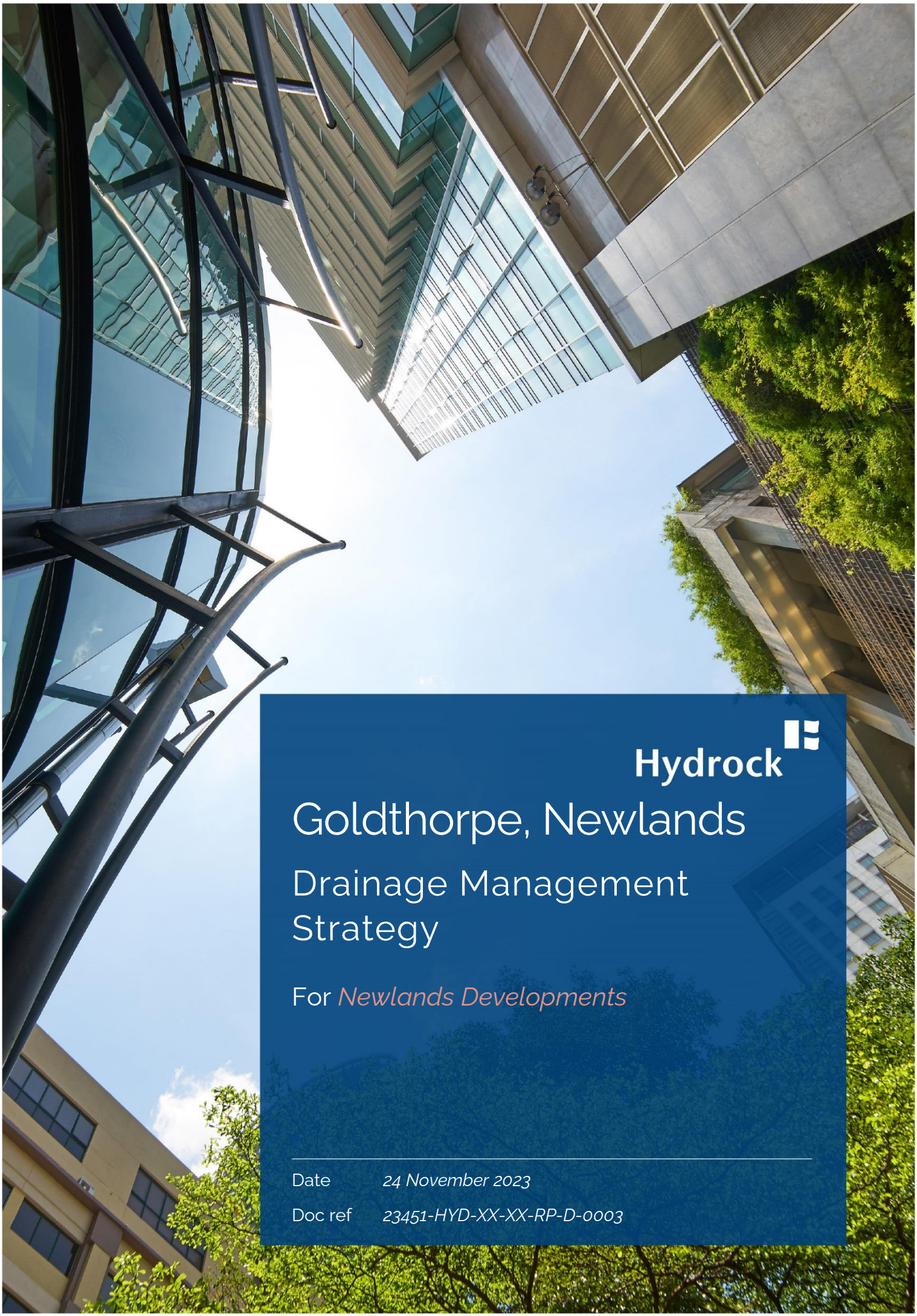

Hydrock

Goldthorpe, Newlands

Drainage Management Strategy

For *Newlands Developments*

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Issued by	Hydrock Consultants Limited St Baldred's Hall 239 Ashley road Hale Cheshire WA15 9NE United Kingdom	T +44 (0)161 2330746 E manchester@hydrock.com hydrock.com
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Prepared by		Sophie Jones, Graduate Civil Engineer
Checked by		Jingchao Yang, Senior Drainage Engineer
Approved by		Neil Byrne, Technical Director

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Executive Summary

This report should be read in conjunction with the Hydrock Flood Risk Assessment 23451-HYD-XX-XX-RP-FR-0002.

The proposal is to construct a new multiple warehouse development with associated offices, HGV loading bays, car parking and associated infrastructure and access road.

The surface water drainage hierarchy has been considered and the preferred drainage solution for disposal of surface water is to discharge to the Carr Dike and its tributary via below ground gravity networks, where flows will discharge to attenuation ponds before entering the watercourse at a restricted flow rate of 1.4l/s/ha. The total site area is approximately 85.32 hectares, with 44.02 hectares of developed area.

The use of Sustainable Drainage Systems (SuDS) has been considered. Pollution prevention and site control methods will be utilised prior to outfall.

Pollution treatment measures will be provided in the form of Class 1 oil separators at car parks and SuDS structures (i.e. ponds, etc). Silt traps on drainage elements will be provided which will filter and trap silts and debris and mitigate against the risk of pollution entering the sewer network. All separators will be alarmed and remotely monitored at all times to ensure reliability.

The SuDS and other drainage elements will be regularly maintained by a nominated management company on behalf of the client/occupier.

It is envisaged that diversion of a Yorkshire Water's critical asset (combined sewer) is required.

Foul flows will outfall at a maximum rate of 4.75 l/s to the diverted public foul sewer to the north east of the site. An agreement in principle will be sought from Yorkshire Water at detailed design stage including diversion layout, when more site-specific information is required.

1. Introduction

1.1 Development Context

1.1.1 This report has been prepared by Hydrock Consultants Limited (Hydrock) on behalf of Newlands Development to support the planning application to construct a new multiple warehouse development with associated offices, HGV loading bays, car parking and associated infrastructure and access road (see Appendix A).

1.1.2 The site is currently undeveloped and is considered to be 'greenfield'.

1.1.3 This report should be read in conjunction with the Hydrock Flood Risk Assessment 23451-HYD-XX-XX-RP-FR-0002.

1.2 Flood Risk

1.2.1 The Flood Risk Assessment *23451-HYD-XX-XX-RP-FR-0002* considers the flood risk posed to the site from all sources, in accordance with the NPPF and the local Strategic Flood Risk Assessment (SFRA). The majority of the site is within Flood Zone 1 (Low Risk) however, mapping identifies a large extent of Flood Zone 2 (Medium Risk) and 3 (High Risk), extending within the site originating from Carr Dike.

2. Development Description and Location

2.1 Site Location

2.1.1 This site is referenced in Table 1, and a location plan is provided in Figure 1.

Site Referencing Information	
Site Name	Goldthorpe, Newlands
Site Address & Location	Dearne Valley Parkway, Billingley, Bolton upon Dearne, Barnsley, South Yorkshire
Council Area	Barnsley Metropolitan Borough Council
Approximate Grid Reference	444239E, 403783N
Site Area	The total site area is 85.32ha, of which 44.02ha will be developed area.
Boundaries & Surrounding Land	The site is located south of A625 Barnsley Road and west of Aldi Goldthorpe RDC.
Existing Land Use and Access	The site is currently undeveloped greenfield.
Elevation and Topography	A topographical survey has been undertaken and indicates that the Carr Dike and its estuary are where the low points on site are situated. The site generally falls towards these low points from the north and south site boundaries with high points of approximately 35.4 mAOD and 44mAOD respectively. See Appendix B for the full topographical survey.
Development Proposals	The proposed development is for the construction of multiple new warehouses with associated offices, HGV loading bays, car parking and associated infrastructure and access road.
Vehicular access	The main vehicular access to the site will be from the new Barnsley Council roundabout at A625 Barnsley Road to south.

Table 1: Site referencing information

Figure 1: Site location

3. Drainage Strategy

3.1 Proposed surface water runoff

3.1.1 The surface water drainage discharge rate shall follow the requirement from Yorkshire & Humber Technical Guidance for Developers, Relevant Powers & Standing Advice for Local Planning Authorities, where it states '**1.4 l/s/ha is the generic standard greenfield runoff rate adopted by most flood risk management authorities. YHDB accept this greenfield runoff rate.**'

3.1.2 The total site area is approximately 85.32 hectares, with a total post-development impermeable area of approximately 44.02 hectares, this includes the surface area of the proposed SuDS structures.

3.1.3 It is intended to discharge surface water runoffs from the post-development site not exceeding the rates shown below in Table 2.

Catchment Reference	Total Impermeable Area (Ha)	Proposed Discharge Rate (l/s)
Plot 1	10.838	15.1
Plot 2 and central infrastructure road	7.156	10
Plot 3 northern & western yard	4.603	6.4
Plot 3 southern yard, carpark and roof, Plot 4 & Infrastructure Road South	17.809	24.9
Infrastructure Road North	1.491	2

Table 2: Proposed Discharge Rate

The infrastructure road referenced above is defined by its location relative to the Carr Dike. A post-development catchment plan is included in Appendix C.

3.2 Drainage Discharge Hierarchy

3.2.1 In accordance with C753 SuDS manual, surface water should be managed following below discharge hierarchy:

(1) Infiltration to the maximum extent that is practical;

(2) Discharge to surface water body;

(3) Discharge to surface water sewer;

(4) Attenuated discharge to a combined sewer.

3.2.2 Discharge via Infiltration

Feasibility of infiltration is subject to further ground investigation and infiltration testing.

The British Geological Survey (BGS) has been reviewed with regard to the underlying ground conditions of the site. The assessment revealed that the north of the site is a backfilled opencast site and south of this area (to the north of Carr Dike) is Alluvium which is expected to be highly saturated exhibiting a high groundwater level. The land south of Carr Dike is expected to be predominantly underlain by sandstone bedrock directly beneath the topsoil, however this area will be subject to large scale earthworks which will alter the ground permeability. On this basis infiltration is unlikely to be feasible.

3.2.3 Discharge to a surface water body

Drainage hierarchy option 2 is the preferred method, whereby it is intended to discharge surface water from the development into the Carr Dike and its tributary located on site.

3.2.4 Discharge to surface water

Not applicable.

3.2.5 Discharge to a combined sewer

Not appliable.

3.3 Sustainable Drainage Systems (SuDS)

3.3.1 Sustainable drainage developed in line with the ideals of sustainable development is collectively referred to as Sustainable Drainage Systems (SuDS). At a particular site, these systems are designed to manage both the environmental risks resulting from the urban runoff and to contribute, wherever possible, to environmental enhancement. Therefore, SuDS objectives are to minimise the impacts from the development on the quantity and quality of the runoff and maximise amenity and biodiversity opportunities (CIRIA C753, 2015).

3.3.2 SuDS help to mimic the natural flow of water ensuring that both the quantity and quality of the surface water is dealt with before feeding it into the drainage network. SuDS features usually come with added maintenance, however the benefits they reap are considered to outweigh this. The selection of the most appropriate SuDS features should consider constraints, requirements and maintenance of the site. It should be remembered that Local Planning Authorities expect SuDS to be investigated on construction projects. The implementation of SuDS features can assist in achieving the drainage requirements set out in the National Planning Policy Framework.

3.3.3 A strong design theme is essential if maximum aesthetic benefits are to be gained from the SuDS approach. At a more local scale SuDS should link with the individual plot structure, planting and amenity areas, gaining multiple benefits from a limited area of land.

3.3.4 The 'Management Train Approach' should be central to the surface water drainage strategy of a proposed site. The main objective is the treatment and control of runoff as near to source as possible, thus protecting downstream habitats and further enhancing the amenity value of the site. This concept uses a hierarchy of drainage techniques to incrementally reduce pollution, flow rates and volumes of storm water discharge from the site, and is as follows:

- Prevention - The use of good site design and housekeeping measures to prevent runoff and pollution (e.g. rainwater re-use).
- Source Control - Control of runoff at source or as close to source as possible (e.g. soakaways, green roofs, pervious pavements).
- Site Control - Management of water in a local area (e.g. ground storage/attenuation, detention ponds/basins).
- Regional Control - Management of water from a site or various sites (e.g. wetlands, balancing ponds).

3.3.5 The SuDS philosophy for a development site is the promotion of Pollution Prevention and Site Control Techniques. The following design philosophy is proposed:

- Surface water treatment using the 'Management Train' approach to remove and isolate contamination at all SuDS facilities prior to conveyance.
- Surface water discharge into the watercourse via attenuation ponds.
- Site Control features (attenuation) to accommodate the additional surface water runoff generated by the development site before discharging into the watercourse.
- Prevention measures in the form of rainwater re-use systems (tbc).
- Provision of suitable oil separators (where applicable).
- Aim to limit, where possible, the impermeable fraction of development.

3.3.6 It is proposed that the development site has two levels of treatment. Prevention is considered as the first level of treatment and the site control as the second.

3.3.7 A review of the possible SuDS solutions that are feasible include:

- Rainwater harvesting tanks
- Below ground storage
- Pond
- Permeable paving
- Oil separators
- Swales
- Filter drains

3.4 Prevention and Source Control - Principles and Objectives

3.4.1 The main objective of prevention and source control is the treatment and control of runoff as near to source as possible. Application of these techniques will require reduction of impermeable areas and techniques to restrict the runoff rates.

3.4.2 Prevention measures to be considered, where possible, as part of the overall approach to the management train at this site include rainwater harvesting. Typical examples are given in the SuDS Manual (Ciria C697) and are briefly described in Table 3 below. It must be noted that the effectiveness of each system is dependent on the final design as well as the actual site conditions.

SuDS Group	Technique	Image	Description	Advantages	Disadvantages	Suitable for us on site?
Retention	Balancing Pond/Swale		Provides both storm water attenuation and treatment. Run-off from each rain event is detained and treated in the pool. The retention time promotes pollutant removal through sedimentation.	Good removal of pollutants, can be used where groundwater is vulnerable, good community acceptability, high ecological, and amenity benefits.	No reduction in run-off volume, land take may limit use in high density sites.	Attenuation ponds have been included in the wider surface water drainage network.
	Sub-Surface Attenuation		Oversized pipes, tank systems and modular geo-cellular systems that can be used to create a below ground storage structure.	Modular and flexible, dual usage (infiltration/storage, high void ratios), can be installed beneath trafficked and soft landscaped areas.	No water quality treatment.	Sub-surface storage can be used.
Infiltration	Infiltration Trench Infiltration Basin Soakaway		Surface water run-off can be discharged directly to ground for infiltration by soakaways, basins, or trenches. A prerequisite is that both groundwater and ground conditions are appropriate to receive the quality and quantity of water generated.	Reduces the volume of run-off, effective at pollutant removal, contributes to groundwater recharge, simple and cost effective, easy performance observation.	Requires appropriate pre-treatment, basins require a large flat area, offset from foundations.	Infiltration subject to further investigation and soakaway testing.

	Porous Paving Permeable Paving		Block or porous paving allows run-off to infiltrate through to sub base layer. Water can then be infiltrated into ground or conveyed into storage or drainage systems.	Reduces the volume of run-off and if designed for infiltration contributes towards groundwater recharge. Easy to install and retrofit. Simple to manage. If lined can be used where groundwater is sensitive.	Not suitable for heavily trafficked areas or adoptable roads. Requires regular sweeping to prevent clogging with dirt.	Permeable paving with a liner may be used which will be conveyed into the proposed drainage system.
Detention	Detention Basin		Surface storage basins that provide flow control through attenuation. Normally dry and in certain situations the land may also function as a recreational facility.	Cater for a wide range of rainfall events, can be used where groundwater is vulnerable, potential for dual land use, easy to maintain.	Land take, little reduction in run-off volume, detention depths constrained by levels.	A detention basin can be included.
	Enhanced Dry Swale Enhanced Wet Swale		Swales are linear vegetated drainage features in which surface water can be stored or conveyed. They can be designed to allow infiltration, where appropriate.	Incorporate into landscaping, good removal of pollutants, reduces run-off rates and volumes, low cost.	Not suitable for steep areas, significant land take, not suitable in areas with roadside parking.	Enhanced dry /wet swales can be included.

Source Control	Green/Brown Roof		Multi-layered system that covers the roof of a building with vegetation cover/landscaping over a drainage layer. Designed to intercept and retain precipitation, reducing the volume of run-off and attenuating peak flows.	Mimics greenfield state of building footprint for high density developments, good removal of pollutants, ecological benefits, insulates buildings, sound absorption.	Additional weight, not appropriate for steep roofs, maintenance of roof vegetation.	Unsuitable for lightweight structure.
	Rainwater Harvesting		Similar to the use of water butts this prevention method stores rainwater runoff from roofs and external areas in below ground tanks. The water can then be used for irrigation purposes to the soft landscaping areas or alternatively pumped to an internal storage tank where the 'Grey' water can be used for WC's and washing machines.	Harvested grey water will collect and automatically be used for various systems, such as toilet flushing, outside taps etc. The result will be less water usage and cheaper bills and a greener building or commercial premises.	Rainfall is hard to predict and sometimes little or no rainfall can limit the supply of rainwater. It also should have a "mains water" top up to ensure that you don't run out of water.	Rainwater Harvesting can be used.
Filtration	Surface Sand Filter Sub-surface Sand Filter Perimeter Sand Filter		Structures designed to treat surface water run-off through filtration using a sand bed filter medium. The filters can be designed with or without infiltration. Temporary storage of run-off is achieved through ponding above the filter layer. They are used where particularly high pollutant removal is required.	Flexibility of design, efficient in removing pollutants, suitable for retrofits and in tightly constrained urban locations.	Not for high sediment content, detention times can support algae growth, minimum hydraulic head of 1.2m required, possible odour problems, high capital and maintenance cost.	There is no requirement for high pollution reduction at this site.

	Bioretention/ filter swale		Vegetated strips of land designed to accept run-off as overland sheet flow between a hard-surfaced area and a receiving system.	Landscaping features, effective in removing pollutants, flexible layout to fit into landscape, suited for highly impervious areas, good retrofit, capability, effective pre-treatment option.	Requires landscaping and management, large land required, not suitable for steep sites; no significant attenuation or reduction of flows.	Rain water garden can be used.
	Filter trench/drain		Shallow excavations filled with rubble or stone that create temporary subsurface storage for filtration of storm water run-off. Receive lateral inflow from an adjacent impermeable surface.	Hydraulic benefits achieved with filter trenches, trenches can be incorporated into site landscaping and fit well beside roads and car parks.	High clogging potential without effective pre-treatment, limited to small catchments, high cost of replacing filter material.	Filter drains can be used.
Conveyance	Conveyance Swales		Formal linear drainage features in which surface water can be stored or conveyed. They can be incorporated with water features such as ponds or waterfalls where appropriate.	Negate the need for underground pipework. Can provide some attenuation. Possible reduction in run-off volume via plant uptake and infiltration.	Potential trip/wheel hazard, disabled access issues.	Conveyance swales can be included.
	Rills					

Wetland	Shallow Wetland Extended Detention Wetland Pond Wetland Pocket Wetland Submerged Gravel Wetland Wetland Channel		Wetlands provide storm water attenuation and treatment. They comprise shallow ponds and marshy areas, covered in aquatic vegetation. Wetlands detail flows for an extended period to allow sediments to settle and to remove contaminants. They can provide significant ecological benefits.	Good pollutant removal and if lined can be used where groundwater is vulnerable. Good community acceptability, ecological and amenity benefits.	Land take is high, requires base flow, little reduction in run-off volume, not suitable for steep sites.	Wetland areas are not possible on this site due to the high land take required.

Table 3: SuDS considerations

3.5 Surface Water Drainage Strategy

3.5.1 Surface water runoff from roofs and external areas will be directed to the below ground gravity network, where it will join the wider private drainage network of carrier drains and will be attenuated prior to outfall, where it will discharge at a restricted rate of 1.4l/s/ha into the Carr Dike and its tributary (see Appendix C for Hydrock Proposed Drainage Layout).

3.5.2 A hydraulic model has been created using drainage software as part of the preliminary drainage design, which defines pipe sizes located under infrastructure road and SuDS attenuation volumes. Hydraulic calculations have been provided in Appendix D. It is noted that these rates and volumes are preliminary and may change at detailed design stage when more specific information is available.

3.5.3 A climate change allowance of 40% has been applied.

3.5.4 The proposed drainage layout is designed in accordance with Design and Construction Guidance. No above ground flooding for the 1 in 30-year storm event should occur. An assessment of extreme storm event, the 100-year event plus 40% climate change has been carried out. The storm-water volumes generated by this event are classed as exceedance flooding and will be safely contained on site and directed away from the buildings, where they will sit in the car parking and landscape area, and drain into the surface water infrastructure as water levels recede.

3.5.5 As part of the drainage strategy, the following is proposed:

- The proposed drainage system will be a managed gravity system with a flow control set at a permissible discharge rate of 1.4l/s/ha into the Carr Dike and its tributary.
- The car parking and yard catchment areas will be developed at the detailed design stage. It is envisaged that surface water runoffs from this catchment will be drained via drainage channels, kerb drains and filter drains and then discharge into the new private surface water network. Surface runoff from the roof will also discharge to the new private surface water network.
- Pollution treatment measures will be provided in the form of Class 1 oil separators for the car park and yard areas, and silt traps on drainage elements which will filter and trap silts and debris and mitigate against the risk of pollution. All separators will be alarmed and remotely monitored at all times to ensure reliability.
- SuDS structures, including ponds are proposed to provide water quality enhancement, prior to discharging to the final receiving waterbody.

3.6 Water Quality

3.6.1 The primary pollution control measure for the infrastructure elements will be in the form of the proposed SuDS features for the wider private surface water network. This includes attenuation ponds, which will provide pollution control through filtration and settlement.

3.6.2 The site mainly comprises of commercial/industry roof, commercial yard, access roads, and parking, which have pollution hazard levels ranging from low to high in accordance with CIRIA C753 table 26.2 as below.

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]

3.6.3 Below CIRIA C753 table 26.3 as below provides treatment capacity for different SuDS structures

	Mitigation indices[1]		
Type of SuDS component	**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.		

3.6.4 In line with C753 where two or more components in series, the total SuDS mitigation index can be calculated as:

Total SuDS mitigation index = mitigation index$_1$ + 0.5 (mitigation index$_2$)

Where:

mitigation Index$_n$ = mitigation index for component n

A factor of 0.5 is used to account for the reduced performance of secondary or tertiary components associated with already reduced inflow concentrations.

3.6.5 In line with the above, Table 4 below summarises the total treatment indices achieved for each plot:

Reference	SuDS Component(s)	Indices mitigated		
Plot 1	Pond	0.7	0.7	0.5
Plot 2	Pond x2	1.05	1.05	0.75
Plot 3	Pond x2	1.05	1.05	0.75
Plot 4	Pond x2	1.05	1.05	0.75

Table 4: Proposed Development Mitigation Indices

It is therefore considered that the proposed SuDS systems will provide ample treatment capacity for plot 2, 3 and 4. In terms of plot 1, it is envisaged that providing catchpit and oil interceptor (proprietary treatment system) will effectively mitigate and remove the residual pollutant.

3.7 Foul Drainage Strategy

3.7.1 It is envisaged that a diversion of the existing combined public sewer is required. A high-level diversion proposal is included in Appendix C, and is subject to S185 technical acceptance with Yorkshire Water. Correspondence from Yorkshire Water (Appendix E) has confirmed that the sewer intended to be diverted is a critical asset and it is not viable to carry out a feasibility assessment at this stage.

3.7.2 A pre-development application has been made to Yorkshire Water who have responded (correspondence in Appendix E) confirming that foul flows are to outfall at a maximum rate of 4.75 l/s to the proposed public foul sewer diversion to the north east of the site (see Appendix C). An agreement in principle will be sought from Yorkshire Water at detailed design stage, when more site-specific information is required.

3.7.3 A map showing the location of the existing Yorkshire Water public sewer is included in Appendix F.

3.8 Management, Maintenance and Residual Risk

3.8.1 The proposed drainage layout will be designed in accordance with building regulations, Design and construction guidance, and Ciria C753 for SuDS structures.

3.8.2 Run-off from roofs is considered to be generally clean with limited contamination, and will be discharged directly to the proposed drainage infrastructure and new SuDS Facilities.

Silt is to be prevented from entering the drainage system by the use of trapped gullies, interceptors or by the use of sustainable drainage techniques.

3.8.3 Run-off from car park and loading areas will be treated via proprietary treatment system of a full-retention oil interceptor.

3.8.4 A private management company will maintain the drainage infrastructure as part of a site-wide management and maintenance schedule as shown in Table 5 below.

3.8.5 Access and egress arrangements to and from the new development, should exceedance flooding occur, will be via the new access road and roundabout to the north of site. It is anticipated that the flooded water from a 1 in 100 year + 40% climate change storm will be maintained within the proposed development.

3.8.6 Flood risk to people and property can be managed but it can never be completely removed. Residual risk remains after flood management or mitigation measures have been put in place. This relates to a rainfall event beyond what can be fully quantified.

Item	Maintenance	Frequency per year
Gullies	Removal of silt accumulation from mud bucket. Gratings checked for operation/damage – replaced if required.	2
Foul Water Manholes	Manhole covers checked for operation/damage – seating's re-greased or replaced as required. Check for blockages and or damage to invert channel/inlets – jetting pipe runs if blocked, any damage to be repaired. All access ladders & other associated ironworks to be checked for corrosion & fixings to be checked for deterioration. To be repaired or replaced dependant of extent of damage.	1
Surface Water Manholes, Flow Controls	As Above. All catch pits/Vortex Separators to have silt/solid accumulation removed & base jetted clean.	1
Drainage Channels/Kerb Drains	All catch/access pits to have silt/solid accumulation removed. Channel run to be jetted through between access points. Any channel grates to be inspected for damage & replaced as necessary.	2
Ponds	Remove litter and debris, Cut Grass – for access routes and around basin, manage other vegetation and nuisance plants. Inspect inlets and outlets for blockages – clear if required. Inspect banksides, structures, pipework for evidence of physical damage. Inspect inlets and facility surface for silt accumulation.	12
Cascading Ponds	As Above.	12

Table 5: Drainage Maintenance

Appendix A - Site Plans