Bridge House, Loughton

Essex

Flood Risk Assessment

March 2015

EAS

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1 Introduction

1.1 This Flood Risk Assessment (FRA) has been prepared by EAS to support a planning application for the demolition of a single dwelling known as Bridge House and replacement with a development of 3 x 1 bed and 3 x 2 bed flats.

1.2 The site is located off Roding Road, Loughton, Essex, IG10 3ED. A location plan is contained in **Appendix A**.

1.3 The site is located within Flood Zone 2 on the Environment Agency (EA) Flood Zone maps, so is at a medium risk of flooding from rivers and the sea (between a 1 in 100 and 1 in 1000 year probability of flooding).

1.4 This report is based on the following data: Epping Forest District Council Level 1 Strategic Flood Risk Assessment (SFRA), EA Flood Maps, BGS geological information and OS mapping.

1.5 The contents of each section of this document are as follows:

Section 2 sets out the national, regional and local flood risk policies.

Section 3 described the site conditions.

Section 4 describes the potential sources of flooding.

Section 5 discusses the on-site drainage.

Section 6 contains the conclusions of the study.

2 Policy framework

National Policy

2.1 The contents of this FRA are based on the advice set out in The National Planning Policy Framework (NPPF) and the Technical Guidance to the NPPF, published March 2012.

2.2 The Technical Guidance to the NPPF Table 1 defines each Flood Zone along with appropriate land use and FRA requirements. The flood risk zones are defined as follows:

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

2.3 A copy of the Environment Agency's Flood Map and full Product 3 data is included in **Appendix B**. The mapping shows that the site is located within Flood Zones 1 & 2 and therefore deemed to be at low to medium risk of fluvial flooding from the Loughton Brook.

2.4 Although the EA will not normally comment on applications for sites under 1ha within Flood Zone 2, as the Loughton Brook passes through the site and therefore works will be taking place within the vicinity Brook, a FRA is required to demonstrate to the EA that the proposed works will not result in an increase in flood risk. This FRA will also be used to inform a future application for a Flood Defence Consent required for any works taking place within 8m of the Brook.

Local Policy

2.5 Epping Forest District Council is in the process of completing their Core Strategy for the district, which will provide planning policy aims up until 2031 and replace the existing Local Plan. The Local Plan Alterations report, adopted July 2006, is the relevant policy document until the Core Strategy has been published, and the following policies relate to flood risk:

Policy U2A – Development in Flood Risk Areas sets out the local policy with regards to flooding. New development should be steered towards low risk areas, and not increase the risk of flooding to others.

Policy U3A – Sustainable Urban Drainage Systems highlights the importance of disposing of surface water runoff in a sustainable manner. The methods outlined within this report follow this guidance and ensure the runoff from the proposed development does not cause a flood risk elsewhere.

Epping Forest District Council Level 1 Strategic Flood Risk Assessment

(SFRA)

2.6 The Epping Forest District Council (EFDC) Strategic Flood Risk Assessment (SFRA) was prepared in March 2011 as supporting evidence to the LDF and outlines the flood risk issues that need to be considered when considering potential allocation sites.

2.7 The SFRA identifies that the Loughton Brook (Staples Road) Flood Storage Reservoir (protection 1 in 75 years) was completed in December 1995. It was built to protect Loughton Town centre from flash flooding from the forested catchment area of the Loughton Brook. The reservoir is formed by an earth embankment 140 metres long varying in height from 0 to 8 metres. A reinforced grass overtoppable section 50 metres long acts as a spillway for storms of an intensity greater than was designed for. The pond will store a maximum 47,200 cubic metres of water during the design 1 in 75 year event. The discharge from this pond is controlled by a penstock within a chamber accessed from the top of the embankment. Water level within the reservoir is continuously monitored via a telemetry system.

2.8 The following figures from the SFRA available on the EFDC website:

- Map 3 - Historic Flooding Incidents
- Map 4 - Flood Zones
- Map 5 - Climate Change
- Map 9 – Flood Defences / Structures

2.9 Historic flood events were recorded from the following sources within the SFRA:

- Flood Incident Databases (EFDC and Harlow).
- Sewer flooding records (Thames Water).
- Environment Agency Database of recorded groundwater incidents since 2001.
- Environment Agency Groundwater flooding reports.

2.10 Map 3 illustrates the historic flooding incidents as recorded from the local authority database (see sources below). It shows that no individual flood events are located in close proximity to the site, however the site is within a general area identified to have been affected by a fluvial flooding event in 1987. Downstream of the site a number of historic flood events are identified to have occurred along the course of the Loughton Brook which is reflected by the fluvial floodplain illustrated on Map 4 - Flood Zones.

2.11 Map 4 identifies the site to be within Flood Zone 3a as a result of a fluvial flood risk from the Loughton Brook, however this would appear to be either incorrect or based on now superceeded modelling; as Map 4 is based on information provided by the EA and the latest EA flood mapping contained in Appendix B clearly identifies that the site is within Flood Zone 2.

2.12 Map 5 which looks at the impacts of climate change does not include the Loughton Brook.

2.13 Map 9 illustrates the location of the Loughton Brook Flood Storage Reservoir located approximately 1.2km to the northwest of the development site.

3 Site Description

3.1 Bridge House is located off Roding Road, Loughton, Essex, IG10 3ED. A location plan is contained in **Appendix A**. The site is bordered by Roding Road to the west and by the recreational ground on all other boundaries.

3.2 The FRA relates to the proposed demolition of Bridge House and replacement with a development of 3 x 1 bed and 3 x 2 bed flats. The development includes car parking at the site frontage. The site covers an area of approximately 680sqm. The proposed site plan is contained in **Appendix C**.

3.3 As part of the development it is proposed that the current bridge located within the northeast of the site be replaced with a bridge in the northwest of the site. A topographical survey contained in **Appendix D** illustrates the current location of the bridge and the proposed site plan in **Appendix C** illustrates the relocated bridge.

3.4 The width of the bridge is set to increase by 1.3m from 2.57m to 4.1m wide in order to accommodate a single parking bay in addition to the pedestrian footway. The bridge is being relocated from a narrower part of the brook with a minimum width of 2.3m to a wider part of the brook with a minimum width of 3.0m. Due to the increase in the width of the brook the hydraulic capacity of the bridge will increase and this is explored further in the next section of this report.

Proximity to Watercourses

3.5 The Loughton Brook passes through the front of the site, and there is currently a 2.57m wide footbridge across the brook within the site. The brook takes the form of a concrete base and straight retaining brick walls, and the bridge takes the form of a concrete slab with brick walls. The photo below shows the construction of the brook and bridge within the site:

3.6 The Loughton Brook is culverted for much of its length and discharges into the River Roding approximately 1km to the southeast of the development site.

Site Levels

3.7 Levels taken from the topographical survey contained in **Appendix D** indicate that the site falls from a high point in the northeast of the site at 25.3m to a low point in the southwest of 23.8m. The brook has a bed level of around 22.6m and a top of bank level of around 24.2m, however on both sides of the brook this is currently extended by a 1.4m high brick wall located on top of the brook, and a wrought iron fence on top of the brick wall.

Underlying Geology

3.8 Reference to the British Geological Survey website indicates that the development site has a bedrock of London Clay Formation (clay, silt and sand), with some superficial deposits of Alluvium along the corridor of the brook (clay, silt, sand and gravel).

Sewer Network

3.9 Sewer records, obtained from Thames Water, illustrate foul water sewers to be located within Roding Road, and that surface water runoff in the local area is directed to the Loughton Brook.

3.10 The Thames Water sewer records are included in **Appendix E**.

4 Potential Sources of Flooding

Fluvial Flooding Loughton Brook

4.1 With reference to the online Environment Agency Flood Map, the site is located entirely within Flood Zone 2. This indicates a medium probability of fluvial flooding of between 1 in 100 and 1 in 1000 years each year. Flood mapping and level information was requested from the EA and forms **Appendix B**.

4.2 The flood levels nearest the site, provided in the flood level data for the closest node, are summarised in Table 1.

Model Node	**1 in 20 year**	**1 in 100 year**	**1 in 100 year +CC**	**1 in 1000 year**
LB_1077u	Defended flood level: 23.51	Defended flood level: 23.69	Defended flood level: 23.82	See levels plan defended flood levels ranges from 24.02 at the south-western boundary to 24.85 on the north-eastern boundary

Table 1: Environment Agency Modelled Flood Levels (undefended)

4.3 Based on the modelled flood levels in Table 1 and a comparison against the topographical survey in **Appendix D**, it can be seen that all of the site is located above the critical 100 year plus climate change event of 23.82m. As such there is no need to consider floodplain compensation and there will be safe access and egress routes from the site above this critical level. The finished floor level of the existing building is 24.261m, which has a 441mm freeboard above the 100 year plus climate change.

4.4 It can also be seen that a 1000 year flood event would result in some very minor flooding on site, with the majority of flooding across the site limited to below a depth of 100mm. The finished floor level of the existing building is 24.261m, which is a 61mm freeboard above the 1000 year level at the entrance of the building of 24.2m.

4.5 It can therefore be concluded that provided the proposed flatted development has a finished floor level for the ground floor that is the same or above that of the existing dwelling (and no basement level development is proposed) that the site will meet the requirements for all residential development being located above the 1000 year flood level and with a freeboard in excess of 300mm above the 100 year plus climate change flood level.

Fluvial Flooding Impact of On-Site Works

4.6 As discussed in section 3, the Loughton Brook passes through the front of the site, and there is currently a 2.57m wide footbridge across the brook within the site. As part of the development it is proposed that the current bridge located within the northeast of the site be replaced with a bridge in the northwest of the site. The width of the bridge is set to increase by 1.55m from 2.57m to 4.12m wide in order to accommodate a single parking bay in addition to the pedestrian footway. The bridge is also being relocated from a narrower part of the brook with a minimum width of 2.3m to a wider part of the brook with a minimum width of 3.0m.

4.7 Calculations to identify the change in hydraulic capacity under the bridge in the existing and proposed situations were calculated using Micro-Drainage, and the results are contained in **Appendix F**. It can be seen that due to the increase in the width of the brook at the relocated position of the bridge the hydraulic capacity of the bridge will increase from $6.7m^3/s$ to $9.3m^3/s$.

4.8 The modelled flow for the critical 100 year plus climate change event provided by the EA and included in **Appendix B**, for node LB-1077u is $3.8m^3/s$. Therefore as a result of the proposed replacement bridge works with the available capacity available within the bridged part of the channel rising will rise from $2.9m^3/s$ to $5.5m^3/s$, in excess of the flow that would be experienced within an extreme 100 year plus climate change event. However it should be noted that the likely flow rate leaving the site will still be restricted by the narrower section of the brook at the position of the existing bridge and therefore the actual flow leaving the site is likely to remain the same.

4.9 It has therefore been demonstrated that the replacement bridge will not restrict or obstruct flow. It should be noted that the bridge construction will be of a similar type to the existing bridge i.e. a concrete span over the brick and concrete brook channel. It is clear therefore that the replacement bridge of a similar type will not have any negative impact on the structural integrity of the brook, restrict in anyway emergency access to the brook, or have any impact on the river bank or bed downstream.

Surface Water Flooding

4.10 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'.

4.11 The EA online surface water flood maps indicate the site to be located in a 'Low' risk area with regards to surface water flooding (**Appendix G**). This indicates that the site has between a 1 in 100 (1%) and 1 in 1000 (0.1%) chance of flooding from surface water each year. The identified depth of flooding is below 300mm. Although these maps are indicative only and not site-specific, they are useful to provide an overview of surface water flooding.

Sewer Flooding

4.12 Sewer records, obtained from Thames Water, illustrate foul water sewers to be located within Roding Road, and it is likely that in the event that flooding occurs as a result of a blockage in the sewer that the effluent would be retained within Roding Road and would not enter the site.

Groundwater

4.13 The EA online mapping does not indicate the site to be located in an area designated as an aquifer based on bedrock or superficial deposits. The EA online groundwater maps do not show the site to be located within a groundwater source protection zone.

4.14 The Level 1 SFRA notes that the Epping Forest District is known to experience groundwater flooding in areas where there are outcrops of highly permeable Lambeth Group Sands and the Kesgrave Sands and Gravels. This is not the case for the site which is located in an area of London Clay with some superficial deposits of Alluvium. London Clay is not usually associated with groundwater flooding issues due to the low level of permeability.

Artificial Sources

4.15 Reference to the EA reservoir flood risk map (**Appendix H**) shows the site is within an area at risk of flooding from a failure of the Loughton Brook Flood Storage Reservoir completed in December 1995. This is not un-expected given the site is within Flood Zone 2 within an area which is protected by the upstream flood defence reservoir located 1.2km to the northwest of the site.

4.16 Based on the modelled flood levels in Table 1 it can be seen that a 1000 year flood event which assumes the defences will have been overwhelmed, would result in some very minor flooding on site, with the majority of flooding across the site limited to below a depth of 100mm. The finished floor level of the existing building is 24.261m, which is a 61mm freeboard above the 1000 year level at the entrance of the building of 24.2m. As such should the reservoir fail under the most extreme rainfall conditions the flood risk to the site will not be high.

5 Mitigation Measures

Finished Floor Levels

5.1 It is proposed that the finished floor level of the existing building of 24.261m, which has a 441mm freeboard above the 100 year plus climate change, is retained and no basement level development be provided.

Flood Compensation

5.2 As the site is within Flood Zone 2 floodplain compensation is not required to be accommodated.

Flood Resilient Construction

5.3 As the ground floor finished floor level is above the 100 year plus climate change level flood resilience measures are not required to be accommodated.

Evacuation/Rescue

5.4 An Evacuation Plan should be prepared for the proposed development to make occupants aware of the flood risk to the premises and to provide guidance on evacuation routes and places to evacuate to should they choose to leave in times of flood.

5.5 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.

5.6 It is recommended that the residents occupying the proposed development sign up to the EA flood warning service. The EA website indicates that the site lies within the Flood Warning Area for the River Roding which is 1km to the southeast of the development site and would provide a good indication of the likely risk of flooding from the Loughton Brook.

5.7 The residents should register with the flood warning service by using the link below: **https://fwd.environment-agency.gov.uk/app/olr/register.** Alternatively registration can be completed by telephone via the EA Floodline on **0845 988 1188** or Typetalk **0845 602 6340**.

5.8 In the event of a serious flood event across the site the competent warning authority is the Environment Agency. When a flood is expected the Local Authority and local emergency services will be responsible for public care and safety. There are five action levels associated with each phase of the flood risk:

i. **Annual Review**

ii.  **Flood Watch**

iii.  **Flood Warning**

iv.  **Severe Flood Warning**

v. **Warnings no Longer in Force**

<u>Annual Review</u>

5.9 The Flood Warning and Evacuation Plan should be reviewed at least annually by the management of the proposed residential development or each resident. The following actions should be taken in line with Environment Agency guidance:

- Reading the plan and updating the contacts list.
- Contact the Environment Agency Floodline Service on **0845 9881188** to check that the flood risk to the property has not changed, for example flood defences may be built.
- Contact the Environment Agency Flood Warning Service on 08459881188 to register to receive flood alerts direct to your phone.
- Prepare and maintain a flood kit to contain items which are essential for evacuation.

5.10 Each resident of the development should have in place a local friend or family member who they can stay with should evacuation be necessary.

5.11 The flood kit will also be useful for general emergency situations and should be stored where it can be easily accessed and should include:

- A torch
- Blankets or a sleeping bag, warm clothing and waterproofs
- A first-aid kit, including a supply of any essential medication
- A list of useful telephone numbers
- A supply of bottled water
- A stock of non-perishable food items
- A portable radio and supply of batteries
- Wellington boots or similar waterproof boots
- Check your insurance cover – ensure it covers flood damage
- Know how to turn off the gas, electricity and water mains supplies
- Think about what items you would want to move to safety during a flood

5.12 It is important that these emergency measures are in place before a flood event so that should evacuation be required, residents do not spend time organising belongings and household members (such as small children) at a time when an evacuation should be taking place.

Flood Alert

5.13 The EA will issue a Flood Alert status when flooding is possible. This will be issued by the EA through their website and Flood Warning Direct based upon the weather and river conditions.

5.14 **Flood Alert means that flooding is possible and that you need to be prepared.**

5.15 At this stage residents should ensure that their neighbours are aware of the Flood Watch alert in case adjacent businesses are not subscribed to Floodline Warning Direct and do not receive the alert.

Flood Warning

5.16 Flood Warning means, ‘Flooding of homes and businesses is expected. Act now.

5.17 The flood warning alert will be issued when water levels are rising and further rain is expected. It is advised to safeguard the property and prepare to evacuate.

5.18 At this stage the following actions should be taken:

- The Environment Agency aim to provide at least 2 hours warning between the Flood Warning alert being issued and the commencement of flooding. The EA recommend that residents should evacuate when a Flood Warning or Severe Flood Warning status is issued. If flood levels continue to rise, residents are advised to evacuate before safe access is lost.
- Move family, pets and valuables to a safe place.
- Locate, water, electricity and gas supplies and switch off before evacuating (if safe to do so). If residents are unsure of how to do this they must contact their supplier.
- Call the EA Floodline on 0845 988 11 88 periodically and listen to and watch for weather and flood warnings on local radio and television stations. Evacuate until the EA removes the Flood Warning.

5.19 At this stage, it is advised that the manager of the commercial property should close and secure the premises. Customers should be evacuated, following the evacuation route detailed below, before safe access is lost. Residents can choose whether to remain in their homes until the floodwaters recede, or evacuate the building.

Severe Flood Warning

5.20 Severe flood warning means that severe flooding is expected. There is extreme danger to life and property and people are advised to act immediately i.e. evacuate.

5.21 At this stage the following actions should be taken:

- At this level it is possible that driving through flood water may become hazardous.
- Residents should monitor the flood progression and evacuate, on foot immediately if not already done so and only if safe to do so.
- At this stage the local authority, the emergency services and the Environment Agency should be managing the situation, with widespread flooding potentially over a large area, and will endeavour to provide advice on an evacuation route, shelter and assistance to evacuees.
- Call 999 if you are in immediate danger.

5.22 The management of the commercial property must evacuate the premises if they have not already done so and ensure that all customers have left, via the evacuation route detailed below. Residents can remain in their homes which are located above the extreme flood level.

Warnings no Longer in Force

5.23 When warnings are no longer in force, no further flooding is currently expected in your area; however flood water may still be present.

5.24 Residents should contact the local authority to check that it is safe to return to their property. If floodwaters have entered the property it will need to be cleaned, disinfected and repaired and fully dried out prior to re-occupation. It must be checked that the building is safe before entering the building, and if there are any doubts professional opinion should be sought.

5.25 If there is any doubt that appliances may be water damaged they must be checked before switching the power or gas back on. Contact your insurance company as soon as possible to get their approval before arranging any clean-up or repairs. Do not throw away damaged goods until your insurer has authorised you to do so. It is a good idea to take photographs of the damage.

5.26 It is very important that the lower ground floor commercial premises and the car park are evacuated immediately upon receipt of a 'Flood Warning'. The onset of flooding can occur quickly and it is vital that customers and residents evacuate the premises quickly and safely if flooding is expected. In particular, more vulnerable people such as the elderly or disabled will take longer to evacuate the area, so it is important to ensure that these people have enough time to leave the premises.

Evacuation Route

5.27 The most appropriate evacuation route is direct onto Roding Road which is located outside of the floodplain.

6 Development Drainage

Existing Surface Water Drainage

6.1 The existing building on the site, Bridge House, discharges surface water direct to the Loughton Brook.

Relevant SuDS Policy

6.2 The NPPF states within Flood Zone 1, *"developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage techniques (SuDS)".*

6.3 SuDS mimic the natural drainage system and provide a method of surface water drainage which can decrease the quantity of water discharged, and hence reduce the risk of flooding. In addition to reducing flood risk, these features can improve water quality and provide biodiversity and amenity benefits.

6.4 The SuDS management train incorporates a hierarchy of techniques and considers all three SUDS criteria of flood reduction, pollution reduction, and landscape and wildlife benefit. In decreasing order of preference, the preferred means of disposal of surface water runoff is:

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

6.5 The philosophy of SuDS is to replicate as closely as possible the natural drainage from a site pre-development and to treat runoff to remove pollutants, resulting in a reduced impact on the receiving watercourses. The benefits of this approach are as follows:

- Reducing runoff rates, thus reducing the flood risk downstream.
- Reducing pollutant concentrations, thus protecting the quality of the receiving water body.
- Groundwater recharge.
- Contributing to the enhanced amenity and aesthetic value of development areas.
- Providing habitats for wildlife in developed areas, and opportunity for biodiversity enhancement.

Site-Specific SuDS

6.6 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 1 outlines the constraints and opportunities to each of the SuDS devices in accordance with the hierarchical approach outlined in The SuDS Manual CIRIA C697i. 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.	A living roof / green roof is proposed.	Yes
Infiltration devices & Soakaways (source control)	Store runoff and allow water to percolate into the ground via natural infiltration.	The underlying geology is likely to have low permeability therefore infiltration devices are not ideal.	No
Pervious surfaces (source control)	Storm water is allowed to infiltrate through the surface into a storage layer, from which it can either infiltrate and/or slowly release to sewers.	The underlying geology is likely to have low permeability therefore infiltration devices are not ideal. However the parking area is proposed as a natural gravel which will allow some natural infiltration to occur.	Yes (gravel on parking area)
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.	Potential for rainwater harvesting to be considered.	Potential
Swales (permeable conveyance)	Broad shallow channels that convey / store runoff, and allow infiltration (ground conditions permitting).	Spatial constraints at the site and low permeability mean swales are unlikely to be viable.	No
Filter drains & perforated pipes (permeable conveyance)	Trenches filled with granular materials (which are designed to take flows from adjacent impermeable areas) that convey runoff while allowing infiltration.	The underlying geology is unlikely to have the potential for infiltration due to low permeability.	No
Filter Strips (permeable conveyance)	Wide gently sloping areas of grass or dense vegetation that remove pollutants from run-off from adjacent areas.	Spatial constraints at the site mean there is unlikely to be room to incorporate filter strips.	No
Infiltration basins (end of pipe treatment)	Depressions in the surface designed to store runoff and allow infiltration.	The underlying geology is unlikely to have potential for infiltration due to low permeability.	No
Wet ponds & constructed wetlands (end of pipe treatment)	Provide water quality treatment & temporary storage above the permanent water level.	Spatial constraints at the site mean there is unlikely to be room to include wet ponds and wetlands.	No
Attenuation Underground (end of pipe treatment)	Oversized pipes or geo-cellular tanks designed to store water below ground level.	The required attenuation volume can be achieved within the green roof so not likely to be required.	No

Table 1: Site-Specific Sustainable Drainage Techniques

Outline Drainage Scheme

6.7 It is proposed that the roof of the building (247sqm) will be constructed of a green/living roof and a large part of the car parking area will be constructed of a gravel construction. As such the area of hardstandings on site draining to the brook without any restriction will be limited to 165sqm of block paving proposed around the building and within the car park. The existing site has an approximate impermeable area of 225sqm made up of roof and paved area, which drains directly to the brook with no restriction on the runoff rate.

6.8 As the overall rate of surface water runoff from the site is therefore not expected to increase above that of the existing site as a result of the development proposals it is not proposed to restrict and attenuate the runoff from the blocked paved area, and the existing drainage connections will be retained. In addition it should be noted that it would be difficult to restrict the runoff to a sufficient level to attenuate the runoff to greenfield runoff rates for such a small area, as a minimum rate of 5l/s is recommended, below which the outfall could easily block which could result in an increase in flood risk.

6.9 In summary it can be seen that the SuDS proposal will provide a green-roof combined with a gravel parking area which will help to meet the SuDS criteria whilst working within the site constraints.

Residual Flood Risk

6.10 With respect to Sections 4 and 5, it can be confirmed that the site is not at significant risk of flooding either before or after the development.

6.11 Extreme rainfall events are generally predictable but by their nature predictions are based on probability and thus subject to uncertainty. Therefore an unquantifiable residual risk remains that events exceeding those predicted may occur, notably surcharging or blockage of drainage systems.

6.12 The drainage systems serving the proposed development will be managed by the owners of the site, and it is recommended that regular inspections of the surface water drainage systems are carried out to ensure that they continue to work effectively.

7 Summary and Conclusions

7.1 It has been demonstrated that the flood risk posed to the site from the Loughton Brook, and the failure of the Loughton Flood Storage Reservoir can be adequately mitigated against by:

- providing a finished floor level no lower than the existing finished floor level;
- having no basement development; and
- by having adequate warning and evacuation plans in place for the future residents.

7.2 All other sources of flooding have been explored and the risks have been deemed to be low.

7.3 A relocation and minor widening of the existing bridge within the site has been proposed, however it has been demonstrated that this would improve rather than restrict the capacity of the channel due to the bridge being relocated to a wider section of the brook.

7.4 In addition to demonstrating that the bridge will not restrict or obstruct the flow of the brook, it has also been demonstrated that as a result of using a similar construction as the existing bridge that the relocation will not: restrict access for maintenance and emergency access, result in channel migration/erosion or an increased risk of river bank and bed erosion downstream, and will not compromise the structural integrity of the watercourse.

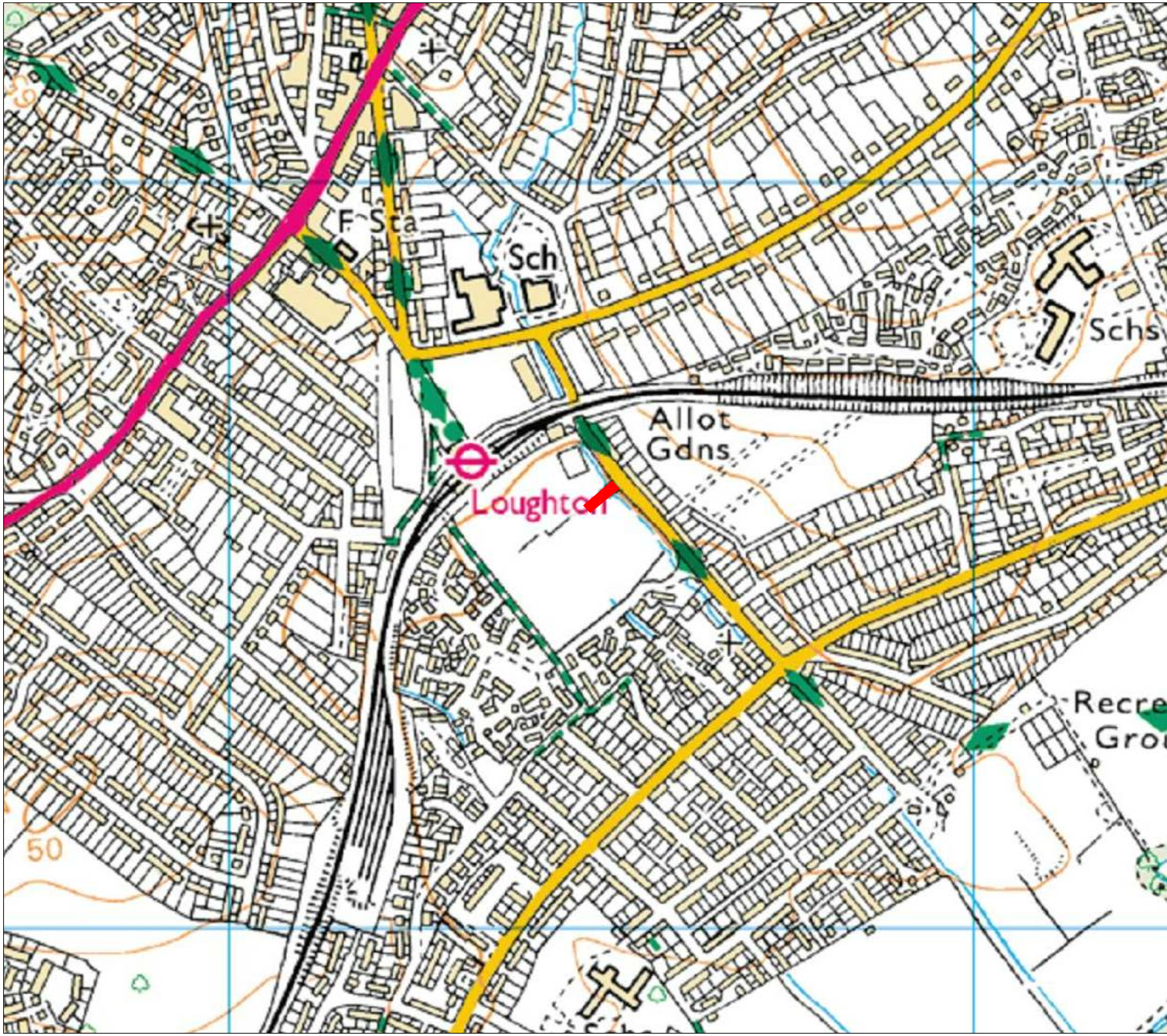
7.5 A SuDS drainage strategy has been proposed including a green roof construction for the building.

7.6 We believe that the development proposals comply with the national and local policy guidance, and that there are no flood risk reasons no object to the development.

Appendices

Appendix: A	Location Plan
Appendix: B	EA Flood Map
Appendix: C	Proposed Site Plan
Appendix: D	Topographical Survey
Appendix: E	Thames Water Sewer Records
Appendix: F	Bridge / Channel Capacity Calculations
Appendix: G	EA Surface Water Flood Map
Appendix: H	EA Reservoir Flood Map

Appendix: A LOCATION PLAN



DEVELOPMENT SITE

REV	DATE	BY	DESCRIPTION	CHK	APD

DRAWING STATUS:

EAS

Unit 108, The Maltings, Stanstead Abbotts, Hertfordshire,
SG12 8HG
Tel: 01920 871777

www.eastp.co.uk

CLIENT:

ARCHITECT:

PROJECT:

BRIDGE HOUSE
LOUGHTON

TITLE:

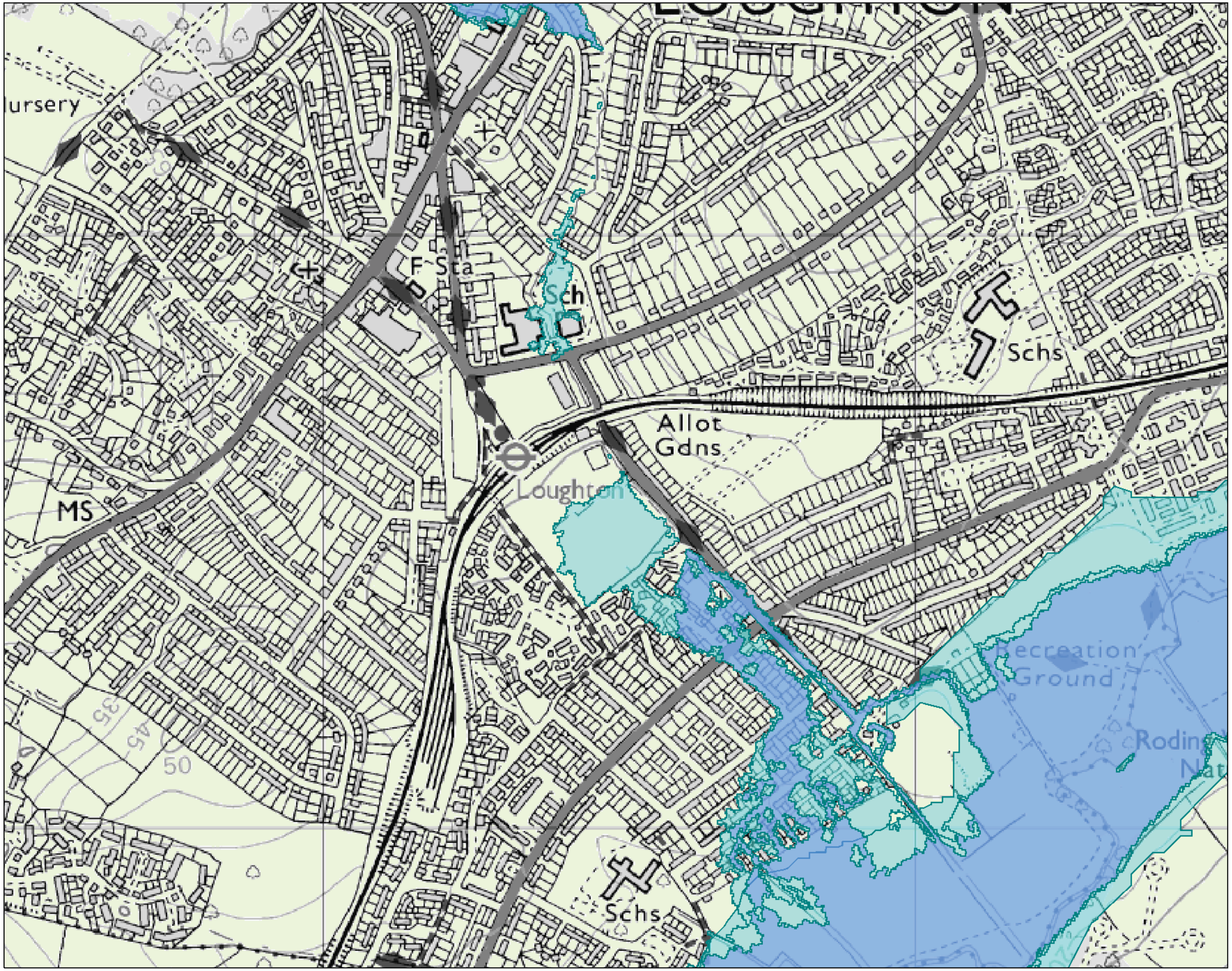
LOCATION PLAN

SCALE @ A3:	DESIGN–DRAWN:	DATE:
1:5000	PL	05/01/2015

PROJECT No:	DRAWING No:
659	SK01

Appendix: B EA FLOOD MAP

Flood map centred on Roding Road, Loughton created 18 December 2014 [Ref:HNL044758 BC]



Environment Agency

Scale 1:10,001

N
W
E
S

Flood Map for Planning (Rivers and Sea)

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

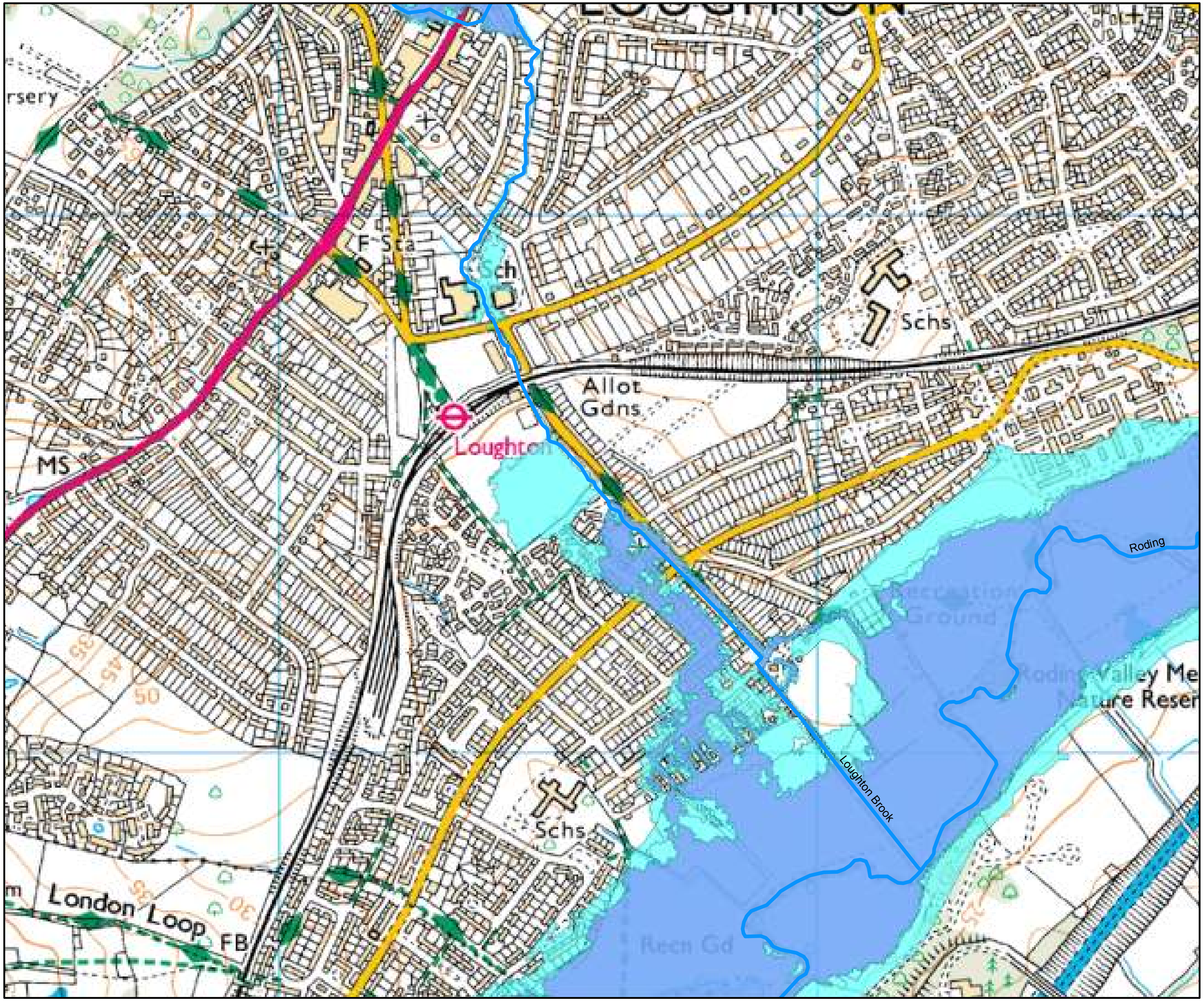
Flood Map for Planning (Rivers and Sea) (assuming no defences)

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.

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

Detailed FRA centred on Loughton IG10 3ED created 12/12/2014 - Ref:HNL044758BC



Environment Agency

Environment Agency
2 Bishops Square Business Park
St Albans Road West
Hatfield
Hertfordshire
AL10 9EX

0 130 260 520
Metres

Legend

Main Rivers

Flood Map for Planning

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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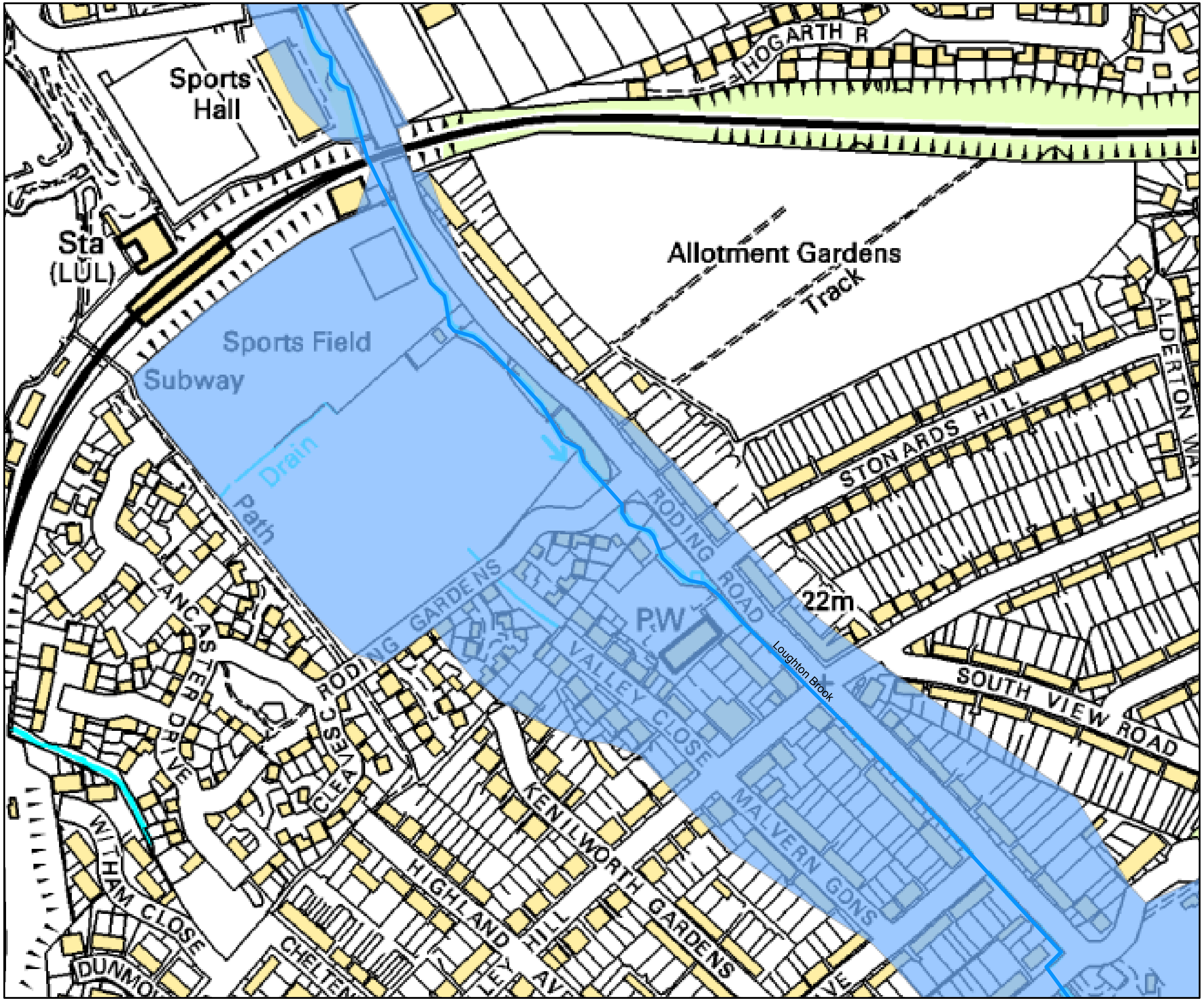
Detailed FRA centred on Loughton IG10 3ED created 12/12/2014 - Ref:HNL044758BC



Environment Agency

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St Albans Road West
Hatfield
Hertfordshire
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0 45 90 180
Metres

Legend

Main Rivers

Flood Event Outlines

1987

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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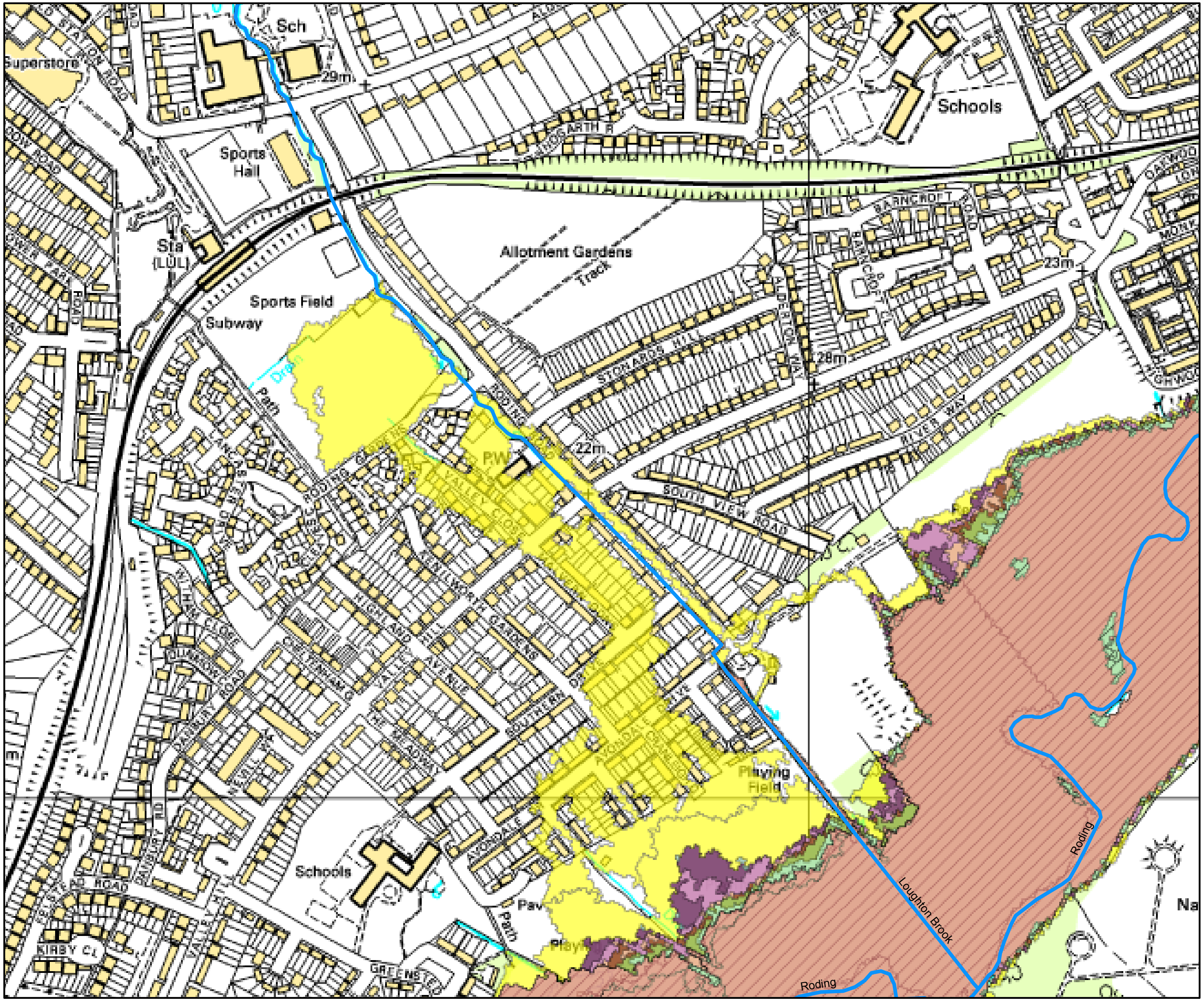
Partnerships & Strategic Overview,
Hertfordshire & North London

Detailed FRA centred on Loughton IG10 3ED created 12/12/2014 - Ref:HNL044758BC



Environment Agency
2 Bishops Square Business Park
St Albans Road West
Hatfield
Hertfordshire
AL10 9EX

0 75 150 300
Metres

Legend

- Main Rivers

Defended Flood Outlines

- 1 in 2 (50%) Defended
- 1 in 5 (20%) Defended
- 1 in 10 (10%) Defended
- 1 in 20 (5%) Defended
- 1 in 30 (3.3%) Defended
- 1 in 50 (2%) Defended
- 1 in 100 (1%) Defended
- 1 in 200 (0.5%) Defended
- 1 in 100+20% (*CC) Defended
- 1 in 1000 (0.1%) Defended

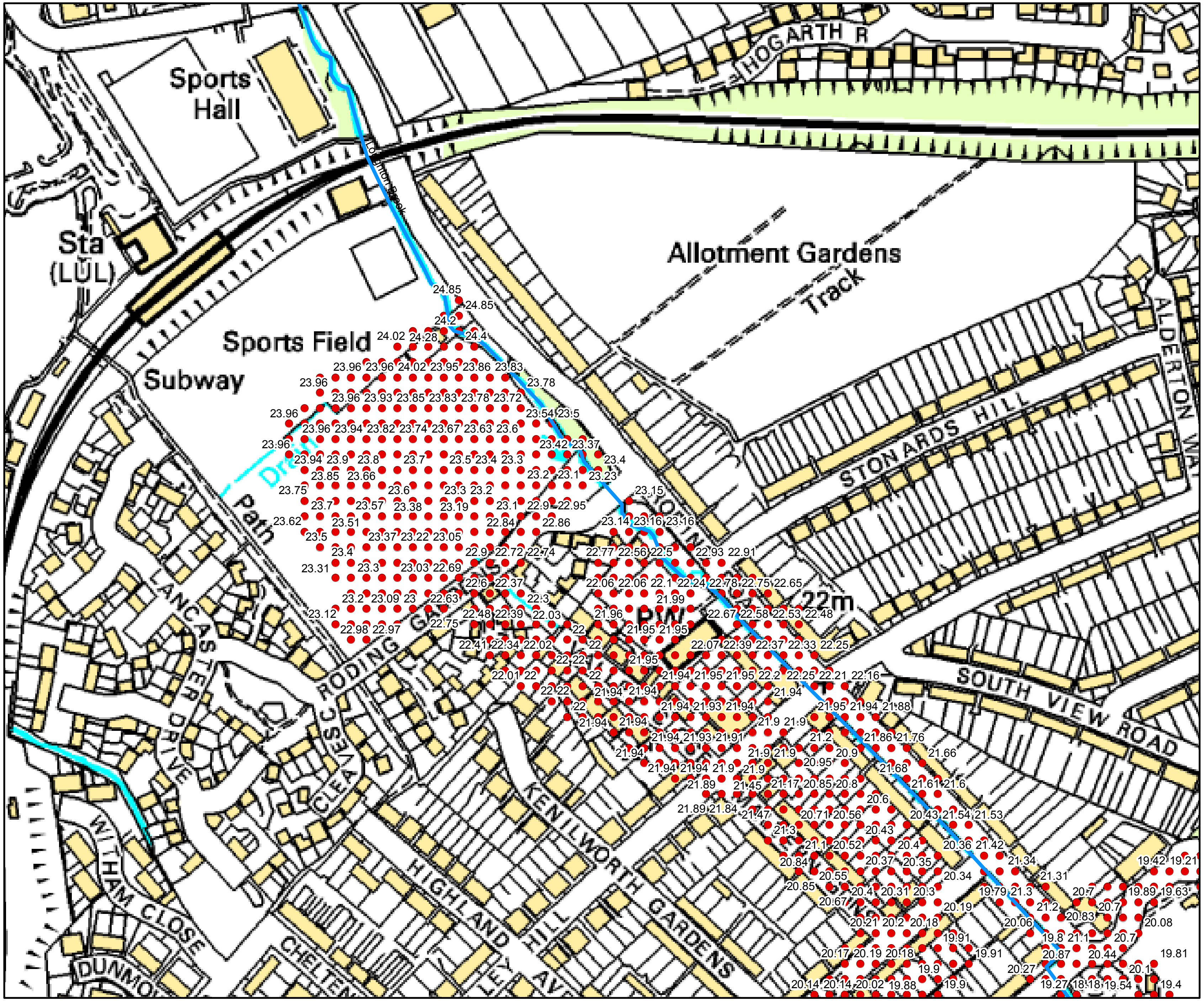
The data in this map has been extracted from the Middle Roding Modelling Study (JBA, 2012).

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 flood defences.

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

Detailed FRA centred on Loughton IG10 3ED created 12/12/2014 - Ref:HNL044758BC



Environment Agency
2 Bishops Square Business Park
St Albans Road West
Hatfield
Hertfordshire
AL10 9EX

0 45 90 180
Metres

Legend

Main Rivers

2D Node Results

1 in 1000 (0.1%) Defended

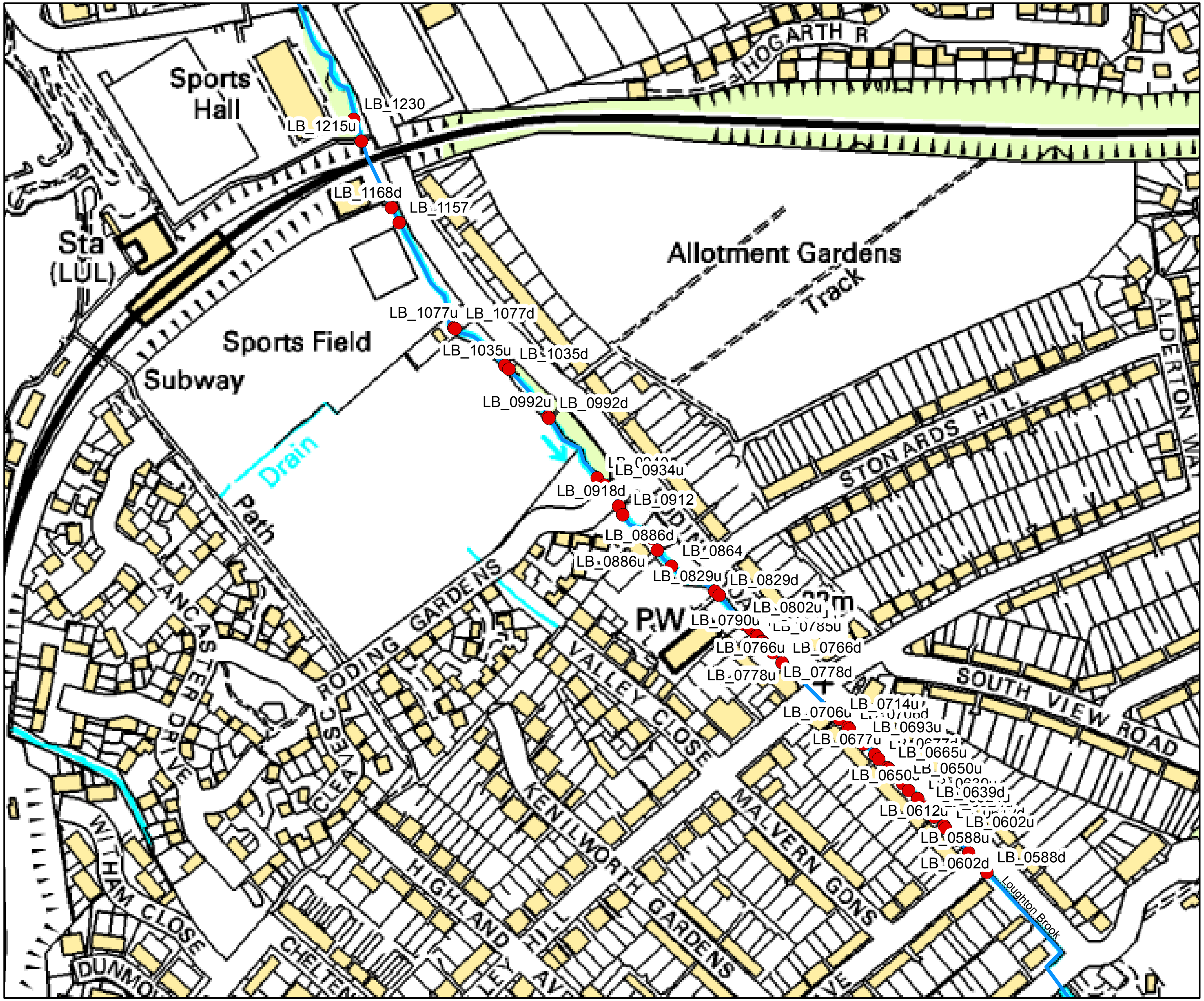
The data in this map has been extracted from the Middle Roding Modelling Study (JBA, 2012).

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 flood defences.

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

Detailed FRA centred on Loughton IG10 3ED created 12/12/2014 - Ref:HNL044758BC



Environment Agency

Environment Agency
2 Bishops Square Business Park
St Albans Road West
Hatfield
Hertfordshire
AL10 9EX

0 45 90 180
Metres

Legend

Main Rivers

1D Node Results

1D Nodes

The data in this map has been extracted from the Middle Roding Modelling Study (JBA, 2012).

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 flood defences.

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

Environment Agency ref: HNL044758BC

The data in this map has been extracted fromthe Middle Roding Modelling Study (JBA, 2012).

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

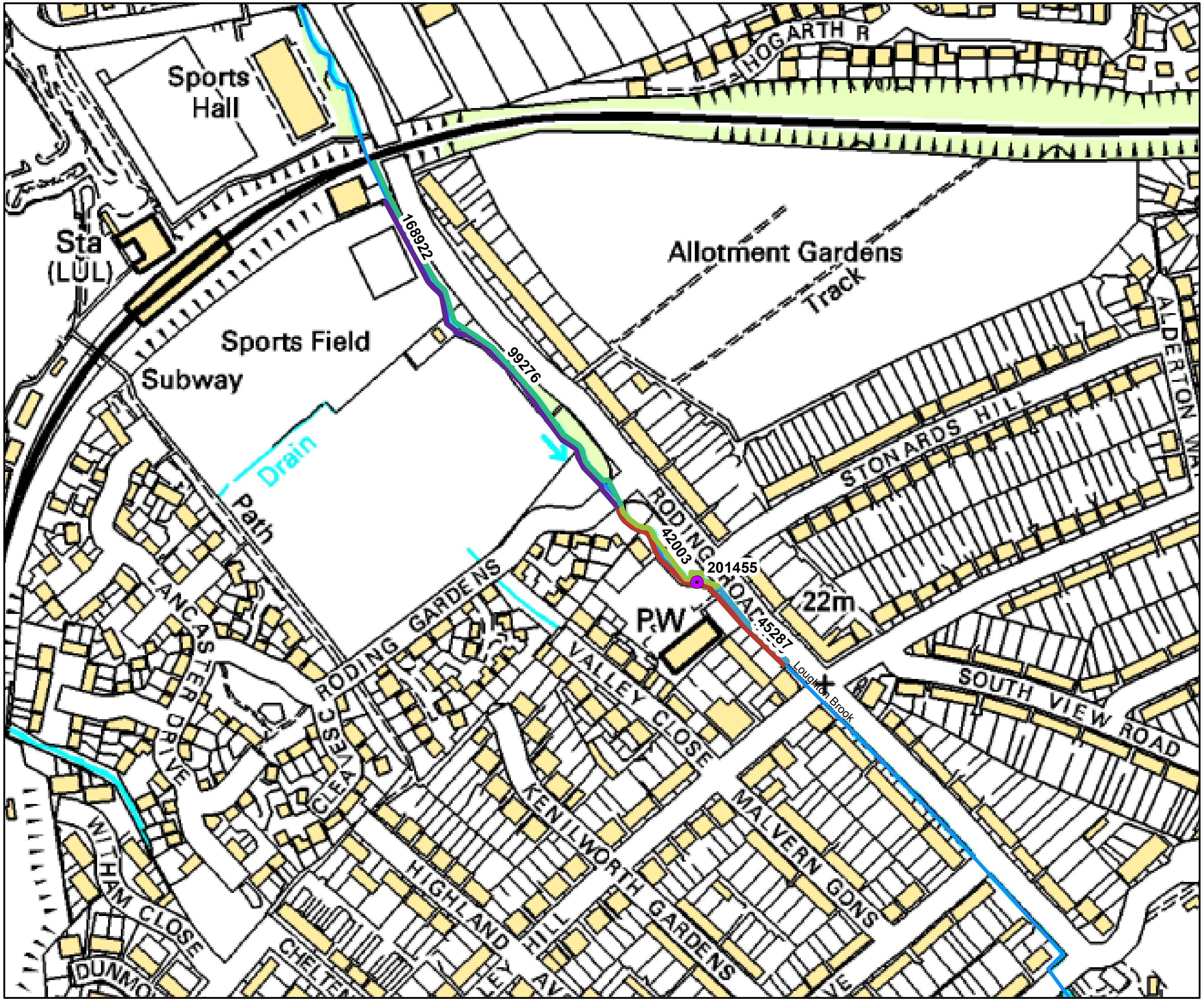
MODELLED FLOOD LEVEL

	Return Period						
Node Label	5 yr	20 yr	50 yr	100 yr	100yr + 20%	Grid reference	
LB_1230	24.32	24.45	24.54	24.62	24.71	542442	195716
LB_1215u	24.28	24.41	24.50	24.59	24.68	542447	195702
LB_1168d	23.81	23.91	23.97	24.03	24.11	542466	195659
LB_1157	23.75	23.87	23.95	24.02	24.12	542471	195649
LB_1077u	23.36	23.51	23.61	23.69	23.82	542507	195581
LB_1077d	23.36	23.51	23.61	23.69	23.78	542508	195580
LB_1035u	23.16	23.29	23.39	23.46	23.55	542540	195556
LB_1035d	23.16	23.29	23.39	23.46	23.55	542542	195554
LB_0992u	22.95	23.06	23.14	23.21	23.27	542568	195523
LB_0992d	22.95	23.06	23.14	23.21	23.27	542568	195522
LB_0940	22.31	22.40	22.46	22.52	22.61	542600	195483
LB_0934u	22.35	22.46	22.54	22.61	22.70	542604	195479
LB_0918d	22.35	22.47	22.54	22.61	22.71	542613	195465
LB_0912	22.25	22.35	22.41	22.47	22.56	542616	195460
LB_0886u	22.14	22.22	22.28	22.34	22.45	542635	195444
LB_0886d	22.14	22.22	22.28	22.33	22.40	542639	195436
LB_0864	22.06	22.12	22.16	22.19	22.25	542648	195426
LB_0829u	22.00	22.07	22.12	22.16	22.24	542676	195410
LB_0829d	22.00	22.07	22.12	22.16	22.24	542679	195407
LB_0802u	21.95	22.02	22.07	22.12	22.20	542694	195390
LB_0802d	21.95	22.02	22.07	22.12	22.20	542694	195389
LB_0794u	21.90	21.97	22.01	22.06	22.14	542698	195386
LB_0794d	21.90	21.97	22.01	22.05	22.12	542700	195385
LB_0790u	21.84	21.91	21.96	22.00	22.07	542703	195381
LB_0790d	21.84	21.91	21.96	22.00	22.06	542703	195381
LB_0785u	21.87	21.94	21.99	22.03	22.09	542706	195378
LB_0785d	21.87	21.94	21.99	22.03	22.08	542707	195377
LB_0782u	21.86	21.93	21.97	22.01	22.07	542708	195376
LB_0782d	21.86	21.93	21.97	22.01	22.07	542709	195375
LB_0778u	21.78	21.85	21.90	21.94	21.99	542713	195371
LB_0778d	21.78	21.85	21.90	21.94	21.99	542714	195370
LB_0766u	21.69	21.76	21.81	21.85	21.91	542720	195364
LB_0766d	21.69	21.76	21.81	21.85	21.91	542720	195364
LB_0714u	21.29	21.36	21.41	21.45	21.50	542757	195327
LB_0714d	21.29	21.36	21.41	21.45	21.50	542757	195327
LB_0706u	21.22	21.30	21.35	21.38	21.43	542762	195322
LB_0706d	21.22	21.30	21.35	21.38	21.43	542763	195321
LB_0693u	21.15	21.22	21.27	21.31	21.36	542771	195312
LB_0693d	21.15	21.22	21.27	21.31	21.36	542772	195311
LB_0677u	21.08	21.16	21.21	21.25	21.30	542779	195304
LB_0677d	21.08	21.16	21.21	21.25	21.30	542782	195301
LB_0665u	21.01	21.09	21.14	21.18	21.23	542788	195296
LB_0665d	21.01	21.09	21.14	21.18	21.23	542789	195295
LB_0650u	20.94	21.02	21.07	21.11	21.16	542798	195285
LB_0650d	20.94	21.02	21.07	21.11	21.16	542801	195281
LB_0639u	20.88	20.95	21.00	21.03	21.09	542807	195276
LB_0639d	20.88	20.95	21.00	21.03	21.09	542812	195270
LB_0624u	20.78	20.85	20.89	20.93	20.98	542816	195267
LB_0624d	20.78	20.85	20.89	20.93	20.98	542818	195264
LB_0612u	20.70	20.76	20.81	20.84	20.89	542824	195258
LB_0612d	20.70	20.76	20.80	20.84	20.89	542825	195256
LB_0602u	20.60	20.67	20.71	20.74	20.79	542832	195251
LB_0602d	20.60	20.67	20.71	20.74	20.78	542833	195249
LB_0588u	20.44	20.50	20.54	20.57	20.61	542840	195241
LB_0588d	20.43	20.50	20.53	20.57	20.61	542852	195228

MODELLED FLOWS

	Return Period						
Node Label	5 yr	20 yr	50 yr	100 yr	100yr + 20%	Grid reference	
LB_1230	2.03	2.58	2.99	3.36	3.80	542442	195716
LB_1215u	2.03	2.58	2.99	3.36	3.80	542447	195702
LB_1168d	2.03	2.58	2.99	3.36	3.80	542466	195659
LB_1157	2.03	2.58	2.99	3.36	3.80	542471	195649
LB_1077u	2.03	2.58	2.99	3.36	3.80	542507	195581
LB_1077d	2.03	2.58	2.99	3.36	3.80	542508	195580
LB_1035u	2.03	2.58	2.99	3.36	3.80	542540	195556
LB_1035d	2.03	2.58	2.99	3.36	3.80	542542	195554
LB_0992u	2.03	2.58	2.99	3.36	3.80	542568	195523
LB_0992d	2.03	2.58	2.99	3.36	3.80	542568	195522
LB_0940	2.03	2.58	2.99	3.36	3.80	542600	195483
LB_0934u	2.03	2.58	2.99	3.36	3.80	542604	195479
LB_0918d	2.03	2.58	2.99	3.36	3.80	542613	195465
LB_0912	2.03	2.58	2.99	3.36	3.80	542616	195460
LB_0886u	2.03	2.58	2.99	3.36	3.80	542635	195444
LB_0886d	2.03	2.58	2.99	3.36	3.80	542639	195436
LB_0864	2.03	2.58	2.99	3.36	3.80	542648	195426
LB_0829u	1.46	1.63	1.75	1.85	1.99	542676	195410
LB_0829d	1.46	1.63	1.75	1.85	1.99	542679	195407
LB_0802u	1.46	1.63	1.75	1.85	1.99	542694	195390
LB_0802d	1.46	1.63	1.75	1.85	1.99	542694	195389
LB_0794u	1.46	1.63	1.75	1.85	1.99	542698	195386
LB_0794d	1.46	1.63	1.75	1.85	1.99	542700	195385
LB_0790u	1.46	1.63	1.75	1.85	1.99	542703	195381
LB_0790d	1.46	1.63	1.75	1.85	1.99	542703	195381
LB_0785u	1.46	1.63	1.75	1.85	1.99	542706	195378
LB_0785d	1.46	1.63	1.75	1.85	1.99	542707	195377
LB_0782u	1.46	1.63	1.75	1.85	1.99	542708	195376
LB_0782d	1.46	1.63	1.75	1.85	1.99	542709	195375
LB_0778u	1.46	1.63	1.75	1.85	1.99	542713	195371
LB_0778d	1.46	1.63	1.75	1.85	1.99	542714	195370
LB_0766u	1.46	1.63	1.75	1.85	1.99	542720	195364
LB_0766d	1.46	1.63	1.75	1.85	1.99	542720	195364
LB_0714u	1.46	1.63	1.75	1.85	1.99	542757	195327
LB_0714d	1.46	1.63	1.75	1.85	1.99	542757	195327
LB_0706u	1.46	1.63	1.75	1.85	1.99	542762	195322
LB_0706d	1.46	1.63	1.75	1.85	1.99	542763	195321
LB_0693u	1.46	1.63	1.75	1.85	1.99	542771	195312
LB_0693d	1.46	1.63	1.75	1.85	1.99	542772	195311
LB_0677u	1.46	1.63	1.75	1.85	1.99	542779	195304
LB_0677d	1.46	1.63	1.75	1.85	1.99	542782	195301
LB_0665u	1.46	1.63	1.75	1.85	1.99	542788	195296
LB_0665d	1.46	1.63	1.75	1.85	1.99	542789	195295
LB_0650u	1.46	1.63	1.75	1.85	1.99	542798	195285
LB_0650d	1.46	1.63	1.75	1.85	1.99	542801	195281
LB_0639u	1.46	1.63	1.75	1.85	1.99	542807	195276
LB_0639d	1.46	1.63	1.75	1.85	1.99	542812	195270
LB_0624u	1.46	1.63	1.75	1.85	1.99	542816	195267
LB_0624d	1.46	1.63	1.75	1.85	1.99	542818	195264
LB_0612u	1.46	1.63	1.75	1.85	1.99	542824	195258
LB_0612d	1.46	1.63	1.75	1.85	1.99	542825	195256
LB_0602u	1.46	1.63	1.75	1.85	1.99	542832	195251
LB_0602d	1.46	1.63	1.75	1.85	1.99	542833	195249
LB_0588u	1.46	1.63	1.75	1.85	1.99	542840	195241
LB_0588d	1.46	1.63	1.75	1.85	1.99	542852	195228

Detailed FRA centred on Loughton IG10 3ED created 12/12/2014 - Ref:HNL044758BC



Environment Agency
2 Bishops Square Business Park
St Albans Road West
Hatfield
Hertfordshire
AL10 9EX

0 45 90 180
Metres

Legend

Main Rivers

Weir

Defences

Asset ID

- 42003
- 44050
- 45287
- 99276
- 168922

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

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

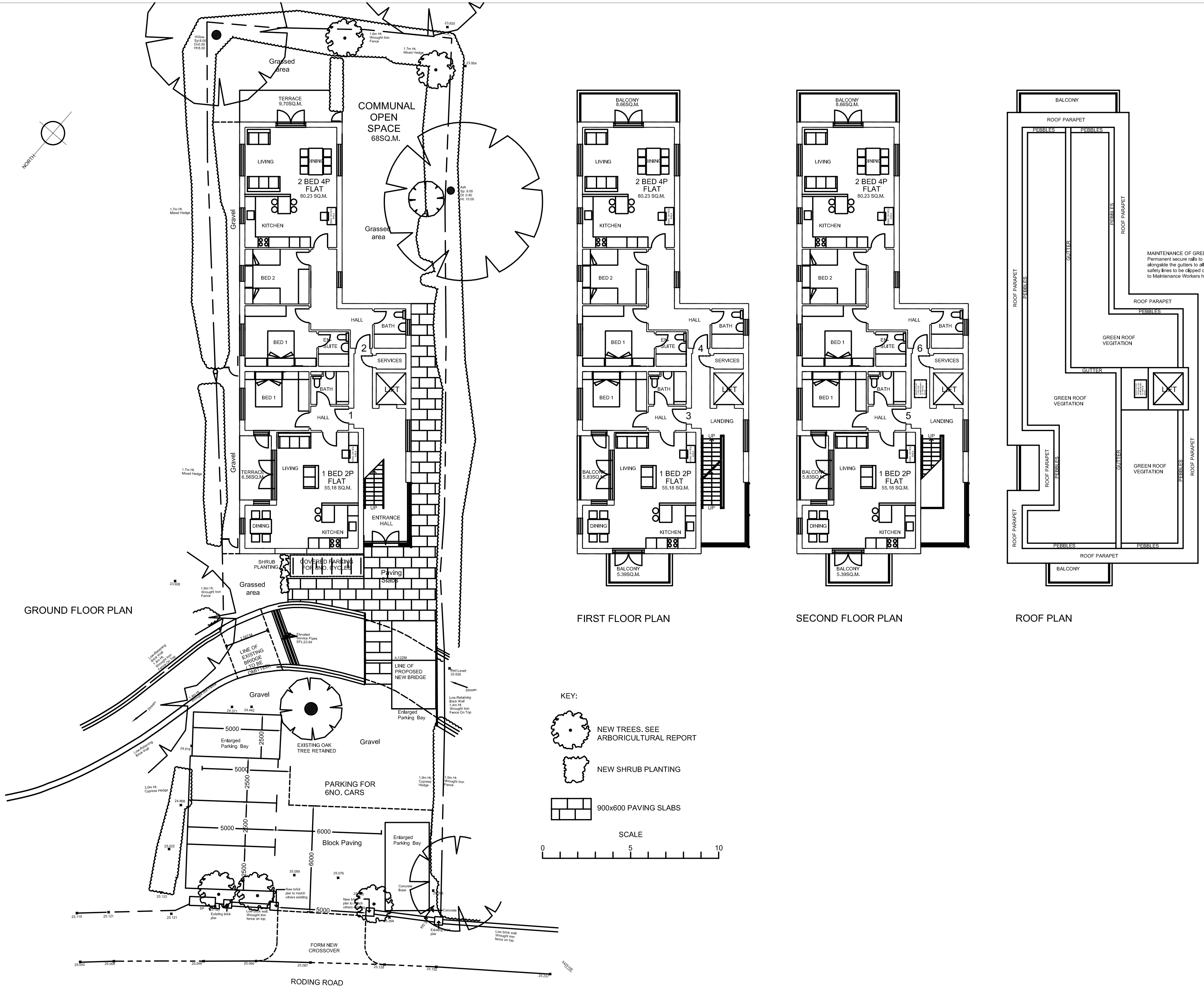
Ref: HNL044758BC

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

Defences

Map ID	Asset Reference	Asset Type	Asset Protection	Asset Comment	Asset Description	Asset Location	Standard of Protection
42003	0625454LO0101L02	Defence	Fluvial	Brick clad concrete channel wall with concrete invert. O & M Manual 54/1.	Loughton Brook Improvement Scheme	Adj to Roding Road. Loughton	75
44050	0625454LO0101R02	Defence	Fluvial	Brick clad concrete flood defence wall. Some joint filler missing. Good condition. O & M Manual 54/1.	Loughton Brook Improvement Scheme	adj to Roding road. Loughton	75
45287	0625454LO0101L30	Defence	Fluvial	Insitu r/c wall and invert with various vehicle crossings to properties on right bank. Mass concrete poured channel side wall.	Lined Channel	Roding Road, Loughton, Essex	5
99276	0625454LO0101L09	Defence	Fluvial	Brick clad concrete walls with concrete invert with some sections of Armourflex revetment for conservation. O & M Manual 54/1.	Loughton Brook Improvements Scheme	U/S of Roding Gardens Culvert, off Roding Lane, Loughton, Essex.	75
168922	0625454LO0101R09	Defence	Fluvial	Brick clad r/concrete wall with insitu r/c invert. Some sections of Dye Tap blocks for conservation. O & M Manual 54/1.	Loughton Brook Improvement Scheme	U/S of Roding Gardens Culvert, Off Roding Lane, Loughton, Essex.	75
201455	0625454LO0101L02002	Structure	Fluvial	7m wide concrete fixed crest Labyrinth weir. High flows into pool and then into bypass culvert. Half round coping stones form crest. Silt in angles of weir and pool. O & M Manual 54/1.	WEIR Labyrinth Weir and Bypass Chamber	Roding Road - Stonards Hill junction, West end of Loughton, Essex	

Appendix: C PROPOSED SITE PLAN



NOTES

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WORK ONLY TO FIGURED DIMENSIONS DO NOT SCALE

CHECK ALL DIMENSIONS ON SITE AND REPORT ANY VARIATIONS TO THE ARCHITECT

REVISIONS:

A. VEHICULAR ENTRY TO THE PROPERTY WIDENED TO 5 METRES FOR THE FIRST 6 METRES FROM THE CARRIAGEWAY EDGE, AND THIS 6M TO BE BLOCK PAVED.
2NO. PARKING SPACES ENLARGED TO ACCOMMODATE LARGER CARS.
JULY 2014

B. PARKING LAYOUT AMENDED TO INCLUDE 2NO. PARKING BAYS AT 5.5M x 2.9M AND 4NO. BAYS AT 5.0 x 2.5M.
MINOR AMENDMENTS TO SITE LAYOUT TO FACILITATE LARGER PARKING SPACES.
JULY 2014

C. ROOF PLAN ADDED SHOWING LAYOUT OF GREEN ROOF.
SEPT. 2014

D. CULVERT ACROSS BROOK OMITTED, EXISTING BRIDGE OMITTED AND NEW BRIDGE ADDED.
DEC.2014

MERRITT DESIGN PARTNERSHIP
105 CHURCH HILL,
LOUGHTON,
ESSEX, IG10 1QR
TEL. 020-8508-9862
FAX. 020-8508-9862

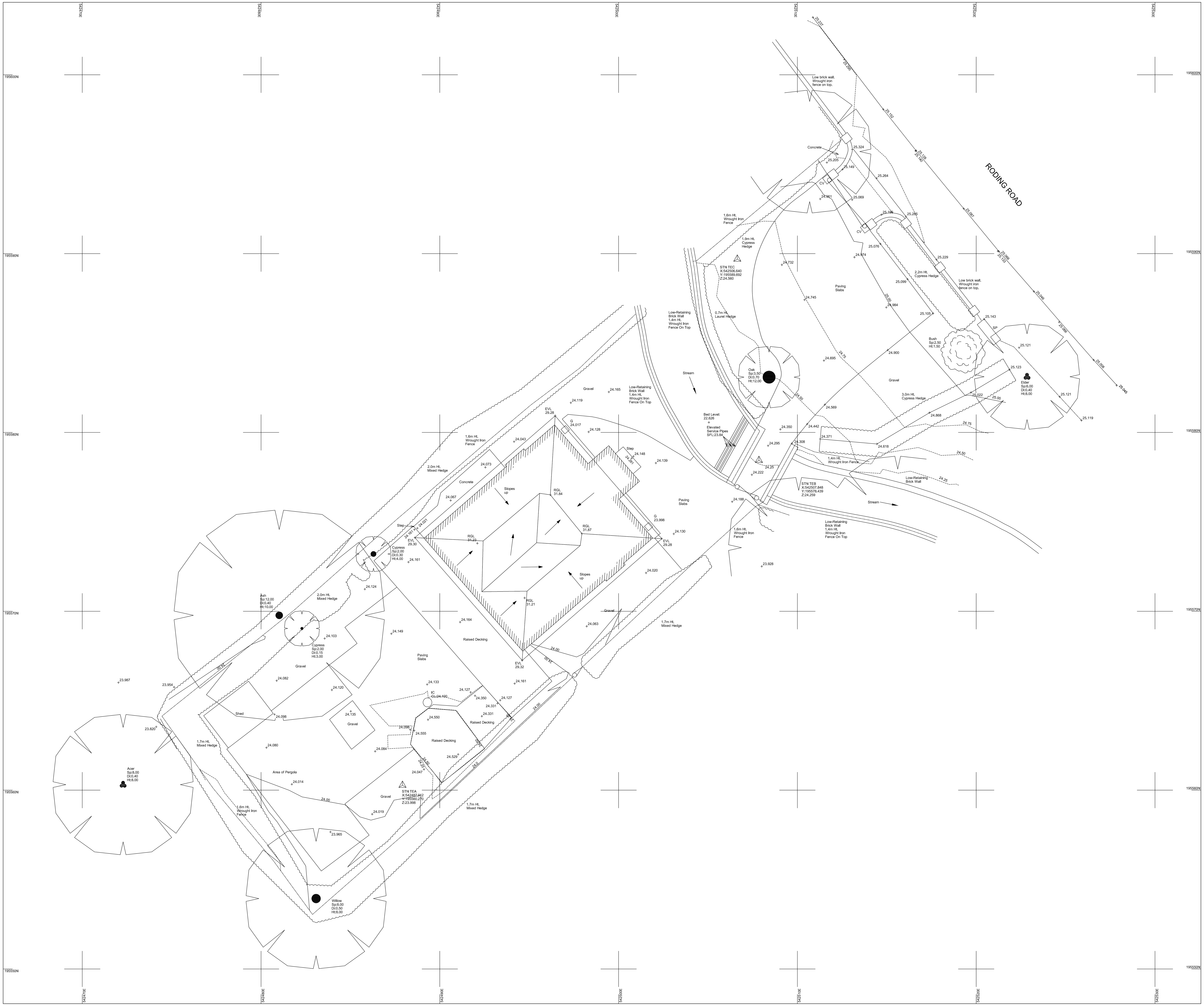
Job:
BRIDGE HOUSE
RODING ROAD, LOUGHTON
ESSEX

Drg Title:
PROPOSED REDEVELOPMENT FLOOR PLANS

Scale:	Date:	Drawn:
1:100	MAR.2014	Checked:

Drg No:	Rev:
MDP.BH/03	D.

Appendix: D TOPOGRAPHICAL SURVEY



LEGEND

Abbreviated Features

AV	Air Valve	FWP	Foul Water Down Pipe	SVP	Soil & Vent Pipe
ACP	Air Conditioning Plant	GP	Gate Post	SW	Surface Water
BB	Belishia Beacon	GV	Gas Valve	SWP	Surface Water Down Pipe
BD	Bollard	G	Gully	Tac.	Tactile Paving
BIG	Building Inlet Gully	HL	Head Level	Tar.	Tarmac
BL	Bed Level	IC	Inspection Cover	TB	Traffic Bollard
Blkp.	Block Paving	IL	Invert Level	TCB	Telephone Call Box
Blk.	Block	KO	Kerb Outlet	TC	Telecom Cover
BM	Bench Mark	LB	Letter Box	TCP	Telecom Pillar
BN	Bin	LG	Light	TF	Traffic Lights
BP	Boundary Peg	LH	Lamp Hole	THL	Thresh Hold Level
Brk.	Brick	LP	Lamp Post	TM	Ticket Machine
BS	Bus Stop	MH	Manhole	TP	Telephone Pole
CB	Cycle Barrier	MP	Marker Peg	UTL	Unable to Lift
CCTV	Close Circuit T.V	MS	Mile Stone	UG	Underground
CL	Cover Level	NB	Notice Board	VC	Valve Chamber
Col.	Column	NP	Name Plate	VT	Vent
Conc.	Concrete	OH	Over Head	VTG	Vent Grill
CTV	Cable TV Cover	PE	Pipe	VTP	Vent Pipe
CTP	Cable TV Pillar	PB	Post Box	WM	Water Meter
CP	Control Post	PM	Parking Meter	WN	Window
CV	Unidentified Cover	PWL	Parapet Wall Level	WT	Water Level
DP	Down Pipe	PT	Post	WO	Wash Out
DPC	Damp Proof Course	RE	Rodding Eye	Av.	Average
DC	Drainage Channel	RFL	Roof level	Ht.	Height
DK	Drop Kerb	RGL	Ridge	(A)	Authorities Information
EC	Electricity Cover	RP	Reflective Post	(BD)	Back Drop
ECP	Electricity Pillar	RS	Road Sign	(CEP)	Concrete Posts
EP	Electricity Pole	RWP	Rain Water Down Pipe	(H)	High Level
EPL	Electric Power Line	SA	Soakaway	(L)	Low Level
ER	Earth Rod	SEP	Service Entry Point	(LI)	Local Information
Est.	Estimated	SC	Stop Cock	(M)	Mid Level
EVL	Eaves Level	SCV	Service Cover	(MTP)	Metal Posts
FDP	Feeder Pillar	SFL	Soffit Level	(TMP)	Timber Posts
FH	Fire Hydrant	SL	Sill Level	(ac)	Assumed Connection
FL	Floor Level	SN	Sign	(uc)	Unknown Connection
FS	Flag Staff	SP	Service Pillar	(us)	Unknown Source
FW	Foul Water	SV	Stop Valve	Ø	Diameter(mm)

Hatching

Building:

Building/Shed:

Glass House :

Underground Line Styles

Cable/Pipe Runs (Undefined):

Electricty Cable:

Gas Main:

Foul Water:

Surface Water:

Telecom:

Water Main:

Symbols:

Service Cover : (Under 250mm)

Manhole/Inspection Chamber :

Inlet Pipe — Inlet Pipe — Out Flow Pipe

Control Station : A

Bush/Shrub : Sp:3.0 Ht:5.0

Tree : Sp:8.0 Di:0.6 Ht:12.0

Tree (Multi-Bole) : Sp:8.0 Di:0.6 Ht:12.0

Tree (Coppice) : Sp:8.0 Di:0.6 Ht:12.0

Gates : Single, Double, Style

Wet/Marsh Land :

Line Types:

Embankment : Top of Bank / Bottom of Bank

Telephone Line :

Electricity Power Line :

Drop Kerb :

Contours : 1 / 0.8

Hedge :

Root Line :

Foliage

Tree Canopy :

Fence :

Change in Boundary type : Chg.

Notes:

Rev.	Date	Revisions

Notes:

1. The Accuracy of this drawing is dependant on the original specification and Sunshine Survey should be consultedbefore use of other scales or in CAD form

2. Where underground services are shown, all reasonable care has been taken with regard to the original specification and requirement. Before use of this information the user should consult sunshine Survey and satisfy themselves of the completeness and accuracy of such detail before undertaking any works. Where identification of the underground services is not possible from visual inspection, it is recommended that additional information is acquired from the statutory authorities, under these circumstances a general annotation "CV" for cover will be used.

3. All reasonable care has been taken in the survey detail represented on this drawing but any discrepancies must be reported to Sunshine Survey immediately.

4. Survey provides position and description of features in relation to control stations and in no way implies legal title or boundary ownership.

Services:

Initial inquiries made to Statuary, Local and County Authorities have provided base information which is added to the drawing and is taken from the records of the equipment.
This is checked on site using CAT scan equipment and lifting covers in order to investigate cable and pipe details which may be Authority equipment or associated services connections.
Pipe/Cable connections & alignments are assumed by inspection of apparatus.
Where possible local information will be included and annotated as appropriate.

Although Sunshine Survey Ltd has taken every care in establishing the whereabouts of underground services the information shown on this plan is given without obligation, or warranty, the accuracy thereof cannot be guaranteed. No liability of any kind whatsoever is accepted by Sunshine Survey Ltd, its agents or servants for any error or omission. Safe digging practices must be used to verify and establish the actual position of mains, pipes and services on site before any mechanical plant is used.

Boundaries:

Survey information is as result of measurement to existing features and does not imply legal ownership of boundaries or land divisions.
Where boundary alignment lines are added to the survey drawing and are taken from legal documents or other information supplied they are done so within the constraints of drawing quality and scale. They are provided on the basis of opinion and do not imply legal contract.

Plan Coordinate Control:-

Survey is based on Ordnance Survey National Grid
OSGB 1936 by GPS OSTN O2 transformation, Scale factor 1.00

Level Datum:-

All levels relate to Ordnance Survey datum Newlyn
using GPS geoid model OSGM O2

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Project Title:
BRIDGE HOUSE, LOUGHTON

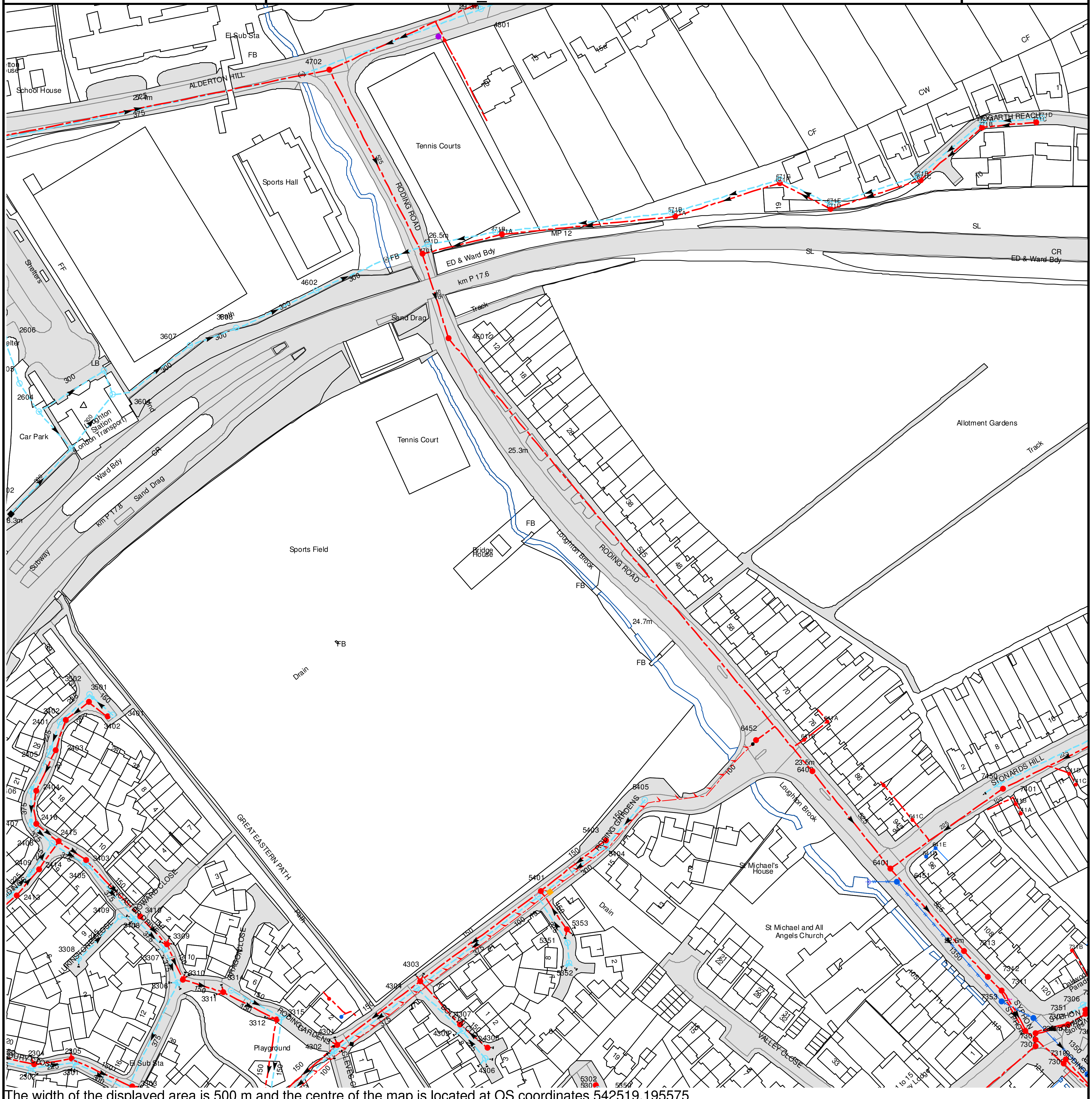
Client:
MERRITT PARTNERSHIP

Description:
TOPOGRAPHICAL SURVEY

Date	31.01.2014	Scale	1\100
Job No.	GY\3921	Surveyor	GEOFF & TOM
Drg No.	1\001	Drawn	TOM

Appendix: E THAMES WATER SEWER RECORDS

Asset Location Search Sewer Map - ALS/ALS Standard/2014_2937109



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 542519,195575

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

EAS

Appendix: F

BRIDGE / CHANNEL CAPACITY CALCULATIONS

System1 - [untitled] - [Storm Network Details]

File Site Network Graphics Results Window Help

Storm

Full Bore Velocity

Pipe Number	Pipe Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Time of Entry (mins)	Base Flow (l/s)	Pipe Rough (mm)	US/IL (m)	US/CL (m)	Pipe DIA (mm)
1.000	2.600	0.005	500.0	0.000	2.00		0.600	0.000	0.000	-2
1.001	4.200	0.008	500.0	0.000			0.600	-0.005	0.000	-3

Pipe Number	Rain (mm/hr)	TC (mins)	DS/IL (m)	Σ Imp. Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Pro. Vel (m/s)	Pro. Depth (mm)	Velocity (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	2.02	-0.005	0.000	0.0	0.0	0.0	0.00	0	2.09	6741.8	0.0
1.001	50.00	2.05	-0.014	0.000	0.0	0.0	0.0	0.00	0	2.22	9304.4	0.0

Conduit Picker

System | User

User

Edit User conduits. Specify as diameters -1 to -999.

Index	Symbol	Major Dim (mm)	Minor Dim (mm)	Side Slope	Corner Splay (mm)	4*Hyd Radius	Area (m²)	Flow / Cap
-1	▯	3000	800	90.0		1.263	2.400	0.000
-2	▯	2300	1400	90.0		1.741	3.220	0.000
-3	▯	3000	1400	90.0		1.909	4.200	0.000

OK Cancel Help

Select required conduit

Enter Pipe Diameter between -999 and 99999. '0' to calculate.

System1, A.P.T. 2013.1.1 2 pipes

11:43 05/01/2015

Appendix: G EA SURFACE WATER FLOOD MAP

Risk of Flooding from Surface Water

Surface water flooding happens when rainwater does not drain away through the normal drainage systems or soak into the ground, but lies on or flows over the ground instead.

The shading on the map shows the risk of flooding from surface water in this particular area.

Click on the map for a more detailed explanation.

Map legend

- ✔ Risk of Flooding from Surface Water
- High
- Medium
- Low
- Very Low

Map of X: 542,536; Y: 195,621 at scale 1:10,000 Data search

Appendix: H EA RESERVOIR FLOOD MAP

Environment Agency

Enter a postcode or place name: Go

Other topics for this area... Risk of Flooding from Reservoirs

View other Interactive Maps

Risk of Flooding from Reservoirs

Reservoir flooding is extremely unlikely to happen.

The shading on the map shows the area that could be flooded if a large reservoir were to fail and release the water it holds. A large reservoir is one that holds over 25,000 cubic metres of water, equivalent to approximately 10 Olympic sized swimming pools. Since this is a worst case scenario, it's unlikely that any actual flood would be this large.

Click on the shading to see details of reservoirs that could cause flooding in this area.

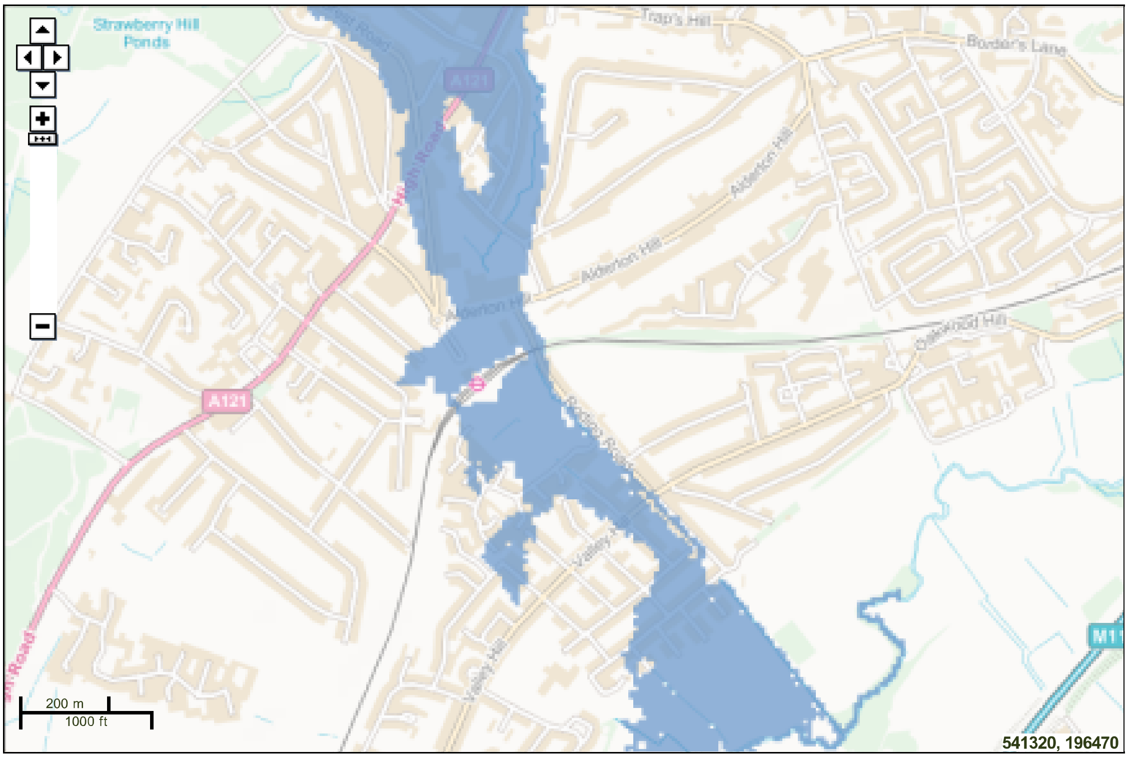
Map legend

Risk of Flooding from Reservoirs

Maximum extent of flooding

Map of X: 542,533; Y: 195,621 at scale 1:10,000

Data search



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Last updated: 05 January 2015

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