



Land & Partners Ltd

LONG COPSE LANE

Flood Risk Assessment & Surface Water
Drainage Strategy





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REPORT (FIRST ISSUE)

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QUALITY CONTROL

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EXECUTIVE SUMMARY

WSP has been appointed by Land & Partners to undertake a Flood Risk Assessment and outline Surface Water Drainage Strategy for a residential development located to the north of Long Copse Lane, Emsworth, Hampshire. This report has been written in accordance with the requirements of the National Planning Policy Framework (NPPF) and other relevant national and local policy guidance documents.

The development proposals consist of the construction of approximately 210 residential dwellings within the applications site.

The flood risk has been assessed through the use of publicly available data and consultation with the appropriate flood risk management authorities, the findings of which are summarised below.

The site covers an area of approximately 14.6 hectares and is located wholly within Flood Zone 1 which is classified in the NPPF as land having a low probability of fluvial/tidal flooding

Other potential sources of flooding including Coastal, Fluvial, Groundwater, Sewers and Drainage Infrastructure and Artificial Sources are not expected to pose a significant flood risk to the development and therefore require no mitigation measures. The main potential risk of flooding from the Proposed Development is from pluvial sources and any associated surface water runoff.

Mitigation measures to manage rainfall run-off have been provided in the form of a surface water drainage strategy. The proposed surface water drainage strategy demonstrates that the Proposed Development can be drained using SuDS features for events up to the 1% AEP storm event, including an allowance for climate change (40% increase on peak rainfall intensity).

The development will provide areas of permanent water within attenuation features, which will act as nitrogen sinks to offset the concentration of Total Nitrogen in the local streams, otherwise increased by the foul water flows from the development.

1 INTRODUCTION

1.1 APPOINTMENT AND BRIEF

- 1.1.1. Land & Partners Ltd has commissioned WSP to undertake a Flood Risk Assessment (FRA) in support of a 14.6 ha development (hereafter referred to as the 'Proposed Development') located north of Long Copse Lane, Emsworth, Hampshire (the 'Application Site').
- 1.1.2. The FRA has been produced in line with the requirements of the National Planning Policy Framework (NPPF), the Environment Agency's Standing Advice, and the site-specific flood risk assessment checklist given in the Flood Risk and Coastal Change Planning Practice Guidance (PPG).
- 1.1.3. The aim of this FRA is to support the outline planning application for the major development proposed at the Application Site and has been produced in consultation with Hampshire County Council (as LLFA), Havant Borough Council, the Environment Agency, and Southern Water (Local Water Company).
- 1.1.4. The FRA investigates flood risk at and near the Application Site and establishes the mitigation measures required, where necessary, to ensure the sustainability and safety of the Proposed Development over its lifetime. This includes the presentation of a conceptual surface water drainage strategy. Climate change allowances have been adopted in accordance to the lifetime of the Proposed Development.

1.2 ADVISORY INFORMATION

- 1.2.1. Third party data / reports have not been validated by WSP and have been relied on as supplied and has been assumed to be fit for purpose.
- 1.2.2. WSP has prepared this report in accordance with the instructions of their client, Land & Partners Ltd, for their sole and specific use relating solely to the above site. Any person who uses any information contained herein does so at their own risk and shall hold WSP harmless in any event.
- 1.2.3. Whilst this report was prepared using the reasonable skill and care ordinarily exercised by engineers practicing under similar circumstances and reasonable checks have been made on data sources and the accuracy of the data, WSP accepts no liability in relation to the report should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WSP. In any event, WSP shall not be liable for any loss or damages arising under or in connection to the use of this report.

2 SITE BACKGROUND

2.1 SITE DESCRIPTION

- 2.1.1. The Application Site is located north of Long Copse Road, Emsworth, Hampshire. The Ordnance Survey grid reference for the Application Site is SU 75074 08082 and the nearest post code is PO10 8SU. The Application Site covers an approximate area of 14.6 ha and is currently a mixed greenfield and brownfield site. Refer to Figure 1 below or Drawing No. 2250-LOC-001 in Appendix A for the Site Location Plan.



Figure 2-1 - Site Location Plan (Red line – Site Boundary)

2.2 TOPOGRAPHY

- 2.2.1. Mayer Brown Limited completed a topographic survey in April 2021. The survey shows a maximum existing ground level within the Application Site of approximately 35.8m AOD located along the western tip of a ridge in the centre of the site. The existing ground levels fall away steadily from the central ridge towards the southern and northern edges of the site, therefore creating two separate water catchments. A minimum level of 18.5m AOD is located in the north east corner of the Site. Levels on the survey have not been independently verified by WSP. Refer to the topographic survey in Appendix B.
- 2.2.2. The Environment Agency Lidar 1m Digital Terrain Model (DTM) levels are qualitatively consistent with those recorded in the topographic survey. Refer to Drawing No. 2250-TOP-001 in Appendix B.

2.3 GEOLOGY AND HYDROGEOLOGY

- 2.3.1. British Geological Survey (BGS) 1:50,000 scale On-shore Digital Mapping shows the Application Site to be mostly underlain by the London Clay Formation (clay, silt and sand). The north-eastern corner the Application Site is underlain by the Lambeth Group (clay, silt and sand). An extract of the BGS bedrock geology mapping is provided on Drawing No. 2250-BGS-001 in Appendix C for reference.
- 2.3.2. Borehole record SU70NW333, located approximately 500m to the north of the Application Site indicated stiff mottled grey and brown silty clay to a depth of 3.5m, with stiff grey clay below to a depth of 10.7m. Water was not encounter within the borehole, which was dug to depth of 26.3m.
- 2.3.3. The are no superficial deposits present at the Application Site. An extract of the BGS superficial geology mapping is provided on Drawing No. 2250-BGS-002 in Appendix C for reference.
- 2.3.4. DEFRA's Magic Map shows the London Clay Formation is classified as an Unproductive Aquifer. These are rocks with essentially no groundwater. The Lambeth Group is classified as a Secondary A Aquifer. These are '*permeable layers capable of supporting water supplies at a local rather than strategic scale and in some cases forming an important source of base flow to rivers.*'
- 2.3.5. . No fixed groundwater level was found as water is believed to have leached into the borehole from the saturated topsoil.
- 2.3.6. The Flood Map Pack, included in Appendix D for reference, indicates there are no source protection zones within 500m of the Application Site.
- 2.3.7. According to DEFRA Magic Map, the whole site lies within the Chichester, Langstone and Portsmouth Harbours Eutrophic Water 2 Nitrate Vulnerable Zone (ET2). An area at the north east of the Application Site also lies within the Sussex Chalk Nitrate Vulnerable Zone (G56).

2.4 IDENTIFICATION OF EXISTING WATERCOURSES

- 2.4.1. A tributary of the River Ems abuts the northern boundary of the Application Site. This watercourse flows in a south easterly direction before meeting the River Ems, an environment agency main river, approximately 500m from the Application Site.
- 2.4.2. Ordnance Survey Mapping shows a small ditch in the south west corner which runs across the Application Site in a south easterly direction. The topographical survey shows a shallow depression between 100mm and 300mm at this location, with side slopes between 1 in 15 and 1 in 30. Hampshire County Council have identified this feature as an Ordinary Water Course, meaning that any changes to its flow or storage will require a formal Ordinary Water Course Land Drainage Consent.

2.5 EXISTING SEWER AND DRAINAGE INFRASTRUCTURE

- 2.5.1. The Application Site is classified as a mixture of greenfield and brownfield. The greenfield areas currently drain via infiltration and natural overland runoff, with the northern catchment of the Application Site draining any overland flows towards the watercourse to the north, while any overland flows from the southern catchment are likely to be intercepted by the drainage system along Long Copse Lane.
- 2.5.2. Southern Water Asset Pans provided in Appendix E.2 show that there is a 150mm public foul water sewer originating on site, which flows towards the southern boundary. Due to the demolition of the existing buildings within the Application Site boundary, the respective section of the sewer serving the buildings will be abandoned. There is another 150mm public foul water sewer that originates to the

south of the south west corner of the Application Site, before flowing a short distance along Long Copse Lane before flowing south.

2.6 EXISTING FLOOD DEFENCES

- 2.6.1. The Environment Agency's Flood Map for Planning indicates that the Application Site does not benefit from any formal fluvial flood defences. Refer to on Drawing No. 2250-EA-001 in Appendix F for reference.

3 THE PROPOSED DEVELOPMENT

3.1 BACKGROUND OF PROPOSALS

- 3.1.1. The Proposed Development consists of demolishing the existing buildings within the Application Site boundary and building approximately 210 residential dwellings along with associated car parking, landscaping and other associated ancillary works.

3.2 VULNERABILITY CLASSIFICATION

- 3.2.1. In accordance with the NPPF and associated Flood Risk PPG Table 2: Flood risk vulnerability classification, the proposed development usage (residential development) is classified as more vulnerable.

3.3 SEQUENTIAL AND EXCEPTION TESTS

- 3.3.1. The purpose of the NPPF Sequential Test is to ensure that land use planning takes due regard of flood risks, to ensure that areas at low or no risk of flooding are developed in preference to areas at higher risk.
- 3.3.2. The NPPF Sequential Test aims to steer development, if possible, towards areas at the lowest risk of flooding, avoiding development within Flood Zone 2 and 3.
- 3.3.3. According to HBC's Strategic Flood Risk Assessment (Local Plan Sites), the Application Site forms part of EMS-EM7, Land North of Long Copse Lane, which states that the site is acceptable for allocation in the new Havant Borough Local Plan. The known drainage capacity issues in the area are to be addressed by a specific policy in the Local Plan to reduce post development runoff.
- 3.3.4. Consequently, the Sequential Test for the Proposed Development has been satisfied which is consistent with its location in Flood Zone 1 (see following sections) and does not require an exception test due to its flood zone location. This is in line with Policy E19 of the Havant Borough Local Plan (Submission Version).

4 POLICY AND CONSULTATION

4.1 CONSULTATION

- 4.1.1. Consultation has been undertaken with regulatory bodies and third parties, during the preparation of this FRA, including:
- The Environment Agency;
 - Hampshire County Council;
 - Havant Borough Council; and,
 - Southern Water.
- 4.1.2. A summary of the pre-application correspondence undertaken with the flood risk stakeholders identified above is given in Table 4-1 with full copies provided in Appendix E for reference

Table 4-1 – Summary of Correspondence

STAKEHOLDER	RESPONSE
The Environment Agency	The Environment Agency holds no records of fluvial flooding in the area to the North of Long Copse Lane. This is shown on their Historic Flood Map reproduced in Appendix D. The Environment Agency confirmed the site is located in Flood Zone 1 and the likelihood of flooding from rivers and seas in the area is estimated as "very low". The Environment Agency were unable to provide any data from their detailed fluvial models as the site is approximately 400m away from Flood Zone 2.
Hampshire County Council	Hampshire County Council hold 5 records of flooding within a 250m radius of the site. The most recent incident occurred in 2020 due to ditches requiring maintenance along Long Copse Ln. Hampshire County Council state the surface water proposals are acceptable in principle since the underlying geology will most likely make infiltration infeasible. The ditch across the south west corner of the site is classified as a detailed river network – offline drainage.
Havant Borough Council	Havant Borough Council do not hold up to date records of flooding in the vicinity of the site. Havant Borough Council generally appreciate the positive impacts of the scheme in terms of biodiversity and to the wider flood risk around Long Copse Ln. Havant Borough Council referred to Hampshire County Council for further information of historic flood risk, hydraulic modelling maps, interpretation of

	climate change guidance and critical drainage issues in the area.
Southern Water	Southern Water confirmed that they have no recorded incidents of sewer flooding in relation to the site and surrounding area.

4.2 POLICY AND GUIDANCE

4.2.1. The report has been informed by, and makes reference where appropriate, the following documents and policies:

- The NPPF, Ministry of Housing, Communities & Local Government (2012, last updated in July 2021);
- The NPPF Flood Risk and Coastal Change PPG, Ministry of Housing, Communities & Local Government (2016, last updated 24 June 2021);
- Non-Statutory Technical Standards for Sustainable Drainage Systems, DEFRA (2015);
- Building Regulations Approved Document H, Ministry of Housing, Communities & Local Government (2015);
- The SuDs Manual (CIRIA C753), CIRIA (2015);
- Design and Construction Guidance, Water UK (2020);
- South East River Basin Management Plan, Environment Agency (2015);
- South East Hampshire Catchment Flood Management Plan, Environment Agency (2009);
- Local Development Framework, Core Strategy, Havant Borough Council (2011);
- Sustainability Appraisal of the Draft Havant Borough Local Plan 2036, Havant Borough Council (2017);
- Havant Borough Local Plan (Submission Version), Havant Borough Council (2021);
- Strategic Flood Risk Assessment (Local Plan Sites), Havant Borough Council (2018);
- Local Flood Risk Management Strategy, Hampshire County Council (2020);
- Preliminary Flood Risk Assessment, Hampshire County Council (2011);
- Surface Water and Sustainable Drainage Guidance for Developers, Designers and Planners, Version 1, Hampshire County Council (2015);
- Strategic Flood Risk Assessment, Partnership for Urban South Hampshire (PUSH) (2016).

4.2.2. Policy H8 of the emerging Havant Borough Local Plan proposes to allocate the site and adjoining parcels of land for residential development of about 260 dwellings. the policy requires the developer to provide a drainage solution on site which reduces surface water run-off and contributes towards identified flood alleviation schemes in the area, in line with Policies E19 and E20. Policy E19 sets out how flood risk is to be managed in new development and Policy E20 sets out the drainage infrastructure requirements in new development.

5 CLIMATE CHANGE

5.1 REVIEW OF CLIMATE CHANGE GUIDANCE

5.1.1. The typical lifespan for a residential development is 100 years. According to the Environment Agency, the contingency allowances for climate change that are potentially applicable to the Proposed Development are given below.

- Surface Water (peak rainfall intensity):
 - Upper End – 40% by 2115; and,
 - Central – 20% by 2115.

5.1.2. The allowance adopted for the design of the proposed surface water drainage water strategy is discussed in the following sub-section.

5.2 IMPACT OF CLIMATE CHANGE ON THE DEVELOPMENT

5.2.1. Surface water flood risk is generally expected to increase in the future as a consequence of climate change and the expected increase in extreme rainfall events. In order to take into account the latest climate change guidance, the proposed surface water drainage strategy has been designed to cater for the 1:100 year return period rainfall event, including a 40% climate change allowance.

6 DEFINITION OF FLOOD HAZARD

6.1 BRIEF CONSIDERATIONS

- 6.1.1. The following section provides an overview of the potential sources of flooding at the Application Site, along with an assessment of flood risk to and arising from the Proposed Development. An assessment has been undertaken for each source that could affect the Proposed Development in accordance with the NPPF Flood Risk and Coastal Change PPG.

6.2 FLOODING FROM COASTAL AND TIDAL SOURCES

- 6.2.1. Tidal flooding occurs when sea levels rise above the level of the land or beyond the operational level of flood defences.
- 6.2.2. The Environment Agency's Flood Map for Planning, reproduced on Drawing No. 2250-EA-001 in Appendix F, shows that the Application Site is not in proximity of a tidal section of watercourse or the coast; consequently, the risk of flooding posed to the Application Site and the Proposed Development from this source is considered to be negligible and will not be considered further.

6.3 FLOODING FROM FLUVIAL SOURCES

- 6.3.1. Fluvial flooding occurs when flows within a watercourse exceed the capacity of the channel causing out of bank flows.
- 6.3.2. The Application Site lies to the south of a tributary for the River Ems. The Environment Agency's Flood Map for Planning, reproduced on Drawing No. 2250-EA-001 in Appendix F, shows the Application Site lies wholly within Flood Zone 1 i.e. at an yearly chance of flooding equal to or below 0.1%. The Environment Agency holds no records of flooding at the Application Site and there is no mention of historic flooding within the SFRA. All the above indicates that the risk of fluvial flooding at the site is low.

6.4 FLOODING FROM PLUVIAL/OVERLAND FLOW SOURCES

- 6.4.1. During extreme storms ground may become saturated and, in addition, surcharged sewers may not be able to accommodate overland flows that arise from such conditions. This may lead to surface water flooding.
- 6.4.2. The Gov.Uk Long Term Flood Risk Map, reproduced on Drawing No. 2250-EA-002 in Appendix F, indicates that the majority of the Application Site lies within an area with an yearly chance of flooding equal to or less than 0.1%.
- 6.4.3. There are however areas along the norther boundary of the Application Site with a yearly chance of flooding equal or greater than 1% (and 3.3%), associated with the tributary for the River Ems. In addition, there is a small area in the south west corner of the Application Site with a yearly chance of flooding equal or greater than 0.1%.
- 6.4.4. The above indicates that the probability of flooding from pluvial/overland flow is generally low within the site, although there areas with higher probability of flooding associate to the unnamed tributary of River Ems.

6.5 FLOODING FROM GROUNDWATER SOURCES

- 6.5.1. Groundwater flooding occurs when water stored below ground reaches the surface. It is commonly associated with porous/permeable underlying geology, such as chalk, sands and gravels.
- 6.5.2. Borehole record SU70NW333, located approximately 500m to the north of the Application Site indicated stiff mottled grey and brown silty clay to a depth of 3.5m, with stiff grey clay below to a depth of 10.7m. Water was not encounter within the borehole, which was dug to depth of 26.3m.
- 6.5.3. Preliminary ground investigations and groundwater monitoring have been undertaken by Geo-Environmental since February 2021. The investigation found silty clay close to ground level.
- 6.5.4. The Environment Agency confirmed the site is underlain by London Clay. The clay is impermeable and considered a 'non-productive' formation in terms of hydrogeology. In addition to this the Environment agency and Hampshire County Council do not hold any records of groundwater flooding.
- 6.5.5. As a result, the existing flood risk from groundwater sources at the Application Site is considered Low.

6.6 FLOODING FROM SEWER AND DRAINAGE INFRASTRUCTURE

- 6.6.1. Southern Water asset plans have confirmed there is a 150mm public foul water sewer originating on the Application Site, which flows towards the southern boundary. There is another 150mm public foul water sewer that originates to the south of the south west corner of the Application Site, before flowing a short distance along Long Copse Lane before flowing south.
- 6.6.2. Hampshire County Council hold 3 records of flooding in relation to sewer and drainage infrastructure within 250m of the Application Site. The most recent record is from 2020 and was caused by ditches requiring maintenance.
- 6.6.3. Southern Water hold no recorded incidents of sewer flooding relating to surcharging on site or nearby. In addition to this, the foul water sewers sit topographically lower than the Application Site. Therefore, the probability of flooding from this source to the Application Site is considered to be low.

6.7 FLOODING FROM ARTIFICIAL SOURCES

- 6.7.1. The Environment Agency's Flood Risk from Reservoirs Mapping, reproduced in on Drawing No. 1334-EA-003 in Appendix F, indicates that the Application Site does not lie within the extreme inundation area of any reservoirs. The risk of flooding from this source to the Application Site, is considered to be negligible.
- 6.7.2. Similarly, as there are no canals or other artificial water storage facilities nearby or proposed within the development. Therefore, the risk of flooding from this source to the Application Site, is considered to be Negligible.

7 FLOOD RISK MITIGATION MEASURES

7.1 MITIGATION MEASURES

- 7.1.1. Following a review of the flood risks to and arising from the Proposed Development, the following section discusses the mitigation measures necessary to ensure the Proposed Development remains safe over its lifetime and does not exacerbate flood risk to neighbouring properties.
- 7.1.2. The risk posed to the Proposed Development, or of the Proposed Development exacerbating risk within the catchment, from tidal/coastal, fluvial, groundwater, sewer and drainage infrastructure, is assessed to be Low to Negligible. Therefore, no measures are considered necessary to mitigate against these potential sources of flooding.
- 7.1.3. Surface water runoff however needs to be managed in light of the expected increase in impermeable areas as a consequence of the development. This is needed to ensure that no surface water flood risk would affect the proposals and that no increase in surface water runoff would potentially increase flood risk downstream.
- 7.1.4. The proposed surface water drainage strategy, detailed in Section 8, demonstrates that the Proposed Development can be drained safely for events up to the 1% AEP event, including an allowance for climate change (40% on peak rainfall intensity).
- 7.1.5. The surface water drainage strategy needs to take into account potential rainfall events exceeding the drainage capacity controlling any exceedance runoff in appropriate exceedance flow paths.
- 7.1.6. Floor levels are proposed to be set a minimum of 150mm above external finished ground levels and no development is proposed within the area shown as risk of surface water flooding in the Gov.UK surface water flood map. Based on Gov.Uk's local surface water flood extents and the site-specific topography, it was estimated that the lowest finished floor levels will be set at least 2m above the 0.1% AEP surface water flood extent which has been assumed as the 1% AEP +40%CC flood extent, associated to the unnamed tributary of River Ems – in the northern part of the site.

NITROGEN OFFSET

- 7.1.7. Although not directly linked to flood risk management, the increase in foul water flows as a result of the Proposed Development has adverse impact on the concentration of Total Nitrogen on streams and rivers, should it not be mitigated appropriately. The Application Site will therefore incorporate a wetland within open SuDS features, which will act as nitrogen sinks to offset increase in Total Nitrogen associated with foul water flows while providing a bio-diversity net gain. The requirements of the Total Nitrogen offset are set out in Appendix G.

7.2 SAFE ACCESS AND EGRESS

- 7.2.1. Safe access and egress will be provided via Long Copse Lane to the south of the Application Site. Long Copse Lane lies fully within Flood Zone 1. Access will be available to both the east and the west of Long Copse Lane, presenting two options of safe egress.

8 SURFACE WATER DRAINAGE STRATEGY

8.1 EXISTING SURFACE WATER DRAINAGE REGIME

- 8.1.1. The Application Site is classified as a mixture of greenfield and brownfield. The greenfield areas currently drain via infiltration and natural overland runoff, with the northern catchment of the Application Site draining any overland flows towards the unnamed tributary of River Ems to the north, and any overland flows from the southern catchments intercepted by the drainage system along Long Copse Lane which is shown not to have sufficient hydraulic capacity from time to time, leading to flooding of the highway and therefore affecting existing properties on the south side of the road.

8.2 PROPOSED SURFACE WATER MANAGEMENT

- 8.2.1. Part H of the Building Regulations: Drainage and Waste Disposal establishes a hierarchy for surface water disposal, which encourages a SuDS approach. This hierarchy stipulates that surface water runoff not collected for reuse must be discharged to one or more of the following in order of priority:
- Ground (infiltration); or, where not reasonably practicable,
 - Surface water body; or, where not reasonably practicable,
 - Surface water sewer, highway drain, or another drainage system; or, where not reasonably practicable,
 - Combined sewer.
- 8.2.2. As discussed in Section 2.3 the Application Site is underlain by Lambeth Group and London Clay Formations, suggesting infiltrations SuDS are unlikely to be suitable for the development. However, this assumption should be confirmed by undertaking further soil investigations, soakage testing, and groundwater monitoring at detailed design stage.
- 8.2.3. The drainage strategy has been looked at in terms of natural water catchment areas defined by the topography. The catchment layout plan is shown on Drawing 70052250-WSP-FR-00-001 in Appendix H.
- 8.2.4. Catchment A will attenuate flows by the means of permeable paving, swales and attenuation basins prior to an off-site discharge into the ordinary watercourse that runs along the northern boundary of the Application site. There is the possibility for basin A1 to cascade down into basin A2 before having one outfall into the watercourse, or to have an outfall at each attenuation basin close to the northern boundary. This decision can be made at the detailed design stage. Outflows from the attenuation basins will be restricted by the means of static flow controls located upstream of the outfall into River Ems tributary.
- 8.2.5. It is proposed that the basins within the Application Site will provide a permanent water feature below the invert level of the proposed outgoing pipe, to act as nitrogen sinks and offset the increase in Total Nitrogen arising from the foul water flows of the Proposed Development. The requirements of which are set out in Appendix G. The locations and depths of these permanent features will be subject to further assessment at detailed design stage.
- 8.2.6. Surface water runoff generated within Catchments B and C will be attenuated by means of a combination of permeable paving, geo-cellular tanks and attenuation basins prior to off-site discharge into a new highway drain on Long Copse Lane. The discharge of outflow will be restricted the means

of hydrostatic flow controls located immediately upstream of the outfall into the new highway spine drain.

- 8.2.7. The new highway drainage scheme will form part of wider improvements to Long Copse Ln carriageway and will be designed and constructed under a separate statutory process. The agreed highway drainage improvements to the carriageway deliver wider community benefits as they provide new infrastructure to drain natural flows and run-off from much of the carriageway, which alleviates some of the loading on the existing public surface water drainage system. This approach is agreed with Hampshire County Council (as Local Lead Flood Authority) and Havant borough Council (as Local Planning Authority). Both parties appreciate that these improvements are expected to prevent surface water from flowing onto the Long Copse Ln highway and provide a significant betterment for residents who are a low point 'hot spot', where flooding does periodically occur.
- 8.2.8. The runoff generated in the roads and car parks of all catchments within the site will be collected by permeable paving, gullies or slot drains and conveyed to the proposed surface water drainage network within the site.
- 8.2.9. Swales are also proposed along some of the major roads of the Proposed Development. These features convey highway surface water runoff to the attenuation features, while at the same time providing additional water quality benefits.
- 8.2.10. The schedule of the catchment, developable and impermeable areas is shown in Table 8-1. The total impermeable areas in the Application Site was estimated as 5.30ha, assuming a 55% ratio between the total developable area and impermeable surfaces.

Table 8-1 – Schedules of areas for catchments A to C (values do not include any allowance for urban creep)

Catchment	Gross Area	Developable Area	Impermeable Area
A	6.79	4.60	2.53
B	3.82	2.61	1.44
C	3.96	2.43	1.34

DISCHARGE RATES

- 8.2.11. The greenfield runoff rates for the 50% (1 in 2), 3.3% (1 in 30) and 1% (1 in 100) AEP events were obtained via ReFH2 and estimated as 4.9 l/s/ha, 10.3 l/s/ha and 13 l/s/ha respectively.
- 8.2.12. The mean annual flood flow (Q_{bar}) was conservatively assumed to be the 50% (1 in 2) AEP greenfield runoff rate i.e. 4.9 l/s/ha.
- 8.2.13. The attenuated outflows for Catchments A to C will be restricted to the pre-development mean annual flood flow (Q_{bar}), for return periods up to the 100 year (including a 40% allowance for climate change). This approach ensures compliance with Policy E20 of Havant Borough Local Plan (Submission Version).

- 8.2.14. Attenuated runoff from Catchment A will be discharged into the ordinary watercourse that flows parallel to the northern boundary, currently proposed as a single discharge outfall located in the north-eastern corner of the site. The total discharge rate was restricted to 12.4 l/s which corresponds to 4.9 l/s/ha.
- 8.2.15. The runoff generated in Catchment B will be attenuated and discharged from Basin B1 into the new proposed highway drainage system, to be constructed along Long Copse Lane carriageway. The total discharge rate was restricted to 7.1 l/s which corresponds to 4.9 l/s/ha.
- 8.2.16. The runoff generated in Catchment C will also be attenuated and discharged into the new highway drainage system, to be constructed along Long Copse Lane carriageway. The total discharge rate was restricted to 6.6 l/s which corresponds to 4.9 l/s/ha.

DESIGN CRITERIA

- 8.2.17. The surface water drainage system is designed to accommodate any on-site generated surface water runoff, without flooding, up to the 100-year return period storm event (including a 40% allowance for climate change).
- 8.2.18. A 5% increase in developable areas is included to account for urban creep within the residential development. The adopted standard time of entry in the network is 4 minutes.
- 8.2.19. The FEH 2013 rainfall data was adopted for the purpose of this assessment.
- 8.2.20. A minimum freeboard of 300mm was adopted between the maximum design water level (1% AEP) and the top of the attenuation basins. The basins would not exceed a depth of 1.5m and have 1 in 3 slide slopes. These design assumptions are of outline design purposes only and will need to be revisited at the detailed design stage to take full account of health and safety issues and mitigate risks to people associated with potential significant depth of water.

REQUIRED ATTENUATION STORAGE VOLUMES

- 8.2.21. As stated previously, the proposed drainage system has been designed to manage storm events up to the 1% AEP rainfall event, with an additional 40% climate change allowance. Attenuation is required as part of the methodology of restricting post development flows to the mean annual flood, Q_{bar} .
- 8.2.22. The attenuation volumes for catchments A to C will be provided by a variety of SuDS including basins, permeable paving and geo-cellular tanks located at multiple points within the catchments.
- 8.2.23. Geo-cellular tanks are proposed to be located under green spaces, which can be used for recreational and amenity purposes.
- 8.2.24.
- 8.2.25. Table 8-2 shows the breakdown of attenuation provided across the different catchments against the required storage for the 1% AEP 40%CC storm event.

Table 8-2 – Attenuation provided

	Basins (m ³)	Permeable Paving (m ³)	Geo-Cellular tanks (m ³)	Swales (m ³)	Total Storage Provided (m ³)	Required Storage for 1% AEP +40% CC
Catchment A	1735	275	-	150	2160	2160
Catchment B	940	300	-	-	1240	1225
Catchment C	705	125	340	-	1170	1140

PROPOSED DRAINAGE NETWORK AND SUDS FEATURES

- 8.2.26. A dedicated surface water drainage network will be laid under onsite roads to convey flows to the different attenuation features.
- 8.2.27. Where drainage may be shallow and does not meet the recommended cover depth of 1.2m – as per the Design and Construction Guidance – for pipework laid under highways, consideration should be taken to protect the pipework.
- 8.2.28. Attenuated run-off will be directed towards the ordinary watercourse in the north of the site or to the new highway drainage system proposed under the improvements for Long Copse Lane.
- 8.2.29. Drawing No. 70052250-WSP-FR-00-001 in Appendix H shows the proposed drainage network general arrangement within the site, including the location of the proposed SuDs features. The drainage strategy discussed in the paragraphs above and shown in the drawing is indicative and the proposed drainage/SuDS solution is subject to further investigation and further refinement. While the drainage principle has been established and agreed, the new highway drainage system is also subject to detailed design through the various Hampshire County Council processes.
- 8.2.30. The attenuation basins for Catchment A are located adjacent to the ordinary watercourse that flows along the northern boundary of the Application Site. Any exceedance flows will be directed towards this watercourse.
- 8.2.31. In Catchments B and C any exceedance flows from the downstream attenuation basins are expected to pond in open spaces. In the worst case scenario, these flows will reach Long Copse Lane and drain into the improved highway drainage system along the carriageway. The detailed design of the highway drainage improvement scheme will need to have regard to the possibility of flows off the land to the north, especially during extreme events – typically above the 1%AEP 40%CC.

8.3 PROPOSED WATER QUALITY MANAGEMENT

- 8.3.1. Table 26.2 of the CIRIA C753 SuDS Manual identifies the pollution hazard level associated with the land uses within the development as being 'low'.
- 8.3.2. The sources of pollution with the highest pollution potential risk in the development are considered to be the main access roads.
- 8.3.3. According to Table 26.2 of the CIRIA C753 SuDS Manual, pollution hazard indices of low trafficked roads are estimated as 0.5, 0.4, and 0.4 for TSS, metals and hydro-carbons respectively.

- 8.3.4. Any pollution hazard associated with runoff from Catchments A to C will be treated by attenuation basins, permeable paving and swales. Table 26.3 of the CIRIA C753 SuDS Manual shows mitigation indices provided by these features to be equal or higher than the hazard indices stated in 8.3.3.

8.4 MAINTENANCE AND ADOPTION

- 8.4.1. At this stage it is unknown whether the surface water drainage system within the site is to be offered for adoption or to remain private. According to the Design and Construction Guidance, water companies can secure adoption of a wide range of SuDS that are compliant with the legal definition of a sewer. If the surface water drainage system is to be adopted by Southern Water, early discussions on a S104 application are encouraged to discuss which parts of the drainage system are potentially adoptable by the water company.
- 8.4.2. Regular inspection and maintenance are required to ensure the effective long-term operation of SuDS; these requirements are detailed in the SuDS Manual CIRIA 753.
- 8.4.3. The general maintenance obligations associated with detention ponds are included in Table 22.1 of the SuDS Manual C753. This includes regular inspections to outlets and inlets, removal of litter and management of vegetation.
- 8.4.4. The general maintenance obligations associated with swales are included in Table 17.1 of the SuDS Manual C753. This includes regular inspections to outlets and inlets, removal of litter and management of vegetation. On top of this, a dedicated regular inspection of the filter material running along the bottom of the swale is advisable (if applicable).
- 8.4.5. The general maintenance obligations associated with geo-cellular tanks are included in Table 21.3 of the SuDS Manual C753. This includes regular inspections to outlets and inlets of the tanks, together with periodical removal of debris from the catchment surface.

9 OFFSITE IMPACT

- 9.1.1. There is a history of flooding in the housing estate developments south of Long Copse Lane – downstream of the proposed development, as a result of unattenuated surface water from the land north of Long Copse Lane flowing on to the highway and thereafter flowing on to the south side of the road.
- 9.1.2. The Proposed Development incorporates mitigation measures to limit the rate of surface water runoff discharged off-site to pre-development Q_{bar} rates. The limited discharge is achieved for extreme rainfall events up to the 1% AEP storm event, including a climate change allowance of 40% in peak rainfall intensity. At the same time, the new highway drainage improvements that have been discussed and agreed with the Highway and Drainage teams at Hampshire County Council provide a new highway drainage system to drain the highway and resolve the existing local flooding issue, and also to receive the attenuated runoff from the proposed development. This is expected to deliver a direct benefit to the wider community around Long Copse Lane and to the Emsworth town, as natural runoff from the Application Site will remain relatively low and bypass the housing estates, thus alleviating some of the pressure of the existing surface water drainage down through the housing estates. The proposal provides the opportunity to solve this pre-existing drainage problem as part of the S278 works associated with the development. An integrated solution for highways and flood risk has been devised with the support of both the Highway Authority and the Lead Local Flood Authority which will satisfy policies H8, E19 and E20 of the emerging Local Plan.
- 9.1.3. There is no impact on the hydrologic regime of the stream that bounds the northern edge of the Application Site as surface water discharge will be limited to Q_{bar} . The Proposed Development will be steered out of the 0.1% AEP surface water flood extent, associated to the unnamed tributary of River Ems.
- 9.1.4. The Proposed Development delivers a positive contribution towards preventing any adverse impacts arising from the increase of Total Nitrogen in local streams and rivers. This contribution is provided both offsite and in the form of wetlands within attenuation basins, where a permanent water level offsets the increase of Total Nitrogen associated with foul water flows from the Proposed Development while providing a bio-diversity net gain.
- 9.1.5. The Proposed Development does not have an adverse ecological impact on the local water receptors. Pollution control and treatment is delivered in the form of source and site control measures, which include permeable paving and open SuDS.

10 RESIDUAL RISK

- 10.1.1. The residual risk arising from the Proposed Development is mitigated by the implementation of a surface water drainage strategy, which caters for storm events up to the 1%AEP, including a 40% climate change allowance.
- 10.1.2. The arrangement of the masterplan takes in account the natural falls of the Application Site and will use the proposed access roads as flow exceedance routes. Any exceedance flows arising from storms in Catchment A will naturally flow towards the watercourse immediately to the north, without affecting any buildings. In catchments B and C, any exceedance flows are expected to pond in open areas around the basins. In the worst case scenario, exceedance flows from these two catchments will be directed towards Long Copse Lane and fed back into the new drainage system.
- 10.1.3. Any exceedance flows from offsite are expected to be channelled down by the network of roads within the Proposed Development, which broadly align with the general fall of the topography.
- 10.1.4. The residual risk related to surface water flooding around the area is mitigated by the raised finished floor levels, which would reduce the likelihood of water entering buildings in case of flooding.
- 10.1.5. The residual risk from flow that overtops the watercourse that runs along the northern boundary is mitigated partly due to the steep slopes on the site. The lowest finished ground level of the development platforms is over 2 metres above the 0.1% AEP surface water flood extent associated to the tributary of River Ems based on the Gov.UK surface water flood map. On top of this, the finished floor levels of the proposed development are to be set a minimum of 150mm above the general surrounding ground levels.

11 CONCLUSIONS

- 11.1.1. WSP has been appointed by Land & Partners to undertake a Flood Risk Assessment and outline Surface Water Drainage Strategy in support of a 14.6 ha mixed greenfield and brownfield development located to the north of Long Copse Lane, Emsworth, Hampshire. The proposed S278 works to Long Copse Lane which address the surface water drainage has already received a Preliminary Design Check approval from Hampshire County Council, something that would normally be undertaken after planning consent.
- 11.1.2. The Proposed Development consists of approximately 210 residential dwellings along with associated car parking, landscaping, and other ancillary works at the Application Site.
- 11.1.3. The Environment Agency's published mapping shows the Application Site lies wholly within Flood Zone 1 which is classified in the NPPF as an area where the probability of surface water flooding is low. An ordinary watercourse flows in a south-easterly direction along the northern boundary of the Application Site.
- 11.1.4. The Environment Agency's published mapping shows the majority of the Application Site to be subject to an annual probability of surface water flooding of less than 0.1% and consequently subject to a "very low" risk of flooding from this source.
- 11.1.5. The proposed surface water drainage strategy demonstrates that the Proposed Development can be drained using SuDS techniques for events up to the 1% AEP 40%CC rainfall event, without increasing flood risk to the Proposed Development and to any downstream existing development.
- 11.1.6. The Proposed Development has a wider benefit to the West Brook and River Ems water catchments as it restricts post-development flows to the pre-development mean annual flood flow (Q_{bar}). This approach has a direct benefit to local residents around Long Copse Lane, who see their properties periodically affected by flooding, in part due to overland flows from the Application Site and other land, which currently flows onto the highway without any attenuation and will be resolved by the new highway drainage scheme. This scheme will be subject to detailed design as part of the S278 process with Hampshire County Council.
- 11.1.7. Finished floor levels are proposed to be set either a minimum of 150mm above external finished levels.
- 11.1.8. The Proposed Development has been designed in line with Policies E19 and E20 of the Havant Borough Local Plan (Submission Version) and won't negate any further phases of the development.
- 11.1.9. All other potential sources of flood risk have been considered and are found to present a negligible or low flood risk for the development.