

Indurent Park
Knowsley

Flood Risk Assessment

HSP2025-C4884-C&S-FRAS1-3331
August 2025



CIVIL | STRUCTURAL | GEOTECHNICAL & ENVIRONMENTAL | TRAFFIC AND TRANSPORT

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Reliance

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Issue & Revision History

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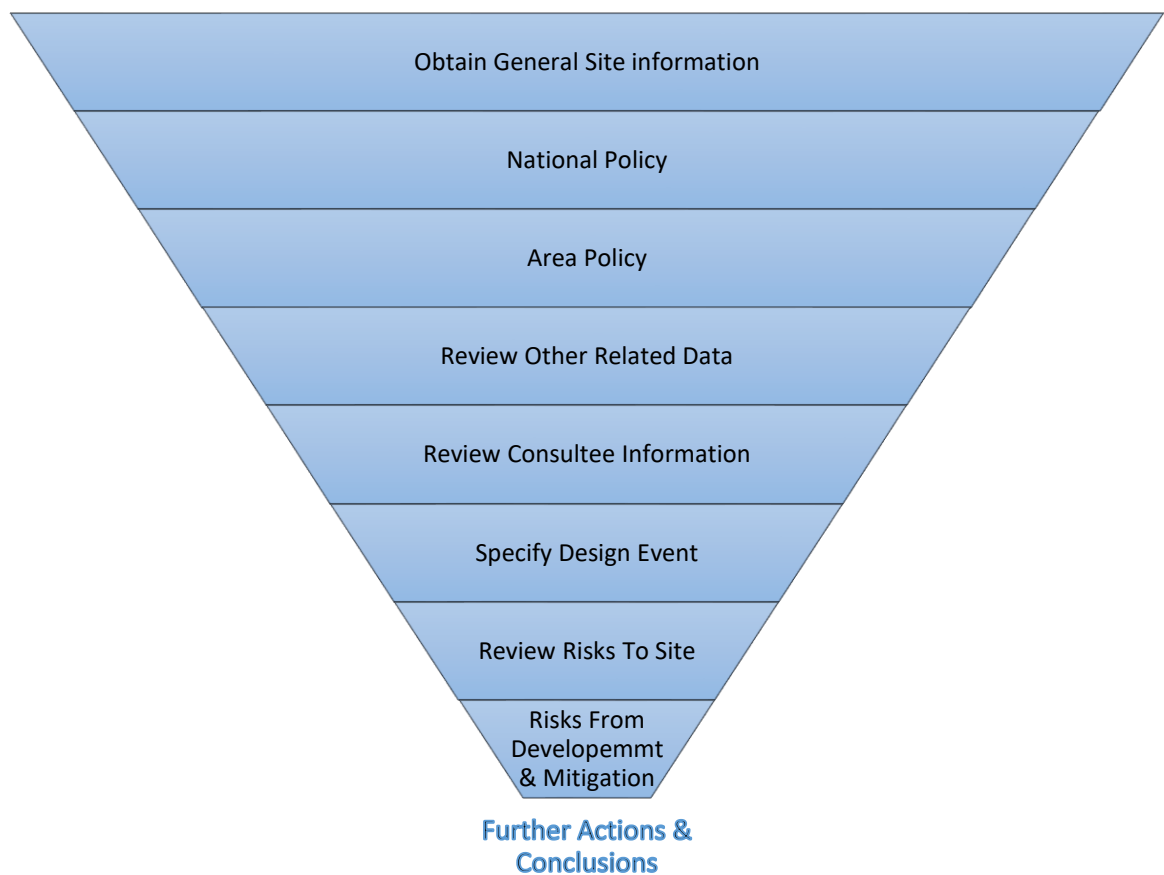
1 Introduction

1.1 General

- 1.1.1 HSP Consulting Engineers Ltd has been commissioned to undertake a Flood Risk Assessment in support of a feasibility appraisal for proposed works at a site located in Knowsley, Liverpool.

1.2 Format of this Report

- 1.2.1 This report is reliant upon publicly available information and/or that provided by Consultees which is then reviewed, in outline terms, in accordance with the graphic below:



1.3 Sources of Data

1.3.1 This report is based on information from the following principal sources of information:

- i.* Environment Agency (EA) Flood Zone (for Planning) Mapping
- ii.* Government Long Term Flood Risk Mapping
- iii.* Phase I Geo-Environmental Desk Study Report
- iv.* CIRCIA C753 “The SuDS Manual”
- v.* Preliminary Flood Risk Assessment (2011 + 2017 Addendum)
- vi.* Strategic Flood Risk Assessment – Level 1 (2011)
- vii.* Strategic Flood Risk Assessment – Level 2 (2012)
- viii.* Local Flood Risk Management Strategy (2017)
- ix.* Knowsley Local Plan – Core Strategy (2016)

2 Site Location, Description & Proposed Development

2.1 Site Location

2.1.1 The site is located off Alchemy Way in Liverpool, with the following address:

Alchemy Way,
Knowsley,
Liverpool,
L33 7XN,

2.1.2 Approximate coordinates (National Grid reference) for the centre of the site are E 342583, N 397209 .

2.1.3 A site location plan is included within Appendix 1 of this document.

2.1.4 The Lead Local Flood Authority (LLFA) is Knowsley Metropolitan Borough Council.

2.1.5 The Sewerage Undertaker is United Utilities.

2.2 Description

- 2.2.1 The site covers approximately 4.62 hectares and consists primarily of overgrown landscaped ground with areas of existing hardstanding used for parking and storage.
- 2.2.2 The main access is via Alchemy Way, located on the southern boundary.
- 2.2.3 The area immediately surrounding the site is characterised as urban.
- 2.2.4 The site boundary is formed as follows:
 - i. North: The site is bounded to the north by a logistics unit with associated car parking and service areas
 - ii. East: To the east, the site adjoins further warehouse development and associated yard space
 - iii. South: The southern boundary is adjacent to a large industrial building with vehicle access and parking areas
 - iv. West: On the western side, the site borders additional logistics operations and hardstanding used for servicing

2.3 Topography

- 2.3.1 A Topographical Survey was conducted by Mapmatic on 26th March 2025. The following commentary provides a summary of the findings of the survey report.
- 2.3.2 The site slopes uniformly from north to south, with ground levels falling from approximately 30.000m at the northern boundary to around 29.000m at the southern boundary. There is minimal variation in levels from east to west.
- 2.3.3 The Topographical Survey will be reproduced within Appendix 1.

2.4 Proposed Development

- 2.4.1 The proposed development comprises the construction of two logistics units with associated service yards, access roads, and a dedicated car park. An attenuation pond will be included within the site to support surface water management. The layout will also incorporate areas of soft landscaping and boundary treatments, with primary access provided via Alchemy Way along the southern site boundary.
- 2.4.2 Development proposals will be reproduced within Appendix 2.

3 Geology, Hydrogeology, Hydrology

3.1 Site Investigation

- 3.1.1 At the time of preparation, an intrusive site investigation specific to the application site was not available. However, to inform the understanding of the likely geological setting, publicly available data was reviewed alongside findings from the adjacent site's investigation, detailed in the report titled "Phase 2 Geo-Environmental & Geotechnical Report – Main" prepared by RPS Consulting.
- 3.1.2 The following information has been sourced from both British Geological Survey (BGS) mapping and Magic Maps.

3.2 Geology

- 3.2.1 Published British Geological Society (BGS) online database records indicate the following:

3.2.2 Superficial Deposits:

The BGS mapping indicates the presence of Chester formation - sandstone throughout the site.

BGS offers the following Lithological description for Sandstone with interbeds of siltstone and mudstone deposits:

3.2.3 Bedrock:

BGS mapping indicates that the site lies between areas of brown sand and glacial till.

BGS offers the following Lithological description for the Brown Sand (Shirdley Hill Sand Formation): *"Well-sorted, fine-grained sand, locally with peat layers in the lower portion."*

Glacial Till: *"Clayey, silty, sandy diamicton with gravel, derived from glacial deposits."*

3.2.4 Made Ground:

The BGS mapping indicates the presence of Made Ground (Artificial Ground) on the site.

3.3 Hydrogeology

- 3.3.1 The Groundwater Vulnerability Map of England, MagicMap and the Environment Agency website have been reviewed to determine the hydrology and aquifer designations.
- 3.3.2 These sources show that:

- i. The site is located within Source Protection Zone III (Total Catchment - SPZ3). The Environment Agency defines SPZ3 zones as:

The area around a supply source within which all the groundwater eventually discharges to the abstraction point. It represents the total catchment area contributing to the source, typically with a groundwater travel time of up to 400 days.'

- ii. Groundwater vulnerability is designated as "medium - high". BGS defines areas of high vulnerability as:

'Areas of medium-high vulnerability as locations where groundwater resources have moderate to limited natural protection. These areas present a significant pollution risk from surface activities, and may require enhanced mitigation measures beyond standard good practice to protect groundwater quality.'

- iii. The Bedrock is depicted as being a "Principal" aquifer. The Environment agency defines principal aquifers as:

'Layers of rock or drift deposits that have high intergranular and/or fracture permeability — meaning they usually provide a high level of water storage. They may support water supply and/or base flow to rivers and are often targeted for abstraction.'

- iv. The superficial deposit is depicted as being a "Secondary undifferentiated" aquifer. The Environment agency defines secondary undifferentiated aquifers as:

' These are formations where it has not been possible to attribute either Secondary A or B status. In many cases, this is due to the variable characteristics of the rock type or limited data. These aquifers may have significant groundwater potential locally but are less consistent than Principal Aquifers.'

- v. Magic Map describes the Soilscape as "Freely draining very acid sandy and loamy soils".

3.4 Hydrology

- 3.4.1 There are no ordinary watercourses evident in close proximity to the site.

4 National Planning Framework

4.1 General

- 4.1.1 Flood Risk Assessments in England are undertaken using the prescriptive procedures and guidance within the National Planning Policy Framework (NPPF) and “Planning practice Guide – Flood Risk and Coastal Change” (PPG) produced by Communities and Local Government, in addition to the details set out in BS 8533:2017 “Assessing and managing flood risk in development - Code of practice”.
- 4.1.2 NPPF provides a directive which seeks to ensure that development does not take place in areas at risk or increase flood risk in offsite areas. NPPF acknowledges that developments vary in their sensitivity to flooding and enables the correlation between proposed use and the underlying environs (flood risk) through the application of the Sequential Test.

4.2 The Sequential Test

- 4.2.1 The aim of the Sequential Test is to steer new development into areas with the lowest and/or appropriate probability of flooding.
- 4.2.2 The sequential test provides the potential to compare the subject site with other available sites to determine which has the lowest flood risk.
- 4.2.3 Table 1 of PPG prescribes three principal flood risk zones:
- Zone 1 (Low Probability) - land assessed as having a less than 0.1% (1 in 1000) annual probability of river or sea flooding;
 - Zone 2 (Medium Probability) - land assessed as having between a 1% (1 in 100) and 0.1% (1 in 1000) annual probability of river flooding; or between a 0.5% (1 in 200) and 0.1% (1 in 1000) annual probability of sea flooding;
 - Zone 3a (High Probability) - land assessed as having a 1% (1 in 100) or greater annual probability of river flooding or a 0.5% (1 in 200) or greater annual probability of flooding from the sea;
 - Zone 3b (The Functional Floodplain) - land where water has to flow or be stored in times of flood. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. However, land which would naturally flood with an annual probability of 1 in 20 (5%) or greater in any year, is typically assumed to be functional floodplain.
- 4.2.4 The Sequential Test is not normally required for developments in Flood Zone 1 (i.e. the lowest probability of flooding), unless other flood related issues exist within the area of the development; for example, a critical drainage area.

4.2.5 Similarly, a Sequential Test is not required in respect of the intended Planning Application if one has already been undertaken for a development of the type proposed (e.g. a residential development) on the subject site. This may be the case where the site is 'allocated' in the Authorities Local Plan.

4.2.6 A Sequential Test is required where both of the following apply:

- The proposed development is in Flood Zone 2 or 3
- A sequential test has not already been undertaken for a development of the type which is planned.

4.3 Land Use and Development

4.3.1 Current guidance accepts that it is not always possible to direct developments into areas of low flood risk and that the type of development/end use materially affects flood risk sensitivity.

4.3.2 Table 3 of "Planning Practice Guide – Flood Risk and Coastal Change", reproduced below, provides the outline mechanism for assessing the suitability of a development within a specific Flood Zone.

Reproduction of Table 3 of "Planning Practice Guide – Flood Risk and Coastal Change"					
Flood risk vulnerability classification	Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception Test required	✓	✓
Zone 3a	Exception Test required	✓	×	Exception Test required	✓
Zone 3b	Exception Test required	✓	×	×	×
Key: ✓ Development is appropriate × Development should not be permitted					

4.3.3 For guidance, Table 2 of "Planning Practice Guide – Flood Risk and Coastal Change", is reproduced below to illustrate Flood Risk Vulnerability classifications.

Reproduction of Table 2 of "Planning Practice Guide – Flood Risk and Coastal Change"	
Essential Infrastructure	• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. • Wind turbines.

Reproduction of Table 2 of "Planning Practice Guide – Flood Risk and Coastal Change"	
Highly Vulnerable	• Police stations, Ambulance stations and Fire stations and Command Centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure').
More Vulnerable	• Hospitals. • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for: dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels. • Non-residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable	• Police, ambulance and fire stations which are not required to be operational during flooding. • Buildings used for: shops; financial, professional and other services; restaurants and cafes; hot food takeaways; offices; general industry; storage and distribution; non-residential institutions not included in 'more vulnerable'; and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do not need to remain operational during times of flood. • Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).
Water compatible Development	• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel workings. • Docks, marinas and wharves. • Navigation facilities. • MOD defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

4.4 The Exception Test

- 4.4.1 The Exception Test may be applied where, following application of the Sequential Test, it is not possible for the development to be located in zones with a lower probability of flooding.
- 4.4.2 For the Exception Test to be passed both of the following conditions must be met:
- iii.* It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk; and,
 - iv.* A site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

5 Local Planning Framework

5.1 Local Flood Risk Management Strategy (2017).

- 5.1.1 While the document outlines a comprehensive range of planning policies, its purpose can be summarised as follows: the Local Flood Risk Management Strategy sets out Knowsley Council's responsibilities as the Lead Local Flood Authority under the Flood and Water Management Act 2010. It details how local sources of flooding—such as surface water, groundwater and ordinary watercourses—are to be managed, and promotes the implementation of sustainable drainage systems (SuDS) in new development.

5.2 Preliminary Flood Risk Assessment (2011, Addendum 2017)

- 5.2.1 The Knowsley Preliminary Flood Risk Assessment (PFRA) provides a high-level overview of flood risk across the borough in accordance with the Flood Risk Regulations 2009. The assessment identified no nationally significant flood risk areas within Knowsley and supports the evidence base for local flood management and planning decisions.

5.3 Knowsley Local Plan – Core Strategy (2016)

- 5.3.1 The Knowsley Local Plan Core Strategy includes Policy CS24, which seeks to ensure that new development is directed away from areas of flood risk. It requires that flood risk is assessed and managed in all relevant planning proposals and encourages the use of SuDS and appropriate mitigation where necessary.

5.4 Strategic Flood Risk Assessment – Level 1 (2012)

- 5.4.1 The Level 1 Strategic Flood Risk Assessment (SFRA) provides a borough-wide appraisal of flood risk to support the preparation of the Local Plan. It identifies areas at risk from various sources of flooding and enables the application of the Sequential and Exception Tests to guide development away from high-risk locations.

5.5 Strategic Flood Risk Assessment – Level 2 (2012)

- 5.5.1 The Level 2 SFRA builds on the Level 1 assessment by providing more detailed, site-specific flood modelling and analysis. It is intended to inform planning decisions on individual sites and to support the development of appropriate flood mitigation and surface water management strategies.
- 5.5.2 As part of this assessment, areas identified as Critical Drainage Areas (CDAs) are highlighted as being particularly sensitive to surface water and drainage-related flooding. These areas are typically subject to existing capacity issues within the drainage infrastructure and require enhanced scrutiny for any new development proposals.
- 5.5.3 Where a site lies within a CDA, drainage strategies are expected to demonstrate that surface water is managed sustainably on-site through the implementation of SuDS, and that discharge rates do not exceed greenfield runoff. The design must also account for climate change, exceedance routing, and long-term maintenance. In this case, the inclusion of permeable paving and an attenuation pond ensures appropriate treatment and attenuation of surface water runoff in line with national guidance (NPPF, PPG, and CIRIA SuDS Manual C753).

6 Consultation Responses

6.1 Public Sewers/Local Drainage Infrastructure

- 6.1.1 United Utilities has been contacted as part of the pre-development consultation process. Their response is currently awaited and will be included within this report once received.
- 6.1.2 Surface water and foul sewers are present within the existing hardstanding car park, with several runs located along the eastern side of the site. These connect to a main sewer that runs eastward and is understood to drain towards Moorgate Road North.

6.2 Environment Agency (EA)

- 6.2.1 The Environment Agency (EA) has confirmed that no additional flood risk information is available beyond the publicly accessible datasets. Accordingly, only publicly available mapping and national datasets have been used to assess EA-designated flood risks.

6.3 Lead Local Flood Authority (LLFA)

- 6.3.1 The LLFA (Knowsley Council) has confirmed that the site lies within a Critical Drainage Area (CDA). Accordingly, the proposed development must incorporate drainage measures that restrict discharge to greenfield runoff rates, include appropriate SuDS components, and ensure that flood risk is not increased on or off site.

7 Flood Risk

7.1 Flood Maps for Planning

- 7.1.1 The Environment Agency (EA) 'Flood Map for Planning' service indicates that the site is located within Flood Zone 1; that is, land assessed as having between less than 0.1% annual probability of river or sea flooding.
- 7.1.2 The respective Flood Map for Planning reports have been reproduced in Appendix 4.

7.2 Flood Maps for Planning Datasets

Flood Risk from Rivers and Sea With Defences.

- 7.2.2 The map shows that the site lies within an area with no identified risk of flooding from rivers or the sea. Climate change scenarios also show no increase in flood extent.

Flood Risk from Rivers and Sea Without Defences

- 7.2.3 Even without the presence of flood defences, the site is not identified as being at risk of fluvial or tidal flooding. Flood risk mapping indicates no risk across the area, and climate change scenarios show no increase in flood extent.

Flood Risk from Surface Water

- 7.2.4 The 1 in 30 surface water flood map shows small, concentrated areas of flooding to the north of the site and to the southeast, just beyond the site boundary.
- 7.2.5 The 1 in 100 surface water flood map identifies small, concentrated areas of flooding to the north of the site and in the southeast, similar to those on the 1 in 30 maps. It also indicates additional surface water flooding to the south of the site and a linear patch running along the western boundary.
- 7.2.6 The 1 in 1,000 surface water flood map shows extensive flooding along the south of the site covering most of the southern area and continuing into the southeast. Scattered patches are present in the northeast and the area beyond the western boundary within the adjacent site is fully flooded.
- 7.2.7 In addition, the site lies within a designated Critical Drainage Area (CDA) as confirmed by the LLFA and SFRA Level 2. Development in CDAs must adopt stricter surface water control measures and ensure runoff is appropriately managed

Reservoir/Failure of Infrastructure

- 7.2.8 The development site is not at risk of flooding in the event of reservoir/infrastructure failure.

Groundwater Flooding

- 7.2.9 The EA's 'Long Term Flood Risk' service states that the groundwater flooding is unlikely in the area.

8 Planning Policy & Compatibility of the Proposed Development

- 8.1 Table 2 of PPG categorises the development proposals as "Less Vulnerable".
- 8.2 Table 3 of PPG indicates that More Vulnerable end uses in Flood Zone 1 are appropriate.

9 Existing Drainage

9.1 Site Specific Existing Drainage

- 9.1.1 Existing foul and surface water drainage infrastructure is present within the site and is anticipated to be incorporated into the proposed drainage strategy. However, sections of the system appear to be in poor condition and are likely to require repair or localised upgrading to ensure suitability for reuse.

10 Climate Change and Design Event

10.1 Lifetime of Development

- 10.1.1 A development of this type is typically considered to have a design life of 25 years to 100 years.
- 10.1.2 Using the precautionary principal, for the purpose of this FRA the design life is assumed to be 100 years.

10.2 Peak Rainfall Intensity

- 10.2.1 The table below, taken from the “Peak Rainfall Allowances Map” from Environment Agency guidance “Flood risk assessments: climate change allowances”, outlines the climate change allowances that should be applied to peak rainfall intensity when considering the Alt and Crossen Management Catchment peak rainfall allowances.

Annual Exceedance Rainfall Event	Allowance	Total potential change anticipated for the ‘2050s’ (up to 2060)	Total potential change anticipated for the ‘2070s’ (2061 to 2125)
3.3% (1 in 30 years)	Central	25%	30%
	Upper end	35%	40%
1% (1 in 100 years)	Central	25%	30%
	Upper end	40%	45%

- 10.2.2 Development with a lifetime beyond 2100, this includes development proposed in applications or local plan allocations should include an appraisal of upper end allowances. This should include the 1% (100 year) and 3.3% (30 year) annual exceedance probability events for the 2070s epoch (2061 to 2125), albeit the 1% (100 year) event is likely to define the attenuation requirements.
- 10.2.3 Development with a lifetime between 2061 and 2100 should utilise a similar approach but use the central allowance for the 2070s epoch (2061 to 2125).
- 10.2.4 Development with a lifetime up to 2060 should use the central allowance for the 2050s epoch (2022 to 2060).

10.3 Design Event (Drainage)

- 10.3.1 Notwithstanding the design life variability, using the precautionary principal and the anticipated Regulator's prescriptive requirements, it is considered appropriate to study the development, and in particular the surface water drainage design, relative to the 1 in 100-year event, including an uplift of 45% for the effects of climate change.
- 10.3.2 It should be noted that this analysis must determine if the impacts of the climate change allowance are significant and lead to any unacceptable flood risks (it is not normally expected that the site would not flood in this scenario, only that if this storm were to occur the impacts would be minimal). The design may need to be modified to avoid any unacceptable risks, but may also need additional mitigation allowances, for example a higher freeboard on attenuation features and/or provision of exceedance routes.
- 10.3.3 An additional allowance for urban creep may be required during the design process. While normally applied to residential development, urban creep may be requested at the discretion of the LLFA/Planning Authority and influences the surface water drainage design and, in particular, the attenuation requirements.
- 10.3.4 Rainfall Runoff Management for Developments, jointly published by the Department for Food & Rural Affairs and the Environment Agency, recommends the following:
- “Urban creep is now an acknowledged issue which results in an increase in runoff from an estate over time. An allowance should be made by factoring the impermeability percentage by 1.1 (10% increase) ...”*
- 10.3.5 As noted, published guidance is typically centred upon residential development. It is therefore recommended that any Urban Creep allowance for non-residential development is be agreed with the LLFA at the pre-application stage once the principles of development (such as proportion of hard area) are known.

11 Potential Sources of Flooding

11.1 General

- 11.1.1 BS 8533: 2011 “Assessing and managing flood risk in development – Code of practice” provides recommendations and guidance the assessment and management of flood risk for proposed development within the UK.
- 11.1.2 Assessment should include an appraisal of risk both to- and from- the development from all sources of flooding, including:

- i.* Tidal and fluvial flooding – flooding from main rivers, ordinary watercourses and the sea.
- ii.* Surface water flooding – flooding from overland flow due to rainfall.
- iii.* Flooding from sewers and drains – flooding from surcharging of below ground drainage systems.
- iv.* Groundwater flooding – flooding related to the water table, where ground water levels rise above surface levels.

11.1.3 Flooding caused by the failure of infrastructure, such as from reservoir, canal or land drainage infrastructure, usually as a result of catastrophic failure.

12 Flooding Risks to the Development

12.1 Tidal Flood Risk

12.1.1 The site is not located within the influence of any tidal watercourses or coastal sources and is therefore not considered to be at risk of tidal flooding.

12.2 Fluvial Flood Risk

12.2.1 According to Environment Agency Flood Maps for Planning, the site lies within Flood Zone 1, which is defined as land having a less than 1 in 1,000 annual probabilities of fluvial flooding. The site is therefore not considered to be at risk from fluvial flooding.

12.3 Groundwater Flooding

12.3.1 Publicly available mapping from the Environment Agency's Long Term Flood Risk service indicates that the site is not at significant risk of groundwater flooding. However, given the absence of site-specific monitoring data, further groundwater investigation is recommended to confirm groundwater levels and assess any potential impact on the development and drainage design.

12.4 Pluvial Flood Risk

12.4.1 Surface water flood mapping identifies varying degrees of risk across the site depending on storm return periods:

- iii.* 1 in 30-year event (3.3% AEP): Localised areas of flooding are shown to the north and southeast, just beyond the site boundary.
- iv.* 1 in 100-year event (1% AEP): Additional areas of surface water flooding are present to the south of the site and along the western boundary, extending the areas seen in the 1 in 30-year map.

- v. 1 in 1,000-year event (0.1% AEP): The most extensive flooding is observed during this event, with significant surface water accumulation across the southern area of the site and into the southeast. Smaller patches of risk are also noted in the northeast, while the adjacent site to the west is fully flooded.

12.5 Sewer Flooding

- 12.5.1 There is limited available data regarding historic sewer flooding at the site. No recorded incidents were identified during the preparation of this report; however, this absence of evidence should not be taken to imply that no risk exists. Based on local context and the presence of existing foul and surface water infrastructure, the risk of sewer flooding is considered to be low but not negligible'.

12.6 Infrastructure/Reservoir Flood Risk

- 12.6.1 Flood risk mapping from the Environment Agency confirms that the site is not located within any area at risk of flooding resulting from the failure of reservoirs or other large-scale infrastructure.

13 Effect of Development on Flooding & Design Inclusions

13.1 Preface

- 13.1.1 The management and/or disposal of surface water is a material planning matter.
- 13.1.2 Building Regulations (Part H) and other contemporary guidance requires that surface water should be disposed according to the following hierarchy.
 - iii. Infiltration to ground.
 - iv. Discharge to a local watercourse.
 - v. Discharge to the local sewerage network
- 13.1.3 Published data suggests that infiltration drainage is unlikely to be viable at the site; however, this will need to be confirmed through site-specific testing. In accordance with the drainage hierarchy, infiltration would remain the preferred method if proven feasible.
- 13.1.4 In the absence of a nearby watercourse, the next preferred option is to discharge surface water into the existing drainage network within the site, subject to capacity and condition assessments.

13.2 Foul Water Drainage

- 13.2.1 Existing foul sewers within the site are intended to be utilised as part of the proposed foul water drainage strategy.
- 13.2.2 However, given the development within the area, it is considered likely that accessible public sewer networks will be present in the area.
- 13.2.3 Notwithstanding the above, once anticipated discharge rates can be confirmed, confirmation of capacity and/or sewer reinforcement requirements should be sought from the Undertaker.
- 13.2.4 It should be noted that all connections to the public sewer, whether made directly to the sewer or indirectly via existing pipework, can only be legally made with the permission of the Undertaker. Such permission will not be given where this presents an unacceptable risk to the receiving sewer. Where there is insufficient capacity, the applicant may be required to contribute to public sewer reinforcements.
- 13.2.5 Assuming on-parcel drainage is designed:
- i.* In accordance with good practice; and,
 - ii.* To discharge flows to the existing public sewer;

The proposed works are not considered likely to adversely impact on offsite flood risk as a result of foul water drainage.

- 13.2.6 In the absence of information, no comment is offered in respect of constraints and the potential to achieve a gravity discharge.

13.3 Floodplain/Displacement of Floodwaters

- 13.3.1 The development area is located within Flood Zone 1; that is, land assessed as having a less than 0.1% (1 in 1000) annual probability of river or sea flooding. Therefore, the displacement of floodwaters is not considered to be problematic.
- 13.3.2 Given the 'very low' fluvial flood risk, it is suggested that floodplain compensation should not be a prerequisite of the development works.

13.4 Means of Access/Egress

- 13.4.1 The main access is via Alchemy Way.
- 13.4.2 The access routes into the site are considered to be at an elevated risk of surface water flooding.
- 13.4.3 In practicable terms, the site is likely to be afforded a means of safe escape during all but the most extreme events.

13.4.4 Nonetheless, mitigation measures should be developed, such as:

- iii.* A means of communicating accessible routes to residents and staff; and,
- iv.* A procedure for residents and staff to remain safe on site.

13.5 Groundwater

13.5.1 While publicly available mapping indicates that the site is not at risk of groundwater flooding, the depth of groundwater has not been thoroughly assessed, necessitating further investigation. Trial holes and groundwater monitoring are underway on site and results will be available in due course to confirm groundwater levels.

14 Proposed Surface Water Drainage Strategy

14.1 Preface

14.1.1 The management and/or disposal of surface water is a material planning matter.

14.1.2 Building Regulations (Part H) and other contemporary guidance requires that surface water should be disposed according to the following hierarchy:

- iii.* Infiltration to ground.
- iv.* Discharge to a local watercourse.
- v.* Discharge to the local sewerage network.

14.1.3 Rainwater Harvesting is beyond the scope of this appraisal. Nonetheless, the re-use of surface water should be considered upon development of proposals.

14.1.4 While infiltration is generally the preferred method for managing surface water, publicly available information from the adjacent site indicates that the ground conditions are likely to have low infiltration potential.

14.1.5 Discharge to a nearby watercourse is not considered a viable option, as no watercourses are present in proximity to the site.

14.1.6 Given the limited infiltration potential and absence of nearby watercourses, the most viable option for surface water disposal is to discharge into the existing surface water sewer network located within the site.

14.2 Sustainability: Discharge Rate and Attenuation Volume

14.2.1 Discharge rates are to be confirmed with Knowsley Metropolitan Borough Council, as the Lead Local Flood Authority (LLFA). In line with local policy and standard practice, it is

expected that runoff rates from the developed site will be restricted to greenfield rates or better, subject to agreement with the LLFA

- 14.2.2 The UK SuDs online Greenfield Runoff Rate Estimation Tool has been used to estimate the greenfield runoff rate using the ICP SuDS methodology, from the existing development parcel. The results are summarised in the table below:

Period	Runoff (l/s) by Developed Area*
Qbar	10.76
1 year	9.36
30 year	18.29
100 year	22.37
200 year	25.49
*Runoff rates based upon 4.62 ha	

- 14.2.3 It should be noted that there are practical constraints when reducing flow rates. 2 l/s is typically nominated as being the minimum practical limit for surface water disposal. Where the greenfield runoff from the *pro-rata* drained area is less 2 l/s, attenuation estimates based upon 2 l/s are provided.
- 14.2.4 For guidance, the MicroDrainage Storage Estimate Tool has been used to calculate the required attenuation volume based on the estimated total drained area of the site. The calculations consider the 1 in 100-year rainfall event with a 45% climate change allowance, using the full site area rather than incremental portions. The resulting attenuation requirement reflects the projected runoff from the proposed impermeable surfaces across the development:

New Drained Area (ha)	Discharge Rate* (l/s)	100 year + 45% Attenuation** (cu.m)
4.62	10.76	2895-3909

- 14.2.5 The required volume of storage may vary depending on the extent of the proposed works and the capacity of the existing on site drainage network. If the existing drainage is found have inadequate capacity, a greater volume of storage may be required.
- 14.2.6 The attenuation estimate is based upon Flood Studies Report (FSR) inputs. Where the site is to be designed with reference to Flood Estimation Handbook (FEH) derived storm events the attenuation is typically in the range of 10% to 20% greater than those for FSR events. However, during detailed design it is often found that FEH attenuation provisions are typically at the upper range of the generic FSR estimates.

- 14.2.7 Attenuation features such as basins, swales and other surficial systems are generally preferred due to their sustainability, water quality and biodiversity benefits. While a range of such features may be suitable in principle, the proposed drainage strategy for this development will specifically include an attenuation pond to manage surface water runoff. This will provide the necessary storage capacity while also offering treatment and supporting sustainable drainage objectives.
- 14.2.8 Moreover, it should also be noted the estimates above are based upon a simple control; that is, the outfall rate is fixed at a single rate. Where a complex control is proven to be feasible during the detailed design (e.g. rising discharge rate to mimic the variation currently experienced during differing return period) the attenuation requirements may reduce.
- 14.2.9 Refer to Appendix 5 for reproductions of preliminary calculations.

14.3 Sustainability: Discharge Volume

- 14.3.1 Controlling the volume of runoff from the site can be a significant matter when considering offsite flood risks.
- 14.3.2 LLFA typically require:
- iii. Discharge rates to mimic existing greenfield runoff rates of the 1:1 year, 1:30 year and 1:100-year storm events as long as long-term storage is utilised for flow volumes in excess of the greenfield volume for the 1:100-year 6-hour event.
 - iv. The long-term storage volume must discharge at a rate no greater than 2 l/s/ha and the total flow rate must not exceed the 1:100-year greenfield flow rate.
 - v. If long term storage is not designed for, Qbar should be applied to all events.
- 14.3.3 Using the precautionary principle, it is assumed that discharge will be restricted Qbar for all events (i.e. simple controls used). Where this is the case, the LLFA's requirements are likely to be achieved without significant additional consideration to long term attenuation. However, this assertion should be verified, and remedied if appropriate, during the detailed drainage design process.

14.4 Sustainability: Discharge Quality and Inclusion of Sustainable Drainage Systems (SuDS)

- 14.4.1 The management of water quality is a significant issue, and it is envisaged that measures will be required.
- 14.4.2 CIRCA C753 "The SuDS Manual" provides guidance of treatment measures (also known as the treatment train) required to offset contaminant and sediment loads.

- 14.4.3 The following is for indicative purposes only and it is envisioned that this design philosophy be further developed upon detailed design.
- 14.4.4 For ease of reference, the following information has been sourced from the CIRClA C753 “The SuDS Manual”. To ensure that appropriate SuDS are implemented, it is advised that the simple index approach be adopted as outlined in box 26.2 in the CIRClA C753 “The SuDS Manual”. The following tables have been sourced from the SuDS Manual.
- 14.4.5 Pollution Hazard Indices are given for different land uses in ‘Table 26.2’ of the SuDS Manual. For ease of reference, the table has been reproduced below.
- 14.4.6 The SuDS manual recommends that the selected SuDS components should have a total SuDS Mitigation Index for each contaminant type that either equals or exceeds the Pollution Hazard Index to provide adequate treatment. The following will have to be achieved for the surface water running off the site:

Total SuDS mitigation index $\geq$ pollution hazard index

- 14.4.7 Where mitigation index of an individual component is insufficient two components (or more) in series will be required, where: -

$$\text{Total SuDS mitigation index} = \text{mitigation index1} + 0.5 \text{ mitigation index2}$$

- 14.4.8 The SuDS specific pollution mitigation indices will be required to equal, or exceed, the pollution hazard indices. On this site the yards, access road and car parks are the most onerous features in terms of runoff water quality and are classified as a Medium Pollution Hazard Level. Roof areas will be classified as Low Pollution Hazard Level (note that they are under ‘other roofs, typically commercial/industrial roofs’).

TABLE 26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways ¹	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways ¹	High	0.8 ²	0.8 ²	0.9 ²

Notes

- 1 Motorways and trunk roads should follow the guidance and risk assessment process set out in Highways Agency (2009).
- 2 These should only be used if considered appropriate as part of a detailed risk assessment – required for all these land use types (Table 4.3). When dealing with high hazard sites, the environmental regulator should first be consulted for pre-permitting advice. This will help determine the most appropriate approach to the development of a design solution.

Where a site land use falls outside the defined categories, the indices should be adapted (and agreed with the drainage approving body) or else the more detailed risk assessment method should be adopted.

Where nutrient or bacteria and pathogen removal is important for a particular receiving water, equivalent indices should be developed for these pollutants (if acceptable to the drainage approving body) or the risk assessment method adopted.

- 14.4.9 Considering table 26.2 of the SuDS Manual above, the pollution hazard level for the site roofs is 'Low', with total suspended solids of 0.3, metals of 0.2 and hydrocarbons of 0.05.
- 14.4.10 Considering table 26.2 of the SuDS Manual above, the pollution hazard level for the site yards, access road and car parking is 'Medium, with total suspended solids of 0.7, metals of 0.6 and hydrocarbons of 0.7.

- 14.4.11 The SuDS mitigation index has been obtained from Table 26.3 of the SuDS Manual (for surface water) which summarises the mitigation indices associated with SuDS components. For ease of reference, the table has been reproduced below.

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters

Type of SuDS component	Mitigation indices ¹		
	TSS	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter drain	0.4 ²	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond ⁴	0.7 ³	0.7	0.5
Wetland	0.8 ³	0.8	0.8
Proprietary treatment systems ^{5,6}	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

Notes

- 1 SuDS components only deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters.
- 2 Filter drains can remove coarse sediments, but their use for this purpose will have significant implications with respect to maintenance requirements, and this should be taken into account in the design and Maintenance Plan.
- 3 Ponds and wetlands can remove coarse sediments, but their use for this purpose will have significant implications with respect to the maintenance requirements and amenity value of the system. Sediment should normally be removed upstream, unless they are specifically designed to retain sediment in a separate part of the component, where it cannot easily migrate to the main body of water.
- 4 Where a wetland is not specifically designed to provide significantly enhanced treatment, it should be considered as having the same mitigation indices as a pond.
- 5 See **Chapter 14** for approaches to demonstrate product performance. A British Water/Environment Agency assessment code of practice is currently under development that will allow manufacturers to complete an agreed test protocol for systems intended to treat contaminated surface water runoff. Full details can be found at: <http://tinyurl.com/qf7yuj7>
- 6 SEPA only considers proprietary treatment systems as appropriate in exceptional circumstances where other types of SuDS component are not practicable. Proprietary treatment systems may also be considered appropriate for existing sites that are causing pollution where there is a requirement to retrofit treatment. SEPA (2014) also provides a flowchart with a summary of checks on suitability of a proprietary system.

- 14.4.12 To summarise, the Simple Index approach should be adopted to ensure that appropriate SuDS components are implemented within the proposed development to ensure that the water quality control is appropriately addressed.
- 14.4.13 It is intended to provide permeable paving for the car parks, oil separators for the yards and an attenuation pond for the main site. Geocellular attenuation systems are proposed for both yards to provide the additional surface water attenuation required to achieve the site discharge rates required. Note that a Triton surface water attenuation tank is proposed for the yard to K72 to provide filtration and act as a filter drain system as well as attenuation.

Mitigation Indices			
K135 Roof			
Contaminants	Total suspended solids	Metals	Hydrocarbons
Pollution hazard indices	0.3	0.2	0.05
Type of mitigation			
Detention Pond mitigation index	0.7	0.7	0.5
Cumulative pollution indices	>0.3 Required	>0.2 Required	>0.05 Required
* Note: If the total aggregated mitigation index is > 1, then the outcome is fixed at >0.95			

Mitigation Indices			
Car Parks			
Contaminants	Total suspended solids	Metals	Hydrocarbons
Pollution hazard indices	0.8	0.8	0.9
Type of mitigation			
Permeable Paving	0.7	0.6	0.7
Detention Pond mitigation index	0.7	0.7	0.5
Cumulative mitigation indices, permeable paving + detention pond	$0.7 + 0.5(0.7) = 1.05$ > 0.95 *	$0.6 + 0.5(0.7) = 0.95$ = 0.95	$0.7 + 0.5(0.5) = 0.95$ = 0.95
Cumulative pollution indices	>0.8 Required	>0.8 Required	>0.9 Required
* Note: If the total aggregated mitigation index is > 1, then the outcome is fixed at >0.95			

Mitigation Indices			
K135 Service yards			
Contaminants	Total suspended solids	Metals	Hydrocarbons
Pollution hazard indices	0.7	0.6	0.7
Type of mitigation			
Full Retention Separator	0.8	0.8	>0.95
Detention Pond mitigation index	0.7	0.7	0.5
Cumulative mitigation indices, separator + detention pond	$0.8 + 0.5(0.7) = 1.15$ > 0.95 *	$0.8 + 0.5(0.7) = 1.15$ > 0.95 *	$0.95 + 0.5(0.5) = 1.20$ > 0.95 *
Cumulative pollution indices	>0.7 Required	>0.6 Required	>0.7 Required
* Note: If the total aggregated mitigation index is > 1, then the outcome is fixed at >0.95			

Mitigation Indices			
K72 Service yards			
Contaminants	Total suspended solids	Metals	Hydrocarbons
Pollution hazard indices	0.7	0.6	0.7
Type of mitigation			
Full Retention Separator	0.8	0.8	>0.95
Triton filtration attenuation tank mitigation index	0.7	0.7	0.5
Cumulative mitigation indices, separator + detention pond	$0.8 + 0.5(0.4) = 1.00$ > 0.95 *	$0.8 + 0.5(0.4) = 1.00$ > 0.95 *	$0.95 + 0.5(0.4) = 1.15$ > 0.95 *
Cumulative pollution indices	>0.7 Required	>0.6 Required	>0.7 Required
* Note: If the total aggregated mitigation index is > 1, then the outcome is fixed at >0.95			

14.4.14 The following commentary is offered in respect of water quality inclusions:

14.4.15 Roofs

No specific pollution mitigations are anticipated for these areas but is dependent upon material usage. The use of catchpits is recommended to limit the passage of 'fines' and detritus.

14.4.16 Permeable Hard Surfacing

Permeable surfacing will be used within the car park to assist with surface water treatment and pollution control. Although infiltration is not proposed, the lined permeable construction will provide effective mitigation. Access roads are expected to be constructed using conventional surfacing.

14.4.17 Impermeable Hard Surfacing

Where site proposals vary and significant area of impermeable surfacing with a pollutant risk (such as roads and parking) is proposed, a petrol interceptor is likely to be required to provide suitable pollution control.

15 Operation and Maintenance

- 15.1.1 The long-term efficacy of any installed drainage system will be compromised by a lack of maintenance.
- 15.1.2 During the detailed design stage, consideration should be given to the maintenance of any proposed system. It is recommended that a drainage maintenance regime is developed and provided in an "Operation and Maintenance Manual" for the scheme which should conform to the requirements set out within CIRIA C753 The SuDS Manual.
- 15.1.3 Refer to Appendix 6 for typical considerations.

16 Further Actions

16.1 Intrusive Site Investigation

- 16.1.1 This report will be updated on receipt of the results of the intrusive site investigation.

16.2 Awaited Consultation Responses

- 16.2.1 The awaited consultation response has now been received from the Lead Local Flood Authority (LLFA), confirming that the site is located within a designated Critical Drainage Area. This information has been reviewed and considered as part of this appraisal, and the surface water drainage strategy has been developed accordingly to ensure compliance with local and national flood risk policies.

16.3 Infiltration Potential

- 16.3.1 Based on publicly available information, infiltration through soakaways is considered unlikely to be viable. However, site-specific soakaway testing will be required to confirm ground conditions and inform the final drainage strategy.

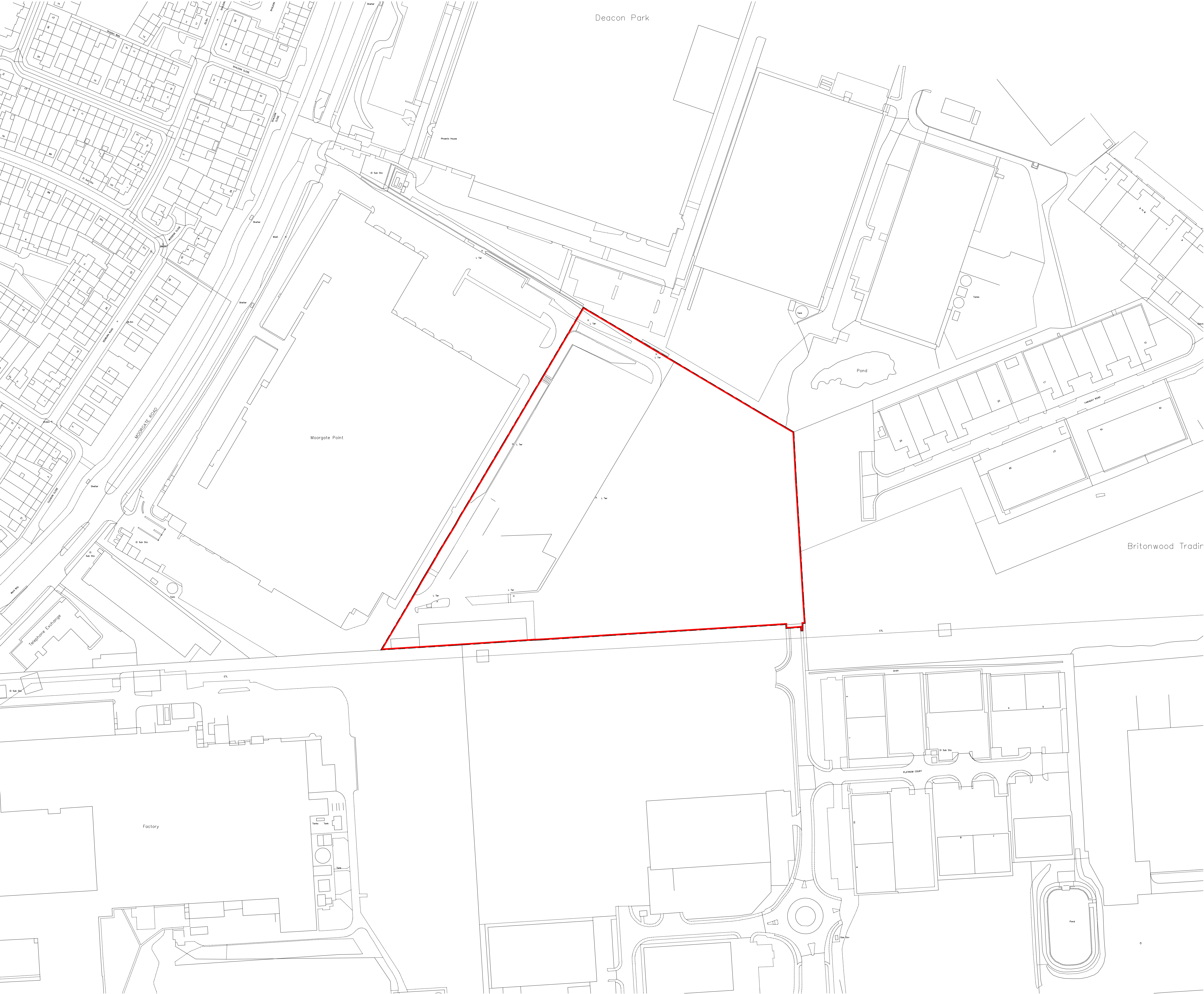
17 Conclusions

- 17.1 The site extends to approximately 4.62 ha and comprises a mix of overgrown landscaped areas and existing hardstanding. The proposed development will result in approximately 3.696 ha of impermeable area.
- 17.2 The existing drainage network, located within the hardstanding area previously used as a car park, contains both foul and surface water drainage infrastructure.
- 17.3 Access to the site is taken from Alchemy Way, located along the southern boundary.
- 17.4 The site generally falls from north to south, creating a uniform slope across the area.
- 17.5 The proposed development consists of two logistics units, an associated car park, an access road and an attenuation pond.
- 17.6 Although the Environment Agency's Long Term Flood Risk mapping indicates the site is not at significant risk of groundwater flooding, the British Geological Survey and Magic Map data classify the site's groundwater vulnerability as medium to high. This indicates a moderate to limited natural protection to groundwater resources, meaning enhanced pollution mitigation measures may be required. Further intrusive investigations, including groundwater monitoring, are being undertaken on site to confirm subsurface conditions including groundwater levels to ensure the drainage design appropriately addresses this elevated vulnerability.
- 17.7 It is anticipated that the use of infiltration drainage for the management of surface water run-off from the proposed development will not be feasible, but this is subject to further testing.
- 17.8 The Environment Agency (EA) 'Flood Map for Planning' service indicates that the site is located within Flood Zone 1; that is, land assessed as having between less than 0.1% annual probability of river or sea flooding.
- 17.9 Surface water flood mapping indicates varying levels of risk across the site under different storm return periods. Localised surface water flooding is evident during the 1 in 30-year event, primarily to the north and southeast just beyond the site boundary. During the 1 in 100-year event, flooding extends further into the site, particularly along the southern and western boundaries. The 1 in 1,000-year scenario presents the most extensive risk, with significant surface water accumulation across the southern and southeastern areas of the site, as well as isolated patches in the northeast. The adjacent site to the west is also shown to be fully flooded in this extreme event. These findings highlight the need for appropriate surface water management and mitigation measures within the development.
- 17.10 Flood risk from all other sources is considered to be low.

- 17.11 Attenuation, in the form of cellular storage crates, is to be provided to ensure that all flow up to the 1 in 100 year storm event with a 45% allowance for climate change are retained limited to greenfield rates.
- 17.12 Permeable paving with an impermeable liner will be used within private parking areas to provide surface water treatment. In addition, an attenuation pond will be incorporated into the drainage strategy to manage runoff volume and provide further storage and treatment prior to discharge.
- 17.13 The site is located within Flood Zone 1 and has been confirmed by the Lead Local Flood Authority as falling within a designated Critical Drainage Area (CDA). In response to this designation, the proposed surface water drainage strategy incorporates sustainable drainage measures, including permeable paving and an attenuation pond, to ensure that runoff is restricted to the greenfield rate and managed on site. These measures will provide both attenuation and water quality treatment, in line with the requirements of the CDA and relevant planning policy. As such, the development will not increase flood risk elsewhere and will contribute positively to the local drainage network capacity.

Appendix 1

- Site Location Plan
- Topographical Survey



General Notes

- This document is to be used for the stated purpose only and should not be used for any other.
- Dimensions are all in millimetres, unless stated otherwise.
- It is the recipient's responsibility to print this document to the correct size & scale.
- All relevant drawings and specifications should be read in conjunction with this document.
- Scaling of this document is not recommended.

North



Document Scale(s)

25m

SCALE 1:1250

Application Boundary
11.19 acres (4.53 Ha)



Project Name

Indurent Park, Moorgate Point, Knowsley

Employer		Project Address	
Indurent		Moorgate Point Liverpool L33 7XW	
RIBA Workstage		Suitability	
3 - Spatial Coordination		S2 - Information	
Drawn	Checked	Created	Size
LBR	TDA	10.07.2025	A1
UMC Project Reference		Scale	LOD
22520		1:1250	1

Document Title

Site Location Plan

Document Reference

22520 - UMC - ZZZZ - SI - DR - A - 0503

Revision Note

Initial Issue

Issue Date

10.07.2025

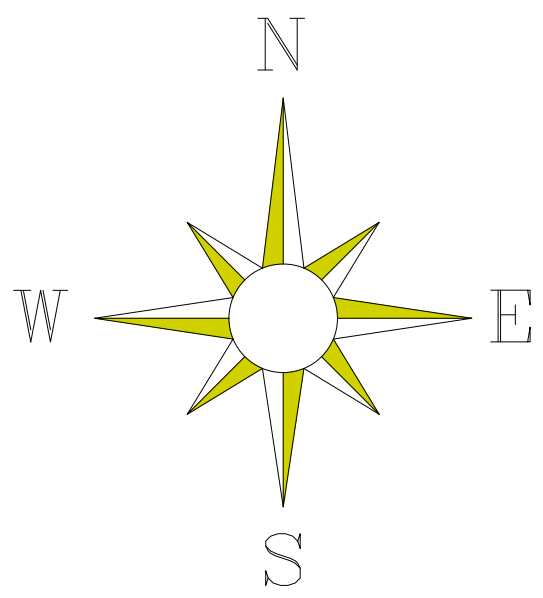
PLANNING

This drawing is to be used for the stated purpose only and should not be used for any other

Status

Current Revision

P02



FL:	Floor level	SHL:	Still height level
CL:	Ceiling level	HHL:	Head height level
SUSCL:	Suspended ceiling level	SPR:	Spring Point
US/SL:	Underside level	Arch:	Arch level
DP:	Down pipe	P Arch:	Pointed Arch level
WP:	Waste pipe		

	Door / sliding door		Building line
	Inspection cover		Beam
			Window
			Dimension

[illegible]

Ordinance Survey information is provided for a guide only.

— OS BUILDING OUTLINE

— OS DETAIL

Station	Easting (m)	Northing (m)	Level (m)
M1	342512.282	397181.552	29.622
M2	342497.708	397155.471	29.452
M3	342428.931	397150.810	28.636
M3A	342374.852	397132.886	27.885
M4	342414.419	397176.775	28.126
M5	342488.324	397300.522	28.133
M6	342526.242	397340.808	28.137

REV	DATE	DESCRIPTION OF WORK	SURVEYOR	CHECKED BY
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SETTING OUT UTILITY SURVEYS CCTV SURVEYS CAMERA SURVEYS FLOOD RISK ASSESSMENT
AERIAL SURVEYS EARTHWORK CALCULATIONS MEASURED-BUILDING SURVEYS TOPOGRAPHICAL SURVEYS

Mapmatic, Unit 14, Prime Parkway, Derby, DE1 3GB
Tel: 01332 690 590 www.mapmatic.com Email: info@mapmatic.com

CLIENT

HSP Consulting

PROJECT
Moorgate Point
Liverpool
L33 7XW

TITLE Topographical Survey

Scale	1: 500@A0	Date	26.03.2025
Drawn	TB/MR	Checked	AW
Level datum	GNSS	Grid orientation	GNSS
Job number	7653	Revision	0
Drawing no.	0001	Sheet	1 of 1

Notes

All other measurements should be checked on site prior to design. No liability will be taken for this plan if the user does not follow these instructions. The user must be aware that the design of the system and the services may be limited due to the use of vehicle location and registration. Please note the drainage information has been ascertained by visual inspection from the situation and therefore values are estimated.

This survey has been undertaken to the Ordnance Survey (OS) national grid via a Global Navigation Satellite System (GNSS) and the OS Active Network (OS ANET). A type OS058R controller has been established near to the site centre via a transformation using the OSTN02 and OSAD15 transformation models. The user must be aware that the OS ANET is not a true north reference and may be used to create a true OS bearing for any angle and/or distance. No scalar factor is applied to the survey therefore the coordinates shown are arbitrary and not true OS coordinates.

Please refer to the Survey station title to establish co-ordination of the service grid.

Notable industrial material & site vehicle obscuring survey area. Some services may be missing due to limited visibility.



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Appendix 2 ■ Proposed Site Plan



General Notes

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- All relevant drawings and specifications should be read in conjunction with this document.
- Scaling of this document is not recommended.

North

Document Scale(s)



- Application Boundary**
119 acres (4.53 Ha)
- Council Land**
- Highways Land**

Schedule of Accommodation

Total GIA	197,880 ft ²	(18,384 m ²)
Total GIA (+Exp/Amn)	207,617 ft ²	(19,288 m ²)
Site Density GIA	40.58%	

Unit K135		
Warehouse Area	121,431 ft ²	(11,261 m ²)
GF Core	1,220 ft ²	(113 m ²)
1 st Office	6,151 ft ²	(571 m ²)
Total GIA	128,802 ft²	(11,966 m²)
Amenity Deck	6,326 ft ²	(588 m ²)
Total GIA (+Exp/Amn)	135,128 ft ²	(12,554 m ²)

Unit K72		
Warehouse Area	65,056 ft ²	(6,044 m ²)
GF Core	706 ft ²	(66 m ²)
1 st Office	3,314 ft ²	(308 m ²)
Total GIA	69,076 ft²	(6,418 m²)
Amenity Deck	3,411 ft ²	(317 m ²)
Total GIA (+Exp/Amn)	72,489 ft ²	(6,734 m ²)



Project Name

Indurent Park, Moorgate Point, Knowsley

Employer	Project Address		
Indurent	Moorgate Point Liverpool L33 7XW		
RIBA Workstage	Suitability		
3 - Spatial Coordination	S2 - Information		
Drawn	Checked	Created	Size
JWY	TDA	08.07.2025	A1
UMC Project Reference	Scale	LOD	LOI
22520	1:500	1	1

Document Title

Proposed Site Plan

Document Reference

22520 - UMC - ZZZZ - SI - DR - A - 0601

Revision Note

Total GIA amended

Issue Date Status Current Revision

Appendix 3 ■ Lead Local Flood Authority Response



Phone: 0151 443 2704

Email: LLFA@knowsley.gov.uk

Website: [Lead Local Flood Authority - Knowsley MBC](#)

Date: 17 Jun 2025

APPLICATION CONSULTATION RESPONSE

APPLICATION No:	25/00024/PREAPP
LOCATION:	LAN EAST OF MOORGATE POINT
GRID REF:	
PROPOSAL:	PROPOSED INDUSTRIAL AND LOGISTICS (CLASS B2 AND/ OR B8 AND/ OR E(G) (III) USE) WITH ANCILLARY OFFICES, INCLUDING PROVISION OF REVISED ACCESS ARRANGEMENTS FROM SOUTH PERIMETER ROAD AND ALL ASSOCIATED WORKS AND LANDSCAPING

Thank you for inviting the [Lead Local Flood Authority \(LLFA\)](#) to comment on the above application. Knowsley Council as Lead Local Flood Authority (LLFA) provides comments on planning applications as our statutory consultee role in relation to surface water drainage and works in relation to ordinary watercourse.

The LLFA has reviewed the submitted information/documents concerning the above application including drawing 22520-UMC-ZZZZ-SI-DR-A 0612 Masterplan and Environmental solutions ecological approach report. The LLFA comments are based on this information and other databases available to the Council.

Having considered the submitted information and reference to the publicly available databases, the LLFA has no objection in principle to the proposed development, as the site is currently located in Flood Risk Zone 1 and low surface water flood risk. Despite the acceptance of the proposed development for the site, the proposed drainage strategy is not satisfactory and any future planning application for site should consider the following key points in developing the site drainage strategy:

- A SuDS aims to minimise the impacts from a proposed development on water quantity and quality and maximise amenity and biodiversity. In designing an appropriate set of SuDS techniques for a development site, the LLFA will therefore be expecting source control features being integrated with above ground, green attenuation storage features to be prioritised to promote water quality, amenity and biodiversity.

- An explanation of existing drainage system/mechanism and flow paths on the site and that how the site is currently affected by off-site surface water runoff shall be required.
- Evidence and justification (e.g. infiltration tests and groundwater levels) shall be required to demonstrate that in choosing drainage features for post development, the surface water drainage discharge hierarchy has appropriately been followed.
- The maximum discharge rate from the development site would be expected to be restricted to QBAR greenfield runoff rate. Volume of attenuation storage required on site for the 1% (1in100) plus climate change storm.
- Where the proposals are connecting to an existing drainage system/watercourse, it is likely that the authorities responsible for maintaining those systems/watercourses will have their own design requirements. These requirements will need to be reviewed and agreed as part of any surface water drainage scheme.
- Detailed Drainage Scheme Plan showing the layout of the proposed drainage network, post development impermeable area, the location of the storage within the proposed development and how these relate to the submitted calculations, including any chamber, pipe numbers, direction of flow, invert and cover levels, gradients diameters and dimensions. The methods of flow control must be detailed as should non-conventional elements such as pond and permeable paving.
- Water quality should be taken into account as part of the proposed drainage design. It will be required to demonstrate that adequate water quality of the off-site surface water flows (draining into a sewer, watercourse and ground) in accordance with the Simplified Index Approach as set out within Section 26 of the SUDS Manual (C753) can be achieved. In this case if an industrial yard is proposed, water quality risk to surface water bodies and groundwater should be assessed (screening risk or detailed risk assessment) and mitigation measures to be adopted to ensure that risk to both surface water bodies, and groundwater are effectively managed (see Table 26.1 of the SUDS Manual).
- The mechanism for securing long-term maintenance will need to be considered and agreed between the applicant and the Local Planning Authority. This may involve discussions with those adopting and/or maintaining the proposed systems, which could include the Highway Authority, Planning Authority, Parish Councils, Water Companies and private management companies.
- Evidence that exceedance flows and runoff in excess of design criteria shall be considered - calculations and plans shall be provided to show where above ground flooding might occur and where this would pool and flow.
- An assessment of groundwater levels and its fluctuations shall be required.
- A Phase II geo-environmental assessment to identify the site physical characteristics, likely existing contamination and potential remediation strategy shall be required.

- A management and maintenance plan for the proposed drainage system, arrangements for adoption and means of access for inspection and maintenance purposes shall be considered.

Yours faithfully,

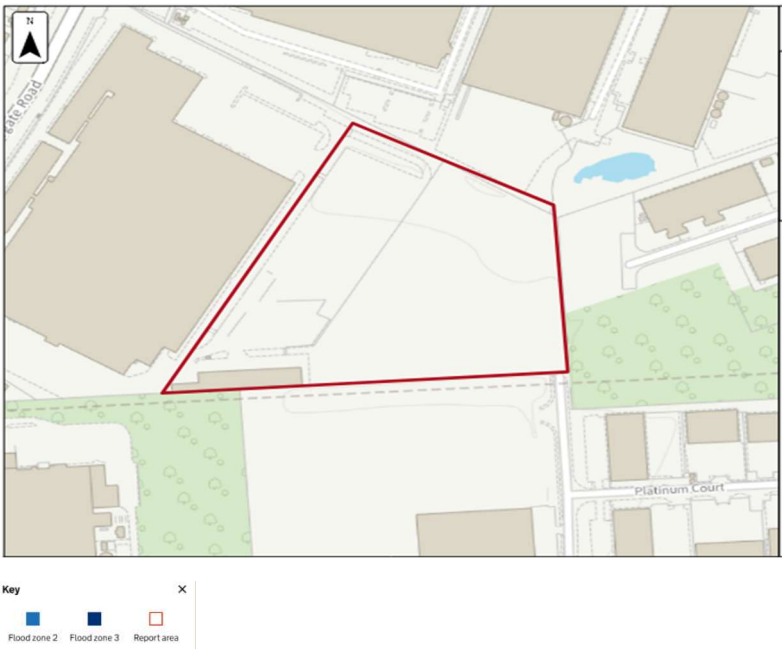
Luke Crilly

[Lead Local Flood Authority \(Knowsley MBC\)](#)

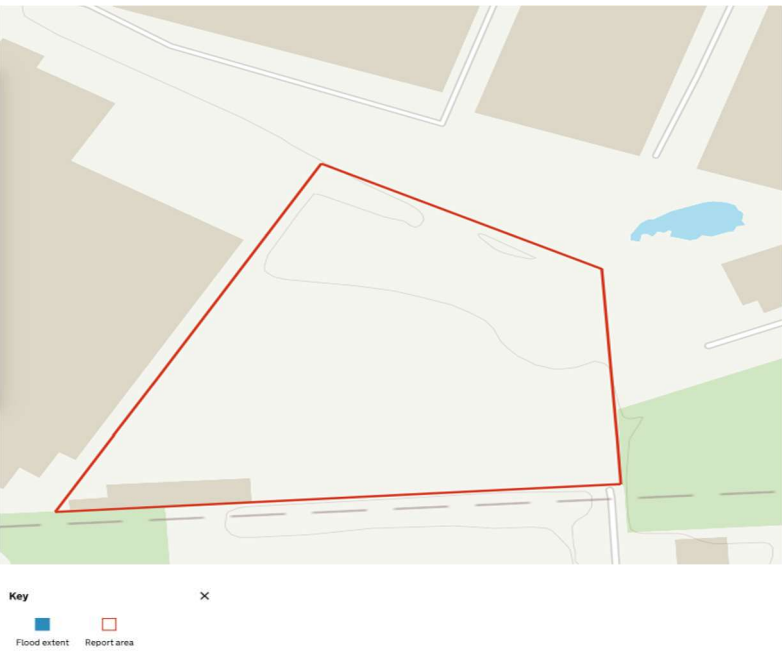
Appendix 4

- Flood Maps For Planning
- Long Term Flood Risk Mapping

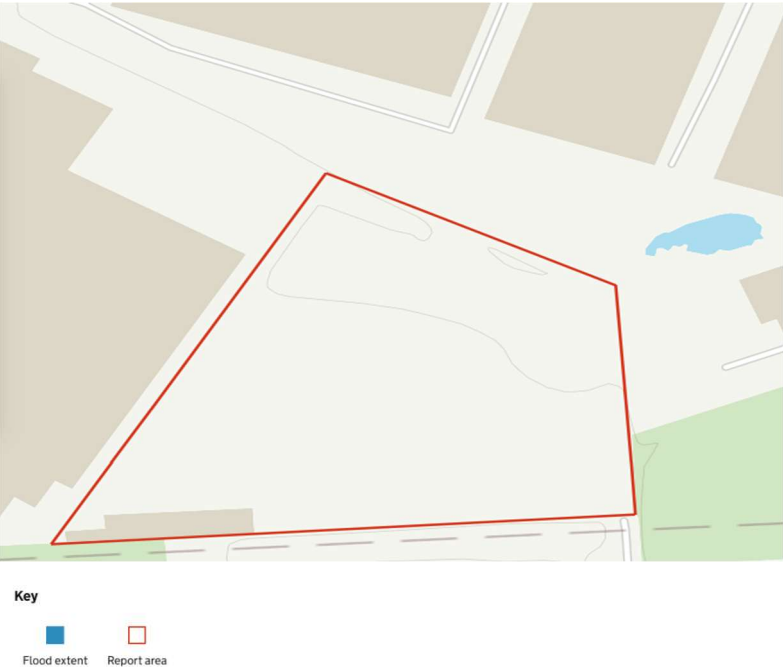
Flood Zones



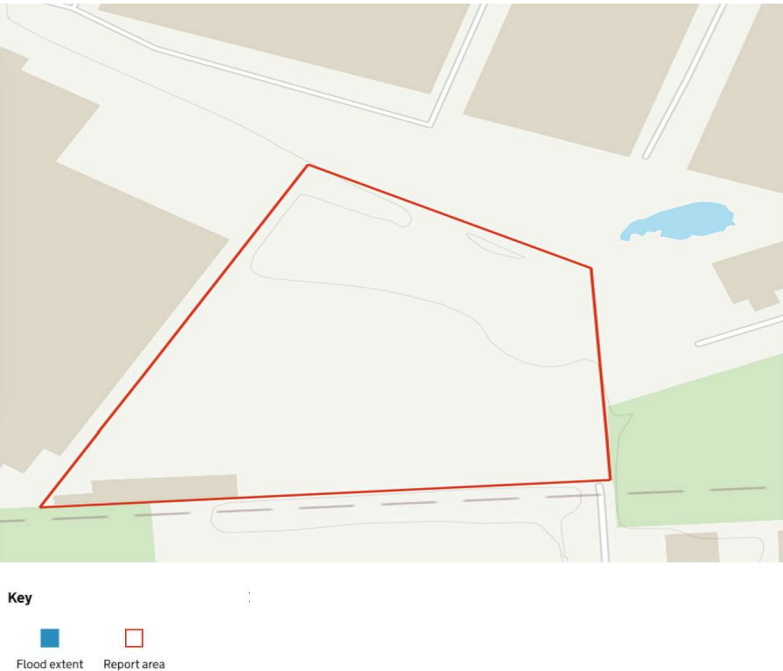
Rivers and Sea with Defences – Present Day 1 in 30



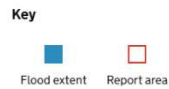
Rivers and Sea with Defences – Present Day 1 in 100



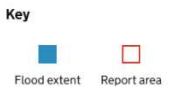
Rivers and Sea with Defences – Present Day 1 in 1000



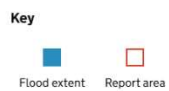
Rivers and Sea with Defences – Climate Change 1 in 30



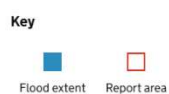
Rivers and Sea with Defences – Climate Change 1 in 100



Rivers and Sea with Defences – Climate Change 1 in 1000



Rivers and Sea without Defences – Present Day 1 in 100



Rivers and Sea without Defences – Present Day 1 in 1000



Key

■ Flood extent □ Report area

Rivers and Sea without Defences – Climate Change in 100



Key

■ Flood extent □ Report area

Rivers and Sea without Defences – Climate Change in 1000



Key

Flood extent Report area

Surface water 1 in 30



Key

Flood extent Report area

Surface Water 1 in 100



Key

 Flood extent

 Report area

Surface Water 1 in 1000



Key

 Flood extent

 Report area

Flood map for planning

Your reference
C4884

Location (easting/northing)
342556/397213

Created
19 June 2025 08:55

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

You will need to do a flood risk assessment if your site is **any of the following**:

- bigger than 1 hectare (ha)
- in an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

Notes

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

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

Flood risk data is covered by the Open Government Licence which sets out the terms and conditions for using government data. <https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3>

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2025 AC0000807064. <https://flood-map-for-planning.service.gov.uk/os-terms>



Flood map for planning

Your reference

C4884

Location (easting/northing)

342556/397213

Scale

1:2,500

Created

19 Jun 2025 08:55

-  Selected area
-  Flood zone 3
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Water storage area



0 20 40 60m

Appendix 5

- Greenfield Runoff Estimations
- Attenuation Volume Estimates
- Surface Water drainage Calculations, Network 1 (South East Outfall)
- Surface Water drainage Calculations, Network 2 (South West Outfall)
- 22520-HSP-00-XX-DR-C-2000 General Arrangement Plan

Calculated by:	Sean Straw
Site name:	Moorgate Point
Site location:	Knowsley

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	53.46792° N
Longitude:	2.86534° W
Reference:	1742098256
Date:	Feb 24 2025 10:08

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	4.62
-----------------------	------

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Notes

(1) Is $Q_{BAR} < 2.0$ l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

Soil characteristics

	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

Hydrological characteristics

	Default	Edited
SAAR (mm):	863	863
Hydrological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

(3) Is $SPR/SPRHOST \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	10.76	10.76
1 in 1 year (l/s):	9.36	9.36
1 in 30 years (l/s):	18.29	18.29
1 in 100 year (l/s):	22.37	22.37
1 in 200 years (l/s):	25.49	25.49

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Quick Storage Estimate (Impermeable Area – 3.696ha)

100 year + 45% Attenuation

The screenshot shows the 'Quick Storage Estimate' software window with the 'Variables' tab selected. The window has a sidebar with buttons for 'Variables', 'Results', 'Design', 'Overview 2D', 'Overview 3D', and 'Vt'. The main area contains input fields for various parameters. At the bottom, there are buttons for 'Analyse', 'OK', 'Cancel', and 'Help', and a status bar that reads 'Enter Safety Factor between 1.0 and 50.0'.

Variable	Value
FSR Rainfall	100
Return Period (years)	100
Region	England and Wales
Map	M5-60 (mm)
Ratio R	19.800
Cv (Summer)	0.750
Cv (Winter)	0.840
Impervious Area (ha)	3.696
Maximum Allowable Discharge (l/s)	10.8
Infiltration Coefficient (m/hr)	0.00000
Safety Factor	2.0
Climate Change (%)	45

The screenshot shows the 'Quick Storage Estimate' software window with the 'Results' tab selected. The window displays the results of the storage estimate. At the bottom, there are buttons for 'Analyse', 'OK', 'Cancel', and 'Help', and a status bar that reads 'Enter Safety Factor between 1.0 and 50.0'.

Global Variables require approximate storage of between 2895 m³ and 3909 m³.

These values are estimates only and should not be used for design purposes.

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Date 01/07/2025	Designed by SMRS	
File C4884-SW Design NET 1 2025-...	Checked by	
XP Solutions	Network 2017.1.2	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for C4884-SW NET 1.SWS

Pipe Sizes C4884-SW NET 1 Manhole Sizes C4884-SW NET 1

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	0
Ratio R	0.391	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	0	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	0.75
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for C4884-SW NET 1.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	65.856	0.274	240.4	0.538	3.00	0.0	0.600	o	450	Pipe/Conduit	
S2.000	40.585	0.239	169.8	0.114	3.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	9.000	0.038	236.8	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.002	9.000	0.038	236.8	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.003	9.285	0.039	238.1	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.004	79.000	0.329	240.1	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.005	41.442	0.207	200.2	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.006	58.406	0.150	389.4	0.040	0.00	0.0	0.600	o	450	Pipe/Conduit	
S3.000	40.165	0.287	139.9	0.054	3.00	0.0	0.600	o	225	Pipe/Conduit	
S4.000	29.368	0.173	169.8	0.054	3.00	0.0	0.600	o	225	Pipe/Conduit	
S4.001	19.302	0.114	169.3	0.054	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	0.00	3.84	28.475	0.538	0.0	0.0	0.0	1.31	207.9	0.0
S2.000	0.00	3.68	28.665	0.114	0.0	0.0	0.0	1.00	39.8	0.0
S1.001	0.00	3.95	28.201	0.652	0.0	0.0	0.0	1.32	209.4	0.0
S1.002	0.00	4.07	28.063	0.652	0.0	0.0	0.0	1.32	209.4	0.0
S1.003	0.00	4.19	28.025	0.652	0.0	0.0	0.0	1.31	208.9	0.0
S1.004	0.00	5.19	27.986	0.652	0.0	0.0	0.0	1.31	208.0	0.0
S1.005	0.00	5.67	27.657	0.652	0.0	0.0	0.0	1.43	227.9	0.0
S1.006	0.00	6.62	27.450	0.692	0.0	0.0	0.0	1.02	162.9	0.0
S3.000	0.00	3.61	28.575	0.054	0.0	0.0	0.0	1.10	43.9	0.0
S4.000	0.00	3.49	28.575	0.054	0.0	0.0	0.0	1.00	39.8	0.0
S4.001	0.00	3.81	28.402	0.108	0.0	0.0	0.0	1.00	39.8	0.0

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XP Solutions	Network 2017.1.2	

Network Design Table for C4884-SW NET 1.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S3.001	12.747	0.075	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.002	4.800	0.085	56.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.003	42.951	0.286	150.0	0.044	0.00	0.0	0.600	o	300	Pipe/Conduit	
S3.004	24.981	0.167	150.0	0.051	0.00	0.0	0.600	o	300	Pipe/Conduit	
S3.005	62.547	0.150	417.0	0.040	0.00	0.0	0.600	o	450	Pipe/Conduit	
S5.000	69.000	0.345	200.0	0.581	3.00	0.0	0.600	o	525	Pipe/Conduit	
S5.001	28.850	0.481	60.0	0.581	0.00	0.0	0.600	o	600	Pipe/Conduit	
S5.002	21.900	0.333	65.8	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S6.000	70.026	0.412	170.0	0.059	3.00	0.0	0.600	o	225	Pipe/Conduit	
S7.000	42.400	0.412	102.9	0.059	3.00	0.0	0.600	o	225	Pipe/Conduit	
S6.001	15.100	0.089	169.7	0.059	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.000	47.394	0.501	94.6	0.059	3.00	0.0	0.600	o	225	Pipe/Conduit	
S9.000	22.063	0.155	142.3	0.059	3.00	0.0	0.600	o	225	Pipe/Conduit	
S9.001	16.900	0.278	60.8	0.059	0.00	0.0	0.600	o	225	Pipe/Conduit	
S6.002	14.750	0.806	18.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S5.003	12.990	0.143	90.8	0.195	0.00	0.0	0.600	o	600	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S3.001	0.00	4.02	28.288	0.162	0.0	0.0	0.0	1.00	39.8	0.0
S3.002	0.00	4.07	28.213	0.162	0.0	0.0	0.0	1.74	69.3	0.0
S3.003	0.00	4.63	28.053	0.206	0.0	0.0	0.0	1.28	90.6	0.0
S3.004	0.00	4.95	27.767	0.257	0.0	0.0	0.0	1.28	90.6	0.0
S3.005	0.00	6.01	27.450	0.297	0.0	0.0	0.0	0.99	157.3	0.0
S5.000	0.00	3.73	28.827	0.581	0.0	0.0	0.0	1.58	342.1	0.0
S5.001	0.00	3.88	28.407	1.162	0.0	0.0	0.0	3.15	890.2	0.0
S5.002	0.00	4.00	27.926	1.162	0.0	0.0	0.0	3.01	849.9	0.0
S6.000	0.00	4.17	29.275	0.059	0.0	0.0	0.0	1.00	39.8	0.0
S7.000	0.00	3.55	29.275	0.059	0.0	0.0	0.0	1.29	51.2	0.0
S6.001	0.00	4.42	28.863	0.177	0.0	0.0	0.0	1.00	39.8	0.0
S8.000	0.00	3.59	29.275	0.059	0.0	0.0	0.0	1.34	53.5	0.0
S9.000	0.00	3.34	29.207	0.059	0.0	0.0	0.0	1.09	43.5	0.0
S9.001	0.00	3.50	29.052	0.118	0.0	0.0	0.0	1.68	66.8	0.0
S6.002	0.00	4.50	28.774	0.354	0.0	0.0	0.0	3.07	122.2	0.0
S5.003	0.00	4.58	27.593	1.711	0.0	0.0	0.0	2.56	722.7	0.0

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Date 01/07/2025	Designed by SMRS	
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XP Solutions		Network 2017.1.2

Network Design Table for C4884-SW NET 1.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S5.004	32.917	0.150	219.4	0.040	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.007	10.125	0.150	67.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.008	6.000	0.075	80.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.009	9.663	0.161	60.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S5.004	0.00	4.92	27.450	1.751	0.0	0.0	0.0	1.64	463.7	0.0
S1.007	0.00	6.71	27.300	2.740	0.0	0.0	0.0	1.92	135.5	0.0
S1.008	0.00	6.80	27.150	2.740	0.0	0.0	0.0	1.12	19.9	0.0
S1.009	0.00	6.93	27.075	2.740	0.0	0.0	0.0	1.30	23.0	0.0

Free Flowing Outfall Details for C4884-SW NET 1.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.009	S32	29.372	26.914	0.000	1500	0

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Lawrence House	Moorgate Point	
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Eastwood Nottingham NG16 3SB	SW Network 1	
Date 01/07/2025	Designed by SMRS	
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Online Controls for C4884-SW NET 1.SWS

Hydro-Brake® Optimum Manhole: S7, DS/PN: S1.005, Volume (m³): 16.6

Unit Reference MD-SHE-0117-6500-1150-6500
Design Head (m) 1.150
Design Flow (l/s) 6.5
Flush-Flo™ Calculated
Objective Minimise upstream storage
Application Surface
Sump Available Yes
Diameter (mm) 117
Invert Level (m) 27.657
Minimum Outlet Pipe Diameter (mm) 150
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.150	6.5	Kick-Flo®	0.731	5.3
Flush-Flo™	0.341	6.5	Mean Flow over Head Range	-	5.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.1	1.200	6.6	3.000	10.2	7.000	15.3
0.200	6.2	1.400	7.1	3.500	11.0	7.500	15.8
0.300	6.5	1.600	7.6	4.000	11.7	8.000	16.3
0.400	6.5	1.800	8.0	4.500	12.4	8.500	16.8
0.500	6.3	2.000	8.4	5.000	13.0	9.000	17.2
0.600	6.1	2.200	8.8	5.500	13.6	9.500	17.7
0.800	5.5	2.400	9.2	6.000	14.2		
1.000	6.1	2.600	9.5	6.500	14.7		

Orifice Manhole: S13, DS/PN: S3.002, Volume (m³): 2.1

Diameter (m) 0.046 Discharge Coefficient 0.600 Invert Level (m) 28.213

Orifice Manhole: S26, DS/PN: S6.002, Volume (m³): 4.5

Diameter (m) 0.042 Discharge Coefficient 0.600 Invert Level (m) 28.774

Hydro-Brake® Optimum Manhole: S30, DS/PN: S1.008, Volume (m³): 6.5

Unit Reference MD-SHE-0124-7800-1400-7800
Design Head (m) 1.400
Design Flow (l/s) 7.8
Flush-Flo™ Calculated
Objective Minimise upstream storage
Application Surface
Sump Available Yes
Diameter (mm) 124
Invert Level (m) 27.150
Minimum Outlet Pipe Diameter (mm) 150
Suggested Manhole Diameter (mm) 1200

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Hydro-Brake® Optimum Manhole: S30, DS/PN: S1.008, Volume (m³): 6.5

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.400	7.8	Kick-Flo®	0.864	6.2
Flush-Flo™	0.411	7.8	Mean Flow over Head Range	-	6.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.4	1.200	7.3	3.000	11.2	7.000	16.7
0.200	7.1	1.400	7.8	3.500	12.0	7.500	17.3
0.300	7.6	1.600	8.3	4.000	12.8	8.000	17.8
0.400	7.8	1.800	8.8	4.500	13.5	8.500	18.4
0.500	7.7	2.000	9.2	5.000	14.2	9.000	18.9
0.600	7.6	2.200	9.6	5.500	14.9	9.500	19.4
0.800	6.8	2.400	10.0	6.000	15.5		
1.000	6.7	2.600	10.4	6.500	16.1		

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Storage Structures for C4884-SW NET 1.SWS

Tank or Pond Manhole: S6, DS/PN: S1.004

Invert Level (m) 28.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	839.8	0.800	839.8	0.801	0.0

Porous Car Park Manhole: S12, DS/PN: S3.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	72.0
Max Percolation (l/s)	200.0	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	28.970	Cap Volume Depth (m)	0.450

Porous Car Park Manhole: S26, DS/PN: S6.002

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	170.0
Max Percolation (l/s)	472.2	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	29.270	Cap Volume Depth (m)	0.450

Tank or Pond Manhole: S29, DS/PN: S1.007

Invert Level (m) 27.300

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	851.5	1.700	1940.0	2.200	2715.9

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for C4884-SW NET 1.SWS

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 0.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 4 Number of Storage Structures 4 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 20.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.391 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
 DVD Status OFF
 Inertia Status OFF

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Summer	1	+0%	30/15 Summer	30/15 Summer			28.695
S2.000	S2	15 Summer	1	+0%	30/15 Summer	30/15 Summer			28.780
S1.001	S3	15 Summer	1	+0%	30/15 Summer				28.479
S1.002	S4	15 Summer	1	+0%	30/15 Summer				28.340
S1.003	S5	15 Summer	1	+0%	30/15 Summer				28.298
S1.004	S6	180 Winter	1	+0%	100/360 Winter				28.063
S1.005	S7	180 Winter	1	+0%	30/15 Summer				28.034
S1.006	S8	600 Winter	1	+0%	30/120 Summer				27.653
S3.000	S9	60 Winter	1	+0%	1/15 Summer				28.983
S4.000	S10	30 Winter	1	+0%	1/15 Summer				28.998
S4.001	S11	30 Winter	1	+0%	1/15 Summer				28.989
S3.001	S12	60 Winter	1	+0%	1/15 Summer				28.979
S3.002	S13	60 Winter	1	+0%	1/15 Summer				28.996
S3.003	S14	15 Winter	1	+0%	100/360 Winter				28.116
S3.004	S15	15 Winter	1	+0%	30/180 Winter				27.850
S3.005	S16	600 Winter	1	+0%	30/120 Summer				27.652
S5.000	S17	15 Summer	1	+0%	30/15 Summer	100/15 Winter			29.030
S5.001	S18	15 Winter	1	+0%	100/15 Summer				28.593
S5.002	S19	15 Winter	1	+0%	30/15 Summer				28.131
S6.000	S20	15 Winter	1	+0%	30/15 Summer	100/15 Summer			29.358
S7.000	S21	15 Winter	1	+0%	30/15 Summer	100/15 Summer			29.349
S6.001	S22	15 Winter	1	+0%	1/15 Summer				29.319
S8.000	S23	15 Summer	1	+0%	30/15 Summer				29.343
S9.000	S24	15 Winter	1	+0%	30/15 Summer				29.323
S9.001	S25	120 Winter	1	+0%	1/15 Summer				29.317
S6.002	S26	120 Winter	1	+0%	1/15 Summer				29.316

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for C4884-SW NET 1.SWS

PN	US/MH Name	Surcharged		Flooded		Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)		
S1.000	S1	-0.230	0.000	0.43		83.3	OK	6
S2.000	S2	-0.110	0.000	0.49		18.5	OK	6
S1.001	S3	-0.172	0.000	0.68		96.7	OK	
S1.002	S4	-0.173	0.000	0.69		97.9	OK	
S1.003	S5	-0.177	0.000	0.68		97.3	OK	
S1.004	S6	-0.373	0.000	0.06		10.8	OK	
S1.005	S7	-0.073	0.000	0.03		6.5	OK	
S1.006	S8	-0.247	0.000	0.05		6.9	OK	
S3.000	S9	0.183	0.000	0.08		3.5	SURCHARGED	
S4.000	S10	0.198	0.000	0.15		5.6	SURCHARGED	
S4.001	S11	0.362	0.000	0.22		7.9	SURCHARGED	
S3.001	S12	0.466	0.000	0.14		4.9	SURCHARGED	
S3.002	S13	0.558	0.000	0.09		3.8	SURCHARGED	
S3.003	S14	-0.237	0.000	0.09		8.0	OK	
S3.004	S15	-0.217	0.000	0.17		13.7	OK	
S3.005	S16	-0.248	0.000	0.03		4.1	OK	
S5.000	S17	-0.322	0.000	0.29		91.4	OK	1
S5.001	S18	-0.414	0.000	0.21		148.2	OK	
S5.002	S19	-0.395	0.000	0.25		146.8	OK	
S6.000	S20	-0.142	0.000	0.22		8.4	OK	2
S7.000	S21	-0.151	0.000	0.18		8.9	OK	2
S6.001	S22	0.231	0.000	0.64		22.6	SURCHARGED	
S8.000	S23	-0.157	0.000	0.18		9.4	OK	
S9.000	S24	-0.109	0.000	0.22		8.7	OK	
S9.001	S25	0.040	0.000	0.09		5.3	SURCHARGED	
S6.002	S26	0.317	0.000	0.02		2.7	SURCHARGED	

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for C4884-SW NET 1.SWS

US/MH		Return Climate		First (X)		First (Y)		First (Z)		Overflow	Water Level	Surcharged Depth
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.			(m)	(m)
S5.003	S27	15 Winter	1	+0%	30/15 Summer						27.880	-0.313
S5.004	S28	15 Winter	1	+0%	30/15 Summer						27.738	-0.312
S1.007	S29	600 Winter	1	+0%	1/240 Winter						27.652	0.052
S1.008	S30	480 Winter	1	+0%	1/15 Summer						27.661	0.361
S1.009	S31	600 Winter	1	+0%							27.139	-0.086

Flooded			Pipe			Level	
US/MH	Volume	Flow / Overflow	Flow			Exceeded	
PN	Name	(m³)	Cap.	(l/s)	(l/s)	Status	
S5.003	S27	0.000	0.46		173.5	OK	
S5.004	S28	0.000	0.46		178.3	OK	
S1.007	S29	0.000	0.11		10.7	SURCHARGED	
S1.008	S30	0.000	0.47		7.7	SURCHARGED	
S1.009	S31	0.000	0.38		7.7	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for C4884-SW NET 1.SWS

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 0.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 4 Number of Storage Structures 4 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 20.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.391 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
 DVD Status OFF
 Inertia Status OFF

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Summer	30	+40%	30/15 Summer	30/15 Summer			29.853
S2.000	S2	15 Summer	30	+40%	30/15 Summer	30/15 Summer			29.790
S1.001	S3	15 Summer	30	+40%	30/15 Summer				29.349
S1.002	S4	15 Summer	30	+40%	30/15 Summer				29.039
S1.003	S5	15 Summer	30	+40%	30/15 Summer				28.727
S1.004	S6	1440 Winter	30	+40%	100/360 Winter				28.330
S1.005	S7	1440 Winter	30	+40%	30/15 Summer				28.331
S1.006	S8	1440 Winter	30	+40%	30/120 Summer				28.313
S3.000	S9	15 Summer	30	+40%	1/15 Summer				29.160
S4.000	S10	15 Summer	30	+40%	1/15 Summer				29.371
S4.001	S11	15 Winter	30	+40%	1/15 Summer				29.280
S3.001	S12	120 Winter	30	+40%	1/15 Summer				29.150
S3.002	S13	120 Winter	30	+40%	1/15 Summer				29.143
S3.003	S14	1440 Winter	30	+40%	100/360 Winter				28.314
S3.004	S15	1440 Winter	30	+40%	30/180 Winter				28.314
S3.005	S16	1440 Winter	30	+40%	30/120 Summer				28.313
S5.000	S17	15 Summer	30	+40%	30/15 Summer	100/15 Winter			29.396
S5.001	S18	15 Winter	30	+40%	100/15 Summer				28.986
S5.002	S19	15 Winter	30	+40%	30/15 Summer				28.762
S6.000	S20	15 Summer	30	+40%	30/15 Summer	100/15 Summer			30.079
S7.000	S21	15 Summer	30	+40%	30/15 Summer	100/15 Summer			29.993
S6.001	S22	15 Summer	30	+40%	1/15 Summer				29.847
S8.000	S23	240 Winter	30	+40%	30/15 Summer				29.535
S9.000	S24	15 Summer	30	+40%	30/15 Summer				29.715
S9.001	S25	15 Summer	30	+40%	1/15 Summer				29.609
S6.002	S26	240 Winter	30	+40%	1/15 Summer				29.533

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for C4884-SW NET 1.SWS

PN	US/MH Name	Surcharged Flooded		Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)					
S1.000	S1	0.928	0.443	1.37		264.2	FLOOD	6
S2.000	S2	0.900	0.192	1.36		51.4	FLOOD	6
S1.001	S3	0.698	0.000	2.18		309.0	SURCHARGED	
S1.002	S4	0.526	0.000	2.18		308.9	SURCHARGED	
S1.003	S5	0.252	0.000	2.19		312.1	SURCHARGED	
S1.004	S6	-0.106	0.000	0.04		8.0	OK	
S1.005	S7	0.224	0.000	0.03		6.5	SURCHARGED	
S1.006	S8	0.413	0.000	0.05		6.9	SURCHARGED	
S3.000	S9	0.360	0.000	0.70		29.0	SURCHARGED	
S4.000	S10	0.571	0.000	0.75		27.8	SURCHARGED	
S4.001	S11	0.653	0.000	1.48		53.3	SURCHARGED	
S3.001	S12	0.637	0.000	0.14		4.9	SURCHARGED	
S3.002	S13	0.705	0.000	0.10		4.2	SURCHARGED	
S3.003	S14	-0.039	0.000	0.05		4.5	OK	
S3.004	S15	0.247	0.000	0.07		5.6	SURCHARGED	
S3.005	S16	0.413	0.000	0.04		6.3	SURCHARGED	
S5.000	S17	0.044	0.000	1.00		315.1	SURCHARGED	1
S5.001	S18	-0.021	0.000	0.69		480.8	OK	
S5.002	S19	0.236	0.000	0.83		482.2	SURCHARGED	
S6.000	S20	0.579	0.000	0.68		26.2	SURCHARGED	2
S7.000	S21	0.493	0.000	0.59		28.9	SURCHARGED	2
S6.001	S22	0.759	0.000	2.32		81.4	SURCHARGED	
S8.000	S23	0.035	0.000	0.10		5.3	SURCHARGED	
S9.000	S24	0.283	0.000	0.79		31.3	SURCHARGED	
S9.001	S25	0.332	0.000	1.03		61.2	SURCHARGED	
S6.002	S26	0.534	0.000	0.03		3.2	SURCHARGED	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for C4884-SW NET 1.SWS

PN	US/MH		Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level	Surcharged Depth
	Name	Storm							(m)	(m)
S5.003	S27	15 Winter	30	+40%	30/15 Summer				28.535	0.342
S5.004	S28	1440 Winter	30	+40%	30/15 Summer				28.314	0.264
S1.007	S29	1440 Winter	30	+40%	1/240 Winter				28.313	0.713
S1.008	S30	1440 Winter	30	+40%	1/15 Summer				28.311	1.011
S1.009	S31	720 Summer	30	+40%					27.139	-0.086

PN	US/MH Name	Flooded		Pipe		Status	Level
		Volume (m³)	Flow / Overflow Cap. (l/s)	Flow (l/s)			Exceeded
S5.003	S27	0.000	1.47	558.5	SURCHARGED		
S5.004	S28	0.000	0.09	34.1	SURCHARGED		
S1.007	S29	0.000	0.16	15.1	SURCHARGED		
S1.008	S30	0.000	0.47	7.7	SURCHARGED		
S1.009	S31	0.000	0.38	7.7	OK		

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for
C4884-SW NET 1.SWS

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m ³ /ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Synthetic Rainfall Details

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

									Water
	US/MH		Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Level
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	(m)
S1.000	S1	15 Winter	100	+45%	30/15 Summer	30/15 Summer			29.869
S2.000	S2	15 Winter	100	+45%	30/15 Summer	30/15 Summer			29.794
S1.001	S3	15 Summer	100	+45%	30/15 Summer				29.435
S1.002	S4	15 Summer	100	+45%	30/15 Summer				29.120
S1.003	S5	15 Summer	100	+45%	30/15 Summer				28.777
S1.004	S6	2160 Winter	100	+45%	100/360 Winter				28.566
S1.005	S7	2160 Winter	100	+45%	30/15 Summer				28.577
S1.006	S8	1440 Winter	100	+45%	30/120 Summer				28.551
S3.000	S9	15 Summer	100	+45%	1/15 Summer				29.309
S4.000	S10	15 Summer	100	+45%	1/15 Summer				29.680
S4.001	S11	15 Summer	100	+45%	1/15 Summer				29.513
S3.001	S12	120 Winter	100	+45%	1/15 Summer				29.257
S3.002	S13	120 Winter	100	+45%	1/15 Summer				29.249
S3.003	S14	1440 Winter	100	+45%	100/360 Winter				28.553
S3.004	S15	1440 Winter	100	+45%	30/180 Winter				28.552
S3.005	S16	1440 Winter	100	+45%	30/120 Summer				28.551
S5.000	S17	15 Winter	100	+45%	30/15 Summer	100/15 Winter			30.552
S5.001	S18	15 Winter	100	+45%	100/15 Summer				30.078
S5.002	S19	15 Winter	100	+45%	30/15 Summer				29.618
S6.000	S20	15 Summer	100	+45%	30/15 Summer	100/15 Summer			30.401
S7.000	S21	15 Summer	100	+45%	30/15 Summer	100/15 Summer			30.394
S6.001	S22	15 Winter	100	+45%	1/15 Summer				30.179
S8.000	S23	15 Summer	100	+45%	30/15 Summer				29.728
S9.000	S24	15 Summer	100	+45%	30/15 Summer				30.030
S9.001	S25	15 Summer	100	+45%	1/15 Summer				29.859
S6.002	S26	360 Winter	100	+45%	1/15 Summer				29.658

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for
C4884-SW NET 1.SWS

PN	US/MH Name	Surcharged Flooded		Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)					
S1.000	S1	0.944	16.395	1.39		268.0	FLOOD	6
S2.000	S2	0.904	4.196	1.38		52.1	FLOOD	6
S1.001	S3	0.784	0.000	2.22		315.4	SURCHARGED	
S1.002	S4	0.607	0.000	2.26		319.7	SURCHARGED	
S1.003	S5	0.302	0.000	2.27		323.6	SURCHARGED	
S1.004	S6	0.130	0.000	0.04		7.5	SURCHARGED	
S1.005	S7	0.470	0.000	0.03		6.4	SURCHARGED	
S1.006	S8	0.651	0.000	0.05		6.9	SURCHARGED	
S3.000	S9	0.509	0.000	0.94		39.2	SURCHARGED	
S4.000	S10	0.880	0.000	1.00		37.1	FLOOD RISK	
S4.001	S11	0.886	0.000	1.99		71.5	FLOOD RISK	
S3.001	S12	0.744	0.000	0.14		4.7	SURCHARGED	
S3.002	S13	0.811	0.000	0.11		4.4	SURCHARGED	
S3.003	S14	0.200	0.000	0.06		5.1	SURCHARGED	
S3.004	S15	0.485	0.000	0.08		6.3	SURCHARGED	
S3.005	S16	0.651	0.000	0.05		7.4	SURCHARGED	
S5.000	S17	1.200	0.079	1.21		379.1	FLOOD	1
S5.001	S18	1.071	0.000	0.96		665.0	SURCHARGED	
S5.002	S19	1.092	0.000	1.16		668.7	FLOOD RISK	
S6.000	S20	0.901	0.903	0.84		32.5	FLOOD	2
S7.000	S21	0.894	0.203	0.77		37.4	FLOOD	2
S6.001	S22	1.091	0.000	2.99		104.7	FLOOD RISK	
S8.000	S23	0.228	0.000	0.84		43.0	SURCHARGED	
S9.000	S24	0.598	0.000	1.04		41.5	SURCHARGED	
S9.001	S25	0.582	0.000	1.36		81.1	SURCHARGED	
S6.002	S26	0.659	0.000	0.03		3.4	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for C4884-SW NET 1.SWS

PN	US/MH		Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level	Surcharged Depth
	Name	Storm							(m)	(m)
S5.003	S27	15 Winter	100	+45%	30/15 Summer				29.168	0.975
S5.004	S28	1440 Winter	100	+45%	30/15 Summer				28.553	0.503
S1.007	S29	1440 Winter	100	+45%	1/240 Winter				28.551	0.951
S1.008	S30	1440 Winter	100	+45%	1/15 Summer				28.546	1.246
S1.009	S31	1440 Winter	100	+45%					27.139	-0.086

PN	US/MH	Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Status	Level Exceeded
	Name	Volume (m³)			Flow (l/s)		
S5.003	S27	0.000	2.08		786.9	SURCHARGED	
S5.004	S28	0.000	0.12		44.9	SURCHARGED	
S1.007	S29	0.000	0.13		12.6	SURCHARGED	
S1.008	S30	0.000	0.47		7.8	SURCHARGED	
S1.009	S31	0.000	0.38		7.8	OK	

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for C4884-SW NET 2.SWS

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	0
Ratio R	0.391	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	0	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	0.75
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for C4884-SW NET 2.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	61.000	0.508	120.0	0.314	3.00	0.0	0.600	o	300	Pipe/Conduit	
S1.001	4.214	0.050	84.3	0.314	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.002	48.625	0.243	200.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.003	56.800	0.396	143.4	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.004	17.285	0.086	200.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S2.000	31.251	0.366	85.4	0.053	3.00	0.0	0.600	o	150	Pipe/Conduit	
S2.001	17.581	0.245	71.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.002	22.727	0.134	170.0	0.149	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.003	9.000	0.060	150.0	0.149	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.004	9.000	0.060	150.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.005	6.000	0.075	80.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	0.00	3.71	28.278	0.314	0.0	0.0	0.0	1.43	101.4	0.0
S1.001	0.00	3.74	27.620	0.628	0.0	0.0	0.0	2.22	352.4	0.0
S1.002	0.00	4.31	27.570	0.628	0.0	0.0	0.0	1.43	228.1	0.0
S1.003	0.00	4.86	27.327	0.628	0.0	0.0	0.0	1.70	269.7	0.0
S1.004	0.00	5.06	26.931	0.628	0.0	0.0	0.0	1.43	228.1	0.0
S2.000	0.00	3.48	28.109	0.053	0.0	0.0	0.0	1.09	19.2	0.0
S2.001	0.00	3.67	27.668	0.053	0.0	0.0	0.0	1.55	61.5	0.0
S2.002	0.00	4.05	27.423	0.202	0.0	0.0	0.0	1.00	39.8	0.0
S2.003	0.00	4.16	27.214	0.351	0.0	0.0	0.0	1.28	90.6	0.0
S2.004	0.00	4.28	27.054	0.351	0.0	0.0	0.0	1.28	90.6	0.0
S1.005	0.00	5.15	26.844	0.979	0.0	0.0	0.0	1.12	19.9	0.0

Free Flowing Outfall Details for C4884-SW NET 2.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
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S1.005	S111	28.192	26.769	0.000	1500	0
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Online Controls for C4884-SW NET 2.SWS

Hydro-Brake® Optimum Manhole: S110, DS/PN: S1.005, Volume (m³): 6.6

Unit Reference	MD-SHE-0077-3000-1350-3000
Design Head (m)	1.350
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	77
Invert Level (m)	26.844
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.350	3.0	Kick-Flo®	0.689	2.2
Flush-Flo™	0.338	2.7	Mean Flow over Head Range	-	2.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.2	1.200	2.8	3.000	4.3	7.000	6.5
0.200	2.6	1.400	3.0	3.500	4.7	7.500	6.7
0.300	2.7	1.600	3.2	4.000	5.0	8.000	6.9
0.400	2.7	1.800	3.4	4.500	5.2	8.500	7.1
0.500	2.7	2.000	3.6	5.000	5.5	9.000	7.3
0.600	2.5	2.200	3.8	5.500	5.8	9.500	7.5
0.800	2.4	2.400	3.9	6.000	6.0		
1.000	2.6	2.600	4.1	6.500	6.2		

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Storage Structures for C4884-SW NET 2.SWS

Tank or Pond Manhole: S104, DS/PN: S1.004

Invert Level (m) 27.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	705.0	1.200	705.0	1.201	0.0

Tank or Pond Manhole: S105, DS/PN: S2.000

Invert Level (m) 28.800

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	20.0	0.650	92.0

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for C4884-SW NET 2.SWS

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 0.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 20.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.391 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
 DVD Status ON
 Inertia Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 40, 45

									Water	Surcharged
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)	Depth (m)
S1.000	S100	15 Summer	1	+0%	30/15 Summer	30/15 Summer			28.439	-0.139
S1.001	S101	15 Summer	1	+0%	30/15 Summer				27.845	-0.224
S1.002	S102	15 Winter	1	+0%	30/15 Summer				27.770	-0.250
S1.003	S103	15 Winter	1	+0%	30/15 Summer				27.505	-0.271
S1.004	S104	360 Winter	1	+0%	30/60 Summer				27.176	-0.205
S2.000	S105	15 Summer	1	+0%	30/15 Summer				28.184	-0.075
S2.001	S106	15 Summer	1	+0%	30/15 Summer				27.730	-0.163
S2.002	S107	15 Winter	1	+0%	30/15 Summer	30/15 Summer			27.564	-0.084
S2.003	S108	15 Winter	1	+0%	30/15 Summer				27.433	-0.081
S2.004	S109	15 Winter	1	+0%	1/15 Summer				27.410	0.056
S1.005	S110	15 Winter	1	+0%	1/15 Summer				27.329	0.335

			Flooded		Pipe			
PN	US/MH Name	Volume (m ³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status	Level Exceeded	
S1.000	S100	0.000	0.51		49.6	OK	6	
S1.001	S101	0.000	0.50		85.1	OK		
S1.002	S102	0.000	0.40		83.1	OK		
S1.003	S103	0.000	0.33		80.6	OK		
S1.004	S104	0.000	0.02		4.0	OK		
S2.000	S105	0.000	0.47		8.6	OK		
S2.001	S106	0.000	0.16		8.9	OK		
S2.002	S107	0.000	0.70		25.4	OK	6	
S2.003	S108	0.000	0.68		42.0	OK		
S2.004	S109	0.000	0.63		38.6	SURCHARGED		
S1.005	S110	0.000	0.16		2.7	SURCHARGED		

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for C4884-SW NET 2.SWS

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 0.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 20.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.391 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
 DVD Status ON
 Inertia Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 40, 45

										Water	Surcharged
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)	Depth (m)	
S1.000	S100	15 Summer	30	+40%	30/15 Summer	30/15 Summer			29.779	1.201	
S1.001	S101	15 Winter	30	+40%	30/15 Summer				28.597	0.528	
S1.002	S102	15 Winter	30	+40%	30/15 Summer				28.320	0.301	
S1.003	S103	15 Winter	30	+40%	30/15 Summer				27.873	0.097	
S1.004	S104	960 Winter	30	+40%	30/60 Summer				27.758	0.378	
S2.000	S105	15 Winter	30	+40%	30/15 Summer				28.913	0.654	
S2.001	S106	15 Winter	30	+40%	30/15 Summer				28.853	0.960	
S2.002	S107	15 Winter	30	+40%	30/15 Summer	30/15 Summer			28.848	1.200	
S2.003	S108	15 Summer	30	+40%	30/15 Summer				28.171	0.656	
S2.004	S109	15 Winter	30	+40%	1/15 Summer				27.995	0.641	
S1.005	S110	60 Winter	30	+40%	1/15 Summer				27.844	0.850	

		<u>Flooded</u>		<u>Pipe</u>					
PN	US/MH Name	Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded		
S1.000	S100	1.491	1.56		150.3	FLOOD	6		
S1.001	S101	0.000	1.78		301.3	SURCHARGED			
S1.002	S102	0.000	1.42		294.4	SURCHARGED			
S1.003	S103	0.000	1.11		274.4	SURCHARGED			
S1.004	S104	0.000	0.03		5.8	SURCHARGED			
S2.000	S105	0.000	1.44		26.6	SURCHARGED			
S2.001	S106	0.000	0.58		31.8	FLOOD RISK			
S2.002	S107	0.126	2.16		78.8	FLOOD	6		
S2.003	S108	0.000	2.42		148.7	SURCHARGED			
S2.004	S109	0.000	2.41		148.1	SURCHARGED			
S1.005	S110	0.000	0.16		2.7	SURCHARGED			

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for C4884-SW NET 2.SWS

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 0.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 20.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.391 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
 DVD Status ON
 Inertia Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 40, 45

									Water
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)
S1.000	S100	15 Winter	100	+45%	30/15 Summer	30/15 Summer			29.794
S1.001	S101	15 Winter	100	+45%	30/15 Summer				29.087
S1.002	S102	15 Winter	100	+45%	30/15 Summer				28.717
S1.003	S103	15 Summer	100	+45%	30/15 Summer				28.087
S1.004	S104	1440 Winter	100	+45%	30/60 Summer				28.063
S2.000	S105	15 Winter	100	+45%	30/15 Summer				29.015
S2.001	S106	15 Winter	100	+45%	30/15 Summer				28.880
S2.002	S107	15 Winter	100	+45%	30/15 Summer	30/15 Summer			28.855
S2.003	S108	30 Summer	100	+45%	30/15 Summer				28.382
S2.004	S109	60 Winter	100	+45%	1/15 Summer				28.204
S1.005	S110	60 Winter	100	+45%	1/15 Summer				28.194

		Surcharged Flooded			Pipe			
PN	US/MH Name	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S100	1.216	16.004	1.63		157.2	FLOOD	6
S1.001	S101	1.017	0.000	2.02		342.4	SURCHARGED	
S1.002	S102	0.697	0.000	1.61		333.7	SURCHARGED	
S1.003	S103	0.311	0.000	1.27		315.5	SURCHARGED	
S1.004	S104	0.682	0.000	0.03		5.5	SURCHARGED	
S2.000	S105	0.756	0.000	1.52		28.0	SURCHARGED	
S2.001	S106	0.987	0.000	0.58		31.6	FLOOD RISK	
S2.002	S107	1.207	6.670	2.53		92.2	FLOOD	6
S2.003	S108	0.868	0.000	2.61		160.4	SURCHARGED	
S2.004	S109	0.850	0.000	1.88		115.1	SURCHARGED	
S1.005	S110	1.200	0.000	0.16		2.7	SURCHARGED	

Key:

Existing Public Foul/Combined -----□-----

Existing Public Surface Water
Source

Proposed Surface Water Sewer

Proposed Foul Sewer

Proposed Surface Water Lateral

Proposed Foul Lateral Drain

Proposed Road Gully

Finished Floor Levels EEI 30,000

Approximate location and height of retaining wall. RW 0.6m

Approximate location of vehicle restraint barrier

Proposed Permeable Pavement
Load Catagory 2

Proposed Permeable Pavement
Load Catgory 4

Proposed public sewer easement

Site Boundary

Note: -
Levels shown are preliminary only and subject to further detailed design. All levels may change, including finished floor levels of buildings, by up to 500mm.

Note: -
Verify all existing connection levels and pipe diameters prior to the commencement of pipe laying. Grills to be placed at the last manholes on site to prevent constructional debris entering the public sewers during construction.

Tan

General Notes

1. Do not scale

3. Should there be any discrepancy between details indicated on this drawing and those indicated on other drawings the Engineer should be informed PRIOR to construction on site.

4. Until technical approval has been obtained from the relevant Authorities it should be understood that all drawings issued are preliminary and NOT for construction. Should the contractor start site work prior to approval been given, it is entirely at his own risk.

5. All dimensions shown are in metres unless noted otherwise.

6. This drawing is based on UMC Architects Drawing reference, 22520-UMC-ZZZZ-SI-M2-A-0616-P.03 Masterplan.

7. All survey information is provided by the surveying company and HSP cannot accept any liability for any discrepancies there in. All survey information to be verified on site by contractor. Should discrepancies be identified, HSP to be notified immediately.

8. Cut & Fill works to be undertaken in accordance with Volume 1 Specification for Highway Works series 600 in the absence of an alternative specification.

9. HSP to approve contractor's earthworks specification and method statement PRIOR to commencing works on site.

10. Cut & Fill volumes shown assume earthworks are undertaken in reasonable conditions. Should a period of inclement weather or excessively dry or wet material be experienced, HSP to be informed PRIOR to recommencing the earthworks to evaluate the suitability of the material and advise on any remediation works that may be required.

11. All earthworks including site stripping of topsoil and stockpiling are to be protected on a daily basis to ensure minimal water ingress and limit deterioration of the below ground.

12. Stock piling of material should be avoided where possible.

13. Should ground conditions contradict the Ground Investigation or the assumption setout on this drawing, HSP Consulting Engineers Ltd are to be informed immediately on discovery of adverse ground conditions.

14. Should the earthworks not be carried out in accordance with the assumptions set out on this drawing the result of this calculation will not be valid. HSP Consulting Engineers Ltd do not accept any liability for costs arising as a consequence.

P05	SS	22.07.25	Additional drainage details added	PD
P04	SS	16.07.25	Vehicle restraint barrier and additional notes added	PD
P03	SS	07.07.25	Minor detail amendments	PD
P02	SS	23.06.25	Generally updated. Additional details added	PD
P01	SS	27.02.25	Initial issue	PD

REV	BY	DATE	DETAILS	CHK
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STATUS	S2 - INFORMATION
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CLIENT

Indurent

PROJECT

Indurent Park
Moorgate Point, Knowsley

TITLE

General Arrangement



Lawrence House, 6 Meadowbank Way, Eastwood, Nottingham, NG16 3SE
Tel: 01773 535555 www.hspconsulting.com

SCALE	PROJECT NO.	SHEET
1:500	C4884	SIZE A1

DATE	DRAWN	CHECKE
27.02.2025	SMRS	PD

DRAWING NO.	REVISION
22520-HSP-00-XX-DR-C-2000	P0

Appendix 6 ▪ Operation & Maintenance Guidance

Manholes and Inspection Chambers

Description

Manholes providing rodding and jetting access to pipe work.

Typically manholes, in distinction to inspection chambers, are designed to allow for operatives to access. Manholes should only be accessed following a risk assessment, and the specification of the safe system of work, paying regard to confined space risks.

Maintenance Issues

Manholes are unlikely to present maintenance issues in themselves. However, they provide access to the drainage infrastructure and allow visual inspection from the surface of any major maintenance issues.

Maintenance Regime

Schedule	Action Required	Frequency
Routine/regular maintenance (including inspections and monitoring)	Lift covers and ensure that there are no blockages.	For 3 months following installation
	Inspect and identify any parts that are not operating correctly and remediate.	
	Ensure covers are in a good state of repair.	Monthly
	Inspect manholes, and inspection chambers, to ensure that the drainage is running freely.	Six Monthly and every autumn after leaf fall
Occasional maintenance	Suction sweeping and cleansing (to WRC Jetting Code of Practice) and CCTV where necessary.	Every 2 – 4 Years
Remedial maintenance	• Silt removal. • Inlet/outlet repair. • Erosion repairs. • System rehabilitation following a pollution event. • Manhole Cover Replacement. • Repairs to brickwork or concrete. • Chancel repair.	As required (tasks to repair problems due to wear, damage or vandalism).

Catchpits

Description

Catchpits are similar to manholes but include a sump to the base which is designed to capture silt and prevent it reaching other parts of the drainage network. Catchpits provide a convenient location to remove silt from drainage networks. Catchpits should only be accessed following a risk assessment, and the specification of the safe system of work, paying regard to confined space risks.

Maintenance Issues

If the silt captured in catchpits is not removed regularly it will cause silt to migrate downstream to other part of the drainage network, some of which may be less accessible, or inaccessible.

Maintenance Regime

Schedule	Action Required	Frequency
Routine/regular maintenance (including inspections and monitoring)	Lift manhole covers and ensure that there are no blockages.	For 3 months following installation
	Inspect and identify any parts that are not operating correctly and remediate.	
	Inspect silt storage in sump. Remove silt as required using subcontractor with vacuum extraction plant.	
	Ensure covers are in a good state of repair. Repair/replace as necessary.	Monthly
	Inspect catchpits to ensure that the drainage is running freely, and free of debris.	Six Monthly and every autumn after leaf fall
	Inspect silt storage in sump. Remove silt as required using subcontractor with vacuum extraction plant.	
Occasional maintenance	Suction sweeping and cleansing (to WRC Jetting Code of Practice) and CCTV where necessary.	Every 2 – 4 Years
	Remediate any chamber structural defects, or any defects that may reduce the free flow of water.	
Remedial maintenance	• Silt removal. • Inlet/outlet repair. • Erosion repairs. • System rehabilitation following a pollution event. • Manhole Cover Replacement. • Repairs to brickwork or concrete.	As required (tasks to repair problems due to wear, damage or vandalism).

Linear Drains

Description

Surface Water is drained over impermeable areas towards grated, or slot-type linear drains at low points and water is conveyed to below ground pipework.

Maintenance Issues

Linear drains can become blocked by silt or debris, causing flooding.

Linear drains often include silts traps at outlets which can cause siltation of downstream drainage infrastructure if not maintained adequately.

Maintenance Regime

Schedule	Action Required	Frequency
Routine/regular maintenance (including inspections and monitoring)	Inspect linear drains to ensure that there are no blockages at surface level.	For 3 months following installation
	Lift covers to outflow boxes and check for blockages or siltation.	
	Inspect and identify any parts that are not operating correctly and remediate.	
	Inspect linear drains to ensure that there are no blockages at surface level.	Monthly
	Lift covers to outflow boxes and check for blockages or siltation.	Six Monthly and every autumn after leaf fall
Occasional maintenance	Jetting of linear drains and suction vacuuming of outlet boxes (to WRC Jetting Code of Practice). CCTV where necessary.	Every 1 – 2 Years
Remedial maintenance	• Silt removal. • Inlet/outlet repair. • Erosion repairs. • System rehabilitation following a pollution event. • Linear drain cover replacement. • Channel repair. • Ensure that impermeable surfaces surrounding linear drains have not settled below top of linear drain level, causing ponding.	As required (tasks to repair problems due to wear, damage or vandalism).

Gullies

Description

Surface Water is drained over impermeable areas towards grated gullies at low points, from where water is conveyed to below ground pipework.

Maintenance Issues

Gullies can become blocked by silt or debris, causing flooding.

Gullies include integral silt traps which can cause siltation of downstream drainage infrastructure if not adequately maintained.

Gullies often include a trapped outlet which prevents liquids lighter than water (ie oil and fuel) leaving the gully. If silt and light liquids are not removed regularly silt and oil will migrate downstream to other part of the drainage network, some of which may be less accessible, or inaccessible.

Maintenance Regime

Schedule	Action Required	Frequency
Routine/regular maintenance (including inspections and monitoring)	Inspect to ensure that there are no blockages at surface level, and that the outfall is operating effectively.	For 3 months following installation
	Inspect and identify any parts that are not operating correctly and remediate.	
	Ensure that there are no blockages at surface level.	Monthly
	Lift covers to check for blockages or siltation.	Six Monthly and every autumn after leaf fall
Occasional maintenance	Remove oil and silt using specialist vacuum extraction plant.	Every 1 – 2 Years
Remedial maintenance	• Silt removal. • Inlet/outlet repair. • Erosion repairs. • System rehabilitation following a pollution event. • Cover replacement. • Structural failure of gully pot. • Ensure that impermeable surfaces surrounding linear drains have not settled below top of gully cover level, causing ponding.	As required (tasks to repair problems due to wear, damage or vandalism).

Pipework

Description

Below ground drainage pipework connects drainage inlets (gullies, linear drains etc) to manholes and also provides connections between manholes.

Maintenance Issues

Pipes can become blocked by silt, debris fat, grease, or suffer structural collapse. It is also possible for pipe joints to become displaced or for roots to grow from the surrounding ground into pipes.

These factors cause a reduction in, or loss of, the hydraulic capacity of the pipes which can in turn cause flooding to land and buildings.

Defects in pipes can also cause a reduction in stability to ground underlying foundations, which can cause settlement and damage to buildings and external surfaces.

The material of pipes and associated couplings can be degraded if aggressive liquids are passed through the pipes.

It is recommended that trees are not planted within 3m of pipes to minimise the risk of root ingress.

Maintenance Regime

Schedule	Action Required	Frequency
Routine/regular maintenance (including inspections and monitoring)	Inspect and identify any parts that are not operating correctly and remediate.	For 3 months following installation
	Monitor working of drainage at ground level. Evidence of damage to pipework may include localised flooding or emission of smells.	Monthly
	Lift manholes covers to check for blockages.	Six Monthly
Occasional maintenance	CCTV pipework, clean to WRC Sewer Jetting Code of Practice. Remediate as necessary.	Every 1 – 2 Years
Remedial maintenance	• Silt removal. • Fat and Grease removal. • Erosion repairs. • Joint displacement. • Structural failure, cracking or collapse. • System rehabilitation following a pollution event.	As required (tasks to repair problems due to wear, damage or vandalism).

Flow Controls

Description

Vortex controls, often called Hydrobrakes, are installed in some manholes to restrict the rate of flow. Vortex controls are usually constructed in steel and are installed in a manhole with a sump.

Maintenance Issues

Vortex controls can become blocked by debris, plastic bags or other sheet material. If silt is allowed build up in the sump the operation of the device can be hampered causing flooding upstream.

Maintenance Regime

Schedule	Action Required	Frequency
Routine/regular maintenance (including inspections and monitoring)	Refer to manufacturer's specification.	For 3 months following installation
	Inspect and identify any parts that are not operating correctly, consult supplier and remediate as required.	
	Monitor working of drainage at ground level.	Monthly
	If there is localised flooding check the condition of all system elements.	
Occasional maintenance	Lift manholes covers to check for blockages.	Six Monthly and every autumn after leaf fall
	Remove sediment from pre-treatment structures, gullies, catchpits etc.	
Occasional maintenance	Clean to WRC Sewer Jetting Code of Practice.	Every 1 – 2 Years
	Remediate as necessary.	
Remedial maintenance	Inspect, and carry out remediation works to ensure that the features are in fully working order.	As required (tasks to repair problems due to wear, damage or vandalism).

Geocellular Attenuation Storage

Description

Geocellular storage systems are modular plastic units with a high porosity that can be used to efficiently create a below-ground structure for the temporary storage of surface water before being released.

Maintenance Issues

The main maintenance issue with geocellular attenuation storage is the prospective build up of silt within the units. It is imperative that the upstream and downstream catchpits are inspected and emptied regularly to prevent the ingress of silt into the system.

Maintenance Regime

Schedule	Action Required	Frequency
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	For 3 months following installation, then annually.
	Remove debris from the catchment surface (where it may cause a risk to performance)	Monthly
	For systems where rainfall infiltrate into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary	Annually
	Remove Sediment from pre-treatment structures and/or internal forebays.	Annual, or as required
Remedial Actions	Repair/rehabilitate inlets, outlets, overflows and vents.	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed.	Annually
	Survey inside of tank for sediment build-up and remove if necessary.	Every five years or as required

Rainwater Harvesting Systems

Description

Rainwater harvesting (RWH) is the collection of rainwater runoff for use. Runoff can be collected from roofs and other impermeable areas, stored, treated (where required), then used as a supply of water for domestic, commercial, industrial and/or institutional properties.

Maintenance Issues

The main maintenance issue with RWH systems is the potential for sediment buildup, filter and pump deterioration.

Maintenance Regime

Schedule	Action Required	Frequency
Regular Maintenance	Inspection of the tank for debris and sediment buildup, inlets/outlets/withdrawal devices, overflow areas, pumps, filters.	Annually (and following poor performance)
	Cleaning of tank, inlets, outlets, gutters, withdrawal devices and roof drain filters of silts and other debris.	Annually (and following poor performance)
Occasional Maintenance	Cleaning and/or replacement of any filters.	Three monthly (or as required)
Remedial Actions	Repair of overflow erosion damage or damage to tank	As required
	Pump repairs	As required



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