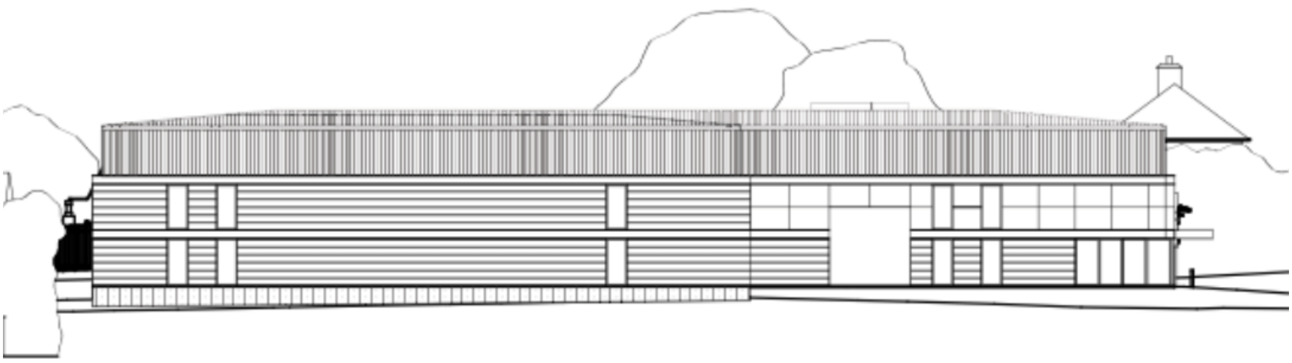

Sustainable Drainage Strategy

DATE OF ISSUE: **30 SEPTEMBER 2022**

ISSUE: **01**

HM REFERENCE: **33003-HML-XX-XX-RP-U-590001**

PROJECT:

FORMER CAR SHOWROOM,
DUDDERY HILL
HAVERHILL
WEST SUFFOLK

CLIENT:

UK STORAGE CONSULTANCY LTD
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LONDON WA14 ODA

PROJECT NAME:	**FORMER CAR SHOWROOM, DUDDERY HILL**
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Contents

Executive Summary

Hilson Moran has been appointed by UK Storage Consultancy Limited to prepare a Sustainable Drainage Strategy for a scheme at a former car showroom in Duddery Hill, Haverhill, West Suffolk CB9 8DS (National Grid Reference TL 67139 45042). The showroom is proposed to be developed for use as a self-storage unit whereby the structure is retained but reclad and comprehensively extended.

This document constitutes a formal Sustainable Drainage Strategy report, appropriate to the scale and nature of the development and risks involved.

The application site comprises a total area of c. 0.41 ha, currently occupied by a by a disused Drive Vauxhall car showroom and garage, hardstanding and soft landscaping.

The development will result in impermeable surfaces, including roof areas and hard landscaping, decreasing from 86.7 % to 81.3 %.

Without the inclusion of mitigation measures, the proposed development will have a positive impact on surface water runoff rates and volumes under current conditions.

Nevertheless, in order to provide betterment and to futureproof the scheme against climate change, it is intended that the proposals will include the attenuation of surface water run-off rates and volumes from the site by incorporating Sustainable Drainage Systems (SuDS) into the design and discharging at the 1 in 1 year greenfield rate (including an allowance for climate change (CC) over the lifetime of the scheme) for all events up to and including the 1 in 100-year (+45% CC) event into the neighbouring adopted surface water sewer on Duddery Hill, as per Anglian Water requirements (as local conditions preclude infiltration to ground and there is an absence of nearby accessible watercourses to discharge to).

Within the development, it is proposed that the access, parking and hardstanding area to the north of the building will be constructed from permeable pavement with an area of sub-surface storage totalling 987 m^2, provided below the permeable pavement. This will provide *c.* 248.5 m^3 storage, which is in excess of the 246.4 m^3 required.

Roof drainage from the new building will be directed to the permeable pavement/sub-surface storage.

Following attenuation, surface water runoff will be released from the sub-surface storage by means of a “complex flow control” such as a Hydrobrake or a simple orifice plate, capped at the **0.81 l/s** 1 in 1-year greenfield rate for all events up to and including the 1 in 100 year event.

Regulated discharge would be via a new 150 mm ∅ connecting sewer laid to the adopted MH1051, located just north of the site near the roundabout between Duddery Hill and Hollands Road.

In this way the proposed development will be drained adequately, whilst discharging at the 1 in 1-year greenfield rate and mitigating against climate change, by including a precautionary +45 % allowance for predicted increases in peak rainfall intensity over the lifetime of the scheme. Consequently, the development of the site will be used as an opportunity for environmental enhancement and the sustainable management of surface water runoff at source.

1. Introduction

1.1. Background

Hilson Moran has been appointed by UK Storage Consultancy Limited to prepare a Sustainable Drainage Strategy for a scheme at a former car showroom in Duddery Hill, Haverhill, West Suffolk CB9 8DS (National Grid Reference TL 67139 45042). The showroom is proposed to be developed for use as a self-storage unit whereby the structure is retained but reclad and comprehensively extended.

1.2. Purpose and Scope of Report

This document constitutes a formal Sustainable Drainage Strategy report, as required by West Suffolk District Council (WSDC), appropriate to the scale and nature of the development and risks involved.

1.3. Structure

The remainder of this document describes the legislative context of surface water management, appraises the pre-existing baseline conditions at the development site, describes the proposed development, presents the surface water runoff calculations and proposes a Sustainable Drainage Strategy for the scheme and finally presents a summary and conclusions relating to this report.

Relevant appendices are included at the end of the report.

1.4. Limitation and Copyright

This report has been prepared on behalf of, and for the exclusive use of, UK Storage Consultancy Limited and is subject to and issued in connection with the provisions of the agreement set out by Hilson Moran Partnership Ltd. Hilson Moran Partnership Ltd accepts no liability or responsibility whatsoever for or in respect of any used of or reliance upon this report by any third party.

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2. Policy Framework and Regulation

2.1. Planning Policy

2.1.1. National

The National Planning Policy Framework (NPPF)[1] sets out policies which apply to the preparation of local plans, and to development management decisions. This framework sets out the Government's economic, environmental and social planning policies for England. Taken together, these policies articulate the Government's vision of sustainable development, which should be interpreted and applied locally to meet local aspirations.

The NPPF states that flood risk and surface water disposal are material considerations for Local Planning Authorities (LPAs) when determining individual land-use planning proposals. The NPPF supersedes the previous Planning Policy Statement 25 on the consideration of flood risk in the planning process.

The NPPF reinforces the importance that the Government attaches to the management and reduction of flood risk in the land-use planning process, whilst also adopting a precautionary approach and fully accounting for the effects of climate change. The NPPF states how flood risk should be considered at all stages of planning and development, in an attempt to reduce future loss of life and damage to property.

The NPPF also states that surface water disposal is a material consideration for LPAs when determining individual land-use planning proposals and that SuDS should be incorporated into a development wherever practical development *"unless there is clear evidence that this would be inappropriate. The systems used should:*

a) take account of advice from the lead local flood authority;

b) have appropriate proposed minimum operational standards;

c) have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and

d) where possible, provide multifunctional benefits".

The NPPF is supported by Planning Practice Guidance[2], which provides further information on key issues in the implementation of policies identified in the NPPF.

2.1.2. Local

Local planning policy is provided through the saved policies of the West Suffolk Local Plan (consisting of the former Forest Heath area (FHDC) and the former St Edmundsbury area (SEBC) Local Plan documents). The site lies within the former SEBC area and therefore the documents included as part of the former St Edmundsbury area Local Plan are most pertinent to this study.

The St Edmundsbury Core Strategy[3], adopted on 14 December 2010, sets out the vision, objectives, spatial strategy and overarching policies for the provision of new development in the St Edmundsbury area up to 2031.

Relevant saved policies include the following.

Core Strategy Policy CS2: "Sustainable Development"

A high quality, sustainable environment will be achieved by designing and incorporating measures appropriate to the nature and scale of development, including:

The protection and enhancement of natural resources:

F) *protecting the quality and availability of water resources;*

G) *maximising the efficient use of water including recycling of used water and rain water harvesting;*

Sustainable design of the built environment:

J) *incorporating the principles of sustainable design and construction in accordance with recognised appropriate national standards and codes of practice to cover the following themes:-*

- Water – ensuring water efficiency by managing water demand and using such waste water reuse methods as rainwater harvesting and grey water recycling;
- Surface Water Run-off – incorporating flood prevention and risk management measures, such as sustainable urban drainage;

K) *ensuring that developments and their occupants are capable of managing the impact of heat stress and other extreme weather events;*

2.2. Legislation

2.2.1. Building Regulations Part H: Drainage and Waste Disposal (2010)

Building Regulations Approved Document Part H3[4] provides guidance on the hierarchy of options for surface water removal from a development site. The document states that, where feasible, the first choice for surface water removal should be to discharge such waters to an adequate soakaway or infiltration system. If this is not reasonably practicable then discharge should be to a watercourse, with discharge to an existing sewer being the least favoured option. Infiltration techniques should therefore be applied wherever they are feasible.

Building Regulation H3 stipulates that "...[Infiltration devices should not be built] *where the presence of any contamination in the run-off could result in the pollution of a groundwater source or resource*". This is re-affirmed in the SuDS Manual[5], which states that "*in areas containing contaminated soils or contaminated groundwater, soakaways are not acceptable.*"

2.2.2. Water Industry Act (1991)

Legislation covering connection to a public sewer is contained in Section 106 to Section 109 of the Water Industry Act 1991[6] (the Act). Section 106 of the Act provides that the owner or occupier of any premises may have their drains or private sewer connected to the public sewers of the sewerage undertaker.

In accordance with the Act, the following types of connection may (subject to approval) be made to the public sewerage system. The type of connection you make will depend on the sewerage system in the area of the required connection.

a) Foul water into a foul sewer (*e.g*. from toilets, sinks, showers and baths);
b) Surface water into a surface water sewer (*e.g.* roof and paved area drainage);
c) Foul and surface water into a combined water sewer (both a. and b. above); and
d) Other types of connections may be permitted in exceptional circumstances, but they would be considered at the time of application.

2.2.3. Environmental Protection Act (1990)

Part II of the Environmental Protection Act 1990[7] states that *"contaminated land is any land which appears to be in such a condition, by reason of substances in, on or under the land, that:*

- *significant harm is being caused or there is a significant possibility of such harm being caused; or,*
- *pollution of controlled waters is being or is likely to be caused*".

2.2.4. Flood and Water Management Act (2010)

The Act[8] states that construction work which has drainage implications may not be commenced unless a drainage system for the work has been approved by an approving body (unitary authority/ County Council).

In determining an application for approval, the approving body must "*grant it, if satisfied that the drainage system if constructed as proposed will comply with national standards for sustainable drainage; or refuse it if not satisfied*".

The Act therefore removes the automatic right to connect to the public sewer if the proposed drainage strategy does not fully consider the feasibility of sustainable drainage techniques.

As part of the provisions of the Act, Defra released '*Non-statutory Technical Standards for Sustainable Drainage Systems*'[9] in March 2015. The Standards include the following general provisions applicable to this development:

- "*For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event;*
- *Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event;*
- *Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body…, the runoff volume must be discharged at a rate that does not adversely affect flood risk;*
- *The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30 year rainfall event;*
- *The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.*

The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100 year rainfall event are managed in exceedance routes that minimise the risks to people and property."

3. Proposed Development

3.1. Location

The site is located on land formerly occupied by Drive Vauxhall Haverhill, Duddery Hill, Haverhill, CB9 8DS, centred approximately on National Grid Reference TL 67139 45042, and occupies an area of approximately 4,111 m^2 (*c*. 0.41 ha) (refer to Figure 3.1).

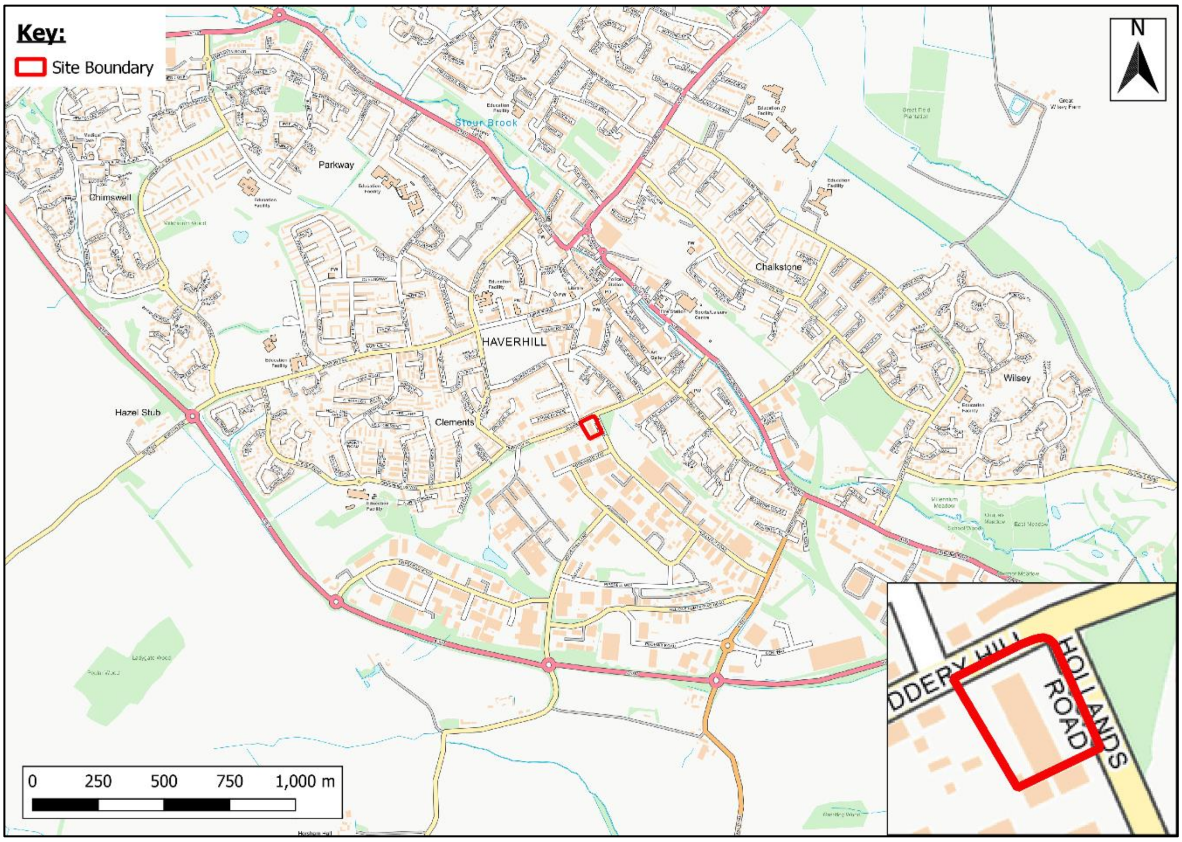

Figure 3.1 ***Site Location Plan*** *(Contains Ordnance Survey data © Crown copyright and database right 2022)*

3.2. Proposal

The proposed development comprises recladding and extending the former car showroom whilst retaining the structure to provide a self-storage facility.

The layout of the proposals is provided in Figure 3.2 below.

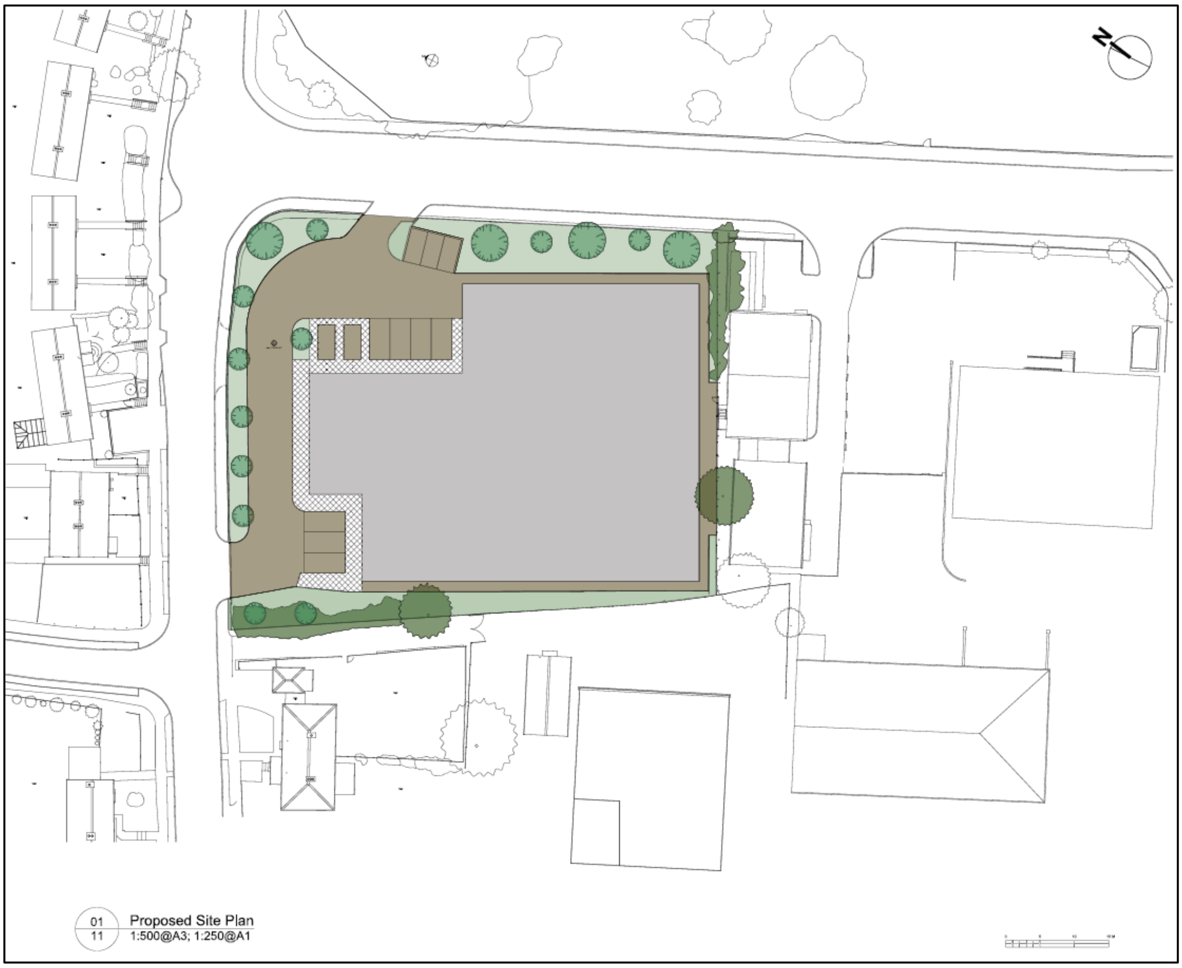

Figure 3.2 ***Proposed Site Plan*** *(from Drawing 11A)*

4. Baseline Conditions

4.1. Existing Site

The site is currently vacant but was formerly occupied by a Drive Vauxhall car showroom which includes a rectangular building where the car showroom and garage were located, hardstanding (access roads and car parking) and soft landscaping (grass bank adjacent to Hollands Road) [refer to Figure 4.1].

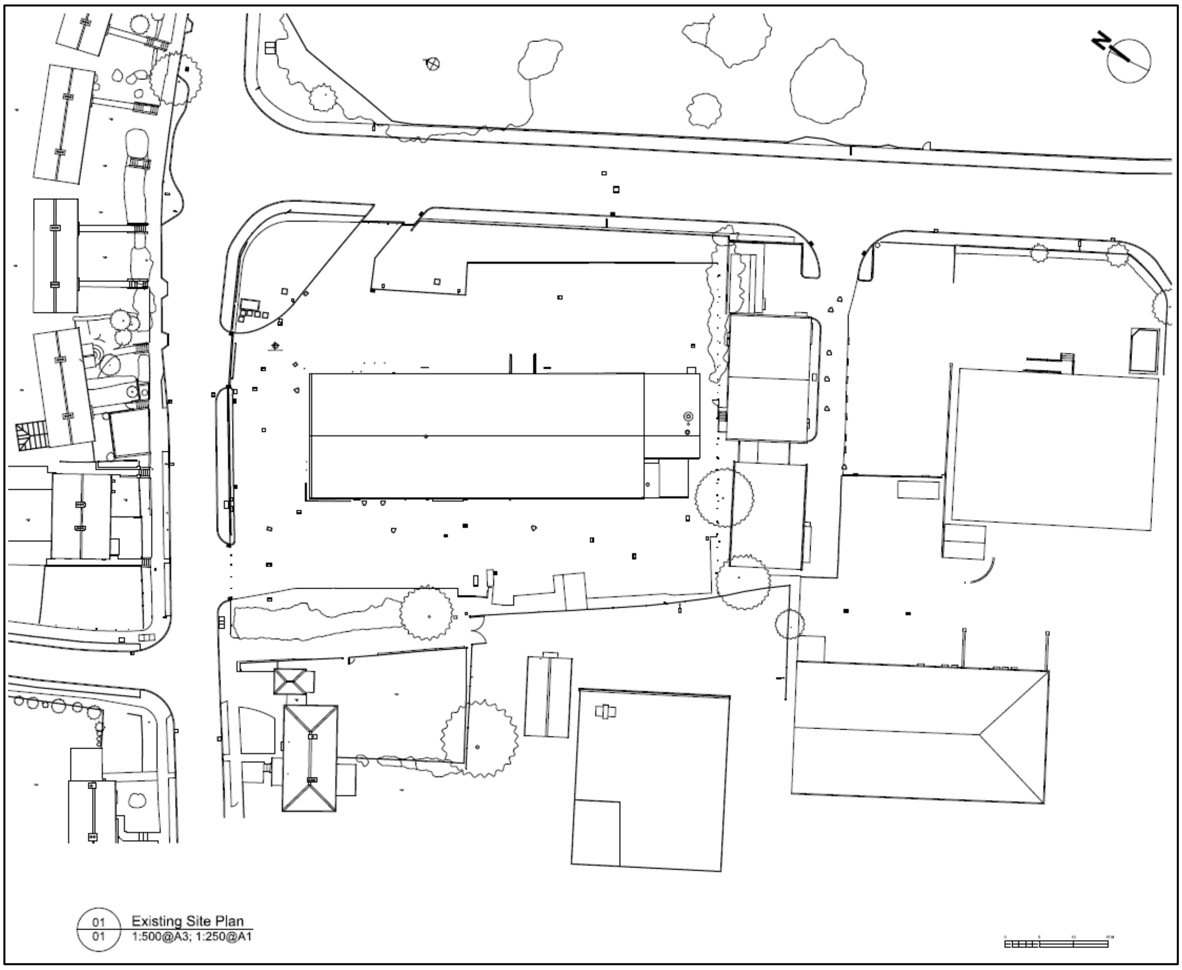

Figure 4.1 Existing Site Plan, Illustrating Existing Garage *(from Drawing 01)*

As shown in Figure 4.3, beyond the site boundary, the site is bordered by:

- Commercial units to the south;
- Residential areas to the west and north; and
- Hollands Road to the east, with undeveloped green space beyond.

Figure 4.3 ***Surrounding land use*** *(not to scale, Source: ©2020 Google)*

4.2. Topography

With reference to LiDAR data and site specific topographic survey data for the plot, the site slopes generally north-eastwards towards Hollands Road (refer to Figure 4.4 below). The western boundary is formed by a grass embankment topped by a hedge. The top of the embankment in the north west corner is at c. 87.04 m above Ordnance Datum (AOD) with the tow of the embankment at 86.14 mAOD (*i.e.* a difference of 0.9 m). The embankment continues along the western boundary with a height difference of around 0.93 m to where it ends halfway along the boundary.

Remaining site areas are fairly flat with a shallow north east gradient, with levels ranging from 86.14 mAOD to 84.92 mAOD.

At the northern and eastern boundaries of the site levels drop sharply from the edge of the car park to Hollands Road. In the east this is characterised by a grass embankment down to the pavement and in the north the hardstanding slopes down and there is an additional small hardstanding embankment down to the pavement adjacent to the roundabout between Duddery Hill and Hollands Road. The embankment in the east has a height difference of 1.75 m and the slope and embankment in the northern corner of the site has a height difference of 1.43 m.

The general slope across the site (not including the embankments on the west and east) is 2.4%.

Beyond the site boundary the LiDAR data demonstrates that the land continues to rise south westwards from the site and falls away from the site north eastwards. LiDAR and topographic survey data for the plot compare well.

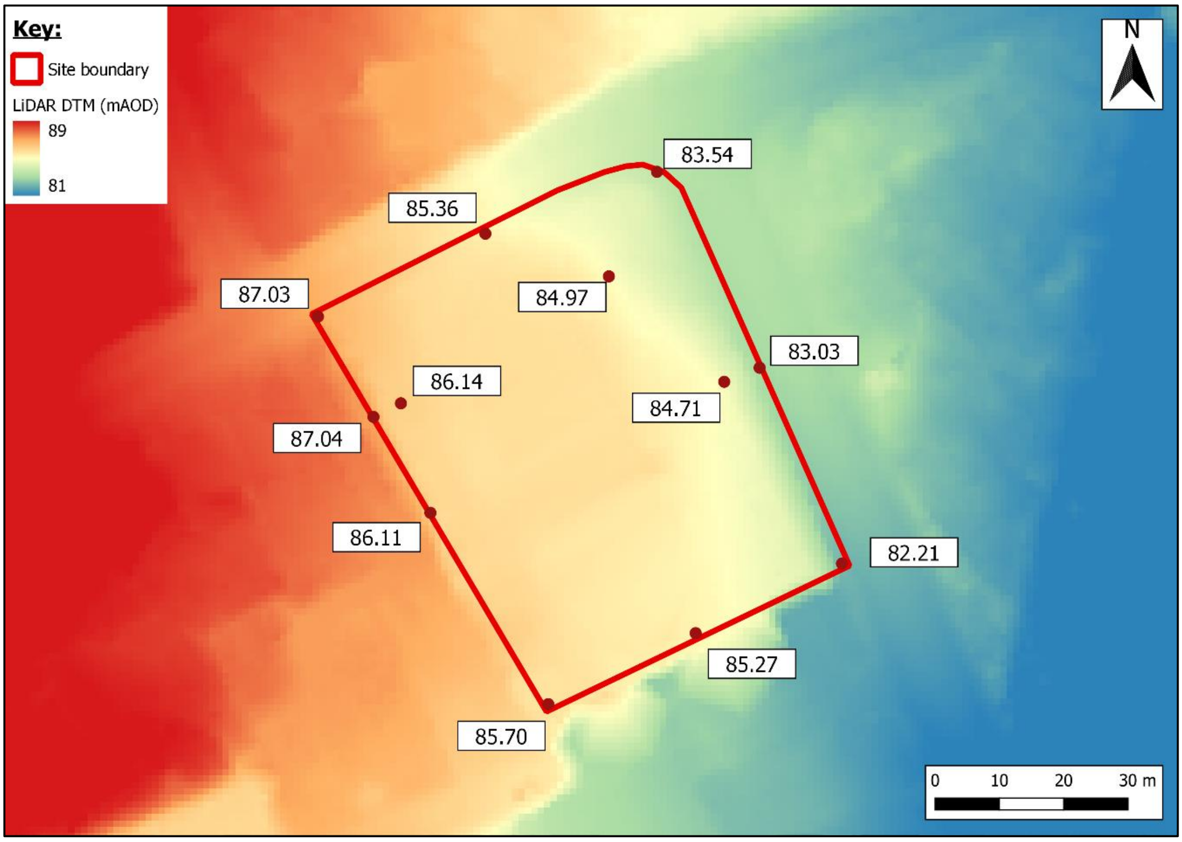

Figure 4.4 ***LiDAR Topographical Plot of the Site and Immediate Environs*** *(Selected Spot Heights, in mAOD) (Contains public sector information licensed under the Open Government Licence v3.0)*

4.3. Geology and Soils

The British Geological Survey's (BGS) Geology of Britain viewer[11] provides an understanding of the geological formations throughout Great Britain. Review of the information at the 1:50,000 scale mapping identifies that the Site is underlain by superficial deposits over bedrock.

The superficial deposits are shown to be Lowestoft Formation - Diamicton, a chalky Till together with outwash sands and gravels, silts and clays (*i.e*. "Boulder Clay" - refer to Figure 4.5).

The bedrock is Lewes Nodular Chalk Formation and Seaford Chalk Formation (Undifferentiated) [refer to Figure 4.6].

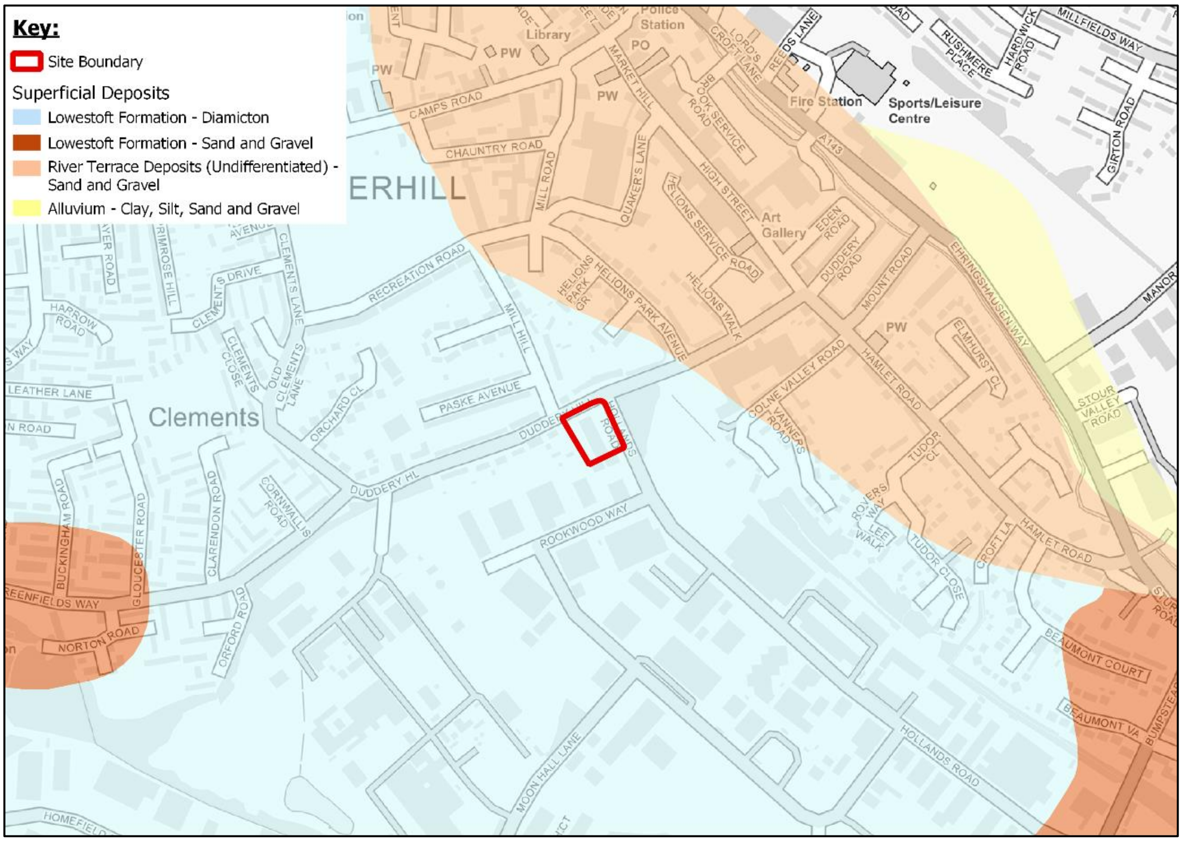

Figure 4.5 ***Superficial geology within the vicinity of the site*** *(not to scale) (Contains Ordnance Survey data © Crown copyright and database right 2022 and British Geological Survey materials © UKRI 2022)*

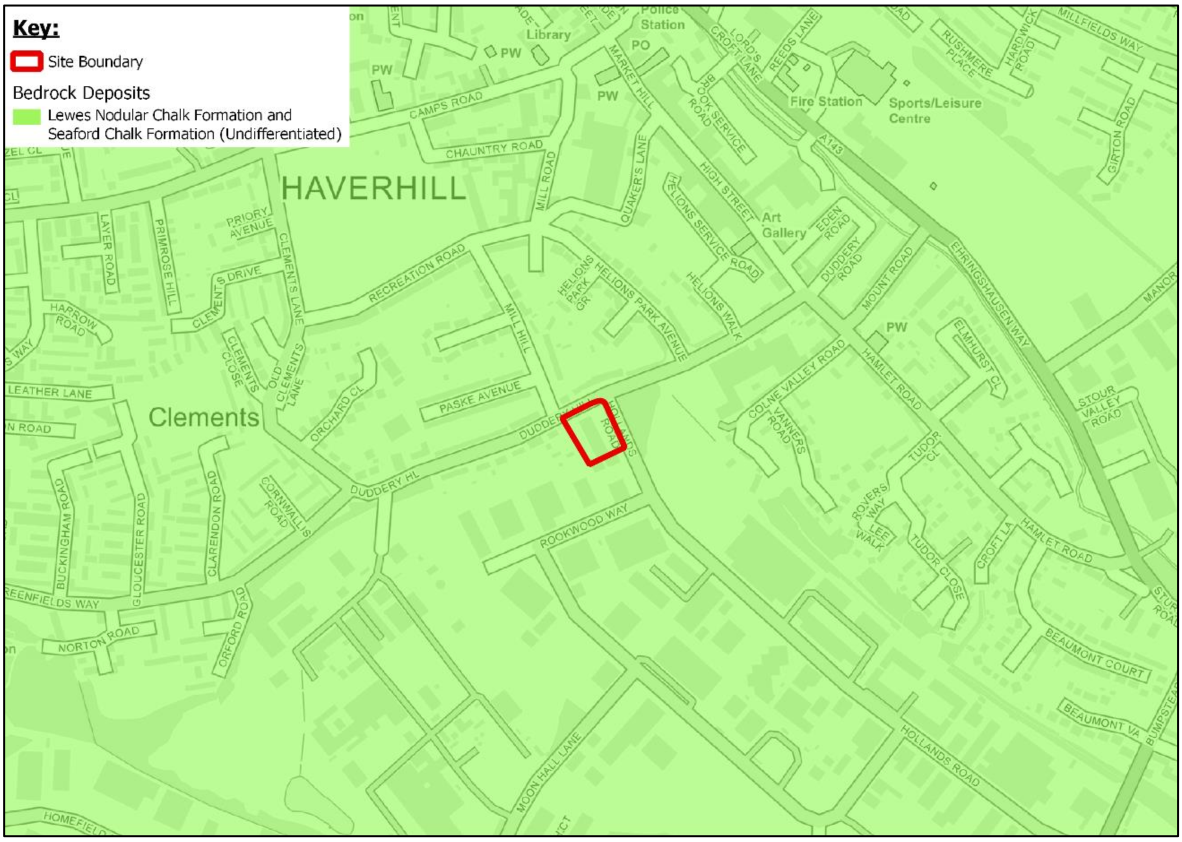

Figure 4.6 ***Bedrock geology within the vicinity of the site*** *(not to scale) (Contains Ordnance Survey data © Crown copyright and database right 2022 and British Geological Survey materials © UKRI 2022)*

There are no historic boreholes recorded on site, however, with reference to the BGS website, the following borehole are located nearby:

- Borehole TL64SE7 – located c. 335 m south west of the site on land currently occupied by the International Flavours and Fragrances (IFF) factory on Duddery Hill, Haverhill. According to the BGS Map, the borehole is located within the same superficial and bedrock geology of the site *i.e*. Lowestoft Formation – Diamicton ("Boulder Clay") underlain by Lewes Nodular Chalk Formation and Seaford Chalk Formation. The borehole log records a geological sequence of 0.5 m of topsoil, underlain by 19.8 m of Blue Boulder Clay, underlain by 2.9 m of Yellow Clay with Chalk below proven until termination of the borehole at 76.2 m below ground level (bgl);
- Borehole TL64NE30 – located *c.* 300 m north of the site on Mill Road, Haverhill. According to the BGS Map, the borehole is located in an area underlain by superficial deposits of River Terrace Sand and Gravel and bedrock deposits of Lewes Nodular Chalk Formation and Seaford Chalk Formation. The borehole log records a geological sequence of 0.9 m of Made Ground, underlain by 2.3 m of Glacial Till, underlain by 1.9 m of Glacial Sand with Upper Chalk below proven until termination of the borehole at 15.0 m bgl. Water was struck in the Chalk at a depth of 13.7 m bgl rising to 12.9 m bgl after an hour.

Consequently, the above intrusive investigations demonstrate that the geology of the locale is typified by Boulder Clay underlain by Sand with Chalk below encountered at depths ranging from *c*. 3.5 to 23.2 m.

The National Soil Resources Institute (NSRI) Soilscape[12] database identifies the soil types across England and Wales. The database identifies the soil in the vicinity of the development site as "*Lime-rich loamy and clayey soils with impeded drainage*" draining to the stream network (refer to Figure 4.7 below).

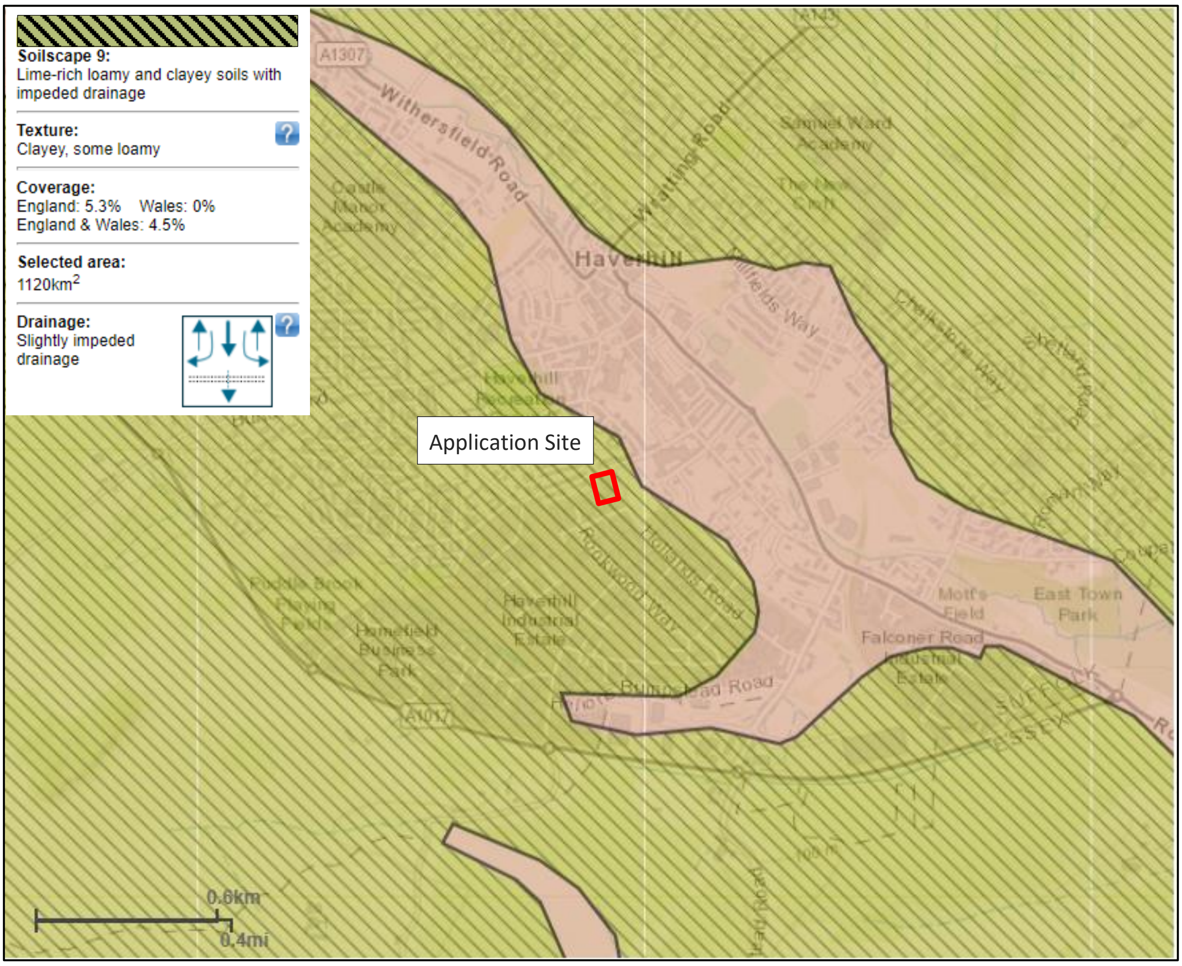

Figure 4.7 ***Soils in The Vicinity of the Site*** *(from Soilscapes website[13])*

4.4. Hydrology

4.4.1. Information Sources

In determining hydrological conditions across the proposed site, reference has been made to a number of sources. In particular, information has been brought together from:

- The EA's Flood Map internet resource;
- West Suffolk Council (WSC) Level 1 Strategic Flood Risk Assessment (SFRA)[14]; and
- Suffolk Local Flood Risk Management Strategy[15].

4.4.2. Surface Waters

The closest watercourse to the site is the Stour Brook which runs through the centre of Haverhill, 435 m north east of the site.

With reference to the EA Flood Map (refer to https://flood-map-for-planning.service.gov.uk), the site is located entirely within EA Flood Zone 1 (low risk) as illustrated in Figure 4.8 below, with the closest Flood Zone 2 (medium risk) and Flood Zone 3 (high risk) associated with the Stour Brook, approximately 400 m to the north east at its closest point.

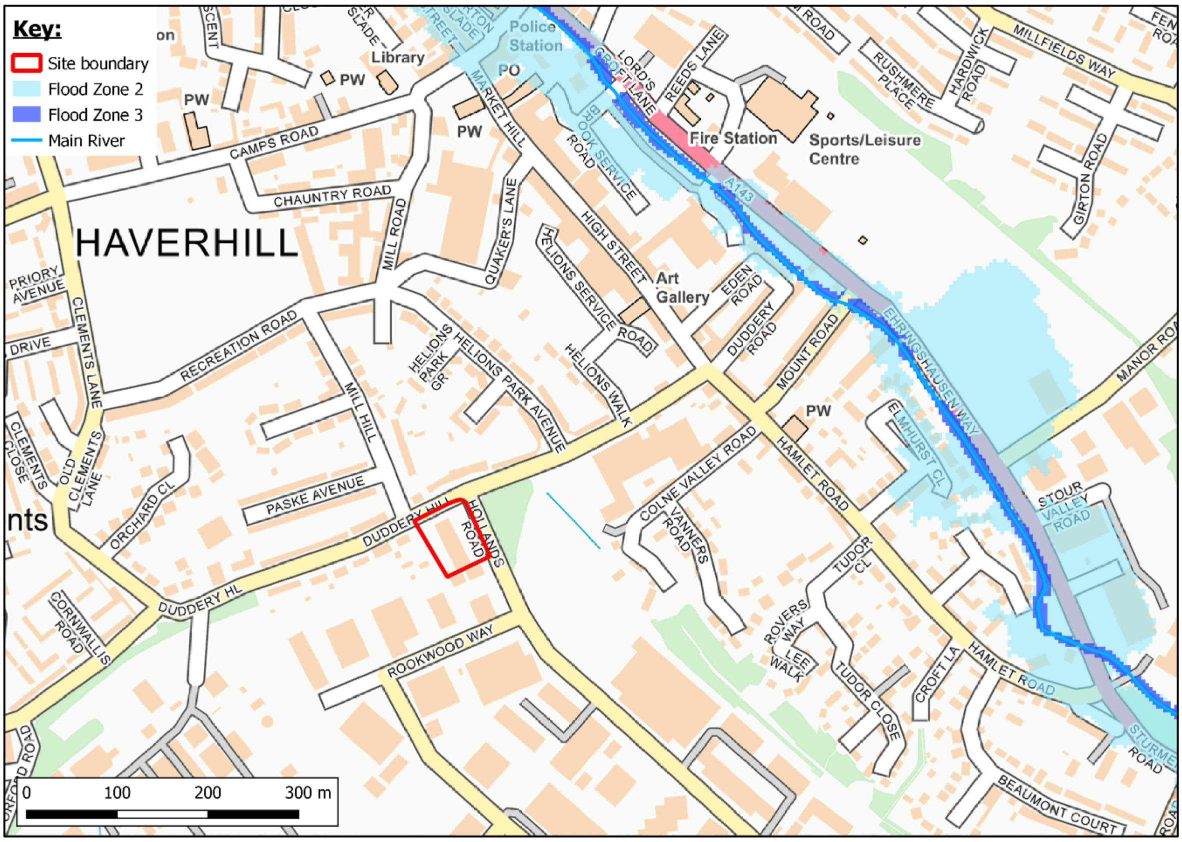

Figure 4.8 ***EA Flood Map*** *(Contains Ordnance Survey data © Crown copyright and database right 2022 and public sector information licensed under the Open Government Licence v3.0)*

With reference to the EA Surface Water Flood Map (refer to Figure 4.9) the main route for surface water within the vicinity of the site is along Duddery Hill adjacent to the north and Rookwood Way to the south. The mapping predicts that there is a risk of surface water flooding along Duddery Hill highway and in site areas in the north west corner during low risk conditions *i.e*. during the 1 in 1000-year rainfall event. Also, during low and medium risk conditions (1 in 100-year rainfall event) surface water is predicted behind commercial buildings 45 m to the south west, down Rookwood Way and pooling at the intersection between Rookwood Way and Hollands Road 30 m south.

During high risk conditions (1 in 30-year rainfall event) no site areas or areas adjacent to the site are impacted by surface water, with the nearest areas impacted located behind commercial buildings 45 m to the south west and on Hollands Road 45 m south east. Flood depths are predicted to reach maximum depths of 300 mm in these areas (refer to Figure 4.10).

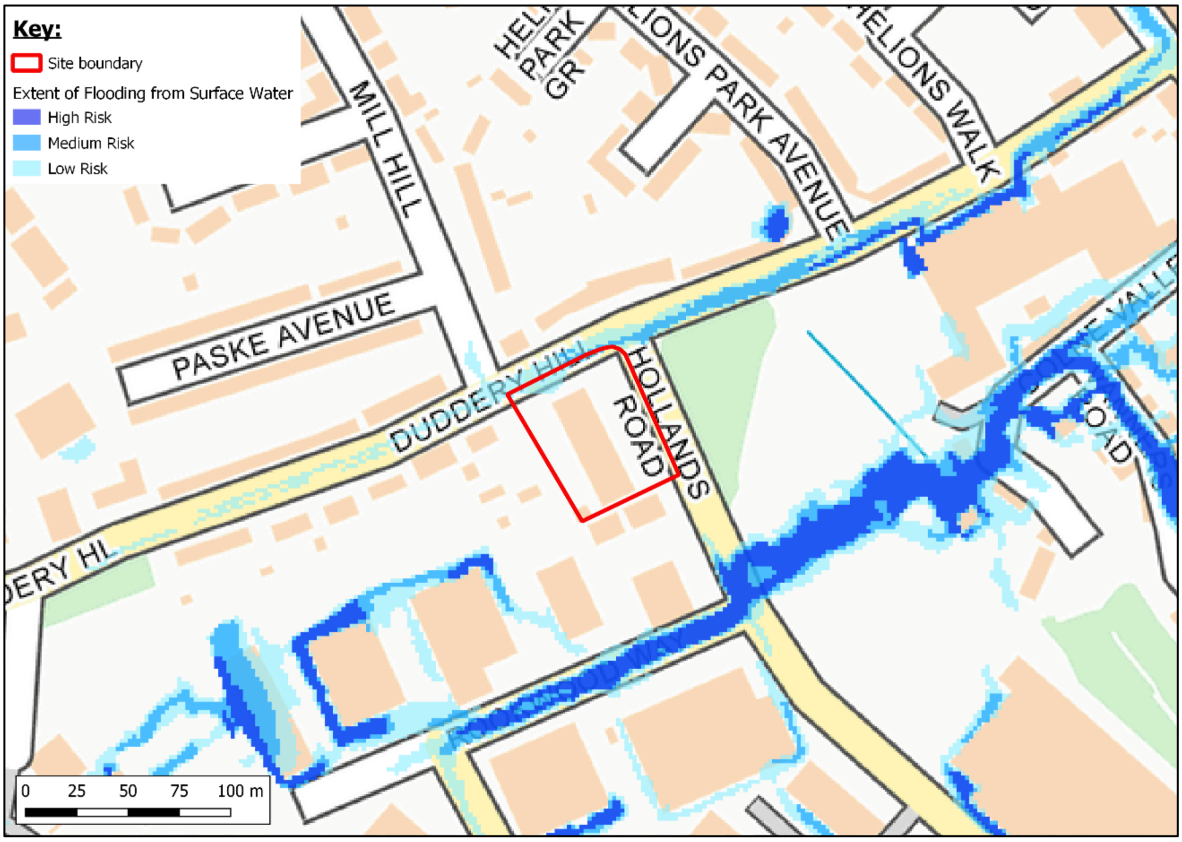

Figure 4.9 ***EA Risk of Flooding from Surface Water Map*** *(Contains Ordnance Survey data © Crown copyright and database right 2022 and public sector information licensed under the Open Government Licence v3.0)*

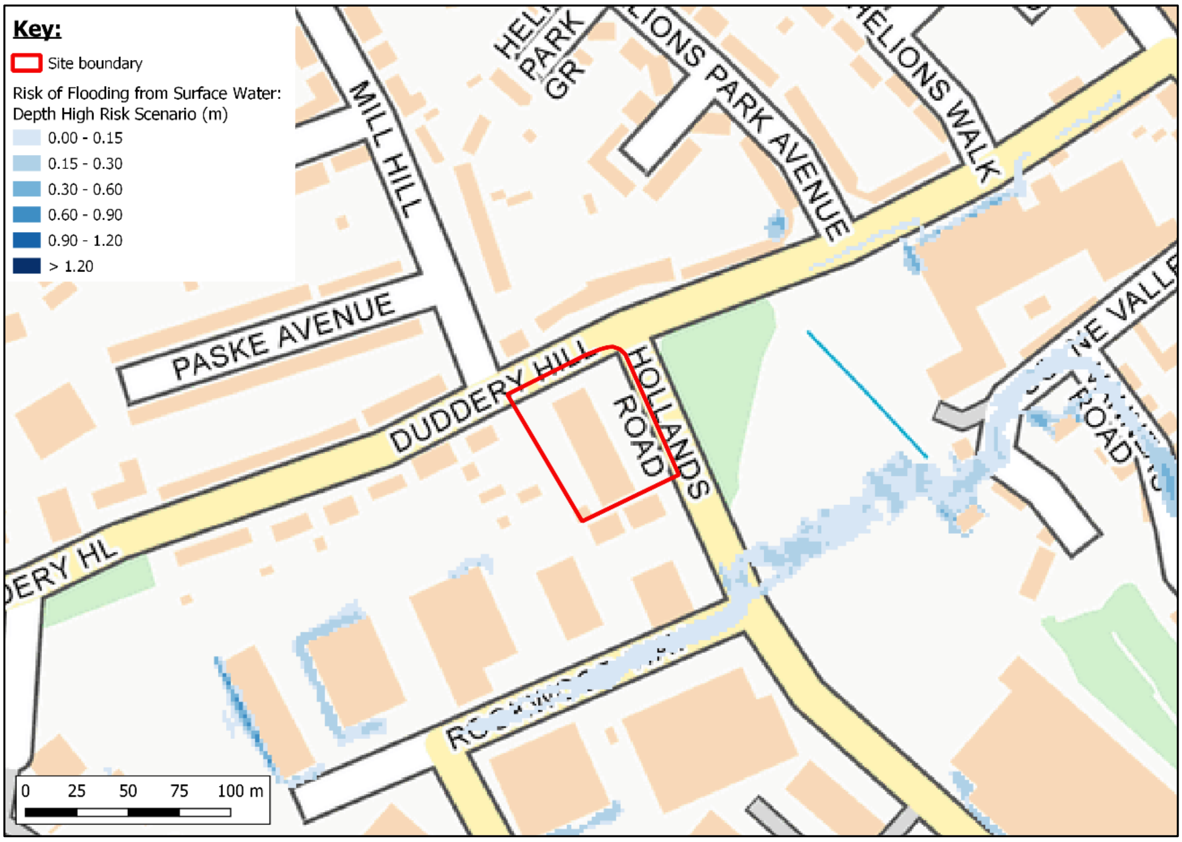

***Figure 4.10 EA Risk of Flooding from Surface Water Map: Water Depth in High Risk Scenario** (Contains Ordnance Survey data © Crown copyright and database right 2022 and public sector information licensed under the Open Government Licence v3.0)*

It should be noted that even though records of the surface water drainage of the site are not currently available, there are no historic records of on-site flooding, whilst effective drainage of the internal access road, car parking and hardstanding areas is provided by means of surface drainage gullies as identified by the site-specific topographic survey of the site (refer to Figure 4.1 above). As discussed in Section 4.4.4 below, it is presumed these gullies discharge to the private drainage of the site, which ultimately discharges to the adopted Anglian Water surface water sewer system on Duddery Hill, which flows beneath the highway in a eastwards direction.

4.4.3. Groundwater

With reference to the EA's Groundwater Protection Zones Map, the proposed development lies within Source Protection Zone (SPZ) 3 – Total Catchment. This zone is defined as the total area needed to support the potable groundwater abstraction from the protected groundwater source. The nearest Zone 1 (Inner Protection Zone) is 3.6 km south east of the site.

The BGS Aquifer maps indicate that the superficial deposits underlying the site (Lowestoft Formation – Diamicton) are classified as a Secondary (Undifferentiated) aquifer which are aquifers where it is not possible to apply either a Secondary A or B definition because of the variable characteristics of the rock type. These have only a minor value.

The bedrock deposits underlying the site (Lewes Nodular Chalk Formation and Seaford Chalk Formation) are classified as a Principal aquifer which provides significant quantities of drinking water and water for business needs and may support rivers, lakes and wetlands. Although the Chalk occurs at depth, there should be due consideration given to the underlying water resource when designing the drainage system for the scheme.

With reference to the WSC Level 1 SFRA, the Haverhill area is described as showing limited potential for groundwater flooding to occur.

4.4.4. Sewer Records

With reference to the Anglian Water sewer records for the site and environs (refer to **Appendix 1**), there are separate adopted surface and foul water sewer systems serving the areas surrounding the site.

The closest surface water sewer is the 150 mm ∅ sewer located adjacent to the north western boundary of the site on Duddery Hill. Two manholes are located along the stretch of Duddery Hill adjacent to the site, MH0052 located just west of the site near the junction between Mill Hill and Duddery Hill and MH1051 located north of the site near the roundabout between Duddery Hill and Hollands Road. The invert level for MH0052 is 86.2 m AOD and the approximate road level is 87 m AOD whilst the invert level for MH1051 is 82.06 m AOD and the approximate road level is 83.5 m AOD. The sewer discharges to an outfall on the eastern side of the undeveloped plot of land south of Duddery Hill and east of Hollands Road.

5. Surface Water Management Philosophy

The Application Site comprises a total area of c. 0.41 ha, currently occupied by a disused Drive Vauxhall car showroom and garage, hardstanding and soft landscaping.

The proposed development comprises the recladding and extending of the former car showroom whilst retaining the structure to provide a self-storage facility.

The development will result in impermeable surfaces, including roof areas and hard landscaping decreasing from 86.7 % to 81.3 %.

Without the inclusion of mitigation measures, the proposed development will have a positive impact on surface water runoff rates and volumes under current conditions.

Nevertheless, in order to provide betterment and to futureproof the scheme against climate change, it is intended that the proposals will include the attenuation of surface water run-off rates and volumes from the site by incorporating Sustainable Drainage Systems (SuDS) into the design and discharging at the 1 in 1 year greenfield rate (including an allowance for CC over the lifetime of the scheme) for all events into the neighbouring sewer on Duddery Hill, as per Anglian Water requirements (as local conditions preclude infiltration to ground and there is an absence of nearby accessible watercourses to discharge to).

With regard to suitable drainage for the proposed development, a series of Government-approved documents have been prepared at national level to provide practical guidance to the Buildings Regulations 2000. Building Regulations, Part H3[16], sets out the legal requirements for Drainage and Waste Disposal and stipulates that:

- Adequate provision shall be made for rainwater to be carried from the roof of the building; and,
- Paved areas around the building shall be so constructed as to be adequately drained.

SuDS can be a combination of both physical structures and techniques used to control surface water runoff as close to its origin as possible, before surface water discharges to a watercourse or to ground. There are a wide variety of sustainable drainage options available that can be applied in different ways to help manage both surface and ground waters in a sustainable manner. Specific solutions need to be developed for each site, the choice of which will depend on factors such as the nature of the site, the type of pollutants potentially present, the hydrology of the area and the presence of Groundwater SPZs.

The implementation of SuDS as an alternative to conventional drainage systems can achieve significant direct and indirect long-term environmental benefits. Depending on the choice of the system these can include:

- Reduction in overall flood risk on-site and downstream from the proposed redevelopment by reducing surface water runoff to watercourses, either permanently or after peak flow periods in the system;
- Providing opportunity for infiltration of surface water into soil, where feasible, to replenish groundwater, and help maintain baseflows in rivers;
- Promoting a healthier waterway flow regime to receiving watercourses and reducing the impact of bank erosion and habitat damage caused by the increase in flow rate of additional surface water runoff;
- Reducing the amount of pollutants reaching waterways and infiltrating the ground;

- Habitat creation and enhancement of the amenity of an area. This applies predominantly to open drainage options, especially where wet ponds or wetlands are implemented;
- Potential reduction in development costs, by reducing costs for the provision of surface water drainage on site;
- Refund of the annual surface water drainage fee that is usually charged for the provision of surface water drainage services on the property. If a SuDS device manages all of a site's surface water and there is an agreement ensuring no surface water connection will be made to foul sewers, the service provider (*e.g.* Southern Water) will annually refund this portion of the service rate;
- If adopted as a philosophy rather than simply an engineering solution and integrated at the outset of a design layout, SuDS can offer significant infrastructure savings and add amenity value to a project.

The NPPF states that the Government's policy is to reduce flood risk. Therefore, development of any greenfield or brownfield site should be seen as an opportunity for environmental enhancement and a net reduction in flood risk. As such; the development should aim to reduce runoff below the existing condition.

5.1. Assessment of Impact

5.1.1. General Design Considerations

For new developments there is a general expectation that a drainage system should be adequate, particularly with regards to drains created by developments subject to Building Regulations. Adequate performance will usually be achieved if the drainage system:

- Conveys the flow via a suitable network or treatment systems to a suitable outfall (a soakaway, a watercourse, a surface water or combined sewer);
- Minimises the risk of blockage or leakage with good access for clearing blockages and any necessary maintenance;
- Has sufficient capacity to carry or retain the expected flow at any point in the system and so does not increase the vulnerability of the development to flooding;
- Provides drainage from roofs or paved areas to an adequately and suitably designed drainage system;
- Where necessary is adequately ventilated such that foul air does not enter buildings;
- It should be noted that:
    i. The priority for discharge of rainwater is firstly to an adequate soakaway or infiltration system, if that is not reasonably practicable then to a watercourse, the last option is to a sewer; and
    ii. Discharges into the ground (where permitted) should be distributed sufficiently so that foundations of buildings or structures are not damaged.

In considering the most appropriate SuDS for the proposed development, reference has been made to the CIRIA "*Sustainable Drainage System* Manual" (the "*SuDS Manual*")[5] and to the Suffolk Flood Risk Management Partnership document "*Sustainable Drainage Systems (SuDS) a Local Design Guide*"[17].

5.1.2. SuDS Hierarchy

When designing the SuDS Strategy, reference has been made to the priorities for discharge (*i.e.* the "*SuDS Hierarchy*") presented in the SuDS Manual and Building Regulations.

The final bespoke SuDS solution has been arrived at through a process of elimination in the following way:

1. "*Infiltration*" - infiltrating SuDS are not deemed feasible for this scheme as the soil characteristics and geology are considered unsuitable for their use, as confirmed by nearby infiltration testing (refer to Sections 4.3 and 5.1.4);
2. "*Discharge to surface waters*" – there are no nearby watercourses that could act as a discharge point for the scheme (refer to Section 4.4.2);
3. "*Discharge to a surface water sewer, highway drain or another drainage system*" – Adopted Anglian Water sewer plans presented in Appendix 1, demonstrate that there are nearby adopted surface water sewers along Duddery Hill and Hollands Road, with the nearest manhole being MH1051 located just north of the site near the roundabout between Duddery Hill and Hollands Road. The invert level for MH1051 is 82.06 m AOD with the approximate road level at 83.5 m AOD. The sewer discharges to an outfall on the eastern side of the undeveloped plot of land south of Duddery Hill and east of Hollands Road (refer to Section 4.4.4 and Appendix 1);
4. "*Discharge to a combined sewer*" – there are no known combined sewer systems within the vicinity of the site (refer to Anglian Water records in Appendix 1).

5.1.3. Preliminary Runoff Calculations

The following section provides an empirical demonstration of the reduction in surface water runoff volumes and rates, anticipated from the installation of appropriate SuDS devices.

5.1.3.1. Methodology

Firstly, the greenfield peak runoff rates for a range of return periods have been estimated using IH124 methodology, included within HR Wallingford's Greenfield Runoff Rate Estimation Tool[18]. For sites <50 ha, the method uses a pro rata methodology based on IH Report 124 with growth curves from the Flood Studies Report[19] and CIRIA Book 14[20]. The method requires input of the standard average annual rainfall (SAAR) for the site in question (*i.e.* 582 mm). The SuDS Manual and Wallingford Procedure Technical Report[21] were used to determine values for soil index (SOIL) and 'urban catchment wetness index' (UCWI) for the Application Site, which are 0.37 and 121, respectively.

Run-off rates and volumes for the proposed development have then been calculated and any impact on run-off has been addressed through the installation of compensatory surface water storage.

In addition, FEH/FSR methods have been employed to facilitate determination of the surface water run-off from the developed site for a range of return periods. The FEH CD-ROM[22] generates the design rainfall depth for a range of specified return periods and storm durations.

Results were obtained using:

- The FEH method to establish rainfall depths for a range of return periods;
- The Modified Rational Method to calculate peak discharges for each return period;
- Derivation of run-off volume from RUNVOL (volume of run-off expressed as mm over total area) using the Wallingford Procedure.

A range of storm return periods have been modelled, using the modified Wallingford Procedure, to simulate a range of worst-case scenario surface water run-off rates and volumes from the site.

There are inherent difficulties in estimating greenfield run-off volumes for specific storm durations using the Wallingford Procedure. Consequently, the existing greenfield run-off volumes were approximated using the simple method presented on HR Wallingford's "UK Sustainable Drainage Guidance & Tools website (refer to https://www.uksuds.com/tools/surface-water-storage-volume-estimation) whereby it is assumed that the greenfield runoff volume is equal to the Standard Percentage Runoff (SPR) value of the soil. With reference to the same website, a value of 0.47 has been determined for the Application Site.

Thus, the greenfield runoff volume for the rainfall event can be calculated as:

$$Greenfield\ Vol = RD \times AREA \times 10 \times SPR,\ m^3$$

Where RD = Rainfall Depth for the return period storm of interest.

Similarly, for those areas of impermeable surfaces the following equation has been used:

$$Runoff\ volume = RD \times AREA \times Runoff\ Coefficient,\ m^3$$

Appropriate runoff coefficients have been sourced from the 2015 CIRIA SuDS Manual[23] and comprise 0.90 for pitched roofs with tiles and 0.75 for all other hardstanding.

With reference to the size and topography of the site and the lack of existing surface water drainage infrastructure, the time to concentration (t_c) of peak overland run-off from the site was determined using the Kinematic Wave Equation. The average time to concentration for a 50.4 mm/hr storm (Building Regs recommended design rainfall intensity for surface water drainage design for normal situations – equating roughly to a 1 hour 1 in 100 year return storm) was estimated to be approximately 7 minutes (on the basis that the existing developable area has an average gradient of around 1 in 19 from a high point near the north west corner to a low point in the south east corner).

Furthermore, the 100-year 6-hour event was also modelled for each scenario, permitting the difference in run-off volume and pre- and post-development for this event to be calculated, as per EA guidance.

5.1.3.2. Greenfield runoff rates

Greenfield runoff rates were calculated using the methodology described in 5.1.3.1. The results of this procedure are presented in Table 5.1.

The runoff rates presented in Table 5.1 demonstrate an estimated greenfield runoff rate for the 100-year storm of 3.0 l/s (7.4 l/s/ha).

Table 5.1 Greenfield runoff rates

Return period (years)	Peak Greenfield runoff rate ($l\ s^{-1}$)	Peak Greenfield runoff rate ($l\ s^{-1}\ ha^{-1}$)
$QBAR_{rural}$	0.95	2.3
1	0.81	2.0
30	2.20	5.2
100	3.00	7.4

5.1.3.3. Existing (pre-developed Brownfield) runoff rates and volumes

Existing runoff rates and volumes have been calculated using the methodology described in Section 5.1.3.1 and a percentage impermeable surface area of 86.7 % which, using the Wallingford Procedure, equates to a winter percentage runoff (PR) value of 69.9 %.

The results are presented in Table 5.2 and demonstrate an estimated runoff rate for the 100-year critical storm (16.8 mm rain) of 149.2 l/s (362.9 l/s/ha) and volume of 48.2 m^3.

The Brownfield 100-year 6-hour storm (66.7 mm rain) was also modelled and returned a runoff rate and volume of 11.5 l/s (28.1 l/s/ha) and 191.5 m^3, respectively.

Table 5.2 Existing (pre-developed) brownfield peak runoff rates and volumes

Return period (years)	Critical storm depth (mm)	Runoff volume (m^3)	Peak Flow Q	
			($l\ s^{-1}$)	($l\ s^{-1}\ ha^{-1}$)
1	4.1	11.8	36.6	89.0
30	13.2	38.0	117.7	286.2
100	16.8	48.2	149.2	362.9

5.1.3.4. Proposed development runoff rates and volumes in the absence of SuDS

Runoff rates and volumes for the proposed redevelopment have been calculated in the absence of any mitigation such as the provision of SuDS. The percentage impermeable surface area will reduce to 81.3 %, which, using the Wallingford Procedure, equates to a percentage runoff (PR) value of 65.4 %.

The results are presented in Table 5.3 and demonstrate an estimated runoff rate for the 100-year critical storm (16.8 mm rain) of 138.6 l/s (339.5 l/s/ha) and volume of 45.1 m^3.

The Brownfield 100-year 6-hour storm (66.7 mm rain) was also modelled and returned a runoff rate and volume of 10.8 l/s (26.3 l/s/ha) and 179.2 m^3, respectively.

Table 5.3 Proposed development peak runoff volumes & rates (without mitigation)

Return period (years)	Critical storm depth (mm)	Runoff volume (m^3)	Peak Flow Q	
			($l\ s^{-1}$)	($l\ s^{-1}\ ha^{-1}$)
1	4.1	11.0	34.2	83.2
30	13.2	35.5	110.1	267.8
100	16.8	45.1	138.6	339.5

Consequently, with reference to Sections 5.1.3.3 and 5.1.3.4 above, in the absence of any mitigation, the proposed development will result in a decrease in the 1 in 100-year critical storm runoff rate and volume of 10.6 l/s (23.4 l/s/ha) and 3.1 m^3, respectively and a decrease in the 1 in 100-year 6-hour storm runoff rate and volume of 0.7 l/s (1.8 l/s/ha) and 12.3 m^3, respectively, when compared against the existing situation.

Within the design of drainage networks for new developments, the incorporation of an appropriate allowance for future climate change impacts on peak rainfall intensities is recommended to ensure that all future developments gives rise to a net reduction in runoff rates and volumes throughout their operational lifetime.

Updated UK Government climate change allowances are available for the “Combined Essex Management Catchment” online at https://environment.data.gov.uk/hydrology/climate-change-allowances/rainfall?mgmtcatid=3018. Both central and upper end predictions for peak rainfall intensity are provided. Associated guidance advises that “*For flood risk assessments and strategic flood risk assessments, assess both the central and upper end allowances to understand the range of impact*”. Assuming a 75 year lifetime for the proposed development, the guidance suggests that the central total potential change anticipated for 2061 to 2125 is +45 % and the upper end total potential change anticipated for the same period is 40 % for the 1 in 100-year event.

Consequently, making a precautionary +45 % allowance for increased rainfall intensity over the anticipated lifetime of the proposed development, the post-development 100-year critical storm duration (24.3 mm rain) was also modelled and returned a run-off rate of 202.4 l/s or 492.2 l/s/ha and a volume of 65.3 m^3.

Therefore, the post-development 100-year critical storm event modelled above, inclusive of a +45 % allowance for increased rainfall intensity due to climate change (45 % CC), indicates that the application site, with the impacts of climate change over the lifetime of the development, would lead to an increase in volume of 39.8 m^3 rainfall run-off during the 100-year critical storm and for the 100-year 6-hour event (96.7 mm rain) there would be an increase of approximately 68.3 m^3 when compared against the existing situation.

Without mitigation the proposed development would not, therefore, facilitate the sustainable management of surface water run-off taking account of the potential increase in rainfall run-off, due to climate change, expected over the operational lifetime of the development.

5.1.4. SuDS Design Concept

5.1.4.1. Infiltration Rate

The effectiveness of infiltration-based SuDS depends on the 'infiltration potential' of the soil, protection of such systems from siltation and avoidance of compaction of the ground during construction. Infiltration techniques may not be effective if the infiltration rate is below 2.8 x10^{-6} m/s (10 mm/hr) for the upper sub-surface soils and strata.

With reference to Section 4.3, the geology of the locale is typified by Boulder Clay underlain by Sand with Chalk below, encountered at depths ranging from *c*. 3.5 to 23.2 m. This was confirmed by the Geotechnical Investigation for planning application DC/19/1019 for a scheme on Paske Avenue, just to the north of the site.

Soils underlying the site comprise "*Lime-rich loamy and clayey soils with impeded drainage*" draining to the local stream network.

Furthermore, infiltration testing conducted for a development on Rookwood Way, *c*. 180 m to the south of the scheme (planning application DC/19/1971), to BRE Digest 365 has previously demonstrated that infiltration of surface water was not suitable for that site. Consequently, it is assumed that infiltrating SuDS or soakaways will not be suitable for this scheme and that the above evidence will negate the need for site-specific infiltration testing to demonstrate this.

5.1.4.2. Soil Contamination

Building Regulation H3 stipulates that '...[Infiltration devices should not be built] *where the presence of any contamination in the run-off could result in the pollution of a groundwater source or resource*'. This is re-affirmed in the SuDS Manual, which states that '*in areas containing contaminated soils or contaminated groundwater, soakaways are not acceptable'*.

Furthermore, The Environmental Protection Act (1990) states that '*Contaminated land is any land which appears to be in such a condition, by reason of substances in, on or under the land, that:*

a) *Significant harm is being caused or there is a significant possibility of such harm being caused; or,*
b) *Pollution of controlled waters is being or is likely to be caused'.*

Historic land use maps indicate that site was greenfield from at least 1877 to 1960. By 1968 the site was occupied by a "garage" of similar footprint the existing Vauxhall Drive showroom and garage. A large electrical sub-station was located directly to the south west of the site and a large "Furniture Factory" beyond. Further infilling of the adjacent industrial estate with various industrial units has continued thereafter, with the use of the site maintained as a garage/car showroom throughout.

As such, in addition to the potential for low level diffuse pollution associated with runoff from nearby highways and general commercial and industrial uses, there is also the potential for soils and groundwater below the site to be contaminated predominantly due to the historic industrial use of the site since at least 1968.

Consequently, taking the above factors into consideration, it is not deemed possible or practical at this stage to incorporate infiltrating SuDS (such as an infiltrating permeable pavements or soakaways) into the proposed development.

5.1.4.3. Mitigation Consideration

It is currently unknown where the pre-existing surface water runoff from the site is discharged to, but in the absence of locally permeable strata, it is assumed the site outfalls to the nearby Anglian Water adopted surface water system on Duddery Hill.

As the site is currently brownfield, and the preference in the SuDS Hierarchy is to discharge to a surface water sewer if infiltration or discharge to a watercourse is not possible (refer to Section 5.1.2). Therefore (if not the case already) it is intended that the proposed development will discharge to the neighbouring adopted surface water sewer on Duddery Hill, at at the 1 in 1 year greenfield rate (including an allowance for CC over the lifetime of the scheme) for all events, as per Anglian Water requirements.

It has been calculated that:

1) The current runoff rate for the 1 in 1 year critical storm is **36.6 l/s,** requiring **4.2 m^3** storage during the critical storm (inclusive of 45 % CC);
2) The current runoff rate for the 1 in 100 year storm is **149.2 l/s**, requiring **17.2 m^3** storage during the critical storm (inclusive of 45 % CC);
3) The peak greenfield runoff rate for the 1 in 1 year critical storm is **0.81 l/s**, which would require **9.8 m^3** storage during the critical storm when a 45 % allowance for climate change is taken into account;
4) The peak greenfield runoff rate for the 1 in 100 year storm is **3.03 l/s** during the critical storm, which would require **39.8 m^3** storage during the critical storm when a 45 % allowance for climate change is taken into account;
5) The additional development runoff volume for the site for the 1 in 100 year, 6 hour rainfall event requires **68.3 m^3** storage when climate change is taken into account;
6) The greenfield runoff volume from the site for the 1 in 100 year, 6 hour rainfall event requires **158.4 m^3** storage when climate change is taken into account; and
7) The greenfield runoff volume from the site for the 1 in 100 year, 6 hour rainfall event maintaining the discharge rate at the 1 in 1-year peak greenfield runoff rate of **0.81 l/s**, as per Anglian Water requirements when discharging to their adopted surface water sewer, requires **246.4 m^3** storage when climate change is taken into account.

Consequently, **246.4 m^3** of surface water attenuation/storage will be targeted within the proposed development *i.e*. discharging at the 1 in 1-year greenfield rate for all events up to and including the 1 in 100-year event (+45 % CC).

5.1.5. SuDS Design Concept

It is anticipated that the above target will be achieved through the provision of permeable pavements with sub-surface storage. This will discharge to Anglian Water surface water MH1051, located just north of the site near the roundabout between Duddery Hill and Hollands Road, with an invert level of 82.06 mAOD (and permeable pavement surface *c*. 85.0 mAOD), as illustrated in Figure 5.1 below.

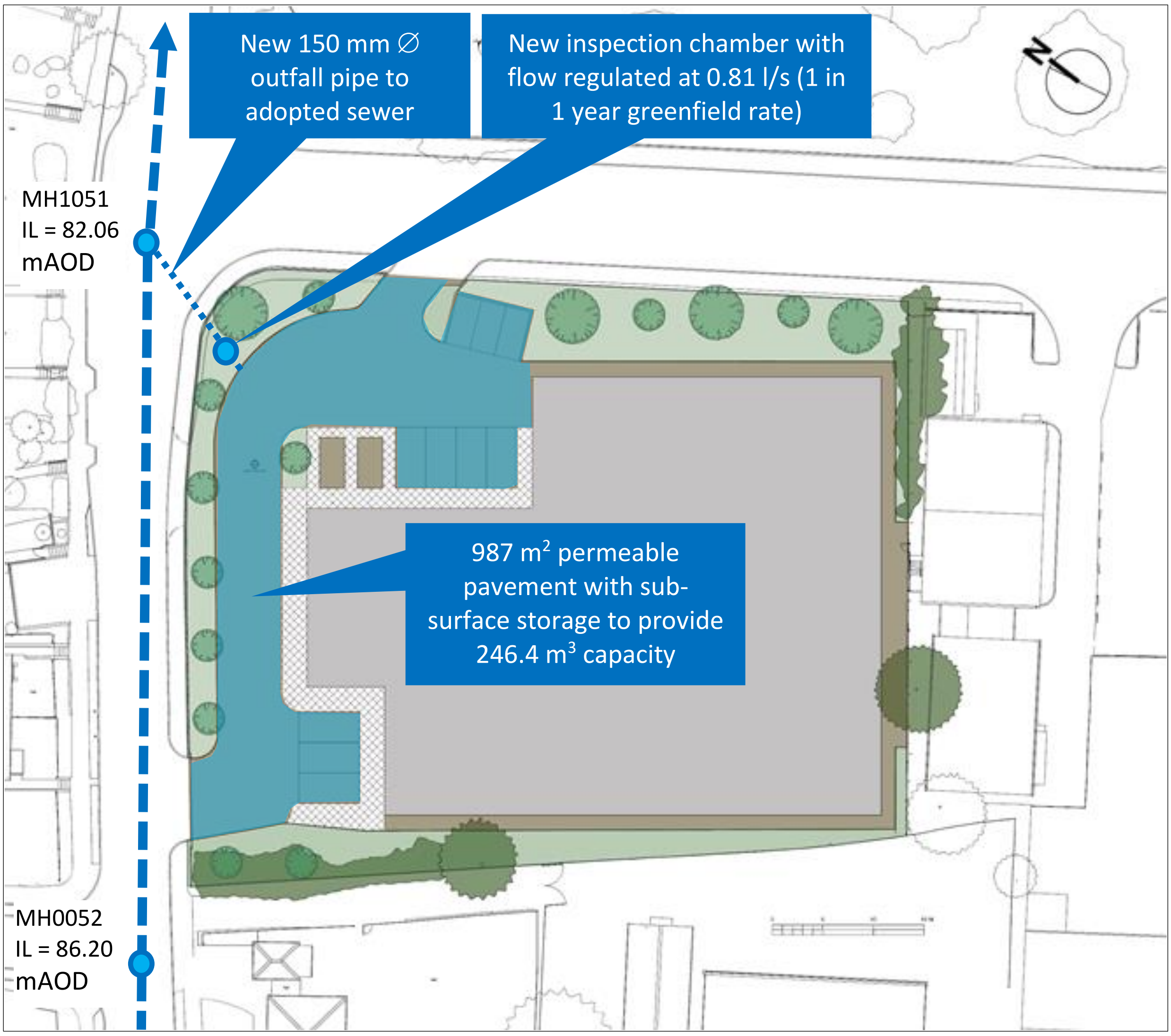

Figure 5.1 ***Proposed SuDS Strategy*** *(from Drawing 11A)*

5.1.5.1. Permeable Car Parking with Sub-surface Storage

Within the development, it is proposed that the access, parking and hardstanding area to the north of the building, illustrated in Figure 5.1 above, will be constructed from permeable pavement with an area of sub-surface storage totalling 987 m^2, provided below the permeable pavement.

For modular "orange crate" type sub-surface storage, assuming modular depth of 0.265 mm below a layer of geotextile and 50 mm depth of 5 mm clean stone to act as a bedding layer for the nominal 80 mm deep permeable blocks (*e.g.* Permavoid Aquaflow) and a void ratio of 95 % for the modular storage, this would provide *c.* 0.252 m^3 of attenuation storage per m^2. Consequently, 987 m^2 of permeable pavement will provide c. 248.5 m^3 storage, which is in excess of the 246.4 m^3 required to discharge at the 1 in 1-year greenfield rate for all events (refer to Section 5.1.3).

Roof drainage from the new building will be directed to the permeable pavement/sub-surface storage.

The Permavoid Source Control System is a modular storage system with sub-surface treatment that can also be used as an alternative to petrol interceptors (Figure 5.2).

In addition to attenuation and infiltration of surface water within the sub-base, the Permavoid Source Control System offers six stages of water treatment within the system, comprising:

- Stage 1 & 2 treatment conferred by the SEL Permachannel© providing oil separation to meet the criteria set out in PPG3 and silt deposition using low velocity (micro catchment) gravity separation;
- Stage 3 treatment conferred by the use of a floating SEL Permafilter© Biomat providing removal and degradation of residual hydrocarbons;
- Stage 4 treatment conferred by the SEL Permavoid©, whereby shallow attenuation within the modular storage provides effective dilution and dispersal over a large surface area;
- Stage 5 treatment conferred by the Flow Control Sump Chamber, in which simple, shallow, low head flow control is used for effective settlement of silt, whilst easy access facilitates simple inspection, monitoring and maintenance.
- Stage 6 treatment conferred by the SEL Permaceptor©, which provides a final polish for sensitive applications on high-risk sites (*e.g.* protected aquifers). It also intercepts and contains hydrocarbons for subsequent removal and disposal where there is a high risk of a catastrophic spillage (*e.g.* refuelling areas or household recycling centres).

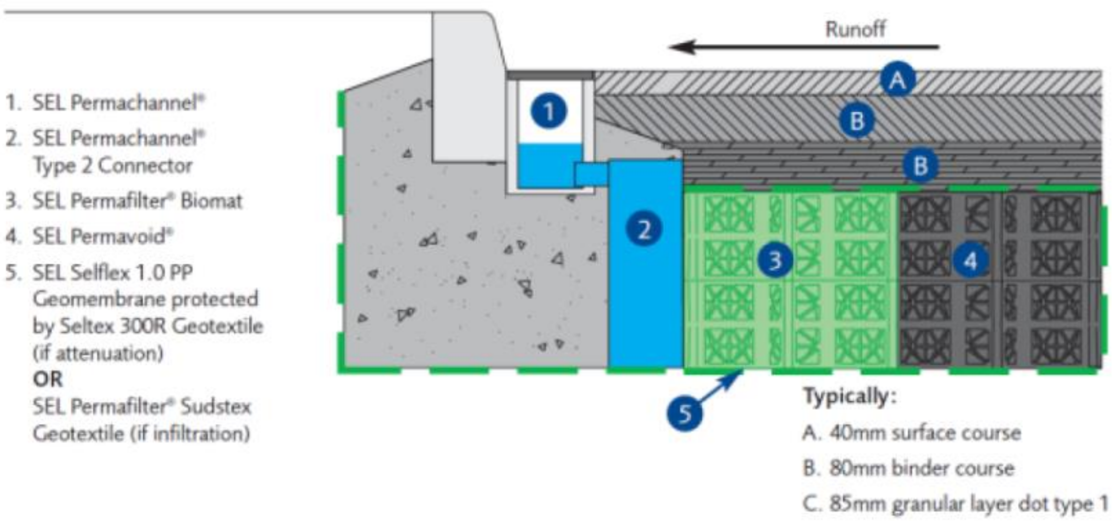

Figure 5.2 Cross-Section through Permavoid Source Control System

Where conditions such as poor infiltration and potential contamination, together with the proximity of building foundations, negate surface water infiltration to sub-surface strata (as per the current proposals), the system can be designed as a 'tanked' or non-infiltrating system using an impermeable membrane.

There are a range of modular sub-surface system products that are suitable for HGV loadings. For example, the Permavoid system can be incorporated into the full range of traffic conditions from domestic driveways to HGV applications and is suitable below pervious and impervious asphaltic, block paved or concrete paved areas. The Permavoid system complies with the requirements of BS 7533-13 '*Guide for the design of permeable pavements constructed with concrete paving blocks and flags, natural stone slabs and setts and clay pavers*'[24] and incorporates a high vertical compressive strength of 715 kN/m^2 and lateral compressive strength of 156 kN/m^2.

Specific benefits of using such a permeable pavement for rainwater collection and re-use include:

<u>Quantity</u>

- Reduction of the occurrence of run-off flooding;
- Reduction of retention requirements elsewhere in the drainage system;
- Delayed release of run-off with much-reduced peak outflow; and,
- Reduction of risk of overloading existing drainage systems during periods of heavy or frequent rain.

<u>Quality</u>

- Improvement of water quality by filtration;
- Retention of pollutants by attachment to the construction materials below the surface;
- Breakdown of hydrocarbons and containment of heavy metals within the pavement; and
- Prevention of storm water movement into contaminated sub-grades.

<u>Amenity</u>

- Provision of sustenance for trees and other planting close to paved areas;
- Potential for direct drainage of roof water into or onto the pavement;
- Elimination of standing water or puddles;
- Comparable or lower costs than conventional surfacing and drainage solutions;
- Minimal maintenance requirement offering lower whole-of-life costs;
- Simple laying, particularly suited to mechanised installation; and
- Compatibility of conventional and permeable block shapes allowing design differentiation within the pavement.

The surface above the storage could be provided either as permeable paving or as an impermeable surface, with runoff conveyed to peripheral drainage channels, which then route it to the modular storage and treatment areas beneath the surface (as per Figure 5.2).

5.1.6. Sewer Outfall

Following attenuation, surface water runoff will be released from the sub-surface storage by means of a "complex flow control" such as a Hydrobrake or a simple orifice plate, capped at the **0.81 l/s** 1 in 1-year greenfield rate for all events up to and including the 1 in 100 year event, as per Anglian Water requirements.

It is recommended that a suitable high level overflow is incorporated into the outfall design (refer to Figure 5.3 for example arrangement) to permit flows during extreme events rarer than the 1 in 100-year event and to minimise the likelihood of flooding from the inspection chamber and permeable pavement surface during such extreme events.

Discussions with Hydro International or a similar supplier of vortex flow/control devices at the detailed design stage would be required to determine the most suitable device(s) and design to achieve the above aims.

Regulated discharge would be via a new 150 mm ∅ connecting sewer laid to the adopted MH1051 located just north of the site near the roundabout between Duddery Hill and Hollands Road, with an invert level of 82.06 mAOD, as illustrated in Figure 5.1 above.

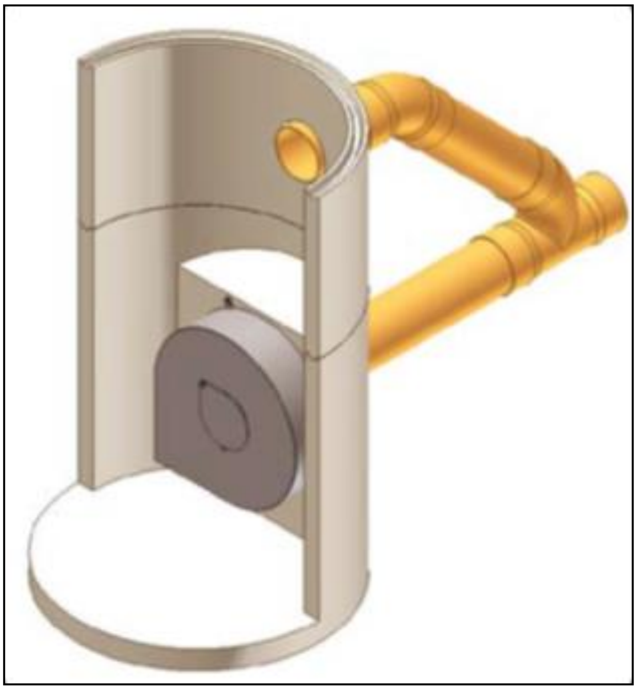

Figure 5.4 Hydro-Brake® Chamber with High Level Overflow

Approval of the above discharge rate and volume to the adopted sewer will need to be gained from Anglian Water at the detailed drainage design stage.

As per other nearby permitted full applications, such as the Paske Avenue scheme (Planning Ref. DC/19/1019/FUL), it is assumed that detailed surface water drainage design will be secured by a standard drainage Condition.

5.1.7. Maintenance of SuDS

Anticipated maintenance will be coordinated and paid for by the owner of the site and comprise:

i. Periodic checking of inspection chambers and pipework for blockages or physical damage, and remediation as required;

ii. Periodic jetting or rodding of pipework as required to clear blockages;

iii. Periodic desiliting of the flow control (*e.g*. Hydrobrake) sump. The sump should be emptied/checked at least as follows (but with an annual inspection and additional cleansing if required): On completion of drainage works, Year 1, Year 3, then every 5 years;

iv. Permeable Pavements: Annual sweep/clearance of permeable external surfaces if a permeable surfacing is installed. Annual inspections of inlet(s) for litter/blockages and annual (or as required) removal of sediment from pre-treatment structures;

5.1.8. Pollution Minimisation during Construction

Minimisation of pollution events during the construction phase will be ensured by the adequate maintenance of vehicles, the responsible handling and storage of potentially polluting materials and liquids and suitable training of staff.

In order to reduce the impact of accidental spillages (*e.g*. from plant fuel) during construction, appropriate planning will identify such risks and the precautionary measures to be taken such as:

- Spillage response kits;
- Seals to drains;
- Bunding of high risk areas; and
- Training of staff in emergency procedures.

Furthermore, the Control of Pollution (Oil Storage) (England) Regulations 2001 (together with the EA's former Pollution Prevention Guidelines 2 [PPG2][25]) will be complied with. The Regulations cover the storage of oil of any kind, including petrol, mineral oil, heating oil, lubricating oil, vegetable oil, heavy oils such as bitumen, and oils used as solvents, such as paraffin or kerosene. The Regulations stipulate the strength, integrity and delivery systems of oil containers and prescribe secondary containment systems such as drip trays or bunds, which will ensure that the likelihood of oil spillages is minimised.

6. Summary & Conclusion

Hilson Moran has been appointed by UK Storage Consultancy Limited to prepare a Sustainable Drainage Strategy for a scheme at a former car showroom in Duddery Hill, Haverhill, West Suffolk CB9 8DS (National Grid Reference TL 67139 45042). The showroom is proposed to be developed for use as a self-storage unit whereby the structure is retained but reclad and comprehensively extended.

This document constitutes a formal Sustainable Drainage Strategy report, appropriate to the scale and nature of the development and risks involved.

The application site comprises a total area of c. 0.41 ha, currently occupied by a by a disused Drive Vauxhall car showroom and garage, hardstanding and soft landscaping.

The development will result in impermeable surfaces, including roof areas and hard landscaping, decreasing from 86.7 % to 81.3 %.

Without the inclusion of mitigation measures, the proposed development will have a positive impact on surface water runoff rates and volumes under current conditions.

Nevertheless, in order to provide betterment and to futureproof the scheme against climate change, it is intended that the proposals will include the attenuation of surface water run-off rates and volumes from the site by incorporating SuDS into the design and discharging at the 1 in 1 year greenfield rate (including an allowance for CC over the lifetime of the scheme) for all events up to and including the 1 in 100-year (+45% CC) event into the neighbouring adopted surface water sewer on Duddery Hill, as per Anglian Water requirements (as local conditions preclude infiltration to ground and there is an absence of nearby accessible watercourses to discharge to).

Within the development, it is proposed that the access, parking and hardstanding area to the north of the building will be constructed from permeable pavement with an area of sub-surface storage totalling 987 m^2, provided below the permeable pavement. This will provide ***c.* 248.5 m^3** storage, which is in excess of the 246.4 m^3 required.

Roof drainage from the new building will be directed to the permeable pavement/sub-surface storage.

Following attenuation, surface water runoff will be released from the sub-surface storage by means of a “complex flow control” such as a Hydrobrake or a simple orifice plate, capped at the **0.81 l/s** 1 in 1-year greenfield rate for all events up to and including the 1 in 100 year event.

Regulated discharge would be via a new 150 mm ∅ connecting sewer laid to the adopted MH1051, located just north of the site near the roundabout between Duddery Hill and Hollands Road.

In this way the proposed development will be drained adequately, whilst discharging at the 1 in 1-year greenfield rate and mitigating against climate change, by including a precautionary +45 % allowance for predicted increases in peak rainfall intensity over the lifetime of the scheme. Consequently, the development of the site will be used as an opportunity for environmental enhancement and the sustainable management of surface water runoff at source.

Appendix 1 Anglian Water Sewer Records

	Date: 11/08/22	Scale: 1:1250	Map Centre: 567135,245037	Data updated: 31/07/22	Our Ref: 924361 - 1	Wastewater Plan A4

Foul Sewer
Surface Sewer
Combined Sewer
Final Effluent
Rising Main*
Private Sewer*
Decommissioned Sewer*

Outfall*
Inlet*
Manhole*

Sewage Treatment Works
Public Pumping Station
Decomissioned Pumping Station

*(Colour denotes effluent type)

jivanova@hilsonmoran.com

Drive Vauxhall

love every drop
anglianwater

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
0001	F	-	90.18	-
0002	F	-	85.88	-
0101	F	-	90.18	-
0102	F	-	87.97	-
1001	F	-	81.75	-
1903	F	-	78.76	-
2001	F	-	-	-
2101	F	-	79.1	-
2902	F	-	78.29	-
0051	S	-	90.14	-
0052	S	-	86.2	-
0151	S	-	90.14	-
0152	S	-	86.17	-
1051	S	-	82.06	-
1151	S	-	80.5	-
1953	S	-	79.16	-
2051	S	-	-	-
2052	S	-	-	-
2152	S	-	80.51	-
2951	S	-	-	-
2952	S	-	78.66	-

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

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