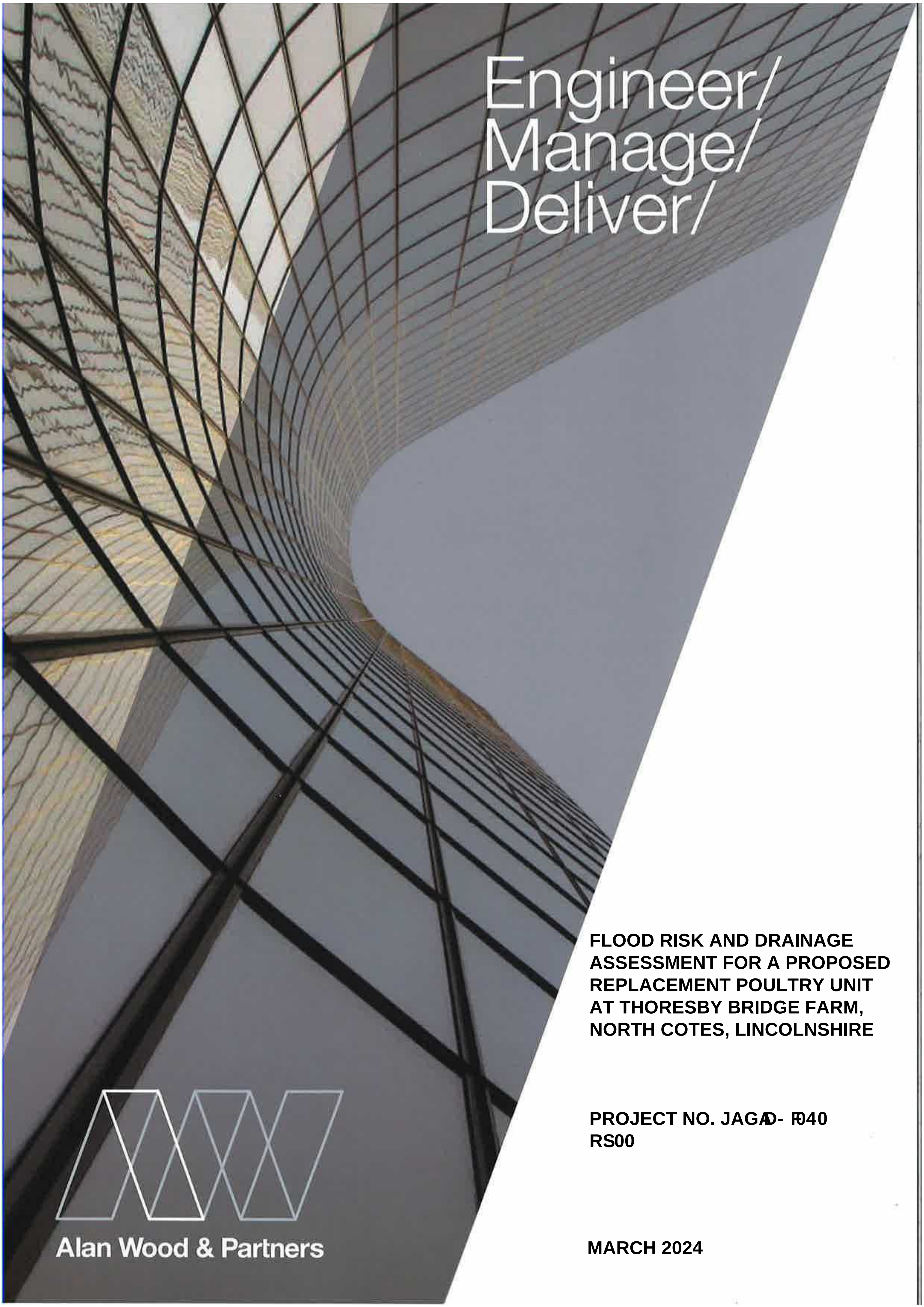

FLOOD RISK AND DRAINAGE ASSESSMENT FOR A PROPOSED REPLACEMENT POULTRY UNIT AT THORESBY BRIDGE FARM, NORTH COTES, LINCOLNSHIRE

PROJECT NO. JAGAD- F040 RS00

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FLOOD RISK AND DRAINAGE ASSESSMENT FOR A PROPOSED REPLACEMENT POULTRY UNIT AT THORESBY BRIDGE FARM, NORTH COTES, LINCOLNSHIRE

Prepared by: A Dunn

Signed: [redacted] ………………………………………………
Date: 22nd March 2024

Approved by: J Gibson, MEng (Hons), CEng, CWEM MCIWEM
Director

Signed: [redacted]..
Date: 22nd March 2024

Issue	Revision	Revised by	Approved by	Revised Date

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APPENDICES

1.0 INTRODUCTION

1.1 Background

1.1.1 Alan Wood & Partners were commissioned by Chesterfield Poultry Ltd to prepare a Flood Risk and Drainage Assessment for a proposed replacement poultry unit at Thoresby Bridge Farm, North Cotes, Lincolnshire 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 to determine the drainage strategy for the development.

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, July 2021) 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 surface water drainage arrangements for the proposed development.

1.2.5 Section 5 considers the operation and maintenance arrangements for the SuDS components of 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.

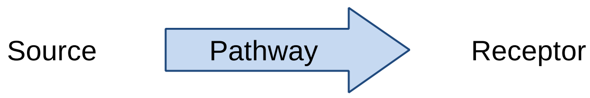
1.2.8 Section 8 of this report provides a summary of the report.

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 consequence 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 the NPPF is provided below.

1.4.2 Sources of Flooding

1.4.2.1 The 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.

Table 1: 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 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 (2015 Edition) direct developers towards the use of SuDS wherever possible.

2.0 EXISTING SITE DESCRIPTION

2.1 Location

2.1.1 The proposed development site is located Thoresby Bridge Farm, North Cotes, Lincolnshire.

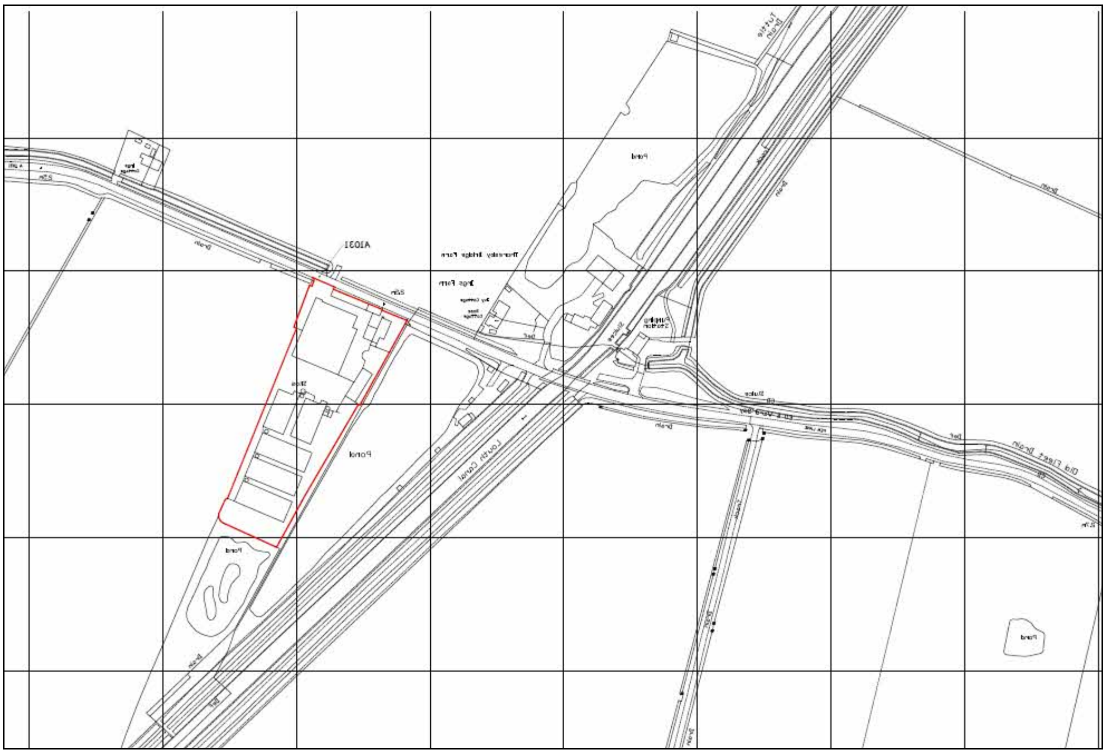
2.1.2 The site lies to the south of Fen Lan (A1031) which provides access to the site.

2.1.3 The application site is located approximately 1.2km to the south west of the centre of the village of North Cotes approximately 2km to the north west of the village of Marshchapel and approximately 3km to the south east of the village of Tetney.

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

Figure 1: Aerial Photograph

Figure 2: Site Location Plan



2.1.5 The Ordnance Survey grid reference for the centre of the site development is approximately 533805, 399685.

2.2 Site Description

2.2.1 The area of the proposed development currently comprises a number of existing agricultural buildings which are to be demolished, together with areas of unsurfaced hardstanding.

2.3 Surrounding Features

2.3.1 The application site lies within an area of extensive agricultural land.

2.3.2 There is an existing fishing pond situated immediately to the east of the site.

2.3.3 There is a small open pond situated immediately to the south of the site.

2.3.4 Louth Canal is situated approximately 100m to the west of the site.

2.3.5 There is a fishing pond situated approximately 200m to the north west of the site.

2.3.6 Covenham Reservoir is situated approx. 3.3km to the south of the site.

2.3.7 There are open drainage ditches situated to the north west of the site, to the north and to the south of Fen Lane.

2.3.8 The coastline of the North Sea lies approximately 5.7km to the north east of the site at its nearest location.

2.4 Topography

2.4.1 LIDAR data has been obtained which shows that the existing ground levels over the application site vary from approximately1.48m to 2.52m OD(N). Over the footprint of the new buildings the existing ground levels are shown to vary from approximately 1.48m to 2.42m OD(N). The average ground level over the area of the new buildings has been calculated at approximately 1.86m OD(N).

2.4.2 Existing road levels on Fen Lane adjacent to the site are shown to vary from approximately 2.36m to 2.69m OD(N), with the existing road level adjacent to the new access shown to be at approximately 2.37m OD(N).

2.5 Ground Conditions

2.5.1 A desktop study of the British Geological Survey map shows that the local geology comprises superficial deposits of Tidal Flat Deposits – Clay and Silt overlaying a bedrock of Burnham Chalk Formation - Chalk.

2.5.2 A study of the local groundwater maps show that the site overlays a Principal Aquifer and lies in an area where the groundwater vulnerability classification is ‘Low’.

2.5.3 Existing borehole records in the vicinity of the site show the existing soils to comprise glacial clays extending to a depth in excess of 4m below ground level.

2.5.4 The ground conditions are therefore unsuitable for soakaways to be used as the means for disposal of the surface water run-off from the development.

3.0 PROPOSED DEVELOPMENT

3.1 The Development

3.1.1 The development involves the replacement of an existing poultry unit to include:-

- Demolition of a number of existing agricultural buildings
- Retention of the existing farmhouse building
- Retention of an existing barn
- The construction of 2 new poultry buildings
- The construction of a control room
- New gas tanks
- New water tank
- New feed silos
- External concrete paving
- Unsurfaced areas of hardstanding

3.1.2 Layout drawings showing details of the development is included in Appendix A.

3.2 Flood Risk

3.2.1 In terms of flood risk vulnerability, the construction of buildings for agricultural use is classed as 'Less Vulnerable' development (Table 3).

3.2.2 In terms of flood zone compatibility, the construction of 'Less Vulnerable' development is considered to be appropriate in Flood Zone 3 (Table 4).

4.0 SURFACE WATER DRAINAGE

4.1 General

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

4.2 Existing Site

4.2.1 From the aerial photograph included in Figure 3 below, it can be seen that the area of the development comprises a number of existing agricultural buildings and unsurfaced areas of hardstanding

Figure 3: Aerial Photograph

4.3 Run-off Destination

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

4.3.2 The underlying strata in the vicinity of the development is considered to be unsuitable for soakaways to be used as the means for disposal of surface water run-off from the new development (see Section 2.5 of this report).

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

4.3.4 There is an open drainage ditch situated to the north east of the development, adjacent to Fen Lane, which is the obvious point of discharge for the surface water run-off from the development. It is therefore proposed that the run-off from the development discharges to this drainage ditch.

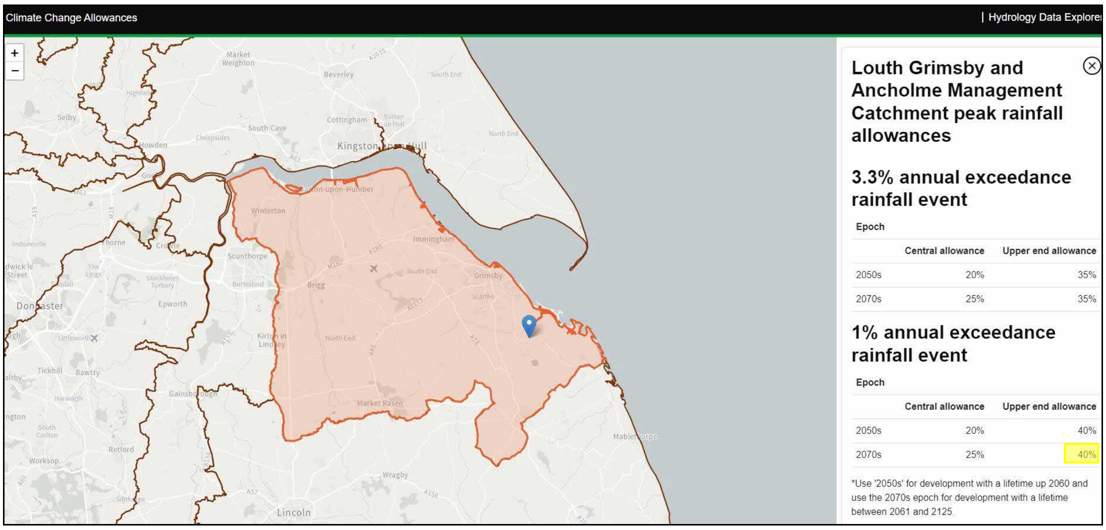
4.4 Flood Risk

4.4.1 For new developments, the current design criteria required for the surface water drainage will need to be based upon the critical 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.

4.5 Climate Change

4.5.1 Based on the UK Government document "Flood Risk Assessments – Climate Change Allowances" published by the Environment Agency, the peak rainfall mapping included in Figure 4 shows that the Louth Grimsby & Ancholme Management Catchment peak rainfall allowance for the 1% annual exceedance rainfall event (upper end allowance) is 40%.

Figure 4: Louth Grimsby & Ancholme Management Catchment Peak Rainfall Map



4.5.3 An additional 40% has therefore been included in the surface water drainage design to account for climate change resulting from global warming.

4.6 Urban Creep

4.6.1 As the development is agricultural and under the control of a single developer there is no requirement to include an additional 10% in the surface water drainage design to account for future urban creep.

4.7 Peak Flow

4.7.1 Based upon the site layout drawings included in Appendix A, the new impermeable area created by the development which will need to be positively drained has been calculated at approximately 6900m^2.

4.7.2 The uncontrolled surface water run-off from the new development could be approximately 96l/s based on BS EN 752 calculations, using a rainfall intensity of 50mm/hour. However, to meet the flood risk planning requirements, it is normally unacceptable to discharge flows freely from the proposed development site at an unrestricted rate.

4.7.3 SuDS Guidance advises that flows from the proposed development should be limited to the greenfield run-off rate.

4.7.4 However, based on the IH124 discharge rate and the contributing area of the site, this would only equate to approximately 1l/s for this development which cannot be achieved in practical terms.

4.7.5 It is considered that the lowest discharge rate which can be achieved in order to avoid blockages and future maintenance issues is 3l/s and consequently this discharge rate has been used for design purposes.

4.8 Design Output

4.8.1 Based upon the above design criteria, hydraulic model calculations have been carried out to assess the pipe sizes and gradients required and to calculate the storage volumes which will need to be provided.

4.8.2 The pipe sizes required are shown to vary from 225mm to 375mm in diameter.

4.8.3 The design work has shown that a gravity outfall cannot be achieved due to the relative levels between the drainage network and the point of discharge. It will therefore be necessary for a pumped outfall to be provided.

4.8.4 On this basis the required restriction to the discharge will be provided by means of appropriate pumps and control equipment within a proprietary package pump station.

4.8.5 The rising main will pump the surface water discharge to an inspection chamber in proximity to the outfall, which will then discharge by gravity to the watercourse.

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

Table 5: Volume of Surface Water Storage Required

Storm Event	1 in 1 Probability Storm Event	1 in 30 Probability Storm Event	1 in 100 Probability Storm Event + 40%
Storage Volume Required	$67m^3$	$177m^3$	$364m^3$
Additional Storage Volume Required	Nil	$110m^3$	$187m^3$

4.8.7 For this development the full volume of storage required to accommodate the peak flows from the 1 in 100 probability storm event, including climate change, will be stored within an attenuation basin located to the south of the new poultry buildings.

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

4.9 Drawings

4.9.1 A drawing showing the surface water drainage strategy for the development is included in Appendix C, together with a drawing showing the SuDS details.

4.10 Volume Control

4.10.1 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.

4.10.2 However, as detailed above, for this development a discharge rate of 3l/s has been used for design purposes.

4.10.3 Whilst the greenfield run-off rate will be marginally exceeded at times of peak flow, it is considered that such a small discharge rate will not have any detrimental effect on the drainage network or other parties downstream of the development.

4.10.4 The impact on the receiving watercourse is therefore considered to be acceptable.

4.11 Pollution Control

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

4.11.2 Adequate pollution control measures will consequently need to be incorporated in the detailed design of the drainage network.

4.11.3 Investigations have revealed that the development site overlays a Principal Aquifer and lies within a Groundwater Vulnerability Zone classified as ‘low’.

4.11.4 In order to minimise the risk of pollution to the final watercourse, clean roof water drainage should discharge directly into the sealed drainage network and then directly towards the watercourse via the on-line attenuation basin.

4.11.5 Surface water run-off from the yard will pass through filter drains and the attenuation basin prior to the outfall.

4.11.6 On this basis, it is considered that the risk of pollutants being discharged to the watercourse has been adequately addressed.

4.12 Wash-Down (Agricultural)

4.12.1 Due to the risk of pollution from the handling and cleaning down of waste from within the building, it will be necessary for the drainage from the external concrete paved area to discharge directly to an appropriately sized sealed storage tank during cleaning operations. This is carried out strictly in compliance with an Environmental Permit which will be in place prior to the development coming into operation.

4.13 Designing for Exceedance

4.13.1 Flood risk from overland exceedance flows from the new surface water drainage network and from off-site sources should be mitigated to a large extent by the new surface water drainage system.

4.13.2 Flood risk from overland exceedance flows from the new surface water drainage network and from off-site sources should be mitigated to a large extent by the new surface water drainage system.

4.13.3 The ground floor construction level of the agricultural buildings will be raised above external ground levels to shed water away from the buildings.

4.13.4 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.

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

4.13.6 Drawings showing the existing and anticipated overland surface water exceedance flood routing resulting from the development are included in Appendix D.

4.14 Highways Drainage

4.14.1 The development does not incorporate any formal highway drainage.

4.15 Water Quality

4.15.1 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.

4.15.2 The output shows that the water quality from the roof and paved areas is of an acceptable standard.

4.15.3 Copies of the matrix outputs from the assessment of the roof and paved areas are included in Appendix E.

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 road 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 Operation and maintenance requirements for the attenuation lagoon are set out in Table 7 below.

Table 7: Operation and Maintenance Requirements for the 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.		

5.5 Operation and maintenance requirements for the filter trenches are set out in Table 8 below.

Table 8: 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.		

5.6 Operation and maintenance requirements for the package pumping station are set out in Table 9 below.

Table 9: Operation and Maintenance Requirements for Package Pumping Stations (based on CIRIA R182, Section 3) – to be used in conjunction with manufacturer's recommendations

Maintenance schedule	Required action	Typical frequency
Routine maintenance	Basic adjustment to equipment	As recommended by manufacturer
	Lubricate systems	As recommended by manufacturer
	Changeover duty pump	As recommended by manufacturer
	Recording systems (where present) – recover data	As recommended by manufacturer/as required by database
	Standby generators (where present) – run off load	Weekly
	Standby generators (where present) – run on load	Monthly
Remedial actions	Clear blockages in pipework	As required
	Clean walls, floor, electrodes and floats	As required
	Replace malfunctioning or worn components	As required
Monitoring	Check operation of non-return valves	6 monthly
	Inspect pump and control equipment for evidence of poor operation or failure	Monthly during the first 6 months of operation, then every 3 months
	Inspect the sump for silt/grease accumulation rate and establish appropriate removal frequencies	Monthly during the first 6 months of operation, then 6 monthly
	Inspect for structural failure of pump chamber(s) and general condition of any ancillary equipment	6 monthly
	Check the pump and pipework seals for leaks	Monthly during the first 6 months of operation, then 6 monthly
Note:- Pump to be isolated from electrical supply prior to maintenance works being undertaken		

5.7 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

5.8 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.

5.9 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. An example of a checklist for SuDS maintenance can be found within Appendix B of the CIRIA C753 SuDS Manual v2. 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).

5.10 The responsibility for the operation and maintenance of the drainage and SuDS will lie with Chesterfield Poultry Ltd, 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 5 below which identifies the development site to be located within an area designated as Flood Zone 3, (high probability of flooding), comprising land assessed as having a 1 in 100 or greater annual probability of river flooding or a 1 in 200 year or greater annual probability of flooding from the sea.

Figure 5: Environment Agency Flood map for planning dated March 2024

6.2 Fluvial Flooding

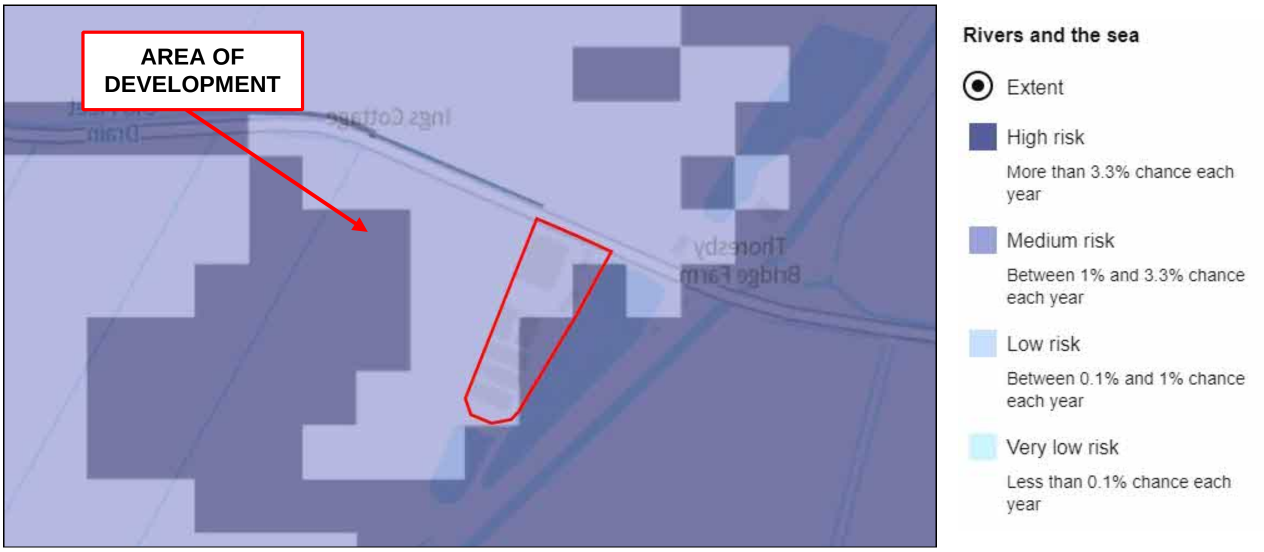
6.2.1 A study of the local region shows that there are no fluvial flood sources which could pose a risk of flooding to the development site.

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

6.3 Tidal Flooding

6.3.1 A copy of the flood map produced from the Environment Agency showing the extent of flooding from rivers or the sea is included in Figure 6 below.

Figure 6: Environment Agency map dated March 2024 showing the extent of Flooding from rivers or the sea



6.3.2 The map shows that the risk from flooding varies across the site, ranging from 'medium risk' to 'high risk'.

6.3.3 Flood Risk Data has been requested from the Environment Agency in respect of potential flooding to the development and is currently awaited.

6.3.4 As the site is shown to be at risk of tidal flooding, flood mitigation measures will need to be considered within the design of the development.

6.3.5 Details of such measures are set out in Section 7 of this report.

6.4 Surface Water Flooding

6.4.1 A copy of the Environment Agency map showing the extent of flooding from surface water is included in Figure 7 below.

Figure 7: Environment Agency map dated March 2024 showing the extent of flooding from surface water

6.4.2 The map shows that the site lies in an area which is considered to be at ‘very low risk’ from overland surface water flooding.

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

6.5 Flooding from Open Drainage Ditches

6.5.1 There are a number of small open drainage ditches situated within the surrounding agricultural land.

6.5.2 Due to their small scale and their distance from the site these drainage ditches are not considered to pose any risk of flooding to the development.

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

6.6 Groundwater Flooding

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

6.6.2 The site is shown to overlay a Principal Aquifer and to lie in an area where the groundwater vulnerability classification is ‘Low’.

6.6.3 It is not anticipated that the proposed development will involve deep excavation works and consequently the risk to the development from this potential flood source is considered to be low and acceptable.

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

6.7 Flood Risk from Existing Water Mains

6.7.1 There are existing water mains present serving the existing buildings, which will be domestic in nature. These will become redundant when the existing buildings are demolished. However, these will become redundant as the site is to be re-developed.

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 Existing Drainage Services

6.8.1 There are existing drainage services present serving a number of existing buildings. However, these will become redundant as the site is to be re-developed.

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

6.9 Flood Risk from New Drainage Services

6.9.1 The drainage will be designed to the required standards and therefore the risk of flooding to the development or to other parties beyond the curtilage of the site will be adequately addressed.

6.9.2 The risk to the development from this potential source is therefore considered to be low and acceptable.

6.10 Flooding from Reservoirs, Canals and Other Artificial Sources

6.10.1 There are a number of small ponds situated within the surrounding agricultural land.

6.10.2 Due to their small scale and their distance from the site these water features are not considered to pose any risk of flooding to the development.

6.10.3 There is a large fishing pond situated immediately to the east of the site. Water levels in the pond are shown to be approximately 600mm lower than the lowest ground level across the site. Any minor flooding resulting from the pond overtopping its banks during an extreme rainfall event would therefore not affect the development site.

6.10.4 Louth Canal lies approximately 100m to the east of the development site. Water levels in the canal are generally shallow and are controlled by a series of lock gates. Water levels in the canal are shown to be approximately 1m lower than the lowest ground level across the site. Any minor flooding resulting from the canal overtopping its banks during an extreme rainfall event would therefore not affect the development site.

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

6.10.6 A copy of the map produced by the Environment Agency showing the extent of flooding from reservoirs is included in Figure 8 below.

Figure 8: Environment Agency map dated March 2024 showing the extent of flooding from reservoirs

6.10.7 The map shows that the development is considered to be at risk from reservoir flooding, should there be a failure of the defences to a local reservoir. However, such an occurrence is extremely remote as reservoir defences are inspected and maintained on a regular basis by the Environment Agency.

6.10.8 The risk to the development from reservoir flooding is considered to be low and acceptable.

6.10.9 The risk to the development from any such potential flood source is therefore considered to be low and acceptable.

7.0 FLOOD MITIGATION MEASURES

7.1 Passive Flood Protection

7.1.1 For new developments lying within Flood Zone 3 the normal requirement is to elevate the ground floor by a minimum of 600mm above the existing ground level or above the predicted flood level where this information is available.

7.1.2 Flood data has been requested from the Environment Agency and is currently awaited.

7.1.3 The average ground level over the area of the development has been calculated at 1.86m OD(N). It is considered that the highest floor level that can be attained in order to gain access from the existing roads and paving and to enable the development to be functional is 300mm.

7.1.4 This result in a finished floor construction level of approximately 2.16m OD(N).

7.1.5 At this level of construction, it is considered that the risk of flooding to the development has been adequately reduced.

7.2 Flood Resilience

7.2.1 For developments lying within Flood Zone 3a, the normal requirement is to provide flood resilient construction up to a height of 300mm above the elevated ground floor construction level in order to minimise the extent of flood damage, should flood waters enter the building and to enable ease of reconstruction and minimise the timescale of any repair works.

7.2.2 As the floor is only being raised by 300mm, it is recommended that the height of flood resilience for this development is increased to 600mm which would result in a flood resilient construction level of 2.76m OD(N).

7.2.3 The buildings comprise a concrete floor, precast concrete planks at low level with profiled metal cladding above, supported on a steelwork frame, with no internal finishes. The building structure is therefore unlikely to suffer from flood damage should the site be affected by future flooding.

7.2.4 However, it is recommended that the following flood mitigation measures should be provided:-

All electrical apparatus or other flood sensitive equipment should be elevated to a minimum height of 600mm above floor level in order to prevent damage occurring should flood waters enter the buildings.

All cables should be routed at high level with vertical drops to the fittings.

7.2.5 On this basis it should therefore be possible for the buildings to be readily cleaned down and brought back into use should a flood situation occur.

7.3 Compensatory Flood Storage

7.3.1 As the flood risk is from tidal flooding there is no requirement to provide compensatory flood storage to account for any displaced flood waters.

7.4 Access/Egress

7.4.1 The public road network in the local vicinity of the development is shown to lie in Flood Zone 3 (high probability of flooding) and consequently access to/or egress from the development could be affected during the peak time of a major flood scenario.

7.4.2 However, the flooding in this area is tidal and consequently restrictions will not be extensive. Access will be predominantly available.

7.4.3 The site will be made aware of any likely flood event which will enable safe evacuation measures to be put in place should this prove to be necessary and make any necessary travel / delivery arrangements.

7.5 Management

7.5.1 If not already subscribed the development should subscribe to the Environment Agency's early 'Flood Direct' warning service which will alert the developer of any likely flood situations. This will then enable a safe evacuation of the development should the need arise.

7.5.2 The development should have a Flood Risk Evacuation Plan in place. Suitable notices should be positioned in common areas to ensure all occupants understand the procedures in place in the event of a flood situation and where to escape to safety, should this prove necessary.

8.0 SUMMARY

8.1 This report has been prepared to assess the flood risk and drainage requirements for the re-development of the existing poultry unit at Thoresby Bridge Farm, North Cotes, Lincolnshire.

8.2 The site is shown to lie in Flood Zone 3 (high probability of flooding) on the Environment Agency Flood Map for Planning. The proposed development is classified as 'Less Vulnerable' in terms of flood risk vulnerability, which is appropriate in this location.

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

8.4 The primary risk to the site is considered to be from tidal flooding from the North Sea resulting from the sea defences being breached or overtopped during an extreme flood event

8.5 The primary risk to the site is considered to be from tidal flooding from the North Sea resulting from the sea defences being breached or overtopped during an extreme flood event.

8.6 The primary focus for flood risk assessment is to protect life, and then consideration should be given to buildings, contents, operation and re-use.

8.7 Mitigation measures are proposed, which it is considered will reduce the risk of flooding to the development to an acceptable level, will ensure the (building) (development) is safe for the lifetime of the development and will not increase the risk of flooding to others.

8.8 Overall, this report demonstrates that the flood risk to the proposed development is reasonable and acceptable providing the mitigation measures detailed in Section 8 of this report are incorporated into the design of the development.

8.9 This report also demonstrates that the site can be suitably drained, with the drainage network serving the development designed and constructed to the required standards in compliance with local and national planning policies.

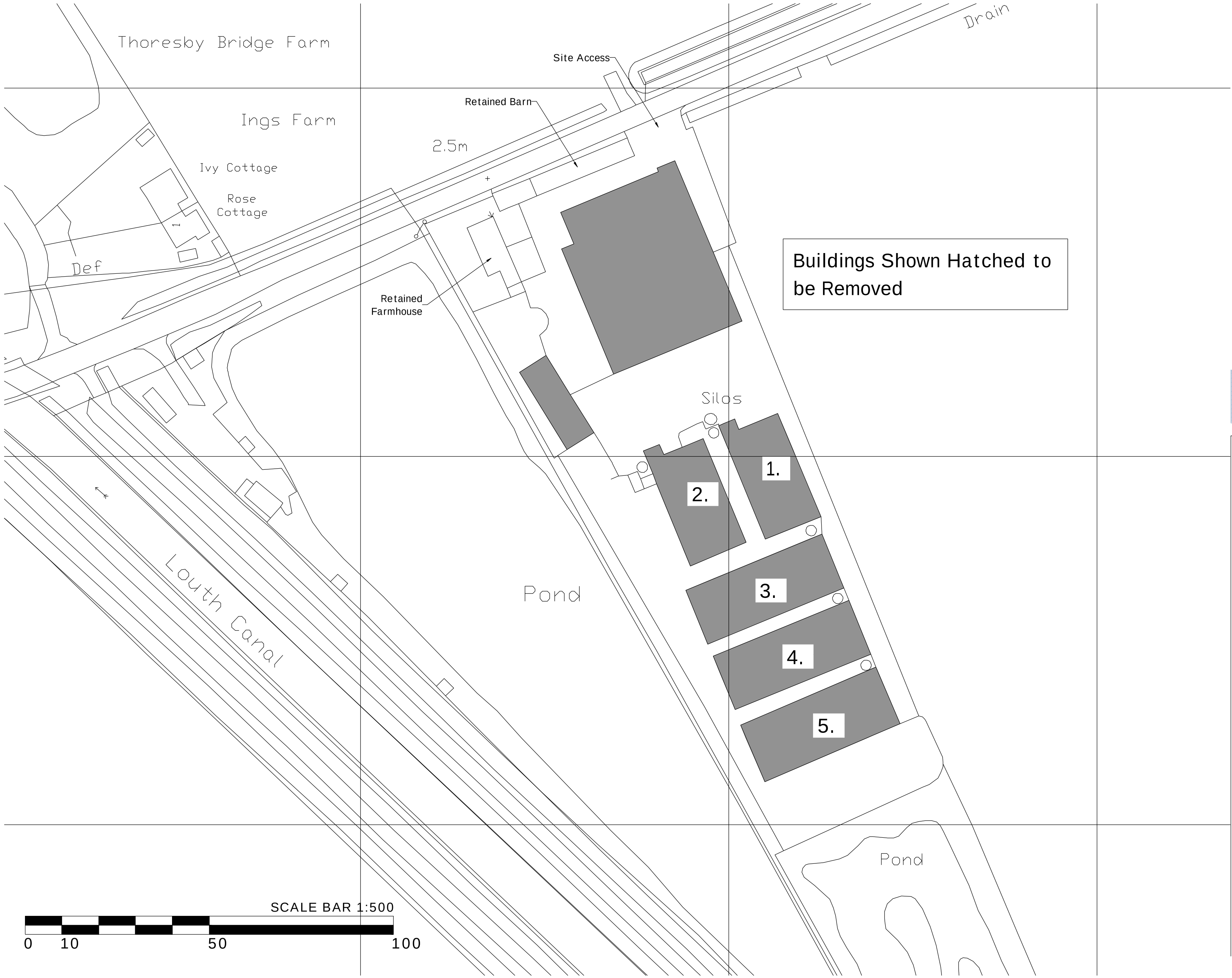
8.10 Surface water run-off from the development will be discharged to the existing open drainage ditch adjacent to Fen Lane to the north east of the development at a restricted rate of discharge with the required volume of storage provided within an attenuation lagoon located to the south of the new poultry buildings to accommodate the peak flows from the 1 in 100 probability storm event, including climate change.

8.11 The sewers will be designed and constructed to meet the requirements of the Building Regulations.

8.12 Based on the details incorporated within our report it is considered that planning consent for the proposed development can be granted in terms of the flood risk and drainage aspects of the project.

APPENDIX A

Site Layout Drawings



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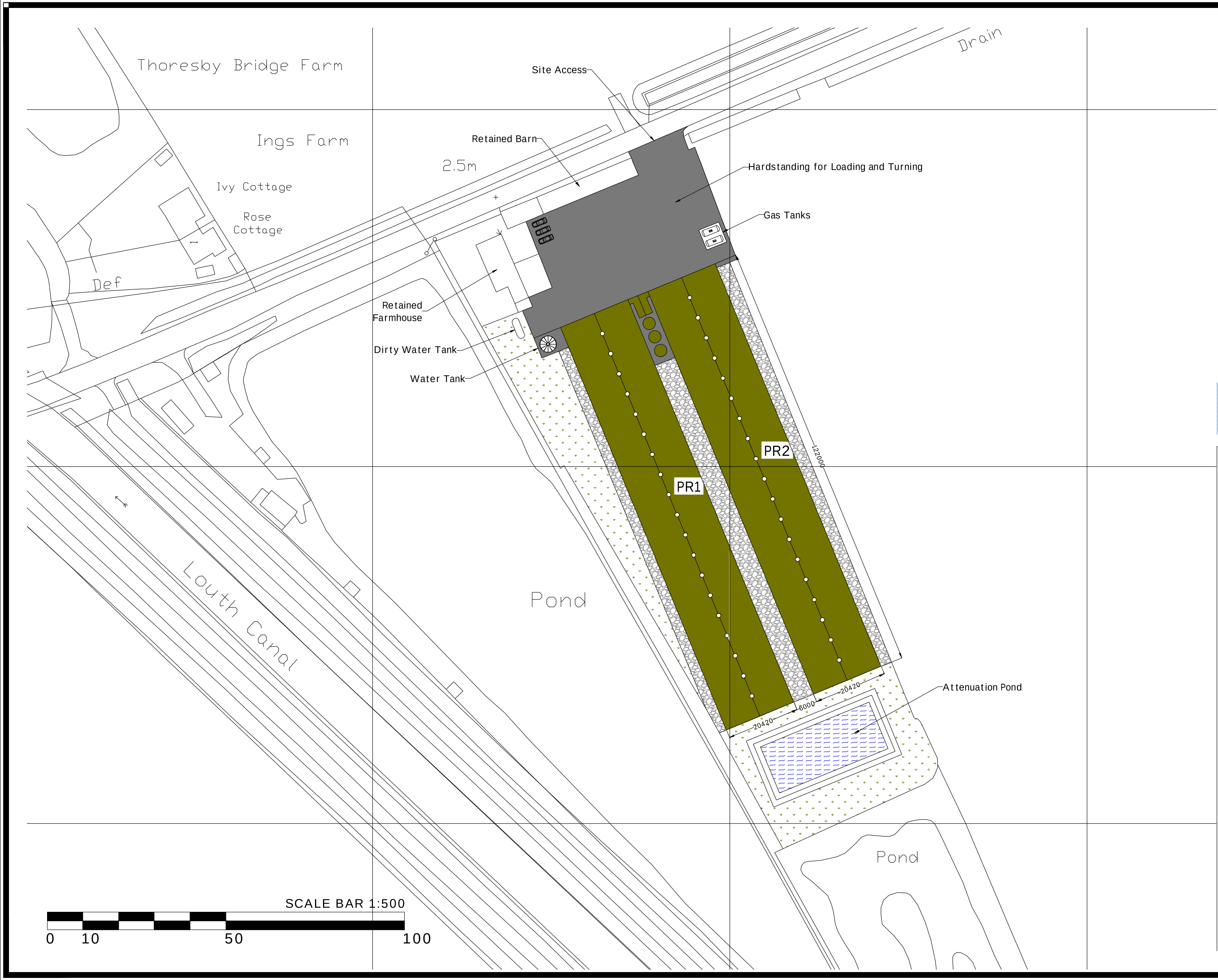
CLIENT	**Chesterfield Poultry Ltd**
JOB TITLE	Thoresby Bridge Farm, North Cotes, DN36 5TY
DWG. TITLE	Existing Site Plan A1
SCALE	1=500
DRN	IP
DWG. NUMBER	**IP/CPL/01**
DATE	Feb 24
REV	-



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CLIENT

Chesterfield Poultry Ltd

JOB TITLE

Thoresby Bridge Farm, North Cotes, DN36 5TY

DWG. TITLE

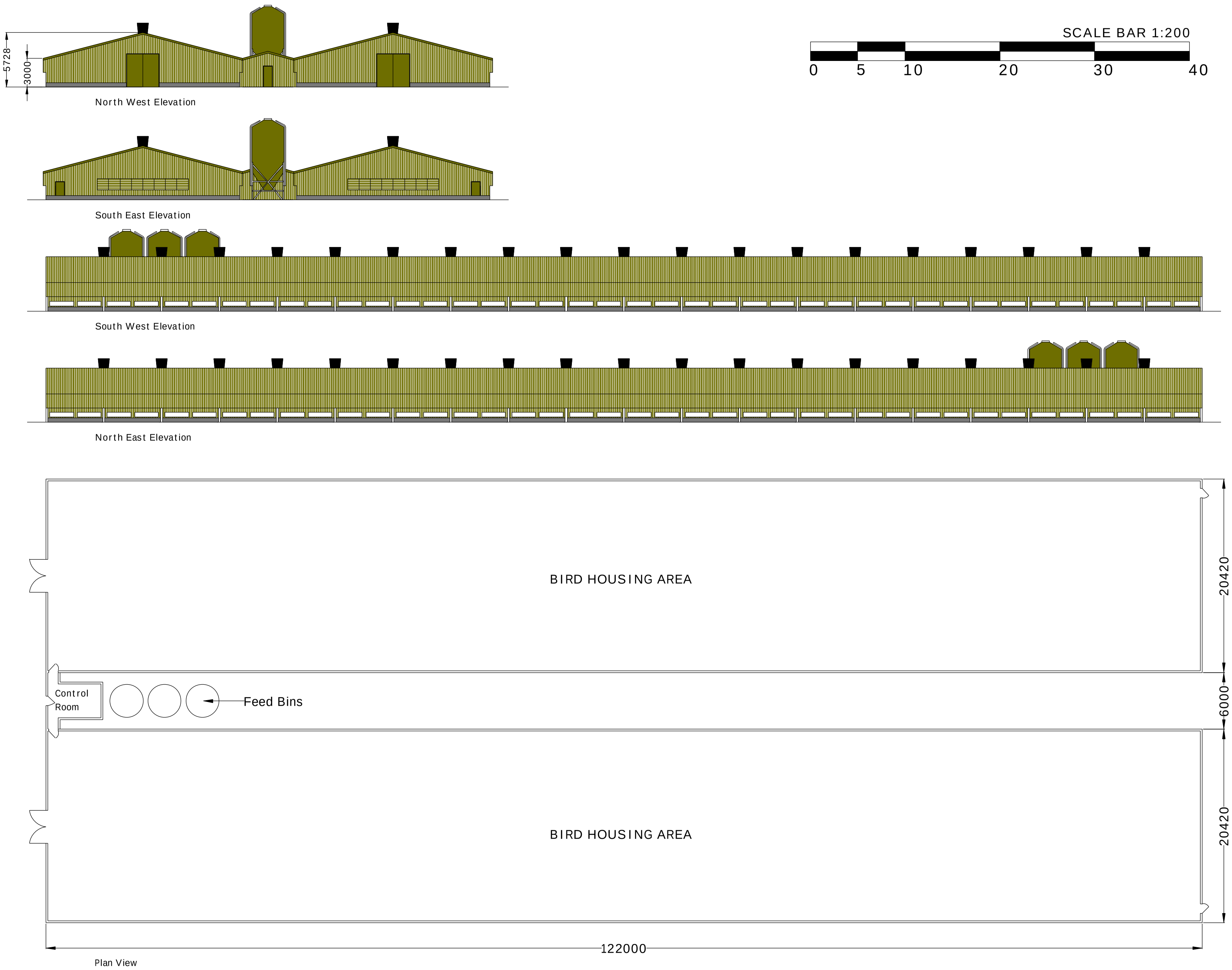
Proposed Site Plan A1

SCALE	DRN
1=500	IP

DWG. NUMBER

IP/CPL/03

DATE	REV
Feb 24	-



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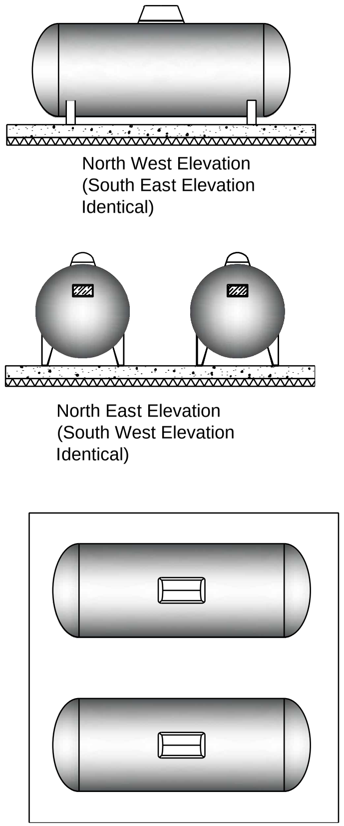
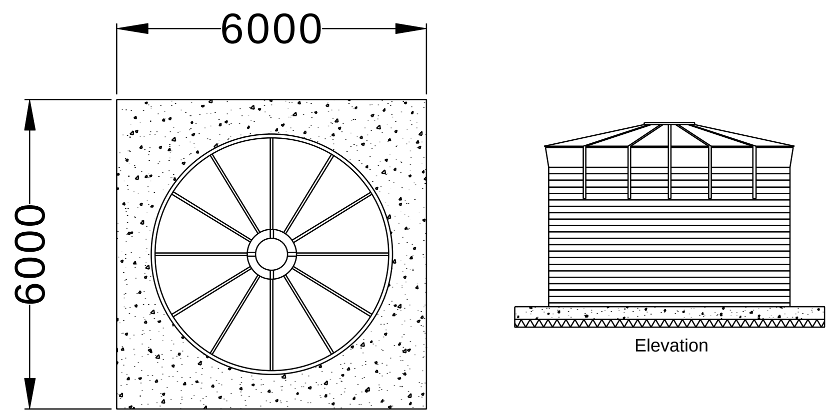
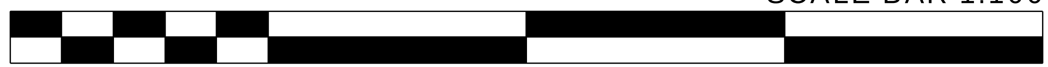
CLIENT	**Chesterfield Poultry Ltd**
JOB TITLE	Thoresby Bridge Farm, North Cotes, DN36 5TY
DWG. TITLE	Proposed Site Plan A1
SCALE	1=200
DRN	IP
DWG. NUMBER	***IP/CPL/04***
DATE	Feb 24
REV	-



Gas Tanks



Water Tank



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CLIENT: **Chesterfield Poultry Ltd**

JOB TITLE: Thoresby Bridge Farm, North Cotes, DN36 5TY

DWG. TITLE: Ancillary Structures A3

SCALE: 1=100

DRN: IP

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

DATE: Feb 24

REV: -

Alan Wood & Partners

APPENDIX B

Hydraulic Model Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 533801 399700 TF 33801 99700
Data Type	Point
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

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)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	36.027	0.111	325.0	0.188	5.00	0.0	0.600		o	375	Pipe/Conduit	
S1.001	7.611	0.023	325.0	0.000	0.00	0.0	0.600		o	375	Pipe/Conduit	
S1.002	5.483	0.017	325.0	0.000	0.00	0.0	0.600		o	375	Pipe/Conduit	
S1.003	64.725	0.199	325.0	0.060	0.00	0.0	0.600		o	375	Pipe/Conduit	
S1.004	64.725	0.199	325.0	0.064	0.00	0.0	0.600		o	375	Pipe/Conduit	
S1.005	24.932	0.077	325.0	0.000	0.00	0.0	0.600		o	375	Pipe/Conduit	
S2.000	59.112	0.348	170.0	0.066	5.00	0.0	0.600		o	225	Pipe/Conduit	
S2.001	59.112	0.348	169.9	0.059	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	5.60	1.250	0.188	0.0	0.0	0.0	1.00	110.4	25.4
S1.001	50.00	5.73	1.139	0.188	0.0	0.0	0.0	1.00	110.4	25.4
S1.002	50.00	5.82	1.116	0.188	0.0	0.0	0.0	1.00	110.4	25.4
S1.003	50.00	6.90	1.099	0.248	0.0	0.0	0.0	1.00	110.4	33.6
S1.004	50.00	7.98	0.900	0.313	0.0	0.0	0.0	1.00	110.4	42.3
S1.005	49.83	8.39	0.701	0.313	0.0	0.0	0.0	1.00	110.4	42.3
S2.000	50.00	5.99	1.250	0.066	0.0	0.0	0.0	1.00	39.8	9.0
S2.001	50.00	6.80	0.827	0.125	0.0	0.0	0.0	1.20	85.1	16.9

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)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
S2.002	24.947	0.147	169.7	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	
S3.000	50.437	0.297	170.0	0.152	5.00	0.0	0.600		o	300	Pipe/Conduit	
S3.001	50.437	0.620	81.4	0.100	0.00	0.0	0.600		o	300	Pipe/Conduit	
S1.006	6.514	0.020	325.0	0.000	0.00	0.0	0.600		o	375	Pipe/Conduit	
S1.007	17.005	0.052	327.0	0.000	0.00	0.0		0.035	→_/		Pond/Tank	
S1.008	4.888	0.015	325.9	0.000	0.00	0.0	0.600		o	375	Pipe/Conduit	
S1.009	6.111	0.019	325.0	0.000	0.00	0.0	0.600		o	375	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)
S2.002	50.00	7.15	0.555	0.125	0.0	0.0	0.0	1.20	85.1	16.9
S3.000	50.00	5.70	1.250	0.152	0.0	0.0	0.0	1.20	85.0	20.6
S3.001	50.00	6.18	0.953	0.252	0.0	0.0	0.0	1.74	123.3	34.2
S1.006	49.49	8.50	0.258	0.690	0.0	0.0	0.0	1.00	110.4	92.4
S1.007	48.99	8.67	0.238	0.690	0.0	0.0	0.0	1.72	51286.9	92.4
S1.008	48.74	8.75	0.186	0.690	0.0	0.0	0.0	1.00	110.2	92.4
S1.009	48.44	8.85	0.171	0.690	0.0	0.0	0.0	1.00	110.4	92.4

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)
S1.009	S	2.000	0.152	0.000	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

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 533801 399700 TF 33801 99700
Data Type	Point
Summer Storms	Yes
Winter Storms	No
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

Online Controls for Storm

Pump Manhole: S10, DS/PN: S1.009, Volume (m³): 3.0

Invert Level (m) 0.171

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.0000	1.200	3.0000	3.000	3.0000	7.000	3.0000
0.200	3.0000	1.400	3.0000	3.500	3.0000	7.500	3.0000
0.300	3.0000	1.600	3.0000	4.000	3.0000	8.000	3.0000
0.400	3.0000	1.800	3.0000	4.500	3.0000	8.500	3.0000
0.500	3.0000	2.000	3.0000	5.000	3.0000	9.000	3.0000
0.600	3.0000	2.200	3.0000	5.500	3.0000	9.500	3.0000
0.800	3.0000	2.400	3.0000	6.000	3.0000		
1.000	3.0000	2.600	3.0000	6.500	3.0000		

Storage Structures for Storm

Tank or Pond Pipe: S1.007

Manning's N 0.035 Invert Level (m) 0.238

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	135.0	1.762	440.5

1 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)	0.750
M5-60 (mm)	18.300	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	1	+0%	100/15 Summer				1.375
S1.001	S2	15 Winter	1	+0%	100/15 Summer				1.283
S1.002	S3	15 Winter	1	+0%	100/15 Summer				1.257
S1.003	S4	15 Winter	1	+0%	100/15 Summer				1.233
S1.004	S5	15 Winter	1	+0%	100/15 Summer				1.043
S1.005	S6	15 Winter	1	+0%	30/240 Winter				0.847
S2.000	S11	15 Winter	1	+0%	100/15 Winter				1.321
S2.001	S12	15 Winter	1	+0%	100/15 Summer				0.913
S2.002	S13	15 Winter	1	+0%	30/60 Summer				0.642
S3.000	S10	15 Winter	1	+0%	100/15 Summer				1.350
S3.001	S11	15 Winter	1	+0%	100/15 Summer				1.056
S1.006	S7	180 Winter	1	+0%	30/15 Summer				0.604
S1.007	S8	180 Winter	1	+0%					0.604
S1.008	S9	180 Winter	1	+0%	1/120 Winter				0.604
S1.009	S10	180 Winter	1	+0%	1/60 Winter				0.622

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

PN	US/MH Name	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	-0.250	0.000	0.23			23.3	OK	
S1.001	S2	-0.231	0.000	0.31			22.6	OK	
S1.002	S3	-0.234	0.000	0.30			22.9	OK	
S1.003	S4	-0.241	0.000	0.26			27.4	OK	
S1.004	S5	-0.231	0.000	0.30			31.5	OK	
S1.005	S6	-0.228	0.000	0.32			31.0	OK	
S2.000	S11	-0.154	0.000	0.22			8.4	OK	
S2.001	S12	-0.214	0.000	0.17			14.1	OK	
S2.002	S13	-0.213	0.000	0.18			13.9	OK	
S3.000	S10	-0.200	0.000	0.24			18.8	OK	
S3.001	S11	-0.197	0.000	0.25			29.2	OK	
S1.006	S7	-0.029	0.000	0.31			21.4	OK	
S1.007	S8	-1.396	0.000	0.00			21.1	OK	
S1.008	S9	0.043	0.000	0.05			3.5	SURCHARGED	
S1.009	S10	0.076	0.000	0.04			3.0	SURCHARGED	

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)	0.750
M5-60 (mm)	18.300	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	30	+0%	100/15 Summer				1.460
S1.001	S2	15 Winter	30	+0%	100/15 Summer				1.387
S1.002	S3	15 Winter	30	+0%	100/15 Summer				1.358
S1.003	S4	15 Winter	30	+0%	100/15 Summer				1.330
S1.004	S5	15 Winter	30	+0%	100/15 Summer				1.148
S1.005	S6	360 Winter	30	+0%	30/240 Winter				1.096
S2.000	S11	15 Winter	30	+0%	100/15 Winter				1.368
S2.001	S12	360 Winter	30	+0%	100/15 Summer				1.096
S2.002	S13	360 Winter	30	+0%	30/60 Summer				1.095
S3.000	S10	15 Winter	30	+0%	100/15 Summer				1.417
S3.001	S11	15 Winter	30	+0%	100/15 Summer				1.135
S1.006	S7	360 Winter	30	+0%	30/15 Summer				1.095
S1.007	S8	360 Winter	30	+0%					1.094
S1.008	S9	360 Winter	30	+0%	1/120 Winter				1.094
S1.009	S10	240 Winter	30	+0%	1/60 Winter				1.096

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

PN	US/MH Name	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	-0.165	0.000	0.57			56.8	OK	
S1.001	S2	-0.127	0.000	0.76			55.2	OK	
S1.002	S3	-0.133	0.000	0.74			55.9	OK	
S1.003	S4	-0.143	0.000	0.65			67.3	OK	
S1.004	S5	-0.127	0.000	0.73			76.2	OK	
S1.005	S6	0.020	0.000	0.14			13.4	SURCHARGED	
S2.000	S11	-0.107	0.000	0.51			19.6	OK	
S2.001	S12	-0.032	0.000	0.07			5.5	OK	
S2.002	S13	0.240	0.000	0.06			4.9	SURCHARGED	
S3.000	S10	-0.133	0.000	0.58			46.1	OK	
S3.001	S11	-0.118	0.000	0.66			76.4	OK	
S1.006	S7	0.462	0.000	0.38			26.9	SURCHARGED	
S1.007	S8	-0.906	0.000	0.00			26.5	OK	
S1.008	S9	0.533	0.000	0.05			3.5	SURCHARGED	
S1.009	S10	0.550	0.000	0.04			3.0	SURCHARGED	

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) 0.750
M5-60 (mm) 18.300 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	100	+40%	100/15 Summer				1.793
S1.001	S2	720 Winter	100	+40%	100/15 Summer				1.711
S1.002	S3	720 Winter	100	+40%	100/15 Summer				1.710
S1.003	S4	720 Winter	100	+40%	100/15 Summer				1.710
S1.004	S5	720 Winter	100	+40%	100/15 Summer				1.709
S1.005	S6	720 Winter	100	+40%	30/240 Winter				1.707
S2.000	S11	720 Winter	100	+40%	100/15 Winter				1.709
S2.001	S12	720 Winter	100	+40%	100/15 Summer				1.707
S2.002	S13	720 Winter	100	+40%	30/60 Summer				1.707
S3.000	S10	15 Winter	100	+40%	100/15 Summer				1.977
S3.001	S11	720 Winter	100	+40%	100/15 Summer				1.708
S1.006	S7	720 Winter	100	+40%	30/15 Summer				1.706
S1.007	S8	720 Winter	100	+40%					1.705
S1.008	S9	720 Winter	100	+40%	1/120 Winter				1.705
S1.009	S10	600 Winter	100	+40%	1/60 Winter				1.725

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

PN	US/MH Name	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	0.168	0.000	1.00			98.9	FLOOD RISK	
S1.001	S2	0.196	0.000	0.12			8.6	FLOOD RISK	
S1.002	S3	0.220	0.000	0.11			8.6	FLOOD RISK	
S1.003	S4	0.236	0.000	0.11			11.3	FLOOD RISK	
S1.004	S5	0.434	0.000	0.13			13.9	FLOOD RISK	
S1.005	S6	0.632	0.000	0.14			13.7	FLOOD RISK	
S2.000	S11	0.234	0.000	0.08			3.0	FLOOD RISK	
S2.001	S12	0.580	0.000	0.07			5.3	FLOOD RISK	
S2.002	S13	0.852	0.000	0.07			5.2	FLOOD RISK	
S3.000	S10	0.427	0.000	0.96			76.6	FLOOD RISK	
S3.001	S11	0.455	0.000	0.09			11.0	FLOOD RISK	
S1.006	S7	1.073	0.000	0.40			28.2	FLOOD RISK	
S1.007	S8	-0.295	0.000	0.00			28.0	FLOOD RISK	
S1.008	S9	1.144	0.000	0.04			3.4	FLOOD RISK	
S1.009	S10	1.179	0.000	0.04			3.0	FLOOD RISK	

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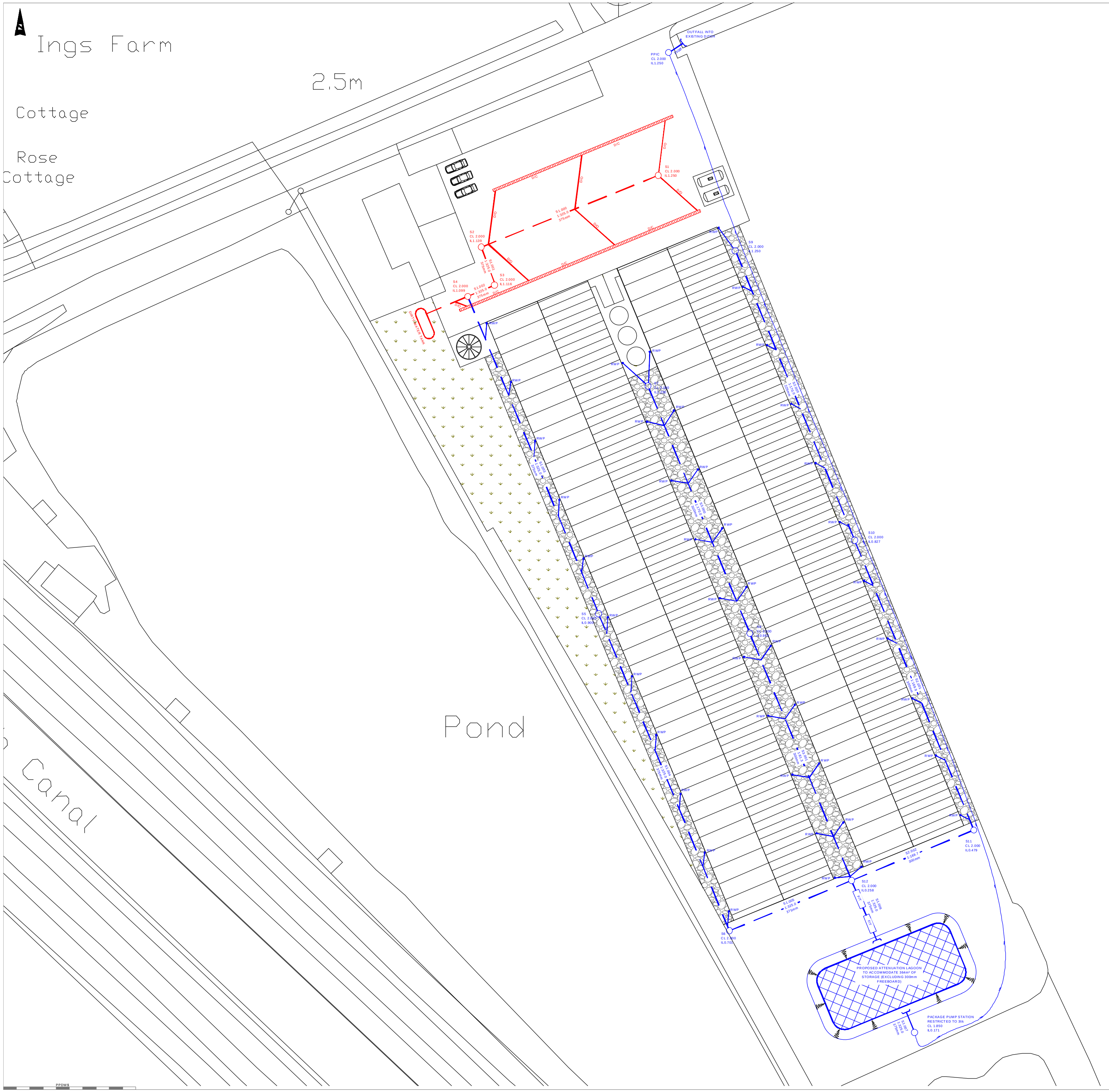
APPENDIX C

Drainage Strategy Drawing DQG SXDS DHWDLOV DUDZ LQJ



Rev	Description	Date	By	Chk	
P1	FIRST ISSUE	21.03.24	HD	AD	--

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Lincoln T. 01522 300210
Scarborough T. 01723 865484
Sheffield T. 01142 440077
York T. 01904 611594

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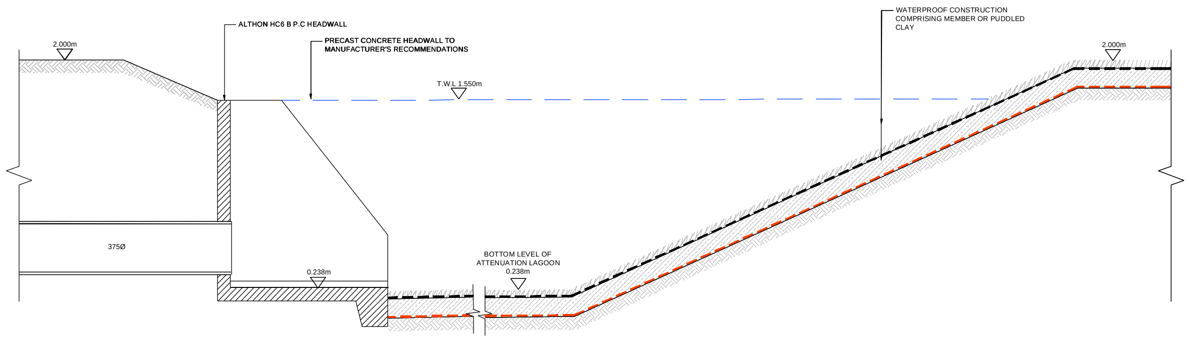
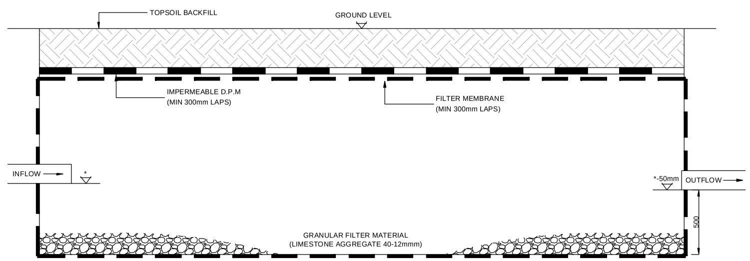


ATTENUATION DETAIL
SCALE 1:20



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APPENDIX D

Surface Water Exceedance Flood Routing Drawings

KEY

= EXISTING SURFACE WATER EXCEEDANCE FLOW PATH ROUTE

P1	FIRST ISSUE	11.03.24	HD	AD	--

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KEY

= PROPOSED SURFACE WATER EXCEEDANCE FLOW PATH ROUTE

P1	FIRST ISSUE	11.03.24	HD	AD	--

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APPENDIX E

CIRIA SuDS Manual Water Quality Matrix Outputs

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 aspart of the strategy for water quantity and quality control for the site. This isrequired in order to deliver both of the water quality criteria set out in Chapter 4 of the SuDS Manual

DROP DOWN LIST	RELEVANT INPUTS NEED TO BE SELECTED FROM THESE LISTS, FOR EACH STEP
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 Hazard Index
- 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 hazardous runoff separately and providing additional treatment.

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

	Runoff Area Land Use Description	*Hazard Level*	Total Suspended Solids (*Pollution Hazard Indices*)	Metals	Hydrocarbons
Select land use type from the drop down list (or 'Other' if none applicable): →	Commercial/Industrial roofing: Low potential for metal leaching	Low	0.3	0.4	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	**Low**	**0.3**	**0.4**	**0.05**

DESIGN CONDITIONS

1	2
This classification should be informed by an assessment of the leachability of metals from the adopted roofing materials. Particular risks are likely to be posed by materials that include copper and galvanised steel	

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

This step should be applied to evaluate the water quality protection provided by 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 required

If the proposed component is bespoke and/or a proprietary treatment product and not generically described by the suggested components, then 'Proprietary treatment system' or 'User defined indices' should be selected and a description of the component and agreed user defined indices should be entered in the rows below the drop down lists

	SuDS Component Description	Total Suspended Solids (*Pollution Mitigation Indices*)	Metals	Hydrocarbons
Select SuDS Component 1 (i.e. the upstream SuDS component) from the drop down list: →	Detention basin	0.5	0.5	0.6
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**

DESIGN CONDITIONS

1	2	3
SuDS components can only be 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 Appendix B	Detention basins should be designed to ensure the effective retention and management of sediment, such that the sediment will not be re-suspended and washed out in subsequent events	

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

Is the runoff now discharged to an infiltration component?

Yes ? Go to Step 2B
No ? Go to Step 2C

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

This step should be 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).

'Groundwater protection' describes the proposed depth of soil or other material through which runoff will flow between the runoff surface and the underlying groundwater.

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

If the proposed groundwater protection is bespoke and/or a proprietary product and not generically described by the suggested measures, then a description of the protection and agreed user defined indices should be entered in the row below the drop down list

		Total Suspended Solids (*Pollution Mitigation Indices*)	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

	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 index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, 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 combined mitigation index exceeds the land use pollution hazard index, 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 above that required for standard discharges), or other equivalent protection, is required that provides environmental protection in the event of an unexpected pollution event or poor system performance. Protected surface waters are those designated for drinking water abstraction. In England and Wales, protected groundwater resources are defined as Source Protection Zone 1. In Northern Ireland, a more precautionary approach may be required and this should be checked with the environmental regulator on a site by site basis.

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.

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

DESIGN CONDITIONS

1
Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see *Chapter 7 The SuDS design process*). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies 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 aspart of the strategy for water quantity and quality control for the site. This isrequired in order to deliver both of the water quality criteria set out in Chapter 4 of the SuDS Manual

DROP DOWN LIST	RELEVANT INPUTS NEED TO BE SELECTED FROM THESE LISTS, FOR EACH STEP
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 Hazard Index
- 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 hazardous runoff separately and providing additional treatment.

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

	Runoff Area Land Use Description	*Hazard Level*	Total Suspended Solids	Metals	Hydrocarbons	*DESIGN CONDITIONS* 1	2
			Pollution Hazard Indices				
Select land use type from the drop down list (or 'Other' if none applicable): →	Standard commercial yard or delivery area	Medium	0.7	0.6	0.7	This classification is not appropriate for haulage yards, lorry parks, waste management areas, or chemical storage/handling zones	
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	**Medium**	**0.7**	**0.6**	**0.7**		

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

This step should be applied to evaluate the water quality protection provided by 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 required

If the proposed component is bespoke and/or a proprietary treatment product and not generically described by the suggested components, then 'Proprietary treatment system' or 'User defined indices' should be selected and a description of the component and agreed user defined indices should be entered in the rows below the drop down lists

	SuDS Component Description	Total Suspended Solids	Metals	Hydrocarbons	*DESIGN CONDITIONS* 1	2	3
		Pollution Mitigation Indices					
Select SuDS Component 1 (i.e. the upstream SuDS component) from the drop down list: →	Filter drain (where the trench is not designed as an infiltration component)	0.4	0.4	0.4	SuDS components can only be 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 Appendix B	Filter drains should be preceded by upstream component(s) that trap(s) silt, or designed specifically to retain sediment in a separate zone, easily accessible for maintenance, such that the sediment will not be re-suspended in subsequent events	
Select SuDS Component 2 (i.e. the second SuDS component in a series) from the drop down list: →	Filter drain (where the trench is not designed as an infiltration component)	0.4	0.4	0.4	SuDS components can only be 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 Appendix B	Filter drains should be preceded by upstream component(s) that trap(s) silt, or designed specifically to retain sediment in a separate zone, easily accessible for maintenance, such that the sediment will not be re-suspended in subsequent events	
Select SuDS Component 3 (i.e. the third SuDS component in a series) from the drop down list: →	Detention basin	0.5	0.5	0.6	SuDS components can only be 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 Appendix B	Detention basins should be designed to ensure the effective retention and management of sediment, such that the sediment will not be re-suspended and washed out in subsequent events	
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	**0.85**	**0.85**	**0.9**	Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).		

Is the runoff now discharged to an infiltration component?

Yes ? Go to Step 2B
No ? Go to Step 2C

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

This step should be 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).

'Groundwater protection' describes the proposed depth of soil or other material through which runoff will flow between the runoff surface and the underlying groundwater.

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

If the proposed groundwater protection is bespoke and/or a proprietary product and not generically described by the suggested measures, then a description of the protection and agreed user defined indices should be entered in the row below the drop down list

		Total Suspended Solids	Metals	Hydrocarbons	*DESIGN CONDITIONS* 1	2	3	4
		Pollution Mitigation Indices						
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	Metals	Hydrocarbons	
	Combined Pollution Mitigation Indices			
Combined Pollution Mitigation Indices for the Runoff Area	**0.85**	**0.85**	**0.9**	Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, 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 combined mitigation index exceeds the land use pollution hazard index, 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 above that required for standard discharges), or other equivalent protection, is required that provides environmental protection in the event of an unexpected pollution event or poor system performance. Protected surface waters are those designated for drinking water abstraction. In England and Wales, protected groundwater resources are defined as Source Protection Zone 1. In Northern Ireland, a more precautionary approach may be required and this should be checked with the environmental regulator on a site by site basis.

	Total Suspended Solids	Metals	Hydrocarbons	*DESIGN CONDITIONS* 1
	Sufficiency of Pollution Mitigation Indices			
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 be made to identify any additional protection required for sites due to habitat conservation (see *Chapter 7 The SuDS design process*). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England

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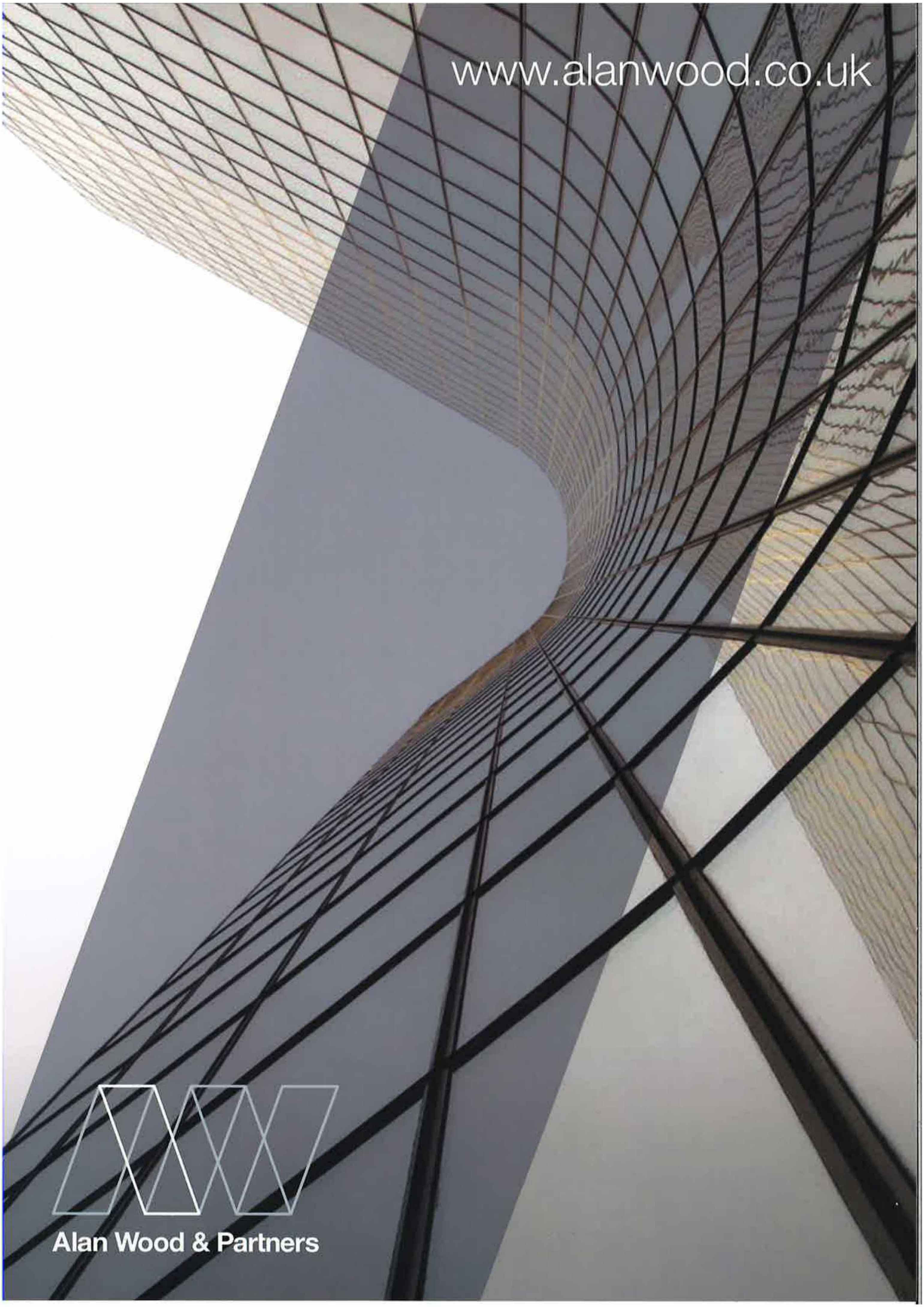
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