Flood Risk Assessment and SuDS Report November 2023

EAS

Quinbury Farm Cottage
Hay Street
Braughing

Kirby Cove Architects

Document History

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

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1 Introduction

1.1 EAS has been commissioned to provide a Flood Risk Assessment and SuDS report in order to inform a planning application for the proposed replacement dwelling at Quinbury Farm, Braughing, SG11 2RE. Proposals consist of the demolition of the existing cottage and a replacement 4-bedroom detached dwelling. (hereafter referred to as 'the site').

1.2 A location plan is enclosed in Appendix A and the replacement dwelling proposals are enclosed in Appendix B.

1.3 The site is shown to be at a low risk of a fluvial (river) flood event being located within the Flood Zone 1 on the Flood Map for Planning. Flood Zone 1 is defined as having a less than 0.1% annual probability of river flooding. This FRA assesses and details the risk form all flood sources and discusses mitigation measures.

1.4 This FRA includes a SuDS Strategy to demonstrate compliance with national and local policy requirements.

1.5 The contents of this FRA are based on the advice set out in the National Planning Policy Framework (NPPF) published in September 2023, Annex 3: Flood risk vulnerability classification, also from the NPPF and PPG 'Guidance for Flood Risk and Coastal Change', updated in August 2022.

1.6 This report is based on the Environment Agency flood maps, geology mapping, OS mapping, topographic survey, Strategic Flood Risk Assessment and local policy.

1.7 This document includes the following sections:

Section 2 – describes any relevant local and national planning policy;

Section 3 – provides a site description and background information

Section 4 – review any potential sources of flooding;

Section 5 – identifies suitable mitigation measures to address the flood risks;

Section 6 – details the proposed drainage strategy;

Section 7 – details the proposed drainage strategy's maintenance and management; and

Section 8 – summarises and concludes the report.

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2 Policy Context

Introduction

2.1 This section sets out the policy context. This report is based on the advice set out in the National Planning Policy Framework (NPPF) published in September 2023 and the Planning Practical Guidance (PPG) updated in August 2022.

2.2 Paragraph 167 footnote 55 of the NPPF states:

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

2.3 The flood zones are defined as:

- Flood Zone 1 - less than a 0.1% (1 in 1000) annual probability of river or tidal flooding.
- Flood Zone 2 - between a 0.1% and 1% (1 in 1000 and 1 in 100) annual probability of river flooding; or between a 0.1% and 0.5% (1 in 1000 and 1 in 200) annual probability of flooding from tidal sources.
- Flood Zone 3a- This zone comprises land assessed as having a 1% (1 in 100) or greater annual probability of river flooding; and for tidal flooding at least a 0.5% (1 in 200) annual probability of flooding from tidal sources.
- Flood Zone 3b - This zone comprises land where water has to flow or be stored in times of flood. This classification is usually classified as land which had a 3.33% (1 in 30) annual probability of flooding.

2.4 Paragraph 159 discusses the suitability of development location, particularly with regards to future risks induced by climate change:

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

2.5 Paragraph 160 of the National Planning Policy Framework (NPPF) sets out how:

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

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2.6 Paragraphs 169 NPPF discusses the application of sustainable drainage systems:

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

Take account of advice from the lead local flood authority;

Have appropriate proposed minimum operational standards;

Have maintenance arrangements in place to ensure an acceptable standard of operation of the lifetime of the development; and

Where possible, provide multifunctional benefits."

2.7 The site is shown to be at a low risk of a fluvial (river) flood event being located within the Flood Zone 1 on the Flood Map for Planning. Flood Zone 1 is defined as having less than 0.1% annual probability of river flooding.

2.8 The site access located at the entrance of the farm to the south of the cottage is located in Flood Zone 3, at high risk of flooding from the River Quinn. Flood Zone 3 is defined as having 1% annual probability of river flooding.

2.9 The EA Flood Map has been enclosed in Appendix C.

East Herts Local Plan (2018)

2.10 Adopted in October 2018, the local plan provides guidance for new development and infrastructure within the district from 2011 to 2033.

2.11 Policy WAT1 'Flood Risk Management' located in Chapter 23 'Water', details how water and flooding should be managed within the District. Some points raised are:

i) The functional floodplain will be protected from inappropriate development and where possible developed flood plain should be returned to Greenfield status with an enhanced level of biodiversity

ii) Development proposals should neither increase the likelihood or intensity of any form of flooding, nor increase the risk to people, property, crops or livestock from such events, both on site and to neighbouring land or further downstream.

iii) Development should take into account the impacts of climate change and should build in long term resilience against increased water levels. Therefore, appropriate distances and buffers between water courses and built development should be maintained in accordance with Environment Agency guidelines

iv) In order to steer new development to areas with the lowest probability of flooding, the Sequential Test will be used. In exceptional circumstances, if developments are proposed which are required to pass the NPPF Exceptions Test, they will need to address flood resilient design and emergency planning by demonstrating that:

A) The development will remain safe and operational under flood conditions;

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B) *A strategy of either safe evacuation and/or safely remaining in the building is followed under flood conditions;*

C) *Key services will continue to be provided under flood conditions; and*

D) *Buildings are designed for quick recovery following a flood.*

2.12 Policy WAT5 'Sustainable Drainage' sets out the preferred methods of draining new developments within the District:

i) Development must utilise the most sustainable forms of drainage systems in accordance with the SUDS hierarchy unless there are practical engineering reasons for not doing so.

ii) Development should aim to achieve Greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible.

iii) Drainage should be designed and implemented in ways that deliver other policy objectives of this Plan, including water use efficiency and quality, biodiversity, amenity and recreation. The provision of balancing ponds as part of an area of public open space for recreation or wildlife should be designed to ensure the safety of other users of the space. Where SUDS are provided as part of a development, applicants should detail how it will be maintained in the long term.

iv) Where practicable, SUDS should be designed to ensure the sustainable drainage networks have the additional capacity required to cope with infrequent adverse weather conditions and therefore reduce flood risk.

2.13 Policies WAT1 and WAT4 were considered during the preparation of this Flood Risk Assessment and Drainage Strategy, and the sustainable drainage measures discussed within this report will demonstrate that the proposed development will be consistent with the policy aims for the District.

East Hertfordshire District Council Level 1 and Level 2 Strategic Flood Risk Assessment (2016) and Addendum (March 2017)

2.14 The SFRA considers all sources of flooding including fluvial, surface water, groundwater, sewers, reservoirs and canals. The key objectives of the SFRA was to update existing policy with the latest flood risk information and data. The assessment identifies and assesses the extent and severity of flood risk across the district.

2.15 Appendix A of the SFRA was updated the SFRA addendum which was published in 2017. Appendix A shows the location of the replacement dwelling is not located within a historic flood extent.

2.16 Appendix E of the SFRA shows the susceptibility of groundwater flooding across the district. The site is shown to be at ≥ 25% < 50% susceptible to groundwater flooding.

2.17 Appendix G of the SFRA shows the area at risk of flooding from reservoirs across the borough. The site is shown not to be affected by flooding from reservoir sources.

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3 Existing Site Assessment

Site Description

3.1 This Flood Risk Assessment and SuDS Report has been prepared in support of proposed replacement dwelling at Quinbury Farm Cottage, Hay Street, Braughing, SG11 2RE. The proposals consist of the demolition of the existing dwelling at the construction of a replacement detached 4-bedroom property and associated parking and landscaping.

3.2 A location plan is included at Appendix A and the proposed development plans are included in Appendix B.

3.3 Immediately south of the cottage is Quinbury Farm which consist of dis-used agricultural buildings. The site is accessed via a track which runs through this site. Quinbury Farm Cottage is surrounded on all other sides by undeveloped agricultural land.

Local Watercourses

3.4 The River Quin, an EA 'Main River' is located approximately 75m east of the proposed location of the replacement dwelling.

3.5 The River Rib, also an EA 'Main River' is located approximately 1.5km directly west of the site. The Braughing Bourne, an ordinary watercourse, is located approximately 600m southeast of the site.

Site Levels

3.6 A topographic survey enclosed in Appendix D and shows the site falls from west to east from levels of around 76.5m AOD to 75.5m AOD. The site also falls steeply from the northern boundary are around 76m AOD falling to around 74m AOD within the driveway in the southern boundary of the site.

Geology

3.7 The online British Geological Survey (BGS) mapping shows the site to be located above Lewes Nodular Chalk Formation and Seaford Chalk Formation (undifferentiated) - chalk with superficial deposits of Glaciofluvial Deposits, Mid Pleistocene - sand and gravel.

3.8 There are no borehole records within the site's proximity.

Sewer Records

3.9 Given the rural location of the site, it is not anticipated there are any adopted foul sewers within the vicinity.

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Existing Drainage

3.10 The existing property is served by a soakaway. The area around the property is not formally drained with surface water simply shedding to ground.

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4 Potential Source of Flooding

Fluvial

4.1 A copy of the Environment Agency's Flood Map is enclosed in Appendix C. The location of the replacement dwelling is in Flood Zone 1, at low risk of fluvial flooding from the River Quinn. The access to the cottage within the wider farm site is located in Flood Zone 3. Mitigation measures are discussed below.

EA Data

4.2 A Product 4 data request was submitted to further explore the flood risks within the wider area. Data from the River Rib modelling study undertaken in 2009 was provided. This data is enclosed in Appendix C.

4.3 The historic flood map shows the area of the replacement dwelling remained outside the flood extents for events which occurred in 1968 and 1993 however the access road leading to the cottage was located in these flood extents.

4.4 The area of the replacement dwelling remains outside the location all modelled flood extents, including the 1000yr modelled event.

4.5 It is therefore concluded the risk of fluvial flood to the replacement dwelling is considered to be low. Mitigation measures relating to the loss of access and egress are detailed below.

Surface Water

4.6 Surface water flooding refers to flooding caused when the intensity of rainfall, particularly in urban areas, can create runoff which temporarily overwhelms the capacity of the local drainage systems or does not infiltrate into the ground. The water ponds on the ground and flows towards low-lying land. This source of flood risk is also known as 'pluvial'.

4.7 The location of the replacement dwelling is at very low risk of surface water flooding. Extracts of the surface water flood risk are included in Appendix E.

Groundwater

4.8 There are no nearby borehole records available on the BGS website.

4.9 The EA groundwater mapping located in MAGIC Maps (available at: http://magic.defra.gov.uk/MagicMap.aspx) shows the site is not located in a Source Protection Zone.

4.10 Based on the bedrock, the site is located above a Principal Aquifer. A Principal Aquifer is defined as "layers of rock or drift deposits that have high intergranular and/or fracture permeability -

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meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer".

4.11 The site is shown to be located within an area of medium to high groundwater vulnerability.

4.12 Given the above, it is important the proposed development does not create pollution pathways. The risk to groundwater has been considered when developing the SuDS strategy.

Artificial

4.13 The EA long term risk maps also display the risk from reservoirs. The site is shown to not be in a reservoir flood risk area.

4.14 There are no other artificial sources of flooding within the site's proximity. Therefore, the risk from artificial sources can be deemed low.

Sewer

4.15 Due to the site's rural location, it is not anticipated there are any adopted sewers within the vicinity. Therefore, the risk of flooding from sewers is considered low.

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5 Flood Mitigation Measures

5.1 This site is considered to be at low risk from all fluvial, surface water, groundwater, artificial and sewer sources. However, should a fluvial flood event occur safe access and egress via the access road from the site could be hindered.

Flood Warning and Evacuation

5.2 Residents are advised to sign up to MET Office weather warning service which can be found here: https://www.metoffice.gov.uk/weather/warnings-and-advice/uk-warnings#?date=2023-04-12.

5.3 The homeowners are recommended to subscribe to the EA flood warning service. The EA operate a flood forecasting and warning service in areas at risk of flooding from rivers or the sea, which relies on direct measurements of rainfall, river levels, tide levels, in-house predictive models, rainfall radar data and information from the Met Office. This service operates 24 hours a day, 365 days a year.

5.4 It is recommended that the residents subscribe to the EA flood warning service by using the link: https://www.fws.environment-agency.gov.uk/app/olr/home. Alternatively, registration can be completed by telephone via the EA Floodline on 0345 988 1188 or Typetalk 0345 602 6340.

5.5 For information on EA Flood Information in the local area, the GOV.UK website can be used: https://flood-warning-information.service.gov.uk/

5.6 Should the residents choose to remain in their dwellings, the flood mapping indicates that they will remain safe inside the property. Should the access road be inaccessible the residents can leave the site via the private road through the yard.

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6 Proposed Drainage Stategy

Relevant SuDS Policy

6.1 SuDS mimic natural drainage patterns and provide a method of surface water drainage which can decrease the quantity of water discharged, and hence reduce the risk of flooding. SuDS design should meet the "four pillars" of SuDS of: water quantity, water quality, amenity and biodiversity, wherever possible.

6.2 In decreasing order of preference, the preferred means of disposal of surface water runoff is:

- Discharge to ground.
- Discharge to a surface water body.
- Discharge to a surface water sewer.
- Discharge to a combined sewer.

Site-Specific SuDS

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

Device	Description	Constraints / Comments	Appropriate
Living roofs (source control)	Provide soft landscaping at roof level which reduces surface water runoff.	Not suitable due to pitch of residential roof	No
Infiltration devices & Soakaways (source control)	Store runoff and allow water to percolate into the ground via natural infiltration.	Proposed permeable paving driveway and soakaway.	Yes
Pervious surfaces (source control)	Storm water is allowed to infiltrate through the surface into a storage layer, from which it can either infiltrate and/or slowly release to sewers.	Permeable paving is proposed for the driveway	Yes

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Rainwater harvesting (source control)	Reduces the annual average rate of runoff from the Site by reusing water for non-potable uses e.g. toilet flushing, recycling processes.	Yes, this is proposed for re-use within the property	Yes
Swales (permeable conveyance)	Broad shallow channels that convey / store runoff, and allow infiltration (ground conditions permitting).	No suitable location onsite	No
Filter drains & perforated pipes (permeable conveyance)	Trenches filled with granular materials (to take flows from adjacent impermeable areas) that convey runoff while allowing infiltration.	No suitable location onsite	No
Filter Strips (permeable conveyance)	Wide gently sloping areas of grass or dense vegetation that remove pollutants from run-off from adjacent areas.	No suitable location onsite	No
Infiltration basins (end of pipe treatment)	Depressions in the surface designed to store runoff and allow infiltration.	No suitable location onsite	No
Wet ponds & constructed wetlands (end of pipe treatment)	Provide water quality treatment & temporary storage above the permanent water level.	No suitable location onsite	No
Attenuation Underground (end of pipe treatment)	Oversized pipes or geo-cellular tanks designed to store water below ground level.	Not required due to infiltrating through soakaway	No
Raingardens	Raingardens are relatively small depressions in the ground that can act as infiltration points for roof water and other 'clean' surface water.	Raingarden has been proposed	Yes

Table 6.1 Site Specific SuDS

Consideration of SuDS Hierarchy

6.4 The local geology and presence of an existing soakaway suggests infiltration is a viable method of drainage at this site. At this stage it is proposed for a new soakaway to replace the existing soakaway.

6.5 Should infiltration tests be undertaken at a later stage and fail. It would be proposed for the attenuated runoff to outfall to the River Quin on the site eastern boundary.

Surface Water Drainage Design Parameters

6.6 The following best practice design parameters have been considered:

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- The 2070s 'Upper End' Climate Change allowance is 40% and shall be applied to the hydraulic drainage network design.
- The Hydraulic Model shall be run for a 1:2yr Storm Event, 1:30yr Storm Event, 1:30yr + 40% Climate Change Event, 1:100yr Storm Event and 1:100yr + 40% Climate Change Storm Event.
- FEH22 Rainfall Data has been used in this assessment.
- The CV Value for Winter and Summer Storms has been set to 1.0.
- A 5min time of entry is used.
- In line with Hertfordshire's LLFA Guidelines, unlined storage devices should drain within 24hrs (1440mins). If this is not achieved, the storage device shall be sized to accommodate a 1:100yr +40%CC + 1:30yr Storm Events.
- Exceedance routes shall be demonstrated.
- 10% Urban Creep has been applied, making the total contributing area at 221.1m^2.
- Factor of Safety of 2 is has been applied.

Pre-Development Runoff Rates and Discharge Volumes

6.7 The only existing impermeable area at the site comprises of roof area (84.04m^2) with the remaining area comprised of grassed and gravel areas.

6.8 Using the Modified Rational Method detailed in Butler, D and Davies, J. (2006), Urban Drainage, 2nd ed.,SPON, the surface water runoff for the existing site has been calculated as follows:-

$$Q = CiA$$

where Q = maximum flow rate (l/s)

C= PIMP/PR

i= rainfall intensity (mm/hr),

A=area (ha)

6.9 It should be noted that a fixed rainfall intensity of 50mm/hr is used in this case, which has been recommended by Butler & Davies (2006) to avoid using inappropriately high intensities for very low concentration times, i.e. small sites. Using the Modified Rationale Method (Butler and Davies, 2006), and assuming an impermeable area on the existing site of 84.04m^2, the total rate of runoff from the impermeable areas of the existing site is estimated to be 1.15 l/s.

Proposed SuDS Strategy

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6.10 As outlined in Table 6.1 above, a number of SuDS Features shall be utilised to form the Surface Water Drainage Strategy in order to meet the 4 Pillars of SuDS.

Water Quantity – Raingarden and Rainwater Harvesting Tank;

Water Quality – Permeable Paving and Raingarden;

Biodiversity – Raingarden;

Amenity – Raingarden.

6.11 The proposed SuDS Layout is included in Appendix F and Causeway Flow Hydraulic Model Outputs are contained in Appendix G.

6.12 There are to be no alteration to the surfacing or drainage associated with the access track leading through the wider farm site.

Rainwater Harvesting Tank

6.13 A rainwater harvesting tank is proposed to collect roof runoff for reuse within the property. The tank is proposed to be connected to the raingarden.

6.14 Graff were consulted to size an approached rainwater harvesting for the proposed dwelling. It is estimated the dwelling will require 150L of water per day considering the number of rooms and due to the annual rainfall figure of 614.04mm (based on the Met Office Climate page for Andrewsfield, SG11) and the catchment area for the rainwater a 3000L cellular storage crate has been sized at 2.1m x 2.4 m and 1.0m deep. This product specification has been enclosed in Appendix H.

6.15 It is proposed to connect an overflow from this tank to the proposed soakaway.

Permeable Paving

6.16 A permeable gravel surface is proposed for the driveway. Due to the existing gradient and site levels of the proposed driveway, it is unlikely for the permeable feature to provide attenuation of surface water runoff. Therefore, it is proposed for the permeable driveway to convey the surface water runoff from the surrounding hardstanding to a diffuser unit on the eastern edge of the driveway which will convey the runoff to the proposed raingarden.

6.17 The driveway permeable surface is to be left unlined to allow for infiltration to occur during conveyance. The permeable paving has not been included in the Causeway Flow calculations.

Raingarden

6.18 A raingarden is proposed alongside an area of the proposed patio on the eastern side of the proposed dwelling.

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6.19 The surface water pipes from the driveway and roof will connect into the raingarden which will attenuate and convey the runoff to the soakaway. The raingarden has not been included in the Causeway Flow calculations.

Soakaway

6.20 It is proposed for the surface water runoff from the re-developed site to outfall to a 43.75m^2 x 1.98m deep soakaway. With a 95% porosity, the soakaway provides a total attenuation volume of 82.3m^3.

6.21 At this stage in the absence of suitable infiltration testing, a minimum recommend infiltration rate from BRE Digest 365 for soakaways of 1x10^{-6} m/s has been used for all calculations.

6.22 Prior to construction it is recommended infiltration testing is undertaken to BRE Digest 365 standards; and based on the chalk geology the size of the soakaway could potentially be reduced from the size shown, which may facilitate re-using the existing soakaway.

Long Term Storage

6.23 Based on the infiltration rate of 10^{-6} m/s, the soakaway does not meet the half drain time requirements. Therefore, the size of the soakaway has been designed to hold the runoff from a 1 in 100-year +40% climate change and a 1 in 30-year event.

Exceedance Event

6.24 The proposed surface water drainage strategy is designed to accommodate a 1:100yr + 40% Climate Change Storm Event. In the unlikely event that an exceedance event occurs, any flood waters would flow in an easterly direction towards the River Quin. An Exceedance Route Plan is included in Appendix F.

Water Quality

6.25 The proposed drainage strategies are to meet the water quality requirements set out by Table 26.2 of the CIRIA SuDS Manual C753 which sets out the specific pollution hazard indices for residential roofs and low traffic roads in Table 6.2 below.

Land Use	Hazard Level	Pollution Hazard Indices		
		Suspended Solids	Metals	Hydrocarbons
Residential roofs	Very low	0.2	0.2	0.05
Individual property driveways and low traffic roads	Low	0.5	0.4	0.4

Table 6.2 Land Use Pollution Hazard Ratings. Extracted from the CIRIA SuDS Manual C753 Simple Index Approach Tool.

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

Table 6.3 SuDS Component Pollution Mitigation for Permeable Paving and Ponds adapted from the CIRIA SuDS Manual C753 Simple Index Approach Tool.

SuDS Component	Pollution Mitigation Indices		
	Suspended Solids	Metals	Hydrocarbons
Bioretention systems (raingardens)	0.8	0.8	0.8

Table 6.4 SuDS Component Pollution Mitigation for Raingardens extracted and adapted from the CIRIA SuDS Manual C753 Simple Index Approach Tool.

6.26 A permeable paved surface is proposed on the driveway. This driveway will collect the runoff form the driveway, surrounding hardstanding's, and part of the roof area. This permeable paving meets the requirements for the Individual Property Driveway Pollution Hazard Indices, as illustrated in Table 6.3 above.

6.27 All surface water runoff will go through the raingarden before entering the soakaway. Table 6.4 shows the raingarden's pollution mitigation indices exceed the required pollution hazard indices detailed in Table 6.2.

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7 Maintenance of Devlopement Drainage

7.1 The maintenance of the SuDS features will remain the responsibility of the site owner. The residents or appointed management company will be responsible for maintaining the permeable paving, raingarden, and soakaway.

7.2 Regular inspections and maintenance should be carried out for each of these elements, particularly after periods of heavy rainfall. Maintenance tasks and frequencies for permeable paving and soakaways are detailed in the CIRIA SUDS Manual (C753) and have been summarised below in Table 7.1, 7.2, and 7.3.

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

Table 7.1 Maintenance tasks for permeable paving (Source: CIRIA C753, The SUDS Manual).

Maintenance Schedule	Required Action	Frequency
Regular inspections	Inspect infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain (if appropriate) to determine if maintenance is necessary Check operation of underdrains by inspection of flows after rain	Quarterly Annually

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	Assess plants for disease infection, poor growth, invasive species etc and replace as necessary Inspect inlets and outlets for blockage	Quarterly Quarterly
Regular Maintenance	Remove litter and surface debris and weeds Replace any plants, to maintain planting density Remove sediment, litter and debris build-up from around inlets or from forebays	Quarterly (or more frequently for tidiness or aesthetic reasons) As required Quarterly or biannually
Occasional Maintenance	Infill any holes or scour in the filter medium, improve erosion protection if required Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium and replacing mulch	As required As required
Remedial Actions	Remove and replace filter medium and vegetation above	As required but likely to be > 20 years

Table 7.2: Maintenance tasks for Bioretention systems and raingardens (Source: CIRIA C753, The SUDS Manual).

Maintenance Schedule	Required Action	Frequency
Regular maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings. Cleaning of gutters and any filters on downpipes. Trimming any roots that may be causing blockages.	Annually Annually or as required base on inspections Annually or as required
Occasional maintenance	Remove sediment and debris from pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings.	As required bas on inspections
Remedial actions	Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs. Replacement of clogged geotextile (will require reconstruction of soakaway).	As required As required
Monitoring	Inspect silt traps and note rate of sediment accumulation. Check Soakaway to ensure emptying is occurring.	Monthly in the first year and then annually Annually.

Table 7.3 Maintenance tasks for soakaways (Source: CIRIA C753, The SUDS Manual).

7.3 It is recommended that during the first 12 months of operation all SuDS and drainage features are visually inspected on a monthly basis to determine any seasonal patterns this includes all SuDS features, inspection chambers, inlets and outlets. This will determine whether or not the recommended service intervals set out by CIRIA in the figures above will be sufficient for maintenance beyond the first year.

7.4 After the first 12 months, the maintenance schedule should be designed to at least meet the requirements set out by CIRIA based on the outcome of the monitoring.

Manholes, Sewers and Inspection Chambers

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7.5 All inspection chambers and manholes should be inspected on a bi-annual basis with further visual checks carried out throughout the year, such as in November after the heaviest leaf-fall has occurred.

7.6 Should a blockage occur at any time, it is advised to seek professional help to jet the drainage system to clean and clear the system.

Gutters and Downpipes

7.7 It is good practice to ensure that these are occasionally inspected to ensure they are in good order and free of leaves & debris. Once every 6 months should be sufficient.

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8 Conclusions

8.1 This Flood Risk Assessment and SuDS report has been prepared in support of an application by for the proposed re-development of Quinbury Farm Cottage, Hay Street, Braughing, SG11 2RE. The proposed development consists of the demolition of the existing building and construction of a 4-bed residential dwelling.

Flood Risk Summary

8.2 The Environment Agency's Product 4 data shows the proposed location of the new dwelling is within Flood Zone 1 and is not within the recorded historic flood extents.

8.3 The site is at low risk of flooding for surface water, groundwater, artificial and sewer sources.

SuDS Summary

8.4 The site has an existing soakaway therefore an infiltration strategy is proposed.

8.5 The driveway is proposed to be permeable to collect and covey the runoff from the driveway, surrounding hardstanding's, and an area of the roof. Due to the existing site gradient, it is unlikely for the permeable paved driveway to attenuate the runoff.

8.6 All runoff will be conveyed through a raingarden to a soakaway which will replace the existing soakaway. The soakaway has been modelled to based on an infiltration rate of $1x10^{-6}$ m/s, which is the minimum recommended infiltration rate for a soakaway (BRE Digest 365); however, it is likely following infiltration testing that the size of the soakaway could be reduced.

8.7 Based on this rate proposed for the soakaway to cover an area 43.75m^2 with a depth of 1.98m, proving an attenuation volume of 82.3m^3. The soakaway is sized to contain a 1 in 100-year +40% climate change, followed by a 1 in 30-year storm event.

8.8 The maintenance of the SuDS features will be the responsibility of the owners.

Conclusion

8.9 All sources of flooding have been considered within this Flood Risk Assessment and a suitable SuDS system proposed.

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Appendices

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Appendix: A - Location Plan

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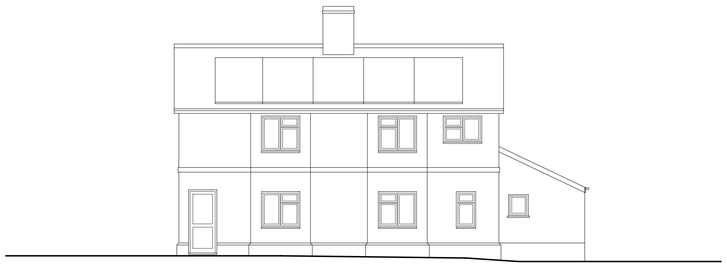
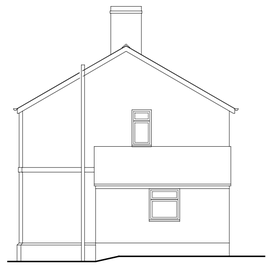
APPLICATION SITE BOUNDARY

N

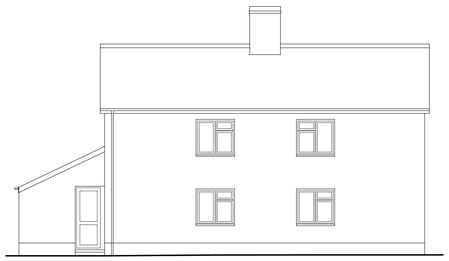
SITE LOCATION PLAN
1:1250



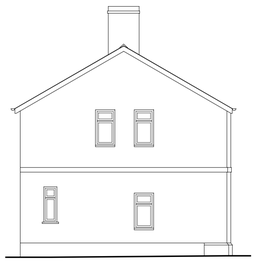
FRONT ELEVATION
existing | south 1:100



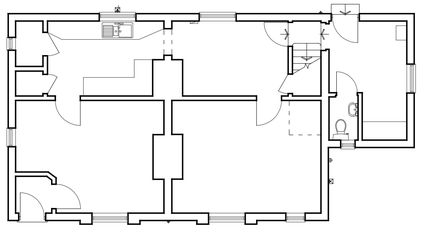
SIDE ELEVATION
existing | east 1:100



REAR ELEVATION
existing | north 1:100

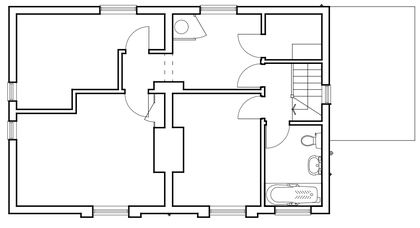


SIDE ELEVATION
existing | west 1:100



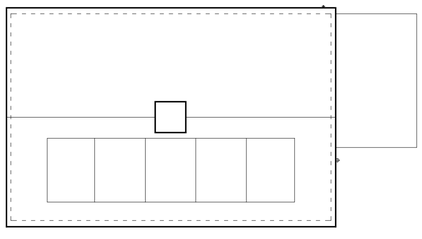
GROUND FLOOR PLAN
existing | 1:100

GIA=73sqm



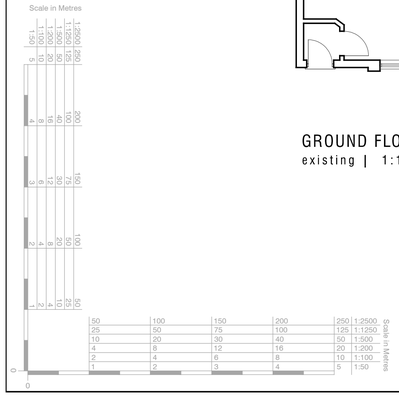
FIRST FLOOR PLAN
existing | 1:100

GIA=62sqm



ROOF PLAN
existing | 1:100

TOTAL GIA=135sqm



Rev.	Date	Description	Name
C	26.10.2023	Show neighbouring barns as demolished	AR
B	19.01.2023	New red line boundary/ vehicular access via existing right of way	AR
A	27.01.2022	Include access within red line boundary	AR

QUINBURY FARM COTTAGE
HAY STREET
BUNTINGFORD

PLANS AND ELEVATIONS
AS EXISTING

Kirby . Cove . Architects
Studio 10 Dimsdale House Hertford SG14 1BY 01992 538088

2346		100		C
drawn AR	date January 2022	chk A -	chk B -	scale as indicated @ A1

Appendix: B – Proposed Site Plan

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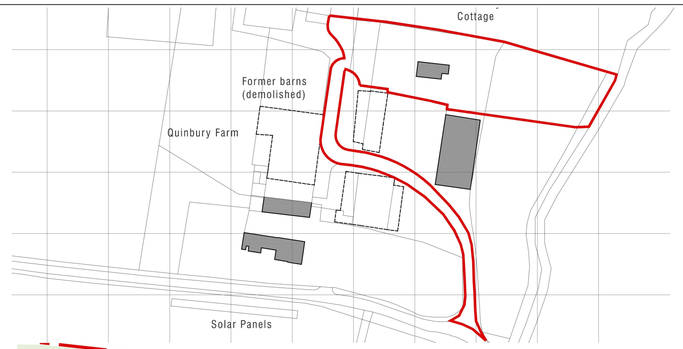

N

SITE LOCATION PLAN
1:1250

EXISTING LANDSCAPE
to be retained

NEW SUSTAINABLE
REPLACEMENT DWELLING
Passive Design Principles

PROPOSED EDIBLE
LANDSCAPE
to enhance biodiversity

NEW ACCESS
drive and gate relocated access
from existing right of way

PARKING
2no parking spaces
1no electric vehicle charging
and secure cycle storage

PV PANELS ARRAY
Sustainable initiatives

EXISTING COTTAGE
footprint outline

FOOTPRINT OF APPROVED
REPLACEMENT DWELLING
3/22/0138/FUL

EXISTING LANDSCAPE
to be retained

NATIVE HEDGING
to create green
infrastructure

EXISTING HEDGES
to be retained

NEIGHBOURING BARN
2 storey building (now
demolished)

NEIGHBOURING BARN
2 storey building

PROPOSED SITE PLAN
1:100

Rev.	Date	Description	Name
D	26.10.2023	Show neighbouring barns as demolished	AR
C	19.01.2023	Relocate building towards the north and vehicular access from existing right of way	AR
B	10.02.2022	Removal of trees to suit arboricultural report	AR
A	27.01.2022	Include access within red line boundary	AR

QUINBURY FARM COTTAGE
HAY STREET
BUNTINGFORD

REPLACEMENT DWELLING
PROPOSED SITE PLAN

Kirby . Cove . Architects
Studio 10 Dimsdale House Hertford SG14 1BY 01992 538088

2346		300		D
drawn AR	date January 2022	chk A -	chk B -	scale 1:100 @ A1

Appendix: C – EA Flood Data

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Flood map for planning

Your reference	Location (easting/northing)	Created
Quinbury Farm	**539618/226216**	**10 Feb 2022 9:13**

Your selected location is in flood zone 1, an area with a low probability of flooding.

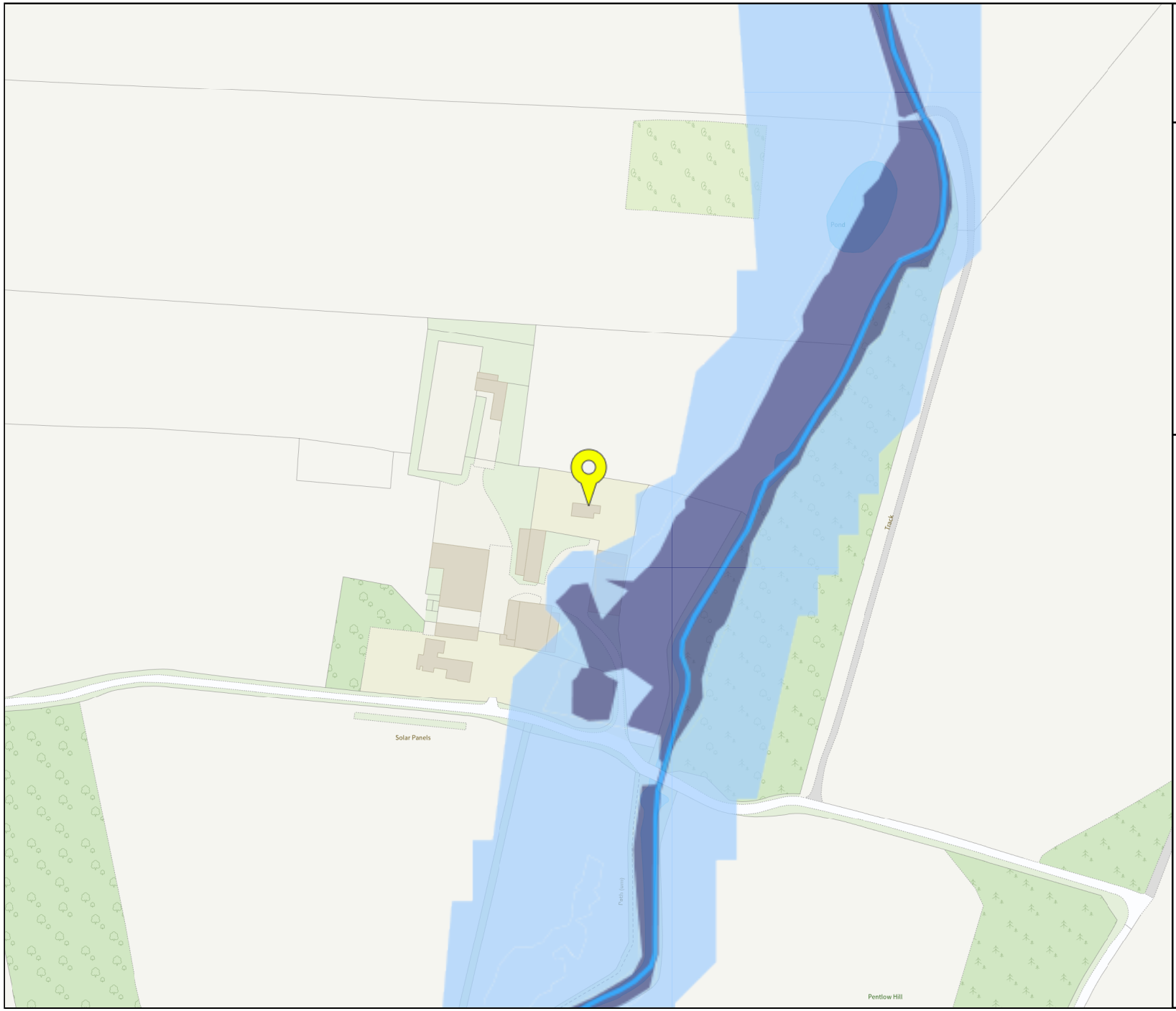
This means:

- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

Notes

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

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



Environment Agency

Flood map for planning

Your reference
Quinbury Farm

Location (easting/northing)
539618/226216

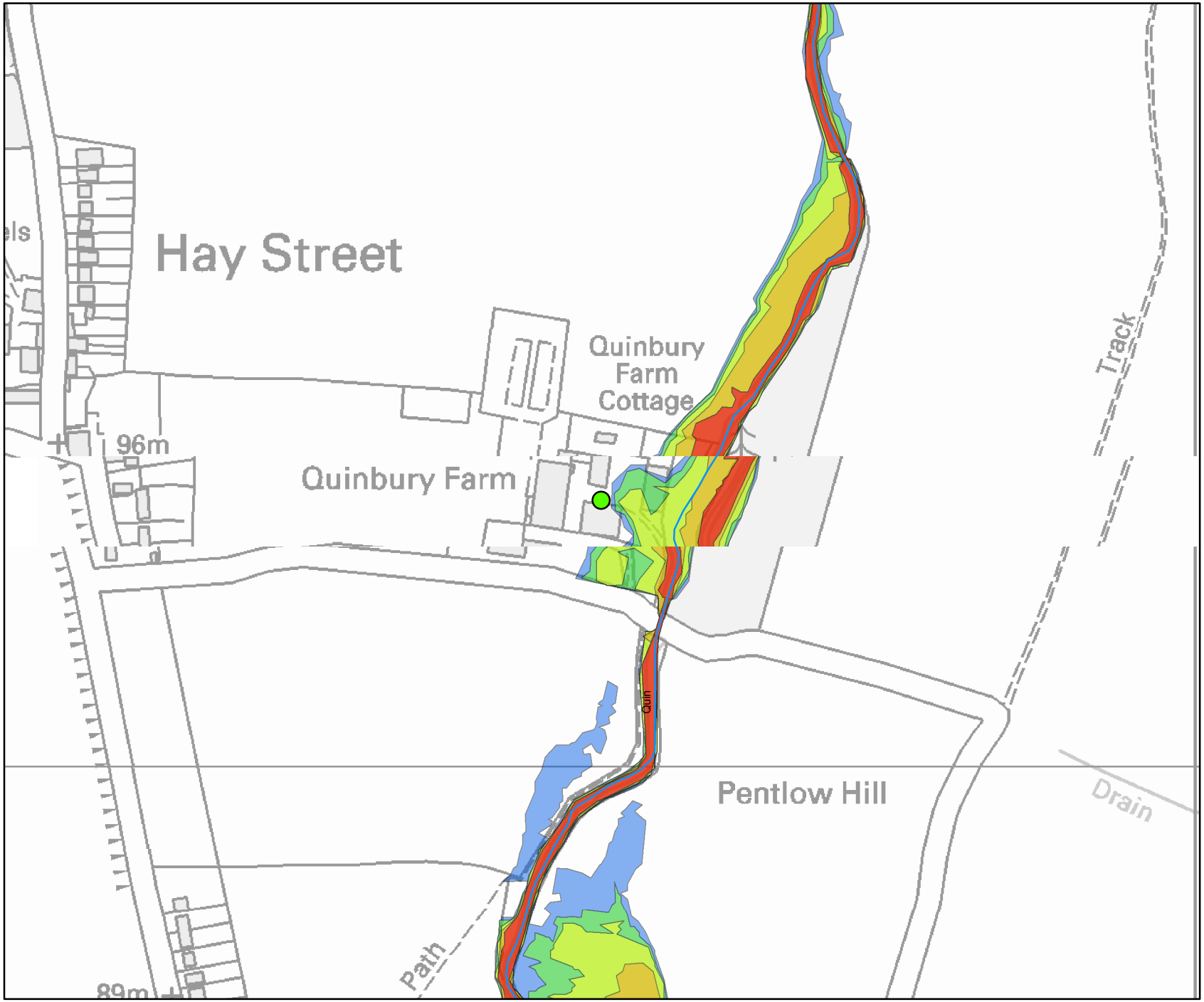
Scale
1:2500

Created
10 Feb 2022 9:13

- Selected point
- Flood zone 3
- Flood zone 3: areas benefitting from flood defences
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Flood storage area

0 20 40 60m

Detailed FRA centred on: Quinbury Farm, Braughing, SG11 2RE - 16/12/2021 - HNL244824NR



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

N

0 50 100 200
Metres

Legend

Main Rivers
Site location

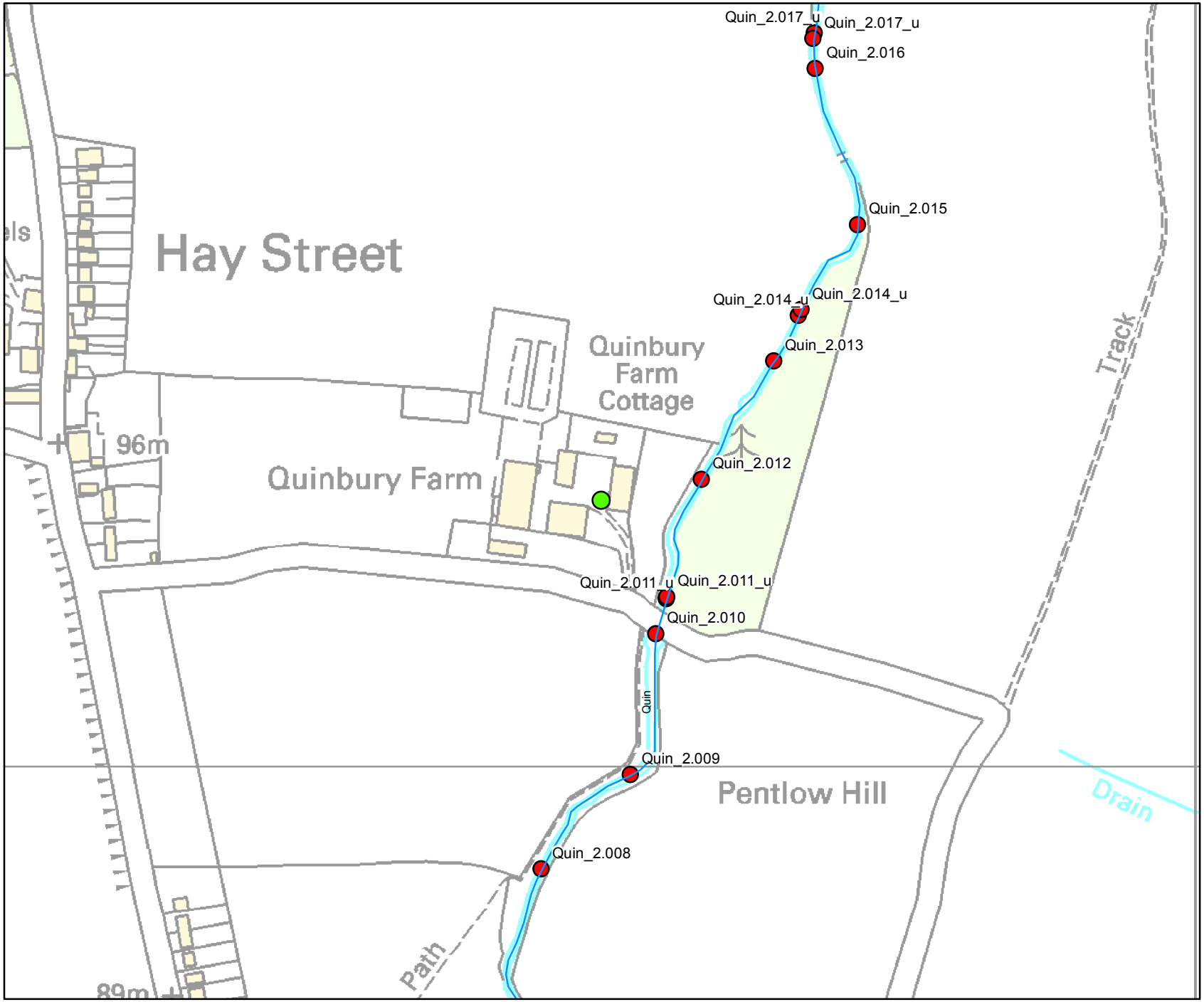
Defended Flood Outlines

- 1 in 5 (20%) Defended
- 1 in 20 (5%) Defended
- 1 in 100 (1%) Defended
- 1 in 100+20% (*CC) Defended
- 1 in 1000 (0.1%) Defended

The data in this map has been extracted River Rib Mapping Study Mott MacDonald (2009)
This study is a catchment scale mapping study and so may need local updates for site specific decisions. 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

Produced by:
Partnerships & Strategic Overview,
Hertfordshire & North London

Detailed FRA centred on: Quinbury Farm, Braughing, SG11 2RE - 16/12/2021 - HNL244824NR



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

N

0 50 100 200
Metres

Legend

- Main Rivers
- Site location

1D Node Results

- Node Locations

The data in this map has been extracted River Rib Mapping Study Mott MacDonald (2009)
This study is a catchment scale mapping study and so may need local updates for site specific decisions. 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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Partnerships & Strategic Overview,
Hertfordshire & North London

Environment Agency Ref: HNL244824NR

The following information has been extracted from the River Rib Mapping Study Mott MacDonald (2009)
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 study is a catchment scale mapping study and so may need local updates for site specific decisions.

All flood levels are given in metres Above Ordnance Datum (mAOD)
All flows are given in cubic metres per second (cumecs)

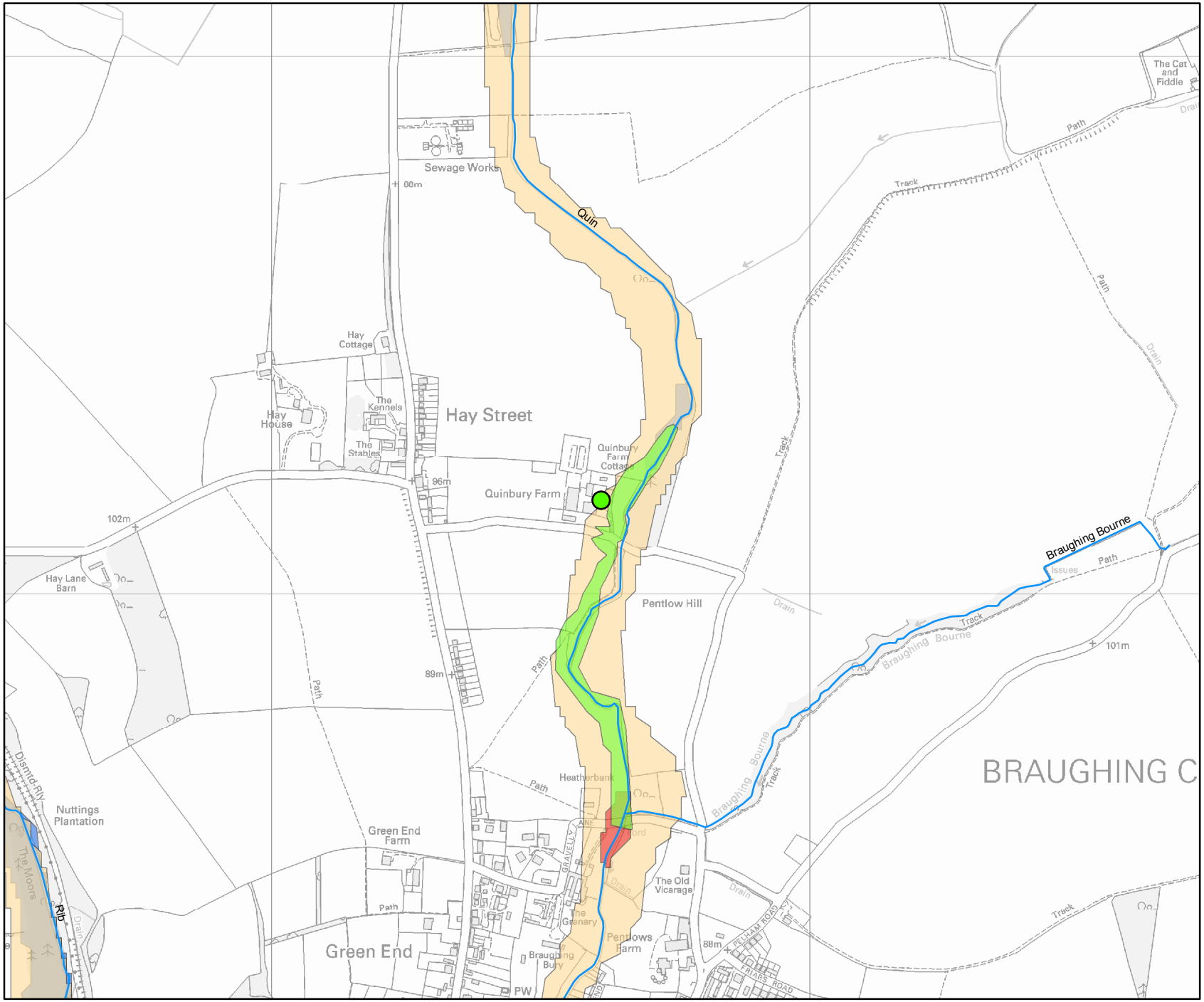
MODELLED FLOOD LEVEL

					Return Period		
Node Label	**Easting**	**Northing**	**5 yr**	**20yr**	**100yr**	**100yr+20%**	**1000yr**
Quin_2.017_u	539753	226476	74.16	74.43	74.71	74.89	75.06
Quin_2.017_u	539752	226473	74.16	74.43	74.71	74.89	75.06
Quin_2.016	539753	226453	74.04	74.25	74.44	74.58	74.74
Quin_2.015	539781	226351	73.91	74.14	74.35	74.50	74.67
Quin_2.014_u	539742	226292	73.75	73.99	74.20	74.34	74.49
Quin_2.014_u	539744	226296	73.75	73.99	74.20	74.34	74.49
Quin_2.013	539726	226263	73.48	73.74	73.94	74.06	74.17
Quin_2.012	539679	226186	73.39	73.68	73.89	74.01	74.13
Quin_2.011_u	539656	226108	73.14	73.40	73.65	73.83	73.98
Quin_2.011_u	539657	226109	73.14	73.40	73.65	73.83	73.98
Quin_2.010	539650	226085	72.16	72.37	72.54	72.64	72.77
Quin_2.009	539633	225994	71.91	72.09	72.23	72.35	72.49
Quin_2.008	539575	225932	71.81	71.98	72.08	72.15	72.28

MODELLED FLOWS

					Return Period				
Node Label	**Easting**	**Northing**	**5 yr**	**10yr**	**20yr**	**50yr**	**100yr**	**100yr+20%**	**1000yr**
Quin_2.017_u	539753	226476	9.37	10.73	12.47	14.98	16.68	19.67	23.02
Quin_2.017_u	539752	226473	9.37	10.73	12.47	14.98	16.68	19.67	23.02
Quin_2.016	539753	226453	9.37	10.73	12.46	14.98	16.68	19.67	23.02
Quin_2.015	539781	226351	9.40	10.73	12.46	14.97	16.67	19.66	23.02
Quin_2.014_u	539742	226292	9.41	10.73	12.46	14.96	16.67	19.65	23.02
Quin_2.014_u	539744	226296	9.41	10.73	12.46	14.96	16.67	19.65	23.02
Quin_2.013	539726	226263	9.40	10.73	12.46	14.96	16.67	19.65	23.02
Quin_2.012	539679	226186	9.35	10.72	12.46	14.96	16.67	19.65	23.01
Quin_2.011_u	539656	226108	9.33	10.72	12.46	14.96	16.66	19.65	23.01
Quin_2.011_u	539657	226109	9.33	10.72	12.46	14.96	16.66	19.65	23.01
Quin_2.010	539650	226085	9.32	10.72	12.46	14.96	16.66	19.65	23.01
Quin_2.009	539633	225994	9.30	10.72	12.45	14.96	16.66	19.65	23.01
Quin_2.008	539575	225932	9.27	10.72	12.45	14.96	16.66	19.64	23.00

Historic Flood Map centred on: Quinbury Farm, Braughing, SG11 2RE - 16/12/2021 - HNL244824NR



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

N

0 150 300 600
Metres

Legend

- Main Rivers
- Site location

Flood Event Outlines

- 1993
- 1987
- 1968
- 1947

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 datain places where we have not been able to record the extent of flooding.
It is also possible for errors occur in the digitisation of historic records of flooding.

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Appendix: D – Topographical Survey

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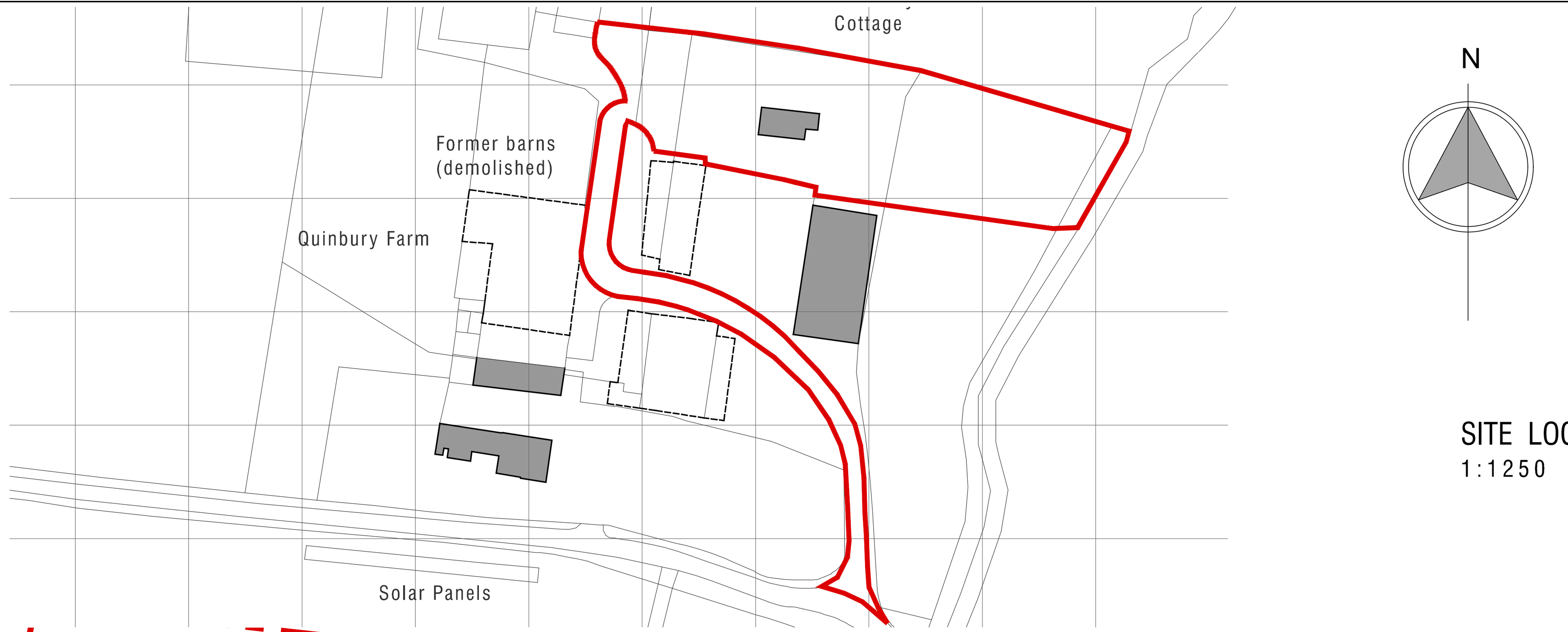

SITE LOCATION PLAN
1:1250

TOPOGRAPHICAL SURVEY
1:100 as existing

Rev. Date Description Name

QUINBURY FARM COTTAGE
HAY STREET
BUNTINGFORD

TOPOGRAPHICAL SURVEY

Kirby . Cove . Architects

Studio 10 Dimsdale House Hertford SG14 1BY 01992 538088

2346	101	-

drawn	date	chk A	chk B	scale
AR	January 2022	-	-	1:100 @ A1

Appendix: E – Flood Risk Area Maps

TRANSPORT PLANNING ■ HIGHWAYS AND DRAINAGE ■ FLOOD RISK
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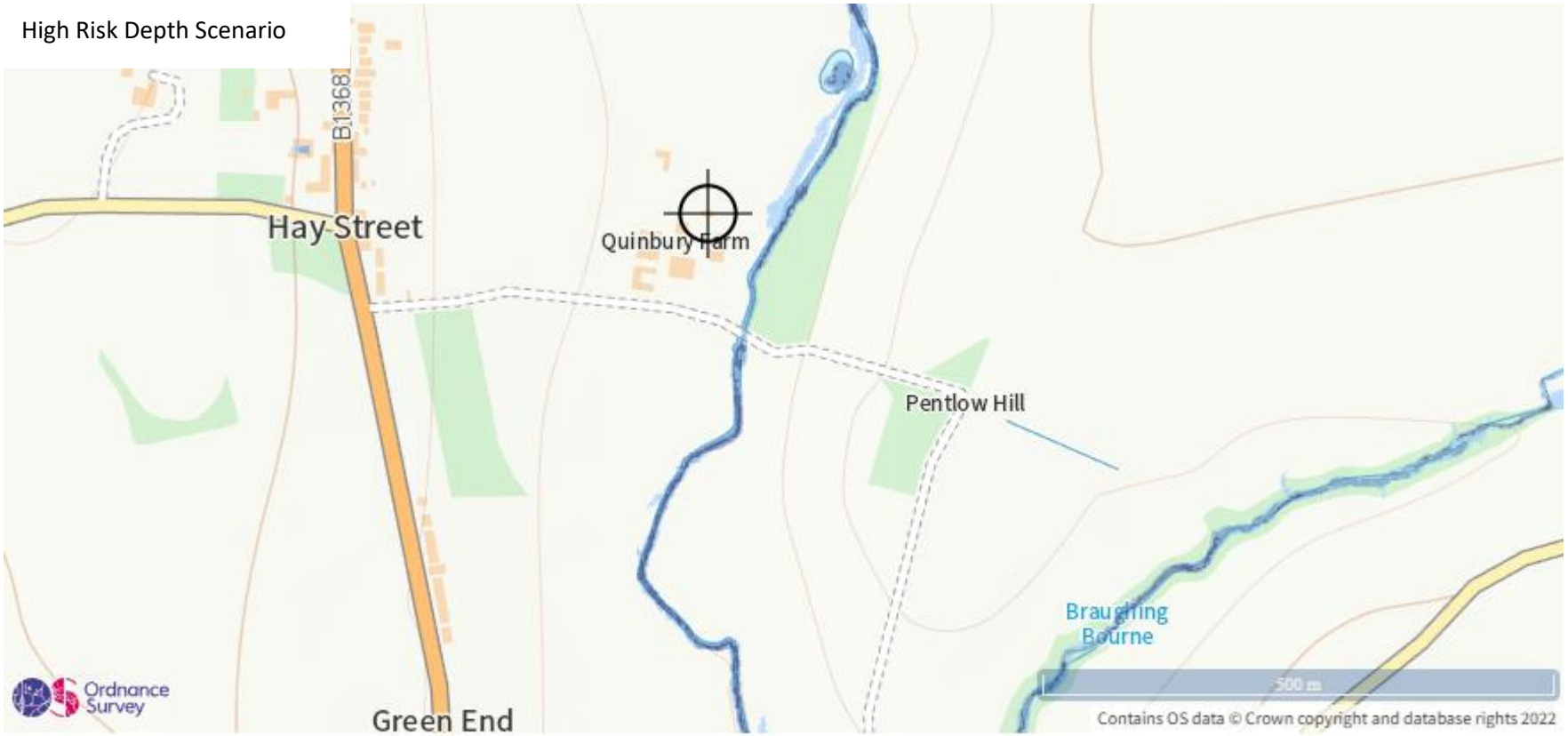
High Risk Depth Scenario



Surface water flood risk: water depth in a high risk scenario

Flood depth (millimetres)

Over 900mm | 300 to 900mm | Below 300mm | Location you selected

https://check-long-term-flood-risk.service.gov.uk/map?easting=539617.68&northing=226214.5&map=SurfaceWater*Contains public sector information licensed under the Open Government Licence v3.0.*

Site Location

Surface water flood risk: water depth in a medium risk scenario

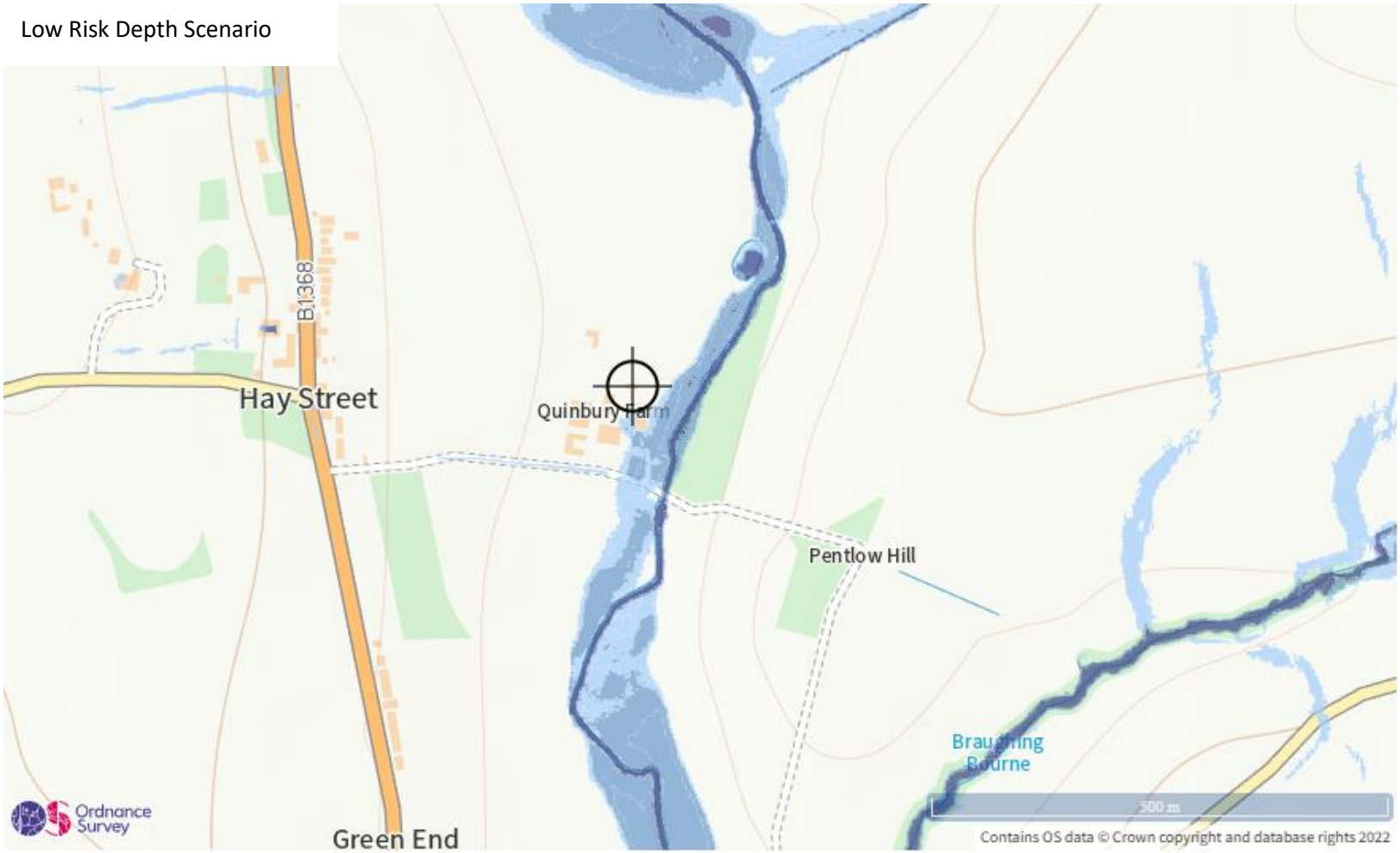
Flood depth (millimetres)

Over 900mm | 300 to 900mm | Below 300mm | Location you selected

https://check-long-term-flood-risk.service.gov.uk/map?easting=539617.68&northing=226214.5&map=SurfaceWater*Contains public sector information licensed under the Open Government Licence v3.0.*

Site Location

Low Risk Depth Scenario



Surface water flood risk: water depth in a low risk scenario

Flood depth (millimetres)

Over 900mm | 300 to 900mm | Below 300mm | Location you selected

https://check-long-term-flood-risk.service.gov.uk/map?easting=539617.68&northing=226214.5&map=SurfaceWater*Contains public sector information licensed under the Open Government Licence v3.0.*

Site Location

Appendix: F – Proposed SuDS Layout

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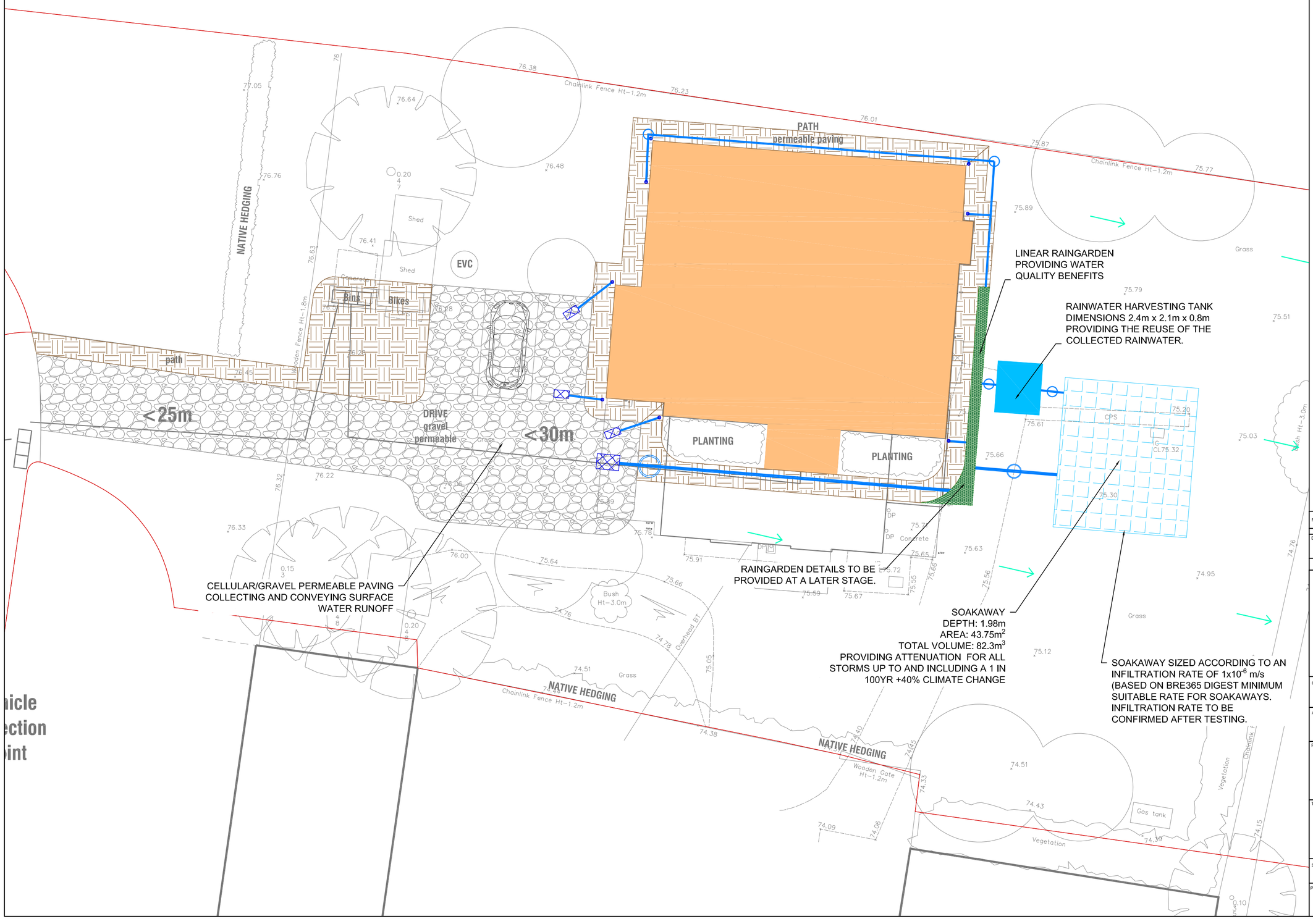

KEY

- SITE BOUNDARY
- PROPOSED ROOF AREA 201m² +10% URBAN CREEP 221.1m²)
- PROPOSED PATIO AND FOOTPATH AREA 108.8m²
- PROPOSED PERMEABLE PAVED DRIVEWAY AREA 159.5m²
- PROPOSED PROPOSED SOAKAWAY
- SURFACE WATER PIPE NETWORK
- SURFACE WATER MANHOLE
- PERMAVOID DIFFUSER UNIT
- RAINWATER DOWNPIPE
- RAINGARDEN
- EXCEEDANCE ROUTE

REV	DATE	BY	DESCRIPTION	CHK	APD

DRAWING STATUS:
PLANNING

EAS
1st Floor Millers House, Roydon Road,
Stanstead Abbotts, Hertfordshire, SG12 8HN
Tel: 01920 871777
www.eastp.co.uk

CLIENT:
KIRBY COVER ARCHITECTS

ARCHITECT:

PROJECT:
QUINBURY FARM COTTAGE
HAY STREET, BRAUGHING

TITLE:
SURFACE WATER DRAINAGE
INFILTRATION STRATEGY

SCALE @ A2:	DESIGN-DRAWN:	DATE:
1:125	AD	27/11/2023

PROJECT No:	DRAWING No:
3762	SK01 REV B

Appendix: G – Causeway Flow Outputs

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Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
Soakaway	0.049	5.00	75.200		51.482	61.837	2.640
1	0.000	5.00	75.200	1200	70.358	61.865	2.861

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	Soakaway	1	18.875	0.600	72.560	72.339	0.221	85.4	150	5.29	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.088	19.2	8.9	2.490	2.711	0.049	0.0	71	1.064

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	20.0
Summer CV	1.000	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	1.000	Drain Down Time (mins)	10000	Check Discharge Volume	x

Storm Durations

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

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

Node Soakaway Online Pump Control

Flap Valve	x	Replaces Downstream Link	✓	Switch on depth (m)	0.100
Downstream Link	1.000	Invert Level (m)	72.560	Switch off depth (m)	0.005

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.000	0.500	0.000	0.900	0.000	1.300	0.000	1.700	0.000
0.200	0.000	0.600	0.000	1.000	0.000	1.400	0.000	1.800	0.000
0.300	0.000	0.700	0.000	1.100	0.000	1.500	0.000	1.900	0.000
0.400	0.000	0.800	0.000	1.200	0.000	1.600	0.000	2.000	0.000

Node Soakaway Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00360	Safety Factor	2.0	Invert Level (m)	72.560
Side Inf Coefficient (m/hr)	0.00360	Porosity	0.95	Time to half empty (mins)	4680

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	43.8	43.8	1.320	43.8	78.7	1.981	0.0	96.2
0.660	43.8	61.2	1.980	43.8	96.2			

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute summer	Soakaway	1470	72.926	0.366	0.7	15.3530	0.0000	SURCHARGED
15 minute summer	1	1	72.339	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Discharge Vol (m³)
1440 minute summer	Soakaway	Pump	1	0.0	0.0
1440 minute summer	Soakaway	Infiltration		0.0	

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	Soakaway	1440	73.266	0.706	0.9	29.6223	0.0000	SURCHARGED
15 minute summer	1	1	72.339	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Discharge Vol (m³)
1440 minute winter	Soakaway	Pump	1	0.0	0.0
1440 minute winter	Soakaway	Infiltration		0.0	

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute summer	Soakaway	1470	73.563	1.003	1.9	42.1085	0.0000	SURCHARGED
15 minute summer	1	1	72.339	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Discharge Vol (m³)
1440 minute summer	Soakaway	Pump	1	0.0	0.0
1440 minute summer	Soakaway	Infiltration		0.0	

Results for 100 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	Soakaway	1440	73.417	0.857	1.1	35.9850	0.0000	SURCHARGED
15 minute summer	1	1	72.339	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Discharge Vol (m³)
1440 minute winter	Soakaway	Pump	1	0.0	0.0
1440 minute winter	Soakaway	Infiltration		0.0	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	Soakaway	1470	73.793	1.233	1.5	51.7798	0.0000	SURCHARGED
15 minute summer	1	1	72.339	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Discharge Vol (m³)
1440 minute winter	Soakaway	Pump	1	0.0	0.0
1440 minute winter	Soakaway	Infiltration		0.0	

Appendix: H – Rainwater Harvesting Tank

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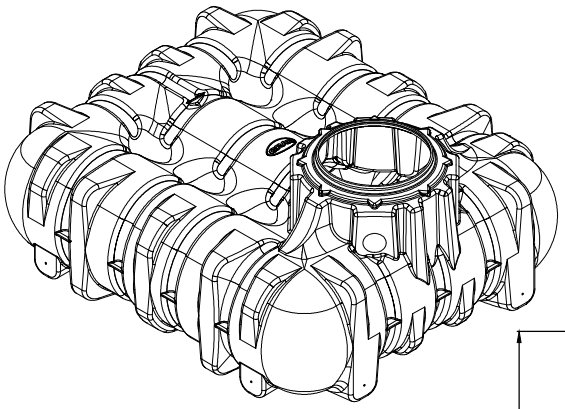

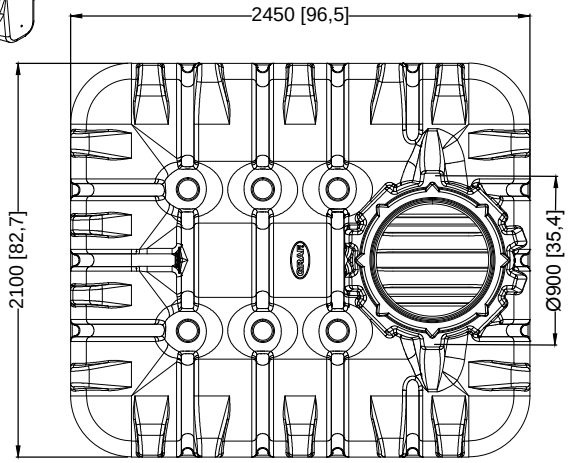

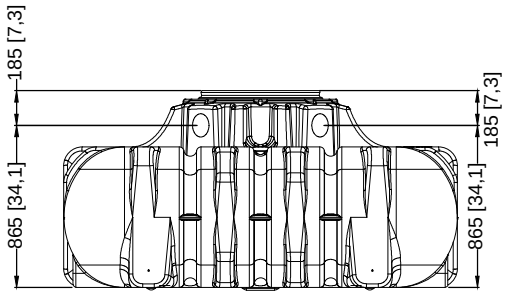

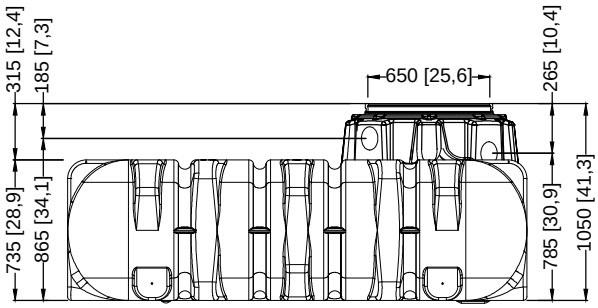

D	GRAF Platin Flachtank 3000 L / 792,5 gal.		Artikel-Nr. product no. article no. articulo no. 390001
GB GRAF Platin flat tank 3000 L / 792,5 gal.	ES GRAF Platin Depósito de poco profundidad 3000 L / 792,5 gal.	FR GRAF Platine Cuve à enterrer 3000 L / 792,5 gal.	revision
gezeichnet / drawn: ISC	Gewicht / weight: 180 kg	Otto Graf GmbH Carl-Zeiss-Str. 2-6 DE-79331 Teningen mail@graf.info www.graf.info	
Datum / date: 2015.11.23	Toleranz / tolerance: +/- 3%		
Maßstab / scale: M 1:40	Einheiten / units: mm [inch] gal. = US gal.		