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FLOOD RISK AND DRAINAGE ASSESSMENT FOR A PROPOSED POULTRY UNIT ON LAND TO THE NORTH OF HAG LANE, RASKELF, NORTH YORKSHIRE

PROJECT NO. JAG/AD/JD/46183-Rp001

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Issue	Revision	Revised by	Approved by	Revised Date

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1.0 INTRODUCTION

1.1 Background

1.1.1 Alan Wood & Partners were commissioned by Dinsdale Farming to prepare a Flood Risk and Drainage Assessment for a proposed Poultry Unit on land to the north of Hag Lane, Raskelf. in support of an application for planning consent.

1.1.2 A Flood Risk and Drainage Assessment (FRDA) for the proposed development is required to assess the development's risk from flooding and the suitability of the site in terms of drainage.

1.2 Layout of Report

1.2.1 Section 1 provides an introduction to the FRDA, explains the layout of this FRDA and provides an introduction to flood risk and the latest guidance on development and flood risk in England.

1.2.2 Section 2 provides an introduction to the site. The site description is based upon a desktop study and information provided by the developer. In order to obtain further information on flood risk, consultation was undertaken with the Environment Agency.

1.2.3 Section 3 of this report details the development proposals and considers the development proposals in relation to the current planning policy on development and flood risk in England (and what type of development is considered appropriate in different flood risk zones). National Planning Policy Framework (NPPF): and its associated Technical Guidance (Communities and Local Government, March 2012) is the current planning policy on flood risk in England, and an introduction to NPPF is provided below.

1.2.4 Section 4 considers the drainage arrangements for the proposed development.

1.2.5 Section 5 considers the operation and maintenance for the proposed development.

1.2.6 Section 6 of this report considers the flood risk to site, and the potential for the development proposals to impact on flood risk. The assessment of flood risk is based on the latest planning policy and utilises all the information gathered in the preparation of the report.

1.2.7 Section 7 of this report provides details of any recommendations for further work to mitigate against possible flooding.

1.2.8 Section 8 of this report provides a summary of the report.

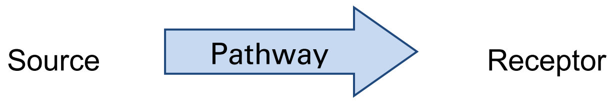
1.3 Flood Risk

1.3.1 Flood risk takes account of both the probability and the consequences of flooding.

1.3.2 Flood risk = probability of flooding x consequences of flooding

1.3.3 Probability is usually interpreted in terms of the return period, e.g. 1 in 100 and 1 in 200 year event, etc. In terms of probability, there is a 1 in 100 (1%) chance of one or more 1 in 100 year floods occurring in a given year. The consequences of flooding depends on how vulnerable a receptor is to flooding.

The components of flood risk can be considered using a source-pathway-receptor model.



1.3.4 Sources constitute flood hazards, which are anything with the potential to cause harm through flooding (e.g. rainfall extreme sea levels, river flows and canals). Pathways represent the mechanism by which the flood hazard would cause harm to a receptor (e.g. overtopping and failure of embankments and flood defences, inadequate drainage and inundation of floodplains). Receptors comprise the people, property, infrastructure and ecosystems that could potentially be affected should a flood occur.

1.4 National Planning Policy Framework

1.4.1 General

1.4.1.1 NPPF and its associated Technical Guidance replaces Planning Policy Statement 25 and provides guidance on how to evaluate sites with respect to flood risk.

1.4.1.2 A summary of the requirements of NPPF is provided below.

1.4.2 Sources of Flooding

1.4.2.1 NPPF requires an assessment to flood risk to consider all forms of flooding and lists six forms of flooding that should be considered as part of a flood risk assessment. These forms of flooding are listed in Table 1, along with an explanation of each form of flooding.

Table1: Forms of flooding

Flooding from Rivers (Fluvial Flooding)
Watercourses flood when the amount of water in them exceeds the flow capacity of the river channel. Flooding can either develop gradually or rapidly, depending on the characteristics of the catchment. Land use, topography and the development can have a strong influence on flooding from rivers.
Flooding from the Sea (Tidal Flooding)
Flooding to low-lying land from the sea and tidal estuaries is caused by storm surges and high tides. Where tidal defences exist, they can be overtopped or breached during a severe storm, which may be more likely with climate change.
Flooding from Land (Pluvial Flooding)
Intense rainfall, often of short duration, that is unable to soak into the ground or enter drainage systems can run quickly off land and result in local flooding. In developed areas this flood water can be polluted with domestic sewage where foul sewers surcharge and overflow. Local topography and built form can have a strong influence on the direction and depth of flow. The design of development down to a micro-level can influence or exacerbate this. Overland flow paths should be taken into account in spatial planning for urban developments. Flooding can be exacerbated if development increases the percentage of impervious area.

Flooding from Groundwater
Groundwater flooding occurs when groundwater levels rise above ground levels (i.e. groundwater issues). Groundwater flooding is most likely to occur in low-lying areas underlain by permeable rocks (aquifers). Chalk is the most extensive source of groundwater flooding.
Flooding from Sewers
In urban areas, rainwater is frequently drained into sewers. Flooding can occur when sewers are overwhelmed by heavy rainfall, and become blocked. Sewer flooding continues until the water drains away.
Flooding from Other Artificial Sources (i.e. reservoirs, canals, lakes and ponds)
Non-natural or artificial sources of flooding can include reservoirs, canals and lakes. Reservoir or canal flooding may occur as a result of the facility being overwhelmed and /or as a result of dam or bank failure.

1.4.3 Flood Zones

1.4.3.1 For river and sea flooding, the NPPF uses four Flood Zones to characterise flood risk. These Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences, and are detailed in Table 2.

Table 2: Flood zones

Flood Zone	Definition
1	Low probability (less than 1 in 1,000 annual probability of river or sea flooding in any year (<0.1%).
2	Medium probability (between 1 in 100 and 1 in 1,000 annual probability of river flooding (1%-0.1%) or between 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5%-0.1%) in any year).
3a	High probability (1 in 100 or greater annual probability of river flooding (>1%) in any year or 1 in 200 or greater annual probability of sea flooding (>0.5%) in any given year).
3b	This zone comprises land where water has to flow or be stored in times flood. Land which would flood with an annual probability of 1 in 20 (5%), or is designed to flood in an extreme flood (0.1%) should provide a starting point for discussions to identify functional floodplain.

1.4.4 Vulnerability

1.4.4.1 The NPPF classifies the vulnerability of developments to flooding into five categories. These categories are detailed in Table 3.

Table 3: Flood risk vulnerability classification

Flood Risk Vulnerability Classification	Examples of Development Types
Essential Infrastructure	- Essential utility infrastructure including electricity generating power stations and grid and primary substations - Wind turbines
Highly Vulnerable	- Police stations, ambulance stations, fire stations, 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.
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. - Sites used for holiday or short-let caravans and camping.
Less Vulnerable	- Building used for shops, financial, professional and other services, restaurants and cafes, hot foot 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.
Water Compatible	- Docks, marinas and wharves. - 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.

1.4.4.2 Based on the vulnerability of a development, NPPF states within what Flood Zones(s) the development is appropriate. The flood risk vulnerability and Flood Zone 'compatibility' of developments is summarised in Table 4.

Table 4: Flood risk vulnerability and flood zone compatibility

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	1	✓	✓	✓	✓	✓
	2	✓	✓	Exception Test	✓	✓
	3a	Exception Test	✓	x	Exception Test	✓
	3b	Exception Test	✓	x	x	x

1.4.5 The Sequential Test, Exception Test and Sequential Approach

1.4.5.1 The Sequential Test is a risk-based test that should be applied at all stages of development and aims to steer new development to areas with the lowest probability of flooding (Zone 1). This is applied by the Local Planning Authority by means of a Strategic Flood Assessment (SFRA).

1.4.5.2 The SFRA and NPPF may require the Exception Test to be applied to certain forms of new development. The test considers the vulnerability of the new development to flood risk and, to be passed, must demonstrate that:

- There are sustainability benefits that outweigh the flood risk and;
- The new development is safe and does not increase flood risk elsewhere.

1.4.5.3 The Sequential Approach is also a risk based approach to development. In a development site located in several Flood Zones or with other flood risk, the sequential approach directs the most vulnerable types of development towards areas of least risk within the site.

1.4.6 Climate Change

1.4.6.1 There is a planning requirement to account for climate change in the proposed design. The recommended allowances should be based on the most relevant guidance from the Environment Agency and the Lead Local Flood Authority.

1.4.7 Sustainable Drainage

1.4.7.1 The key planning objectives in NPPF are to appraise, manage and where possible, reduce flood risk. Sustainable Drainage Systems (SuDS) provide an effective way of achieving some of these objectives, and NPPF and Part H of the Building Regulations (DTLR 2002) direct developers towards the use of SuDS wherever possible.

1.4.7.2 The surface water drainage has been designed in accordance with current CIRIA C753 SuDS Manual guidelines.

2.0 EXISTING SITE DESCRIPTION

2.1 Location

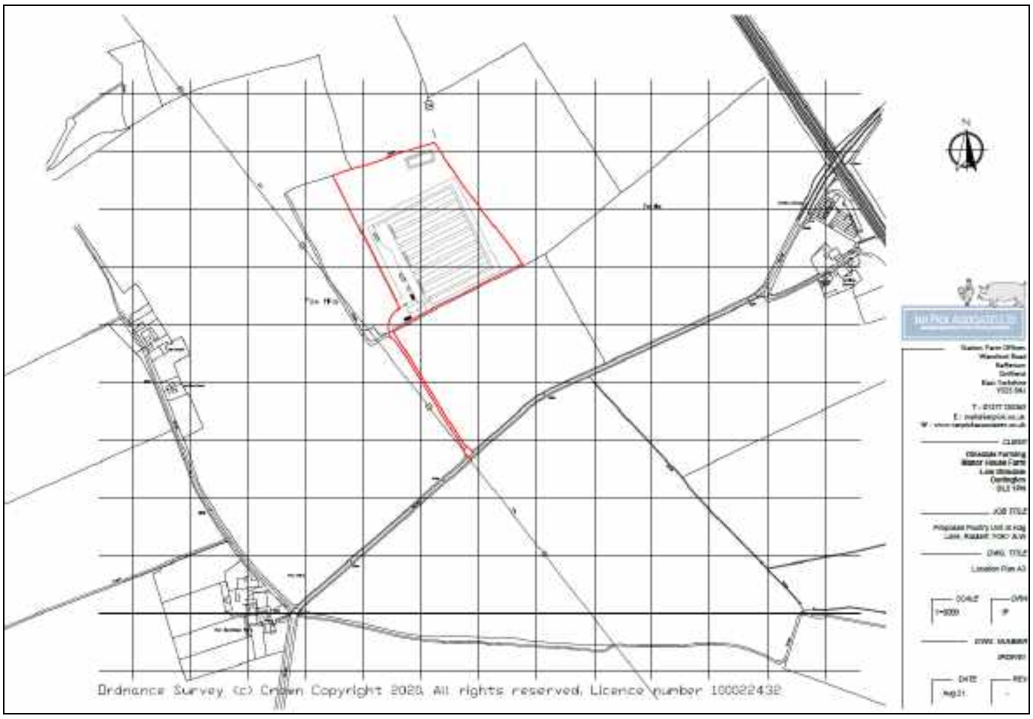
2.1.1 The site occupies land to the south west of the village of Raskelf, North Yorkshire.

2.1.2 The site lies approximately 1.9km to the south west of the village of Raskelf, approximately 7km to the south east of the village of Helperby, approximately 2.7km to the north east of the village of Tholthorpe and approximately 4.8km to the west of Easingwold.

2.1.3 An aerial photograph and location plan are included in Figure 1 and Figure 2 below, which identify the location of the site.

Figure 1: Aerial Photograph

Figure 2: Site Location Plan



2.1.3 The Ordnance Survey grid reference for the centre of the site development is approximately 447945, 469535.

2.2 Existing Site Description

2.2.1 The site currently comprises an area of agricultural land extending to approximately 5.6 hectares in area.

2.2 Surrounding Features

2.2.1 The site lies within an area of extensive agricultural land.

2.2.2 There is an existing access track to the west of the site which provides access to the development from Hag Lane which lies beyond the agricultural field to the south of the development site.

2.2.3 There is a small open drainage ditch in the north eastern corner of the site.

2.2.4 The York to Thirsk railway lines lie to the east of the site.

2.2.5 There are a number of small fishing ponds in the vicinity of the site.

2.2.6 Derrings Beck lies to the west of the site.

2.2.7 The River Swale lies to the west of the site.

2.3 Topography

2.3.1 A topographic survey of the development site has not been undertaken at this stage.

2.3.2 However, Lidar data covering the area of the development site has been obtained.

2.3.3 Over the area of the development, existing ground levels are shown to vary from approximately 20.25m to 21.82m OD(N).

2.3.4 Over the footprint of the new buildings the existing ground levels are shown to vary from approximately 20.86m to 21.82m OD(N), with an average ground level of approximately 21.35m OD(N).

2.4 Ground Conditions

2.4.1 A desktop study of the British Geological Survey map reveals that the local geology comprises superficial deposits of Lacustrine Deposits – Clay overlaying bedrock comprising Triassic Rocks (Undifferentiated) – Mudstone, Siltstone and Sandstone.

2.4.2 Local borehole records reveal the underlying strata to comprise glacial clays extending to a depth exceeding 15m below ground level.

2.4.3 Soakaway testing was undertaken in order to assess whether the local ground conditions are suitable for soakaways/infiltration trenches to be utilised for the disposal of surface water run-off from the development.

2.4.4 After a period of 24 hours the water level in the trial pit did not fall to the 75% level.

2.4.5 The ground conditions are therefore unsuitable for soakaways/infiltration methods to be utilised for the disposal of surface water run-off from the development.

2.4.6 A study of the groundwater maps in the region shows that the proposed development overlays a Secondary B Aquifer. The groundwater vulnerability in the area of the development is classified as 'Medium - High'.

3.0 PROPOSED DEVELOPMENT

3.1 The Development

3.1.1 The proposed development comprises the construction of a new poultry unit to include:-

- 6 new poultry buildings with control room annexes
- Amenity building
- Plant room
- Dead bird store
- Water tank
- Gas tanks
- Generator
- Feed Bins
- Concrete paving
- Unsurfaced hardstanding for access, car parking and vehicle manoeuvres
- Treed landscaping

3.1.2 Indicative layout drawings of the proposed development are included in Appendix B.

3.2 Flood Risk

3.2.1 In terms of flood risk vulnerability, the construction of development to be used for agriculture is classed as 'Less Vulnerable' (Table 3).

3.2.2 In terms of flood zone compatibility, the construction of 'Less Vulnerable' development is considered appropriate in Flood Zone 1 (Table 4).

4.0 DRAINAGE ASSESSMENT

4.1 General

4.1.1 The surface water drainage has been designed in accordance with current CIRIA C753 SuDS Manual guidelines.

4.2 Surface Water Drainage

4.2.1 Existing Site

4.2.1.1 From the aerial photograph included in Figure 3, it can be seen that the area of the development site currently comprises agricultural land.

Figure 3: Aerial Photograph

4.2.1.2 We have calculated the greenfield surface water run-off from the existing site to be approximately 7.8 litres per second, based upon an agricultural run-off rate of 1.4 litres per second per hectare.

4.2.2 Run-off Destination

4.2.2.1 Requirement H3 of the Building Regulations establishes a preferred hierarchy for disposal of surface water. Consideration should firstly be given to soakaway, infiltration, watercourse, surface water sewer and combined sewer in that priority order.

4.2.2.2 The existing ground conditions are considered to be unsuitable for the disposal of surface water run-off to soakaways/infiltration trenches (See Section 2.4).

4.2.2.3 The second preferred option would be to discharge the surface water run-off from the development to a watercourse.

4.2.2.4 Investigations have revealed that there is an open drainage ditch present on the northern boundary of the development site into which the surface water run-off could be discharged.

4.2.2.5 It is therefore proposed that the surface water run-off from the development is discharged into this drainage ditch.

4.2.3 Flood Risk

4.2.3.1 For new developments, the current design criteria required for the surface water drainage will need to be based upon a 1 in 100 year storm event, with an additional allowance to account for climate change resulting from global warming. There should be no above ground flooding for the 1 in 30 year return period and no property flooding or off site flooding from the critical 1 in 100 year storm event, with the additional allowance to account for climate change.

4.2.3.2 An additional 30% allowance will need to be included for the potential change to peak rainfall intensity resulting from climate change in accordance with York City Council and North Yorkshire County Council SuDS guidelines.

4.2.4 Urban Creep

4.2.4.1 The project is an agricultural development under the control of a single owner and consequently there is no requirement to allow an additional 10% to the calculated impermeable areas for urban creep within the drainage design.

4.2.5 Peak Flow Control

4.2.5.1 Based upon the site layout drawing, the developable site area becoming impermeable in the form of roofs and areas of paving which will need to be positively drained has been calculated at approximately 1.88 hectares, with the remainder of the site discharging at an agricultural run-off rate.

4.2.5.2 The uncontrolled surface water run-off from the new development could be approximately 261 litres per second, based on BS EN 752 calculations, using a rainfall intensity of 50mm/hour. However, to meet the flood risk planning requirements, it is unacceptable to discharge flows freely from the proposed development site at an unrestricted rate. Therefore flows from the proposed development are normally limited to the greenfield runoff rate, established as 1.4 litres per second per ha, based on the impermeable contributing area of the site. For this development this would equate to approximately 2.7 litres per second.

4.2.5.3 It is considered that the lowest discharge rate which can be achieved in practical terms without creating future maintenance issues is 3 litres per second (marginally above the greenfield discharge rate) and consequently this rate has been used for design purposes.

4.2.5.4 In order to ensure the discharge of surface water will not increase the risk of flooding to other properties, it will be necessary to attenuate the drainage by restricting the discharge and providing storage as required.

4.2.5.5 The design will need to be based upon the critical 100 year storm event with the required additional allowance of 30% to account for climate change.

4.2.5.6 Based upon the design criteria set out above, an hydraulic model study has been undertaken in order to determine the pipe sizes and gradients and to assess the required volume of storage which will need to be provided.

4.2.5.7 The model output shows that the pipe sizes required will vary from 150mm to 600mm in diameter.

4.2.5.8 A summary of the storage volumes required is set out in Table 5 below.

Table 5: Volume of Surface Water Storage Required

Storm Event	30 Year Storm	100 Year Storm + 30%
Storage Volume Required	985m^3	1764m^3
Additional Storage Volume Required	Nil	779m^3

4.2.5.9 The required storage will be provided within an attenuation lagoon located in the north eastern corner of the overall development site.

4.2.5.10 A copy of the hydraulic model study calculations is included in Appendix B.

4.2.5.11 An indicative drainage layout drawing is included in Appendix C.

4.2.6 Volume Control

4.2.6.1 SuDS guidance advises that the run-off volume from the developed site for the 1 in 100 year 6-hour rainfall event should not exceed the greenfield run-off volume for the same event.

4.2.6.2 With a design discharge rate of 3 litres per second, a greenfield run-off rate has virtually been achieved.

4.2.6.3 We consider that the impact on the receiving watercourse has been minimised as far as is reasonably practicable.

4.2.7 Pollution Control

4.2.7.1 It is a requirement to ensure that the quality of any receiving body is not adversely affected by the development.

4.2.7.2 Investigations have revealed that the development site overlays a Secondary B Aquifer and lies within a Groundwater Vulnerability Zone classified as 'Medium - High'.

4.2.7.3 In order to minimise the risk of pollution to the final watercourse, clean roof water drainage should discharge directly into the sealed drainage network (i.e. not via gullies) and then directly towards the watercourse.

4.2.7.4 Discharge to a watercourse enables dilution to take place at the discharge point and thus reduces the likelihood of pollution occurring.

4.2.7.5 In order to minimise the risk of pollutants entering the watercourse, it is recommended that the final inspection chamber prior to the outfall to the watercourse should contain a silt trap.

4.2.7.6 The run-off from the areas of paving will need to pass through a filter trench prior to the outfall.

4.2.7.7 On this basis the risk of pollutants being discharged to the watercourse is extremely remote.

4.2.8 Wash – Down

4.2.8.1 The drainage run-off from the external paved area discharges directly to a SSAFO Regulated sealed storage tank during clean-down operations, for which an Environmental Permit is in place.

4.2.9 Designing for Exceedance

4.2.9.1 Overland flood risk from exceedance flows and from off-site sources will be mitigated to a large extent by the creation of the new surface water sewerage system as described above. Where possible proposed ground levels will be set to channel flows away from the proposed building.

4.2.9.2 Furthermore, the ground floor construction level for the new buildings will be raised above the finished ground level, which will provide additional clearance above any likely overland flooding.

4.2.9.3 The existing overland flow routes should generally be maintained within the final layout of the development site without increasing the flood risk to off-site parties.

4.2.9.4 Any existing flood risk may reduce by the creation of a formal surface water drainage system but cannot be entirely removed.

4.2.9.5 A drawing showing the anticipated overland surface water exceedance flood routing resulting from the development is included in Appendix D.

4.2.10 Highways Drainage

4.2.10.1 The development does not incorporate any formal highway drainage.

4.2.11 Water Quality

4.2.11.1 The water quality from the development via the surface water drainage system has been assessed in accordance with the simple index approach set out in Chapter 26 of the CIRIA SuDS Manual C753.

4.2.11.2 The output shows that the water quality from the roof areas and areas of external paving is of an acceptable standard without any further treatment.

4.2.11.3 A copy of the matrix output from the assessment is included in Appendix E.

4.3 Foul Water Drainage

4.3.1 The new poultry unit does not incorporate any foul water drainage.

5.0 OPERATION AND MAINTENANCE

5.1 The drainage pipework is designed with self-cleansing gradients and consequently the network should require little or no maintenance.

5.2 All gullies or drainage channel systems serving areas of hardstanding will need to be regularly inspected to ensure the system remains operable. See Table 6 below.

5.3 The inspection chambers should be regularly inspected to ensure the system is free-flowing. See Table 6 below.

Table 6: Operation and Maintenance Requirements for Silt Traps/Trapped Gullies (Based on CIRIA C753 Table 14.2)

Maintenance schedule	Required action	Typical frequency
Routine maintenance	Remove litter and debris and inspect for sediment, oil and grease accumulation	6 monthly
	Change the filter media	As recommended by manufacturer
	Remove sediment, oil, grease and floatables	As necessary – indicated by system inspections or immediately following significant spill
Remedial actions	Replace malfunctioning parts or structures	As required
Monitoring	Inspect for evidence of poor operation	6 monthly
	Inspect filter media and establish appropriate replacement frequencies	6 monthly
	Inspect sediment accumulation rates and establish appropriate removal frequencies	Monthly during first half year of operation, then every 6 months
*During the first year of operation, inspections should be carried out at least monthly (and after significant storm events) to ensure that the system is functioning as designed and that no damage is evident.		

5.4 On the basis that a Hydro-Brake® Vortex Flow Control Device station needs to be provided, then this should be maintained as set out in Table 7 below.

Table 7: Operation and Maintenance Requirements for Hydro-Brake® Vortex Flow Control Device (Based on Manufacturer's recommendations)

Maintenance schedule	Required action	Typical frequency
Routine maintenance	Remove litter and debris and inspect for sediment, oil and grease accumulation	6 monthly
	Remove sediment, oil, grease and floatables	As necessary – indicated by system inspections or immediately following significant spill
Remedial actions	Replace malfunctioning parts or structures	As required
Monitoring	Inspect for evidence of poor operation	Monthly during the first three months, then every 6 months
	Inspect sediment accumulation rates and establish appropriate removal frequencies	Monthly during first half year of operation, then every 6 months

5.5 Operation and maintenance requirements for the attenuation lagoon are set out in Table 8 below.

Table 8: Operation and Maintenance Requirements for Attenuation Lagoon

Maintenance schedule	Required action	Typical frequency*
Routine maintenance	Remove litter and debris	6 monthly
	Vegetation management	As required
Occasional maintenance	Clean inlet/outlet pipe	As required
Remedial actions	Repair/re-construct damaged component/structure	As required
	Remove silt and debris	As required
Monitoring	Inspect for evidence of damage or erosion	6 monthly
	Inspect sediment accumulation	Yearly
*During the first year of operation, inspections should be carried out at least monthly (and after significant storm events) to ensure that the system is functioning as designed and that no damage is evident.		

5.6 Operation and maintenance requirements for the filter trenches are set out in Table 9 below.

Table 9: Operation and Maintenance Requirements for Filter Trenches

Maintenance schedule	Required action	Typical frequency*
Regular maintenance	None	
Occasional maintenance	Remove silt and debris from inspection chamber	As required
Remedial actions	Re-construct filter trench if evidence of heavy siltation or failure	As required
Monitoring	Inspect downstream PPIC for evidence of siltation and to ensure system is free-flowing	Yearly
*During the first year of operation, inspections should be carried out at least monthly (and after significant storm events) to ensure that the system is functioning as designed and that no damage is evident.		

5.7 The sludge storage tank is to be fitted with an automatic alarm, located in a nearby suitable location, such that it can be easily seen and operated by those responsible for the operation and maintenance of the tank in compliance with the requirements of the Environmental Permit.

5.8 The sludge storage tank should be regularly inspected and tested to ensure the integrity of the system is maintained. See Table 10 below.

Table 10: Operation and Maintenance Requirements for Sludge Storage Tank (based on manufacturer's recommendations)

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Check level of sludge	After each wash-down operation
	Check alarm and controls are functioning correctly	12 monthly
Occasional maintenance	De-sludge tank	As required by appointed waste operator
Monitoring	If alarm sounds arrange immediate sludge removal	As required

5.9 Operation and maintenance requirements of the drainage components, as listed above, should be undertaken in accordance with Chapter 32 of the CIRIA SuDS Manual, along with the relevant tables and any relevant manufacturer's recommendations. See also BS 8582:2013 Code of Practice for Surface Water Management for Development Sites Section 11 and Susdrain Fact Sheet on SuDS Maintenance and Adoption Options (England) dated September 2015.

5.10 The personnel undertaking the maintenance should have appropriate experience of SuDS and drainage maintenance and should be capable of keeping sufficiently detailed records of any inspections. If personnel do not have appropriate experience, then specific inspection visits may be necessary. During the first year of operations of SuDS, inspections should usually be carried out at monthly intervals (and after significant storm events).

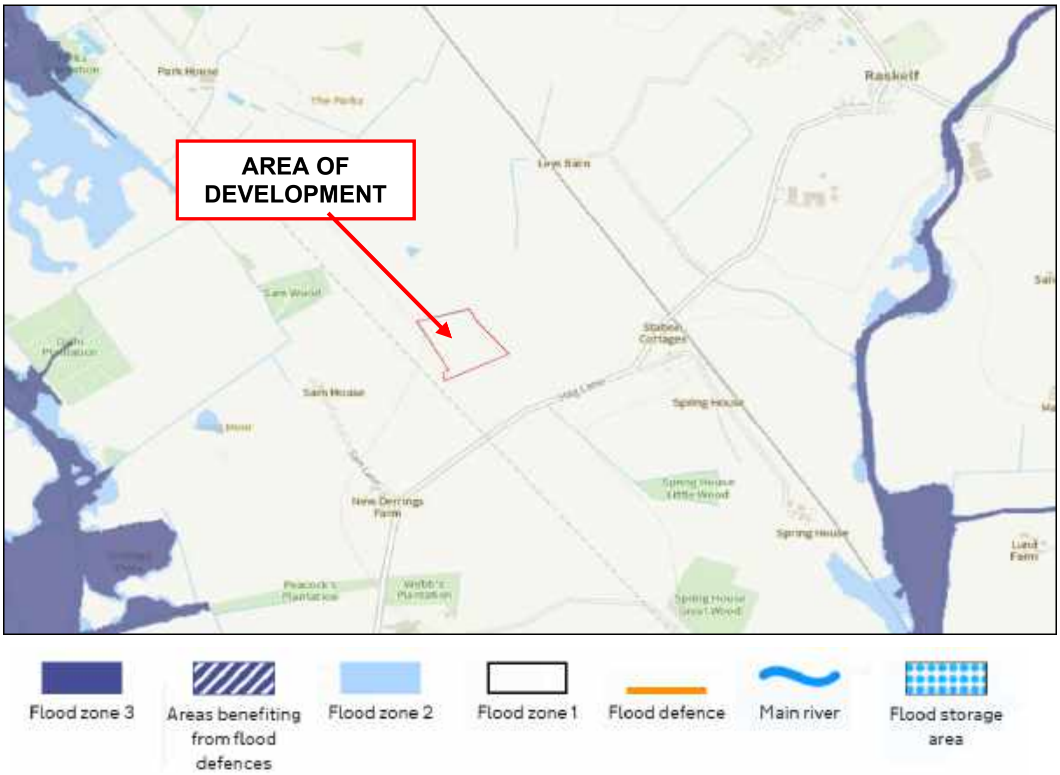
5.11 The responsibility for the operation and maintenance of the drainage and SuDS will lie with Dinsdale Farming, or any subsequent landowner of the site.

6.0 FLOOD RISK ASSESSMENT

6.1 Flood Zone

6.1.1 A copy of the Environment Agency Flood Map for Planning is included in Figure 4 below which identifies the development site to be located within an area designated as Flood Zone 1, (low probability of flooding), with a less than 1 in 1000 annual probability of flooding in any year.

Figure 4: Environment Agency Flood Map for Planning dated October 2021



6.2 Fluvial Flooding

6.2.1 Derrings Beck lies approximately 1.6km to the west of the development.

6.2.2 The River Swale lies approximately 4.5km to the west of the development at its nearest location.

6.2.3 The site is considered to be sufficiently elevated and at a sufficient distance from these potential flood sources not be at risk of flooding.

6.2.4 The risk of flooding to the development from this potential flood source is considered to be low and acceptable.

6.3 Surface Water Flooding

6.3.1 A copy of the Environment Agency map showing the extent of flooding from surface water is included in Figure 5 below.

Figure 5: Environment Agency map dated October 2021 showing the Extent of Flooding from Surface Water

6.3.2 The map shows that the majority of the site lies in an area which is considered to be at very low risk from overland surface water flooding, with a small isolated area of the site in the south eastern corner shown to be prove to overland surface water flooding.

6.3.3 Copies of the maps produced by the Environment Agency showing the likely depth of surface water flooding are included in Figures 6, 7 and 8 below.

Figure 6: Environment Agency map dated October 2021 showing the likely depth of flooding from surface water – low risk

Figure 7: Environment Agency map dated October 2021 showing the Likely Depth of Flooding from Surface Water – Medium Risk

Figure 8: Environment Agency map dated October 2021 showing the Likely Depth of Flooding from Surface Water – High Risk

6.3.4 The maps show that for a "low risk" scenario the likely depth of flooding in the affected area would be 300mm – 900mm.

6.3.5 For a "medium risk" scenario the maps show that the area likely to be affected would be reduced, with a likely flood depth of less than 300mm.

6.3.6 For a "high risk" scenario the maps show that the site would not be affected.

6.3.7 However, the extent of likely overland surface water flooding does not extend as far as the new poultry building and consequently it is not considered to be necessary for any flood mitigation measures to be provided.

6.3.8 The risk of flooding to the development from this potential flood source is therefore considered to be low and acceptable.

6.4 Flooding from Open Drainage Ditches

6.4.1 There is a small open drainage ditch located on the northern boundary of the development site.

6.4.2 There are a number of small agricultural ditches in the local surrounding area.

6.4.3 Due to their small scale and limited catchment area they are not considered to pose any risk of flooding to the development.

6.4.4 We therefore consider the risk of flooding from this source to be low and acceptable.

6.5 Groundwater Flooding

6.5.1 Groundwater flooding can occur when the sub-surface water levels are high and emerges above ground level.

6.5.2 It is not anticipated that the proposed development will involve deep excavation works.

6.5.3 The risk of flooding to the development from this potential flood source is considered to be low and acceptable.

6.6 Flood Risk from Existing Water Mains

6.6.1 There are no existing water mains in the vicinity of the development.

6.6.2 The risk of flooding to the development from this potential flood source is therefore considered to be low and acceptable.

6.7 Flood Risk from Existing Drainage Services

6.7.1 There are no existing drainage services present within the vicinity of the development.

6.7.2 The risk of flooding to the development from this potential flood source is therefore considered to be low and acceptable.

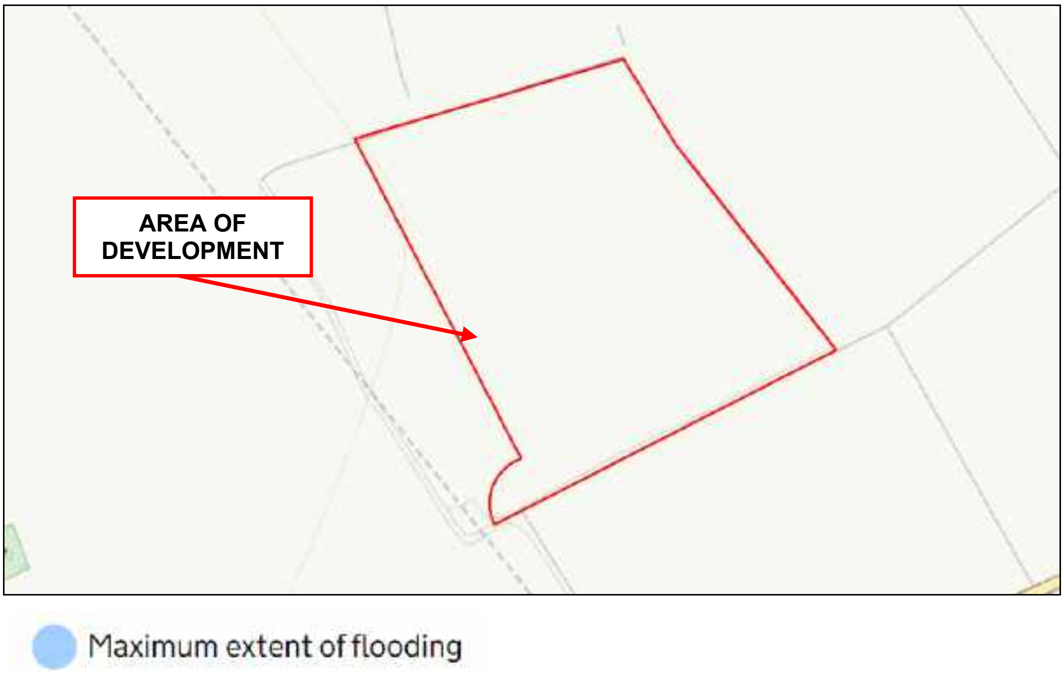
6.8 Flood Risk from Reservoirs, Canals and Other Artificial Sources

6.8.1 A study of the local area shows that there are a number of small ponds in the local area of the development site.

6.8.2 Due to the scale of these water features and their distance from the site, it is not considered that they pose any risk of flooding to the development.

6.8.3 A copy of the map produced by the Environment Agency showing the extent of flooding from reservoirs is included in Figure 9 below.

Figure 9: Environment Agency map dated October 2021 showing the Extent of Flooding from Reservoirs



6.8.4 The map shows that the development site is not considered to be at risk from reservoir flooding.

6.8.5 The risk of flooding to the development from any such potential flood source is considered to be low and acceptable.

7.0 FLOOD MITIGATION MEASURES

7.1 The development site is shown to lie within an area classified as 'low probability of flooding' on the maps produced by the Environment Agency.

7.2 The development site is not shown to be at risk of flooding from surface water or reservoir flooding on the maps produced by the Environment Agency.

7.3 It is considered that the floor levels of the new poultry buildings can be constructed at traditional levels of construction, normally approximately 150mm above adjacent external ground level. For this development, the floor construction level will be at approximately 21.50m OD(N).

7.4 As the development is not considered to be at risk from fluvial flooding there is no requirement to incorporate any flood resilience within the new construction methods.

7.5 No specific flood mitigation measures are considered necessary in respect of the proposed development.

8.0 SUMMARY

8.1 This report has been prepared to assess the flood risk and drainage implications for the construction of a new poultry unit on land to the north of Hag Lane, Raskelf, North Yorkshire.

8.2 The site falls in Flood Zone 1 (low probability of flooding) on the Environment Agency maps and the proposals are considered to be 'Less Vulnerable' in terms of flood vulnerability (Table 3) which is considered to be appropriate development in terms of flood zone compatibility (Table 4).

8.3 The development site is not shown to be at risk from overland surface water flooding or from reservoir flooding on the maps produced from the Environment Agency.

8.4 The surface water drainage for the development should be installed in accordance with Section 4 of this report to ensure the development does not increase the risk of flooding to other parties.

8.5 This report has considered potential sources of flooding to the site, including fluvial, groundwater, surface water, existing sewers, water mains and other artificial sources.

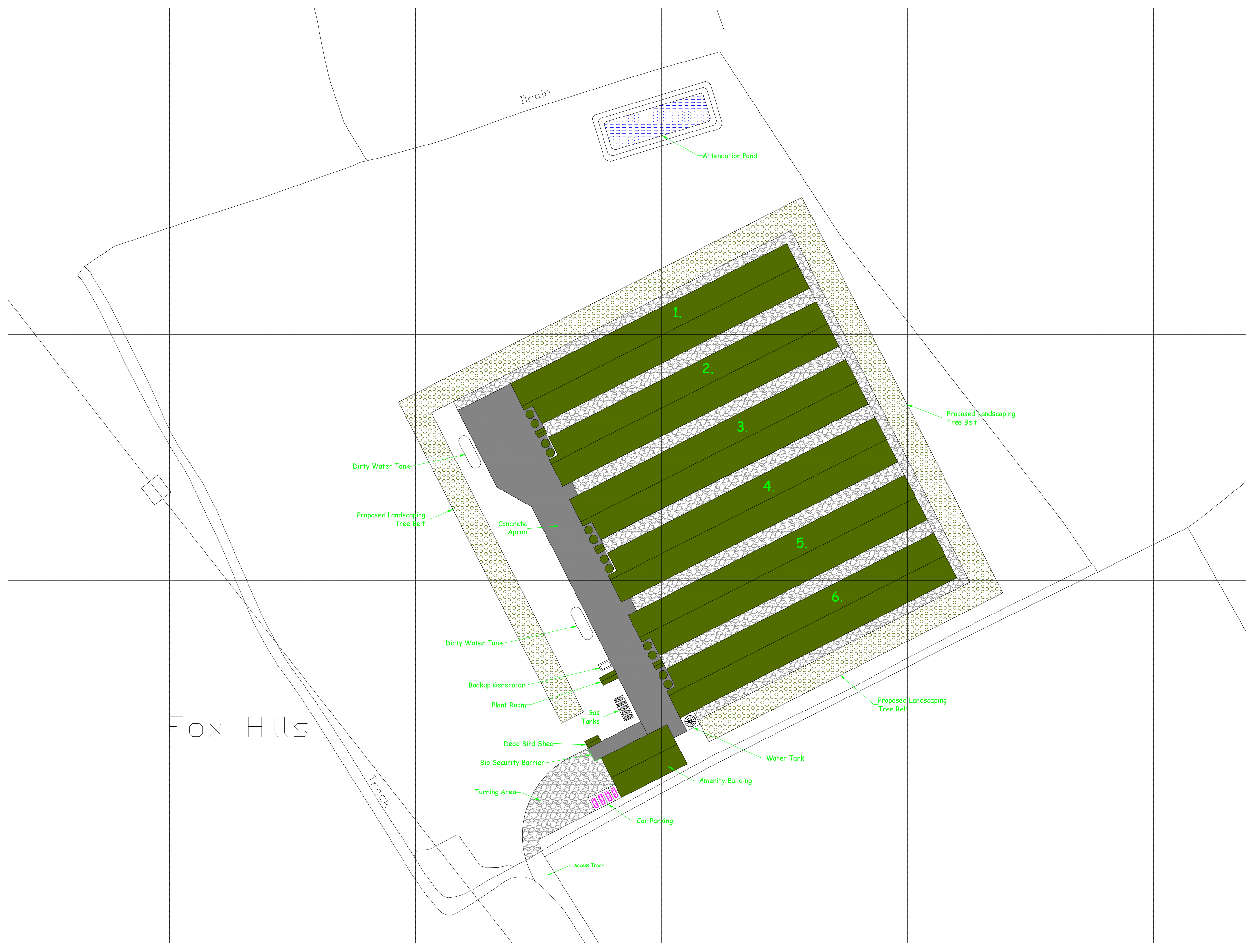
8.6 Overall, this report demonstrates that the flood risk to the site is reasonable and acceptable.

8.7 The report also demonstrates that the site can be suitably drained, with the development being designed to the required standards.

8.8 It is proposed that the surface water run-off from the development will discharge at a restricted rate to an existing open drainage ditch located on the northern boundary of the site and the appropriate volume of storage provided within an attenuation lagoon located within the development site.

APPENDIX A

Indicative Layout Drawings



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Manor House Farm
Low Dinsdale
Darlington
DL2 1PN

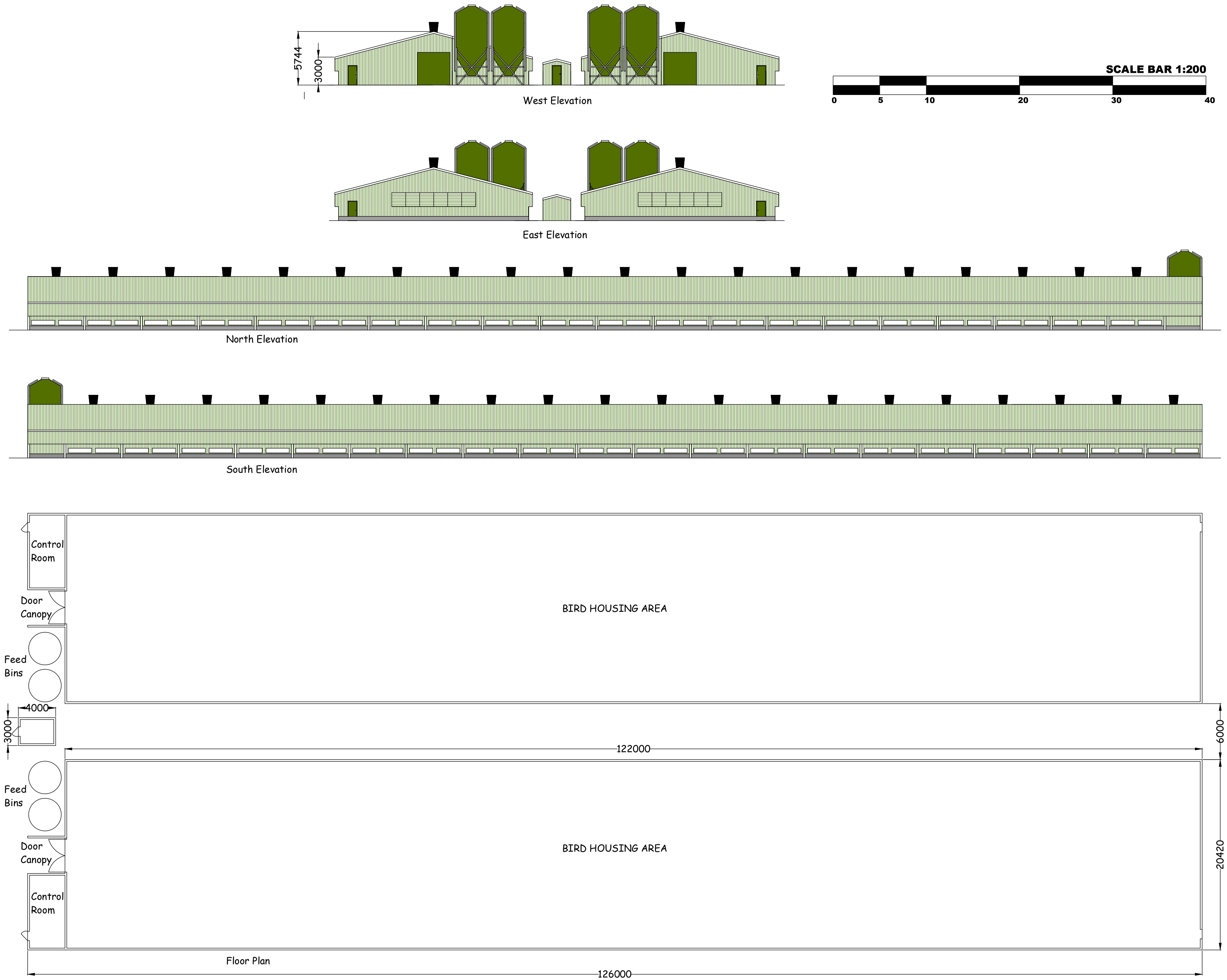
JOB TITLE
Proposed Poultry Unit at Hag Lane, Raskelf, YO61 3LW

DWG. TITLE
Site Plan A0

SCALE	DRN
1=500	IP

DWG. NUMBER
IP/DF/02

DATE	REV
Aug 21	-



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JOB TITLE

Proposed Poultry Unit at Hag Lane, Raskef, YO61 3LW

DWG. TITLE

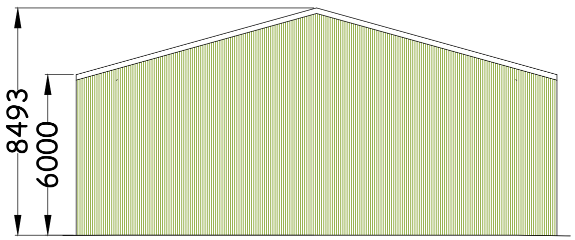
Elevations Poultry Units 1 and 2 (3 & 4 and 5 & 6 identical) A1

SCALE	*DRN*
1=200	IP

DWG. NUMBER

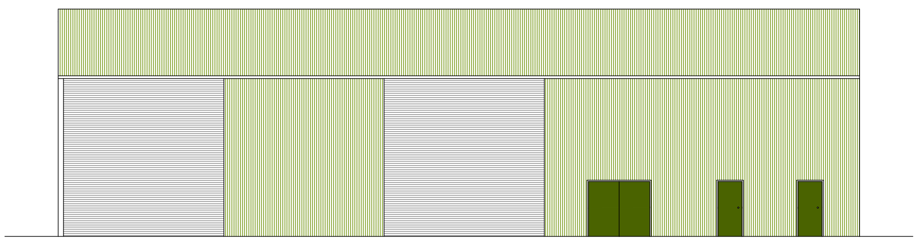
IP/DF/03

DATE	*REV*
Aug 21	-

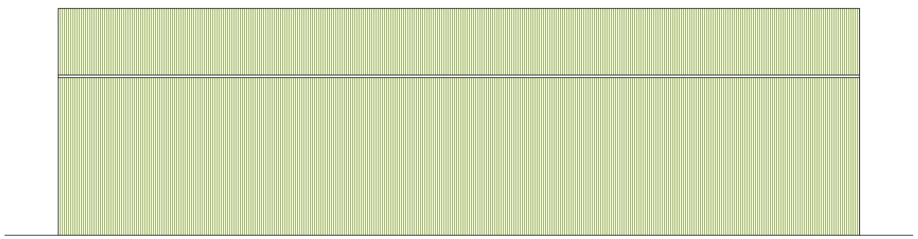


East Elevation

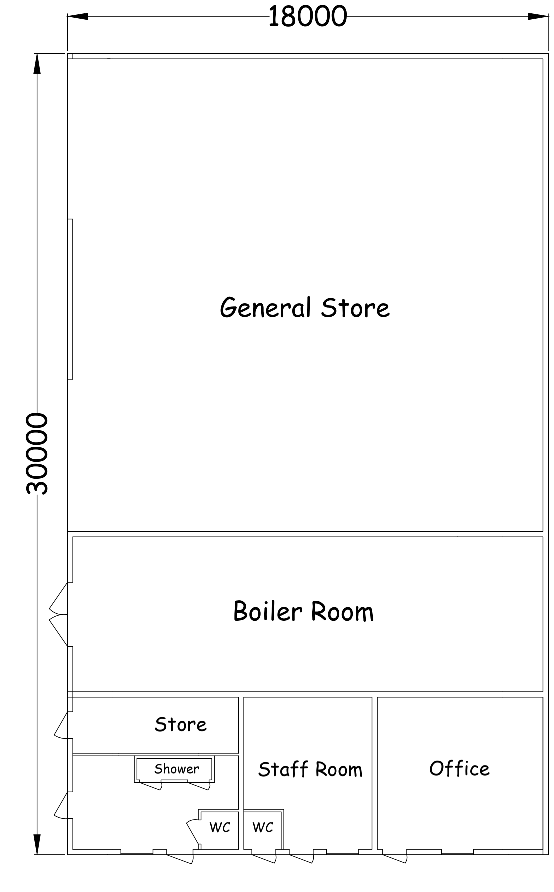
West Elevation



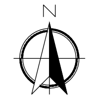
North Elevation



South Elevation



Floor Plan



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JOB TITLE

Proposed Poultry Unit at Hag Lane, Raskef, YO61 3LW

DWG. TITLE

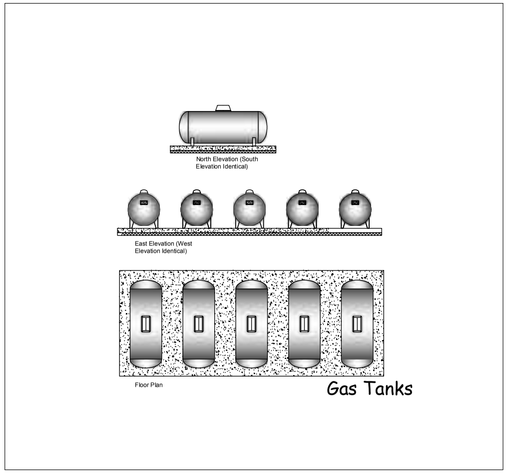
Elevations Amenity Building A1

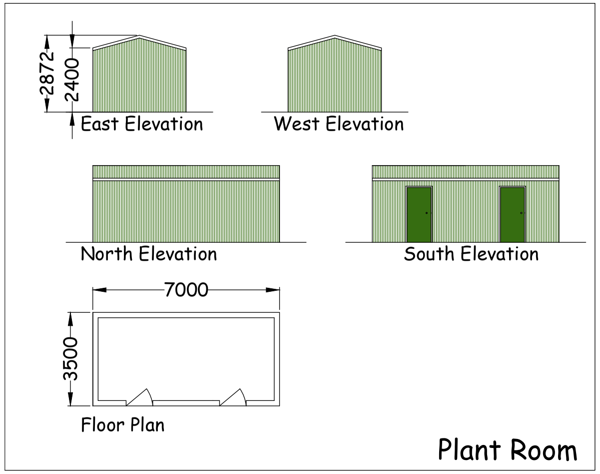
SCALE	*DRN*
1=100	IP

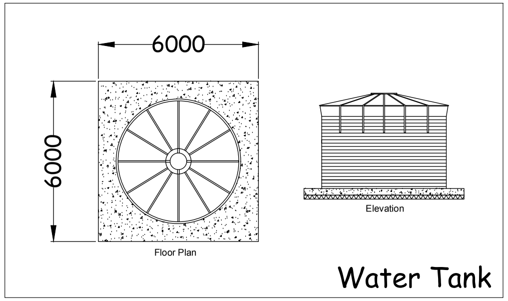
DWG. NUMBER

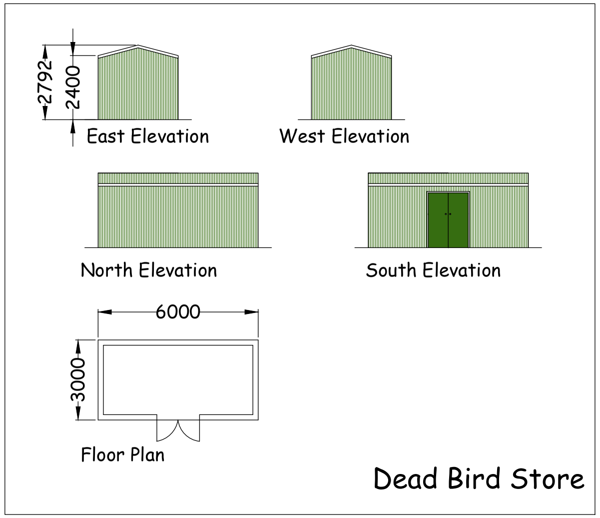
IP/DF/04

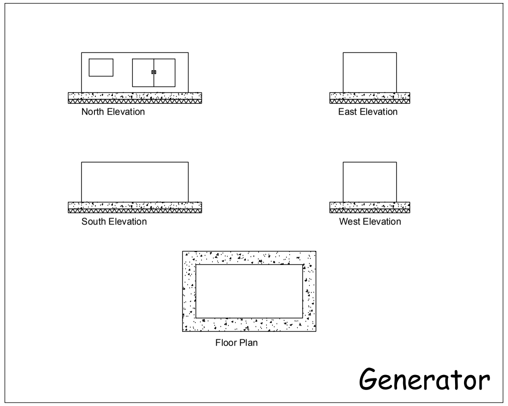
DATE	*REV*
Aug 21	-











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DL2 1PN

JOB TITLE

Proposed Poultry Unit at Hag Lane, Raskef, YO61 3LW

DWG. TITLE

Elevations Ancillary Structures A1

SCALE: 1=100

DRN: IP

DWG. NUMBER: ***IP/DF/05***

DATE: Aug 21

REV: -

APPENDIX B

Hydraulic Model Study

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes Pvt MH

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.400	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
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)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.463	4-8	1.400	8-12	0.013

Total Area Contributing (ha) = 1.876

Total Pipe Volume (m³) = 162.071

Network Design Table for Storm

« - Indicates pipe capacity < flow

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	24.954	0.250	100.0	0.018	3.00	0.0	0.600	o	375	Pipe/Conduit	
S1.001	16.831	0.168	100.0	0.009	0.00	0.0	0.600	o	375	Pipe/Conduit	
S2.000	25.051	0.251	100.0	0.018	3.00	0.0	0.600	o	300	Pipe/Conduit	
S2.001	3.036	0.092	33.0	0.009	0.00	0.0	0.600	o	300	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	50.00	3.23	20.500	0.018	0.0	0.0	0.0	1.81	200.1	2.5
S1.001	50.00	3.38	20.250	0.027	0.0	0.0	0.0	1.81	200.1	3.7
S2.000	50.00	3.27	20.500	0.018	0.0	0.0	0.0	1.57	111.1	2.4
S2.001	50.00	3.28	20.249	0.027	0.0	0.0	0.0	2.75	194.1	3.6

Network Design Table for Storm

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
S1.002	69.114	0.691	100.0	0.032	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.003	63.842	0.376	170.0	0.064	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.004	25.406	0.149	170.0	0.032	0.00	0.0	0.600	o	375	Pipe/Conduit	
S3.000	60.092	0.804	74.7	0.058	3.00	0.0	0.600	o	375	Pipe/Conduit	
S3.001	62.017	0.830	74.7	0.129	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.005	26.302	0.107	245.0	0.064	0.00	0.0	0.600	o	450	Pipe/Conduit	
S4.000	62.044	0.620	100.0	0.064	3.00	0.0	0.600	o	375	Pipe/Conduit	
S4.001	64.002	1.123	57.0	0.129	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.006	26.475	0.156	170.0	0.064	0.00	0.0	0.600	o	450	Pipe/Conduit	
S5.000	59.998	0.353	170.0	0.187	3.00	0.0	0.600	o	375	Pipe/Conduit	
S5.001	61.928	1.544	40.1	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.007	26.433	0.108	245.0	0.065	0.00	0.0	0.600	o	450	Pipe/Conduit	
S6.000	62.092	0.621	100.0	0.064	3.00	0.0	0.600	o	300	Pipe/Conduit	
S6.001	64.030	1.312	48.8	0.128	0.00	0.0	0.600	o	300	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)
S1.002	50.00	4.02	20.082	0.086	0.0	0.0	0.0	1.81	200.1	11.7
S1.003	50.00	4.79	19.391	0.150	0.0	0.0	0.0	1.39	153.2	20.4
S1.004	50.00	5.09	19.015	0.183	0.0	0.0	0.0	1.39	153.2	24.7
S3.000	50.00	3.48	20.500	0.058	0.0	0.0	0.0	2.10	231.8	7.9
S3.001	50.00	3.97	19.696	0.187	0.0	0.0	0.0	2.10	231.8	25.3
S1.005	50.00	5.43	18.791	0.434	0.0	0.0	0.0	1.29	205.9	58.8
S4.000	50.00	3.57	20.500	0.064	0.0	0.0	0.0	1.81	200.1	8.7
S4.001	50.00	4.01	19.880	0.193	0.0	0.0	0.0	2.40	265.5	26.2
S1.006	50.00	5.71	18.682	0.692	0.0	0.0	0.0	1.56	247.5	93.6
S5.000	50.00	3.72	20.500	0.187	0.0	0.0	0.0	1.39	153.2	25.3
S5.001	50.00	4.08	20.147	0.187	0.0	0.0	0.0	2.87	316.8	25.3
S1.007	50.00	6.06	18.526	0.943	0.0	0.0	0.0	1.29	205.9	127.7
S6.000	50.00	3.66	20.500	0.064	0.0	0.0	0.0	1.57	111.1	8.6
S6.001	50.00	4.13	19.879	0.192	0.0	0.0	0.0	2.26	159.5	26.0

Network Design Table for Storm

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
S1.008	26.559	0.054	495.0	0.064	0.00	0.0	0.600	o	600	Pipe/Conduit	
S7.000	60.035	0.600	100.1	0.058	3.00	0.0	0.600	o	300	Pipe/Conduit	
S7.001	61.963	1.386	44.7	0.129	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.009	25.280	0.051	495.0	0.064	0.00	0.0	0.600	o	600	Pipe/Conduit	
S8.000	51.948	0.519	100.1	0.032	3.00	0.0	0.600	o	300	Pipe/Conduit	
S8.001	63.948	1.519	42.1	0.064	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.010	7.017	0.014	500.0	0.032	0.00	0.0	0.600	o	600	Pipe/Conduit	
S9.000	62.213	0.622	100.0	0.074	3.00	0.0	0.600	o	300	Pipe/Conduit	
S9.001	62.213	0.366	170.0	0.130	0.00	0.0	0.600	o	300	Pipe/Conduit	
S9.002	26.123	0.107	245.0	0.093	0.00	0.0	0.600	o	375	Pipe/Conduit	
S9.003	67.775	0.277	245.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S9.004	67.775	0.680	99.7	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.011	53.466	0.107	500.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.012	20.777	0.208	100.0	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)
S1.008	50.00	6.46	18.268	1.199	0.0	0.0	0.0	1.09	307.5	162.4
S7.000	50.00	3.64	20.500	0.058	0.0	0.0	0.0	1.57	111.1	7.8
S7.001	50.00	4.07	19.900	0.187	0.0	0.0	0.0	2.36	166.7	25.3
S1.009	50.00	6.85	18.214	1.451	0.0	0.0	0.0	1.09	307.5	196.5
S8.000	50.00	3.55	20.500	0.032	0.0	0.0	0.0	1.57	111.1	4.3
S8.001	50.00	3.99	19.981	0.096	0.0	0.0	0.0	2.43	171.8	13.0
S1.010	50.00	6.96	18.163	1.579	0.0	0.0	0.0	1.08	306.0	213.8
S9.000	50.00	3.66	20.500	0.074	0.0	0.0	0.0	1.57	111.1	10.0
S9.001	50.00	4.52	19.878	0.204	0.0	0.0	0.0	1.20	85.0	27.6
S9.002	50.00	4.90	19.437	0.297	0.0	0.0	0.0	1.15	127.4	40.2
S9.003	50.00	5.88	19.330	0.297	0.0	0.0	0.0	1.15	127.4	40.2
S9.004	50.00	6.50	19.054	0.297	0.0	0.0	0.0	1.81	200.4	40.2
S1.011	50.00	7.78	18.149	1.876	0.0	0.0	0.0	1.08	306.0	254.0
S1.012	50.00	8.13	18.042	1.876	0.0	0.0	0.0	1.00	17.8«	254.0

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S1	21.350	0.850	Open Manhole	1500	S1.000	20.500	375				
S2	21.350	1.100	Open Manhole	1500	S1.001	20.250	375	S1.000	20.250	375	
S3	21.350	0.850	Open Manhole	1500	S2.000	20.500	300				
S4	21.350	1.101	Open Manhole	1500	S2.001	20.249	300	S2.000	20.249	300	
S5	21.350	1.268	Open Manhole	1500	S1.002	20.082	375	S1.001	20.082	375	
								S2.001	20.157	300	
S6	21.350	1.959	Open Manhole	1500	S1.003	19.391	375	S1.002	19.391	375	
S7	21.350	2.335	Open Manhole	1500	S1.004	19.015	375	S1.003	19.015	375	
S8	21.350	0.850	Open Manhole	1500	S3.000	20.500	375				
S9	21.350	1.654	Open Manhole	1500	S3.001	19.696	375	S3.000	19.696	375	
S10	21.350	2.559	Open Manhole	1500	S1.005	18.791	450	S1.004	18.866	375	
								S3.001	18.866	375	
S11	21.350	0.850	Open Manhole	1500	S4.000	20.500	375				
S12	21.350	1.470	Open Manhole	1500	S4.001	19.880	375	S4.000	19.880	375	
S13	21.350	2.668	Open Manhole	1500	S1.006	18.682	450	S1.005	18.683	450	1
								S4.001	18.757	375	
S14	21.350	0.850	Open Manhole	1500	S5.000	20.500	375				
S15	21.350	1.203	Open Manhole	1500	S5.001	20.147	375	S5.000	20.147	375	
S16	21.350	2.824	Open Manhole	1500	S1.007	18.526	450	S1.006	18.526	450	
								S5.001	18.603	375	2
S17	21.350	0.850	Open Manhole	1500	S6.000	20.500	300				
S18	21.350	1.471	Open Manhole	1500	S6.001	19.879	300	S6.000	19.879	300	
S19	21.350	3.082	Open Manhole	1500	S1.008	18.268	600	S1.007	18.418	450	
								S6.001	18.567	300	
S20	21.350	0.850	Open Manhole	1500	S7.000	20.500	300				
S21	21.350	1.450	Open Manhole	1500	S7.001	19.900	300	S7.000	19.900	300	
S22	21.350	3.136	Open Manhole	1500	S1.009	18.214	600	S1.008	18.214	600	
								S7.001	18.514	300	
S23	21.350	0.850	Open Manhole	1500	S8.000	20.500	300				
S24	21.350	1.369	Open Manhole	1500	S8.001	19.981	300	S8.000	19.981	300	
S25	21.350	3.187	Open Manhole	1500	S1.010	18.163	600	S1.009	18.163	600	
								S8.001	18.462	300	
S26	21.350	0.850	Open Manhole	1500	S9.000	20.500	300				
S27	21.350	1.472	Open Manhole	1500	S9.001	19.878	300	S9.000	19.878	300	
S28	21.350	1.913	Open Manhole	1500	S9.002	19.437	375	S9.001	19.512	300	
S29	21.350	2.020	Open Manhole	1500	S9.003	19.330	375	S9.002	19.330	375	
S30	21.350	2.296	Open Manhole	1500	S9.004	19.054	375	S9.003	19.054	375	
S31	21.350	3.201	Open Manhole	1500	S1.011	18.149	600	S1.010	18.149	600	

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
								S9.004	18.374	375	
S32	21.350	3.308	Open Manhole	1500	S1.012	18.042	150	S1.011	18.042	600	
S	21.350	3.516	Open Manhole	0		OUTFALL		S1.012	17.834	150	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1	447889.353	469413.371	447889.353	469413.371	Required	
S2	447911.544	469424.783	447911.544	469424.783	Required	
S3	447880.285	469431.287	447880.285	469431.287	Required	
S4	447902.660	469442.553	447902.660	469442.553	Required	
S5	447904.017	469439.837	447904.017	469439.837	Required	
S6	447965.625	469471.163	447965.625	469471.163	Required	
S7	448022.533	469500.100	448022.533	469500.100	Required	
S8	447902.108	469467.530	447902.108	469467.530	Required	
S9	447955.705	469494.703	447955.705	469494.703	Required	
S10	448011.019	469522.747	448011.019	469522.747	Required	
S11	447886.627	469489.291	447886.627	469489.291	Required	
S12	447941.989	469517.300	447941.989	469517.300	Required	

Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S13	447999.099	469546.193	447999.099	469546.193	Required	
S14	447878.353	469514.659	447878.353	469514.659	Required	
S15	447931.866	469541.790	447931.866	469541.790	Required	
S16	447987.100	469569.793	447987.100	469569.793	Required	
S17	447862.659	469536.269	447862.659	469536.269	Required	
S18	447918.026	469564.374	447918.026	469564.374	Required	
S19	447975.121	469593.356	447975.121	469593.356	Required	
S20	447854.311	469561.787	447854.311	469561.787	Required	
S21	447907.838	469588.972	447907.838	469588.972	Required	
S22	447963.085	469617.031	447963.085	469617.031	Required	
S23	447848.250	469587.175	447848.250	469587.175	Required	
S24	447894.587	469610.658	447894.587	469610.658	Required	
S25	447951.628	469639.566	447951.628	469639.566	Required	
S26	447895.829	469450.378	447895.829	469450.378	Required	
S27	447867.612	469505.823	447867.612	469505.823	Required	

Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S28	447839.394	469561.268	447839.394	469561.268	Required	
S29	447827.545	469584.550	447827.545	469584.550	Required	
S30	447888.001	469615.187	447888.001	469615.187	Required	
S31	447948.456	469645.825	447948.456	469645.825	Required	
S32	447924.287	469693.516	447924.287	469693.516	Required	
S	447918.742	469713.539			No Entry	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	375	S1	21.350	20.500	0.475	Open Manhole	1500
S1.001	o	375	S2	21.350	20.250	0.725	Open Manhole	1500
S2.000	o	300	S3	21.350	20.500	0.550	Open Manhole	1500
S2.001	o	300	S4	21.350	20.249	0.801	Open Manhole	1500
S1.002	o	375	S5	21.350	20.082	0.893	Open Manhole	1500
S1.003	o	375	S6	21.350	19.391	1.584	Open Manhole	1500
S1.004	o	375	S7	21.350	19.015	1.960	Open Manhole	1500
S3.000	o	375	S8	21.350	20.500	0.475	Open Manhole	1500
S3.001	o	375	S9	21.350	19.696	1.279	Open Manhole	1500
S1.005	o	450	S10	21.350	18.791	2.109	Open Manhole	1500
S4.000	o	375	S11	21.350	20.500	0.475	Open Manhole	1500
S4.001	o	375	S12	21.350	19.880	1.095	Open Manhole	1500
S1.006	o	450	S13	21.350	18.682	2.218	Open Manhole	1500
S5.000	o	375	S14	21.350	20.500	0.475	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	24.954	100.0	S2	21.350	20.250	0.725	Open Manhole	1500
S1.001	16.831	100.0	S5	21.350	20.082	0.893	Open Manhole	1500
S2.000	25.051	100.0	S4	21.350	20.249	0.801	Open Manhole	1500
S2.001	3.036	33.0	S5	21.350	20.157	0.893	Open Manhole	1500
S1.002	69.114	100.0	S6	21.350	19.391	1.584	Open Manhole	1500
S1.003	63.842	170.0	S7	21.350	19.015	1.960	Open Manhole	1500
S1.004	25.406	170.0	S10	21.350	18.866	2.109	Open Manhole	1500
S3.000	60.092	74.7	S9	21.350	19.696	1.279	Open Manhole	1500
S3.001	62.017	74.7	S10	21.350	18.866	2.109	Open Manhole	1500
S1.005	26.302	245.0	S13	21.350	18.683	2.217	Open Manhole	1500
S4.000	62.044	100.0	S12	21.350	19.880	1.095	Open Manhole	1500
S4.001	64.002	57.0	S13	21.350	18.757	2.218	Open Manhole	1500
S1.006	26.475	170.0	S16	21.350	18.526	2.374	Open Manhole	1500
S5.000	59.998	170.0	S15	21.350	20.147	0.828	Open Manhole	1500

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S5.001	o	375	S15	21.350	20.147	0.828	Open Manhole	1500
S1.007	o	450	S16	21.350	18.526	2.374	Open Manhole	1500
S6.000	o	300	S17	21.350	20.500	0.550	Open Manhole	1500
S6.001	o	300	S18	21.350	19.879	1.171	Open Manhole	1500
S1.008	o	600	S19	21.350	18.268	2.482	Open Manhole	1500
S7.000	o	300	S20	21.350	20.500	0.550	Open Manhole	1500
S7.001	o	300	S21	21.350	19.900	1.150	Open Manhole	1500
S1.009	o	600	S22	21.350	18.214	2.536	Open Manhole	1500
S8.000	o	300	S23	21.350	20.500	0.550	Open Manhole	1500
S8.001	o	300	S24	21.350	19.981	1.069	Open Manhole	1500
S1.010	o	600	S25	21.350	18.163	2.587	Open Manhole	1500
S9.000	o	300	S26	21.350	20.500	0.550	Open Manhole	1500
S9.001	o	300	S27	21.350	19.878	1.172	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S5.001	61.928	40.1	S16	21.350	18.603	2.372	Open Manhole	1500
S1.007	26.433	245.0	S19	21.350	18.418	2.482	Open Manhole	1500
S6.000	62.092	100.0	S18	21.350	19.879	1.171	Open Manhole	1500
S6.001	64.030	48.8	S19	21.350	18.567	2.483	Open Manhole	1500
S1.008	26.559	495.0	S22	21.350	18.214	2.536	Open Manhole	1500
S7.000	60.035	100.1	S21	21.350	19.900	1.150	Open Manhole	1500
S7.001	61.963	44.7	S22	21.350	18.514	2.536	Open Manhole	1500
S1.009	25.280	495.0	S25	21.350	18.163	2.587	Open Manhole	1500
S8.000	51.948	100.1	S24	21.350	19.981	1.069	Open Manhole	1500
S8.001	63.948	42.1	S25	21.350	18.462	2.588	Open Manhole	1500
S1.010	7.017	500.0	S31	21.350	18.149	2.601	Open Manhole	1500
S9.000	62.213	100.0	S27	21.350	19.878	1.172	Open Manhole	1500
S9.001	62.213	170.0	S28	21.350	19.512	1.538	Open Manhole	1500

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S9.002	o	375	S28	21.350	19.437	1.538	Open Manhole	1500
S9.003	o	375	S29	21.350	19.330	1.645	Open Manhole	1500
S9.004	o	375	S30	21.350	19.054	1.921	Open Manhole	1500
S1.011	o	600	S31	21.350	18.149	2.601	Open Manhole	1500
S1.012	o	150	S32	21.350	18.042	3.158	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S9.002	26.123	245.0	S29	21.350	19.330	1.645	Open Manhole	1500
S9.003	67.775	245.0	S30	21.350	19.054	1.921	Open Manhole	1500
S9.004	67.775	99.7	S31	21.350	18.374	2.601	Open Manhole	1500
S1.011	53.466	500.0	S32	21.350	18.042	2.708	Open Manhole	1500
S1.012	20.777	100.0	S	21.350	17.834	3.366	Open Manhole	0

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.018	0.018	0.018
1.001	User	-	100	0.009	0.009	0.009
2.000	User	-	100	0.018	0.018	0.018
2.001	User	-	100	0.009	0.009	0.009
1.002	User	-	100	0.032	0.032	0.032
1.003	User	-	100	0.064	0.064	0.064
1.004	User	-	100	0.032	0.032	0.032
3.000	User	-	100	0.029	0.029	0.029
	User	-	100	0.029	0.029	0.058
3.001	User	-	100	0.064	0.064	0.064
	User	-	100	0.065	0.065	0.129
1.005	User	-	100	0.032	0.032	0.032
	User	-	100	0.032	0.032	0.064
4.000	User	-	100	0.032	0.032	0.032
	User	-	100	0.032	0.032	0.064
4.001	User	-	100	0.064	0.064	0.064
	User	-	100	0.065	0.065	0.129
1.006	User	-	100	0.032	0.032	0.032
	User	-	100	0.033	0.033	0.064
5.000	User	-	100	0.029	0.029	0.029
	User	-	100	0.029	0.029	0.058
	User	-	100	0.064	0.064	0.122
	User	-	100	0.065	0.065	0.187
5.001	-	-	100	0.000	0.000	0.000
1.007	User	-	100	0.032	0.032	0.032
	User	-	100	0.032	0.032	0.065
6.000	User	-	100	0.032	0.032	0.032
	User	-	100	0.032	0.032	0.064
6.001	User	-	100	0.064	0.064	0.064
	User	-	100	0.064	0.064	0.128
1.008	User	-	100	0.032	0.032	0.032
	User	-	100	0.032	0.032	0.064
7.000	User	-	100	0.029	0.029	0.029
	User	-	100	0.029	0.029	0.058
7.001	User	-	100	0.065	0.065	0.065
	User	-	100	0.064	0.064	0.129
1.009	User	-	100	0.032	0.032	0.032
	User	-	100	0.032	0.032	0.064
8.000	User	-	100	0.032	0.032	0.032
8.001	User	-	100	0.064	0.064	0.064
1.010	User	-	100	0.032	0.032	0.032
9.000	User	-	100	0.074	0.074	0.074
9.001	User	-	100	0.130	0.130	0.130
9.002	User	-	100	0.093	0.093	0.093
9.003	-	-	100	0.000	0.000	0.000
9.004	-	-	100	0.000	0.000	0.000
1.011	-	-	100	0.000	0.000	0.000
1.012	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				1.876	1.876	1.876

Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
S1.000	S1	375	0.475	0.725	Unclassified	1500	0	0.475	Unclassified
S1.001	S2	375	0.725	0.893	Unclassified	1500	0	0.725	Unclassified
S2.000	S3	300	0.550	0.801	Unclassified	1500	0	0.550	Unclassified
S2.001	S4	300	0.801	0.893	Unclassified	1500	0	0.801	Unclassified
S1.002	S5	375	0.893	1.584	Unclassified	1500	0	0.893	Unclassified
S1.003	S6	375	1.584	1.960	Unclassified	1500	0	1.584	Unclassified
S1.004	S7	375	1.960	2.109	Unclassified	1500	0	1.960	Unclassified
S3.000	S8	375	0.475	1.279	Unclassified	1500	0	0.475	Unclassified
S3.001	S9	375	1.279	2.109	Unclassified	1500	0	1.279	Unclassified
S1.005	S10	450	2.109	2.217	Unclassified	1500	0	2.109	Unclassified
S4.000	S11	375	0.475	1.095	Unclassified	1500	0	0.475	Unclassified
S4.001	S12	375	1.095	2.218	Unclassified	1500	0	1.095	Unclassified
S1.006	S13	450	2.218	2.374	Unclassified	1500	0	2.218	Unclassified
S5.000	S14	375	0.475	0.828	Unclassified	1500	0	0.475	Unclassified
S5.001	S15	375	0.828	2.372	Unclassified	1500	0	0.828	Unclassified
S1.007	S16	450	2.374	2.482	Unclassified	1500	0	2.374	Unclassified
S6.000	S17	300	0.550	1.171	Unclassified	1500	0	0.550	Unclassified
S6.001	S18	300	1.171	2.483	Unclassified	1500	0	1.171	Unclassified
S1.008	S19	600	2.482	2.536	Unclassified	1500	0	2.482	Unclassified
S7.000	S20	300	0.550	1.150	Unclassified	1500	0	0.550	Unclassified
S7.001	S21	300	1.150	2.536	Unclassified	1500	0	1.150	Unclassified
S1.009	S22	600	2.536	2.587	Unclassified	1500	0	2.536	Unclassified
S8.000	S23	300	0.550	1.069	Unclassified	1500	0	0.550	Unclassified
S8.001	S24	300	1.069	2.588	Unclassified	1500	0	1.069	Unclassified
S1.010	S25	600	2.587	2.601	Unclassified	1500	0	2.587	Unclassified
S9.000	S26	300	0.550	1.172	Unclassified	1500	0	0.550	Unclassified
S9.001	S27	300	1.172	1.538	Unclassified	1500	0	1.172	Unclassified
S9.002	S28	375	1.538	1.645	Unclassified	1500	0	1.538	Unclassified
S9.003	S29	375	1.645	1.921	Unclassified	1500	0	1.645	Unclassified
S9.004	S30	375	1.921	2.601	Unclassified	1500	0	1.921	Unclassified
S1.011	S31	600	2.601	2.708	Unclassified	1500	0	2.601	Unclassified
S1.012	S32	150	3.158	3.366	Unclassified	1500	0	3.158	Unclassified

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.012	S	21.350	17.834	18.108	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.400		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S32, DS/PN: S1.012, Volume (m^3): 20.5

Unit Reference	MD-SHE-0075-3000-1500-3000
Design Head (m)	1.500
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	18.042
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.500	3.0
Flush-Flo™	0.329	2.6
Kick-Flo®	0.671	2.1
Mean Flow over Head Range	-	2.4

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	2.1	1.200	2.7	3.000	4.1	7.000	6.1
0.200	2.5	1.400	2.9	3.500	4.4	7.500	6.3
0.300	2.6	1.600	3.1	4.000	4.7	8.000	6.5
0.400	2.6	1.800	3.3	4.500	5.0	8.500	6.7
0.500	2.5	2.000	3.4	5.000	5.2	9.000	6.9
0.600	2.3	2.200	3.6	5.500	5.5	9.500	7.1
0.800	2.2	2.400	3.7	6.000	5.7		
1.000	2.5	2.600	3.9	6.500	5.9		

Storage Structures for Storm

Tank or Pond Manhole: S32, DS/PN: S1.012

Invert Level (m) 18.042

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	826.0	3.008	2001.2	3.009	0.0

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR
Region England and Wales
M5-60 (mm) 19.000
Ratio R 0.400
Cv (Summer) 1.000
Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep Fine
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, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	15 Summer	1	+0%	100/15 Summer			
S1.001	S2	15 Summer	1	+0%	100/15 Summer			
S2.000	S3	15 Summer	1	+0%	100/15 Summer			
S2.001	S4	15 Summer	1	+0%	100/15 Summer			
S1.002	S5	15 Summer	1	+0%	100/15 Summer			
S1.003	S6	15 Summer	1	+0%	30/15 Summer			
S1.004	S7	15 Summer	1	+0%	30/15 Summer			
S3.000	S8	15 Summer	1	+0%	100/15 Summer			
S3.001	S9	15 Summer	1	+0%	100/15 Summer			
S1.005	S10	15 Summer	1	+0%	30/15 Summer			
S4.000	S11	15 Summer	1	+0%	100/15 Summer			
S4.001	S12	15 Summer	1	+0%	100/15 Summer			
S1.006	S13	15 Summer	1	+0%	30/15 Summer	100/5760 Winter		
S5.000	S14	15 Summer	1	+0%	100/15 Summer			
S5.001	S15	15 Summer	1	+0%	100/15 Summer			
S1.007	S16	15 Summer	1	+0%	30/15 Summer	100/5760 Winter		
S6.000	S17	15 Summer	1	+0%	100/15 Summer			
S6.001	S18	15 Summer	1	+0%	100/15 Summer			
S1.008	S19	15 Summer	1	+0%	30/15 Summer			

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	20.539	-0.336	0.000	0.02			3.8	OK	
S1.001	S2	20.295	-0.331	0.000	0.03			5.1	OK	
S2.000	S3	20.538	-0.262	0.000	0.04			3.7	OK	
S2.001	S4	20.300	-0.249	0.000	0.07			5.0	OK	
S1.002	S5	20.151	-0.306	0.000	0.07			14.0	OK	
S1.003	S6	19.492	-0.274	0.000	0.15			22.1	OK	
S1.004	S7	19.129	-0.261	0.000	0.20			26.1	OK	
S3.000	S8	20.559	-0.316	0.000	0.05			11.8	OK	
S3.001	S9	19.788	-0.283	0.000	0.14			29.6	OK	
S1.005	S10	18.983	-0.257	0.000	0.35			61.2	OK	
S4.000	S11	20.568	-0.307	0.000	0.07			13.1	OK	
S4.001	S12	19.968	-0.287	0.000	0.12			31.0	OK	
S1.006	S13	18.908	-0.224	0.000	0.46			97.1	OK	
S5.000	S14	20.636	-0.239	0.000	0.26			37.5	OK	
S5.001	S15	20.236	-0.286	0.000	0.12			37.0	OK	
S1.007	S16	18.830	-0.146	0.000	0.78			136.0	OK	
S6.000	S17	20.572	-0.228	0.000	0.12			12.9	OK	
S6.001	S18	19.970	-0.209	0.000	0.20			30.9	OK	
S1.008	S19	18.729	-0.139	0.000	0.66			162.9	OK	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S7.000	S20	15 Summer	1	+0%				
S7.001	S21	15 Summer	1	+0%	100/15 Summer			
S1.009	S22	15 Summer	1	+0%	30/15 Summer	100/7200 Summer		
S8.000	S23	15 Summer	1	+0%				
S8.001	S24	15 Summer	1	+0%				
S1.010	S25	15 Summer	1	+0%	30/15 Summer	100/7200 Summer		
S9.000	S26	15 Summer	1	+0%	100/15 Summer			
S9.001	S27	15 Summer	1	+0%	30/15 Summer			
S9.002	S28	15 Summer	1	+0%	30/15 Summer			
S9.003	S29	15 Summer	1	+0%	100/15 Summer			
S9.004	S30	15 Summer	1	+0%	100/15 Summer			
S1.011	S31	15 Summer	1	+0%	30/15 Summer			
S1.012	S32	1440 Winter	1	+0%	1/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S7.000	S20	20.569	-0.231	0.000	0.11			11.7	OK
S7.001	S21	19.987	-0.213	0.000	0.19			29.9	OK
S1.009	S22	18.687	-0.127	0.000	0.77			187.1	OK
S8.000	S23	20.551	-0.249	0.000	0.06			6.5	OK
S8.001	S24	20.043	-0.238	0.000	0.10			15.6	OK
S1.010	S25	18.633	-0.130	0.000	1.05			199.8	OK
S9.000	S26	20.578	-0.222	0.000	0.14			14.9	OK
S9.001	S27	20.011	-0.167	0.000	0.39			31.7	OK
S9.002	S28	19.603	-0.209	0.000	0.40			44.0	OK
S9.003	S29	19.487	-0.218	0.000	0.34			41.0	OK
S9.004	S30	19.172	-0.257	0.000	0.21			40.2	OK
S1.011	S31	18.590	-0.159	0.000	0.88			238.0	OK
S1.012	S32	18.479	0.287	0.000	0.15			2.6	SURCHARGED

PN	US/MH Name	Level Exceeded
S7.000	S20	
S7.001	S21	
S1.009	S22	
S8.000	S23	
S8.001	S24	
S1.010	S25	
S9.000	S26	
S9.001	S27	
S9.002	S28	
S9.003	S29	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Level Exceeded
S9.004	S30	
S1.011	S31	
S1.012	S32	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

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 Coeffiecient 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 Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.400
Region England and Wales Cv (Summer) 1.000
M5-60 (mm) 19.000 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	15 Summer	30	+0%	100/15 Summer			
S1.001	S2	15 Summer	30	+0%	100/15 Summer			
S2.000	S3	15 Summer	30	+0%	100/15 Summer			
S2.001	S4	15 Summer	30	+0%	100/15 Summer			
S1.002	S5	15 Summer	30	+0%	100/15 Summer			
S1.003	S6	15 Summer	30	+0%	30/15 Summer			
S1.004	S7	15 Summer	30	+0%	30/15 Summer			
S3.000	S8	15 Summer	30	+0%	100/15 Summer			
S3.001	S9	15 Summer	30	+0%	100/15 Summer			
S1.005	S10	15 Summer	30	+0%	30/15 Summer			
S4.000	S11	15 Summer	30	+0%	100/15 Summer			
S4.001	S12	15 Summer	30	+0%	100/15 Summer			
S1.006	S13	15 Summer	30	+0%	30/15 Summer	100/5760 Winter		
S5.000	S14	15 Summer	30	+0%	100/15 Summer			
S5.001	S15	15 Summer	30	+0%	100/15 Summer			
S1.007	S16	15 Summer	30	+0%	30/15 Summer	100/5760 Winter		
S6.000	S17	15 Summer	30	+0%	100/15 Summer			
S6.001	S18	15 Summer	30	+0%	100/15 Summer			
S1.008	S19	15 Summer	30	+0%	30/15 Summer			

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	S1	20.557	-0.318	0.000	0.05			9.5	OK
S1.001	S2	20.325	-0.300	0.000	0.08			13.4	OK
S2.000	S3	20.562	-0.238	0.000	0.09			9.1	OK
S2.001	S4	20.335	-0.214	0.000	0.18			13.3	OK
S1.002	S5	20.201	-0.256	0.000	0.21			40.0	OK
S1.003	S6	19.941	0.175	0.000	0.41			59.7	SURCHARGED
S1.004	S7	19.898	0.507	0.000	0.62			82.8	SURCHARGED
S3.000	S8	20.594	-0.281	0.000	0.13			28.8	OK
S3.001	S9	19.921	-0.150	0.000	0.40			87.5	OK
S1.005	S10	19.878	0.637	0.000	0.76			132.7	SURCHARGED
S4.000	S11	20.608	-0.267	0.000	0.17			32.0	OK
S4.001	S12	20.038	-0.217	0.000	0.36			90.7	OK
S1.006	S13	19.835	0.702	0.000	0.85			178.7	SURCHARGED
S5.000	S14	20.732	-0.143	0.000	0.64			92.0	OK
S5.001	S15	20.290	-0.232	0.000	0.30			90.5	OK
S1.007	S16	19.724	0.748	0.000	1.43			248.8	SURCHARGED
S6.000	S17	20.617	-0.183	0.000	0.30			31.5	OK
S6.001	S18	20.047	-0.132	0.000	0.59			89.7	OK
S1.008	S19	19.505	0.637	0.000	1.34			327.8	SURCHARGED

PN	US/MH Name	Level Exceeded
S1.000	S1	
S1.001	S2	
S2.000	S3	
S2.001	S4	
S1.002	S5	
S1.003	S6	
S1.004	S7	
S3.000	S8	
S3.001	S9	
S1.005	S10	
S4.000	S11	
S4.001	S12	
S1.006	S13	
S5.000	S14	
S5.001	S15	
S1.007	S16	
S6.000	S17	
S6.001	S18	
S1.008	S19	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S7.000	S20	15 Summer	30	+0%				
S7.001	S21	15 Summer	30	+0%	100/15 Summer			
S1.009	S22	15 Summer	30	+0%	30/15 Summer	100/7200 Summer		
S8.000	S23	15 Summer	30	+0%				
S8.001	S24	15 Summer	30	+0%				
S1.010	S25	15 Summer	30	+0%	30/15 Summer	100/7200 Summer		
S9.000	S26	15 Summer	30	+0%	100/15 Summer			
S9.001	S27	15 Summer	30	+0%	30/15 Summer			
S9.002	S28	15 Summer	30	+0%	30/15 Summer			
S9.003	S29	15 Summer	30	+0%	100/15 Summer			
S9.004	S30	15 Summer	30	+0%	100/15 Summer			
S1.011	S31	15 Summer	30	+0%	30/15 Summer			
S1.012	S32	2160 Winter	30	+0%	1/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S7.000	S20	20.611	-0.189	0.000	0.27			28.5	OK
S7.001	S21	20.061	-0.139	0.000	0.55			87.4	OK
S1.009	S22	19.406	0.592	0.000	1.68			409.1	SURCHARGED
S8.000	S23	20.581	-0.219	0.000	0.15			15.9	OK
S8.001	S24	20.089	-0.192	0.000	0.28			45.2	OK
S1.010	S25	19.234	0.471	0.000	2.36			448.4	SURCHARGED
S9.000	S26	20.627	-0.173	0.000	0.35			36.6	OK
S9.001	S27	20.256	0.078	0.000	1.06			86.0	SURCHARGED
S9.002	S28	19.815	0.003	0.000	1.04			115.2	SURCHARGED
S9.003	S29	19.624	-0.082	0.000	0.93			111.9	OK
S9.004	S30	19.267	-0.162	0.000	0.59			110.6	OK
S1.011	S31	19.047	0.298	0.000	1.96			529.4	SURCHARGED
S1.012	S32	19.012	0.820	0.000	0.15			2.6	SURCHARGED

PN	US/MH Name	Level Exceeded
S7.000	S20	
S7.001	S21	
S1.009	S22	
S8.000	S23	
S8.001	S24	
S1.010	S25	
S9.000	S26	
S9.001	S27	
S9.002	S28	
S9.003	S29	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Level Exceeded
S9.004	S30	
S1.011	S31	
S1.012	S32	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

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 Coeffiecient 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 Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.400
Region England and Wales Cv (Summer) 1.000
M5-60 (mm) 19.000 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	15 Summer	100	+30%	100/15 Summer			
S1.001	S2	15 Summer	100	+30%	100/15 Summer			
S2.000	S3	15 Summer	100	+30%	100/15 Summer			
S2.001	S4	15 Summer	100	+30%	100/15 Summer			
S1.002	S5	15 Summer	100	+30%	100/15 Summer			
S1.003	S6	15 Summer	100	+30%	30/15 Summer			
S1.004	S7	15 Summer	100	+30%	30/15 Summer			
S3.000	S8	15 Summer	100	+30%	100/15 Summer			
S3.001	S9	15 Summer	100	+30%	100/15 Summer			
S1.005	S10	15 Summer	100	+30%	30/15 Summer			
S4.000	S11	15 Summer	100	+30%	100/15 Summer			
S4.001	S12	15 Summer	100	+30%	100/15 Summer			
S1.006	S13	15 Summer	100	+30%	30/15 Summer	100/5760 Winter		
S5.000	S14	15 Summer	100	+30%	100/15 Summer			
S5.001	S15	15 Summer	100	+30%	100/15 Summer			
S1.007	S16	15 Summer	100	+30%	30/15 Summer	100/5760 Winter		
S6.000	S17	15 Summer	100	+30%	100/15 Summer			
S6.001	S18	15 Summer	100	+30%	100/15 Summer			
S1.008	S19	15 Summer	100	+30%	30/15 Summer			

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	S1	21.160	0.285	0.000	0.09			16.0	FLOOD RISK
S1.001	S2	21.156	0.531	0.000	0.18			28.4	FLOOD RISK
S2.000	S3	21.159	0.359	0.000	0.16			15.4	FLOOD RISK
S2.001	S4	21.152	0.603	0.000	0.30			23.0	FLOOD RISK
S1.002	S5	21.149	0.692	0.000	0.35			65.5	FLOOD RISK
S1.003	S6	21.173	1.407	0.000	0.62			88.7	FLOOD RISK
S1.004	S7	21.182	1.791	0.000	0.88			117.4	FLOOD RISK
S3.000	S8	21.311	0.436	0.000	0.22			48.3	FLOOD RISK
S3.001	S9	21.298	1.227	0.000	0.51			110.5	FLOOD RISK
S1.005	S10	21.171	1.930	0.000	0.95			165.3	FLOOD RISK
S4.000	S11	21.261	0.386	0.000	0.28			52.2	FLOOD RISK
S4.001	S12	21.245	0.990	0.000	0.50			126.0	FLOOD RISK
S1.006	S13	21.102	1.970	0.000	1.20			250.6	FLOOD RISK
S5.000	S14	21.064	0.189	0.000	1.08			155.5	FLOOD RISK
S5.001	S15	20.980	0.458	0.000	0.41			122.6	SURCHARGED
S1.007	S16	20.857	1.881	0.000	2.04			355.2	SURCHARGED
S6.000	S17	21.032	0.232	0.000	0.49			52.0	SURCHARGED
S6.001	S18	20.992	0.813	0.000	0.75			114.4	SURCHARGED
S1.008	S19	20.407	1.539	0.000	1.93			472.8	SURCHARGED

PN	US/MH Name	Level Exceeded
S1.000	S1	
S1.001	S2	
S2.000	S3	
S2.001	S4	
S1.002	S5	
S1.003	S6	
S1.004	S7	
S3.000	S8	
S3.001	S9	
S1.005	S10	
S4.000	S11	
S4.001	S12	
S1.006	S13	
S5.000	S14	
S5.001	S15	
S1.007	S16	
S6.000	S17	
S6.001	S18	
S1.008	S19	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S7.000	S20	15 Summer	100	+30%				
S7.001	S21	15 Summer	100	+30%	100/15 Summer			
S1.009	S22	15 Summer	100	+30%	30/15 Summer	100/7200 Summer		
S8.000	S23	15 Summer	100	+30%				
S8.001	S24	15 Summer	100	+30%				
S1.010	S25	5760 Winter	100	+30%	30/15 Summer	100/7200 Summer		
S9.000	S26	15 Summer	100	+30%	100/15 Summer			
S9.001	S27	15 Summer	100	+30%	30/15 Summer			
S9.002	S28	15 Summer	100	+30%	30/15 Summer			
S9.003	S29	15 Summer	100	+30%	100/15 Summer			
S9.004	S30	15 Summer	100	+30%	100/15 Summer			
S1.011	S31	2880 Winter	100	+30%	30/15 Summer			
S1.012	S32	2880 Winter	100	+30%	1/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S7.000	S20	20.728	-0.072	0.000	0.45			48.0	OK
S7.001	S21	20.691	0.491	0.000	0.75			118.7	SURCHARGED
S1.009	S22	20.194	1.380	0.000	2.42			588.1	SURCHARGED
S8.000	S23	20.607	-0.193	0.000	0.26			26.8	OK
S8.001	S24	20.126	-0.155	0.000	0.46			76.1	OK
S1.010	S25	19.930	1.167	0.000	0.12			23.5	SURCHARGED
S9.000	S26	21.286	0.486	0.000	0.53			55.9	FLOOD RISK
S9.001	S27	21.160	0.982	0.000	1.58			127.7	FLOOD RISK
S9.002	S28	20.467	0.655	0.000	1.54			170.1	SURCHARGED
S9.003	S29	20.296	0.591	0.000	1.29			154.6	SURCHARGED
S9.004	S30	19.887	0.458	0.000	0.76			143.4	SURCHARGED
S1.011	S31	19.619	0.870	0.000	0.11			30.8	SURCHARGED
S1.012	S32	19.602	1.410	0.000	0.18			3.0	SURCHARGED

PN	US/MH Name	Level Exceeded
S7.000	S20	
S7.001	S21	
S1.009	S22	
S8.000	S23	
S8.001	S24	
S1.010	S25	
S9.000	S26	
S9.001	S27	
S9.002	S28	
S9.003	S29	

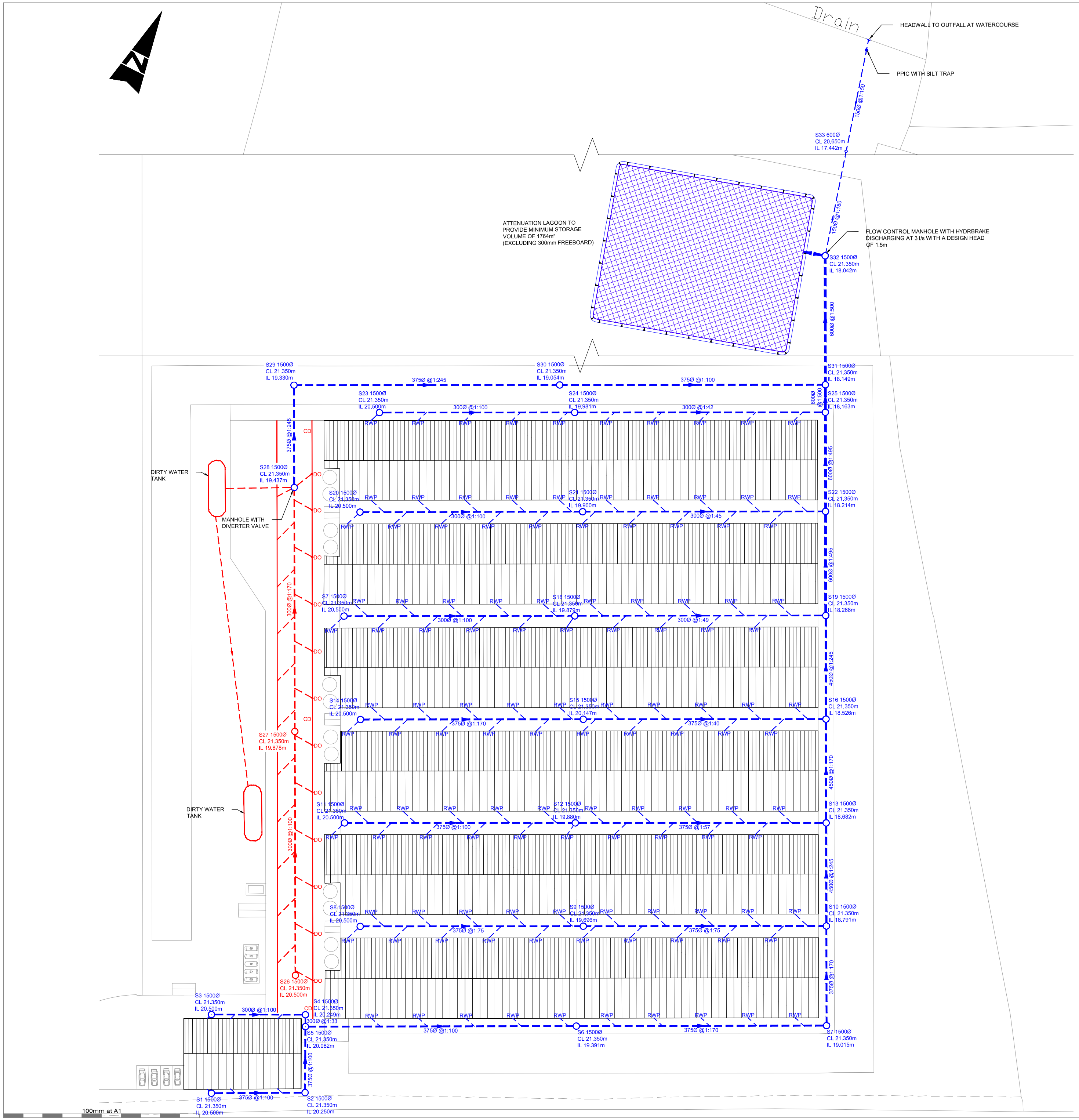
100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

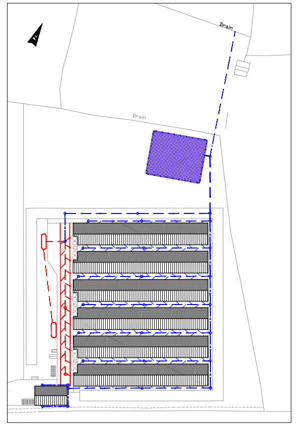
PN	US/MH Name	Level Exceeded
S9.004	S30	
S1.011	S31	
S1.012	S32	

Alan Wood & Partners

APPENDIX C

Drainage Layout Drawing





LOCATION PLAN
1:2500

NOTES:

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3. DRAWINGS NOT TO BE SCALED. ALL DIMENSIONS TO BE CHECKED ON SITE BY THE CONTRACTOR. ANY DISCREPANCIES TO BE NOTIFIED TO THE ENGINEER AND FURTHER INSTRUCTIONS OBTAINED BEFORE WORK IS COMMENCED.
4. THE STRUCTURE IS DESIGNED TO BE SELF-SUPPORTING AND STABLE AFTER THE BUILDING IS FULLY COMPLETED. IT IS THE CONTRACTORS SOLE RESPONSIBILITY TO DETERMINE THE ERECTION PROCEDURE AND SEQUENCE AND ENSURE THAT THE BUILDING AND ITS COMPONENTS ARE SAFE DURING ERECTION. THIS INCLUDES THE ADDITION OF WHATEVER TEMPORARY BRACING, GUYS OR TIE-DOWNS WHICH MAY BE NECESSARY, SUCH MATERIAL REMAINING THE THE PROPERTY OF THE CONTRACTOR ON COMPLETION, AND FOR ENSURING THAT THE WORKS AND ANY ADJACENT PROPERTIES ARE SAFE IN THE TEMPORARY CONDITION.

KEY:

- = PROPOSED SURFACE WATER DRAINAGE
- = PROPOSED SURFACE WATER MANHOLE
- RWP = PROPOSED RAIN WATER PIPE
- = PROPOSED COMBINED DRAINAGE
- = PROPOSED COMBINED MANHOLE
- DC = PROPOSED COMBINED DRAINAGE CHANNEL
- DO = PROPOSED COMBINED DRAINAGE OUTLET

Rev	Description	Date	By	Chk	App
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Sheffield	T. 01142 440077
York	T. 01904 611594

Project: Proposed Poultry Unit, Hag Lane, Raskelf, York, YO61 3LW

Client: Dinsdale Farming Ltd

Drawing: Proposed Drainage Layout

Role: Civil Engineer

Drawing Status: For Approval

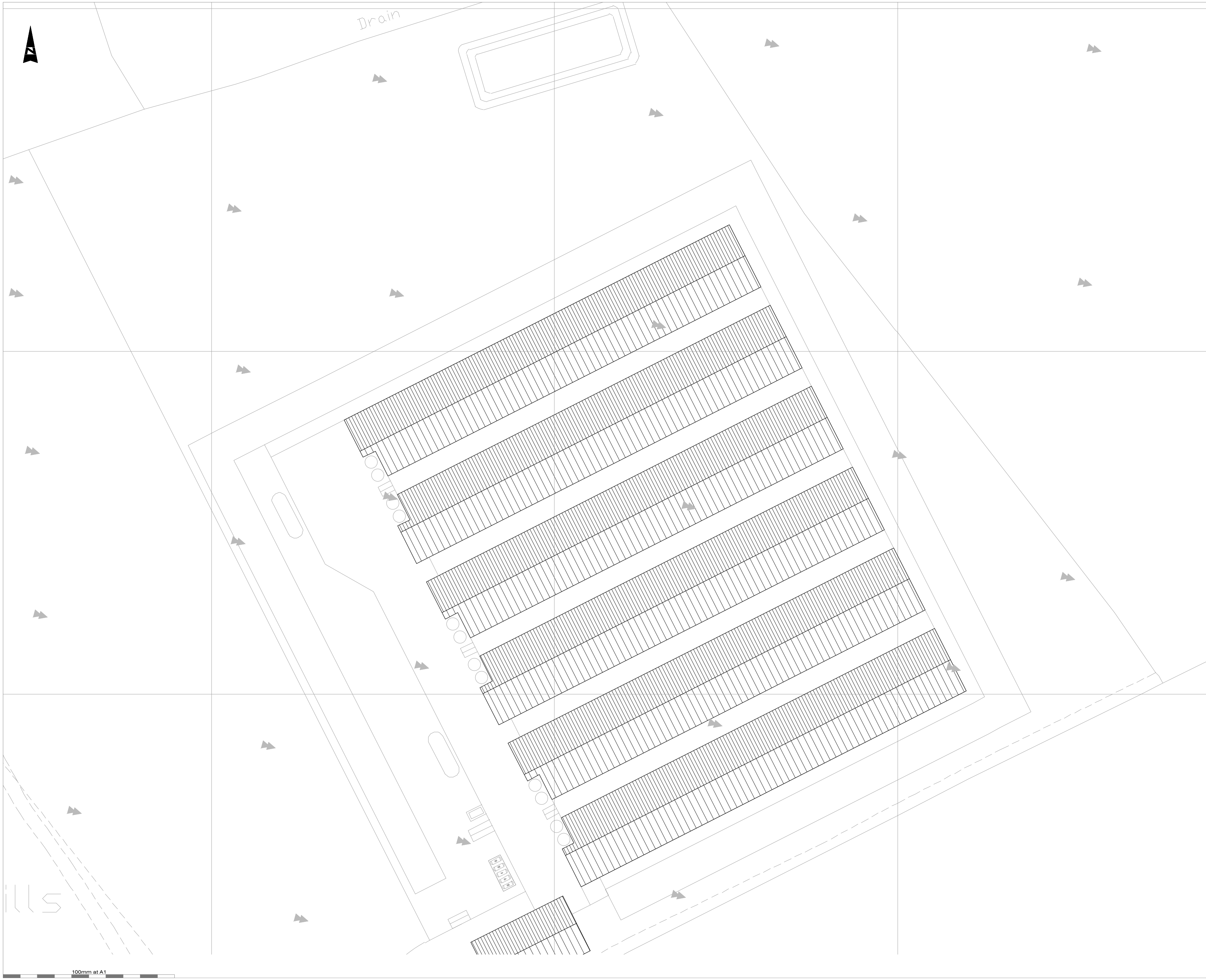
Job. no. 46183 | Scale@A1: 1:500 | Rev. P1

Project - Originator - Volume - Level - Type - Role - Number

DFP - AWP - ZZ - XX - DR - C - 3300

APPENDIX D

Surface Water Exceedance Flood Routing Drawing



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KEY

= PROPOSED SURFACE WATER EXCEEDANCE FLOW PATH ROUTE

= EXISTING SURFACE WATER EXCEEDANCE FLOW PATH ROUTE

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Project: Proposed Poultry Unit at Hag Lane, Raskelf

Client: Dinsdale Farming Ltd

Drawing: Existing Surface Water Exceedance Flood Routing

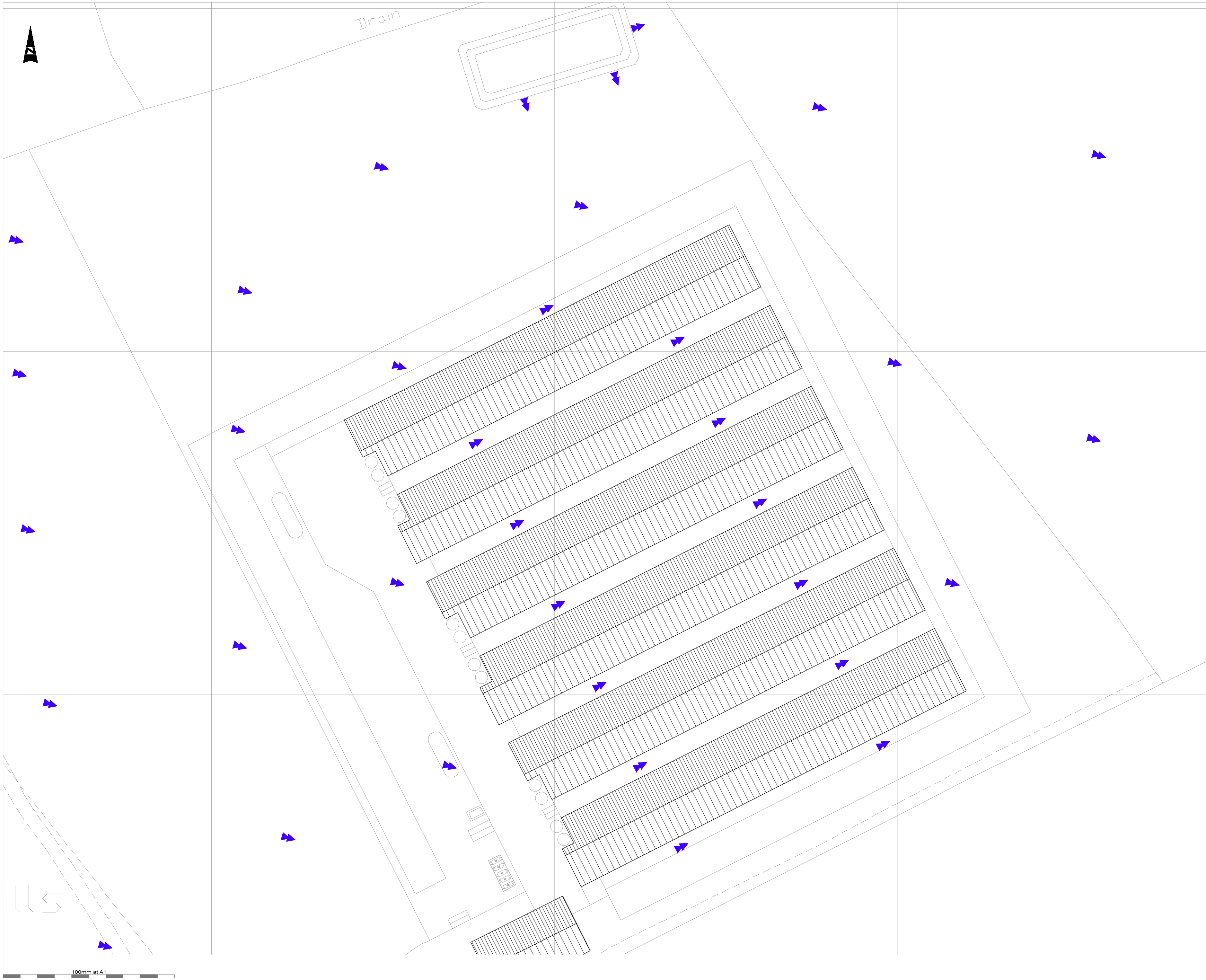
Role: Civil Engineer

Drawing Status: For Approval

Job. no. 46183 | Scale@A1: 1:500 | Rev. P1

Project - Originator - Volume - Level - Type - Role - Number

DFP - AWP - ZZ - XX - DR - 3001



NOTES:

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KEY

= PROPOSED SURFACE WATER EXCEEDANCE FLOW PATH ROUTE

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Project: Proposed Poultry Unit at Hag Lane, Raskelf

Client: Dinsdale Farming Ltd

Drawing: Proposed Surface Water Exceedance Flood Routing

Role: Civil Engineer

Drawing Status: For Approval

Job. no. 46183 | Scale@ A1: 1:500 | Rev. P1

Project - Originator - Volume - Level - Type - Role - Number

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APPENDIX E

CIRIA SuDS Manual Water Quality Matrix Output

SIMPLE INDEX APPROACH: TOOL

1. The steps set out in the tool should be applied for each inflow or 'runoff area' (ie each impermeable surface area separately discharging to a SuDS component).

2. The supporting 'Design Conditions' stated by the tool must be fully considered and implemented in all cases.

3. The process that is automated in this tool is described in the SuDS Manual, Chapter 26 (Section 26.7)

3. Relevant design examples are included in the SuDS Manual Appendix C.

4. Each of the steps below are part of the process set out in the flowchart on Sheet 3.

5. Sheet 4 summarises the selections made below and indicates the acceptability of the proposed SuDS components.

6. Interception should be delivered for all upstream impermeable areas as part of the strategy for water quantity and quality control for the site. This is required in order to deliver both of the water quality criteria set out in Chapter 4 of the SuDS Manual

[blue box]	**DROP DOWN LIST**	**RELEVANT INPUTS NEED TO BE SELECTED FROM THESE LISTS, FOR EACH STEP**
[green box]	**USER ENTRY**	**USER ENTRY CELLS ARE ONLY REQUIRED WHERE INDICATED BY THE TOOL**

STEP 1: Determine the Pollution Hazard Index for the runoff area discharging to the proposed SuDS scheme

This step requires the user to select the appropriate land use type for the area from which the runoff is occurring

If the land use varies across the runoff area , either

- use the land use type with the highest Pollution Ha ard Inde
- apply the approach for each of the land use types to determine whether the proposed SuDS design is sufficient for all If it is not, consider collecting more ha ardous runoff separately and providing additional treatment

If the generic land use types suggested are not applica le, select Other and enter a description of the land use of the runoff area and agreed user defined indices in the row elow the drop down lists

	Runoff Area Land Use Description	*Hazard Level*	Total Suspended Solids (*Pollution Hazard Indices*)	Metals	Hydrocarbons	*DESIGN CONDITIONS* 1	2
Select land use type from the drop down list (or 'Other' if none applicable): →	Agricultural/industrial roofing Inert materials	ery low	0 3	0 2	0 05		
If the generic land use types in the drop down list above are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in this row:							
	Landuse Pollution Hazard Index	**Very low**	**0.3**	**0.2**	**0.05**		

STEP 2A: Determine the Pollution Mitigation Index for the proposed SuDS components

This step requires the user to select the proposed SuDS components that will be used to treat runoff - before it is discharged to a receiving surface waterbody or downstream infiltration component

If the runoff is discharged directly to an infiltration component, without upstream treatment, select 'None' for each of the 3 SuDS components and move to Step 2B

his step should e applied to evaluate the water uality protection provided y proposed SuDS components for discharges to receiving surface waters or downstream infiltration components (note in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design)

If you have fewer than 3 components, select None for the components that are not re uired

If the proposed component is espoke and or a proprietary treatment product and not generically descri ed y the suggested components, then Proprietary treatment system or User defined indices should e selected and a description of the component and agreed user defined indices should e entered in the rows elow the drop down lists

	SuDS Component Description	Total Suspended Solids (*Pollution Mitigation Indices*)	Metals	Hydrocarbons	*DESIGN CONDITIONS* 1	2	3
Select SuDS Component 1 (i.e. the upstream SuDS component) from the drop down list: →	Detention asin	0 5	0 5	0 6	SuDS components can only e assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual See also checklists in Appendi B	Detention asins should e designed to ensure the effective retention and management of sediment, such that the sediment will not e re-suspended and washed out in su se uent events	
Select SuDS Component 2 (i.e. the second SuDS component in a series) from the drop down list: →	None	0	0	0			
Select SuDS Component 3 (i.e. the third SuDS component in a series) from the drop down list: →	None	0	0	0			
If the proposed SuDS components are bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary treatment system' or 'User defined indices' and enter component descriptions and agreed user defined indices in these rows:							
	Aggregated Surface Water Pollution Mitigation Index	**0.5**	**0.5**	**0.6**	Note If the total aggregated mitigation inde is 1 (which is not a realistic outcome), then the outcome is fi ed at 0 5 In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should e sufficient for any proposed land use (note where risk assessment is re uired, this outcome would need more detailed verification)		

Is the runoff now discharged to an infiltration component?

Yes ? o to Step 2B
No ? o to Step 2

STEP 2B: Determine the Pollution Mitigation Index for the proposed Groundwater Protection

This step requires the user to select the type of groundwater protection that is either part of the SuDS component or that lies between the component and the groundwater

his step should e applied where a SuDS component is specifically designed to infiltrate runoff (note in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design)

roundwater protection descri es the proposed depth of soil or other material through which runoff will flow etween the runoff surface and the underlying groundwater

Where the discharge is to surface waters and risks to groundwater need not e considered, select None

If the proposed groundwater protection is espoke and or a proprietary product and not generically descri ed y the suggested measures, then a description of the protection and agreed user defined indices should e entered in the row elow the drop down list

		Total Suspended Solids (*Pollution Mitigation Indices*)	Metals	Hydrocarbons	*DESIGN CONDITIONS* 1	2	3	4
Select type of groundwater protection from the drop down list: →	None							
If the proposed groundwater protection is bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary product' or 'User defined indices' and enter a description of the protection and agreed user defined indices in this row:								
	Groundwater Protection Pollution Mitigation Index	**0**	**0**	**0**				

STEP 2C: Determine the Combined Pollution Mitigation Indices for the Runoff Area

This is an automatic step which combines the proposed SuDS Pollution Mitigation Indices with any Groundwater Protection Pollution Mitigation Indices

	Total Suspended Solids (*Combined Pollution Mitigation Indices*)	Metals	Hydrocarbons	
Combined Pollution Mitigation Indices for the Runoff Area	**0.5**	**0.5**	**0.6**	Note If the total aggregated mitigation inde is 1 (which is not a realistic outcome), then the outcome is fi ed at 0 5 In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should e sufficient for any proposed land use (note where risk assessment is re uired, this outcome would need more detailed verification)

STEP 2D: Determine Sufficiency of Pollution Mitigation Indices for Selected SuDS Components

This is an automatic step which compares the Combined Pollution Mitigation Indices with the Land Use Hazard Indices, to determine whether the proposed components are sufficient to manage each pollutant category type

When the com ined mitigation inde e ceeds the land use pollution ha ard inde , then the proposed components are considered sufficient in providing pollution risk mitigation

In England and Wales, where the discharge is to protected surface waters or groundwater, an additional treatment component (ie over and a ove that re uired for standard discharges), or other e uivalent protection, is re uired that provides environmental protection in the event of an une pected pollution event or poor system performance Protected surface waters are those designated for drinking water a straction In England and Wales, protected groundwater resources are defined as Source Protection one 1 In Northern Ireland, a more precautionary approach may e re uired and this should e checked with the environmental regulator on a site y site asis

	Total Suspended Solids (*Sufficiency of Pollution Mitigation Indices*)	Metals	Hydrocarbons	*DESIGN CONDITIONS* 1
Note: In order to meet both Water Quality criteria set out in the SuDS Manual (Chapter 4), Interception should be delivered for all impermeable areas wherever possible. Interception delivery and treatment may be met by the same components, but Interception requires separate evaluation.	**Sufficient**	**Sufficient**	**Sufficient**	Reference to local planning documents should also e made to identify any additional protection re uired for sites due to ha itat conservation (see *Chapter 7 The SuDS design process*) he implications of developments on or within close pro imity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should e considered via consultation with relevant conservation odies such as Natural England

SIMPLE INDEX APPROACH: TOOL

1. The steps set out in the tool should be applied for each inflow or 'runoff area' (ie each impermeable surface area separately discharging to a SuDS component).

2. The supporting 'Design Conditions' stated by the tool must be fully considered and implemented in all cases.

3. The process that is automated in this tool is described in the SuDS Manual, Chapter 26 (Section 26.7)

3. Relevant design examples are included in the SuDS Manual Appendix C.

4. Each of the steps below are part of the process set out in the flowchart on Sheet 3.

5. Sheet 4 summarises the selections made below and indicates the acceptability of the proposed SuDS components.

6. Interception should be delivered for all upstream impermeable areas as part of the strategy for water quantity and quality control for the site. This is required in order to deliver both of the water quality criteria set out in Chapter 4 of the SuDS Manual

[blue box]	DROP DOWN LIST	RELEVANT INPUTS NEED TO BE SELECTED FROM THESE LISTS, FOR EACH STEP
[green box]	USER ENTRY	USER ENTRY CELLS ARE ONLY REQUIRED WHERE INDICATED BY THE TOOL

STEP 1: Determine the Pollution Hazard Index for the runoff area discharging to the proposed SuDS scheme

This step requires the user to select the appropriate land use type for the area from which the runoff is occurring

If the land use varies across the runoff area , either

- use the land use type with the highest Pollution Ha ard Inde
- apply the approach for each of the land use types to determine whether the proposed SuDS design is sufficient for all If it is not, consider collecting more ha ardous runoff separately and providing additional treatment

If the generic land use types suggested are not applica le, select Other and enter a description of the land use of the runoff area and agreed user defined indices in the row elow the drop down lists

	Runoff Area Land Use Description	*Pollution Hazard*	*Pollution Hazard Indices* Total Suspended Solids	Metals	Hydrocarbons
Select land use type from the drop down list (or 'Other' if none applicable): →	Low traffic roads (e g residential roads and general access roads, 300 traffic movements day)	Low	0 5	0 4	0 4
If the generic land use types in the drop down list above are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in this row:					
	Landuse Pollution Hazard Index	**Low**	**0.5**	**0.4**	**0.4**

DESIGN CONDITIONS

1	2

STEP 2A: Determine the Pollution Mitigation Index for the proposed SuDS components

This step requires the user to select the proposed SuDS components that will be used to treat runoff - before it is discharged to a receiving surface waterbody or downstream infiltration component
If the runoff is discharged directly to an infiltration component, without upstream treatment, select 'None' for each of the 3 SuDS components and move to Step 2B

his step should e applied to evaluate the water uality protection provided y proposed SuDS components for discharges to receiving surface waters or downstream infiltration components (note in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design)

If you have fewer than 3 components, select None for the components that are not re uired

If the proposed component is espoke and or a proprietary treatment product and not generically descri ed y the suggested components, then Proprietary treatment system or User defined indices should e selected and a description of the component and agreed user defined indices should e entered in the rows elow the drop down lists

	SuDS Component Description		*Pollution Mitigation Indices* Total Suspended Solids	Metals	Hydrocarbons
Select SuDS Component 1 (i.e. the upstream SuDS component) from the drop down list: →	Swale		0 5	0 6	0 6
Select SuDS Component 2 (i.e. the second SuDS component in a series) from the drop down list: →	User defined indices	Enter User Defined Indices in row elow			
Select SuDS Component 3 (i.e. the third SuDS component in a series) from the drop down list: →	None		0	0	0
If the proposed SuDS components are bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary treatment system' or 'User defined indices' and enter component descriptions and agreed user defined indices in these rows:					
	atchpit Manhole rapped ullies	SuDS omponent 2	0 4	0 2	0 2
	Aggregated Surface Water Pollution Mitigation Index		**0.7**	**0.7**	**0.7**

DESIGN CONDITIONS

1	2	3
SuDS components can only e assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual See also checklists in Appendi B		
Detailed assessment of performance of designed component in reducing inflow concentrations of each pollutant type re uired as evidence of adopted indices Enter indices approved y the environmental regulator in appropriate User Defined Indices row elow		

Note If the total aggregated mitigation inde is 1 (which is not a realistic outcome), then the outcome is fi ed at 0 5 In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should e sufficient for any proposed land use (note where risk assessment is re uired, this outcome would need more detailed verification)

Is the runoff now discharged to an infiltration component?

Yes ? o to Step 2B
No ? o to Step 2

STEP 2B: Determine the Pollution Mitigation Index for the proposed Groundwater Protection

This step requires the user to select the type of groundwater protection that is either part of the SuDS component or that lies between the component and the groundwater

his step should e applied where a SuDS component is specifically designed to infiltrate runoff (note in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design)

roundwater protection descri es the proposed depth of soil or other material through which runoff will flow etween the runoff surface and the underlying groundwater

Where the discharge is to surface waters and risks to groundwater need not e considered, select None

If the proposed groundwater protection is espoke and or a proprietary product and not generically descri ed y the suggested measures, then a description of the protection and agreed user defined indices should e entered in the row elow the drop down list

		Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
Select type of groundwater protection from the drop down list: →	None			
If the proposed groundwater protection is bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary product' or 'User defined indices' and enter a description of the protection and agreed user defined indices in this row:				
	Groundwater Protection Pollution Mitigation Index	**0**	**0**	**0**

DESIGN CONDITIONS

1	2	3	4

STEP 2C: Determine the Combined Pollution Mitigation Indices for the Runoff Area

This is an automatic step which combines the proposed SuDS Pollution Mitigation Indices with any Groundwater Protection Pollution Mitigation Indices

	Combined Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
Combined Pollution Mitigation Indices for the Runoff Area	**0.7**	**0.7**	**0.7**

Note If the total aggregated mitigation inde is 1 (which is not a realistic outcome), then the outcome is fi ed at 0 5 In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should e sufficient for any proposed land use (note where risk assessment is re uired, this outcome would need more detailed verification)

STEP 2D: Determine Sufficiency of Pollution Mitigation Indices for Selected SuDS Components

This is an automatic step which compares the Combined Pollution Mitigation Indices with the Land Use Hazard Indices, to determine whether the proposed components are sufficient to manage each pollutant category type

When the com ined mitigation inde e ceeds the land use pollution ha ard inde , then the proposed components are considered sufficient in providing pollution risk mitigation

In England and Wales, where the discharge is to protected surface waters or groundwater, an additional treatment component (ie over and a ove that re uired for standard discharges), or other e uivalent protection, is re uired that provides environmental protection in the event of an une pected pollution event or poor system performance Protected surface waters are those designated for drinking water a straction In England and Wales, protected groundwater resources are defined as Source Protection one 1 In Northern Ireland, a more precautionary approach may e re uired and this should e checked with the environmental regulator on a site y site asis

Note: In order to meet both Water Quality criteria set out in the SuDS Manual (Chapter 4), Interception should be delivered for all impermeable areas wherever possible. Interception delivery and treatment may be met by the same components, but Interception requires separate evaluation.

Sufficiency of Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
Sufficient	**Sufficient**	**Sufficient**

DESIGN CONDITIONS

1
Reference to local planning documents should also e made to identify any additional protection re uired for sites due to ha itat conservation (see *Chapter 7 The SuDS design process*) he implications of developments on or within close pro imity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should e considered via consultation with relevant conservation odies such as Natural England

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Geo-environmental Investigations
Historic Building Services
Highway Design
Land Remediation Advice
Land Surveying
Marine Works
Mining Investigations
Modular Design
Parametric Modelling
Party Wall Surveyors
Planning Applications
Project Managers
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