
Mains of Dhuloch

784-B067657

Flood Risk and Drainage Impact Assessment

For Planning

Aitken Turnbull Architects

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TABLE OF CONTENTS

1.0 INTRODUCTION	4
1.1 Purpose of this Report.....	4
1.2 Requirement for this report.....	4
1.3 Scope of this Report.....	4
1.4 Limitations of this Report.....	4
2.0 SITE DESCRIPTION	6
2.1 Site Location	6
2.2 Site Description.....	6
2.3 Site Topography.....	8
2.4 Watercourses.....	8
2.5 Drainage	10
2.6 Ground Conditions	11
3.0 FLOOD RISK.....	12
3.1 Coastal and Fluvial Risk.....	12
3.2 Surface Water & Overland Flows	13
3.3 Groundwater Flooding.....	14
3.4 Sewer Flooding.....	14
3.5 Reservoir Flooding.....	15
3.6 Canal Flooding.....	15
4.0 DEVELOPMENT PROPOSALS	16
4.2 Planning Policy & Guidance.....	16
4.3 Development and Flood Risk	18
5.0 SURFACE WATER MANAGEMENT.....	19
5.1 Drainage Hierarchy	19
5.2 Impermeable Areas and Discharge Rates	19
5.3 Required Attenuation	20
5.4 Sustainable Drainage.....	21
5.5 Proposed Surface Water Drainage Strategy.....	23
5.6 Exceedance Flow Routes.....	26
6.0 CONCLUSIONS & RECOMMENDATIONS	27

6.1 Conclusions	27
6.2 Recommendations	27

LIST OF TABLES

Table 5-1 - Existing and Proposed Permeable Areas.....	20
Table 5-2 - Estimated Attenuation Requirements.....	20
Table 5-3 - Review of suitability of SuDS features to the developed site	22
Table 5-4 - Catchments' Attenuation Requirements	24
Table 5-5 - Pollution Hazard Indices	25
Table 5-6 - SuDS Mitigation Indices.....	25
Table 5-7 - SuDS maintenance schedule for Swales and Detention Basins.....	25

LIST OF FIGURES

Figure 2-1 Site Location.....	6
Figure 2-2 View across south of the site, looking northward.....	7
Figure 2-3 View across north of the site, looking southward.....	7
Figure 2-4 SEPA LiDAR Composite DTM	8
Figure 2-5 Watercourses	9
Figure 2-6 Pooling in the north of the site, looking southward	10
Figure 2-7 Pooling in the south of the site, looking northward	10
Figure 3-1 SEPA Flood Risk Map	12
Figure 3-2 SEPA Surface Water Flood map.....	14
Figure 5-1 - SuDS Management Train	21

APPENDICES

Appendix A: Topographic Survey	
Appendix B: Scottish Water Sewer Asset Plan	
Appendix C: SEPA Groundwater Flood Risk Map	
Appendix D: SEPA Reservoirs Inundation Map	
Appendix E: Development Proposals	
Appendix F: Catchment Areas Plan	
Appendix G: Greenfield Runoff Rate Calculations	
Appendix H: Quick Storage Estimation Calculations	
Appendix I: Surface Water Drainage Strategy	
Appendix J: Micro Drainage Source Control Calculations	
Appendix K: Correspondence with DGC	

ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
AEP	Annual Exceedance Probability
FRDIA	Flood Risk and Drainage Impact Assessment
SEPA	Scottish Environmental Protection Agency
SPG	Scottish Planning Guidance
PPG	Planning Practice Guidance
SuDS	Sustainable Drainage Systems
DGC	Dumfries and Galloway Council
LLFA	Lead Local Flood Authority
BGS	British Geological Survey
SPZ	Source Protection Zone
FRA	Flood Risk Assessment
CC	Climate Change
FFL	Finished Floor Levels
AOD	Above Ordnance Datum

NOTE OF FLOOD FREQUENCIES

AEP (%)	50	20	10	5	3.33	2	1.33	1	0.5	0.1
AEP	0.5	0.2	0.1	0.05	0.033	0.02	0.0133	0.01	0.005	0.001
Return Period (1 in X Years)	2	5	10	20	30	50	75	100	200	1000

1.0 INTRODUCTION

1.1 PURPOSE OF THIS REPORT

1.1.1 Tetra Tech Ltd have been appointed by Aitken Turnbull Architects (the 'Client') to prepare a Flood Risk and Drainage Impact Assessment (FR&DIA) for the proposed development of a poultry farm including two buildings and associated ancillary buildings and access at Mains of Dhuloch Farm, Stranraer, approximate postcode: DG9 0RF.

1.2 REQUIREMENT FOR THIS REPORT

1.2.1 The site more than 2 hectares (ha) in size and therefore is classified as a Major Development and necessitates the preparation of a Flood Risk Assessment for the purposes of planning under Policy 22 of the Scottish National Planning Framework (NPF).

1.2.2 The proposed development will result in an increase in impermeable areas within the site, therefore management of surface water runoff is required to ensure there is no increase in downstream flood risk as a result of the proposed development.

1.2.3 The FR&DIA has been undertaken in accordance with the Scottish Government's Fourth National Planning Framework (NPF4), Planning Practice Guidance (PPG) (Flood Risk and Coastal Change), Scottish Environmental Protection Agency (SEPA) guidance, and the Dumfries and Galloway Council (DGC) local policy.

1.3 SCOPE OF THIS REPORT

1.3.1 The FR&DIA will consider all potential sources of flood risk including the sea, watercourses, surface water and overland flow routes, groundwater, sewers, canals and reservoirs. It will identify the level of risk and, where necessary, propose mitigation to manage flood risk.

1.3.2 The report will identify a surface water drainage strategy for surface water runoff from the proposed development site such that flood risk to the site and adjoining areas is not exacerbated, as required by SEPA and DGC as the Lead Local Flood Authority (LLFA) with a particular focus on the provision of SuDS on the site. The drainage strategy will be produced in accordance with the statutory National Standards for Sustainable Drainage Systems and The SUDS Manual (CIRIA C753).

1.3.3 A site visit was undertaken by a Tetra Tech representative on 26/09/2024, and information gathered from this visit is included in this report where relevant.

1.4 LIMITATIONS OF THIS REPORT

1.4.1 This report has been prepared by Tetra Tech Ltd on behalf of the Client in connection with the scope of the report as described in Section 1.3 above and taking into account the particular instructions and requirements set out in Tetra Tech's fee proposal and the Client's acceptance. It is not intended for and should not be relied on by any third party and no responsibility is undertaken to any third party.

- 1.4.2 Tetra Tech Ltd accepts no duty or responsibility (including in negligence) to any party other than the Client and disclaims all liability of any nature whatsoever to any such party in respect of this report.
- 1.4.3 This report cannot be reproduced without Tetra Tech's written consent.
- 1.4.4 This assessment has been completed based on the best available data at the time of writing. Flood risk and climate change is an evolving science and therefore documents such as this should be revisited at regular intervals in the future when new flood risk and climate change information, guidance or data is published

2.0 SITE DESCRIPTION

2.1 SITE LOCATION

2.1.1 The site is located on greenfield agriculture land at Mains of Dhuloch Farm on the Stranraer peninsula. The approximate postcode of the site is DG9 0RF and the central grid reference is NW 98760 66014. A site location plan is included as Figure 2-1.



Figure 2-1 Site Location

2.2 SITE DESCRIPTION

2.2.1 The site measures an area of approximately 7.11 hectares (ha). The site is currently largely greenfield consisting of several grassed fields, and the access road to Mains of Dhuloch farm is located through the centre of the site. A small area of forest is located in the west of the site next to the Mains of Dhuloch access road.

2.2.2 A site walkover was completed by Tetra Tech on 26/09/2024 and confirmed the site's current setting as largely grassed grazing land, as shown in Figure 2-2 and Figure 2-3 below.



Figure 2-2 View across south of the site, looking northward



Figure 2-3 View across north of the site, looking southward

2.2.3 The site is located in a rural setting with grass fields all around, and is otherwise bounded by:

- The Mains of Dhuloch Farm buildings to the north; and
- An unnamed road to the west.

2.3 SITE TOPOGRAPHY

2.3.1 A Topographic Survey of central areas of the site was undertaken by Tetra Tech Ltd in September 2024 and is included as Appendix A.

2.3.2 A review of SEPA 0.5 m LiDAR data at the site and the areas surrounding has also been undertaken and is included as Figure 2-4.

2.3.3 These sources indicate that:

- The centre of the site forms a high point with ground levels rising to approximately 92 m Above Ordnance Datum (AOD);
- In the south, the site slopes down to between 70 m – 76 m AOD at the southeastern border; and
- In the north, the site slopes down to between 70 m – 72 m AOD in the northwestern border and approximately 60 m AOD at the northeast corner.

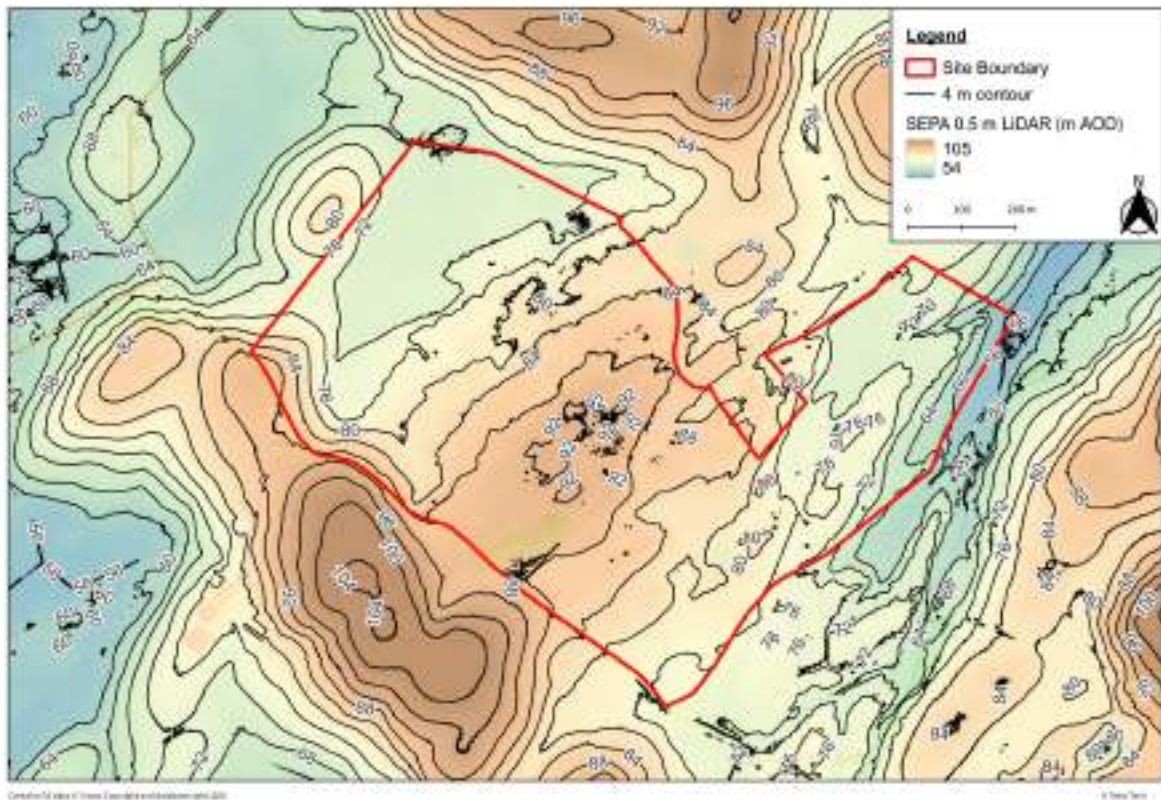


Figure 2-4 SEPA LiDAR Composite DTM

2.4 WATERCOURSES

2.4.1 Ordnance Survey Mapping indicates the location of two unnamed watercourses within the northwest and east of the site, as shown in Figure 2-5. The watercourse in the northwest of the site discharges into another unnamed watercourse on the site's northern border. The watercourse in

the east of the site discharges into the Glengyre Burn on the site's eastern border. The Glengyre Burn is a larger watercourse with SEPA modelled flood extents by SEPA, as shown in flood maps in Section 3 below. Other unnamed tributaries of the Glengyre Burn are indicated within 10 m and 50 m to the south of the site respectively. Other watercourses in the site's vicinity include an unnamed watercourse is approximately 200 m west of the site, and the tributaries of the High Mark Burn are approximately 300 m southwest of the site.

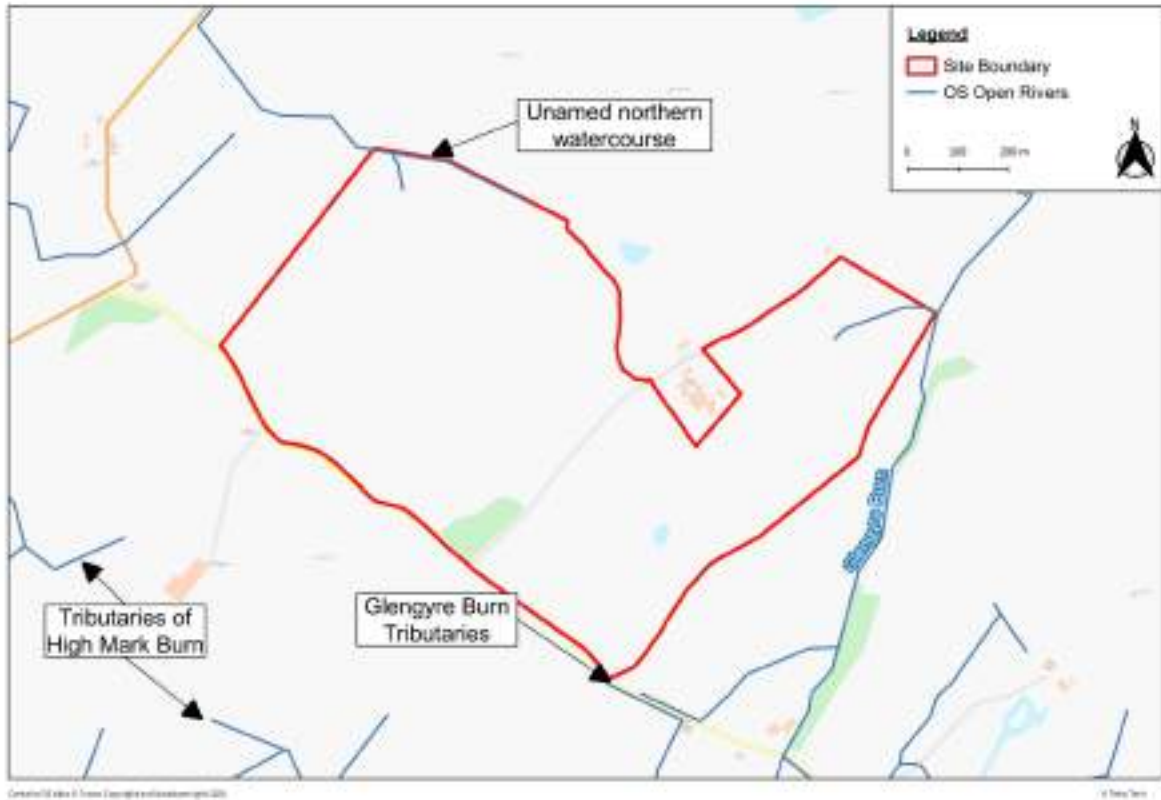


Figure 2-5 Watercourses

2.4.2 The Topographic Survey indicates the presence of a ditch that runs adjacent to the Mains of Dhuloch farm access track (see Appendix A). Levels as measured indicate this flows south-westward to the site access point. Furthermore, the site walkover confirmed the location of numerous areas of pooling and marsh in central areas of the site, as shown in the Figure 2-6 and Figure 2-7 below.



Figure 2-6 Pooling in the north of the site, looking southward



Figure 2-7 Pooling in the south of the site, looking northward

2.5 DRAINAGE

On-Site Drainage

2.5.1 The site currently comprises largely undeveloped agriculture land with walls and an access road. The Topographic Survey indicates the presence of a field drain / ditch running adjacent to the central access road. It has been confirmed by the client and site walkover that the ditch flows in a

south-westward direction and finishes at the access point from the road to the southwest. It is expected that this ditch drains the access road and a small part of the neighbouring field.

Off-Site Drainage

2.5.2 Public sewer records obtained from Scottish Water, included as Appendix B, indicate no sewers are present within the site or its vicinity.

2.6 GROUND CONDITIONS

Soil

2.6.1 A review of the Scottish Government's one soil mapping indicates that the underlying soils are classified as 'Red brown clayey drifts containing Ordovician and Silurian greywacke stones'.

Geology

2.6.2 A review of the British Geological Survey (BGS) online geological mapping indicates the site is underlain by no superficial deposits. The majority of the site is indicated to be underlain by bedrock deposits from the Kirkcolm Formation which is described as comprising interbedded sandstone and siltstone. The northern area of the site is shown to be underlain by bedrock deposits from the North Britain Siluro-devonian Calc-alkaline Dyke Suite, which is described as comprising Felsite.

2.6.3 No BGS boreholes data is available within the site or its vicinity.

Hydrogeology

2.6.4 A review of Scotland's Environment online mapping indicates the site lies on Class 2c aquifer. This aquifer is a low productivity aquifer.

2.6.5 The site is not located in any Source Protection Zones (SPZs).

3.0 FLOOD RISK

3.1 COASTAL AND FLUVIAL RISK

3.1.1 A floodplain is the area that would naturally be affected by flooding if inundated by the sea (coastal or tidal flooding) or if a river rises above its banks (fluvial flooding). In Scotland, the flood risk is divided as follows:

- High Likelihood is land assessed as having a 10% Annual Exceedance Probability (AEP) of river flooding.
- Medium Likelihood is land assessed as having 0.5% AEP of river flooding.
- Low Likelihood is land assessed as having a 0.1% AEP of river flooding.

3.1.2 Given the site's inland location and its elevation between 58 m – 92 m AOD, the risk of flooding from coastal and tidal sources is considered as **negligible**.

3.1.3 The SEPA Flood Map, shown in Figure 3-1 below, indicates site is almost entirely located outside of the risk areas as detailed above, except for an area of high to low risk in the far east of the site, associated with the Glengyre Burn.

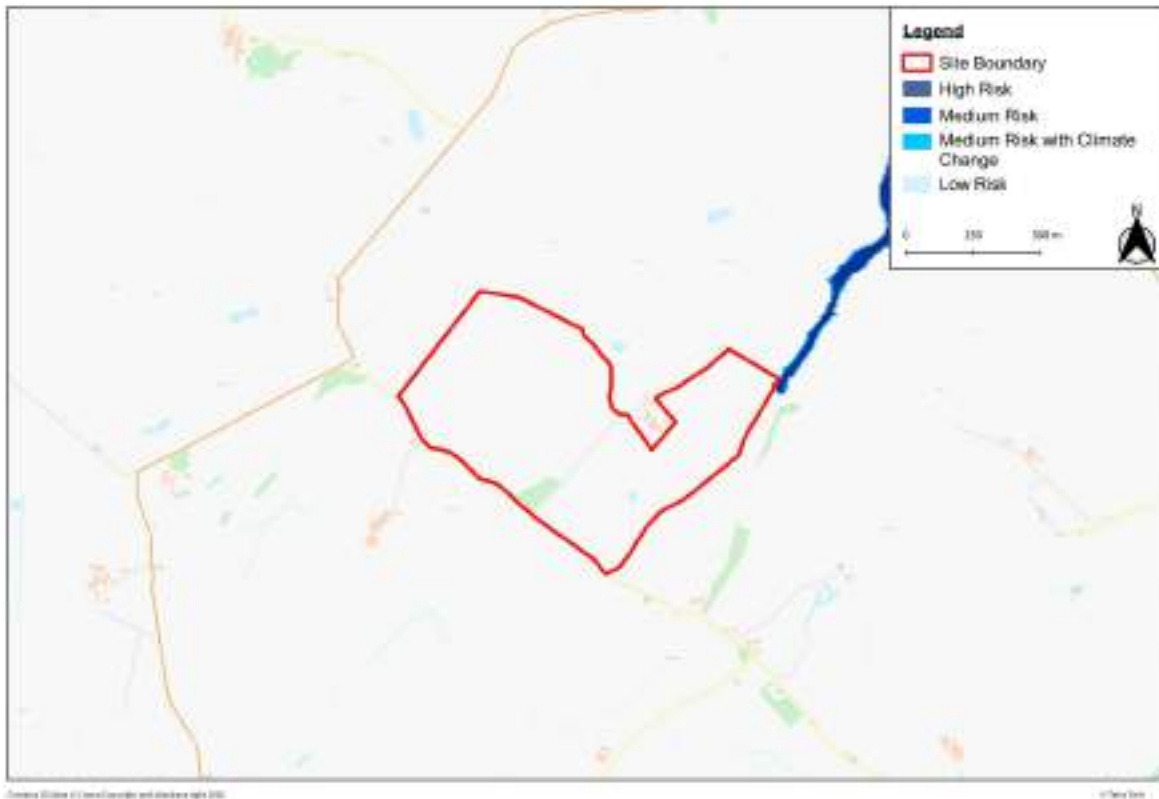


Figure 3-1 SEPA Flood Risk Map

3.1.4 This shows the site lies almost entirely outside of any fluvial flood risk extent in the present day.

- 3.1.5 The SEPA Flood Risk Map also includes an extent for the Medium Risk (0.5 % AEP) event with consideration of climate change to 2080. As indicated in Figure 4-1, the site is shown to remain almost entirely unaffected by fluvial flooding in this event.
- 3.1.6 The extents of the unnamed watercourses in the northwest and east of the site, and ditch by the access road are not shown in SEPA Flood Risk mapping. Notwithstanding, the SEPA Surface Water Flood Map (included as Figure 3-2 and described further in Section 3.2 below) indicates that the surface water flood extents (which can be considered as proxy for potential fluvial flooding) associated with these watercourses appear to be relatively contained.
- 3.1.7 Given the proposed development is elevated between 10 m - 20 m above and more than 200 m from the closest watercourses, it is considered that the proposals would remain at low risk of fluvial flooding considering the impacts of climate change.
- 3.1.8 Based on the above, the risk of flooding from fluvial sources is considered as **low**.

3.2 SURFACE WATER & OVERLAND FLOWS

- 3.2.1 Surface water flooding can occur during high intensity rainfall events as sheet runoff from fields or hard paved areas. It is particularly prevalent in areas with significant hardstanding or poorly permeable soils (i.e., clay). This is because the grounds capacity for infiltration is reduced. In addition, the inability to enter local drainage systems also contributes to risk from this source. The risk of surface water flooding is divided as follows, as defined by the Scottish Environmental Protection Agency:
- High risk means that the annual probability of flooding is 1 in 10 (10% AEP).
 - Medium means that the annual probability of flooding is 1 in 200 (0.5% AEP).
 - Low risk means that the annual probability of flooding is 1 in 1,000 (0.1% AEP).
- 3.2.2 An extract of SEPA's Surface Water Flood Map is shown in Figure 4-2 below. The map indicates the site is located almost entirely outside of any risk extents for surface water except for several small areas of medium to low risk in the northwest and east of the site, away from the location of the proposed development.



Figure 3-2 SEPA Surface Water Flood map

3.2.3 Based on the above, the overall risk of surface water flooding is considered to be **low**.

3.3 GROUNDWATER FLOODING

3.3.1 Groundwater flooding occurs when groundwater emerges at the surface under conditions where the 'normal' range of groundwater levels and groundwater flows is exceeded.

3.3.2 The SEPA Groundwater Flood Risk Map, as featured in the Solway Flood Risk Management Plan online viewer, indicates the site to be located outside of any area at potential risk of groundwater flooding (Appendix C).

3.3.3 The proposed development does not include basement or below ground levels, thereby reducing the potential for groundwater ingress.

3.3.4 Based on the above, the overall risk of groundwater flooding is considered to be **low**.

3.4 SEWER FLOODING

3.4.1 Sewer flooding occurs when intense rainfall overloads the sewer system capacity and/or when sewers cannot discharge properly to watercourses due to high water levels. Sewer flooding can also be caused when problems such as blockages, collapses or equipment failure occur in the sewerage system.

3.4.2 As outlined in Section 2.5, no public sewers are located within the vicinity of the site, and therefore the risk of flooding from sewers is considered to be **negligible**.

3.5 RESERVOIR FLOODING

3.5.1 Flooding from reservoirs occurs when a reservoir dam is overtopped or breaches due to structural failure.

3.5.2 According to SEPA's Reservoirs Inundation map (included as Appendix D) the site is shown to be located in an area that is not at risk of flooding in the event of reservoir failure.

3.5.3 Based on the above, the overall risk of reservoir flooding is considered to be **negligible**.

3.6 CANAL FLOODING

3.6.1 Flooding from a canal occurs when the canal is overtopped or breaches due to failure. No canals are located within the vicinity of the site.

3.6.2 Based on the above, the overall risk of canal flooding is considered to be **negligible**.

4.0 DEVELOPMENT PROPOSALS

- 4.1.1 The proposed development comprises the construction of two poultry shed buildings, ancillary buildings and associated access on a site covering in excess of 2 ha area. The proposed site layout is included as Appendix E.
- 4.1.2 The proposed development will be classified as 'Least Vulnerable' development in accordance with SEPA Flood Risk and Land Use Vulnerability Guidance.
- 4.1.3 The proposed development will result in an overall impermeable area of 1.556 ha associated with the proposed barns and access. A Proposed Catchment Plan is included as Appendix F.

4.2 PLANNING POLICY & GUIDANCE

National Policy

- 4.2.1 The Scottish Planning Circular 5 – Hierarchy of Developments (2009) Schedule of Major Developments stipulates that proposals at any development site with an area in excess of 2 hectares is classified as a Major Development. Since the site is in excess of 2 hectares in area, a Flood Risk Assessment is therefore required for planning application submission under the NPF4 Policy 22.

Sequential Assessment

- 4.2.2 One of the aims of the Scottish Government's fourth National Planning Framework (NPF4) is to steer development away from zones of high flood risk. The proposed development components are classified as 'Least Vulnerable' in accordance with Table 2 of SEPA's Matrix of Flood Risk. The development would be suitable given that the site lies outside of the 1 in 200 year plus climate change extent for fluvial and tidal flood risk, is almost entirely outside of any surface water flood extent.

Local Policy

- 4.2.3 The Dumfries and Galloway Local Development Plan 2 (LDP) was adopted in October 2019. It provides the planning framework and guides the future use and development of land in towns, villages and the rural area. It also indicates where development, including regeneration, should happen and where it should not. The LDP sets out the following policy with relation to Flood Risk and Sustainable Drainage:

"Policy IN7: Flooding and Development

The avoidance principle is the most sustainable form of flood management, in accordance with the policy principle for managing flood risk of SPP and the Flood Risk Management (Scotland) Act 2009. Where proposed development could lead to an unacceptable on-site or off-site flood risk, as defined by the Risk Framework in SPP, then it will not be permitted. Where a proposed development could lead to an unacceptable flood risk, it may be that a Flood Risk Assessment (FRA) is able to clarify to the satisfaction of the Council and SEPA that the level of risk both on and off site would be acceptable. For any site a Drainage Impact Assessment (DIA) may be required to ensure that

surface water flows are properly taken into account in the development design. Consideration should be given to pluvial flows especially those which exceed the capacity of the proposed drainage systems. Design of development must avoid flood risk from exceedance flows. (See also Policy IN8 for Surface Water Drainage and SuDS).

Policy IN8: Surface Water Drainage and SuDS

With the exception of single houses and those with direct discharges to coastal waters, Sustainable Drainage Systems (SuDS) will be a required part of all proposed development as a means of treating the surface water and managing flow rates and must form part of any planning permission in principle proposal.

Consideration of drainage issues is a planning requirement for every planning proposal. This consideration should be initiated as part of any preliminary site assessment and should progressively inform the generation of schemes as they develop. For any site a Drainage Impact Assessment (DIA) at the appropriate level may be required to ensure that surface water flows are properly taken into account in the development design.

Planning applications must include appropriate and proportionate details of the proposed SuDS to show how they will:

- *Ensure the system is designed to avoid flood risk from exceedance flows;*
- *Be accommodated within the proposed site, and understood as an essential factor in determination of the overall capacity of any site;*
- *Be based on a unified approach to cover surface water drainage from on-site roads and from the remainder of the site;*
- *Contribute positively to the biodiversity, general amenity and water quality of the area of the proposal;*
- *Include a coordinated approach between new developments that are adjacent to one another; and*
- *Include the arrangements for its long term maintenance.*

There should be appropriate arrangements for surface water drainage during the construction phase of a development site. This could be by way of a SuDS scheme or some alternative interim solution.”

4.2.4 At the time of writing, Dumfries and Galloway Council are in the process of preparing a New LDP. With the LDP 3 being at consultation stage, the LDP 2 is considered as current at the time of writing and therefore should be considered for planning applications until the LDP 3 is published and adopted.

4.3 DEVELOPMENT AND FLOOD RISK

Flood Risk to the Development

- 4.3.1 As discussed in Section 3, the site is considered to be at negligible to low risk of flooding from all sources, and the proposed development is considered to remain unaffected in the 0.5% AEP 'Medium Risk' surface water and fluvial flood event.

Flood Risk Arising from the Development

- 4.3.2 The proposed development is located outside of any fluvial or surface water flood risk areas and as such, there will be no obstruction to flood flow routes or the displacement of floodwater and therefore no requirement to provide floodplain compensation.
- 4.3.3 The proposed development will result in an overall impermeable area of 1.556 ha which will result in an increase in surface water runoff. A Drainage Impact Assessment has been prepared to demonstrate that there will be no increase in downstream flood risk as a result of the proposed development. Further details of the proposed surface water drainage strategy are provided in Chapter 5 below.

5.0 SURFACE WATER MANAGEMENT

5.1 DRAINAGE HIERARCHY

5.1.1 In order to ensure that surface water runoff from a developed site does not increase the risk of flooding, in accordance with national and local policy, Building (Scotland) Regulations 2004 and accompanying technical advice, Building Standards technical handbook 2017: domestic buildings, the following options for the disposal of runoff have been considered at a high level, in order of preference:

- Discharge to an adequate soakaway or some other adequate infiltration system (i.e., to ground);
- Discharge to a watercourse;
- Discharge to a sewer (surface water before combined).

Discharge to an adequate soakaway or some other adequate infiltration system

5.1.2 The published geology indicates the site is predominantly underlain by bedrock deposits comprising Kirkcolm Formation comprising interbedded sandstone and siltstone. The northern area of the site is shown to be underlain by bedrock deposits of Felsite. No superficial deposits are indicated. There are no borehole records within the site.

5.1.3 During the site walkover by a Tetra Tech operative, the site was observed as boggy in nature and therefore likely to be infiltration poor. For the purposes of this assessment and in lieu of site specific infiltration rates, the use of infiltration has not been considered further.

Discharge to a Watercourse

5.1.4 OS mapping indicates the presence of two watercourses in the far north and east of the site respectively. The location of these watercourses was confirmed by a Tetra Tech operative during site walkover. It is proposed to discharge surface water runoff generated by the proposed development to these watercourses, subject to survey and agreement with DGC.

Discharge to Sewer

5.1.5 Scottish Water Asset plans included as Appendix B indicate there are no public sewers or highway drains within the vicinity of the site.

5.2 IMPERMEABLE AREAS AND DISCHARGE RATES

5.2.1 As outlined in Section 4.3, the proposed development will result in an increase in impermeable areas on site of approximately 1.556 ha, which includes 0.778 ha as associated with each of the proposed barn buildings respectively. The access roads and turning circles are considered to be of crushed stone, and therefore will be permeable and are excluded from consideration of impermeable areas.

5.2.2 Given the higher topography between the two proposed barns, it is proposed to split drainage from the proposed development between the northern and southern barns (Catchments 01 and 02 respectively), as shown in the Proposed Catchments Plan in Appendix F.

5.2.3 Existing greenfield runoff rates have been calculated for each of the two catchments using the UK Greenfield Runoff Calculator. Results are summarised in Table 5-1 and Appendix G.

Table 5-1 - Existing and Proposed Permeable Areas

Return Period	Existing Discharge Rate (l/s)	
	Catchment 01	Catchment 02
QBAR	6.5	6.5
1 in 30	12.7	12.7
1 in 200	19.5	19.5

5.2.4 Following recommendation from the Solway LDP2 Surface Water Drainage and SuDS document (2020), greenfield runoff calculations have been undertaken based on the IH124 method.

5.2.5 The Standard Annual Average Rainfall (SAAR) value used within the greenfield runoff calculator is from the Flood Estimation Handbook data, which represents more recent data as derived from 1961-2006. This was considered as more suitable than the comparatively older IH 124 SAAR value as derived from the period 1941-1970.

5.2.6 The Soil Type used within the greenfield runoff calculator is Type 4, which represents a more realistic consideration of surface conditions within the site, since during the site walkover by a Tetra Tech operative, the site was observed as boggy in nature and therefore likely to be infiltration poor. Soil Type 4 was therefore considered as more suitable than the more infiltrating Type 3 soils as indicated at the site by the UK SUDS map tool.

5.2.7 It is proposed to limit discharge from the site to the existing QBAR rate of 6.5 l/s from each catchment respectively during all events up to the 1 in 200 year plus 38% climate change event in line with DGC requirements. Restricting surface water runoff to the existing QBAR rate for all events up to and including during the 1 in 200 year plus 38% climate change scenario will provide betterment during the greater return period events.

5.3 REQUIRED ATTENUATION

5.3.1 Micro Drainage Quick Storage Estimates have been undertaken to determine the attenuation requirements based on the proposed impermeable areas and limit to discharge rate. These are included as Appendix H and are summarised in Table 5-2 below.

Table 5-2 - Estimated Attenuation Requirements

Catchment	Discharge Rate (l/s)	1 in 30 years (m ³)	1 in 200 year + 38% CC (m ³)
C1	6.5	202 - 306	520 – 724
C2	6.5	202 - 306	520 – 724

5.4 SUSTAINABLE DRAINAGE

Review of SuDS Options

5.4.1 In order to comply with national and local policy and guidance, the design of the surface water drainage system should seek to use SuDS. This section reviews the suitability of the different SuDS features to the proposed development site.

The SUDS Management Train

5.4.2 The main purpose of SuDS is to manage surface water runoff generated by a development within the development site, attenuating additional flows generated by the introduction of impermeable areas whilst providing water quality treatment to the runoff and amenity and landscape benefits to the community. SuDS features can be categorised as follows:

1. Source Control: manage runoff at its source
 - Water butts, green/brown roofs, permeable pavements, rainwater harvesting systems, bio-retention systems.
2. Site Control: manage runoff generated by a wider area
 - Swales, ponds, infiltration devices, filter strip, French drains.
3. Regional Control: manage runoff generated by several sites
 - Basins, ponds and wetlands

5.4.3 The following is an illustration of the SuDS principles and how they may be applied to a development via a SuDS Management Train.

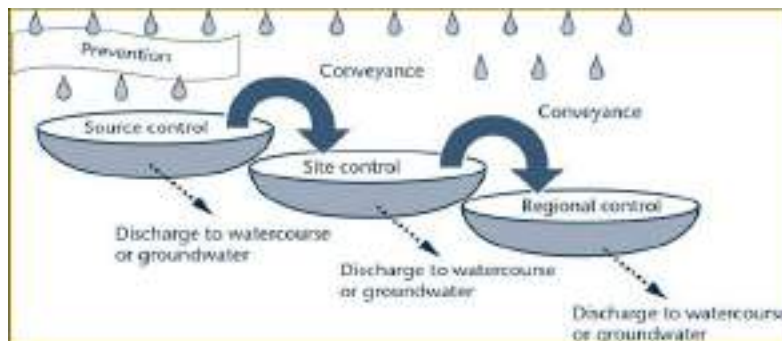


Figure 5-1 - SuDS Management Train¹

¹ CIRIA (2008) Sustainable Drainage Systems: promoting good practice – a CIRIA initiative

5.4.4 Table 5-3 below summarises the suitability of the different SuDS features to the developed site.

Table 5-3 - Review of suitability of SuDS features to the developed site

Type of SuDS	Description	Applicability for the Site
Source Control		
Water butts	Small storage tanks on each individual housing plot.	Rainwater harvesting could be implemented to provide water for non-potable uses such as toilet flushing or irrigation of external landscaped areas.
Rainwater harvesting	Recycling of water from roofs and impermeable areas.	However, the attenuation benefits provided by rainwater harvesting techniques are limited and would only be realised when the storage was not full.
Green roofs	Vegetated roofs that reduce runoff and remove pollutants.	Based on the nature of the proposed development, the use of green roofs is not considered to be feasible.
Pervious surfaces	Pavements that allow surface water to flow into underlying layers of the pavement and either infiltrate or drain to an on-site drainage network.	Pervious surfaces could be utilised within the proposed access road and turning circle which are to be of crushed stone.
Rain gardens & bioretention systems	Shallow depressions with free draining soil and planted with vegetation that withstands occasional flooding.	There is potential for use of rain gardens at the site to coincide with the landscaping. However, rain gardens and bioretention systems provide limited attenuation and therefore have been discounted from consideration at this stage. Further consideration of this will be required at the detailed design stage.
Site & Regional Control		
Filter drains	Linear drains or trenches filled with granular material that allow infiltration to the surrounding ground.	The use of infiltration based SuDS features have not been considered further at this stage given the boggy nature of the site and in lieu of site specific infiltration testing. Infiltration testing in accordance with BRE365 Digest guidance may be required to confirm site specific infiltration rates as part of the detailed design stage.

Flood Risk & Drainage Impact Assessment
Mains of Dhuloch

Swales	Vegetated channels to convey store and treat runoff.	The use of swales has been considered as suitable to coincide with topography. Further details of the proposed swales are provided in Section 5.5 below
Detention basins & ponds	Shallow areas of open space that temporarily hold water and collect silt.	The use of detention basins has been considered as suitable within the proposed development based on available space. Further details of the proposed detention basins are provided in Section 5.5 below.
Infiltration basins	Shallow depression that stores runoff before it infiltrates into the subsoil.	The use of infiltration based SuDS features have not been considered further at this stage given the boggy nature of the site and in lieu of site specific infiltration testing. Infiltration testing in accordance with BRE365 Digest guidance may be required to confirm site specific infiltration rates as part of the detailed design stage.
Infiltration devices	Generally granular trenches or soakaways that store water and allow infiltration to the surrounding ground.	The use of infiltration based SuDS features have not been considered further at this stage given the boggy nature of the site and in lieu of site specific infiltration testing. Infiltration testing in accordance with BRE365 Digest guidance may be required to confirm site specific infiltration rates as part of the detailed design stage.

5.4.5 Table 5-3 identifies that there are several SuDS that could be used within the development site, subject to detailed design. All SuDS should be designed in accordance with The SuDS Manual (Ciria C753) and Defra’s Non-technical standards for sustainable drainage systems.

5.5 PROPOSED SURFACE WATER DRAINAGE STRATEGY

Drainage Strategy

5.5.1 A surface water drainage strategy has been prepared for the proposed development and is included as Appendix I.

5.5.2 The requirements for each catchment are summarised in Table 5-4 below:

Table 5-4 - Catchments' Attenuation Requirements

Catchment	Impermeable Area	Discharge Rate (l/s)	Attenuation Volume 1 in 200 year + 38% CC (m ³)
C1	0.778	6.5	520 – 724
C2	0.778	6.5	520 – 724

- 5.5.3 Attenuation requirements for each catchment are calculated as 520 m³ – 724 m³. As shown in Micro Drainage Source Control model calculations in Appendix J, a basin in each catchment of 551 m³ provides the required attenuation in the 1 in 200 year plus 38% climate change event without causing flooding, and therefore it is proposed to provide 551 m³ of attenuative storage.
- 5.5.4 Both basins are to be located away from their respective catchments at lower topographic levels, where ground levels are relatively flat, hence reducing the risk of surface water ingress to the proposed barns in the event of failure of the proposed drainage system.
- 5.5.5 It is proposed to discharge from each respective catchment at a restricted rate of 6.5 l/s via a hydrobrake or similar flow control device. Catchment 01 will discharge to the watercourse in the far northwest, and Catchment 02 to the watercourse in the far east of the site.
- 5.5.6 It is proposed to convey runoff from the proposed barns to the ponds via a swale. As highlighted in the Surface Water Layout Plan, both swales pass across areas of sloping topography. The steep gradient of the swales' routes in places has been managed by routing swales' diagonally across these slopes, however, check dams may be required to regulate flow here.
- 5.5.7 It should be noted that consideration of the interaction between site levels, access roads, swales and the proposed basins, will be required at the detailed design stage. In addition to this, survey of the watercourses at points of proposed discharge will be required to confirm dimensions as necessary.
- 5.5.8 DGC confirmed on 16th December 2024 that they hold no objection to the proposed surface water drainage arrangement. Correspondence with DGC is included as Appendix K.

Water Quality

- 5.5.9 The SuDS design should seek to effectively mitigate the pollution risks associated with the land use. Step 1 of the 'Simple index approach' outlined in The SuDS Manual is to identify the pollution hazard indices for the proposed land uses. These are set out in Table 5-5 below, which is an extract of Table 26.2 of The SuDS Manual.

Table 5-5 - Pollution Hazard Indices

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Residential roofs (representing the proposed poultry barns)	Very Low	0.2	0.2	0.05
Low Traffic Roads and individual property driveways	Low	0.5	0.4	0.4

5.5.10 Step 2 of the Simple Index Approach is to select SuDS features with a total pollution mitigation index that equals or exceeds the pollution hazard index. SuDS mitigation indices for the SuDS applicable to the site are shown in Table 5-6 below. These are derived from Table 26.3 of the CIRIA SuDS Manual.

Table 5-6 - SuDS Mitigation Indices

SuDS Feature	TSS	Metals	Hydrocarbons
Swales	0.5	0.6	0.6
Detention Basins	0.5	0.5	0.6
Combined	0.75	0.85	0.9

5.5.11 Based on the above, the provision of swales and detention basins will provide sufficient treatment of surface water runoff.

SUDS & Drainage Systems Maintenance

5.5.12 SuDS require regular maintenance to keep them working effectively. It is assumed that drainage and SuDS on the site will be non-adoptable and therefore the responsibility of the Client or a delegated management company. Table 5-7 below shows the maintenance requirements for each of the proposed SuDS features for the scheme.

Table 5-7 - SuDS maintenance schedule for Swales and Detention Basins

SuDS Feature	Required Action	Typical Frequency
Swales	Inspect inlets and outlets for blockages. Clear if required.	Monthly
	Remove litter and debris.	Monthly (as required)
	Manage vegetation and nuisance plants	
	Inspect inlets and outlets and swales for silt accumulation and establish a silt removal frequency	Every 6 months
	Grass cutting and vegetation management. Minimum grass length 75mm, max grass length 200mm	

Flood Risk & Drainage Impact Assessment
Mains of Dhuloch

	Reseed area of poor vegetation growth and alter plant types to better suit growing condition	
	Repair erosion or other damage by reseeding or re-turfing	
	Repair inlets and outlets	
	Re-level uneven surfaces and reinstate design levels	
Detention Basins	Remove litter and debris	Monthly
	Cut grass & vegetation management	Monthly in Spring and Summer or as required
	Inspect inlets, outlets, and structures	Every 12 months
	Remove sediments from inlet and outlet	
	Prune and trim trees	
	Remove sediments from main basin	Every 5 years
	Repair erosion and other damages	As required
	Relevel surfaces	0.85
	Remove litter and debris	

5.6 EXCEEDANCE FLOW ROUTES

5.6.1 The proposed drainage strategy provides surface water attenuation for all events up to and including the 1 in 200 year plus 38% climate change scenario. In an event exceeding this magnitude, exceedance flow should be routed towards the proposed swales and detention basins. However, if the basins are overtopped, exceedance flows would likely discharge onto the low lying ground in the north and east of the site and into the watercourses at these locations, away from the area of the proposed development, as per the existing situation.

6.0 CONCLUSIONS & RECOMMENDATIONS

6.1 CONCLUSIONS

- 6.1.1 The proposed development comprises the construction of two poultry shed buildings, ancillary buildings and associated access.
- 6.1.2 According to the SEPA Flood Risk Maps, the site is wholly located outside of any risk extents for tidal and coastal, and fluvial flooding. The site is considered to be at low to negligible risk of flooding from all sources.
- 6.1.3 The proposed development is considered to meet the requirements of the NPF 4 on sequential development.
- 6.1.4 The proposed development will result in an overall impermeable area of 1.556 ha.
- 6.1.5 It is proposed to restrict runoff generated by each poultry shed to the existing QBAR runoff rate of 6.5 l/s during all events up to and including the 1 in 200 year plus 38% climate change scenario.
- 6.1.6 The attenuation requirement of each catchment is 520 – 724 m³ respectively.
- 6.1.7 Attenuation will be provided in the form of a 551 m³ detention basin for each of the catchments and source control calculations show that this volume is sufficient to accommodate the 1 in 200 year + 38% climate change rainfall event
- 6.1.8 Water stored in the basins is proposed to discharge via a hydrobrake or similar flow control device to nearby watercourses in the north and east of the site, subject to agreement with.
- 6.1.9 Surface water will be conveyed to each of the basins by a swale.
- 6.1.10 DGC have confirmed no objection to the proposed surface water drainage arrangement. Detailed drainage design will be required at the detailed design stage.

6.2 RECOMMENDATIONS

- 6.2.1 It is recommended that infiltration testing in accordance with BRE365 Digest guidance is carried out to confirm infiltration at the site is unsuitable at the detailed design stage.