 Meadow Close
Ruislip
Middlesex

Drawing Title

Proposed Single Storey Rear
Extension.

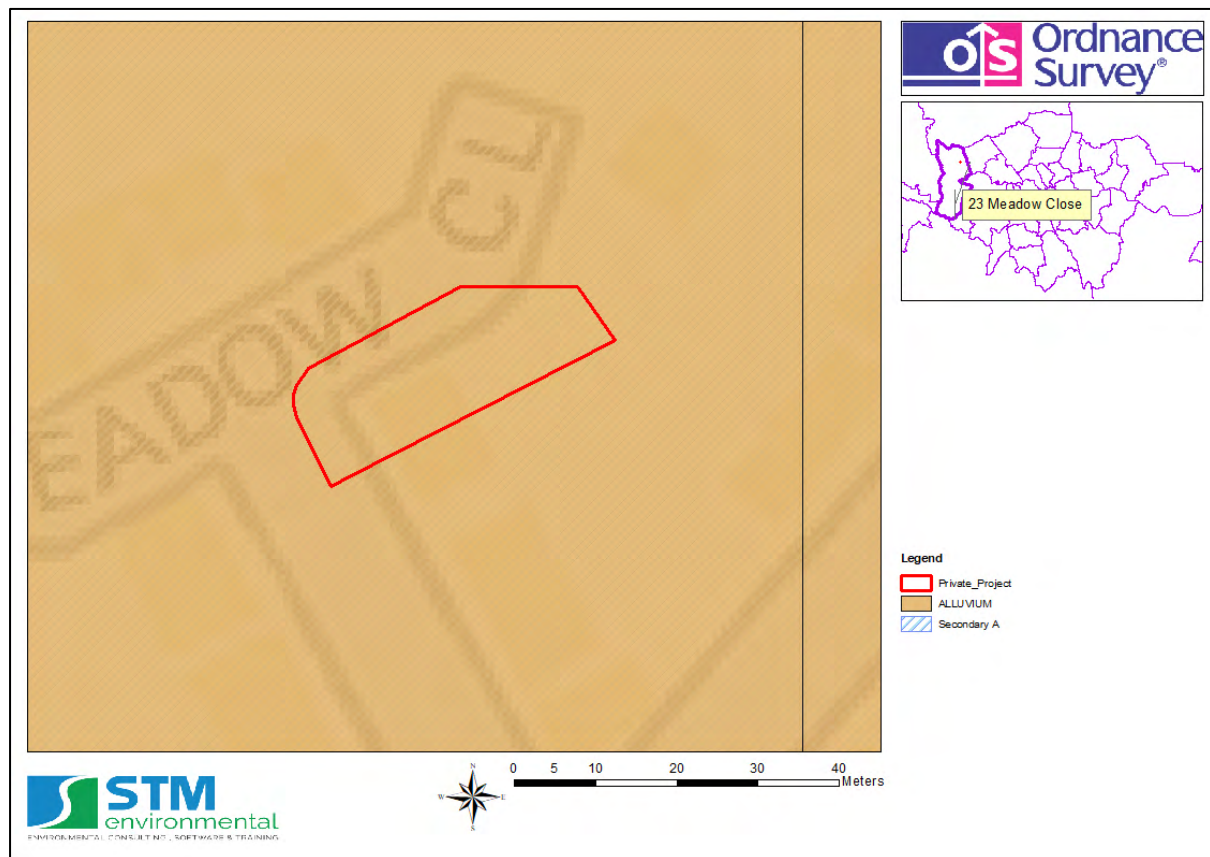
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1:50, 100, 200

Date January 2019	Drawn by MDP
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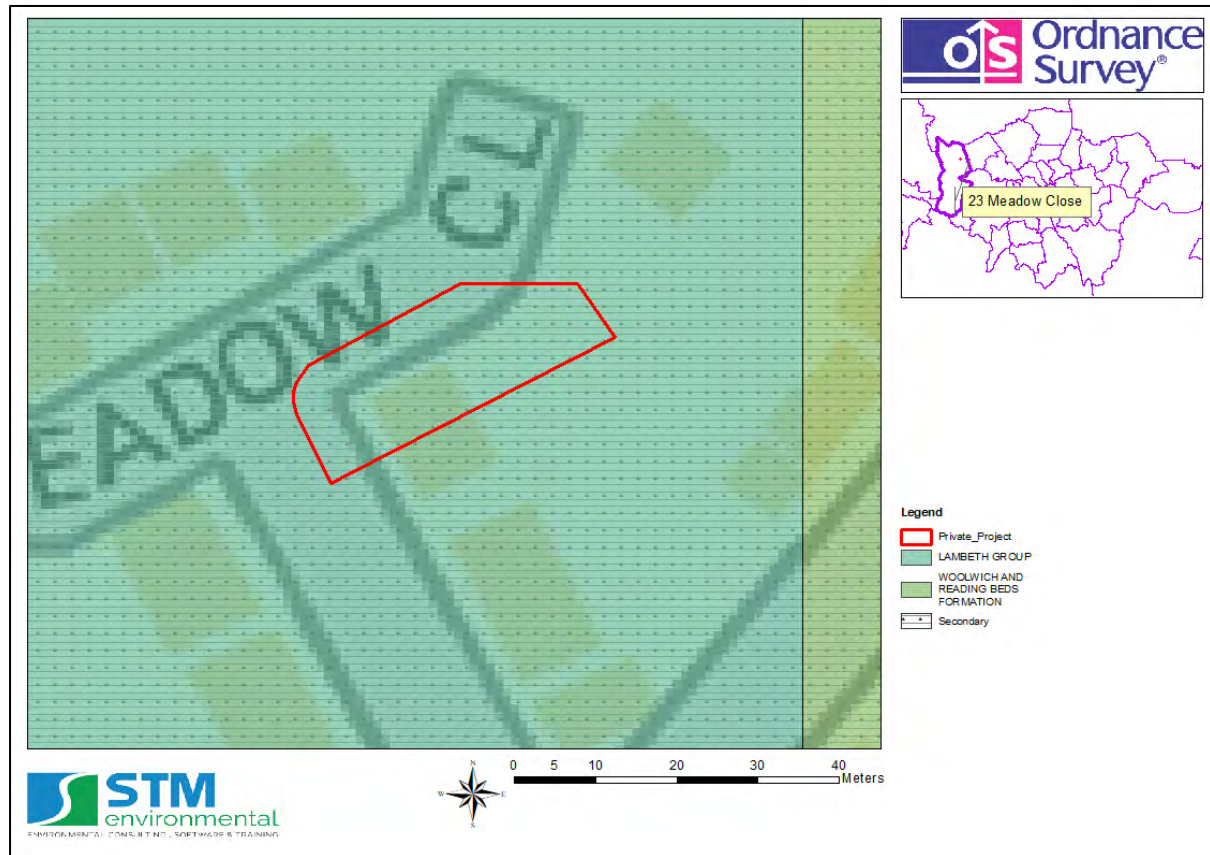
Drg No.
4197/02

16.3 Appendix 3 – Environmental Characteristics

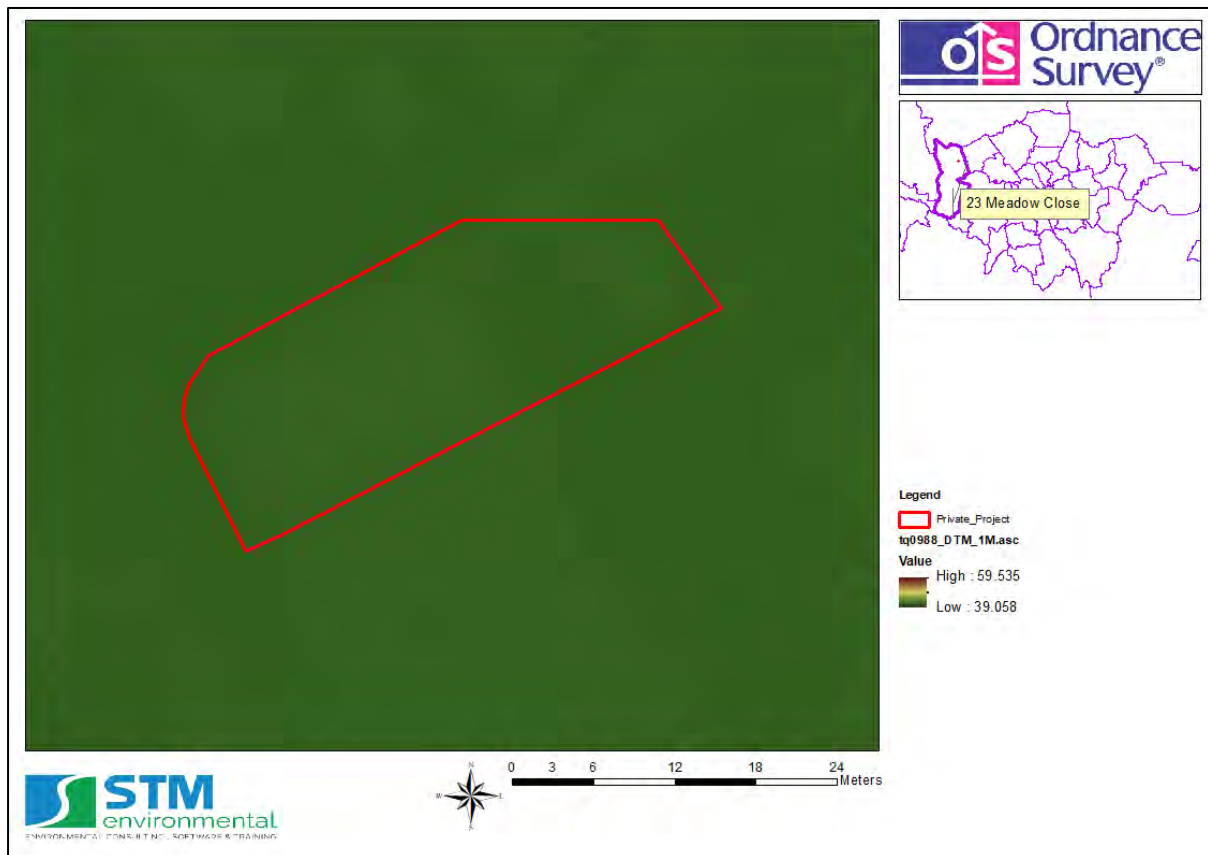
16.3.1 Superficial Hydrogeology Map



16.3.2 Bedrock Hydrogeology Map

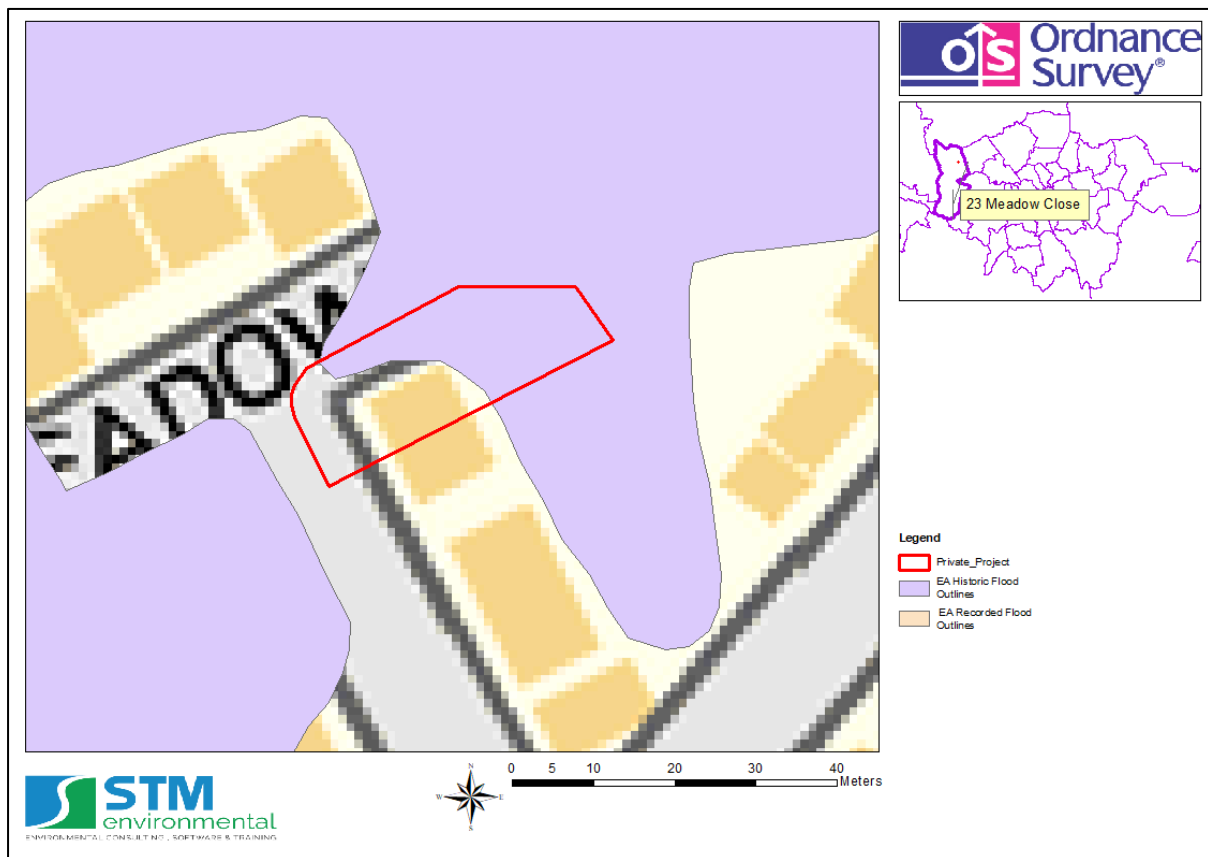


16.3.3 Topology Map



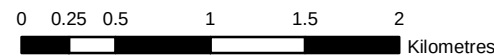
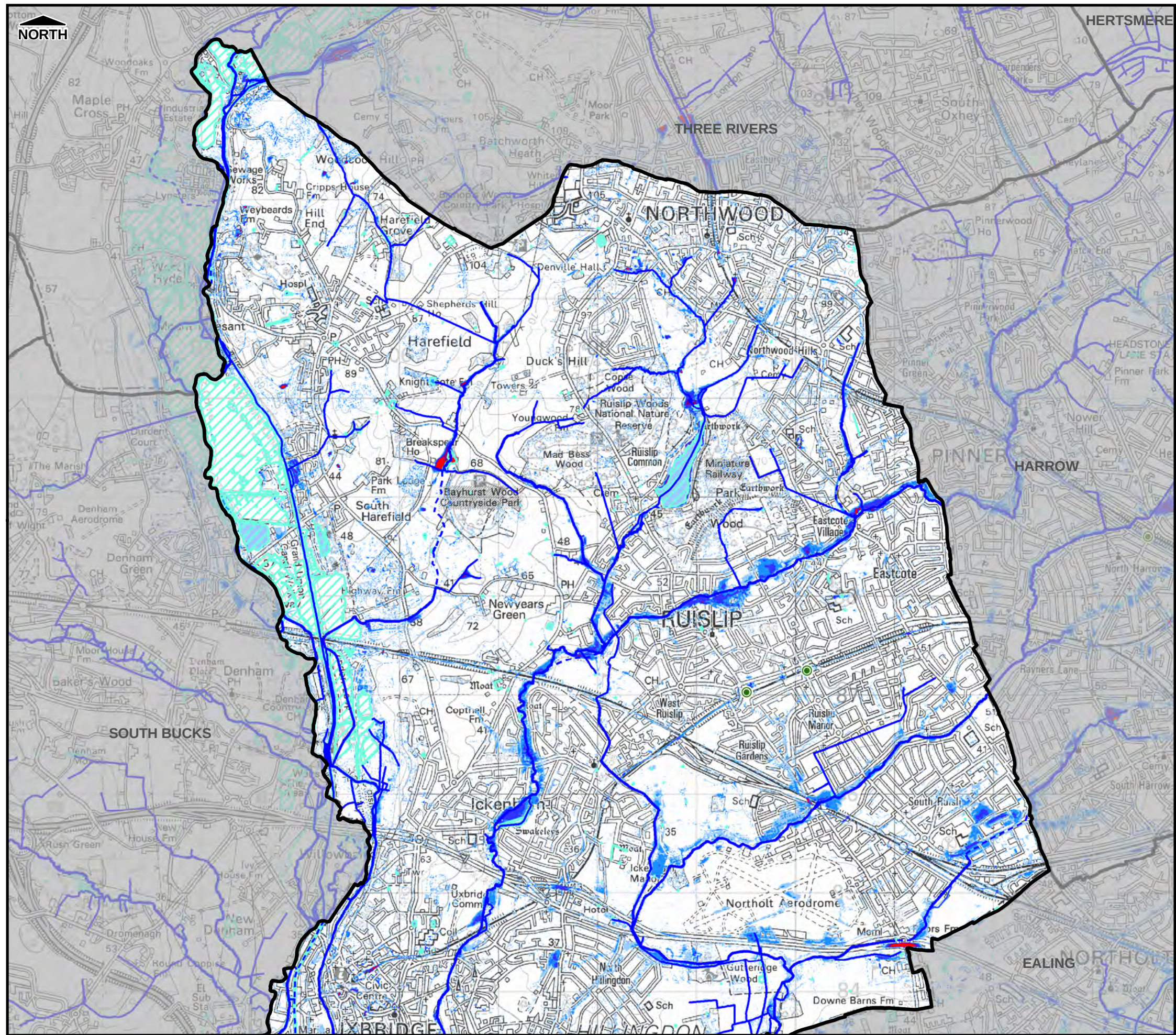
16.4 Appendix 4 – Historical Flood Incident Maps

16.4.1 EA Historic Flood Outlines



16.4.2 Map Recorded Surface Water Flooding

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THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Culverted Watercourse (Main River)
- Permanent Water Bodies
- Surface Water Flooding Incidents
- Surface Water Flood Outline

Flood Depth

< 0.1m	0.5m - 1.0m
0.1m - 0.25m	1.0m - 1.5m
0.25m - 0.5m	> 1.5m

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood/hazard extents shown.

London Borough of Hillingdon

Surface Water Management Plan

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Scale at A3 1:40,000	Date 08/04/2011	Drawn by R.MOORE	Approved by P.HLINOVSKY
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1 in 100 year rainfall event depth and recorded surface water flood incidents

Consultants

Capita Symonds
Level Seven,
52 Grosvenor Gardens,
Belgravia,
London
SW1W 0AU

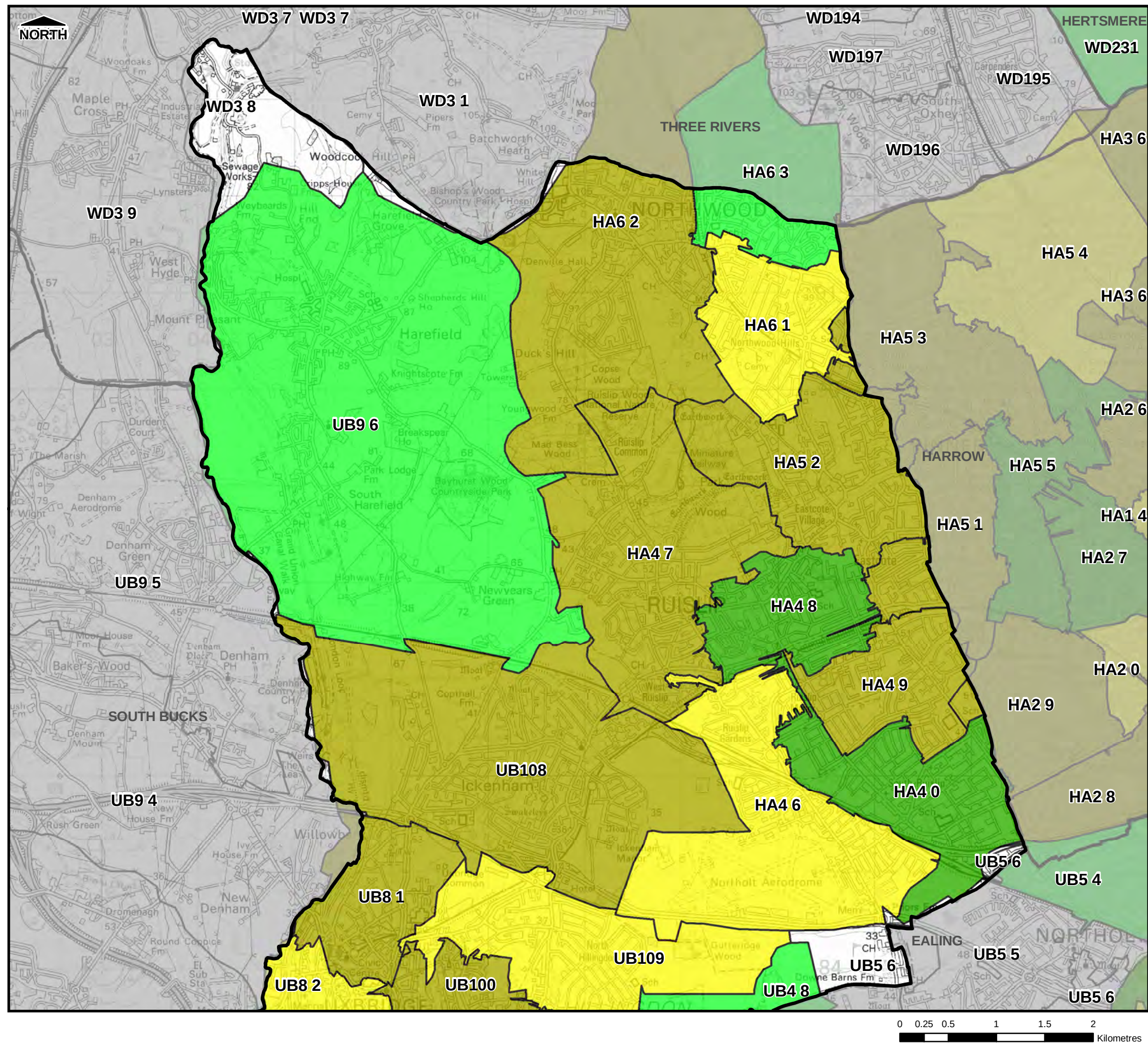
Drain London Programme Board Members

GREATER LONDON AUTHORITY

FIGURE 5.1

16.4.3 Map Recorded Sewer Flooding

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THIS DRAWING MAY BE USED ONLY FOR
THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Sewer Flooding Incidents
- Sewer Flood Outline
- No. of Sewer Flood Records
 - None
 - 1 - 5
 - 6 - 10
 - 11 - 20
 - 21 - 50
 - 51 - 100
 - 101+

Notes

- Sewer flood records relate to internal and external flooding of properties
- Data supplied by Thames Water Ltd and is correct as at June 2010

London Borough of Hillingdon



Preliminary Flood Risk Assessment

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Scale at A3	Date	Drawn by	Approved by
1:40,000	06/04/2011	R.MOORE	P.HLINOVSKY

Summary Map of Past Floods - Sewer Incidents

Consultants
CAPITA SYMONDS Capita Symonds
Level Seven,
52 Grosvenor Gardens,
Belgravia,
London
SW1W 0AU

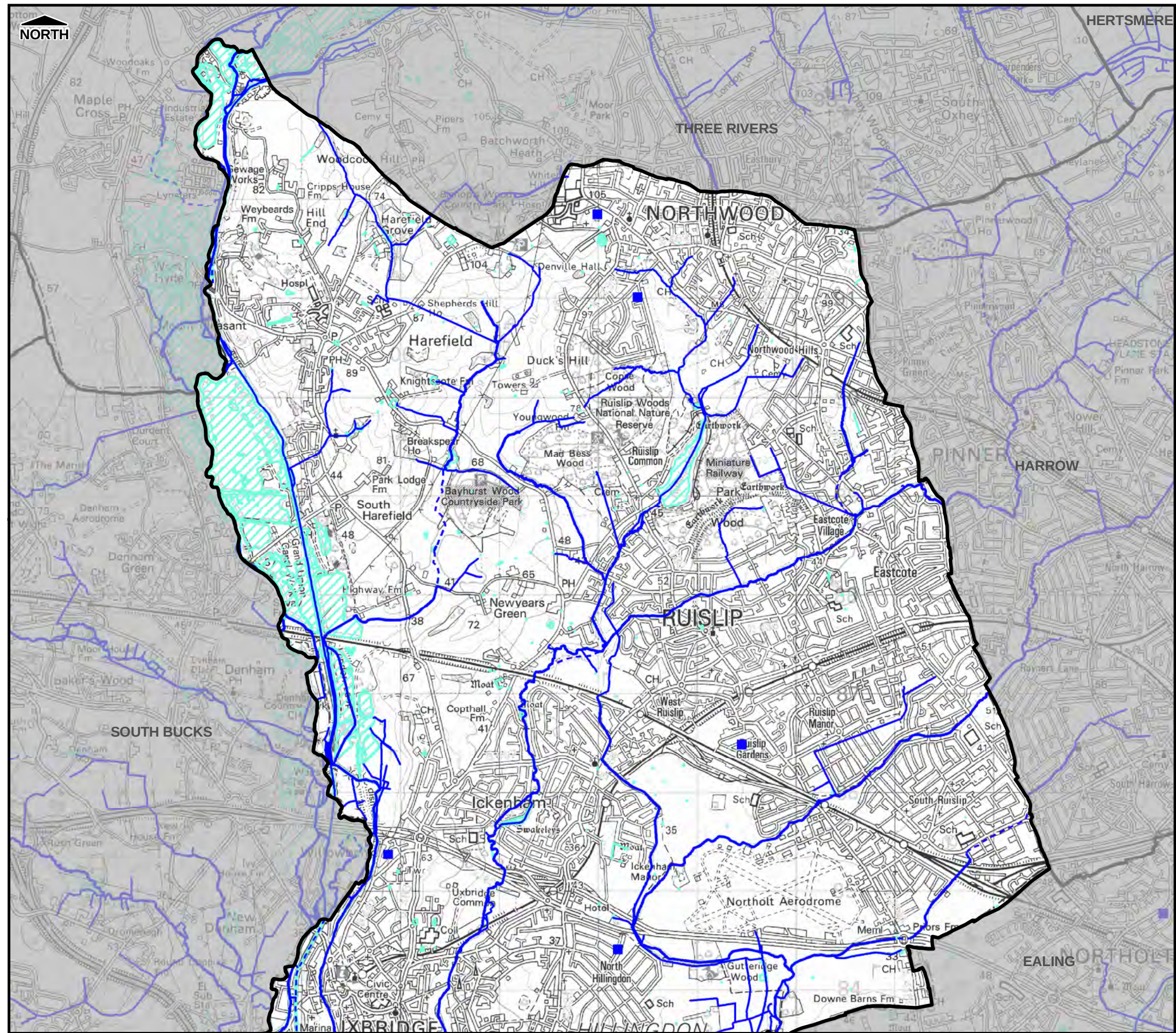
Drain London Programme Board Members



FIGURE A-4.1

16.4.4 Map of Recorded Groundwater Flooding

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THIS DRAWING MAY BE USED ONLY FOR
THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Culverted Watercourse (Main River)
- Permanent Water Bodies
- Groundwater Flood Incident (EA Records)
- Ground Water Flood Outline

Notes

London Borough of Hillingdon



Preliminary Flood Risk Assessment

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Scale at A3	Date	Drawn by	Approved by
1:40,000	06/04/2011	R.MOORE	P.HLINOVSKY

Summary Map of Past Floods - Ground Water Incidents

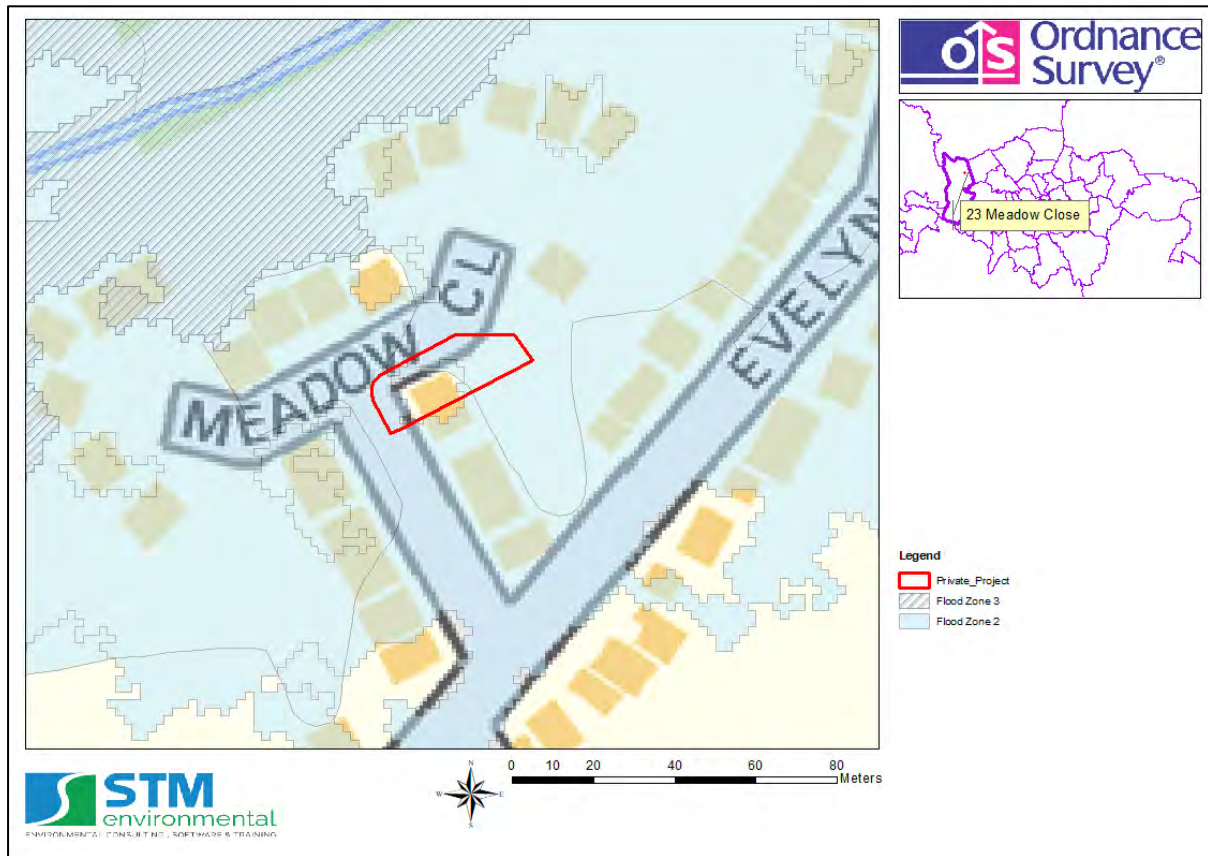
Consultants	Capita Symonds Flood Risk Management	Scot Wilson	Capita Symonds Level Seven, 52 Grosvenor Gardens, Belgravia, London SW1W 0AU
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Drain London Programme Board Members



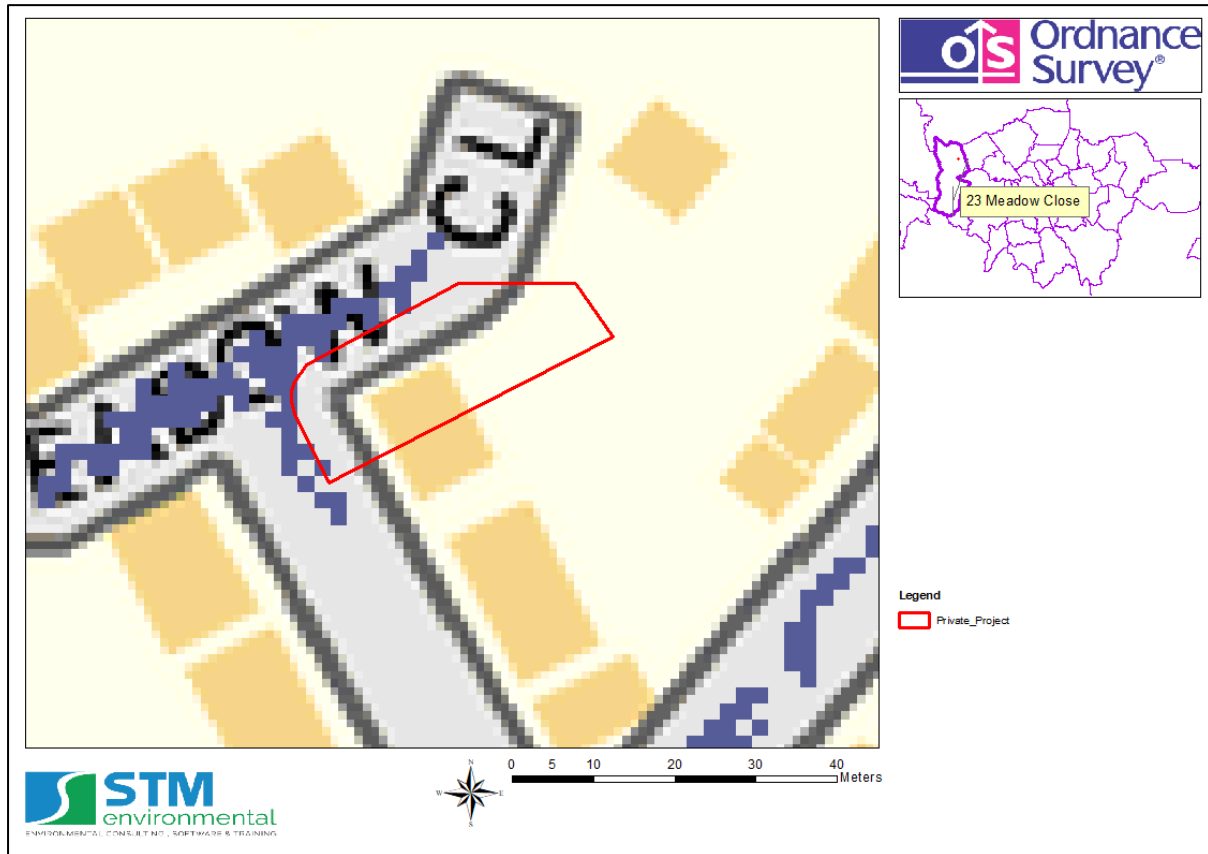
FIGURE A-3.1

16.5 Appendix 5 - EA Flood Zone Map

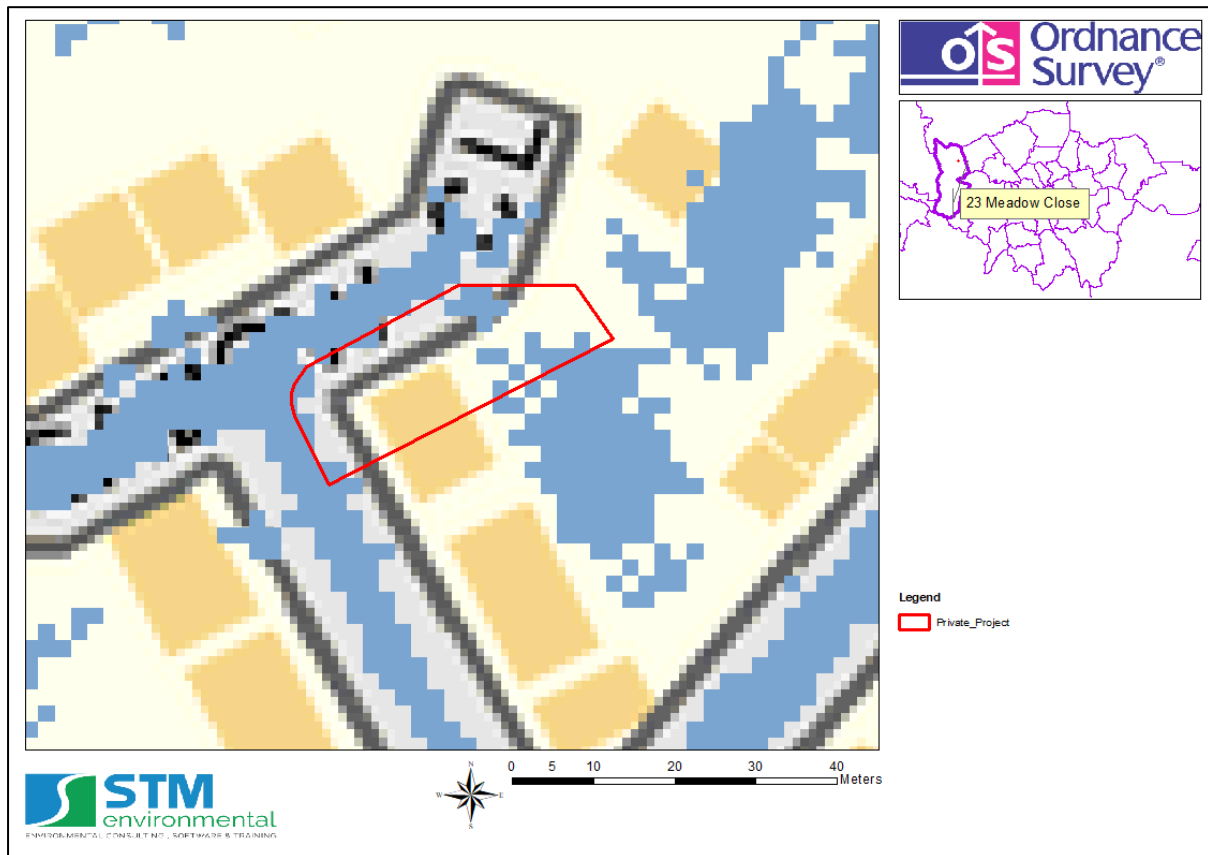


16.6 Appendix 6 – Surface Water Flood Extent and Depth Maps

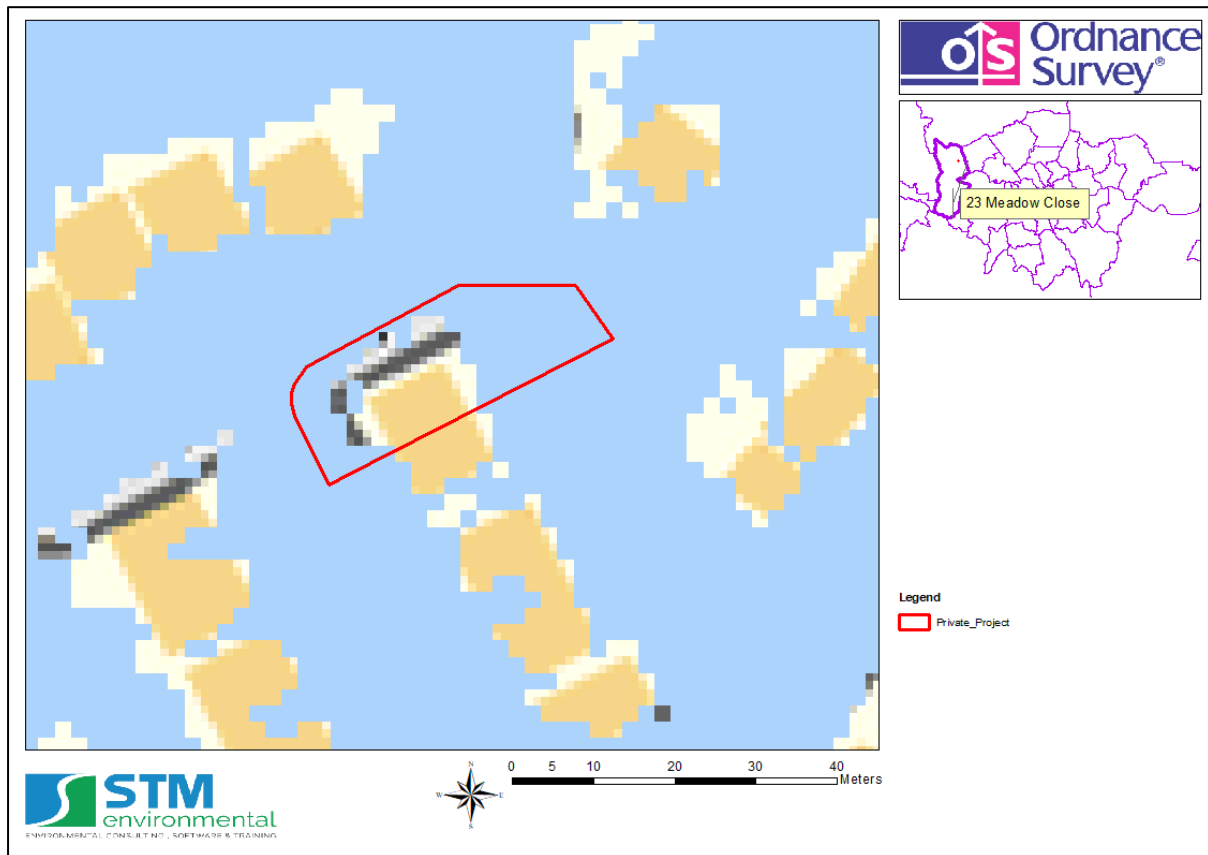
16.6.1 Map showing surface water flood extent for the 1 in 30-year rainfall return period (Source: EA, 2016).



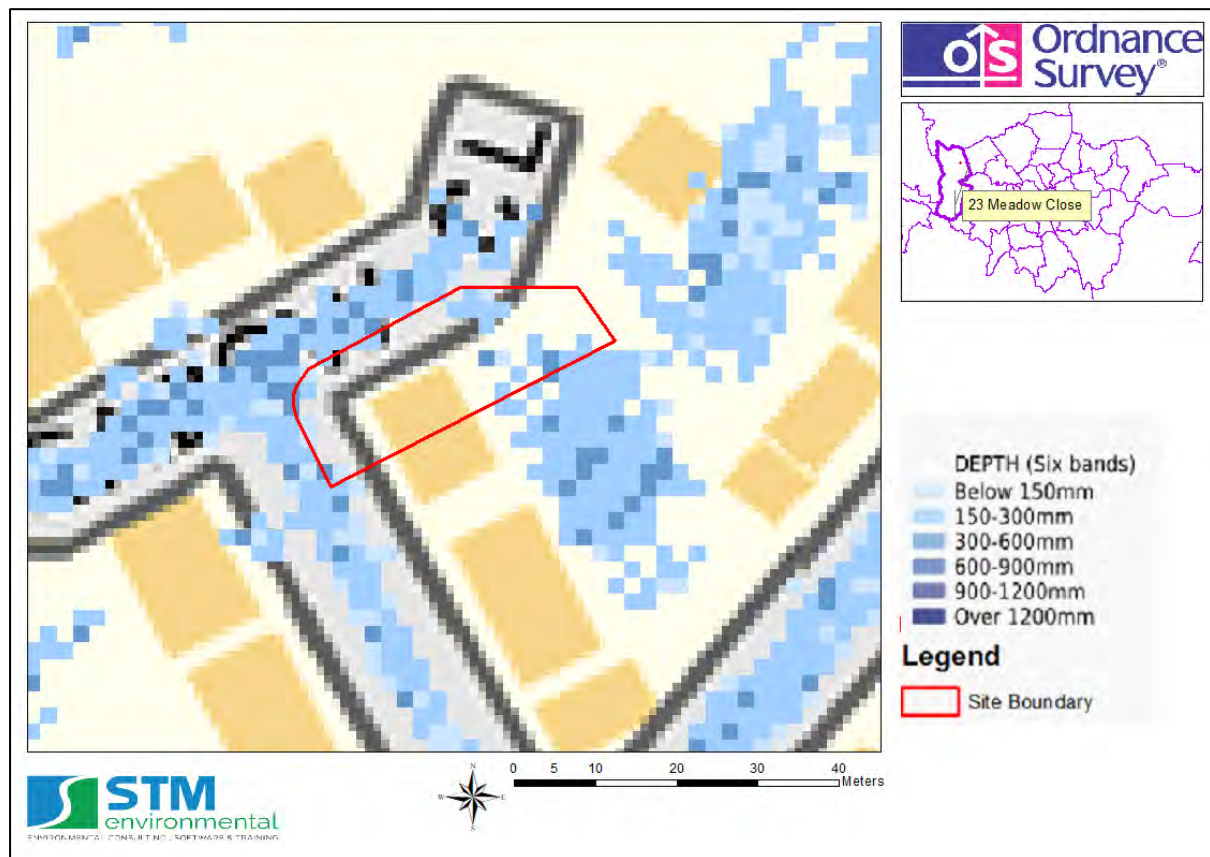
16.6.2 Map showing surface water flood extent for the 1 in 100-year rainfall return period (Source: EA, 2016).



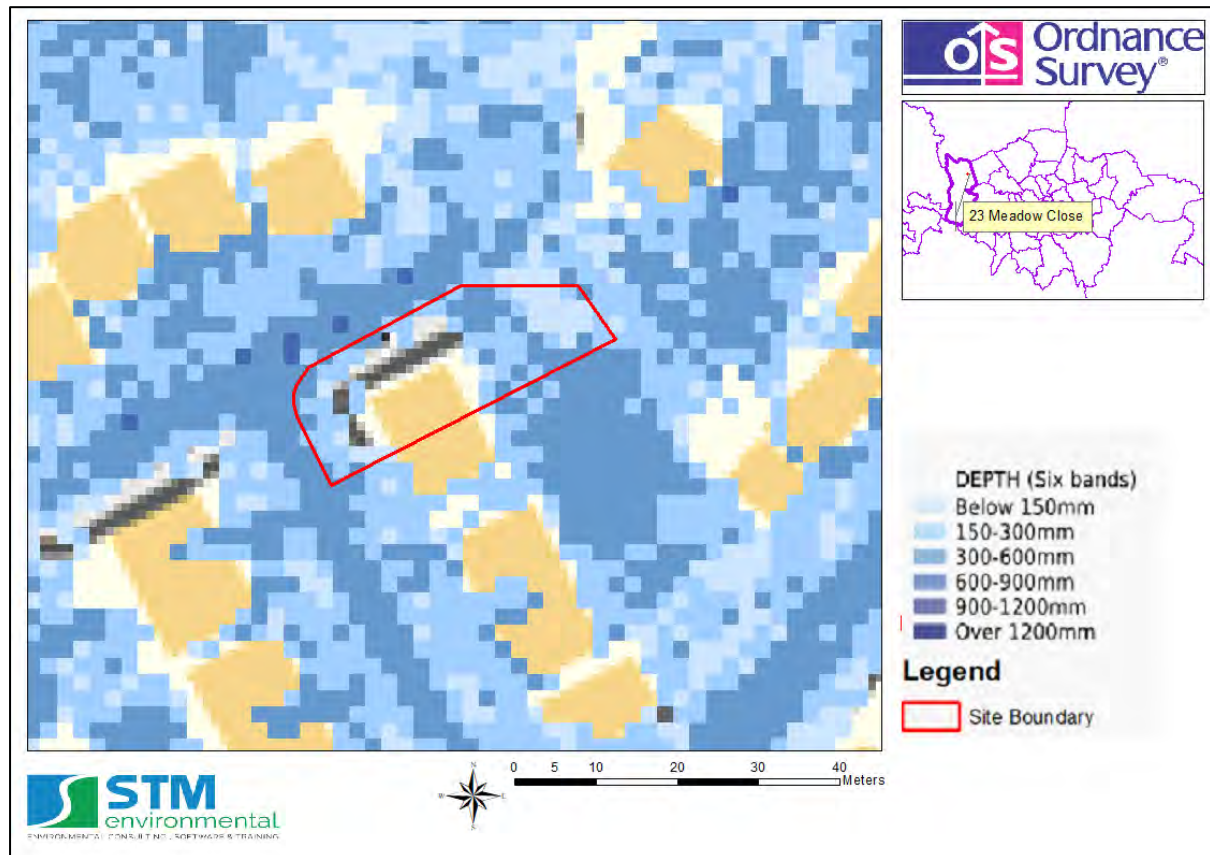
16.6.3 Map showing surface water flood extent for the 1 in 1000-year rainfall return period (Source: EA, 2016).



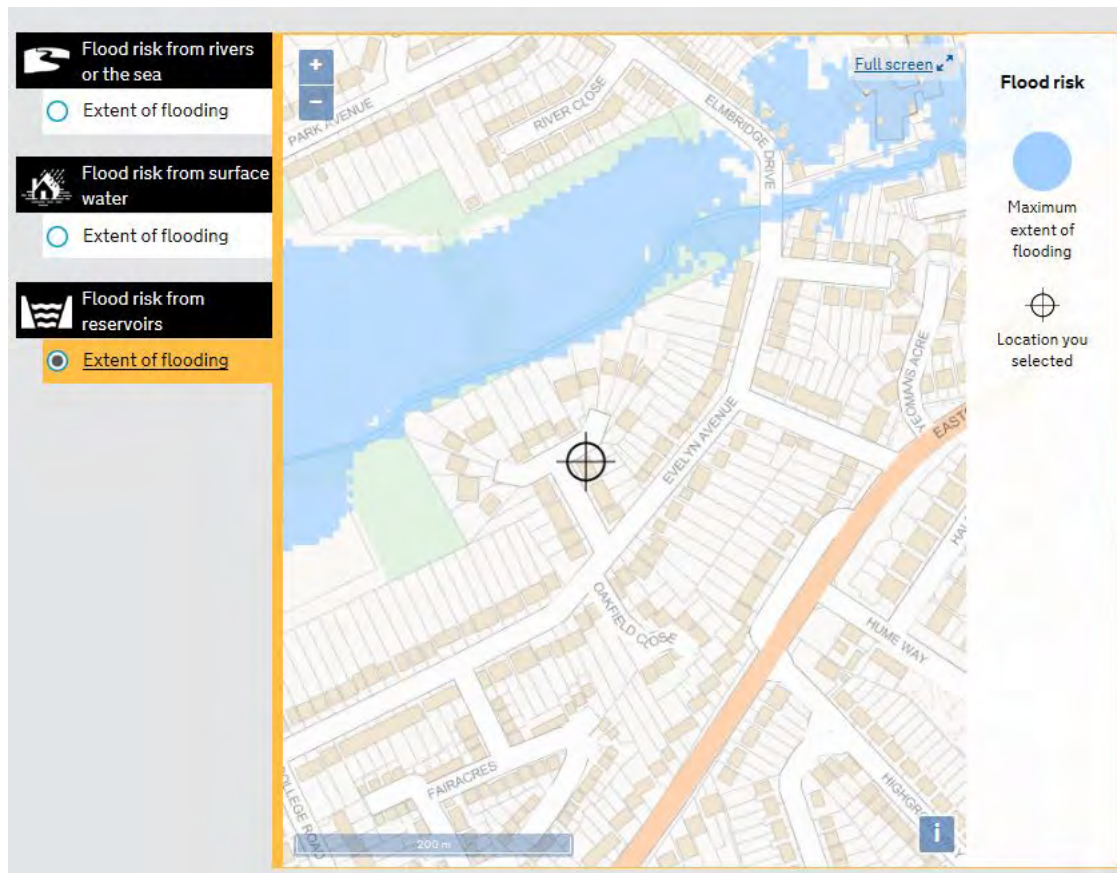
16.6.4 Predicted surface water flood depth for the 1 in 100-year return period
(Source: EA, 2016).



16.6.5 Predicted surface water flood depth for the 1 in 1000-year return period
(Source: EA, 2016).

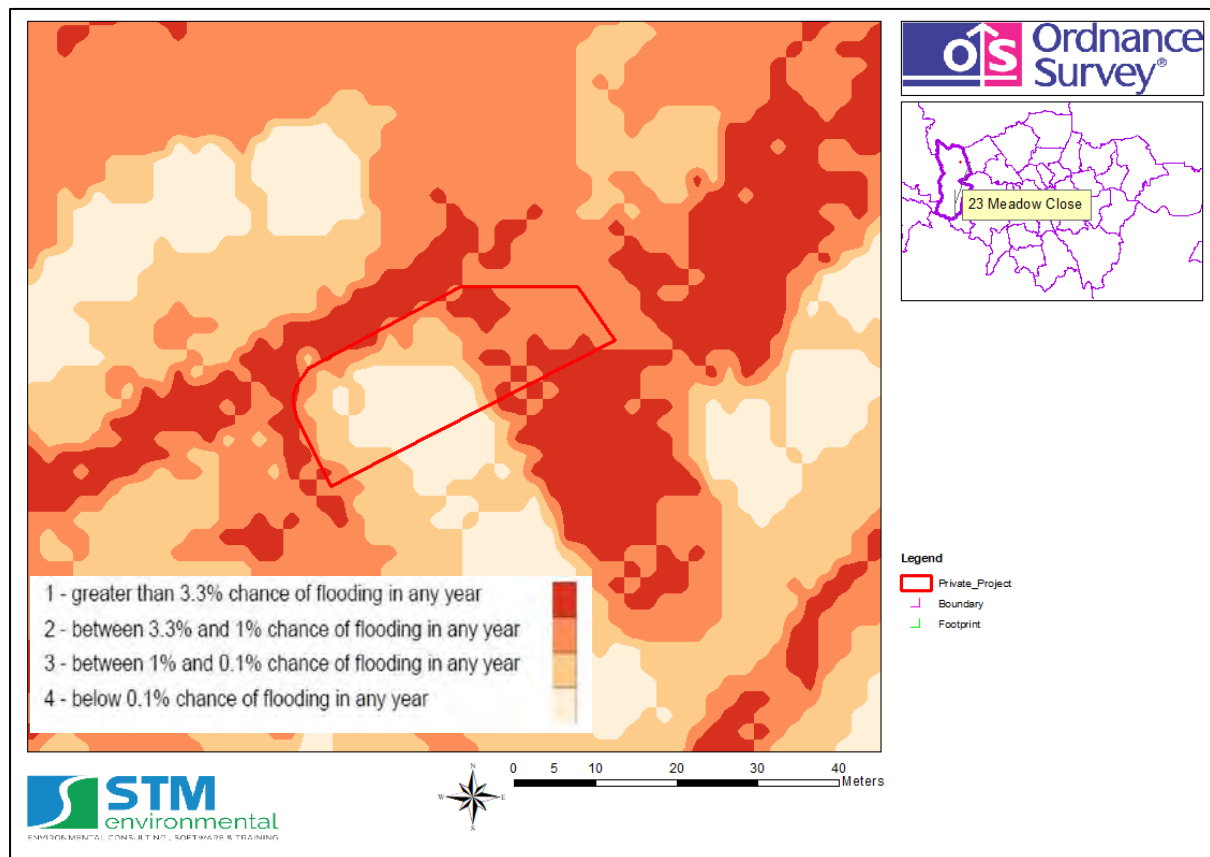


16.7 Appendix 7 – Reservoir Flood Risk Maps

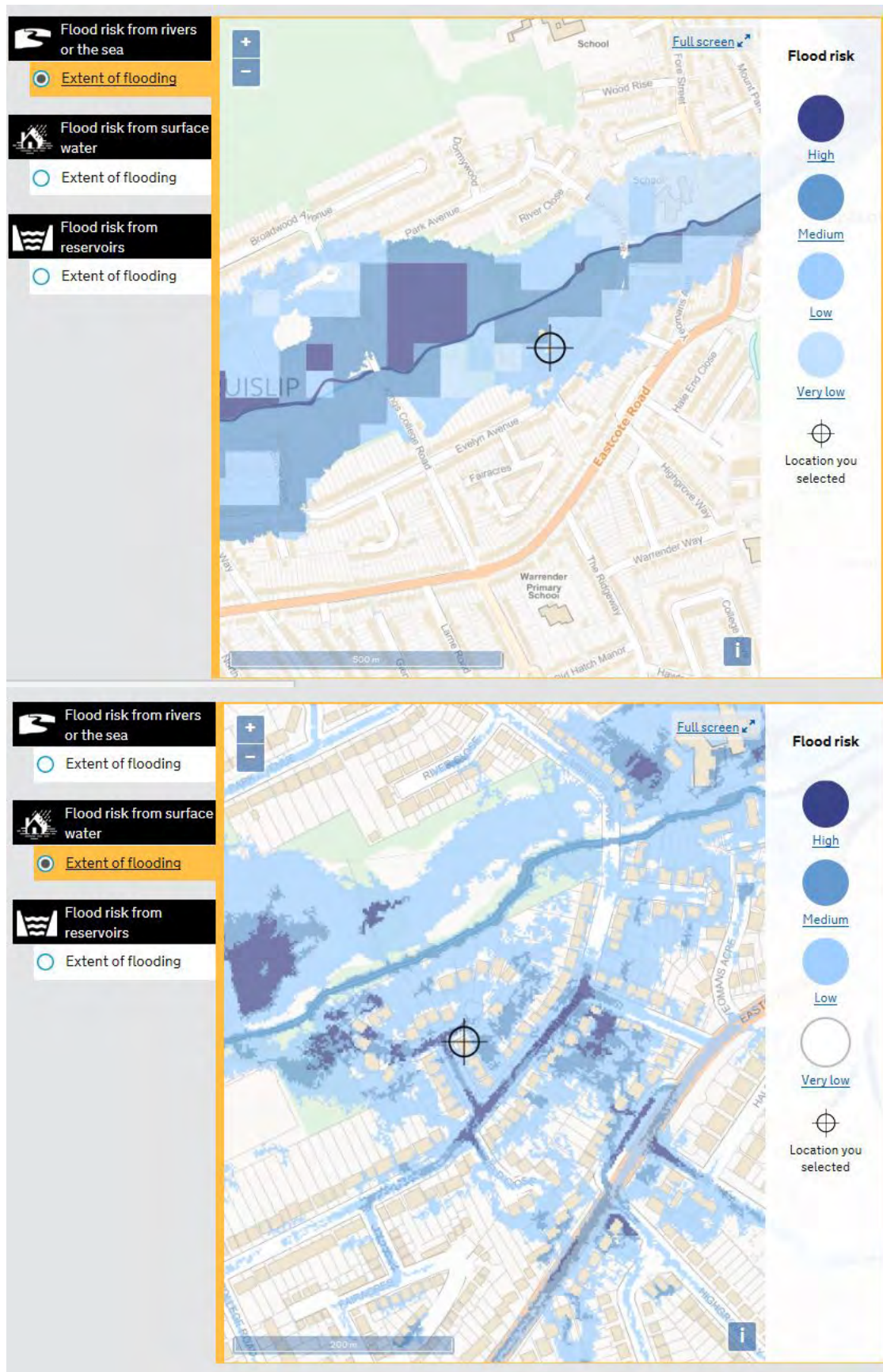


16.8 Appendix 8 – Flood Risk Maps

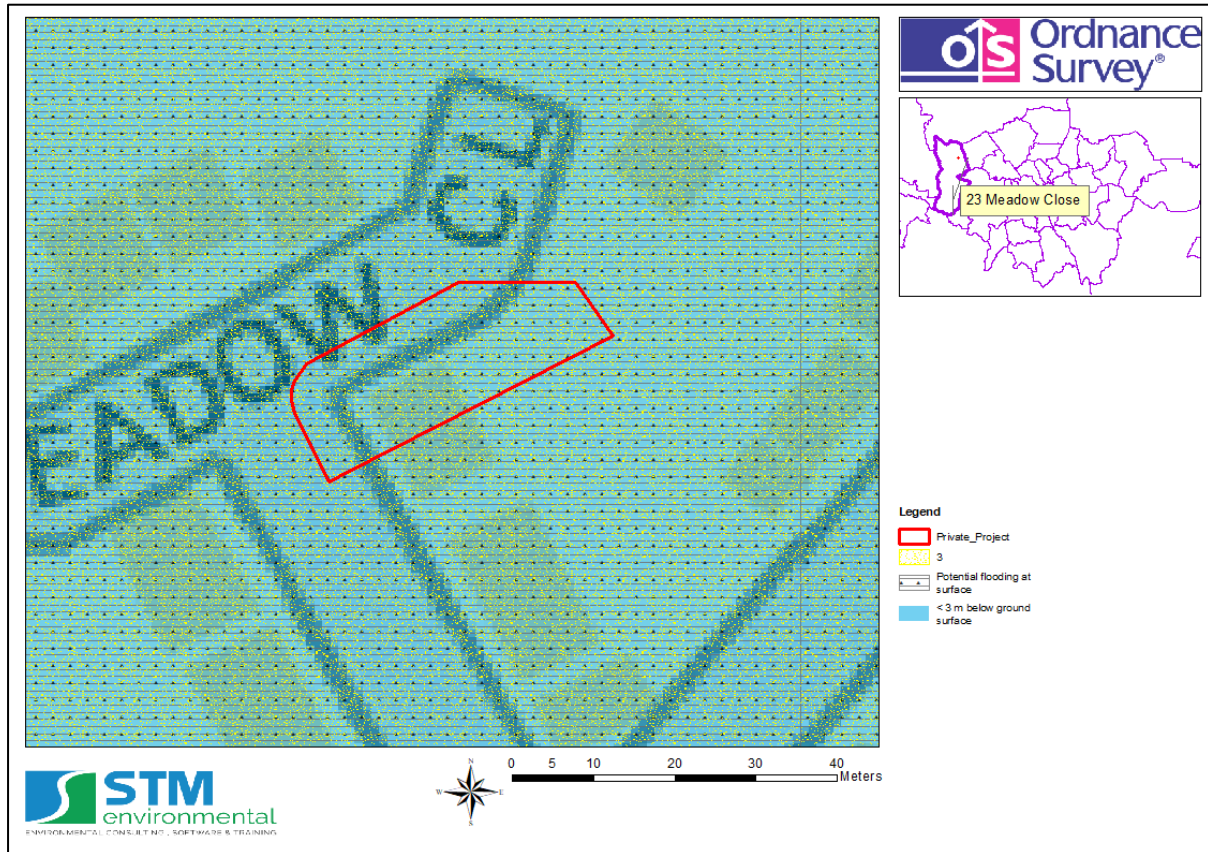
16.8.1 Risk of Flooding from Multiple Sources Map



16.8.2 Long Term Flood Risk Maps

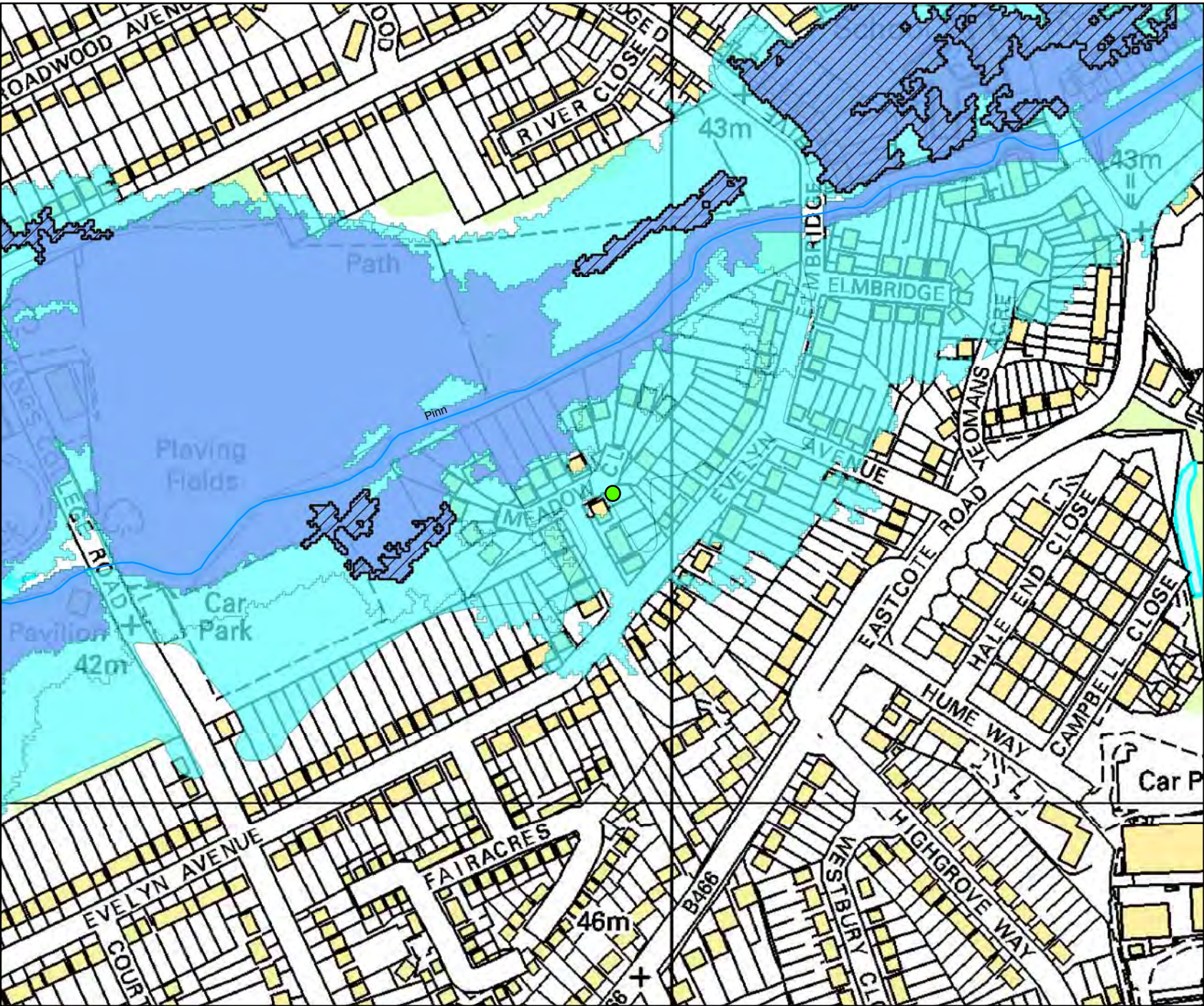


16.9 Appendix 9 – Groundwater Flood Susceptibility Map

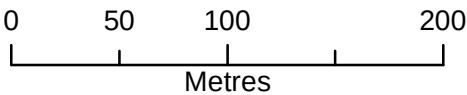


16.10 Appendix 10 - EA Product 4 (Detailed Flood Risk) Data

Flood Map for Planning centred on: 23 Meadow Close, Ruislip, HA4 8AP - 16/05/2019 - HNL 127385/AS



Environment Agency
Alchemy,
Bessemer Road,
Welwyn Garden City,
Hertfordshire,
AL7 1HE



Legend

- Main Rivers
- Site location

Flood Map for Planning

- Flood Storage Area
- Areas Benefiting from Flood Defences
- Flood Zone 3
- Flood Zone 2

Flood Map for Planning (assuming no defences)

Flood Zone 3 shows the area that could be affected by flooding:
- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

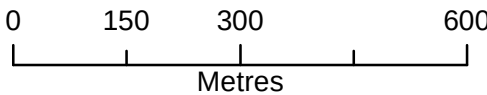
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Flood Map for Planning centred on: 23 Meadow Close, Ruislip, HA4 8AP - 16/05/2019 - HNL 127385/AS



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Alchemy,
Bessemer Road,
Welwyn Garden City,
Hertfordshire,
AL7 1HE



Legend

- Main Rivers
- Site location

Flood Map for Planning

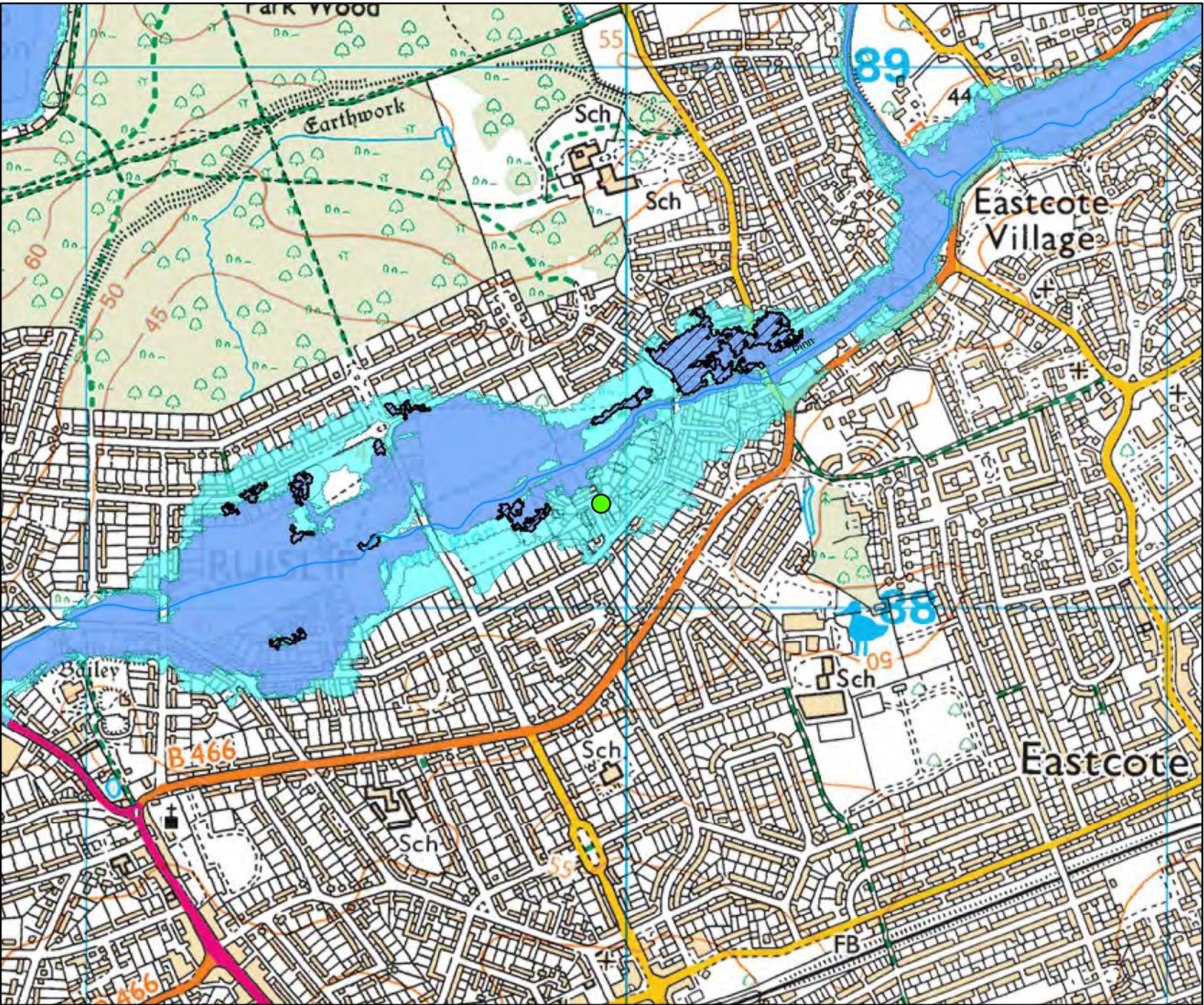
- Flood Storage Area
- Areas Benefiting from Flood Defences
- Flood Zone 3
- Flood Zone 2

Flood Map for Planning (assuming no defences)

Flood Zone 3 shows the area that could be affected by flooding:
- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

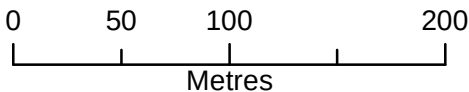
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Bessemer Road,
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Hertfordshire,
AL7 1HE



Legend

- Main Rivers
- Site location

Defended Flood Outlines

- 1 in 2 year (50%) Defended
- 1 in 5 year (20%) Defended
- 1 in 10 year (10%) Defended

The data in this map has been extracted from the River Pinn Mapping Study (JBA, 2015). This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment. Modelled outlines take into account catchment wide defences.

Flood risk data requests including an allowance for climate change will be based on the 1 in 100 flood plus 20% allowance for climate change, unless otherwise stated. You should refer to 'Flood risk assessments: climate change allowances' to check if this allowance is still appropriate for the type of development you are proposing and its location. You may need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence.

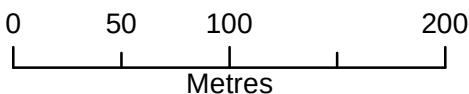
<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

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Hertfordshire,
AL7 1HE



Legend

- Main Rivers
- Site location

Defended Flood Outlines

- 1 in 20 year (5%) Defended
- 1 in 30 year (3.33%) Defended
- 1 in 50 year (2%) Defended

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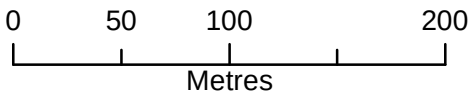
<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

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Legend

- Main Rivers
- Site location

Defended Flood Outlines

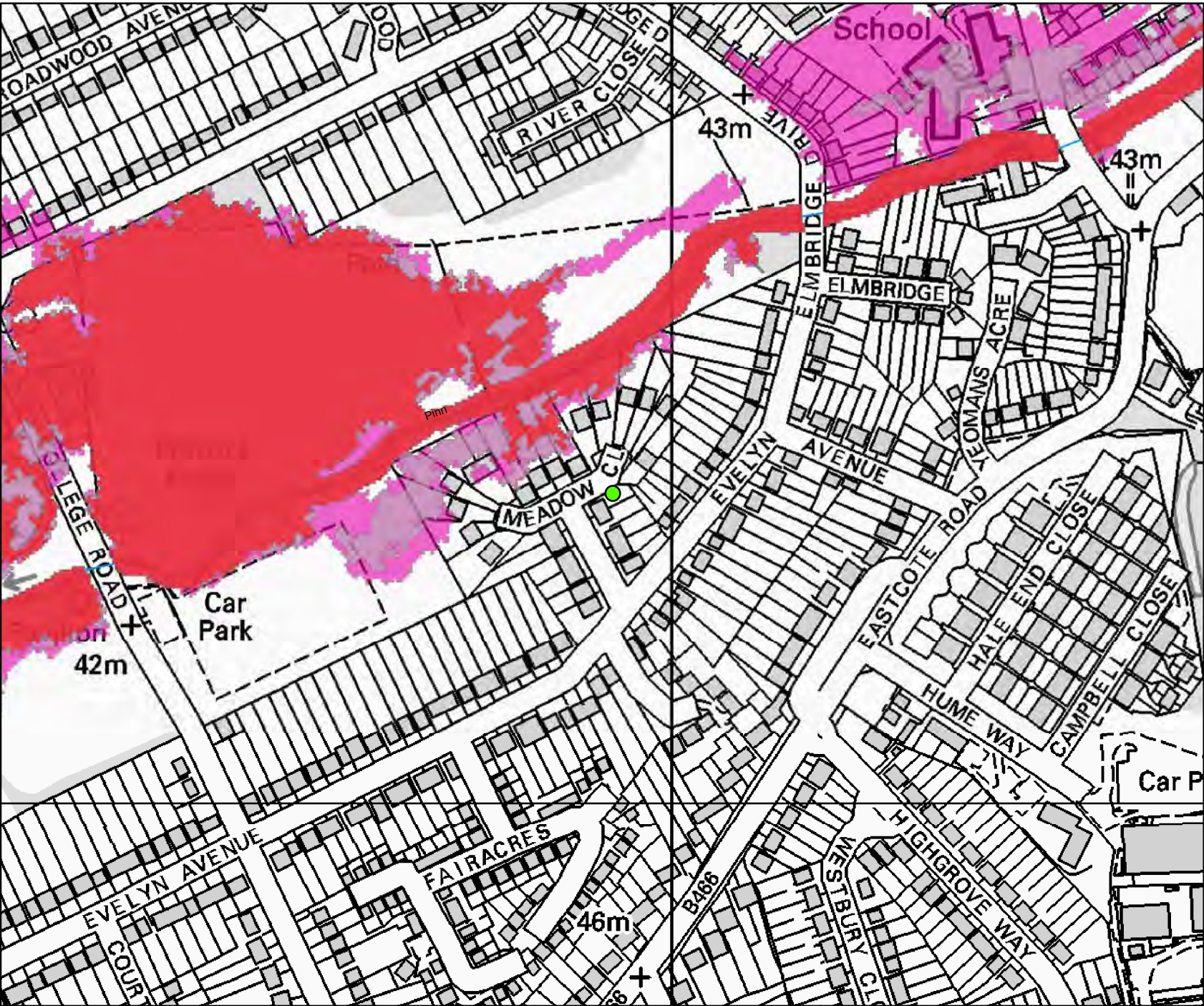
- 1 in 75 year (1.33%) Defended
- 1 in 100 year (1%) Defended
- 1 in 100 year + 20% (*CC) Defended

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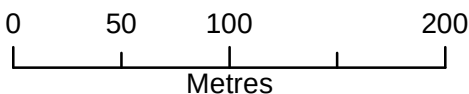
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Legend

- Main Rivers
- Site location

Defended Flood Outlines

- 1 in 100 year + 25% (*CC) Defended
- 1 in 100 year + 35% (*CC) Defended
- 1 in 100 year + 70% (*CC) Defended

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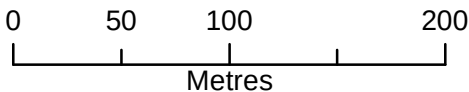
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Legend

- Main Rivers
- Site location

Defended Flood Outlines

- 1 in 250 year (0.4%) Defended
- 1 in 1000 year (0.1%) Defended

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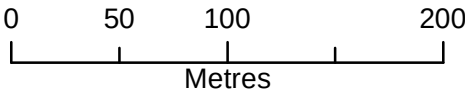
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Legend

- Main Rivers
- Site location

1D Node Results

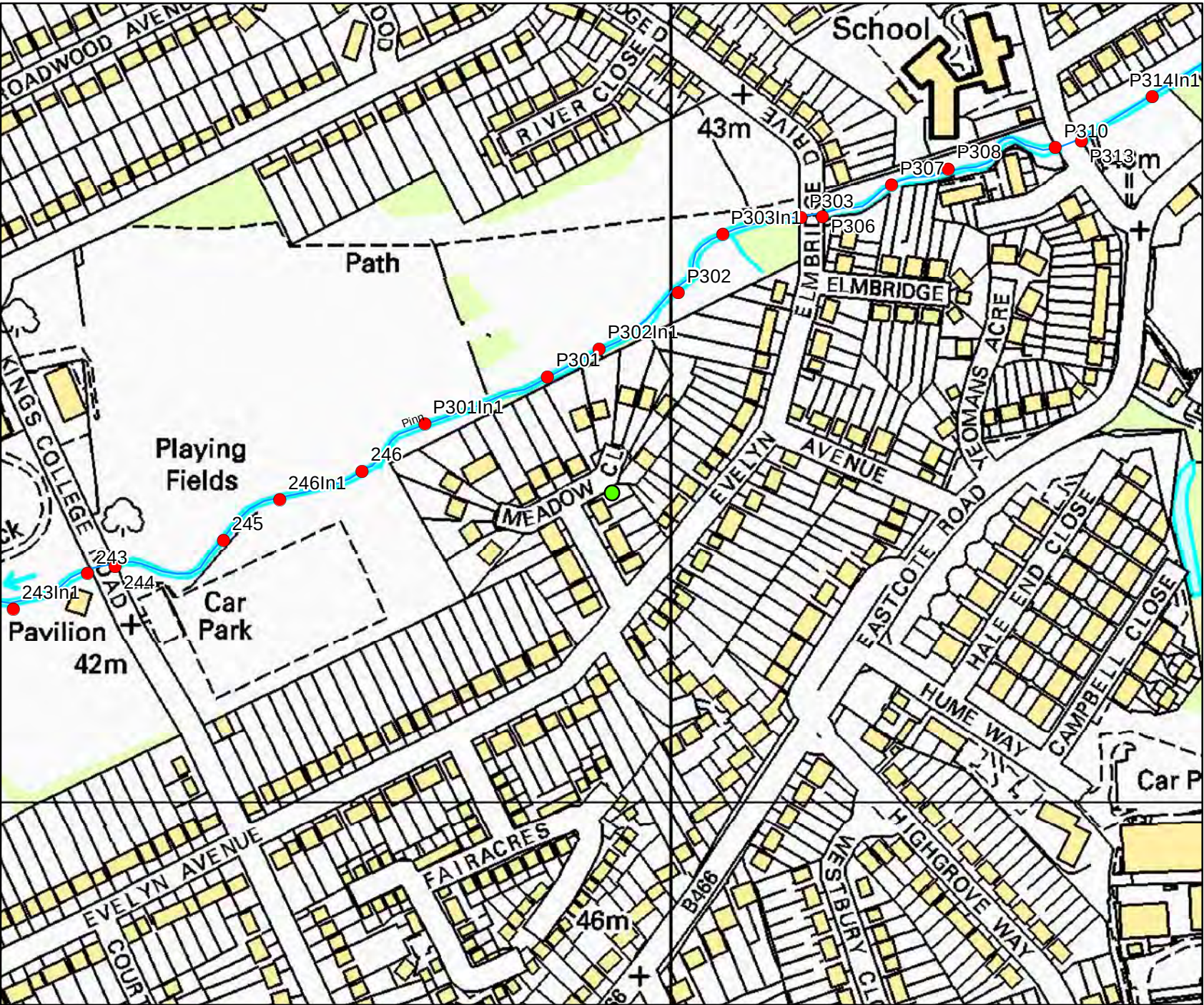
- Nodes

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Environment Agency ref: HNL 127385/AS

The following information has been extracted from the River Pinn Mapping Study (JBA, 2015)

Flood risk data requests including an allowance for climate change will be based on the 1 in 100 flood plus 20% allowance for climate change, unless otherwise stated. You should refer to 'Flood risk assessments: climate change allowances' to check if this allowance is still appropriate for the type of development you are proposing and its location. You may need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence.

<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

Caution:

This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites across the entire catchment.

All flood levels are given in metres Above Ordnance Datum (mAOD)

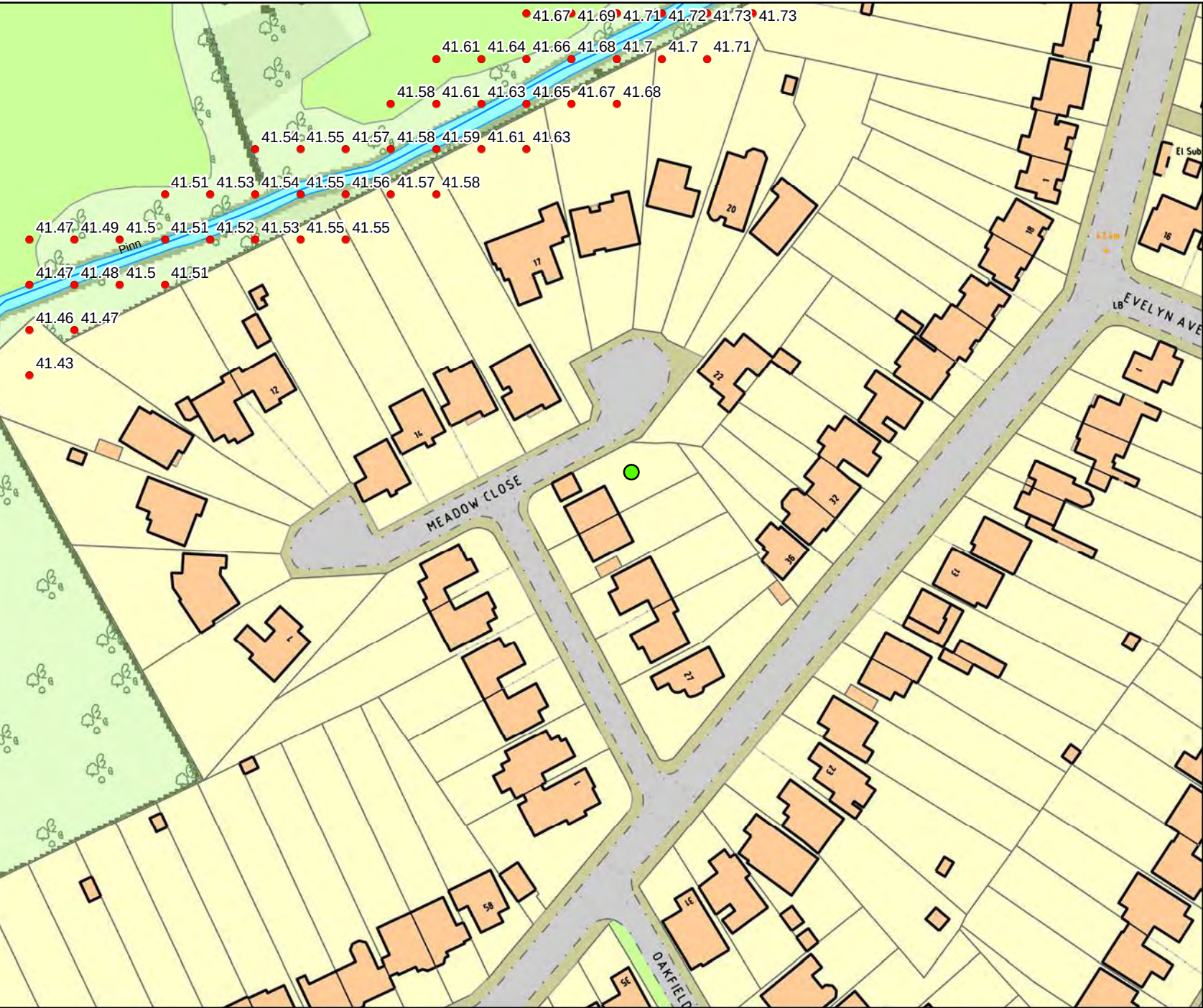
All flows are given in cubic metres per second (cumecs)

MODELLER FLOOD LEVEL

				Return Period												
Node Label	Easting	Northing	2 yr	5 yr	10 yr	20 yr	30 yr	50 yr	75 yr	100 yr	100yr + 20%	100yr + 25%	100yr + 35%	100yr + 70%	250 yr	1000yr
P314In1	510312	188456	42.33	42.56	42.66	42.76	42.83	42.92	43.00	43.07	43.19	43.22	43.30	43.46	43.29	43.54
P313	510266	188427	42.28	42.50	42.59	42.69	42.76	42.85	42.92	42.99	43.11	43.14	43.23	43.40	43.21	43.50
P310	510249	188423	42.27	42.49	42.59	42.68	42.75	42.83	42.91	42.97	43.08	43.11	43.19	43.36	43.18	43.44
P309	510210	188419	42.16	42.37	42.47	42.56	42.63	42.71	42.78	42.85	42.95	42.98	43.06	43.25	43.05	43.34
P308	510180	188409	42.11	42.32	42.41	42.51	42.57	42.65	42.72	42.78	42.87	42.90	42.98	43.18	42.96	43.28
P307	510143	188398	42.08	42.29	42.39	42.48	42.55	42.62	42.69	42.75	42.85	42.87	42.94	43.11	42.93	43.21
P306	510098	188378	41.92	42.12	42.21	42.30	42.36	42.43	42.50	42.55	42.64	42.66	42.71	42.84	42.70	42.93
P303	510084	188377	41.91	42.10	42.19	42.28	42.34	42.41	42.47	42.52	42.59	42.61	42.66	42.75	42.65	42.81
P303In1	510033	188366	41.85	42.04	42.13	42.21	42.27	42.33	42.38	42.43	42.49	42.50	42.54	42.61	42.54	42.65
P302	510005	188329	41.78	41.97	42.05	42.13	42.19	42.24	42.29	42.33	42.38	42.39	42.42	42.47	42.41	42.51
P302In1	509954	188292	41.68	41.87	41.96	42.04	42.09	42.15	42.20	42.23	42.28	42.29	42.32	42.36	42.31	42.39
P301	509920	188274	41.59	41.78	41.86	41.95	42.00	42.05	42.09	42.12	42.16	42.17	42.18	42.21	42.18	42.24
P301In1	509840	188244	41.48	41.67	41.76	41.84	41.89	41.94	41.98	42.01	42.05	42.05	42.07	42.12	42.07	42.16
246	509800	188213	41.37	41.56	41.64	41.72	41.77	41.82	41.86	41.89	41.94	41.95	41.98	42.04	41.97	42.11
246In1	509747	188195	41.29	41.47	41.56	41.63	41.68	41.74	41.80	41.84	41.89	41.90	41.93	42.01	41.93	42.08
245	509710	188168	41.22	41.40	41.48	41.55	41.60	41.68	41.76	41.80	41.87	41.89	41.92	42.01	41.92	42.08
244	509640	188151	41.11	41.25	41.32	41.38	41.41	41.49	41.57	41.62	41.68	41.70	41.73	41.81	41.72	41.89
243	509622	188147	41.10	41.24	41.31	41.36	41.39	41.46	41.53	41.57	41.62	41.63	41.65	41.71	41.65	41.76
243In1	509574	188124	41.01	41.12	41.17	41.21	41.23	41.27	41.31	41.34	41.39	41.41	41.43	41.53	41.43	41.64

MODELLED FLOWS

				Return Period												
Node Label	Easting	Northing	2 yr	5 yr	10 yr	20 yr	30 yr	50 yr	75 yr	100 yr	100yr + 20%	100yr + 25%	100yr + 35%	100yr + 70%	250 yr	1000yr
P314In1	510312	188456	5.02	6.72	7.59	8.50	9.21	10.16	11.05	11.89	13.38	13.65	14.09	14.44	14.04	16.05
P313	510266	188427	5.03	6.72	7.59	8.50	9.21	10.16	11.05	11.89	13.38	13.66	14.15	14.88	14.08	15.10
P310	510249	188423	5.03	6.72	7.59	8.50	9.21	10.16	11.05	11.89	13.38	13.66	14.15	14.88	14.08	15.10
P309	510210	188419	5.02	6.72	7.59	8.50	9.21	10.16	11.05	11.89	13.39	13.71	14.31	15.48	14.22	17.12
P308	510180	188409	5.02	6.72	7.59	8.50	9.21	10.16	11.05	11.89	13.39	13.72	14.55	16.20	14.41	17.64
P307	510143	188398	5.02	6.72	7.59	8.50	9.21	10.16	11.05	11.89	13.39	13.81	15.01	17.48	14.79	18.86
P306	510098	188378	5.03	6.72	7.59	8.50	9.21	10.16	11.05	11.89	13.39	13.81	15.00	18.17	14.80	20.38
P303	510084	188377	5.03	6.72	7.59	8.50	9.21	10.16	11.05	11.89	13.39	13.81	15.00	18.17	14.80	20.38
P303In1	510033	188366	5.16	6.91	7.82	8.79	9.50	10.47	11.40	12.26	13.82	14.19	15.41	18.51	15.19	20.54
P302	510005	188329	5.16	6.91	7.82	8.79	9.50	10.47	11.40	12.26	13.72	14.04	15.04	17.22	14.86	18.57
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243In1	509574	188124	5.30	7.09	7.98	8.77	9.26	10.32	11.03	11.56	12.28	12.41	12.75	13.51	12.68	13.93





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0153060

Metres

Legend

Main Rivers

Site location

2D Node Results: Heights

1 in 2 year (50%) Defended

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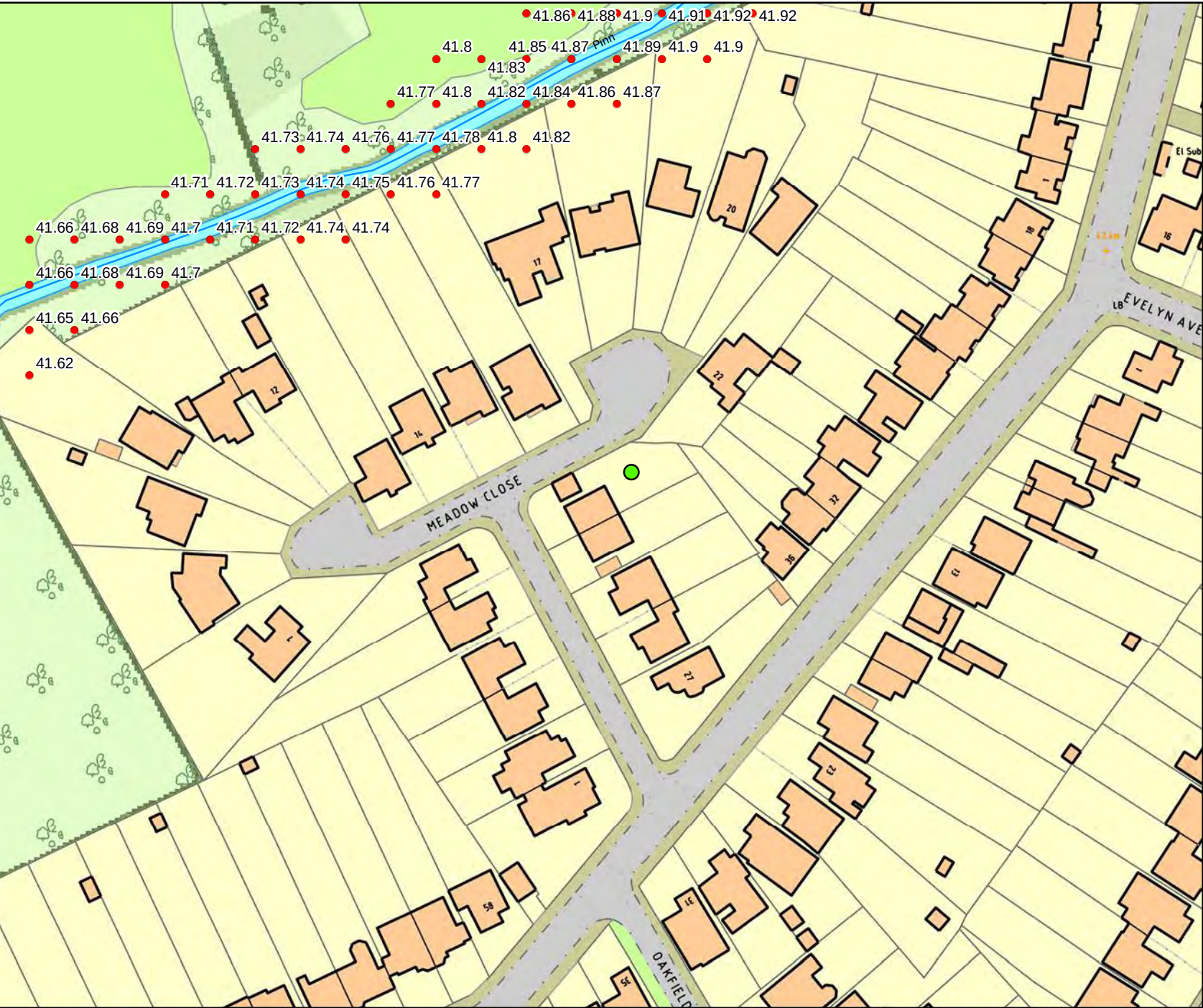
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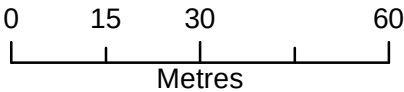
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Detailed FRA centred on:

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Legend

- Main Rivers
- Site location

2D Node Results: Heights

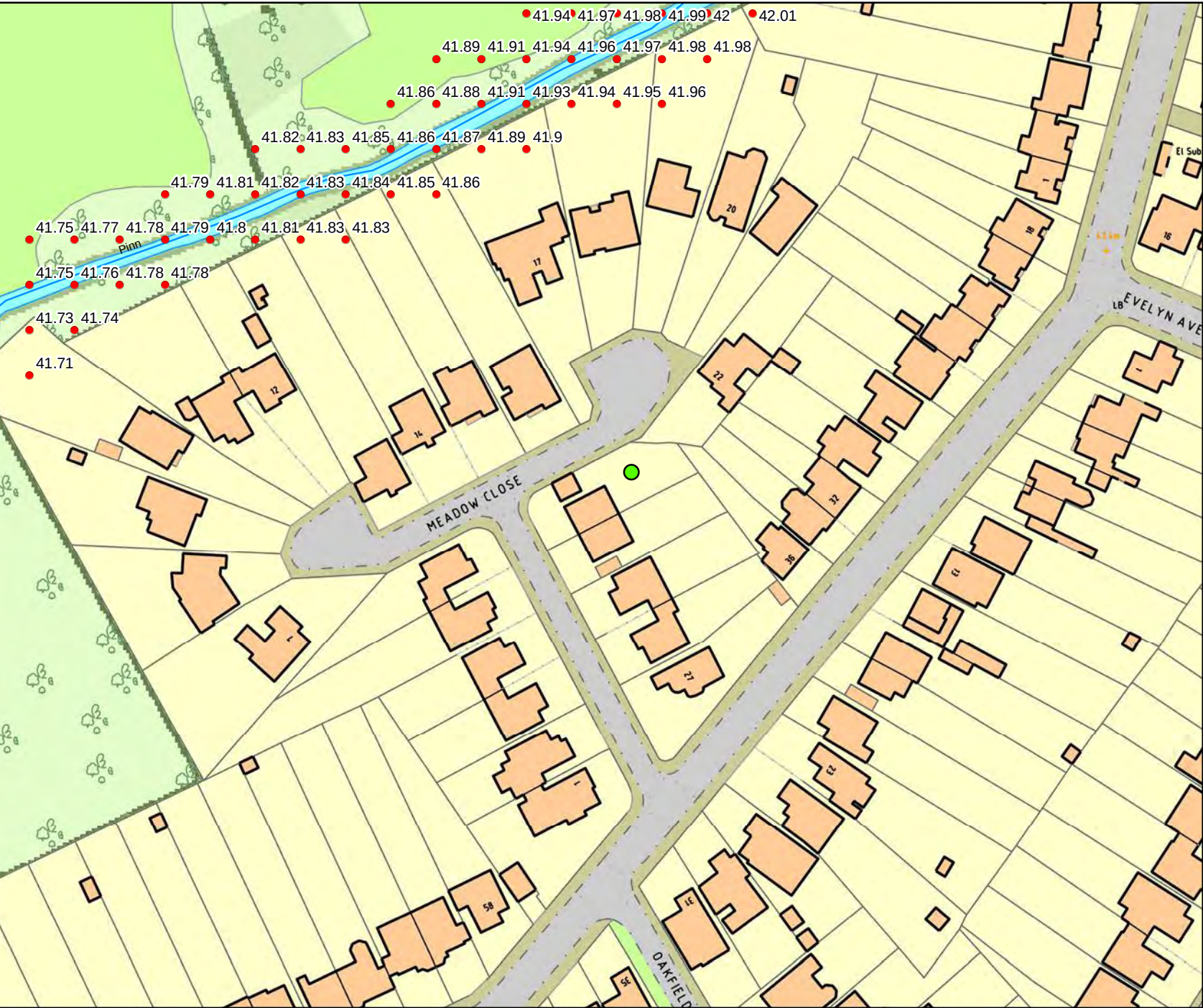
- 1 in 5 year (20%) Defended

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0153060

Metres

Legend

Main Rivers

Site location

2D Node Results: Heights

1 in 10 year (10%) Defended

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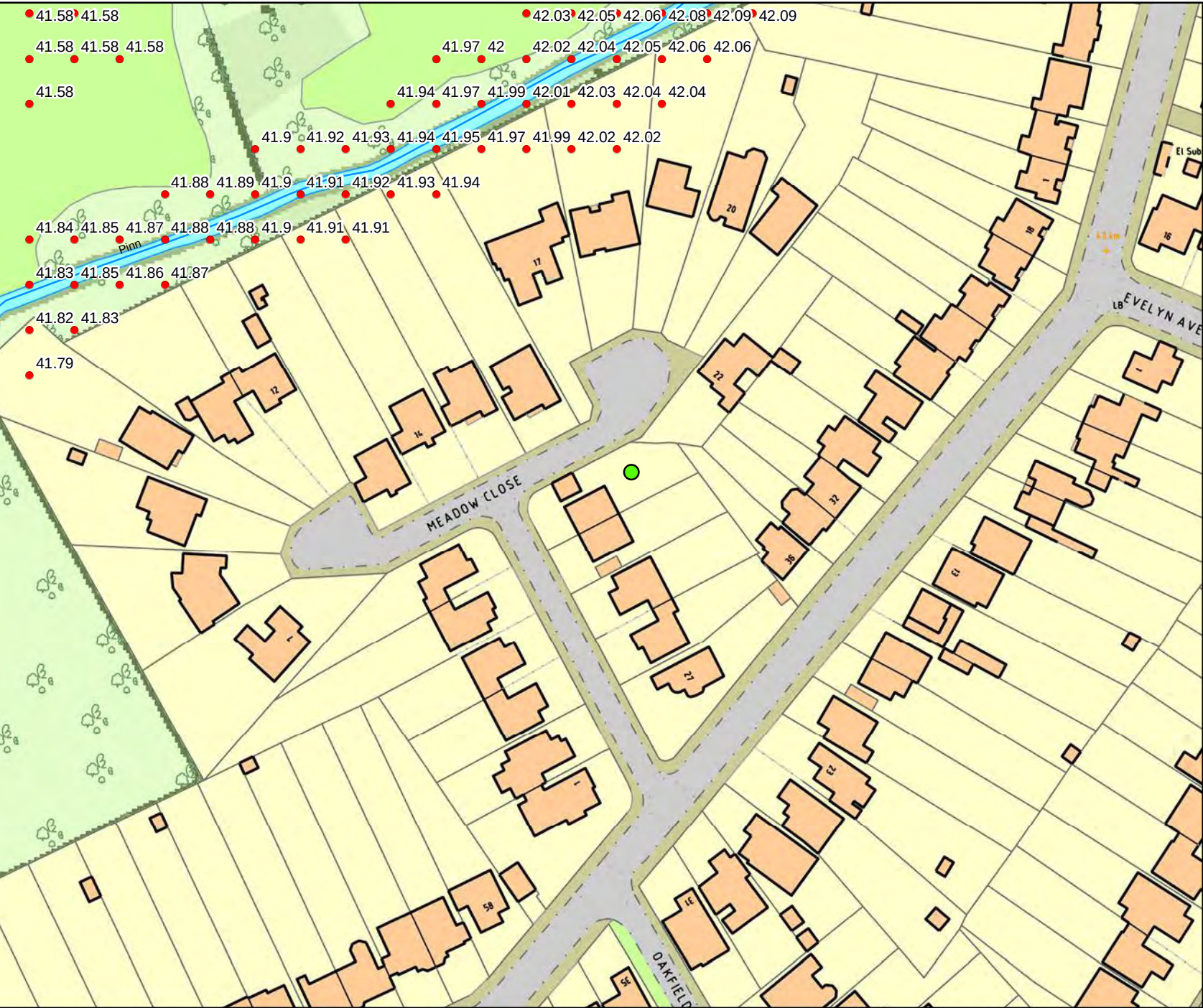
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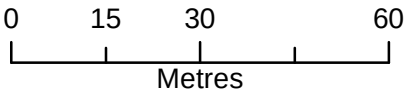
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Legend

- Main Rivers
- Site location

2D Node Results: Heights

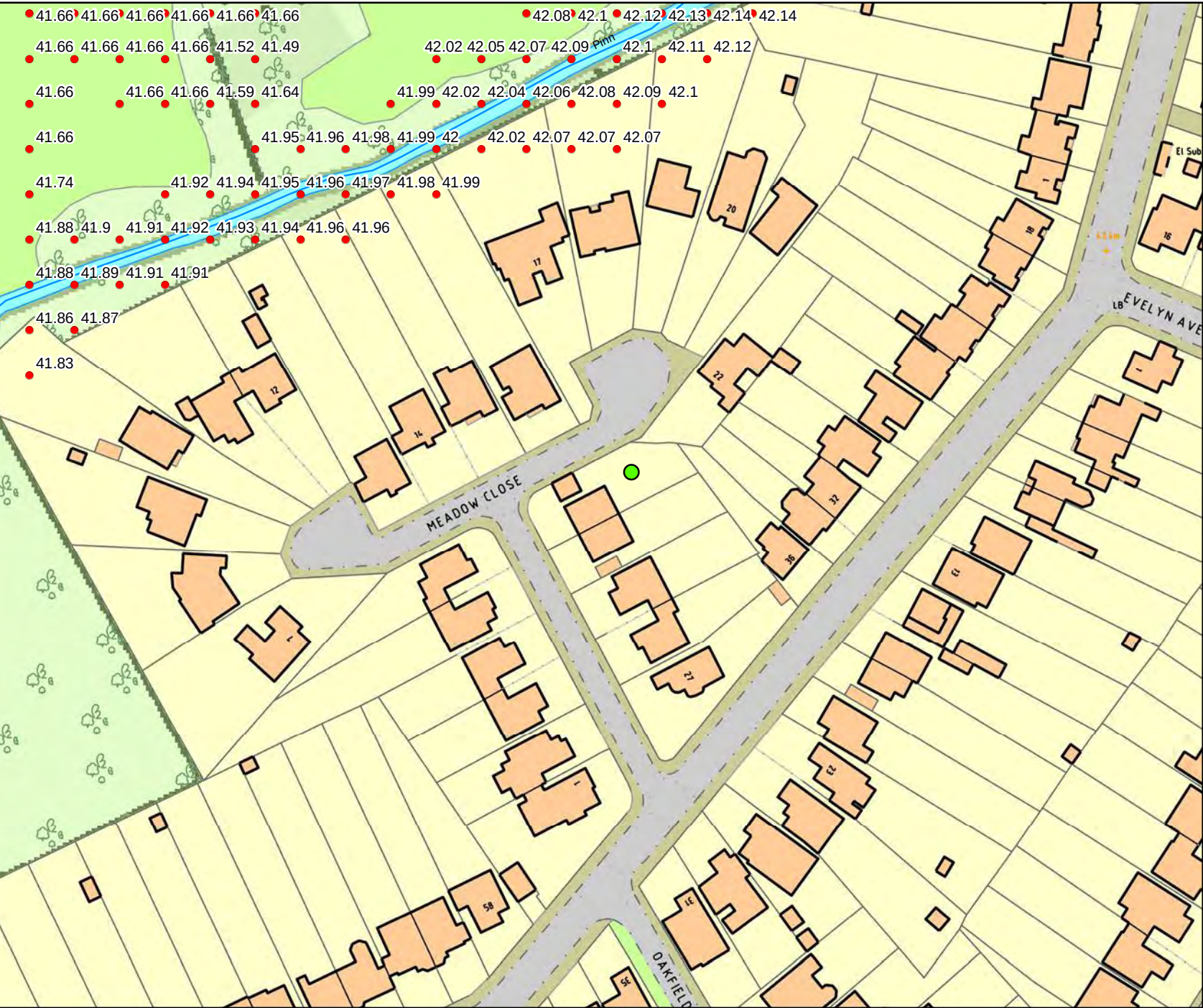
- 1 in 20 year (5%) Defended

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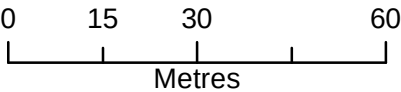
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Legend

- Main Rivers
- Site location

2D Node Results: Heights

- 1 in 30 year (3.33%) Defended

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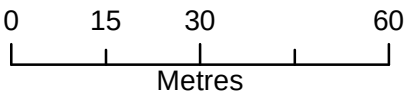
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Legend

- Main Rivers
- Site location

2D Node Results: Heights

- 1 in 50 year (2%) Defended

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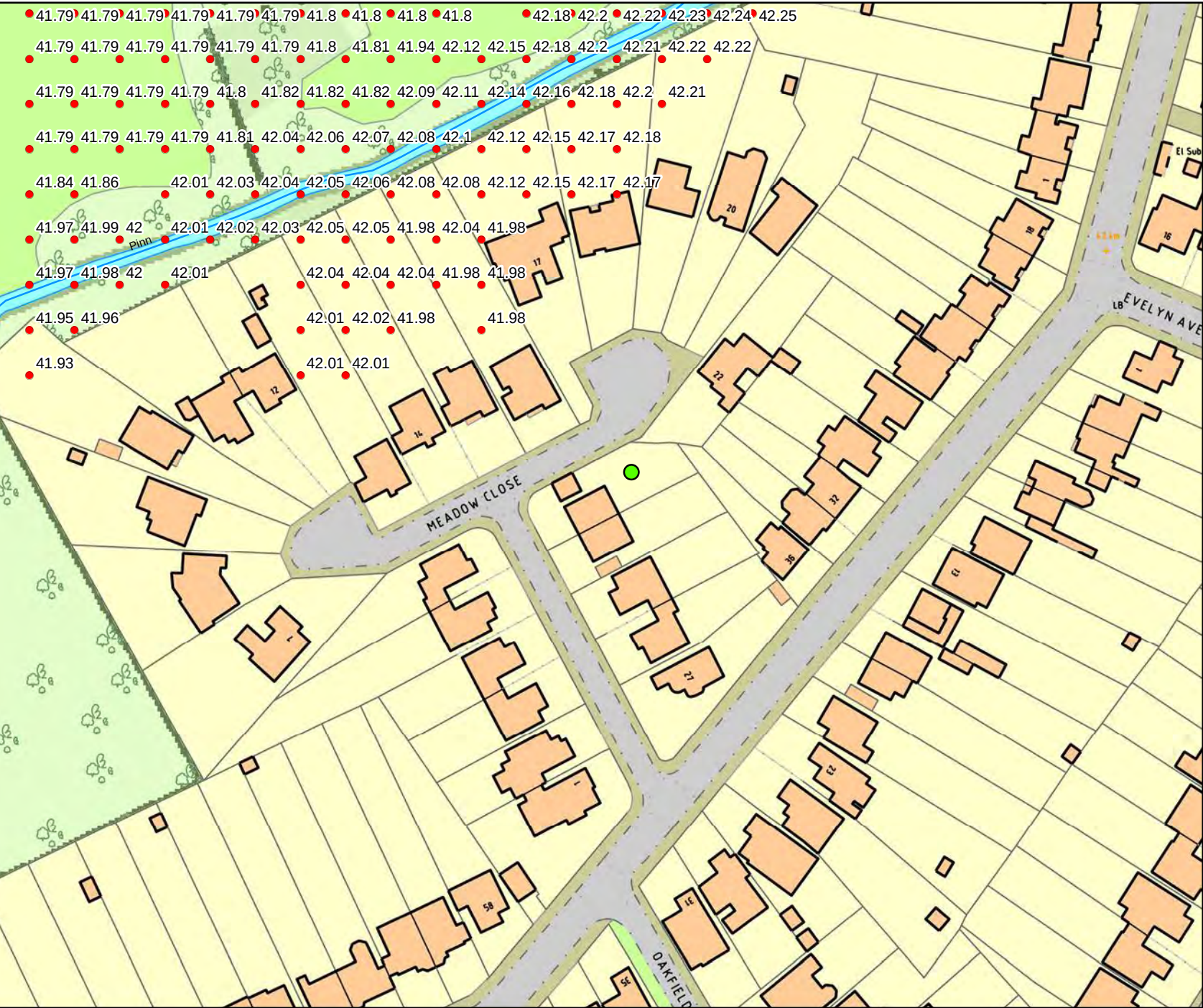
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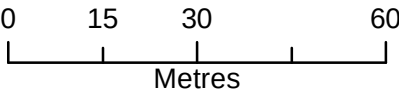
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2D Node Results: Heights

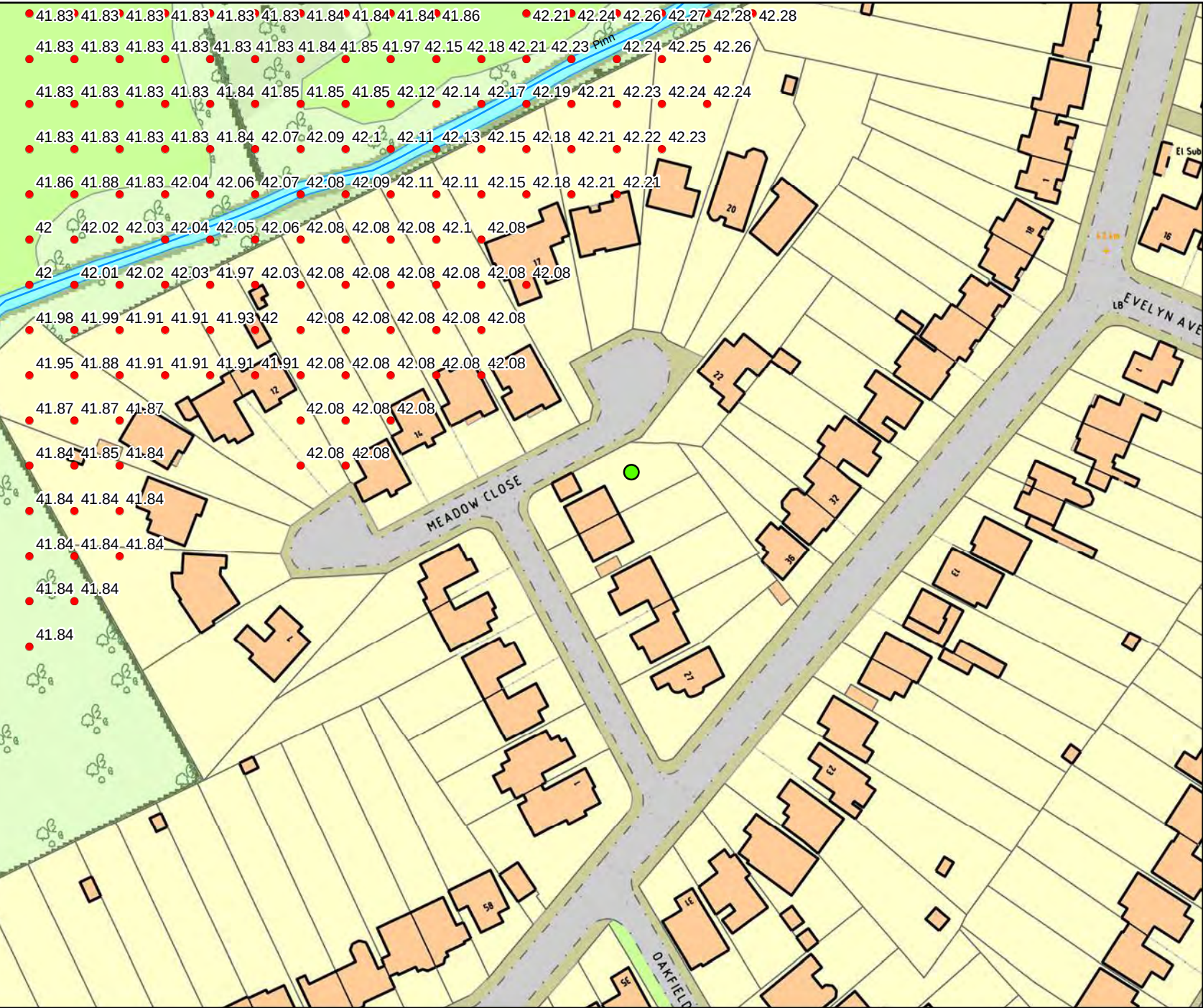
- 1 in 75 year (1.33%) Defended

The data in this map has been extracted from the River Pinn Mapping Study (JBA, 2015). This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment. Modelled outlines take into account catchment wide defences. Flood risk data requests including an allowance for climate change will be based on the 1 in 100 flood plus 20% allowance for climate change, unless otherwise stated. You should refer to 'Flood risk assessments: climate change allowances' to check if this allowance is still appropriate for the type of development you are proposing and its location. You may need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence. <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

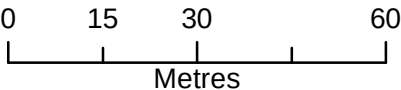
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Legend

- Main Rivers
- Site location

2D Node Results: Heights

- 1 in 100 year (1%) Defended

The data in this map has been extracted from the River Pinn Mapping Study (JBA, 2015). This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment. Modelled outlines take into account catchment wide defences.

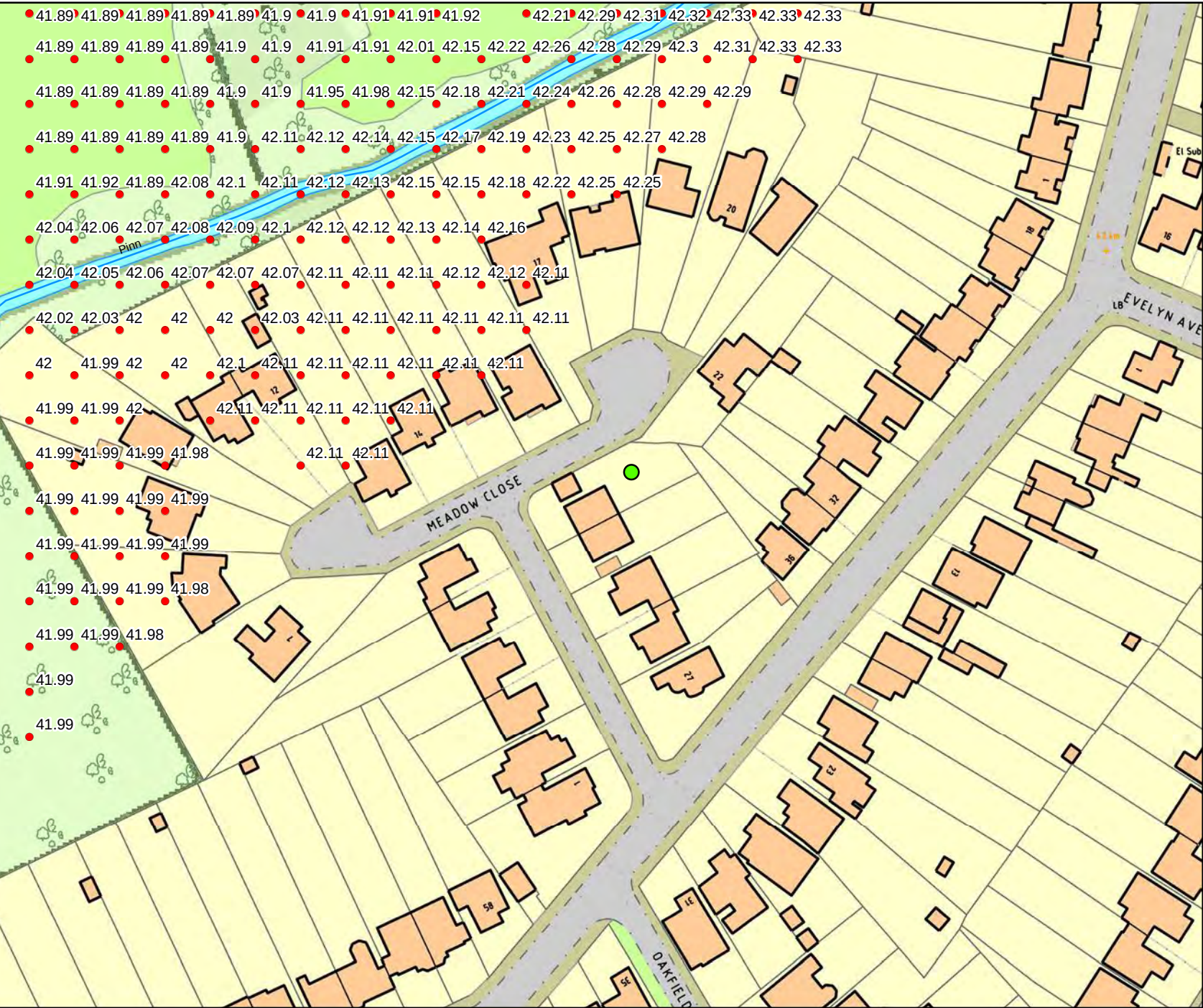
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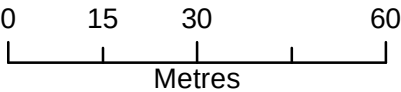
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Legend

- Main Rivers
- Site location

2D Node Results: Heights

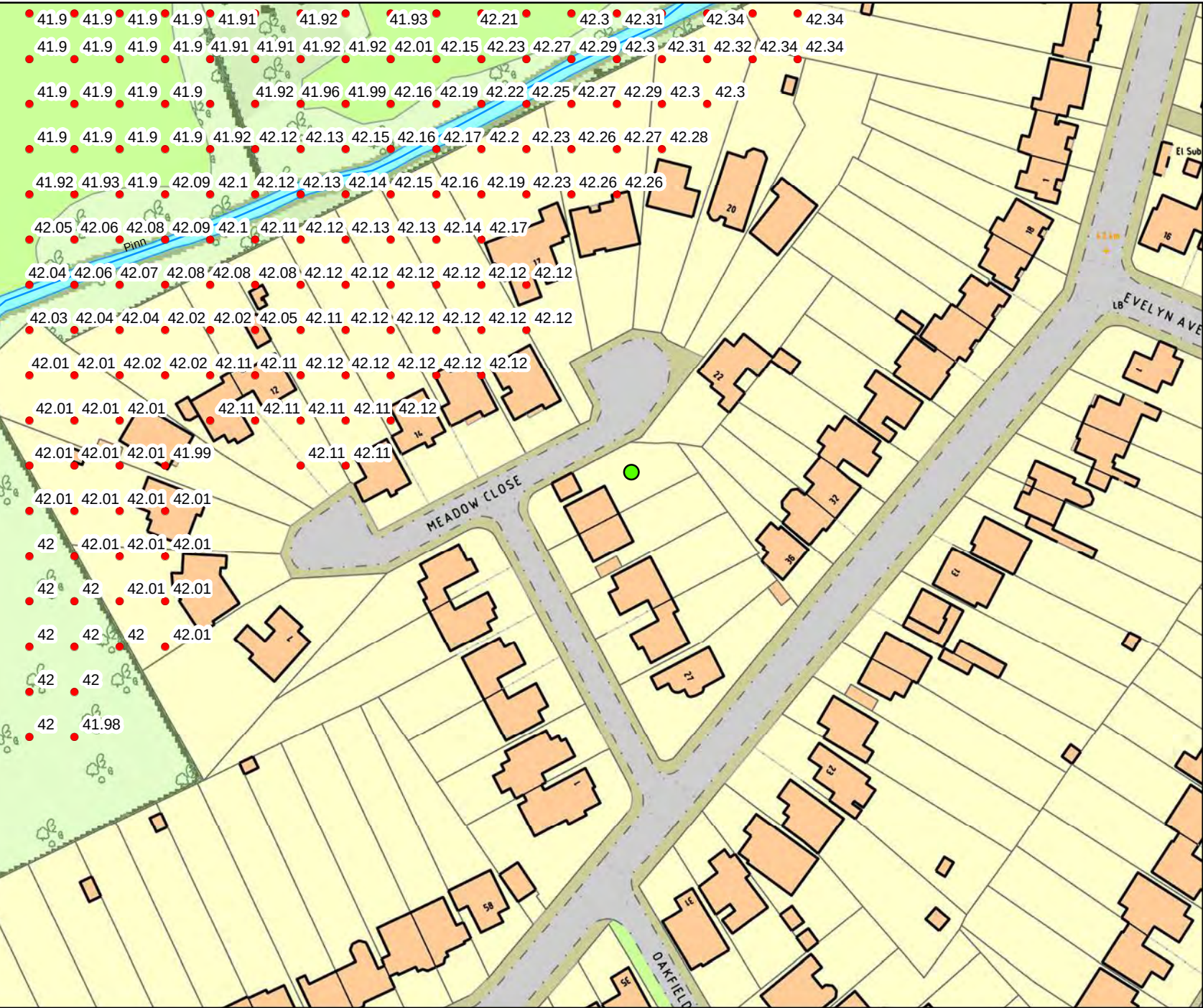
- 1 in 100 year + 20% (*CC) Defended

The data in this map has been extracted from the River Pinn Mapping Study (JBA, 2015). This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment. Modelled outlines take into account catchment wide defences. Flood risk data requests including an allowance for climate change will be based on the 1 in 100 flood plus 20% allowance for climate change, unless otherwise stated. You should refer to 'Flood risk assessments: climate change allowances' to check if this allowance is still appropriate for the type of development you are proposing and its location. You may need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence. <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

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0153060

Metres

Legend

Main Rivers

Site location

2D Node Results: Heights

1 in 100 year + 25% (*CC) Defended

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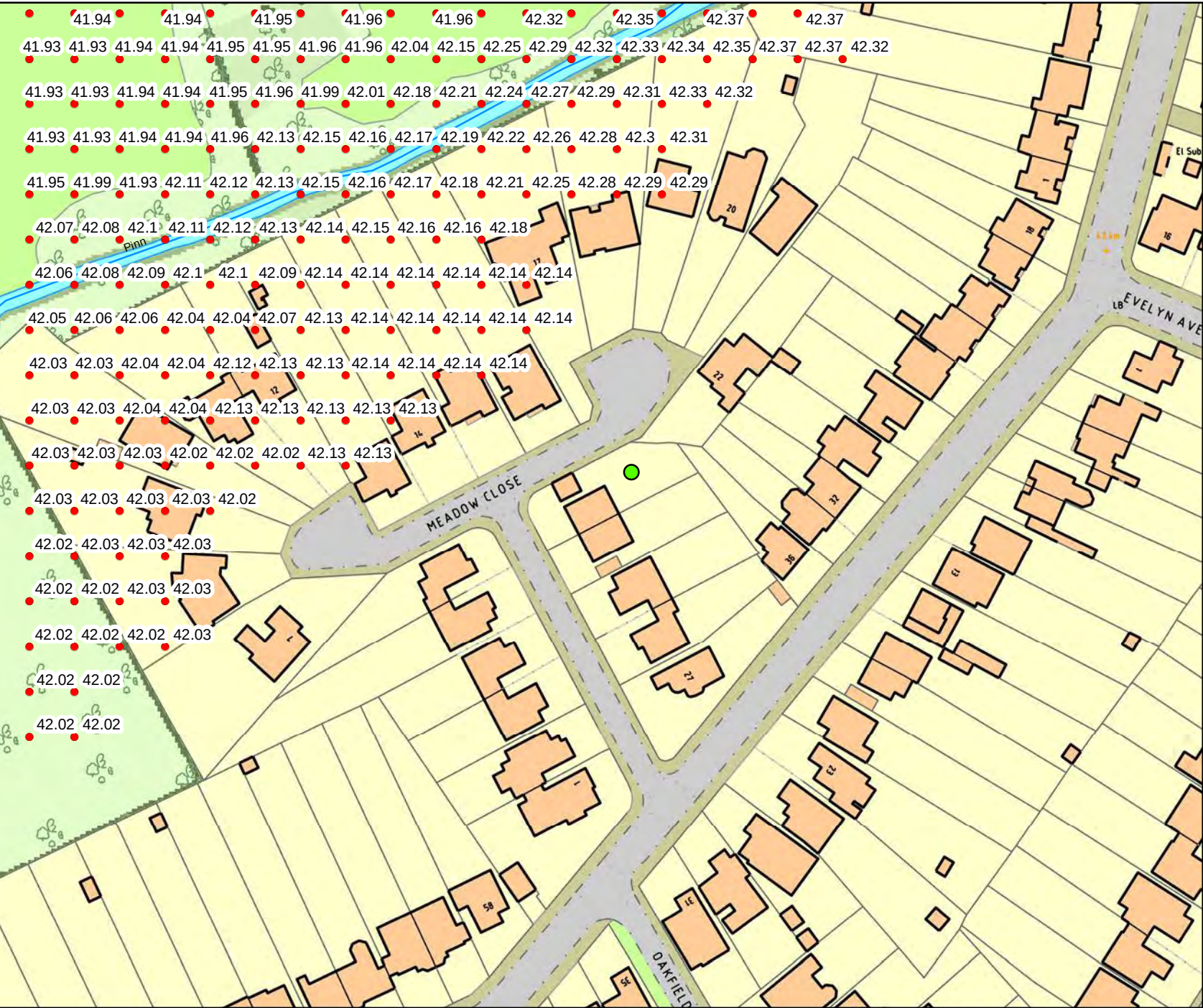
<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

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0153060

Metres

Legend

Main Rivers

Site location

2D Node Results: Heights

1 in 100 year + 35% (*CC) Defended

The data in this map has been extracted from the River Pinn Mapping Study (JBA, 2015). This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment. Modelled outlines take into account catchment wide defences.

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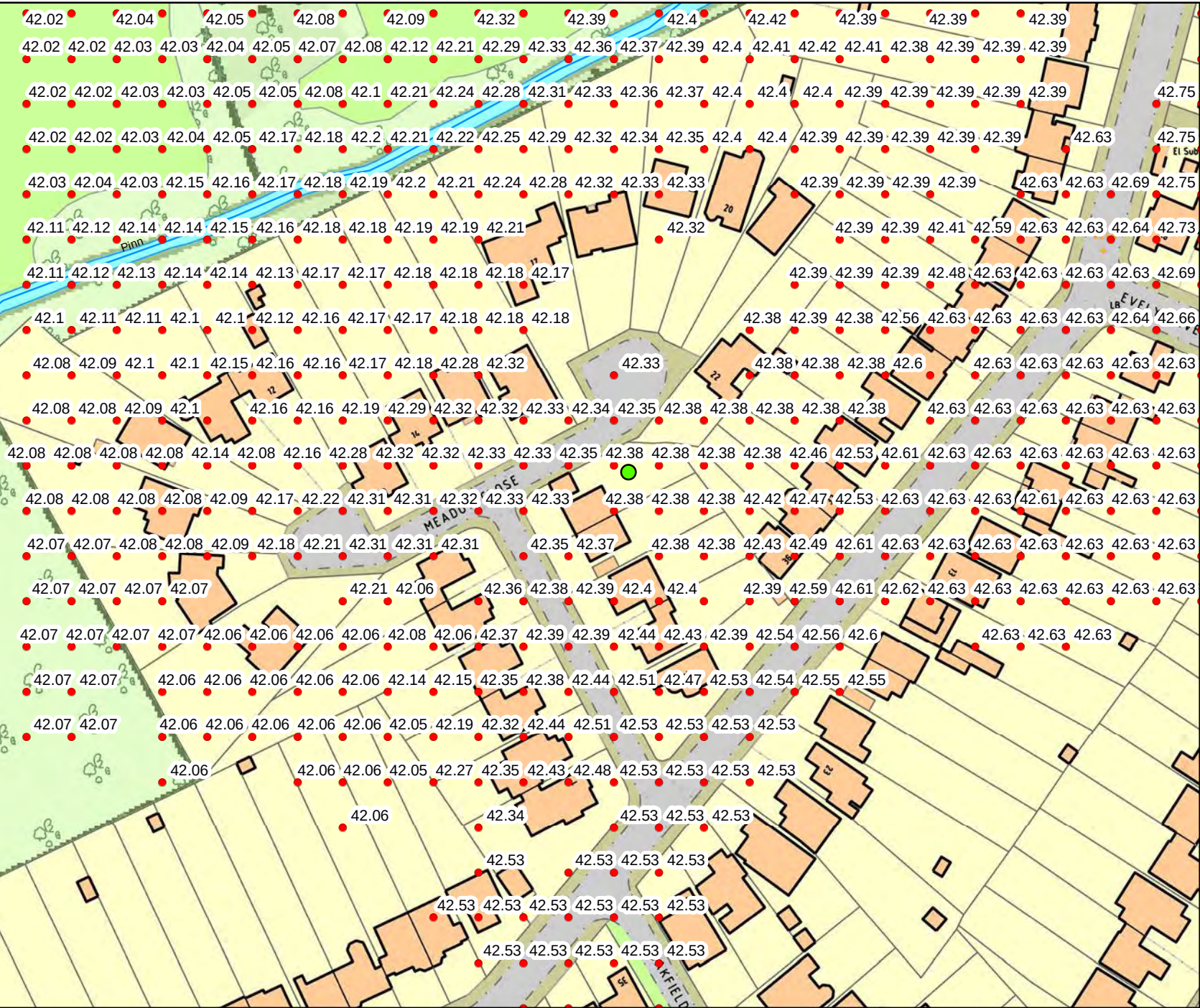
<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

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0 15 30 60

Metres

Legend

- Main Rivers
- Site location

2D Node Results: Heights

- 1 in 100 year + 70% (*CC) Defended

The data in this map has been extracted from the River Pinn Mapping Study (JBA, 2015). This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment. Modelled outlines take into account catchment wide defences.

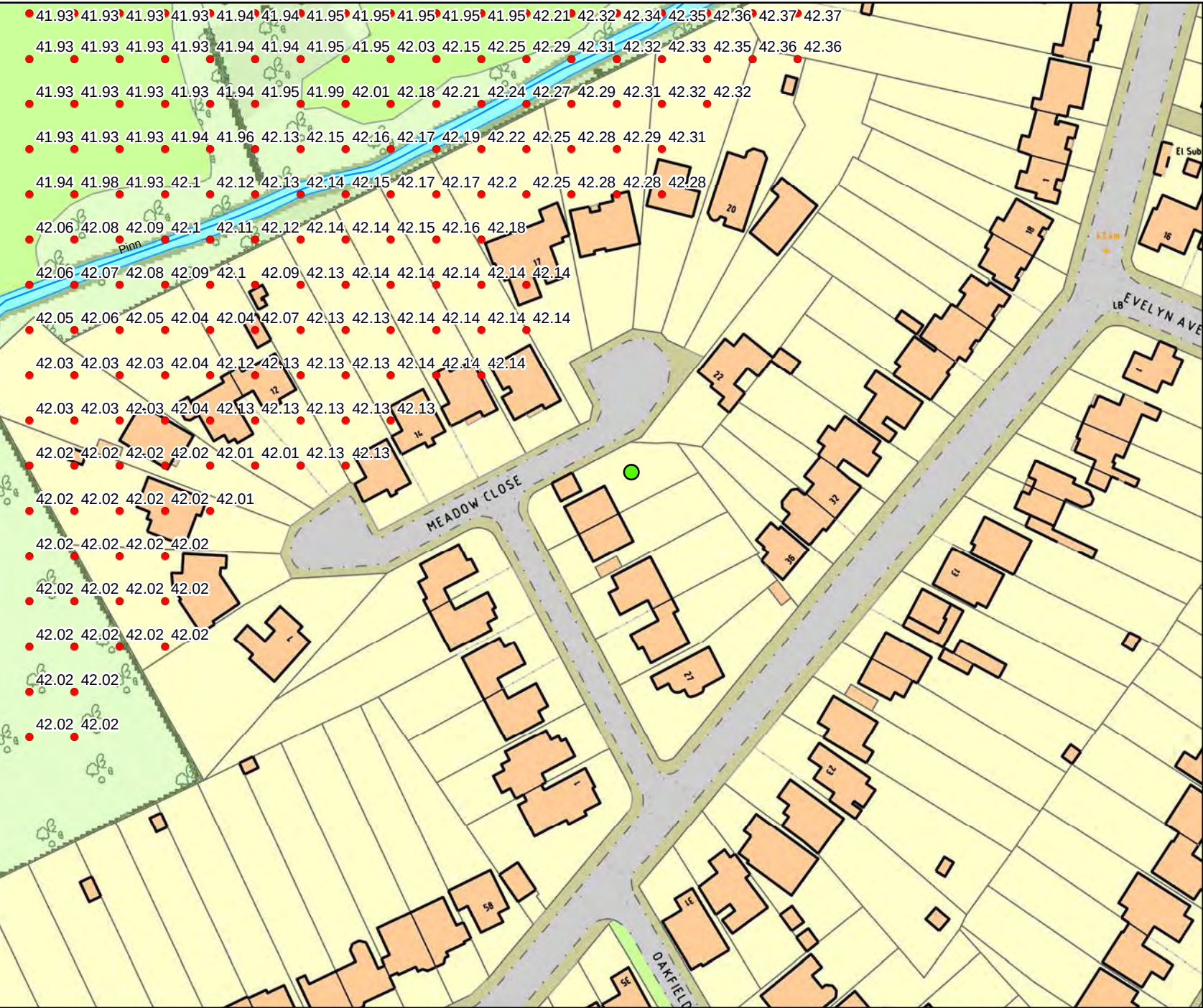
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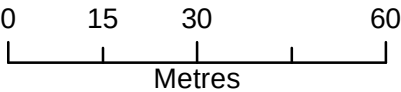
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Legend

- Main Rivers
- Site location

2D Node Results: Heights

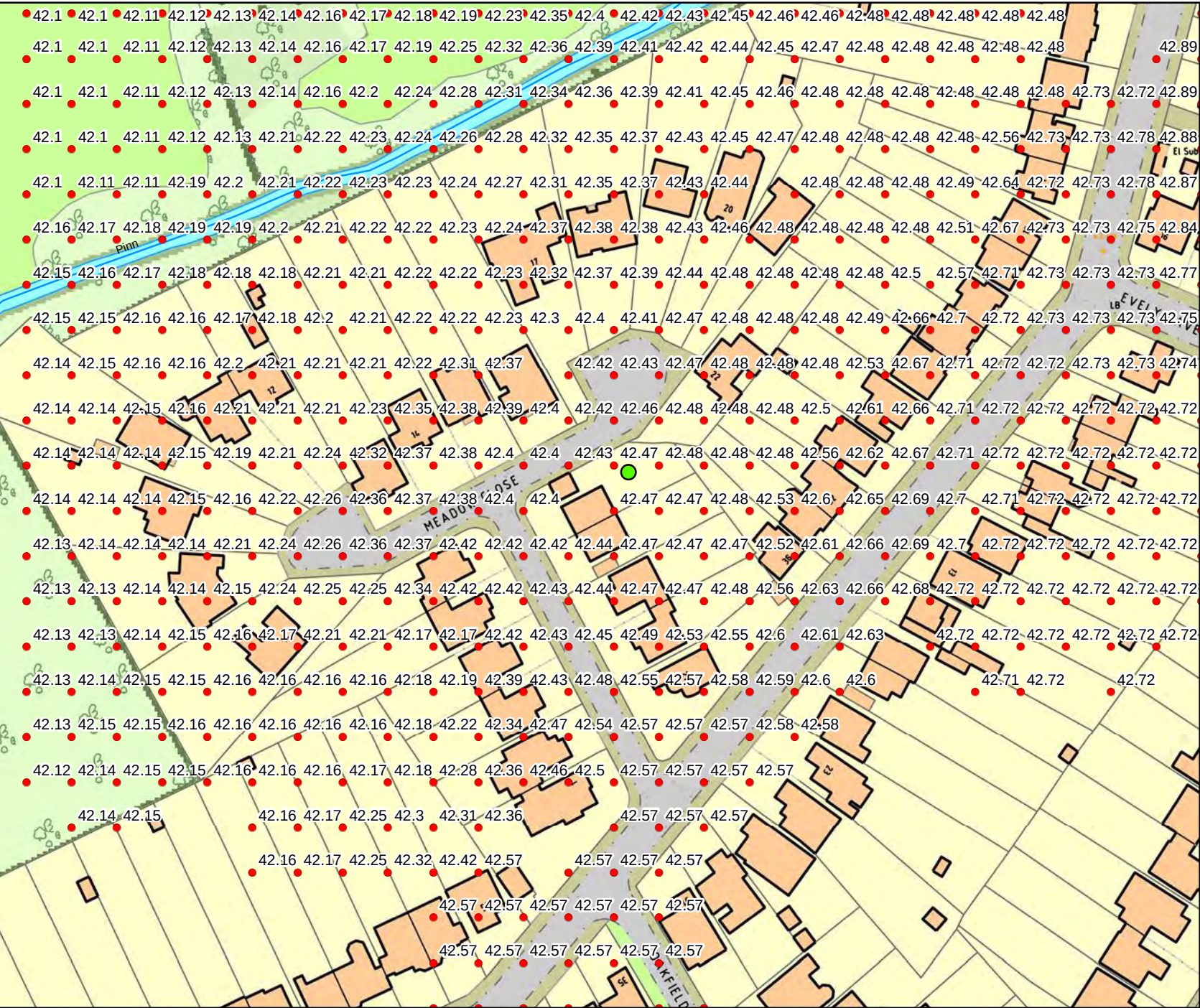
- 1 in 250 year (0.4%) Defended

The data in this map has been extracted from the River Pinn Mapping Study (JBA, 2015). This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment. Modelled outlines take into account catchment wide defences. Flood risk data requests including an allowance for climate change will be based on the 1 in 100 flood plus 20% allowance for climate change, unless otherwise stated. You should refer to 'Flood risk assessments: climate change allowances' to check if this allowance is still appropriate for the type of development you are proposing and its location. You may need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence. <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

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Metres

Legend

Main Rivers

Site location

2D Node Results: Heights

1 in 1000 year (0.1%) Defended

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<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

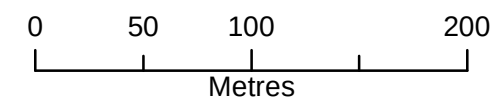
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Legend

- Main Rivers
● Site location

Flood Event Outlines

- 1977

The historic flood event outlines are based on a combination of anecdotal evidence, Environment Agency staff observations and survey.

Our historic flood event outlines do not provide a definitive record of flooding. It is possible that there will be an absence of data in places where we have not been able to record the extent of flooding. It is also possible for errors to occur in the digitisation of historic records of flooding.

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Legend

Main Rivers

Site location

Flood Event Outlines

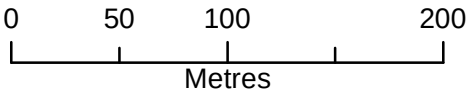
1977

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It is also possible for errors to occur in the digitisation of historic records of flooding.

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Legend

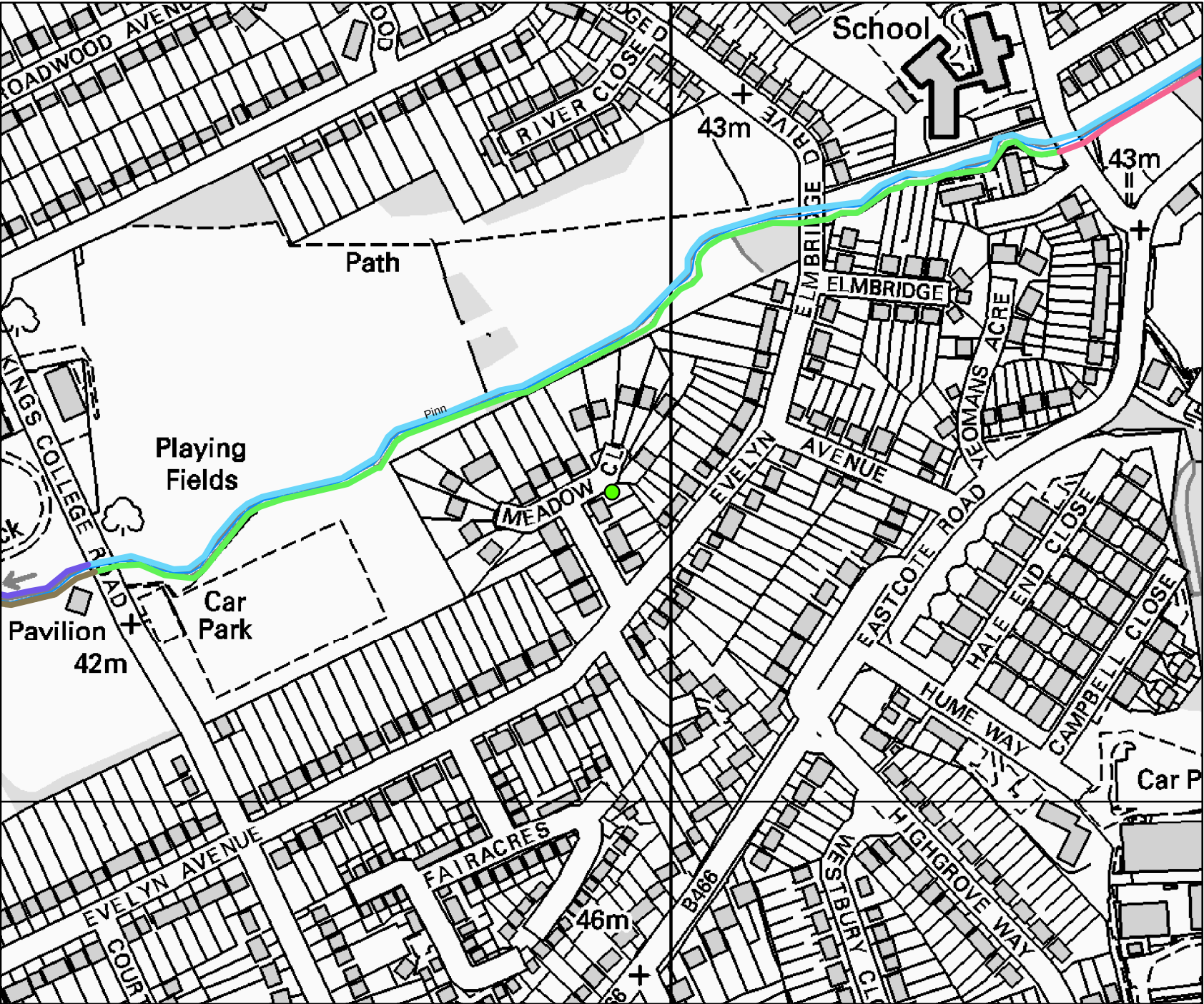
- Main Rivers
- Site location

ASSET_ID

- 82646
- 84073
- 153564
- 153565
- 154977

The following information on defences
has been extracted from the Asset
Information Management System
(AIMS)

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Environment Agency ref: [HNL 127385/AS](#)

The following information on defences has been extracted from the Asset Information Management System (AIMS)

Defences

Asset ID	Asset Type	Asset Protection	Asset Comment	Asset Description	Design Standard of protection (years)	Downstream Crest Level	Upstream Crest Level	Condition of Defences (1=Good, 5 = Poor)
154977	high_ground	fluvial	Natural Vegetated bank. 23-02-10 AP - Changed to TC 9 in line with Natural Channel	Natural Bank	2	41.6	44.1	2
153564	high_ground	fluvial	Natural Vegetated Channel. 23-02-10 AP Changed to TC 9 in line with Natural Channel	Natural Bank	5	41.9	43.6	2
153565	high_ground	fluvial	Natural Vegetated channel. 23-02-10 AP Changed to TC 9 in line with Natural Channel	Natural Bank	10	43.6	43.8	2
82646	high_ground	fluvial	Natural Vegetated Channel. 23-02-10 AP Changed to TC 9 in line with Natural Channel	Natural Bank	5	41.4	41.6	2
84073	high_ground	fluvial	Natural Vegetated Channel. 23-02-10 AP - Changed to TC 9 in line with Natural Channel	Natural Bank	2	41.4	41.6	2

16.11 Appendix 11 – Safe Egress to Flood Zone 1 Map

