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**FORMER RELIANCE GARAGE,
TURNLEE ROAD, GLOSSOP**

FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY

Final Report for:

CAPRICE CONSTRUCTION Ltd

April 2024

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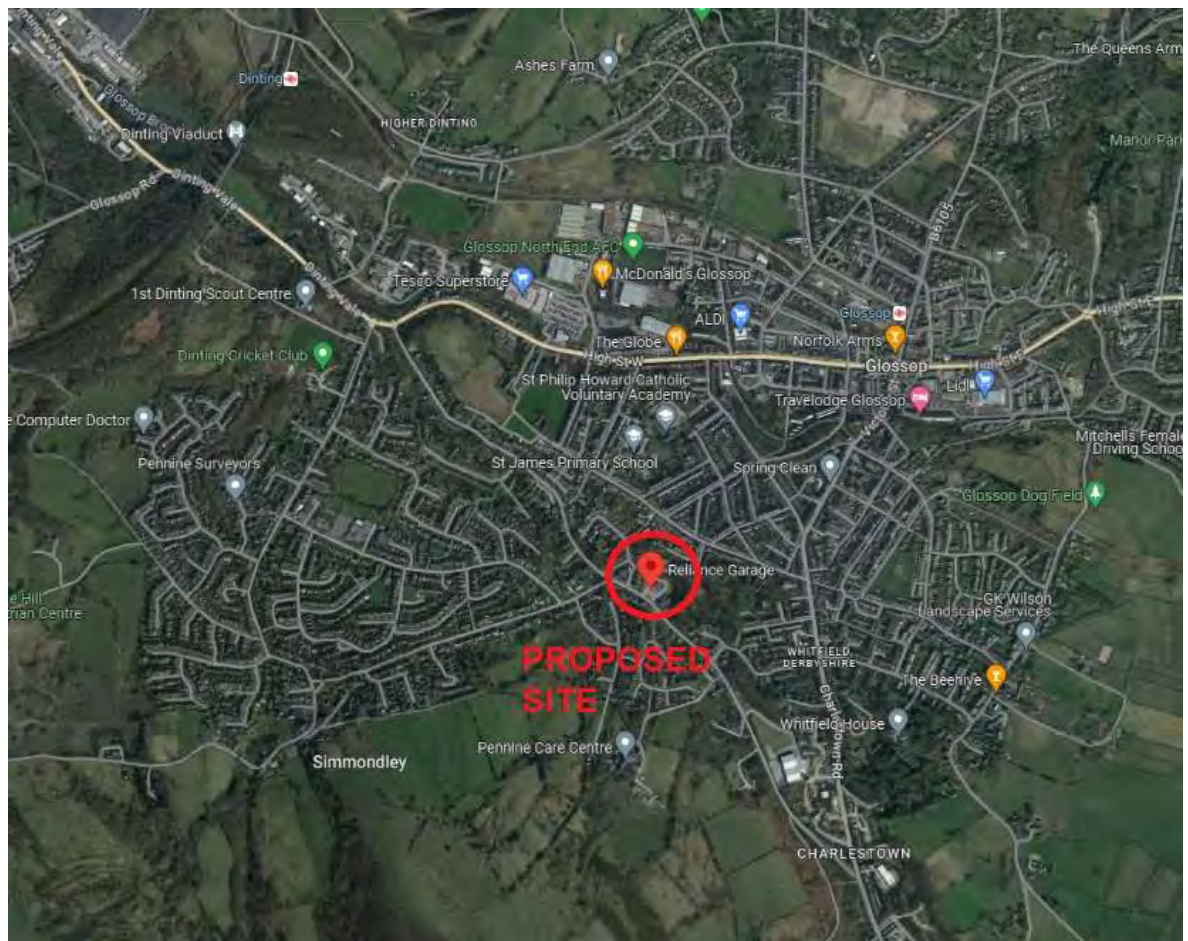
APPENDIX F – INDICATIVE DRAINAGE STRATEGY

1.0 INTRODUCTION

1.1 Overview

- 1.1.1 Cora IHT have been instructed by Caprice Construction Ltd to prepare a Flood Risk Assessment and Sustainable Drainage Strategy (SDS) to support proposals for a new residential development off Turnlee Road, Glossop Figure 1.1 illustrates the site location.
- 1.1.2 This report presents the findings of a drainage strategy that has been carried out in accordance with flood risk and coastal change guidance and the High Peak Borough Council Level 2 strategic flood risk assessment April 2014.
- 1.1.3 This SDS considers the management of surface water run-off and outlines the proposed sustainable drainage strategy.
- 1.1.4 Consideration must also be given to minimising the risk of pollution to controlled waters and the site conditions prior to, during and after development.

Figure 1.1: Site Location



2.0 SITE DESCRIPTION AND EXISTING CONDITIONS

2.1 *Site Description*

- 2.1.1 The site was previously occupied by The Reliance Garage vehicle repair and MOT station with an identified impermeable area of 4,599m² (0.46 hectares). The site is located approximately 760m to the south west of Glossop Centre and 8.42km to the east of Hyde. National Grid reference 402929 , 393544 is located at the central point of the proposed site area with the nearest postcode is identified as SK13 6PW.
- 2.1.2 A proposed site layout plan produced by Creative Forge Limited is shown in **Appendix A**.
- 2.1.3 The previous site use of a vehicle repair garage which currently benefits from an existing connection via an interceptor to the offsite United Utilities public sewer network, prior to detailed design a site specific CCTV survey should be completed to confirm suitability for reuse.
- 2.1.4 The presence of underground culverts is not anticipated, should the detailed CCTV survey identify their presence the exact routes are to be confirmed.
- 2.1.5 The Long Clough Brook runs along the northern boundary of the proposed site.

2.2 *Proposed Future Use*

- 2.2.1 A new residential development is to be introduced with off carriageway parking bays, access road and access to a green corridor link, shown in **Appendix A**.

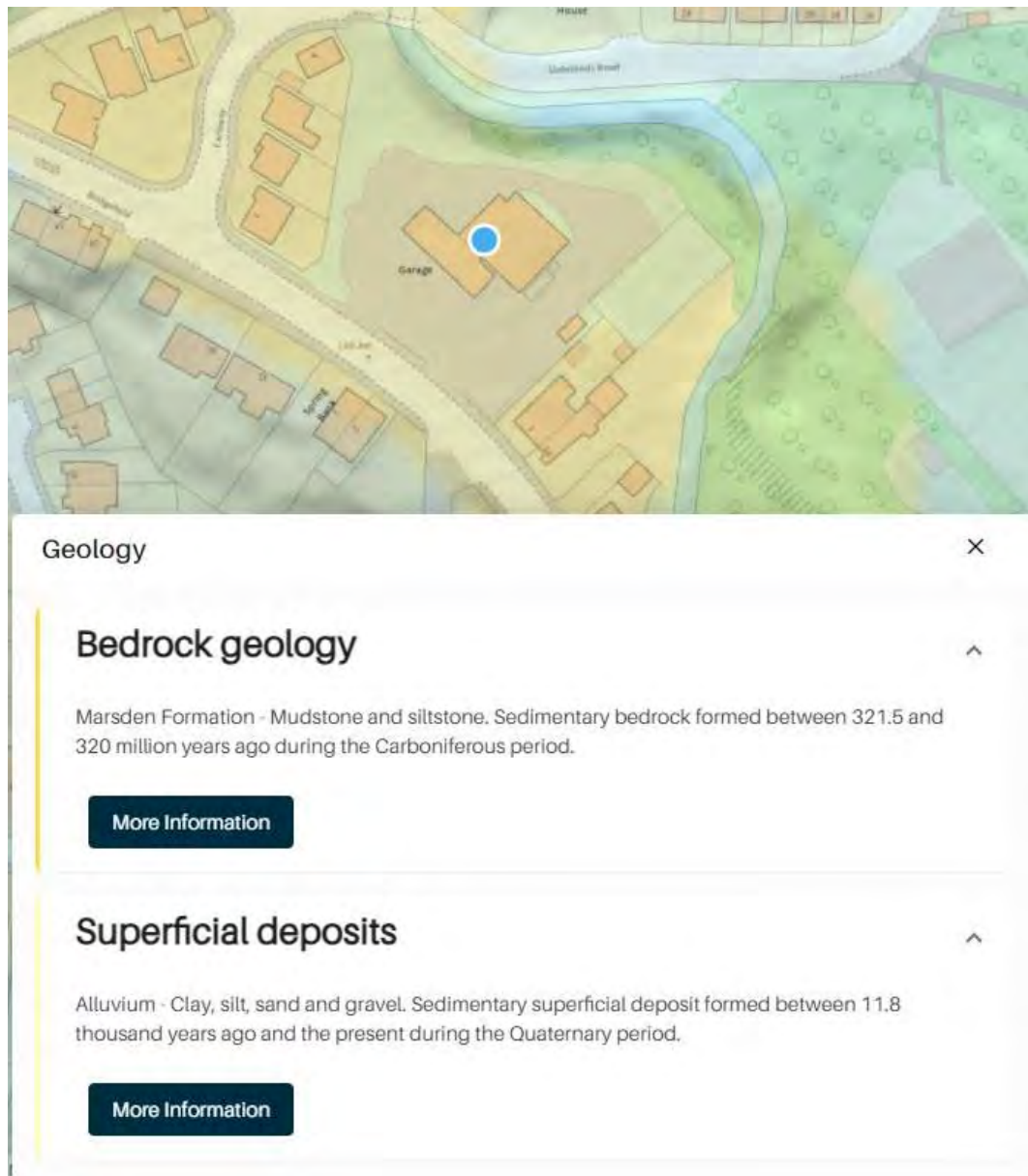
2.3 *Site Levels*

- 2.3.1 The site appears to be relatively flat with a nominal fall from east to west, the topographical survey is shown in **Appendix B**.

2.4 *Underlying Ground*

- 2.4.1 Review of the British Geological Survey (BGS) geology mapping records indicate the site would be underlain by Marsden Formation - Mudstone, siltstone, Sedimentary bedrock, with superficial deposits of Alluvium Clay, Silt, Sand and Gravel Extract from the previous report is found below with the BGS information shown in **Figure 2.1** below.

Figure 2.1: BGS Information



- 2.4.2 The bedrock geology includes many lithologies, often classified into three types based on origin: igneous, metamorphic and sedimentary.
- *Igneous rocks - are derived from molten magma in the Earth's crust. They may, for example, be extruded at the surface by volcanic activity to form lavas and tuffs (ash) or intruded into other rocks to form large masses of granite and gabbro at depth or minor, cross-cutting basalt dykes near the surface.*
 - *Metamorphic rocks - such as schist and gneiss are those that have been changed from one rock type to another in the solid state by the recrystallisation of minerals, often at high temperatures and pressures when buried deep in the Earth's crust.*
 - *Sedimentary rocks - are formed when grains and fragments of existing rocks are eroded away by ice, water and wind action, transported elsewhere and redeposited as a sediment. These sediments are often laid down in layers or strata of loose particles of gravel, sand, silt and clay. Over time they may be buried by later sediments and consolidated or cemented to form stratified or bedded rocks such as conglomerate, sandstone, siltstone and claystone. Other sedimentary rocks such as ironstone and limestone are created by chemical or biogenic (life) action.*
- 2.4.3 LK Consult Limited has completed 17no. window sample locations across the site, the locations are shown on drawing reference LKC 21 1086 3 Rev B which is included within the Phase 2 Geo Environmental Investigation document reference CL-602-LKC 21 1086-02 included within **Appendix D**.
- 2.4.4 The ground conditions have been identified as predominantly made ground over various depths of gravels, silts and clay which is consistent with the BGS information shown in figure 2.1.
- 2.4.5 The window sample records indicate water strikes within all of the sample holes at depths from 1.3m to 2.2m deep with additional secondary strikes at 3m within a number of results.

3.0 FLOOD RISK and FLOOD ZONES

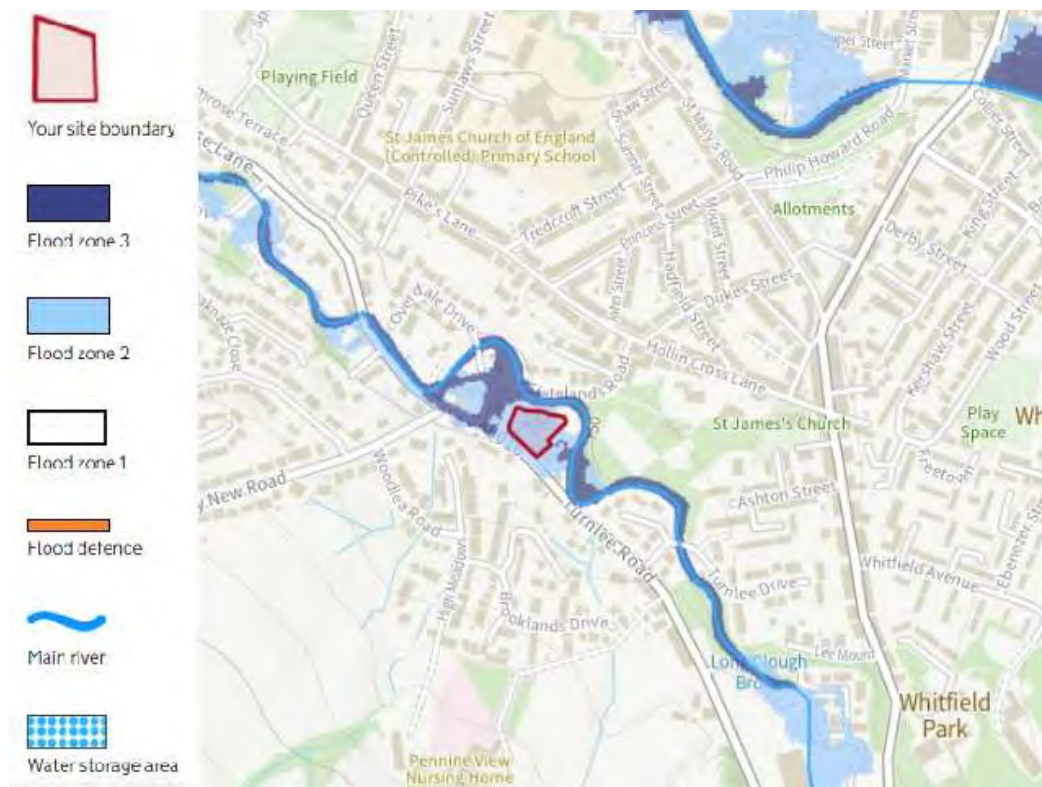
3.1 Brief

- 3.1.1 The vulnerability of the site to flooding from rivers, sea and other sources has been considered, along with the potential to increase flooding elsewhere through the addition of impermeable areas and the effect on surface water run-off. Typical sources of flooding include fluvial, tidal, surface water, groundwater, sewers and anthropogenic sources; these are considered below

3.2 Fluvial, Tidal

- 3.2.1 Flood maps are produced by the EA for the whole of the UK to highlight areas at particular risk of flooding by categorising them into different Zones. These maps are based on a broad assessment of areas using digital mapping techniques and extracts from the EA flood maps for the site and its surroundings are included in the figures below.
- 3.2.2 The EA flood map for planning shows river and sea flooding data only, extract in **Figure 3.1**, below full report provided in **Appendix C**, shows that the development area and its immediate surroundings are wholly located within EA Flood Zone 2 (light blue shaded areas).

Figure 3.1: Flood Map for Planning Extract



- 3.2.3 Zone 2 areas are defined in NPPF Table 1 as "Land having between a 1% and 0.1% annual probability of river flooding; or land having between a 0.5% and 0.1% annual probability of sea flooding. (Land shown in light blue on the Flood Map) .

- 3.2.4 Annex 3 within the National Planning Policy Framework Technical Guidance (NPPF) indicates that the proposed development is designated as More Vulnerable see **Figure 3.2** below.

Figure 3.2 – Annex 3: Flood Risk Vulnerability Classification

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.

- 3.2.5 Table 2 within paragraph 079 of the Flood Risk and Coastal Change Guidance shown in **Figure 3.3** below, indicates that more vulnerable uses are acceptable within flood zone 2.

Figure 3.3: Table 2 Flood Risk Vulnerability and Flood Zone 'Incompatibility'

Table 2: Flood risk vulnerability and flood zone 'incompatibility'

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	X	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	X	X	X	✓ *

Key:

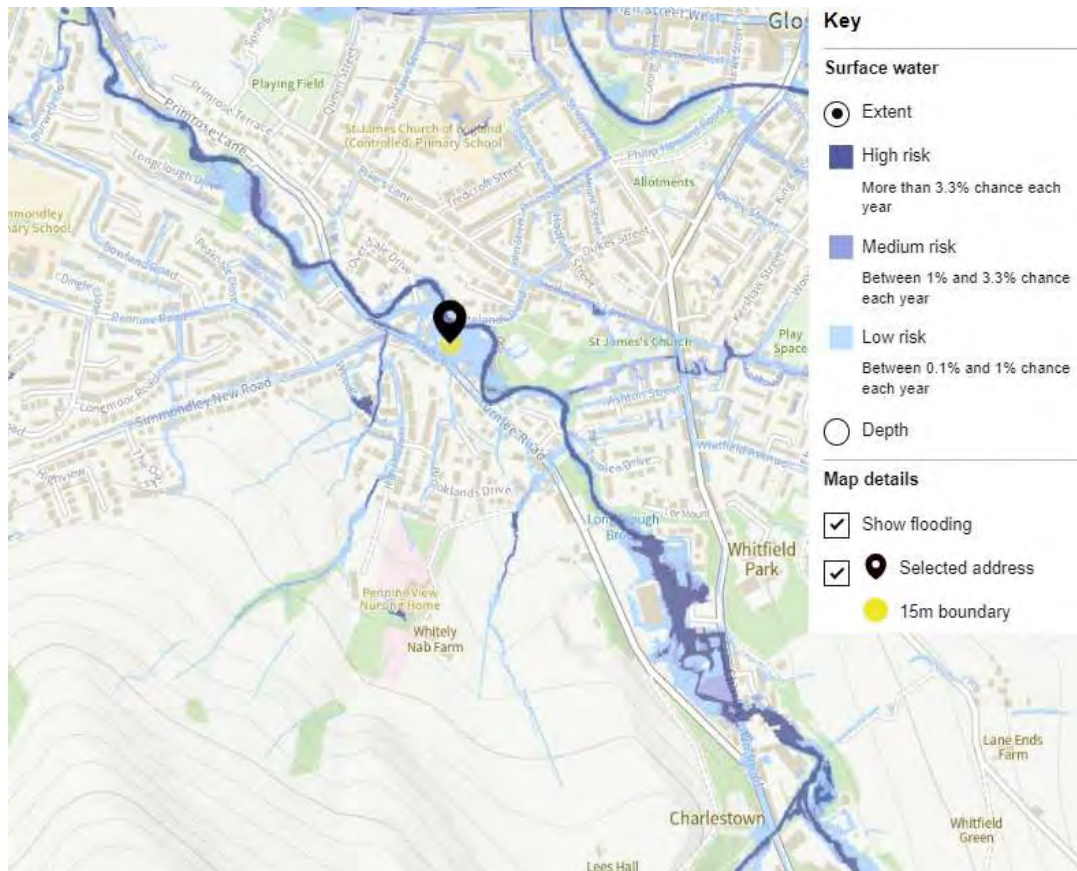
✓ Exception test is not required

X Development should not be permitted

3.3 Surface Water

- 3.3.1 The EA's surface water flood map shown in **Figures 3.4** below, identifies the surface water flood risk for the proposed site. The surface water flood zone for the site has been identified as being low risk.

Figure 3.4 Surface Water flood Map – Extents



- 3.3.2 Surface water flooding occurs when rainwater does not drain away through normal drainage systems or soak into the ground but lies on or flows over the ground instead.
- 3.3.3 Post development the introduction of the proposed development will provide the opportunity for the introduction of more vegetated spaces which can be used to incorporate sustainable technologies that were not a requirement when the previous development was constructed.
- 3.3.4 Management of surface water is being considered as part of the development proposals and a preliminary drainage strategy is outlined within Section 6 of this strategy report.

3.4 Other Sources

- 3.4.1 The EA's other flood risks guidance shown in **Figures 3.5** identifies the potential extents of both reservoir and groundwater flooding. The extract below indicates that the site is not at risk from either flood source.

Figure 3.5 Reservoir flood Map – Extents

Other flood risks	
Groundwater	Flooding from groundwater is unlikely in this area. ▼ What groundwater is and how we check an area's risk Groundwater is the water that is usually held in rocks and soil underground. Groundwater flooding happens when this water rises and flows above the surface. We use flood alert data to check the risk of flooding from groundwater.
Reservoirs	Flooding from reservoirs is unlikely in this area. ▼ What a reservoir is and how we check an area's risk A reservoir is a large natural or artificial lake that is designed to collect and store water. We use predicted scenarios to understand the risk of flooding from reservoirs. Flooding from reservoirs is extremely unlikely. An area is considered at risk if people's lives could be threatened in the event of a dam or reservoir failure.

3.5 Ground Water

- 3.5.1 Groundwater flooding typically results from heavy/prolonged rainfall causing the level of the groundwater table to rise, which may lead to emergence of groundwater at the surface or into underground features such as basements. Low lying areas of land with permeable underlying strata may be particularly susceptible.
- 3.5.2 Existing groundwater levels under the proposed site have been identified at between 1.3m – 2.2m with secondary strikes in a number of holes at a depth of 3m.

4.0 SUMMARY

- 4.1.1 The site is considered to be at low risk from all sources of flooding.
- 4.1.2 The proposed end use is classified as More Vulnerable which is acceptable in areas designated as flood zone 2.
- 4.1.3 Instances of surface water flooding have been noted across the site, potentially related to the Long Clough Brook. As the proposed development will restrict the flows generated by the development using sustainable technologies surface water flooding should not preclude safe site development.
- 4.1.4 A preliminary drainage strategy is discussed in Section 6 which shows that post-development flood risks will not be increased due to the development plans.
- 4.1.5 Considering the above, overall flood risks to and from the site are considered to be low.

5.0 MANAGING SURFACE WATER

- 5.1.1 In accordance with the NPPF and SFRA, consideration should be given to natural water flows at the site. The development should not adversely affect flow or increase flood risk elsewhere, including increasing run-off rates. The disposal of surface water should be dealt with in a sustainable way and climate change should also be accounted for. The site drainage strategy is discussed in Section 6.

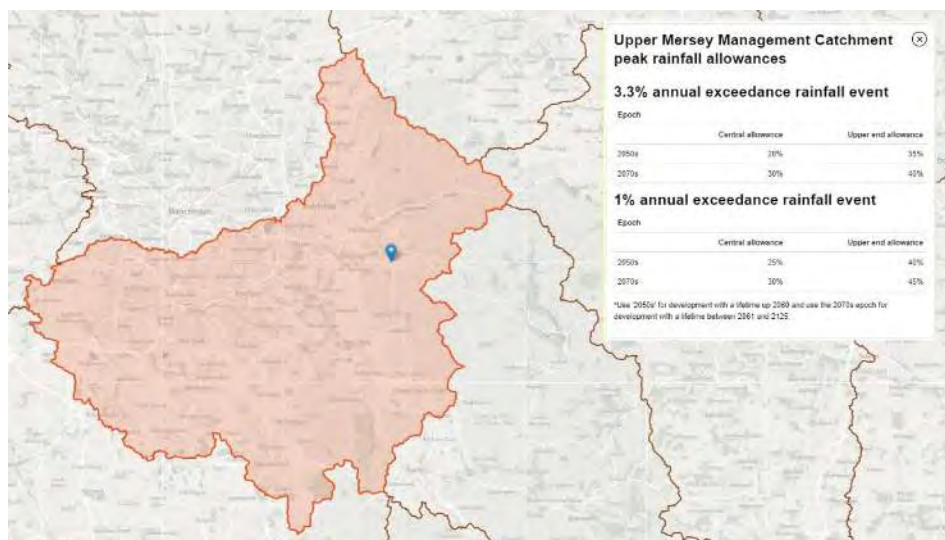
5.2 Previous Situation and Development Proposals

- 5.2.1 The site is currently occupied by the Reliance Garage and is noted as being approximately 100% impermeable. The proposed development will introduce a number of additional opportunities for sustainable technologies and significantly increase the level of permeable area. Although the existing site appears to discharge unrestricted to the offsite adopted network, the proposed development proposes to reuse the existing connection for all foul flows with the surface water flows communicating with the Long Clough Brook at a significantly reduced rate of flow, once a comprehensive CCTV survey has been completed. The proposed drainage strategy is included in Section 6.

5.3 Climate Change

- 5.3.1 There is evidence to suggest that the climate is changing with sea levels predicted to continue to rise along with more frequent short-duration, high-intensity rainfall and more frequent periods of long-duration rainfall. The NPPF recommends that the effects of climate change be accounted for within any proposed drainage strategy or flood risk assessment (FRA), with consideration of the EA flood maps and local authority SFRA.
- 5.3.2 Increased rainfall or higher intensity short-duration rainfall may increase as a result of climate change. The .GOV website states that for the [Upper Mersey Management Catchment](#) which includes upper end climate change allowances of 40% for the 1 in 30-year storm (3.3%) and 45% for the 1 in 100-year event (1%), are therefore being allowed for within the new surface water drainage design to take account of climate change as discussed in Section 6.

Figure 5.1 Climate Change Allowances



5.4 Sustainable Drainage Systems (SUDS)

5.4.1 SUDS are a desirable way to manage surface water disposal within new developments and SUDS methods for surface water drainage management are discussed further within the SUDS Manual. When designing surface water drainage strategies priority should be given to disposal of surface water via infiltration drainage systems over (first) discharge to watercourses (second) prior to identifying a possible discharge to sewers.

SuDS hierarchy

- Into the ground (infiltration)
- To a surface water body (rivers, watercourses, lakes, ponds, canals etc.)
- Into a surface water sewer, highway drain, or another drainage system
- Into a combined sewer

5.4.2 In order to address the contents of the SuDS hierarchy the potential for infiltration is not considered an option within the LK Consult document, together with the presence of clay within the window samples could significantly reduce the potential infiltration rates making infiltration impossible to achieve.

5.4.3 The Long Lough Brook water body runs along the northern boundary of the site as such it is proposed that all surface water flows will be discharged to the water course at a flow equivalent to greenfield run off rates based on a site area of 4,599m² (0.46 hectares)

5.4.4 There are two methods for calculating the greenfield run-off rate: the IH124 method and the ICP method. The IH124 method calculates the peak Greenfield run-off flow rates by correlation of the Soil Index Value, the Average Annual Rainfall and the Site Area (SOIL, SAAR and AREA). The IH124 Method should be used for sites in excess of 50 hectares and the resulting discharge is linearly interpolated for the required area. The ICP method uses the IH124 method and automatically interpolates the discharge for sites less than 50 hectares and therefore this is the method that has been used extract shown in **Figure 5.2**

Figure 5.2 Greenfield Discharge Rate

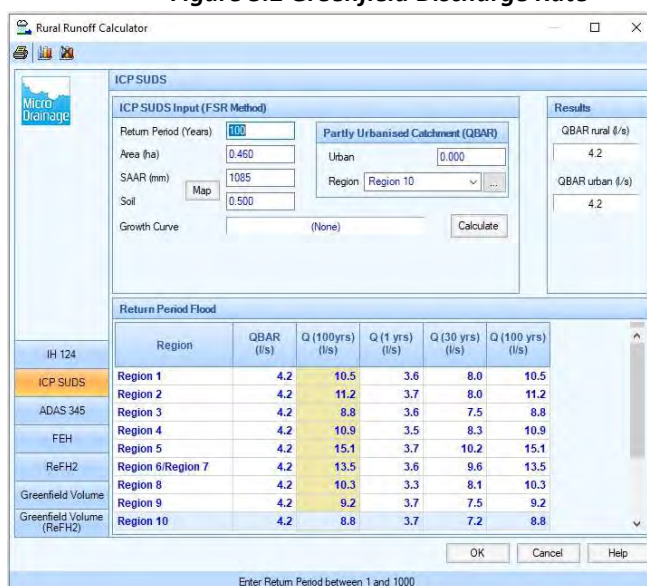
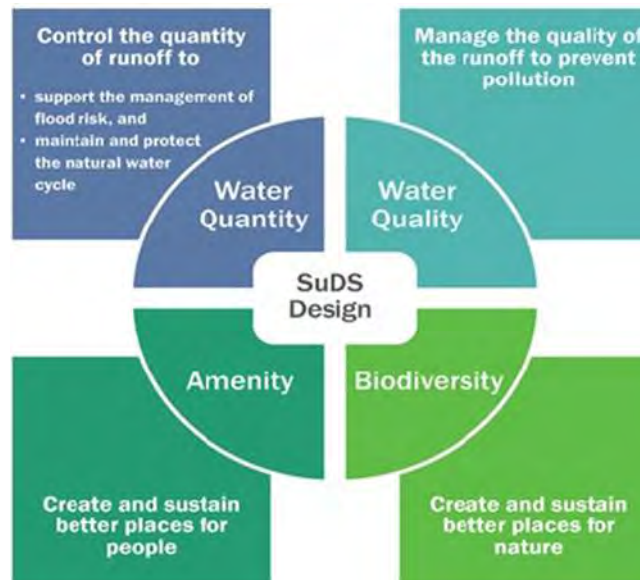


Figure 5.2 Four Pillars of SuDS



5.4.5 The proposed development will address the above 4 pillars of SuDS design criteria with the inclusion of a range of sustainable features through a comprehensive treatment train.

- **Water Quantity** will be strictly controlled to Greenfield run off rates in line with the requirements of the SFRA, for the 1 in 100-year critical storm plus the upper end climate change allowance of 45%.

With the above in mind the proposed site will restrict surface water flows to a maximum of 8.8 l/s for the 1 in 100 year critical storm plus 45% allowance for climate change.

- **Water Quality** will be provided through the construction of a comprehensive treatment train across the site, including areas of permeable paving within the proposed parking bays providing the opportunity for both attenuation to take place, any flows remaining will be passed through a bioretention / rain garden area further cleaning and attenuating the proposed flows.

The simple index approach tool has been used shown in **Appendix E**, for both residential roofs and access road, the spreadsheets have been included to confirm that the proposed treatment train is sufficient to achieve pollution mitigation indices for the selected SuDS components.

The proposed treatment train has been deemed sufficient to achieve an acceptable level of water quality prior to discharge from the site.

- **Biodiversity** will be provided through the introduction of a bioretention / rain garden facility which when established will create a better environment for nature to thrive.
- **Amenity** The introduction of the rain garden areas presents the opportunity to create a visually attractive area within the proposed site, which can connect the residents to water. Such features have been shown to improve the well-being of people that take up residence on the proposed development.

6.0 DRAINAGE STRATEGY

6.1 *Surface Water Drainage Strategy*

- 6.1.1 Following completion of the development with the inclusion of significant areas of vegetation and permeable surfacing within the parking bays, the level of post development impermeable area has been estimated to have been reduced to 0.12 hectares (1,262m²)
- 6.1.2 When 10% has been added to address the potential for urban creep the maximum impermeable area has been identified as approximately 0.14 hectares (1388m²)
- 6.1.3 The existing site is currently classified as brownfield, and has previously been assumed to discharge into the offsite adopted network at an unrestricted rate.
- 6.1.4 Although the existing site condition has been identified as brownfield ,In line with the SFRA:
Surface water discharges from any development on the site should be restricted to present day greenfield run off values with allowances to climate change included in the developed scenario.
- 6.1.5 The result of the above greenfield calculation for a range of critical storm return periods is shown in **Figure 5.2** above, with the flow for the 1 in 100-year critical storm being established as **8.8 l/s**
- 6.1.6 The maximum flow from the site is to be 8.8 l/s for the 1 in 100 year critical storm plus 45% allowance for climate change.
- 6.1.7 Attenuation will be provided on the site to ensure that the calculated greenfield run off rate for the 1 in 100-year storm event plus a climate change allowance of 45% does not exceed more than 8.8 l/s.
- 6.1.8 It is proposed that the areas of permeable surfacing and Rain Gardens will act as inline storage structures for the flows generated by the all-external areas.
- 6.1.9 Microdrainage modelling software has been used to identify the necessary storage volumes inclusive of 45% allowance for climate change and a safety factor of 2 shown in **Figure 6.1** below
- 6.1.10 The maximum storage volume of 75m³ will be applied to the indicative drainage arrangement shown in **Appendix F**
- 6.1.11 The permeable parking areas will provide an approximate volume of storage currently estimated as 70m³ for an assumed construction depth of 350mm with the rain garden area providing an additional volume of storage 40m³ providing a total of 110.0m³
- 6.1.12 The available void ratio throughout the SuDS treatment train is understood to be a maximum of only 35%, as such the actual available volume within the storage layers have been reduced to 71.5m³ which is inline with the maximum estimated storage volume required.

Figure 6.1 - storage volume calculations

Quick Storage Estimate - Variables

FSR Rainfall	Cv (Summer)	0.750
Return Period (years)	Cv (Winter)	0.840
Region	Impervious Area (ha)	0.140
Map	Maximum Allowable Discharge (l/s)	8.8
M5-60 (mm)	Infiltration Coefficient (m/hr)	0.00000
Ratio R	Safety Factor	2.0
	Climate Change (%)	45

Buttons: Analyse, OK, Cancel, Help

Enter Safety Factor between 1.0 and 50.0

Quick Storage Estimate - Results

Global Variables require approximate storage of between 41 m³ and 75 m³.
These values are estimates only and should not be used for design purposes.

Buttons: Analyse, OK, Cancel, Help

Enter Safety Factor between 1.0 and 50.0

6.1.13 At detailed design stage, The site drainage network will be designed in accordance with current best practice to have sufficient capacity not to flood during the critical 1 in 30-year storm (plus 40% allowance for climate change) and also to constrain within the site the flood water generated for the critical 1 in 100-year storm event (plus 45% allowance for climate change). In this way the risk of off-site flooding, which could result in damage to other buildings and essential services, will be minimised and the risk of flooding elsewhere should not be increased as a result of the development proposals.

6.1.14 Using Sustainable drainage techniques it will be possible to avoid any exceedance occurring at the site for all storms up to and significantly beyond the 1 in 100-year storm plus 45% climate change allowance.

6.2 Foul Flows

6.2.1 Foul flows will be collected by a network of pipes and inspection chambers before communicating with the United Utilities public sewer network off site, potentially via the existing connection.

6.2.2 All pipes to be set with a minimum gradient of 1 in 80 to allow flexibility in pipe diameters in line with Table 6 of Building Regulations Part H.

7.0 Maintenance Strategy

- 7.1.1 SuDS components require good maintenance including inspections to identify performance issues and plan appropriate maintenance needs, checks on the operation and maintenance of the drainage system and landscape management. Therefore, it is intended that those responsible for the drainage within a development will be provided with an Operation and Maintenance Manual as part of the documentation provided under the Construction (Design and Management) regulations 2015 at the end of the construction works. Maintenance requirements that would be appropriate for this development, to be included in the document are outlined below.
- 7.1.2 All maintenance necessary will be undertaken, appointed and/or suitably managed by the developer.
- 7.1.3 The Drainage network and inherent SuDS have been designed with minimal maintenance in mind. The maintenance is generally of a 'common sense' approach and is to comprise:
- 7.1.4 Regular day to day care: - litter collection, grass cutting and checking the inlets and outlets where water enters or leaves a drainage feature.
- 7.1.5 Occasional tasks: - managing vegetation in wet areas (ponds, swales, etc.) and removing any silt that builds up in the drainage features.
- 7.1.6 Remedial work: -repairing damage when, and where, necessary.
- 7.1.7 Specific recommendations for each feature are provided in the following sections, and should be referred to in the first instance if there are any issues.

Permeable Surfacing

- 7.1.8 The drainage scheme utilises permeable construction for the parking bays as in line storage structures, at the base of the stone build-up is a perforated pipe, which slowly collects the water and conveys it to the attenuation tank and Bioretention area, via a network of catchpit PPIC's and manholes.

Maintenance schedule	Required action	Frequency
Regular maintenance	Litter and debris removal from permeable surface and access	Monthly (or as required).
	Remove weeds within joints of any permeable paving.	Monthly (at start, then as required).
	Trimming of any roots that may be causing blockages.	Annual (6monthly for the first year).
Occasional maintenance	Removal of sediment from catchpit.	Six monthly (or following significant rainfall event).
Remedial actions	Inspect inlets, outlets and inspection points for blockages, clogging, standing water and structural damage.	Monthly.
	Clear perforated pipework of blockages.	As required.
	Replace geotextiles and clean and replace filter media, if clogging occurs.	As required.
Monitoring	Inspect inlets, surfaces and perforated pipework for silt accumulation. Establish appropriate silt removal frequencies.	6 monthly.

Piped System

- 7.1.9 All pipes will be laid to the specified falls and installed along with the manufacturers' instructions and recommended ancillaries

Regular maintenance	Clean catch pits and manholes and the associated pipes system to remove sediments and debris accumulated during the summer	Annually (6monthly for the first year).
Monitoring	Inspect catch pits and manholes for signs of silt build up within the piped system.	6 monthly

Manholes and PPICs

- 7.1.10 Manholes are typically sized in accordance with Sewers for Adoption, which relates to the incoming and outgoing pipe diameters. However, as the system is not Adopted, PPICs have been used where manufacturer's limitations permit. Typically PPICs can be used for depths up to 3m and for pipe diameters up to 150mm.
- 7.1.11 Personnel access into PPIC chambers is not possible, and therefore rodding/jetting should be carried out from ground level. This is generally accepted as good practice and in accordance with good health and safety procedures. Where larger manholes, which could accommodate man access, have been included maintenance should also take place from ground level. Man access should be resisted and only used as a last resort.

Maintenance schedule	Required action	Frequency
Occasional Maintenance and Monitoring	Covers should be lifted and inspected for litter and debris to ensure that the runs are free-flowing.	3 Monthly (or as required).

Flow Control Device

- 7.1.12 The surface water flow off site is limited to Greenfield run-off rate of no more than 8.8 l/s. The flow is limited by a Hydrobrake Optimum. This is a proprietary system and will be installed in line with the manufacturers written instructions. Operation and Maintenance guidance is provided within the manufacturers' standard documentation.

7.2 Rain Garden / Bioretention areas

7.2.1 The drainage scheme utilises permeable construction within parking bays which will provide surface water flows the opportunity to recharge the existing ground, although infiltration will be provided to minimise the opportunity for flooding during significant storm events a perforated pipe will be provided at the base of the stone build-up.

Maintenance schedule	Required action	Frequency
Regular maintenance	Litter and debris removal from planted areas.	Every 3 months
	Monitor performance after heavy rain	Every 3 months
Occasional maintenance Every 6 Months	Litter and debris removal from permeable surface and access	Six monthly (or following significant rainfall event).
	Inspection of inlets and outlets and for sediment in external chambers	
	Monitor performance after heavy rain	
	Inspection of surface for settlement	
Remedial actions When Required	Full structure rehabilitation	As required
	Infiltration surface reconditioning	As required.