# PROPOSED DEVELOPMENT ACROSS LAND OFF BLACKMORE ROAD, BLACKMORE, ESSEX

# FLOOD RISK ASSESSMENT AND SURFACE WATER DRAINAGE/SUDS STRATEGY

**MARCH 2018**

**REPORT REF: 2043/RE/03-18/01**


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## CONTRACT

Evans Rivers and Coastal Ltd has been commissioned by Mrs Ann Topham to carry out a flood risk assessment and surface water drainage/SUDS strategy for a proposed development across land off Blackmore Road, Blackmore, Essex.

## QUALITY ASSURANCE, ENVIRONMENT AND HEALTH AND SAFETY

Evans Rivers and Coastal Ltd operates a Quality Assurance, Environmental, and Health and Safety Policy.

This project comprises various stages including data collection; hydrological and hydrogeological assessments; surface water drainage designs; and reporting. Quality will be maintained throughout the project by producing specific methodologies for each work stage. Quality will also be maintained by initiating internal quality procedures including the validation of third party deliverables; creation of an audit trail to record any changes made; and document control using a database and correspondence log file system.

To adhere to the Environmental Policy, data will be obtained and issued in electronic format and alternatively by post. Paper use will also be minimised by communicating via email or telephone where possible. Documents and drawings will be transferred in electronic format where possible and all waste paper will be recycled. Meetings away from the office of Evans Rivers and Coastal Ltd will be minimised to prevent unnecessary travel, however for those meetings deemed essential, public transport will be used in preference to car journeys.

The project will follow the commitment and objectives outlined in the Health and Safety Policy operated by Evans Rivers and Coastal Ltd. All employees will be equipped with suitable personal protective equipment prior to any site visits and a risk assessment will be completed and checked before any site visit. Other factors which have been taken into consideration are the wider safety of the public whilst operating on site, and the importance of safety when working close to a water source and highway. Any designs resulting from this project and directly created by Evans Rivers and Coastal Ltd will also take into account safety measures within a “designers risk assessment”.

Report carried out by:

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## DISCLAIMER

This report has been written and produced for Mrs Ann Topham. No responsibility is accepted to other parties for all or any part of this report. Any other parties relying upon this report without the written authorisation of Evans Rivers and Coastal Ltd do so at their own risk.

## COPYRIGHT

## CONTENTS

# 1. INTRODUCTION

## 1.1 Project Scope

1.1.1 Evans Rivers and Coastal Ltd has been commissioned by Mrs Ann Topham to carry out a flood risk assessment and surface water drainage/SUDS strategy for a proposed development across land off Blackmore Road, Blackmore, Essex.

1.1.2 It is understood that this assessment will be submitted to the Planning Authority as part of a planning application. Specifically, this assessment intends to:

1) Carry out an assessment of the practical use of sustainable drainage (SUDS) measures using the relevant soil maps, software and other literature;

2) Carry out an appraisal of flood risk from all sources as required by NPPF;

3) Report findings and recommendations.

1.1.3 This assessment is carried out in accordance with the requirements of the National Planning Policy Framework (NPPF) dated March 2012. Other documents which have been consulted include:

- Woods-Ballard., et al. 2015. *The SUDS Manual, Report C753*. London: CIRIA.
- Woods-Ballard., et al. 2007. *The SUDS Manual, Report C697*. London: CIRIA.
- BS8582:2013 entitled *Code of practice for surface water management for development sites*.
- DEFRA document entitled *Sustainable Drainage Systems – Non statutory technical standards for sustainable drainage systems* dated March 2015.
- LASOO document entitled *Non statutory technical standards for sustainable drainage systems – Best Practice Guidance* dated 2015.
- DEFRA/EA document entitled *Rainfall runoff management for developments* dated 2013.
- Communities and Local Government 2007. *Improving the Flood Performance of New Buildings*. HMSO.
- DEFRA/EA document entitled *The flood risks to people methodology (FD2321/TR1),* 2006;
- EA *Supplementary Note on Flood Hazard Ratings and Thresholds for Development Planning and Control Purpose*, 2008;
- National Planning Practice Guidance – Flood Risk and Coastal Change.
- Essex County Council's SUDS Design Guide dated 2014.
- Essex County Council Local Flood Risk Management Strategy (LFRMS) dated 2013.
- Essex County Council Preliminary Flood Risk Assessment dated 2011 (PFRA).

- Brentwood Borough Council Level 1 Strategic Flood Risk Assessment (SFRA) dated 2011.

- Brentwood Borough Council Surface Water Management Plan (SWMP) dated 2015.

## 2. DATA COLLECTION

2.1 To assist with this report, the data collected included:

- Ordnance Survey 1:10,000 street view map obtained via Promap (Evans Rivers and Coastal Ltd OS licence number 100049458).

- British Geological Survey, *Online Geology of Britain Viewer*.

- Filtered LIDAR data at 1m resolution.

- 1:250,000 *Soil Map of Eastern England* (Sheet 4) published by Cranfield University and Soil Survey of England and Wales 1983.

- 1:625,000 *Hydrogeological Map of England and Wales*, published in 1977 by the Institute of Geological Sciences (now the British Geological Survey).

# 3. SITE CHARACTERISTICS

## 3.1 Existing Site Characteristics and Location

3.1.1 The site is located across land off Blackmore Road, Blackmore, Essex. The approximate Ordnance Survey (OS) grid reference for the site is 560155 201701 and the location of the site is shown on Figure 1.

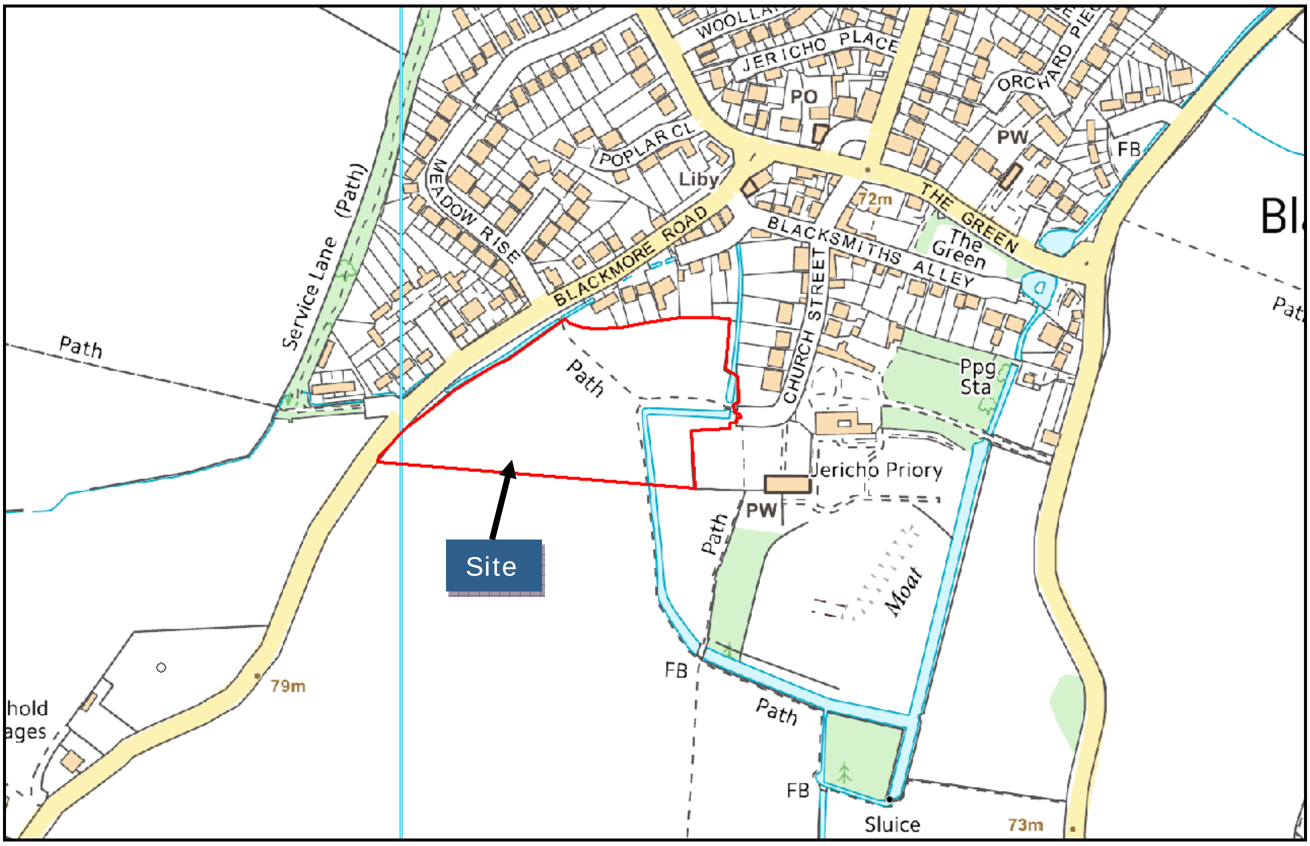


**Figure 1: Site location plan (Source: Ordnance Survey)**

3.1.2 The site is irregular in shape and covers an area of approximately 2.52 ha. The site currently comprises grassland and is accessed from Blackmore Road adjacent to the north western frontage of the site. The northern and eastern frontages of the site are bounded by residential dwellings and the southern frontage is bounded by a tree belt and agricultural land beyond.

3.1.3 The village of Blackmore has a network of small watercourses which exist both as open channels and culverts to provide access across them at various points. A watercourse exists adjacent to the north western frontage and flows to the north east before turning south and flowing through parts of the site across which it is commonly referred to as the 'Moat'. The watercourse continues in a southerly direction before forming the upper reaches of the River Wid as indicated on Figure 2. A weir is located downstream of the site and controls the water level within the watercourse and discharge into the River Wid.

3.1.4 Filtered LIDAR data at 1m resolution has been obtained in order to determine the topography across the site. Figure 3 shows that ground levels across the site fall in a north easterly to easterly direction.

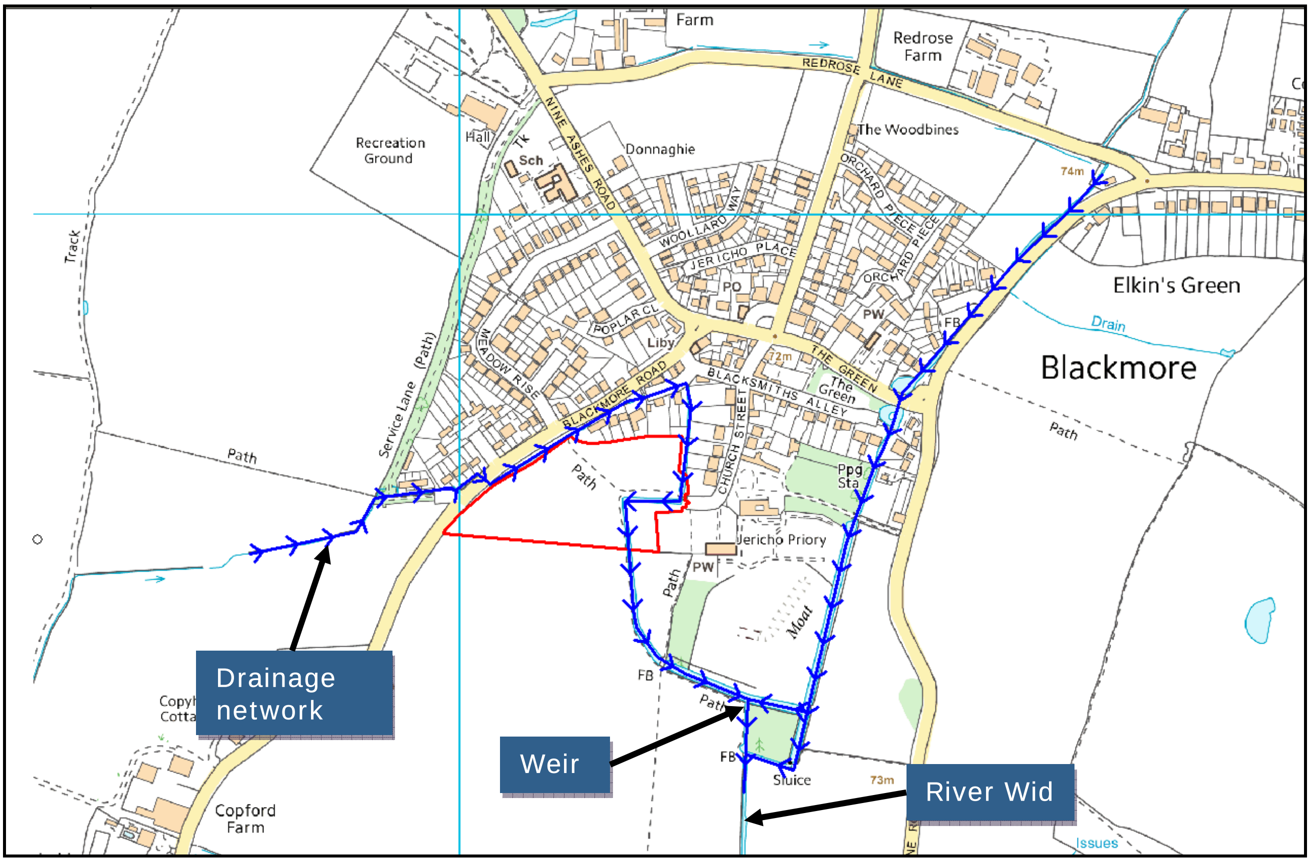


**Figure 2: Drainage network**

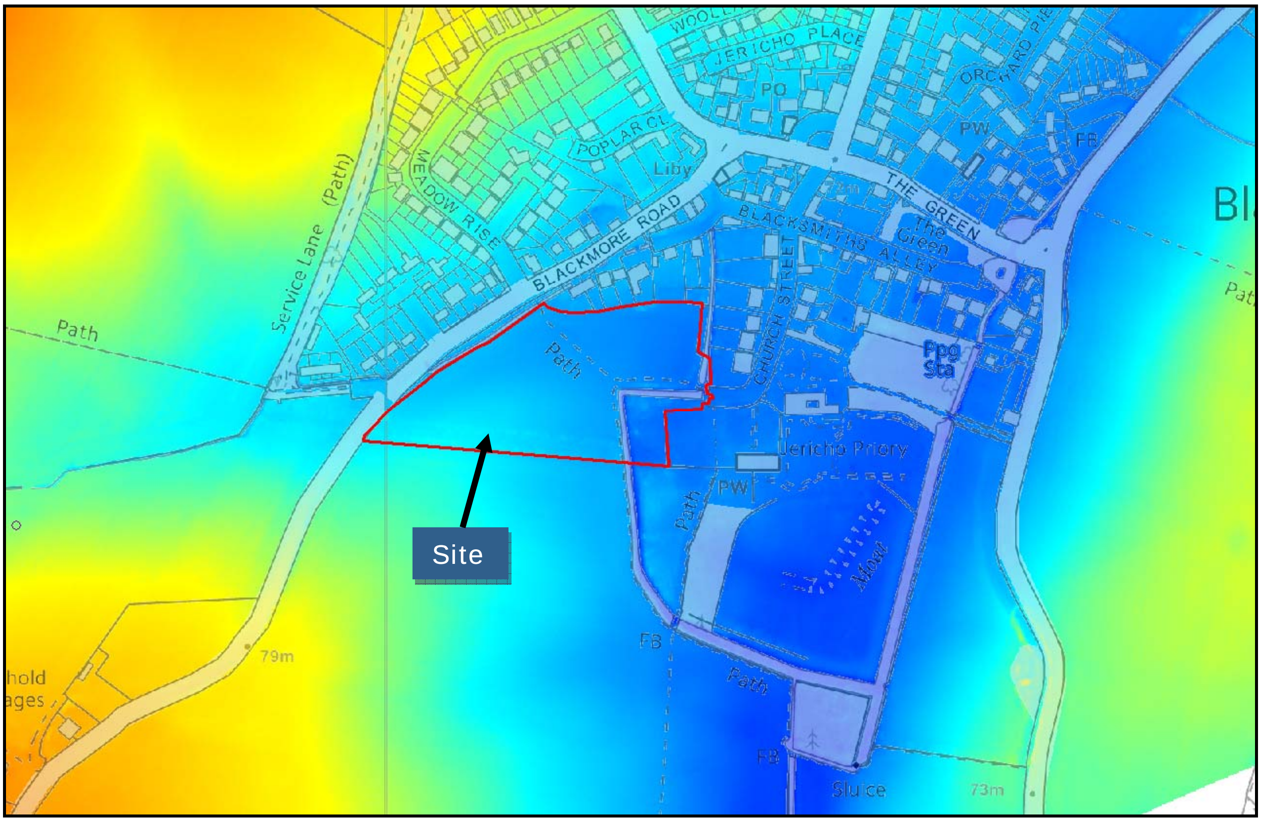


**Figure 2: Filtered LIDAR survey data at 1m resolution where higher ground is denoted by red and orange colours and lower ground is denoted by blue colours**

## 3.2 Site Proposals

3.2.1 It is the Client's wish to develop the site with a number of residential dwellings, together with gardens, driveways, access road and open space. Access will be provided from Blackmore Road.

# 4. BASELINE INFORMATION

## 4.1 Environment Agency Flood Zone Map

4.1.1 The Environment Agency Flood Map (Figure 4) and Figure A4-B of the SFRA shows that the site is located within the NPPF Flood Zone 1, 'Low Probability' which comprises land as having less than a 1 in 1000 year annual probability of fluvial or tidal flooding (i.e. an event more severe than the extreme 1 in 1000 year event).

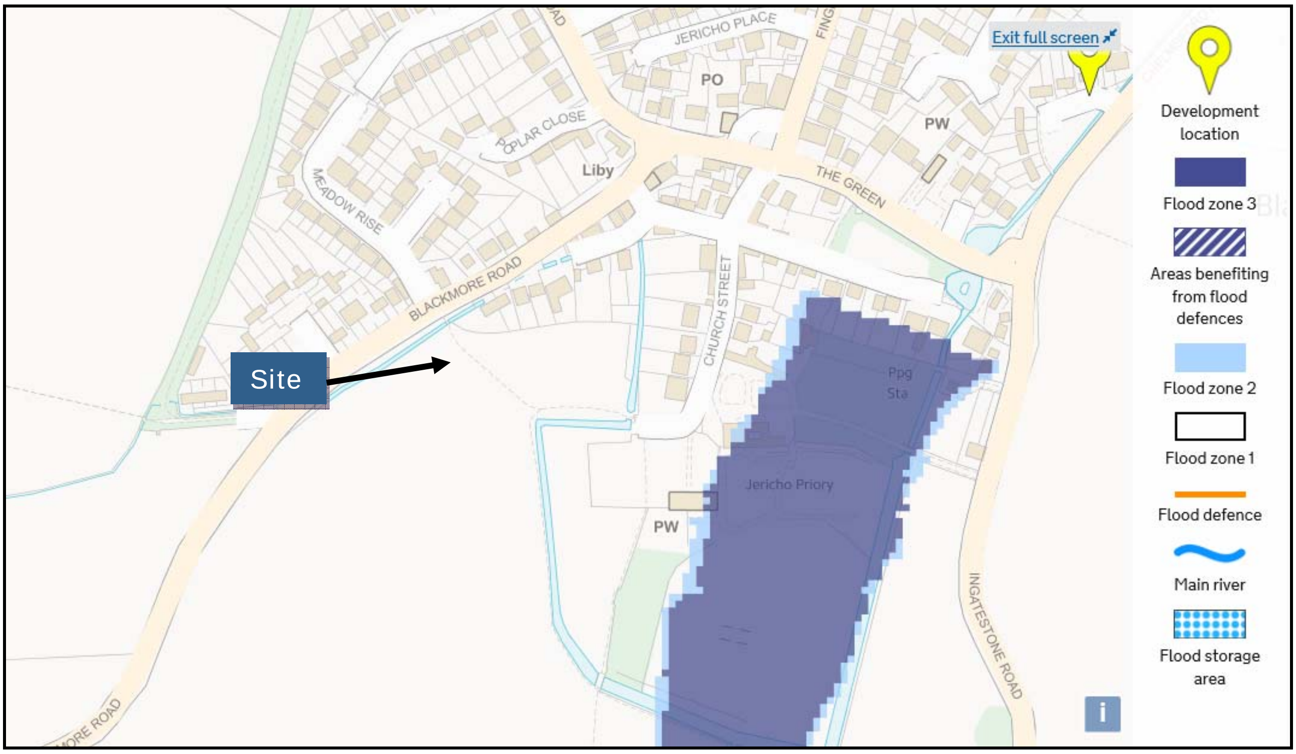


**Figure 4: Environment Agency Flood Map (Source: Environment Agency)**

## 4.2 Catchment Characteristics

4.2.1 The FEH CD-ROM Version 3 (Figure 5) shows the location of the site within the catchment. Catchment descriptors for extracted from the FEH CD-ROM Version 3 (Figure 6) indicate that the area receives a standard average annual rainfall (SAAR) of 606mm. The catchment has a moderate gradient (DPSBAR = 15.8m/km) and is of moderate to high elevation (ALTBAR = 83).

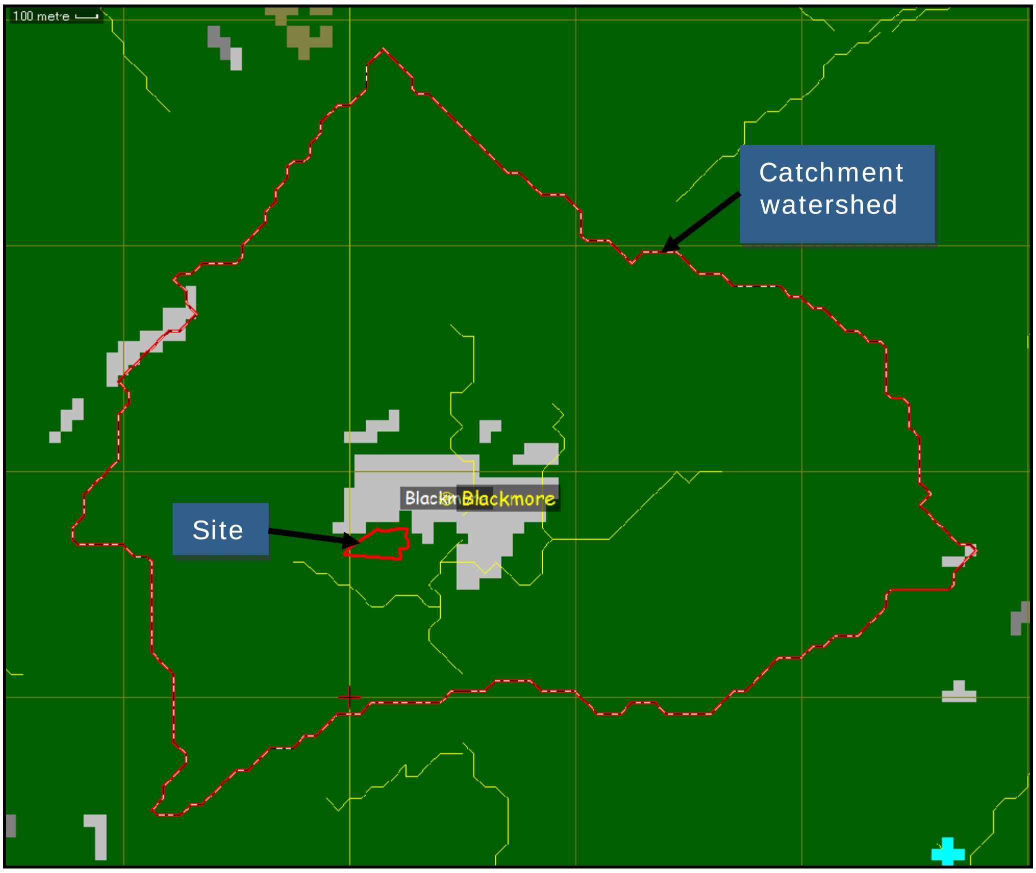


**Figure 5: Location of site in relation to catchment watershed (Source: FEH CD-ROM Version 3)**

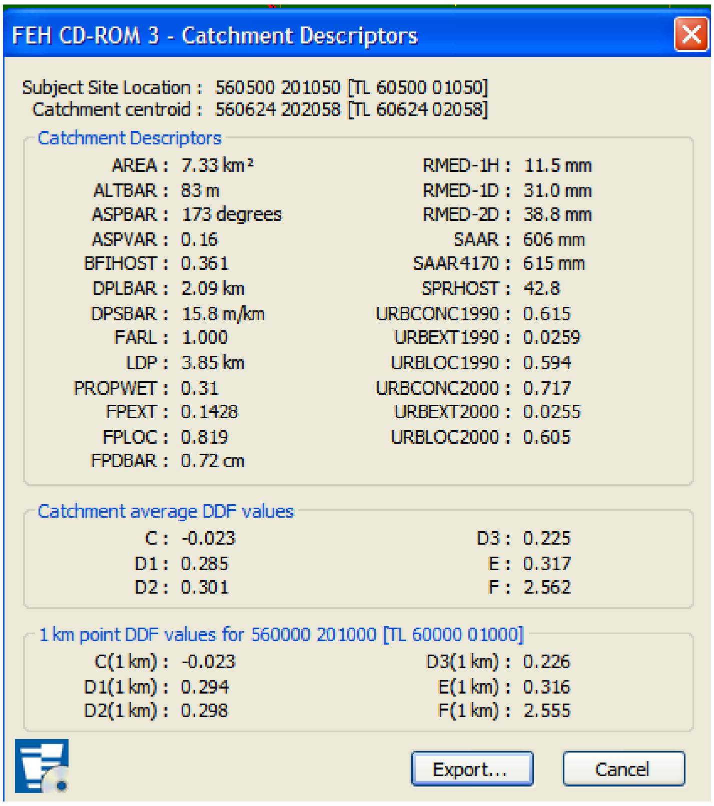


**Figure 6: Catchment descriptors (Source: FEH CD-ROM Version 3)**

# 5. OTHER SOURCES OF FLOODING

## 5.1 Groundwater Flooding

5.1.1 In order to assess the potential for groundwater flooding during higher return period rainfall events, the Jacobs/DEFRA report entitled *Strategy for Flood and Coastal Erosion Risk Management: Groundwater Flooding Scoping Study*, published in May 2004, was consulted, together with the guidance offered within the document entitled *Groundwater flooding records collation, monitoring and risk assessment (ref HA5)*, commissioned by DEFRA and carried out by Jacobs in 2006.

5.1.2 According to Cobby et al (2009), groundwater flooding can be defined as flooding caused by the emergence of water originating from subsurface permeable strata. The greatest risks of groundwater flooding are considered to be from either:

- a rise of groundwater in unconfined permeable strata, such as Chalk, after prolonged periods of extreme rainfall;
- a rise of groundwater in unconsolidated, permeable superficial deposits, which are in hydraulic continuity with local river water levels and where the hydraulic gradient of the water table is low.

5.1.3 As described above, it is widely accepted that groundwater flooding generally occurs from both permeable strata (e.g. Chalk) and superficial deposits (e.g. sands and gravels). In particular, unconfined water-bearing deposits (i.e. those with permeable soils above them) are susceptible to a rise in groundwater during prolonged, extreme rainfall and during periods of high recharge throughout autumn and winter. Antecedent conditions, such as, above average groundwater levels prior to the rainfall event, are also a contributing factor to a variation in the water table.

5.1.4 Permeable superficial deposits can also hold quantities of groundwater, although these tend to be insignificant compared to the stored quantities within consolidated aquifers. Unconsolidated deposits such as sand and gravels are sufficiently permeable to store water; however such deposits which yield a low quantity of water are commonly termed a non-aquifer.

5.1.5 Deposits comprising a mixture of permeable and impermeable soils can lead to a presence of perched water. Perched water tables are located above less permeable deposits such as clay and are located within water-bearing soils such as sand and gravel. If perched water is unconfined then the potential for recharge and groundwater flooding can be high. If the perched water is confined by less permeable clay deposits, then the clay deposits will have a buffering effect on percolating surface water and thus the recharge potential and rise in the water table is low.

### Soil and Geology at the Site

5.1.6 The British Geological Survey's *Online Geology of Britain Viewer* indicates that the soils beneath the site comprise Head deposits (i.e. clay, silt, sand and gravel) and London Clay.

### Groundwater Flooding Potential at the Site

5.1.7 There have been no recorded groundwater flood events across the area between 2000 and 2003, as indicated by the Jacobs study.

5.1.8 The SWMP states that there have been no recorded groundwater flooding incidents across the area. The SFRA states that there is no risk of flooding from groundwater.

5.1.9 Overall it is unlikely that during periods of prolonged or heavy rainfall the water table will have the capacity to rise and breach the ground surface, particularly as the soils across the site have an overall low permeability and will be confining the water table. It is considered that the evidence suggests a low risk of groundwater flooding to the site.

5.1.10 Despite this, it is considered that a precautionary approach is adopted when considering groundwater flood risk to foundations. A *Water Exclusion Strategy* as outlined further in the DEFRA/EA document *Improving the Flood Performance of New Buildings* is recommended, which aims to prevent groundwater from affecting the foundations below ground. For example, concrete blocks used in foundations should be sealed with an impermeable material or encased in concrete to prevent water movement from the ground to the wall construction.

5.1.11 Furthermore, it is recommended that finished floor levels are set up to 150mm higher than existing ground levels in order to reduce the risk of groundwater flooding.

### 5.2 Surface Water Flooding and Sewer Flooding

5.2.1 Surface water and sewer flooding across urban areas is often a result of high intensity storm events which exceed the capacity of the sewer thus causing it to surcharge and flood. Poorly maintained sewer networks and blockages can also exacerbate the potential for sewer flooding. Surface water flooding can also occur as a result of overland flow across poorly drained rural areas.

5.2.2 Figure A6-B of the SFRA and Drawing 2012s6570-002 of the SWMP shows that there has been a recorded incident of surface water flooding in the village and more specifically along Chelmsford Road. The SWMP states that the flood risk in Blackmore mainly originates from watercourses running through the village.

5.2.3 The site is not located within a Critical Drainage Area. There are also no flood investigation reports undertaken by Essex County Council at this location.

5.2.4 The Environment Agency's Surface Water Flooding Map (Figures 7 to 10) indicates that across the site there is a:

- very low surface water flooding risk (i.e. chance of flooding less than 1 in 1000 years);
- low surface water flooding risk (i.e. chance of flooding of between 1 in 1000 years and 1 in 100 years);
- medium surface water flooding risk (i.e. chance of flooding of between 1 in 100 years and 1 in 30 years) and;
- high surface water flooding risk (i.e. chance of flooding greater than 1 in 30 years).

5.2.5 It is generally accepted that as the surface water flood map does not include a scenario which considers climate change, the low risk flood event is used as a substitute to provide a worst-case scenario.

5.2.6 The Agency's map generally shows lower areas of ground where water may pond during storm events and identify areas which receive subsequent runoff from surrounding land during heavy rainfall events.

5.2.7 The map and LIDAR survey indicate that the pattern of surface water flooding is a result of ground levels across the site typically forming a depression in comparison to adjacent areas (typically up to 0.30m deep).

5.2.8 This correlates well with the data associated with the Agency's map which indicates that the flood depth during worst-case low risk events would largely be less than 0.3m. The hazard would be *Very low* when using the hazard equation in paragraph 13.7.2 of *FD2320/TR2.* The map also shows some areas of the site during low to high risk events to have a depth of between 0.3m and 0.9m, however, the LIDAR data suggests that the depth is more likely to be 0.3m. The hazard would be *Dangerous for Most*.

5.2.9 It is recommended that all dwellings are located across *Very low* risk areas in order to avoid the flood risk in the first instance and to provide safe refuge. This will also prevent surface water flood displacement thus not increasing the risk to adjacent areas.

5.2.10 Proposed access roads could be located across areas where the flood depth is shown to be less than 0.3m in order to provide safe access/egress during the peak of the event. Furthermore, the proposed site entrance from Blackmore Road would be affected to a depth of below 0.3m and hence safe access/egress would be available. People should travel in a north easterly direction along Blackmore Road during the peak of the event in order to remain safe.

5.2.11 There is scope in the future to develop additional parts of the site which are shown to be affected by surface water flooding. As the flood depth is likely to be up to 0.3m across these areas it would be necessary for proposed dwellings to be set between 0.15m and 0.3m higher than existing ground levels (depending on the flood depth). This would prevent internal flooding. Regarding off-site impact, it is recommended that surface water flood modelling is undertaken to ensure that the proposed dwellings do not cause a negative effect in terms of flood displacement and to explore flood compensation/alleviation measures as appropriate.

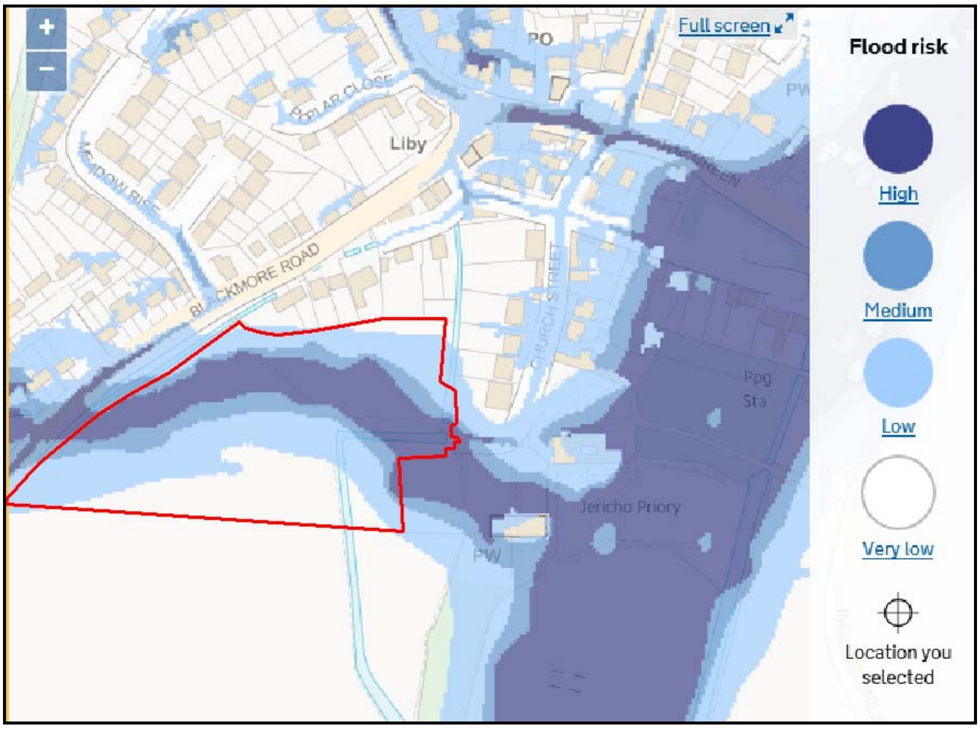


**Figure 7: Environment Agency Surface Water Flooding Map and site extent (Source: Environment Agency, 2018)**

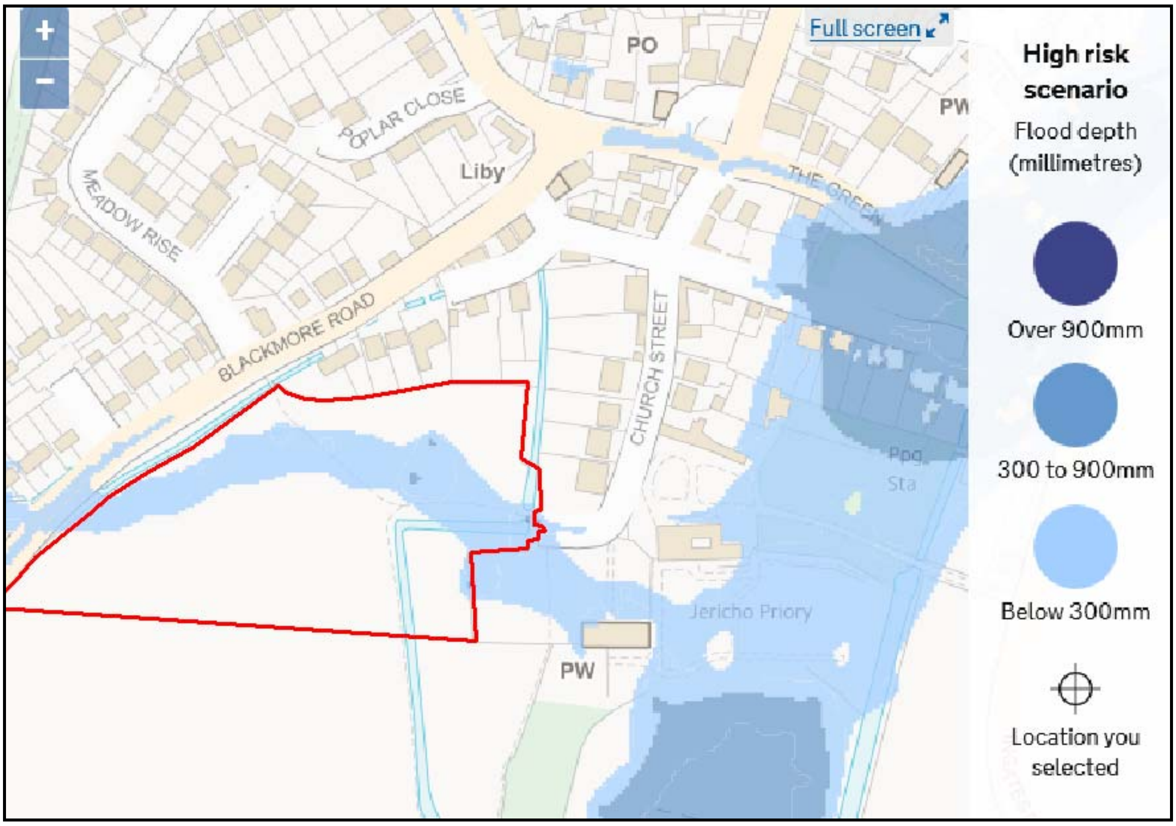


**Figure 8: Environment Agency Surface Water Flooding Map for high risk events (Source: Environment Agency, 2018)**

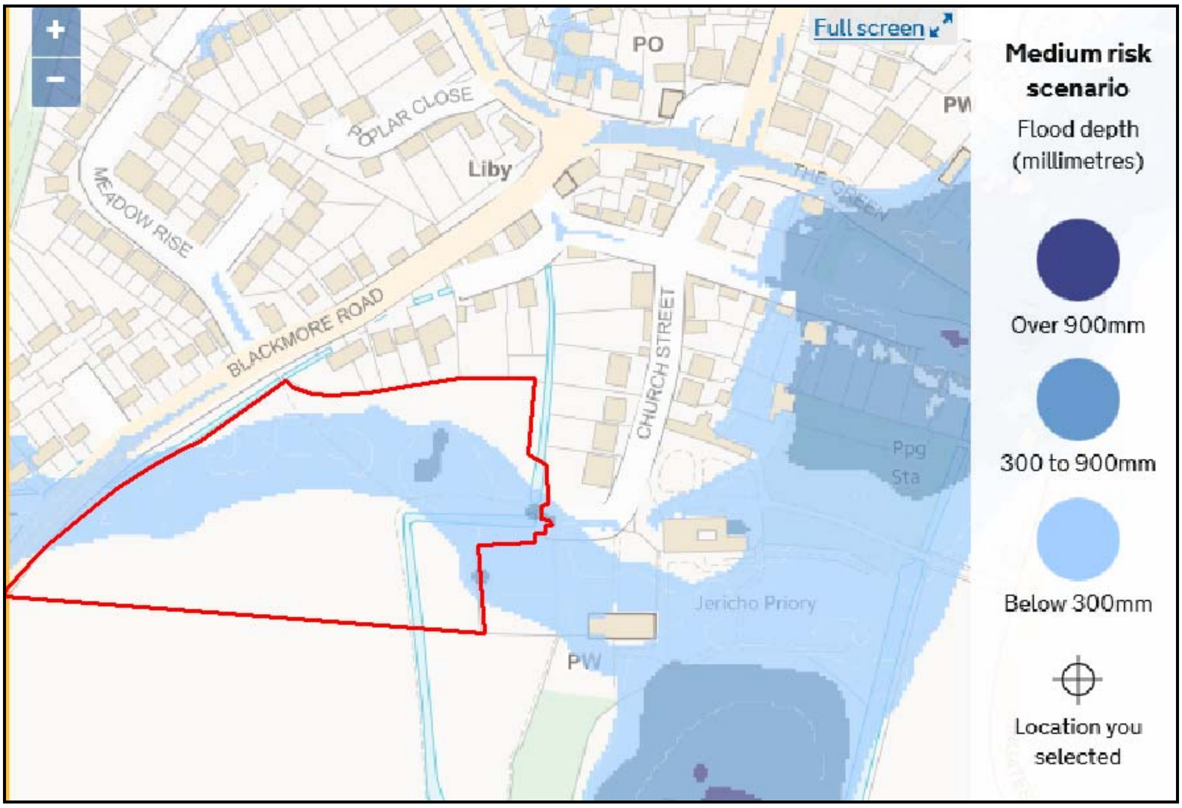


**Figure 9: Environment Agency Surface Water Flooding Map for medium risk events (Source: Environment Agency, 2018)**

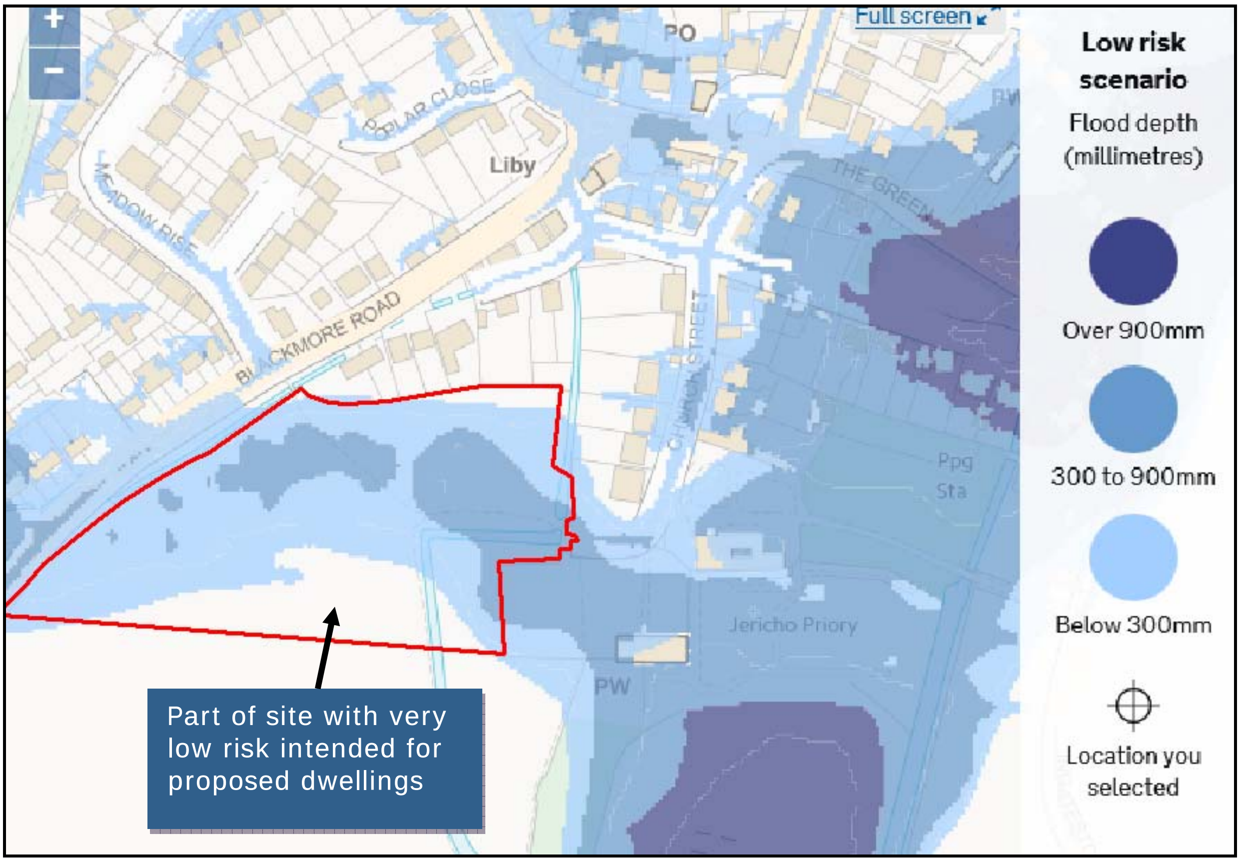


**Figure 10: Environment Agency Surface Water Flooding Map for low risk events (Source: Environment Agency, 2018)**

5.2.12 The Client is aware that there is a flooding problem in the village. She has stated that *'Water comes from the other side of the village and flows into the moat and out over the weir and into the River Wid which is its only way out of the village. The weir on the moat holds the water back as it enters the downstream reach which is the source of the River Wid. Once the water has flowed past the weir the watercourse is overgrown and shallow, however, the section of watercourse adjacent to the eastern frontage of the site up to the footbridge downstream of the site flows freely and is looked after by the neighbours and scouts. If the weir out of the moat was lowered the moat would most probable dry up'.*

5.2.13 Further anecdotal evidence from Dr Jennings of The Moathouse (adjacent to the eastern frontage of the site) is acknowledged. This evidence was submitted to Brentwood Borough Council as part of a comment form in relation to preferred site allocations. The evidence compares well with the data on the Agency's map and also in the SWMP regarding previous flood events and provides information about more recent events which post-dates the SWMP. There is no specific reference to the site flooding however.

5.2.14 It is not clear whether the existing weir downstream of the site is causing a more frequent drainage issue in the village or whether it simply controls the baseflow within the watercourse, and during higher return period events becomes 'drowned-out' and not hydraulically significant.

5.2.15 It is likely that the drainage of the village could be improved by regular maintenance of the watercourse. It is recommended that a watercourse maintenance programme is agreed with the land owner and Essex County Council to ensure that the watercourse is able to convey surface water effectively long-term.

5.2.16 It is considered that the avoidance of flood risk across the site in the first instance as discussed in paragraph 5.2.9, together with attenuated runoff from the proposed site as discussed in Chapter 6, will ensure that existing flood risk issues across the site and off-site are not exacerbated.

## 5.3 Reservoirs, Canals And Other Artificial Sources

5.3.1 The failure of man-made infrastructure such as flood defences and other structures can result in unexpected flooding. Flooding from artificial sources such as reservoirs, canals and lakes can also occur suddenly and without warning, leading to high depths and velocities of flood water which pose a safety risk to people and property.

5.3.2 The Environment Agency's "Risk of flooding from reservoirs" map suggests that the site is not at risk from such features.

## 6. SURFACE WATER DRAINAGE AND SUDS

### 6.1 Introduction

6.1.1 Planning policy recommends the maximum practical use of Sustainable Drainage Systems (SUDS) within proposals for new sites. There is a requirement that sustainable drainage systems (SUDS) be installed where appropriate, in order to limit the amount of surface water runoff entering drainage systems and to return surface water into the ground to follow its natural drainage path.

### 6.2 Soil Types and SUDS Suitability

6.2.1 Part H of the Building Regulations and Section 3.2.3 of CIRIA 753 prioritises discharges to the ground and then a watercourse, with discharge to a sewer only to be considered when both infiltration and discharge to a watercourse is not reasonably practicable.

6.2.2 By consulting the information outlined in Section 5.1 the soils at the site comprise clayey deposits. The infiltration rates associated with the soils are not considered sufficient for the practical use of infiltration devices such as soakaways or permeable surfaces. BRE Digest 365 and Section 13.4 of CIRIA 753 require that the time taken for infiltration devices to empty to 50% should be within 24 hours. This requirement is unlikely to be achieved in these soils.

6.2.3 Therefore, due to the soil types/infiltration capacity across the site, there is a stronger case to implement an attenuation SUDS solution at the site instead of an infiltration SUDS solution.

6.2.4 Lined permeable paving (used for attenuation and water quality) could be used to construct the proposed hardstanding areas such as car parking areas, driveways and access road. Surface water from building roofs could then be drained onto, or into, the permeable paving directly thus providing additional water quality treatment. This approach is described further in CIRIA 582 entitled *Source control using constructed pervious surfaces.*

6.2.5 An attenuated discharge can be directed into the watercourse along the eastern frontage of the site.

### 6.3 Pervious Surfaces

6.3.1 It is proposed that the driveways, car parking areas and access roads are constructed using pervious surfaces such as permeable block paving or grass reinforcement/plastic grids with gravel as discussed further in Section 20.1.3 of CIRIA 753, which will be used for attenuation rather than infiltration. Surface water from the proposed building roofs could then be drained onto, or into, these surfaces directly. This approach is described further in CIRIA 582 entitled *Source control using constructed pervious surfaces.*

6.3.2 The Interpave document entitled *Understanding permeable paving: Guidance for designers, planners and local authorities* dated 2010, suggests that permeable paving can permit a flow rate of up to 4000mm/hr. The system shown on Figure 11 allows for the complete capture of water using an impermeable, flexible membrane placed on top of the subgrade level and up the sides of the permeable sub-base.

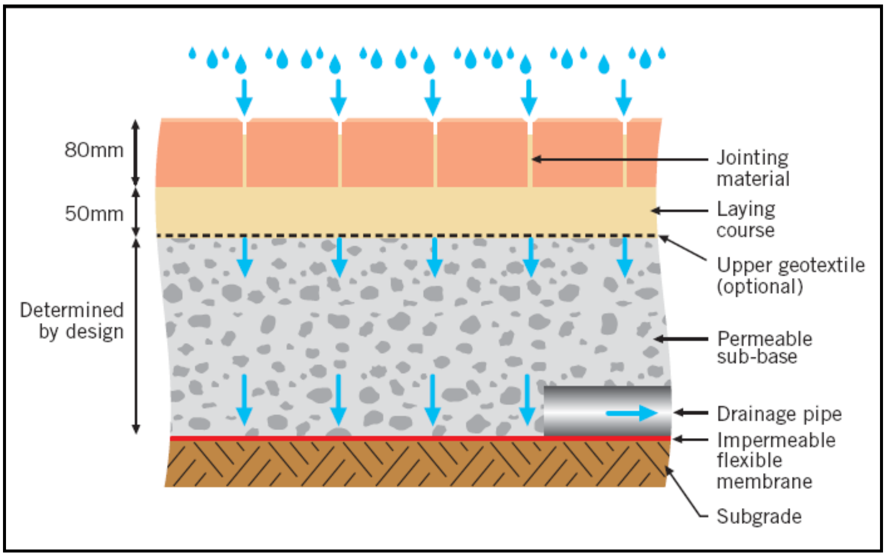


**Figure 11: Section through a permeable surface (Source: Interpave *Permeable pavements – guide to the design construction and maintenance of concrete block permeable pavements* dated 2010)**

6.3.3 Local Standard 1 of the ECC SUDS Design Guide states that in all cases, wherever practicable, the runoff rate should be restricted to the Greenfield 1 in 1 year rate.

6.3.4 It should be noted that the Client has riparian responsibilities and any proposed headwalls may require a land drainage consent issued by Essex County Council. The Environment Agency document *Living on the Edge* should also be consulted further.

6.3.5 Table 20.1 of CIRIA 753 indicates that for the infiltration rates expected at the site, it may be possible for the permeable paving to incorporate partial infiltration in order to help with interception (i.e. the capture and retention of the first 5mm of rainfall), although this cannot be factored into the storage design. Section 13.4.2 of CIRIA 753 states that infiltration can play an important role in providing interception even on sites with low infiltration rates.

## 6.4 Pollution Prevention

6.4.1 Table 26.2 of CIRIA 753 shows that residential roof water has a very low pollution hazard level. Table 26.2 of CIRIA 753 shows that residential driveways and low traffic roads (e.g. proposed access roads) have a low pollution hazard level.

6.4.2 Permeable paving will sufficiently cleanse surface water from roofs and hardstanding areas such as driveways, roads and car parking areas. Chapter 20 of CIRIA 753 confirms that permeable paving can improve water quality by sedimentation, filtration, adsorption and biodegradation. Where applicable, roof water draining to the permeable paving is also considered to be of a suitable quality and will not be required to be subjected to additional pollution prevention measures.

6.4.3 It is therefore considered that (collectively) the SUDS measures included within this report will sufficiently improve water quality across the proposed site and comply with Box 4.3 of CIRIA 753.

6.4.4 When considering water quality treatment, the Simple Index Approach set out in 26.7.1 of CIRIA 753 needs to be considered. Using Tables 26.2 and 26.3 in CIRIA 753, it can be seen on Table 1 below, that the use of permeable paving to cleanse roof water and access road/car parking areas will meet the pollution mitigation requirements (i.e. values in Table 1 for SUDS components should be equal to, or greater than the values for Land Use).

**Table 1: Simple Index Approach**

| Land Use | Total Suspended Solids index | Metals index | Hydrocarbons index |
|---|---|---|---|
| Residential Roofs | 0.2 | 0.2 | 0.05 |
| Residential Driveways/car parking areas/Low traffic roads | 0.5 | 0.4 | 0.4 |
| **SUDS Component for treatment** | **Total Suspended Solids index** | **Metals index** | **Hydrocarbons index** |
| Permeable Paving | 0.7 | 0.6 | 0.7 |

## 6.5 Adoption and Maintenance

6.5.1 The SUDS measures are likely to be privately adopted and maintained (perhaps by a management company and/or homeowners). The permeable paving should be maintained in accordance with Table 20.15 of CIRIA 753, shown as Tables 2 hereafter.

**Table 2: Maintenance regime for permeable paving (Source: taken from Table 20.15 of CIRIA 753)**

**TABLE 20.15 Operation and maintenance requirements for pervious pavements**

| Maintenance schedule | Required action | Typical frequency |
|---|---|---|
| Regular maintenance | Brushing and vacuuming (standard cosmetic sweep over whole surface) | Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment |
| Occasional maintenance | Stabilise and mow contributing and adjacent areas | As required |
| | Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying | As required – once per year on less frequently used pavements |
| Remedial Actions | Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving | As required |
| | Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material | As required |
| | Rehabilitation of surface and upper substructure by remedial sweeping | Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging) |
| Monitoring | Initial inspection | Monthly for three months after installation |
| | Inspect for evidence of poor operation and/or weed growth – if required, take remedial action | Three-monthly, 48 h after large storms in first six months |
| | Inspect silt accumulation rates and establish appropriate brushing frequencies | Annually |
| | Monitor inspection chambers | Annually |

## 7. CONCLUSIONS

- A review of the relevant guidance documents and various types of data collected at the site has enabled a full assessment of the flood risks to be quantified.

- The site is located within the Flood Zone 1 therefore all uses of land are appropriate in this zone.

- This assessment has investigated the possibility of groundwater flooding and flooding from other sources at the site. It is considered that there is a low risk of groundwater flooding, however, as a precaution the proposed dwellings will be raised by 150mm and a *Water Exclusion Strategy* will be applied to foundations.

- There is a very low to high surface water flooding risk across the site, and it is recommended that all built development is located across very low risk areas in the first instance. Safe access/egress will be available at all times.

- There is scope in the future to develop additional parts of the site which are shown to be within the surface water flood risk area, and in these circumstances it is recommended that surface water flood modelling is undertaken to ensure that the proposed dwellings do not cause a negative effect in terms of flood displacement and to explore flood compensation/alleviation measures as appropriate.

- An assessment of the practical use of sustainable drainage techniques has been carried out. As soil types will not support the effective use of infiltration devices, it is proposed that surface water is attenuated through the use of permeable paving prior to discharge into the existing watercourse system.

- Local flood issues have been acknowledged in the report. Overall, there will not be an increased risk of flooding to neighbouring areas and by incorporating surface water management and SUDS across the proposed site there could be a reduced flood risk to local residents.

## 8. BIBLIOGRAPHY


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