Residential Development
Skirden Lodge
Wigglesworth Road
Slaidburn
Lancashire
BD23 4SX

Drainage Strategy Report

Rev	Date	Purpose/Status	Document Ref.	QA
A	18.11.2025	For approval	First issue	EPC/RAC
B				
C				
D				
E				

Disclaimer

This report is for the use of the Client only and is not for the use of any other parties without the express permission of the Client. All calculations and related quantified assumptions are indicative for planning purposes only and are based solely on the available design proposals and must be reassessed during detailed design with the appropriate compliance methodology.

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Executive Summary

RCD Consultants Ltd has been appointed to design the surface water and foul water drainage aspects of the proposed development at the Skirden Lodge, Wigglesworth Road, Slaidburn, Lancashie, BD23 4SX

The site is Brownfield with an existing dwelling with a roof area of 140m^2 and a permeable access track.

The report outlines the strategy for the surface water and foul water drainage for the proposed development with reference to the NPPF (National Planning Policy Framework), Ciria 753 (The SUDS Manual) and the Lancashire County Council website for Sustainable Drainage System Guidance.

The proposed development includes the construction of the conversion of an existing holiday cottage into a family dwelling.

The British Geological Society website indicates that the site is underlain by superficial deposits of Till over bedrock of the Pendleside Sandstone Member.

Test pits for soakage testing did not drain as would be expected within the Till superficial deposits.

Surface water from the roof will discharge to the stream approximately 140m southeast of the development. The flow rate will be restricted and attenuation will be provided using a combination of a cellular storage tank and porous paving.

FEH 2022 rainfall data has been used and climate change allowance of 50% and 40% have been used for the 1 in 100 year and 1 in 30 year storm events respectively.

Foul drainage will discharge to a Biodisk sewerage treatment plant and treated effluent will discharge to the stream.

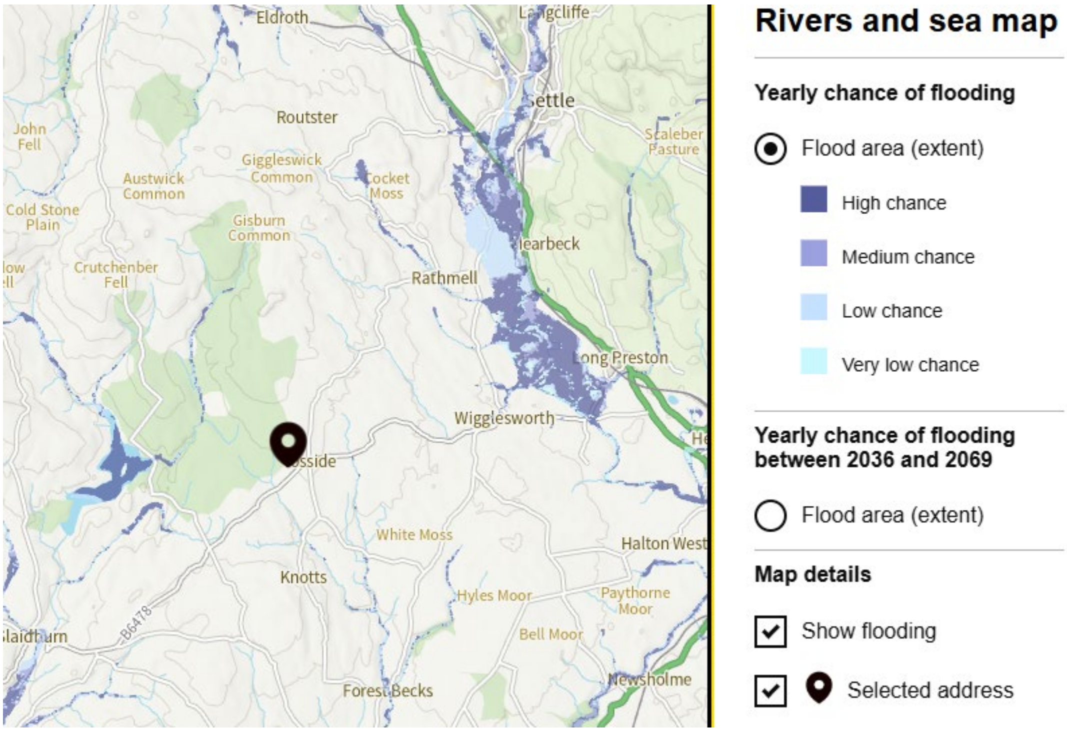
The Flood Warning Information Services website confirms that the site is in flood zone 1 and that there is no risk of surface water flooding.

The Magic website confirms that the groundwater vulnerability is medium to low, the superficial deposit aquifer is secondary undifferentiated and the bedrock aquifer is secondary undifferentiated.

1.0 Flooding

1.1 Pluvial and Fluvial Flooding

The Flood Warning Information Services website confirms that the site is in flood zone 1 and that there is no risk of surface water flooding.



2.0 Existing Drainage

The site is Brownfield with an existing dwelling with a roof area of 140m^2 and a permeable access track.

A copy of the existing site layout and location plan are shown in Appendix A.

The British Geological Society website indicates that the site is underlain by superficial deposits of Till over bedrock of the Pendleside Sandstone Member.

Test pits for soakage testing did not drain as would be expected within the Till superficial deposits.

The existing rainwater pipes discharge directly onto the ground.

The existing foul drainage discharges to a cess pit.

The nearest watercourse is a stream approximately 140m southeast from the development.

HR Wallingford Greenfield surface water calculations are shown in Appendix B.

Pre-development surface water calculations are shown in Appendix B.

3.0 Proposed Drainage Strategy

The proposed development includes the construction of the conversion of an existing holiday cottage into a family dwelling.

Surface water from the roof will discharge to the stream approximately 140m southeast of the development. The flow rate will be restricted and attenuation will be provided using a combination of a cellular storage tank and porous paving.

FEH 2022 rainfall data has been used and climate change allowance of 50% and 40% have been used for the 1 in 100 year and 1 in 30 year storm events respectively.

Foul drainage will discharge to a Biodisk sewerage treatment plant and treated effluent will discharge to the stream.

The Drainage Layout is shown in Appendix C.

3.1 Surface Water Drainage

In accordance with Ciria 753, SUDS Manual, flooding is permitted above ground during the 1 in 100 year storm event + climate change allowance but all flood water is to be contained within the site boundaries. No flooding is permitted during the 1 in 30 year storm event.

The calculations confirm that no flooding occurs during the worst-case 1 in 100 year storm event with a 50% climate change allowance. The half drain time during the 1 in 100 year storm event with 50% climate change allowance is less than 24 hours.

3.1.1 Surface water flows and volumes

3.1.2 Existing and proposed site run-off flows

A summary of the existing and proposed peak flows are detailed in Table 1 below and include the 50% climate change allowances for the worst case 1 in 100 year storm event.

Return Period	Greenfield rate l/s	Pre-Development Rate l/s	Post-Development rate l/s
1 in 2 year	0.3	2.1	1.0
1 in 30 years (+40%CC)	0.6	4.6	(1.2)
1 in 100 years (+50% CC)	0.7	5.6	(1.3)

Table 1: Summary of Existing and Proposed Surface Water Flows

The pre-development surface water flow calculations are shown in Appendix B and the post-development calculations are shown in Appendix D.

3.1.3 Existing and proposed site run-off volumes

A summary of the existing and proposed peak volumes are detailed in Table 2 below and include the 40% climate change allowances for the worst case 1 in 100 year storm event. The volumes are based upon a pond design with zero outflow during the 360 minute storm event.

Return Period	Pre-Development m^3	Post-Development m^3
1 in 2 year	0.9	3.0
1 in 30 years (+40%CC)	2.0	7.0
1 in 100 years (+50% CC)	2.5	9.4

Table 2: Summary of Existing and Proposed Surface Water Volumes

The pre-development surface water critical volume calculations are shown in Appendix B and the post-development surface water critical volume calculations are shown in Appendix D.

3.1.4 Standards

The performance of the surface water drainage system will be designed to BS EN 752 Parts 3 and 4, and the most current issue of Part H of the Building Regulations.

In accordance with the Local Water Authority guidance a flood exceedance plan shown in Appendix D indicates the routes water will take in the unlikely event of SUDS failure.

The materials specification for the scheme will be in accordance with the Highways Agency Specification for Highway Works. For the purposes of the indicative design, the following material types have been assumed:

- Drainage pipes up to 300mm diameter – Vitrified clayware, plastic pipes will be permitted subject to ground conditions.
- Manholes and chambers - Precast concrete with concrete surround or PPIC
- Chamber covers – Class D400 infill type in hard paved areas.
- Pipe bedding - Imported granular material.
- Pipe Trench backfill - Selected as dug or imported material.
- Manholes should be located at every change of alignment or gradient; at the head of all sewers; at every junction of a public sewer.

The drainage shall be designed utilizing the following criteria:

- Minimum flow velocity 1.0m/s for self-cleansing
- Standard pipe roughness “Ks” of 0.6.

3.2 Foul Water Drainage

3.2.1 Proposed Infrastructure

Foul drainage will discharge to a Biodisk sewerage treatment plant and treated effluent will discharge to the stream.

Average water flows will be 0.05l/s in accordance with sewers for adoption.

3.2.2 Standards

The performance of the foul drainage system has been designed to BS EN 752 Parts 3 and 4, and the most current issue of Part H of the Building Regulations. The main criteria used are as follows.

- Drainage pipes up to 100mm diameter – Vitrified clayware, plastic pipes will be permitted subject to ground conditions.
- Manholes and chambers - Precast concrete with concrete surround or PPIC
- Chamber covers – Class D400 infill type in higher quality paved areas.
- Class D400 standard type in all other road / parking areas
- Class C250 standard type in all footpath areas
- Pipe bedding - Imported granular
- Pipe Trench backfill - Selected as dug or imported material
- Manholes should be located at every change of alignment or gradient; at the head of all sewers; at every junction of a public sewer

The drainage shall be designed utilizing the following criteria:

- Minimum flow velocity 0.75m/s for self-cleansing
- Standard pipe roughness “Ks” of 1.5.

4.0 Attenuation

It is proposed that Sustainable Urban Drainage Systems (SUDS) will be the primary consideration for surface water management. There are several different methods that may be used to provide sufficient attenuation of the surface water described in Section 5 below.

Attenuation should be positioned as close to the outfall as possible and would control the surface water discharge from the site. Implementation of one or all of the SUDS methods outlined in Section 5 of this report is highly recommended to reduce the requirement for below ground storage.

Surface water from the roof will discharge to the stream approximately 140m southeast of the development. The flow rate will be restricted and attenuation will be provided using a combination of a cellular storage tank and porous paving.

5.0 Sustainable Urban Drainage Systems (SUDS)

The objective of SUDS is to minimise the impacts of the development on the quantity and quality of site runoff and maximise amenity and biodiversity opportunities. Surface water SUDS will be designed and installed in accordance with NPPF and associated technical guidance March 2012 and associated CIRIA documents.

The mix of SUDS to be used is determined by the conditions on site, in this case a development with areas of external space which can be utilised for SUDS. The methodology of surface water control is to slow the entry of the surface water into the system by using flow control devices, in this instance an orifice plate will limit the flow of water into the stream.

5.1 Infiltration Devices

Infiltration devices drain water directly into the ground. Infiltration trenches and soakaways are more practicable for urban sites with limited space available. Infiltration devices can be integrated into and form part of the landscaped areas.

Infiltration trenches are completely below ground, and water should not occur on the surface.

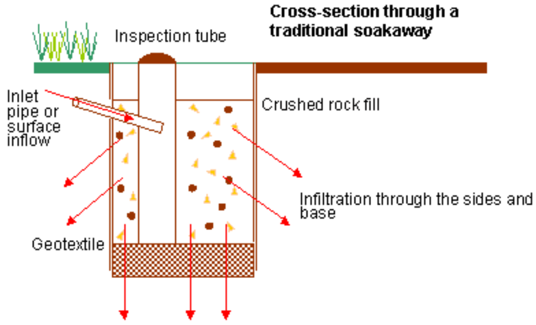


Figure 1 – Typical cross section through infiltration trench

Advantages – Reduces the volume of runoff, effective at pollutant removal, contributes to ground water recharge, simple and cost effective.

Disadvantages – Potentially high failure rates, comprehensive ground investigations required, offset from foundations (min. 5m away), risk of ground water pollution, reduced performance during prolonged wet periods.

Suitable for use – No, soakage test pits did not drain as would be expected in superficial deposits of Till.

5.2 Brown/Green Roofs

Green roofs comprise a multi-layered system that covers the roof of a building or podium structure with vegetation cover/landscaping over a drainage layer. They are designed to intercept and retain precipitation, increasing the time of concentration and reducing the volume of runoff and attenuation peak flows. Green roofs can be anything from a thin growing layer of sedums and mosses to plants, shrubs and large trees.

These roofs vary in specification and can be designed to attract bird and invertebrate species. Referring to CIRIA document C644, green and brown roofs also participate in attenuating rainwater. This would reduce the requirement for below ground storage attenuation on the site.

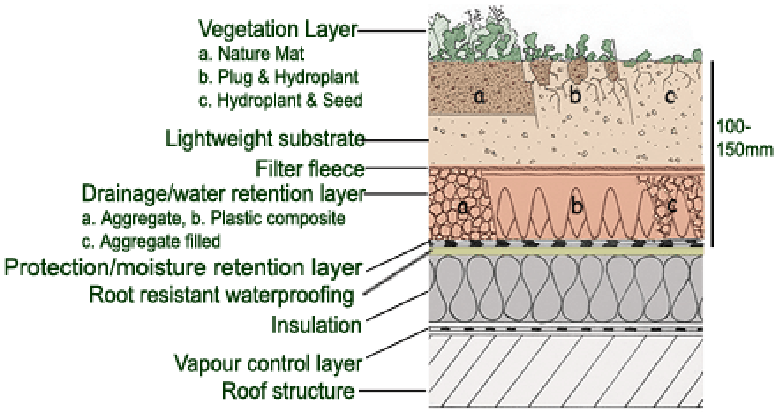


Figure 2 – Typical section through green roof build up

Advantages – Mimic greenfield state of building footprint, good removal of pollutants, ecological and amenity benefits, improve air quality, insulates building.

Disadvantages – Costs, increased structural loading, roof height, design, maintenance and exposure may preclude use.

Suitable for use – **No**, the types of property proposed have pitched roofs that are not suitable to support Green Roofs.

5.3 Rainwater Harvesting

These tanks act as mini-storage chambers for surface water, reducing the extent of underground storage required. They provide a source of water for plant irrigation, washing machines and for flushing toilets.

Harvested rainwater is stored below ground and pumped to provide a substitute for potable mains water reducing both the site discharge and water consumption.

Figure 4 – Rainwater Harvesting

Advantages – Provided source control of storm water runoff, reduces demand on mains water.

Disadvantages – Costs, Risk to public health, use dependant on demand requirements and seasonal rainfall characteristics, maintenance of pumps & control systems.

Suitable for use – No, there will be insufficient demand for this small development..

5.4 Porous Paving

Porous pavement is an alternative to conventional paving in which water permeates through the paved structure rather than draining off it. The surface water will be held in a reservoir structure (high void content sub-base) under the pavement for subsequent delayed discharge or infiltration into the sub-strata below.

The porous paving can be materials such as gravel, grasscrete, porous (no fines) concrete, concrete blocks or porous asphalt. Pollutant removal rates have been shown to be high, as the majority of the removal occurs as a result of the filtration of the water through the aggregate sub-base.

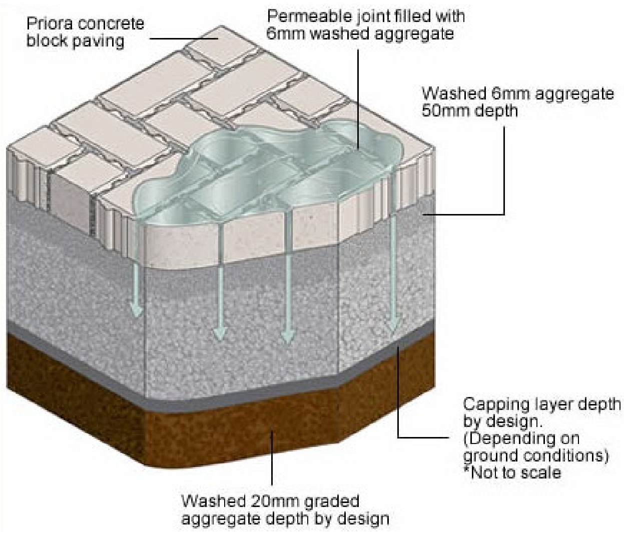


Figure 3 – Typical section through porous paving

Advantages – Effective in removing pollutants, lined systems can be used to avoid infiltration, reduces volume and rate of surface water runoff, suitable for high density developments. Mimics existing Greenfield conditions by filtering into the surrounding soft landscaped areas.

Disadvantages – Costs, used for low traffic volumes, low axel loads and speeds, risk of long-term clogging due to poor maintenance.

Suitable for use – Yes, porous paving is proposed for the parking spaces.

5.5 Below Ground Attenuation

Attenuation involves the storing of surface water within pipework or underground tanks prior to controlled discharge into the public system. Attenuation tanks can also provide offline storage.

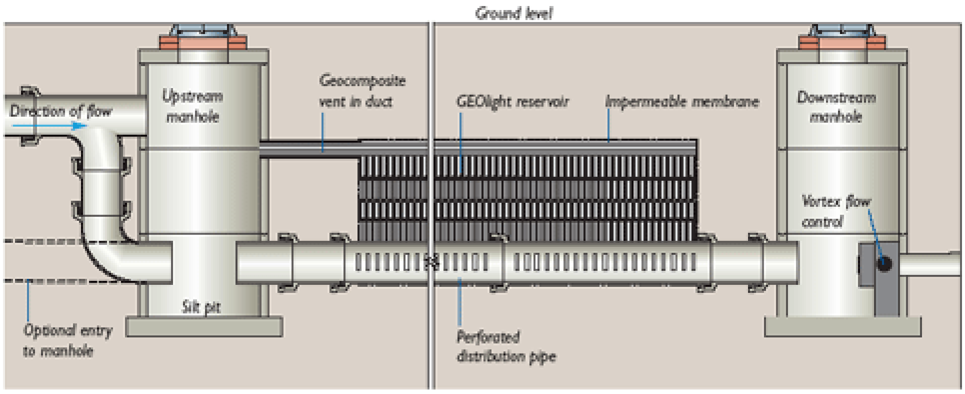


Figure 5 – Typical section through below ground attenuation chamber (cellular storage)

Advantages – Effective storage of surface water, can be used below trafficked areas, can be used below public open areas, minimum maintenance.

Disadvantages – No water quality treatment.

Suitable for use – Yes, a cellular storage tank is proposed.

5.6 Wetlands

Wetlands provide both stormwater attenuation and treatment. They comprise shallow ponds and marshy areas, covered in aquatic vegetation. Wetlands provide settlement of sediment and remove contaminants.

Advantages – Effective storage of surface water, good pollutant removal, ecological and amenity benefits.

Disadvantages – Requires large surface area. Health & Safety issues associated with large bodies of water.

Suitable for use – **No,** there is no space available.

5.7 Swales

Swales are vegetated drainage structures up to 500mm deep and used to provide flow control through attenuation. They can be used for infiltration, where possible.

Advantages – Can be incorporated into landscaping, good removal of contaminants, reduces discharge rates. Low costs.

Disadvantages – Requires large surface area. Limits the extent of trees used in landscaping. Health & Safety issues are associated with large bodies of water following heavy rainfall.

Suitable for use – **No,** there is no space available.

5.8 Ponds/Rain gardens

Ponds or rain gardens are irregular shaped vegetated drainage structures used to provide flow control through attenuation. They can be used for infiltration, where possible.

Advantages – Can be incorporated into landscaping, good removal of contaminants, reduces discharge rates. Low costs.

Disadvantages – Requires large surface area. Limits the extent of trees used in landscaping. Health & Safety issues are associated with large bodies of water following heavy rainfall.

Suitable for use – **No,** there is no space available.

6.0 Proposed SUDS solution

It is advised that a combination of Sustainable Drainage Systems (SUDS) is used to increase the time of concentration of the water before it from the development.

In this instance surface water from the roofs and porous paved parking spaces will discharge to the stream. The discharge rate will be restricted using an orifice plate and attenuation will be provided using a combination of a cellular storage tank and porous paving.

7.0 Management and Maintenance of SUDS

The owners will be responsible for completion of all maintenance and remedial works to the proposed SUDS components.

Refer to the SUDS operation and maintenance schedule in Appendix F.

8.0 Contamination mitigation

The British Geological Society website indicates that the site is underlain by superficial deposits of Till over bedrock of the Pendleside Sandstone Member.

The Magic website confirms that the groundwater vulnerability is medium to low, the superficial deposit aquifer is secondary undifferentiated and the bedrock aquifer is secondary undifferentiated.

Ciria 753 Chapter 26 Mitigation indices:

Pre-development pollution indices:

The former use of the site was a residential dwelling with a very low hazard in Table 26.2 of Ciria 753;

Roofs: Total Solids = 0.2, Metals = 0.2 and Hydrocarbons = 0.05

The mitigation index is therefore MI = 0.2 + 0.5x0.2 + 0.5x0.05 = 0.325

Post-development

Residential use is identified in Table 26.2 as very low pollution hazard level;

Roofs: Total Solids = 0.7, Metals = 0.6 and Hydrocarbons = 0.7

Roofs: Total Solids = 0.2, Metals = 0.2 and Hydrocarbons = 0.05

The mitigation index is therefore MI = 0.2 + 0.5x0.2 + 0.5x0.05 = 0.325

The pre-development and post-development mitigation indices are the same.

The porous paving will provide additional mitigation by removing contaminants before water reaches the stream.

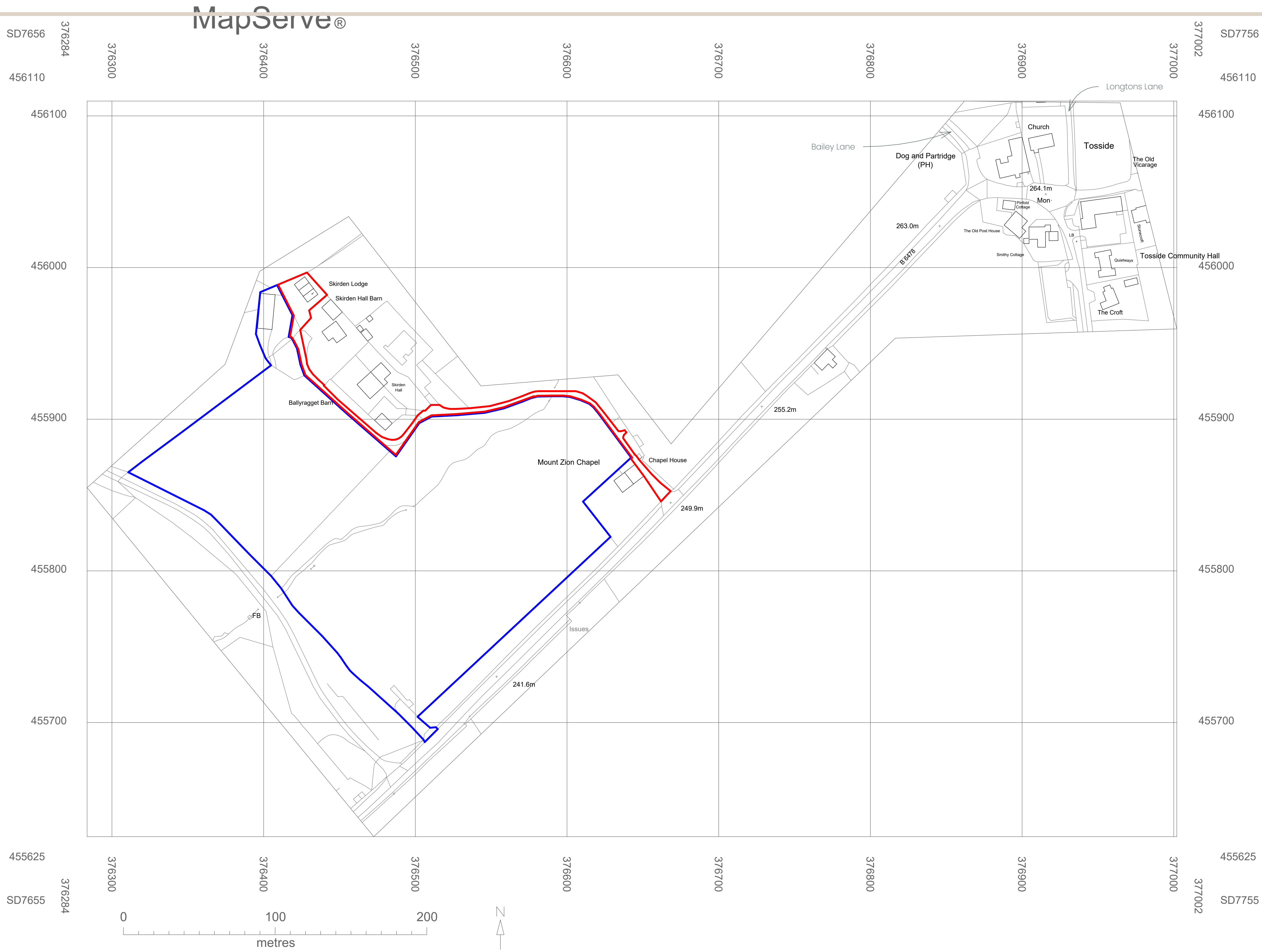
Table 26.5 Risk matrix

Element Number	Description	Risk Score	Weighting Factor	Score
1	Pollution Hazard Traffic Density	1	15	15
2	Average annual rainfall	3	15	45
3	Type of SUDS	2	15	30
4	Unsaturated zone depth	1	20	20
5	Flow through sub-soils	1	20	20
6	Unsaturated zone material	1	10	10
7	Soil organic matter	1	5	5
8	Unsaturated zone ph	1	5	5
Total				**150**

Based upon the above table the risk to groundwater is low as the total value is less than 180.

Appendix A

Existing site layout and location plan



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project no. HA1069

LAND AT SKIRDEN HALL BARN, TOSSIDE, BD23 4SX

client: MR & MRS WADDINGTON

rev.	remark	date
1	Amended red line	28/01/25

document date: 28/01/2025

document stage: PLANNING

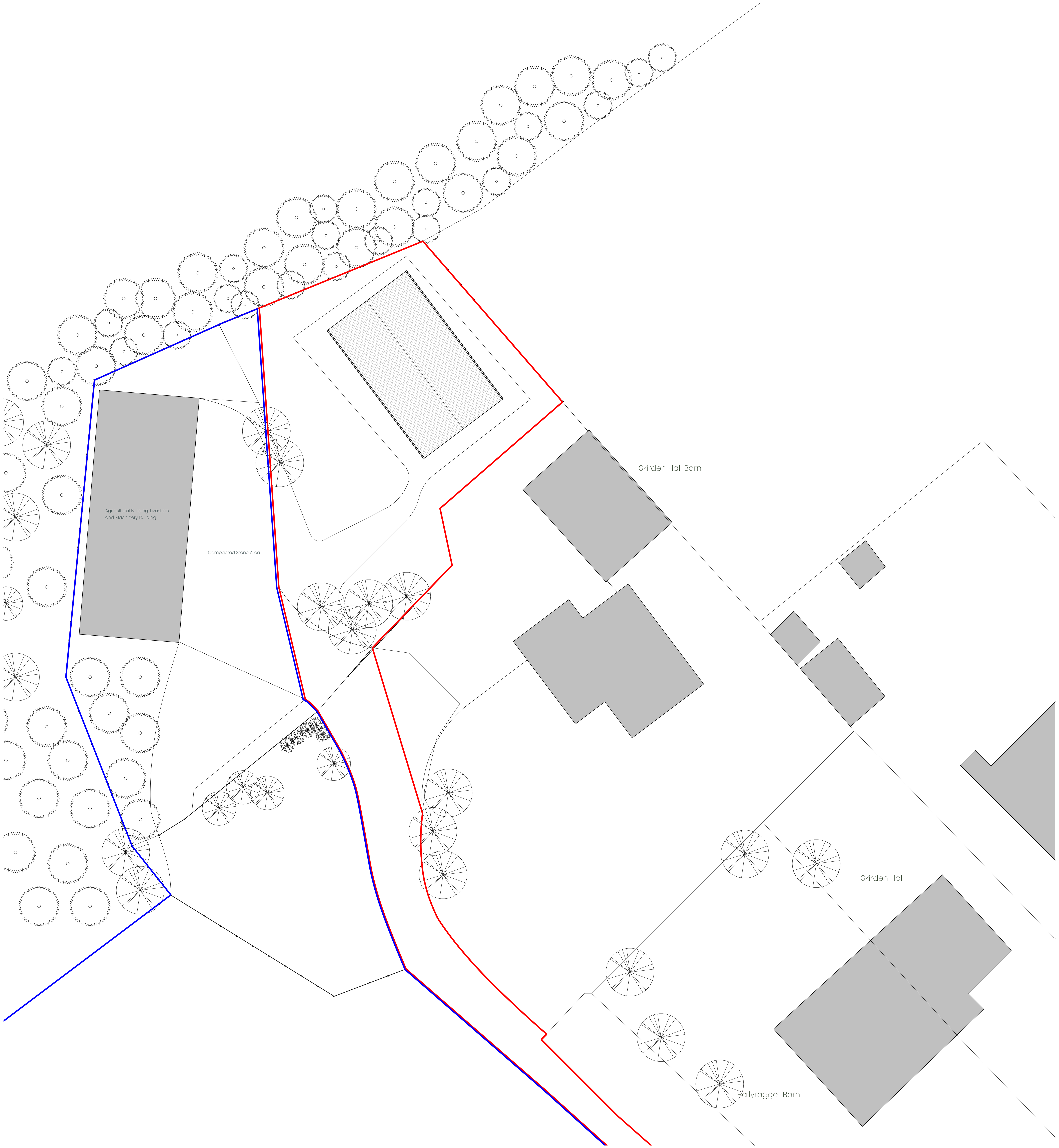
drawn by: RH

checked by: RH

sheet name: Location Plan

A0.0 Rev1

sheet size A3



1 Existing Site Plan
1 : 200

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revisions:

rev.	remark	date
1	Amended red line	28/01/25

notes:

The contractor shall be responsible for the design and specification of all temporary works necessary for the execution of the permanent works shown on the drawings.

The contractor shall be responsible for the design and specification of any temporary works necessary to maintain the stability of existing structures (both on and off site) unless noted otherwise.

All work and materials should comply with recent and up to date Health and Safety Legislation.

All works to be executed in accordance with the general requirements of BS 8000 with respect to workmanship and tolerances.

Refer to Structural Engineers drawings for full structural information.

Tanking and waterproofing (where required) to be to specialists design and detail. Specialist to provide insurance backed warranty for all works.

All dimensions are in mm unless stated otherwise.

Do not scale off these drawings, if in doubt, ask.

Where proprietary products are specified, if the component is sourced from an alternative manufacturer the contractor is responsible for ensuring the replacement is the equal and equivalent of the specified item.

For works in the vicinity of a party wall (including its foundation) or floor, the advice of a competent Party Wall Surveyor should be sought at the earliest opportunity to assess the specific requirements of the Party Wall Act in relation to the works.

All dimensions are in millimeters unlesswhere explicitly shown otherwise.

Any discrepancies or unforeseen obstructions are to be reported to the Designer.

The designer is in no way liable for work undertaken prior to full Planning Consent and/or Building Regulations Approval.

! CDM caution

document date:
28/01/2025

document stage:
PLANNING

drawn by: RH
checked by: RH

sheet name:
Existing Site Plan

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A1.0 Rev1

sheet size A1

Appendix B

Greenfield calculations

Pre-development surface water calculations

Greenfield runoff rate estimation tool

hr wallingford
www.uksuds.com | Greenfield runoff rate estimation tool (https://www.uksuds.com/)

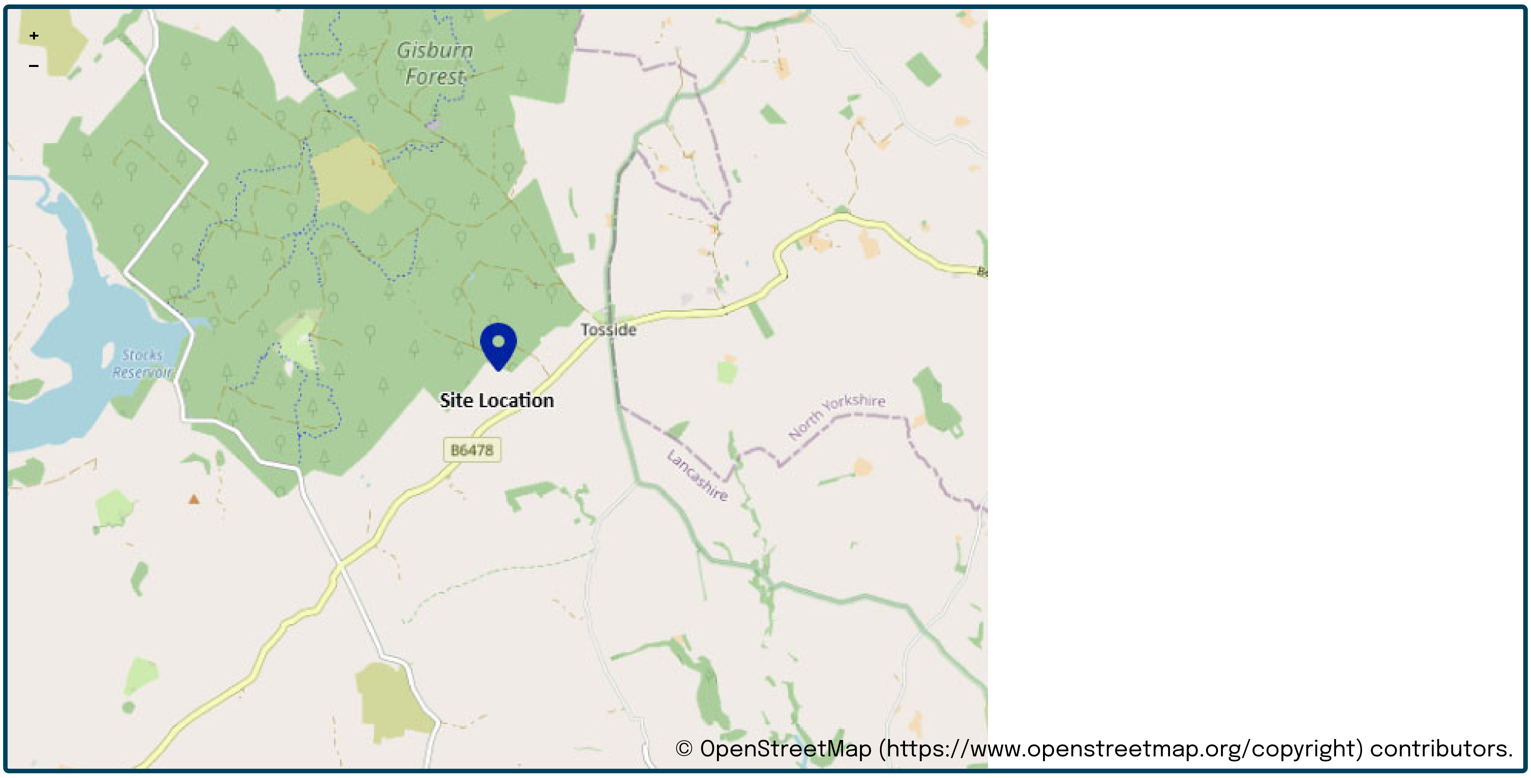
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Project details

Date	18/11/2025
Calculated by	RAY CLARK
Reference	1165-2501
Model version	2.2.2

Location

Site name	SKIRDEN LODGE
Site location	SLAIDBURN



Site easting (British National Grid)	376071
Site northing (British National Grid)	455556

Site details

Total site area (ha)	0.018 ha

Greenfield runoff

Method

Method	FEH statistical (2025)

FEH statistical (2025)

	My value	Map value
SAAR9120 (mm)	1495 mm	
BFIHOST19scaled	0.296	
QMed-QBar conversion	1.075	1.075
QMed (l/s)	0.3 l/s	
QBar (FEH statistical 2025) (l/s)	0.3 l/s	

Growth curve factors

	My value	Map value
Hydrological region	10	10
1 year growth factor	0.87	
2 year growth factor	0.93	
10 year growth factor	1.38	
30 year growth factor	1.7	
100 year growth factor	2.08	
200 year growth factor	2.37	

Results

Method	FEH statistical (2025)
Flow rate 1 year (l/s)	0.3 l/s
Flow rate 2 year (l/s)	0.3 l/s
Flow rate 10 years (l/s)	0.5 l/s
Flow rate 30 years (l/s)	0.6 l/s
Flow rate 100 years (l/s)	0.7 l/s
Flow rate 200 years (l/s)	0.8 l/s

Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent 'zero' figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

Disclaimer

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	0.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
S1	0.014	5.00	249.000	450	0.600
S2	0.000	5.00	249.000	450	0.700
S3	0.000		249.000	450	0.800
DITCH	0.000		249.000	100	0.900

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	S1	S2	10.000	0.600	248.400	248.300	0.100	100.0	100	5.22	0.0
1.001	S2	S3	10.000	0.600	248.300	248.200	0.100	100.0	100	5.43	0.0
1.002	S3	DITCH	10.000	0.600	248.200	248.100	0.100	100.0	100	5.65	0.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.769	6.0	0.0	0.500	0.600	0.014	0.0	0	0.000
1.001	0.769	6.0	0.0	0.600	0.700	0.014	0.0	0	0.000
1.002	0.769	6.0	0.0	0.700	0.800	0.014	0.0	0	0.000

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	10.000	100.0	100	Circular	249.000	248.400	0.500	249.000	248.300	0.600
1.001	10.000	100.0	100	Circular	249.000	248.300	0.600	249.000	248.200	0.700
1.002	10.000	100.0	100	Circular	249.000	248.200	0.700	249.000	248.100	0.800

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S1	450	Manhole	Adoptable	S2	450	Manhole	Adoptable
1.001	S2	450	Manhole	Adoptable	S3	450	Manhole	Adoptable
1.002	S3	450	Manhole	Adoptable	DITCH	100	Manhole	Adoptable

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
S1	249.000	0.600	450	○	0	1.000	248.400	100
S2	249.000	0.700	450	○	1	1.000	248.300	100
					0	1.001	248.300	100
S3	249.000	0.800	450	○	1	1.001	248.200	100
					0	1.002	248.200	100
DITCH	249.000	0.900	100	○	1	1.002	248.100	100

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	1.000	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	1.000	Drain Down Time (mins)	10080	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	0	0	0

Other (defaults)

Entry Loss (manhole)	0.250	Entry Loss (junction)	0.000	Apply Recommended Losses	x
Exit Loss (manhole)	0.250	Exit Loss (junction)	0.000	Flood Risk (m)	0.300

Approval Settings

Node Size	✓	Minimum Backdrop Height (m)	
Node Losses	✓	Maximum Backdrop Height (m)	1.500
Link Size	✓	Full Bore Velocity	✓
Minimum Diameter (mm)	150	Minimum Full Bore Velocity (m/s)	
Link Length	✓	Maximum Full Bore Velocity (m/s)	3.000
Maximum Length (m)	100.000	Proportional Velocity	✓
Coordinates	✓	Return Period (years)	
Accuracy (m)	1.000	Minimum Proportional Velocity (m/s)	0.750
Crossings	✓	Maximum Proportional Velocity (m/s)	3.000
Cover Depth	✓	Surcharged Depth	✓
Minimum Cover Depth (m)		Return Period (years)	
Maximum Cover Depth (m)	3.000	Maximum Surcharged Depth (m)	0.100
Backdrops	✓	Flooding	✓

Approval Settings

Return Period (years)	30	Discharge Volume	✓
Time to Half Empty	x	100 year 360 minute (m³)	
Discharge Rates	✓		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 15 minute summer	90.889	25.718	30 year 180 minute summer	53.873	13.863
2 year 15 minute winter	63.782	25.718	30 year 180 minute winter	35.019	13.863
2 year 30 minute summer	62.086	17.568	30 year 240 minute summer	43.995	11.626
2 year 30 minute winter	43.569	17.568	30 year 240 minute winter	29.229	11.626
2 year 60 minute summer	44.273	11.700	30 year 360 minute summer	35.076	9.026
2 year 60 minute winter	29.414	11.700	30 year 360 minute winter	22.800	9.026
2 year 120 minute summer	32.996	8.720	30 year 480 minute summer	28.428	7.513
2 year 120 minute winter	21.922	8.720	30 year 480 minute winter	18.887	7.513
2 year 180 minute summer	28.272	7.275	30 year 600 minute summer	23.771	6.502
2 year 180 minute winter	18.377	7.275	30 year 600 minute winter	16.241	6.502
2 year 240 minute summer	24.061	6.359	30 year 720 minute summer	21.529	5.770
2 year 240 minute winter	15.986	6.359	30 year 720 minute winter	14.469	5.770
2 year 360 minute summer	20.152	5.186	30 year 960 minute summer	18.101	4.767
2 year 360 minute winter	13.099	5.186	30 year 960 minute winter	11.991	4.767
2 year 480 minute summer	16.758	4.429	30 year 1440 minute summer	13.554	3.632
2 year 480 minute winter	11.134	4.429	30 year 1440 minute winter	9.109	3.632
2 year 600 minute summer	14.234	3.893	30 year 2160 minute summer	10.004	2.765
2 year 600 minute winter	9.725	3.893	30 year 2160 minute winter	6.893	2.765
2 year 720 minute summer	13.026	3.491	30 year 2880 minute summer	8.546	2.290
2 year 720 minute winter	8.755	3.491	30 year 2880 minute winter	5.743	2.290
2 year 960 minute summer	11.090	2.920	30 year 4320 minute summer	6.848	1.791
2 year 960 minute winter	7.346	2.920	30 year 4320 minute winter	4.510	1.791
2 year 1440 minute summer	8.392	2.249	30 year 5760 minute summer	5.954	1.524
2 year 1440 minute winter	5.640	2.249	30 year 5760 minute winter	3.854	1.524
2 year 2160 minute summer	6.248	1.727	30 year 7200 minute summer	5.329	1.359
2 year 2160 minute winter	4.305	1.727	30 year 7200 minute winter	3.440	1.359
2 year 2880 minute summer	5.368	1.439	30 year 8640 minute summer	4.888	1.247
2 year 2880 minute winter	3.608	1.439	30 year 8640 minute winter	3.155	1.247
2 year 4320 minute summer	4.332	1.133	30 year 10080 minute summer	4.569	1.166
2 year 4320 minute winter	2.853	1.133	30 year 10080 minute winter	2.949	1.166
2 year 5760 minute summer	3.784	0.969	100 year 15 minute summer	255.734	72.364
2 year 5760 minute winter	2.449	0.969	100 year 15 minute winter	179.462	72.364
2 year 7200 minute summer	3.403	0.868	100 year 30 minute summer	181.200	51.273
2 year 7200 minute winter	2.196	0.868	100 year 30 minute winter	127.158	51.273
2 year 8640 minute summer	3.133	0.799	100 year 60 minute summer	132.243	34.948
2 year 8640 minute winter	2.022	0.799	100 year 60 minute winter	87.859	34.948
2 year 10080 minute summer	2.938	0.749	100 year 120 minute summer	82.621	21.834
2 year 10080 minute winter	1.896	0.749	100 year 120 minute winter	54.892	21.834
30 year 15 minute summer	207.606	58.745	100 year 180 minute summer	65.357	16.819
30 year 15 minute winter	145.689	58.745	100 year 180 minute winter	42.484	16.819
30 year 30 minute summer	145.474	41.164	100 year 240 minute summer	53.047	14.019
30 year 30 minute winter	102.087	41.164	100 year 240 minute winter	35.243	14.019
30 year 60 minute summer	104.928	27.729	100 year 360 minute summer	42.033	10.817
30 year 60 minute winter	69.712	27.729	100 year 360 minute winter	27.323	10.817
30 year 120 minute summer	67.329	17.793	100 year 480 minute summer	34.000	8.985
30 year 120 minute winter	44.732	17.793	100 year 480 minute winter	22.589	8.985

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year 600 minute summer	28.430	7.776	100 year 2880 minute winter	7.010	2.796
100 year 600 minute winter	19.425	7.776	100 year 4320 minute summer	8.313	2.173
100 year 720 minute summer	25.777	6.909	100 year 4320 minute winter	5.474	2.173
100 year 720 minute winter	17.324	6.909	100 year 5760 minute summer	7.176	1.837
100 year 960 minute summer	21.760	5.730	100 year 5760 minute winter	4.644	1.837
100 year 960 minute winter	14.414	5.730	100 year 7200 minute summer	6.379	1.627
100 year 1440 minute summer	16.429	4.403	100 year 7200 minute winter	4.117	1.627
100 year 1440 minute winter	11.041	4.403	100 year 8640 minute summer	5.815	1.483
100 year 2160 minute summer	12.194	3.370	100 year 8640 minute winter	3.753	1.483
100 year 2160 minute winter	8.402	3.370	100 year 10080 minute summer	5.406	1.379
100 year 2880 minute summer	10.431	2.796	100 year 10080 minute winter	3.489	1.379

Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S1	10	248.442	0.042	2.1	0.0067	0.0000	OK
15 minute summer	S2	11	248.342	0.042	2.1	0.0066	0.0000	OK
15 minute summer	S3	11	248.242	0.042	2.1	0.0066	0.0000	OK
15 minute summer	DITCH	11	248.140	0.040	2.1	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S1	1.000	S2	2.1	0.673	0.343	0.0308	
15 minute summer	S2	1.001	S3	2.1	0.673	0.341	0.0308	
15 minute summer	S3	1.002	DITCH	2.1	0.684	0.342	0.0302	0.9

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S1	10	248.470	0.070	4.7	0.0111	0.0000	OK
15 minute summer	S2	11	248.370	0.069	4.6	0.0110	0.0000	OK
15 minute summer	S3	11	248.270	0.070	4.6	0.0111	0.0000	OK
15 minute summer	DITCH	11	248.165	0.065	4.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S1	1.000	S2	4.6	0.799	0.769	0.0581	
15 minute summer	S2	1.001	S3	4.6	0.799	0.764	0.0581	
15 minute summer	S3	1.002	DITCH	4.6	0.823	0.766	0.0562	2.0

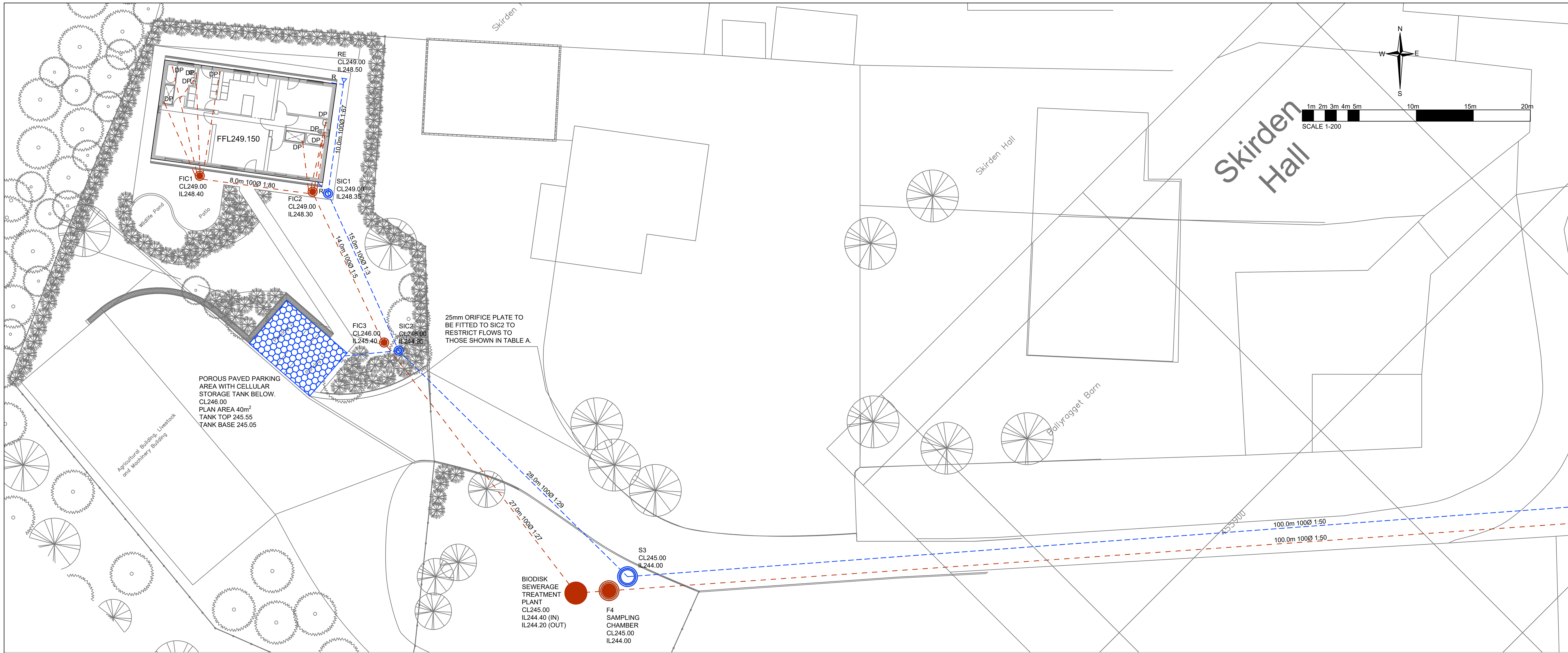
Results for 100 year Critical Storm Duration. Lowest mass balance: 100.00%

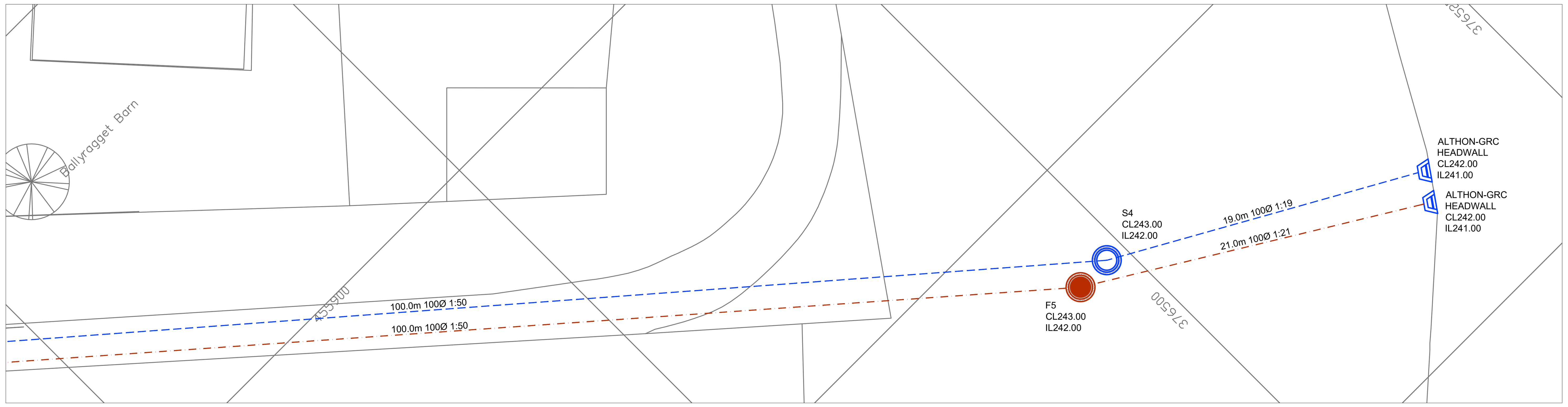
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S1	10	248.485	0.085	5.8	0.0135	0.0000	OK
15 minute summer	S2	11	248.385	0.085	5.7	0.0135	0.0000	OK
15 minute summer	S3	11	248.283	0.083	5.7	0.0133	0.0000	OK
15 minute summer	DITCH	11	248.177	0.076	5.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S1	1.000	S2	5.7	0.824	0.945	0.0705	
15 minute summer	S2	1.001	S3	5.7	0.820	0.943	0.0702	
15 minute summer	S3	1.002	DITCH	5.6	0.844	0.935	0.0670	2.5

Appendix C

Drainage Layout



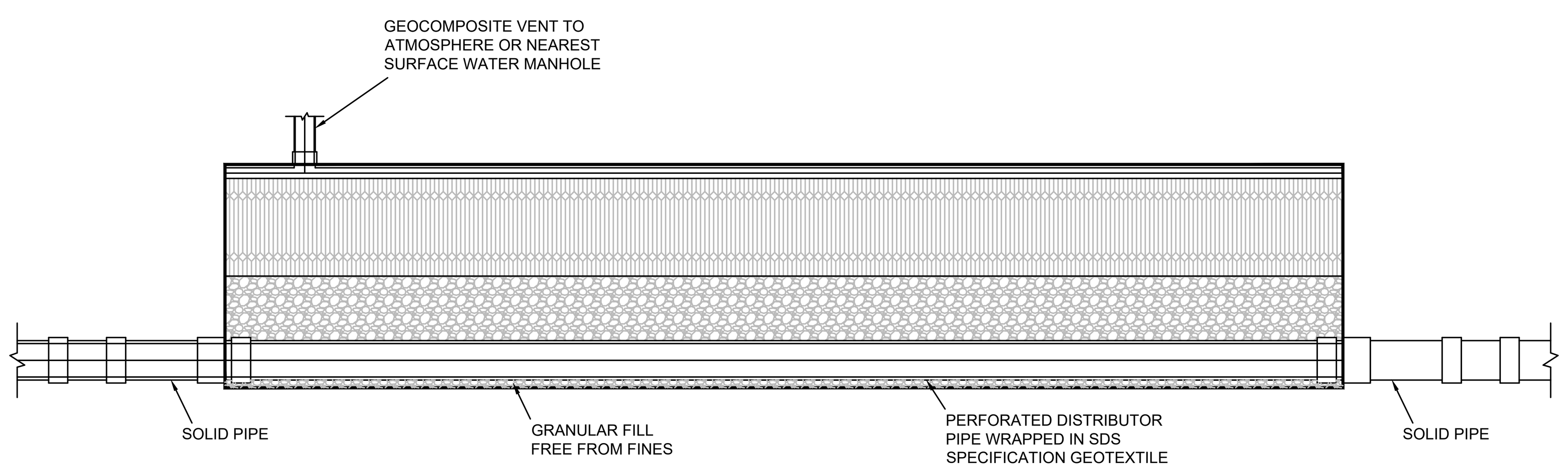


DRAWING LEGEND

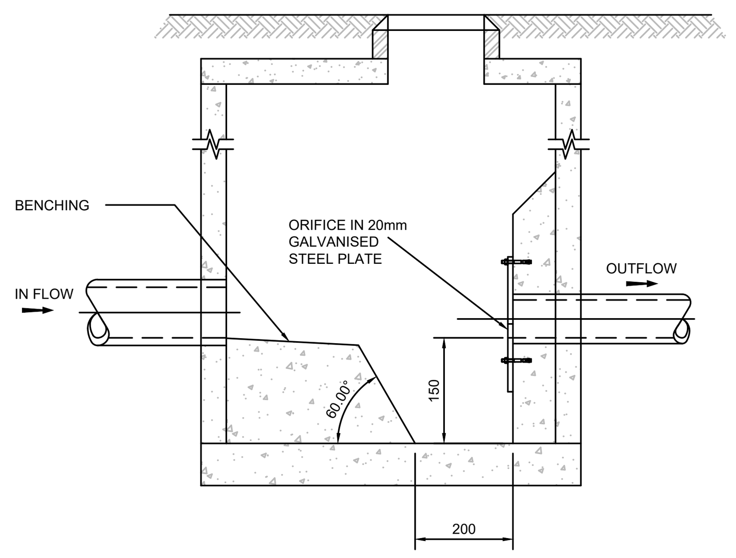
SURFACE WATER DRAINAGE	
SIC	INSPECTION CHAMBER
	SURFACE WATER SEWER
R	RAINWATER PIPE
RE	RODDING EYE
DT	708x708x150 PERMAVOID DISTRIBUTION TANK
	450mm THICK POROUS PAVING CONSTRUCTION
FOUL WATER DRAINAGE	
FIC	INSPECTION CHAMBER
	FOUL WATER SEWER
DP	DRAINAGE POINT

TABLE A

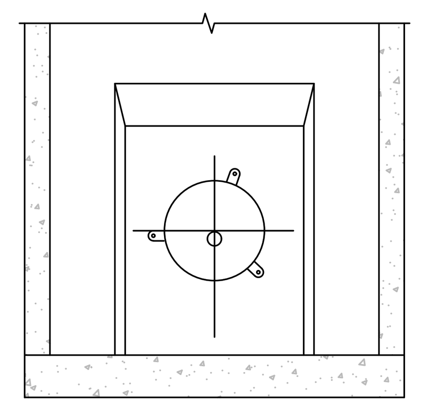
STORM EVENT (1 IN)	GREENFIELD FLOW RATE l/s	PRE-DEVELOPMENT FLOW RATE l/s	POST-DEVELOPMENT FLOW RATE l/s
2	0.3	2.1	1.0
30 (+ 40%CC)	0.6	4.6	(1.2)
100 (+ 50%CC)	0.7	5.6	(1.3)



TYPICAL CELLULAR STORAGE TANK DETAIL
(NTS)



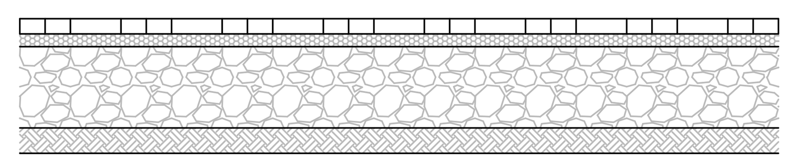
SECTION A-A



SECTION B-B

ORIFICE PLATE MANHOLE
(NTS)

CBR SUBGRADE %	3%
60mm POROUS PAVING BLOCKS	60
LAYING COURSE 6mm WASHED (mm)	50
MARSHALLS MT120 FILTRATION MEMBRANE	-
OPEN GRADED CRUSHED ROCK OGCR (mm) 20mm AGGREGATE	440
MARSHALLS MT120 FILTRATION MEMBRANE	-
TOTAL CONSTRUCTION DEPTH (mm)	550



POROUS PAVED DRIVE DETAIL
SCALE 1:25

NOTES

CONTRACTORS MUST VERIFY ALL DIMENSIONS ON SITE BEFORE COMMENCING ANY WORK ON SHOP DRAWINGS

DO NOT SCALE FROM THIS DRAWING

NOTES

1. ALL DIMENSIONS IN MILLIMETERS UNLESS NOTED OTHERWISE.
2. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER ENGINEERING DRAWINGS AND CALCULATIONS ASSOCIATED WITH THIS PROJECT.
3. ALL COMPONENTS AND MATERIALS ARE TO BE MANUFACTURED AND SUPPLIED IN ACCORDANCE WITH THE RELEVANT BRITISH STANDARDS, AND LAID AND BACKFILLED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS AND THE RELEVANT BRITISH STANDARDS.
4. THE CONTRACTOR SHALL, BEFORE COMMENCING THE WORKS, VERIFY ALL SITE AND SETTING OUT DIMENSIONS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE TRUE AND PROPER SETTING OUT OF THE WORKS AND FOR THE CORRECTNESS OF THE POSITION, LEVELS, DIMENSIONS, AND ALIGNMENT OF ALL PARTS OF THE WORKS.
5. ALL BUILDING DRAINAGE TO BE INSTALLED AND TESTED IN COMPLIANCE WITH THE BUILDING REGULATIONS 2000 DRAINAGE AND WASTE DISPOSAL APPROVED DOCUMENT H 2002 EDITION.
6. SMALL LIGHTWEIGHT ACCESS COVERS SHOULD BE SECURED (FOR EXAMPLE WITH SCREWS) TO DETER UNAUTHORISED ACCESS.
7. ALL ABOVE GROUND DRAINAGE TO INCORPORATE RODDING ACCESS FACILITIES.
8. INSITU CONCRETE FOR USE IN GENERAL DRAINAGE WORKS, GRADE TO BS: 5328.
9. FOR INTERNAL DRAINAGE POSITIONS REFER TO ARCHITECT'S CURRENT WORKING DRAWINGS.
10. FOR LANDSCAPING SURFACE MATERIAL FINISHES REFER TO ARCHITECT'S CURRENT WORKING DRAWINGS.
11. ALL PIPES TO BE 100mm DIAMETER UNLESS NOTED OTHERWISE.

REV	AMENDMENT	DATE	CHKD
P1	PRELIMINARY ISSUE	18.11.2025	RAC

DRAWING STATUS
PRELIMINARY

RCD

RCD CONSULTANTS LTD
EMAIL: ray@rcd-consultants.com

CLIENT

PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
SKIRDEN LODGE, WIGGLESWORTH ROAD
SLAIDBURN, BD23 4SX

DRAWING TITLE
DRAINAGE LAYOUT

CIVILS

SCALE	DRAWN BY	CHECKED	DATE
1:200 @ A1 1:400 @ A3	EPC	RAC	NOV 2025

DRAWING NUMBER	REVISION
1165-2501-CIV-10	P1

Appendix D

Post Development surface water calculations

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	0.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
SIC1	0.014	5.00	249.000	450	0.650
SIC2	0.004	5.00	246.000	450	1.050
S3	0.000		245.000	1200	1.000
S4	0.000		243.000	1200	1.000
DITCH	0.000		242.000	100	1.000

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	SIC1	SIC2	15.000	0.600	248.350	244.950	3.400	4.4	100	5.07	0.0
1.001	SIC2	S3	28.000	0.600	244.950	244.000	0.950	29.5	100	5.39	0.0
1.002	S3	S4	100.000	0.600	244.000	242.000	2.000	50.0	100	6.92	0.0
1.003	S4	DITCH	19.000	0.600	242.000	241.000	1.000	19.0	100	7.10	0.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	3.707	29.1	0.0	0.550	0.950	0.014	0.0	0	0.000
1.001	1.426	11.2	0.0	0.950	0.900	0.018	0.0	0	0.000
1.002	1.092	8.6	0.0	0.900	0.900	0.018	0.0	0	0.000
1.003	1.780	14.0	0.0	0.900	0.900	0.018	0.0	0	0.000

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	15.000	4.4	100	Circular	249.000	248.350	0.550	246.000	244.950	0.950
1.001	28.000	29.5	100	Circular	246.000	244.950	0.950	245.000	244.000	0.900
1.002	100.000	50.0	100	Circular	245.000	244.000	0.900	243.000	242.000	0.900
1.003	19.000	19.0	100	Circular	243.000	242.000	0.900	242.000	241.000	0.900

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	SIC1	450	Manhole	Adoptable	SIC2	450	Manhole	Adoptable
1.001	SIC2	450	Manhole	Adoptable	S3	1200	Manhole	Adoptable
1.002	S3	1200	Manhole	Adoptable	S4	1200	Manhole	Adoptable
1.003	S4	1200	Manhole	Adoptable	DITCH	100	Manhole	Adoptable

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SIC1	249.000	0.650	450	0	1.000	248.350	100
SIC2	246.000	1.050	450	1	1.000	244.950	100
				0	1.001	244.950	100
S3	245.000	1.000	1200	1	1.001	244.000	100
				0	1.002	244.000	100
S4	243.000	1.000	1200	1	1.002	242.000	100
				0	1.003	242.000	100
DITCH	242.000	1.000	100	1	1.003	241.000	100

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	1.000	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	1.000	Drain Down Time (mins)	10080	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	40	0	0
100	50	0	0

Node SIC2 Online Orifice Control

Flap Valve	x	Invert Level (m)	244.950	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.025		

Node SIC2 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	245.550	Slope (1:X)	1000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	71	Depth (m)	
Safety Factor	2.0	Width (m)	5.000	Inf Depth (m)	
Porosity	0.30	Length (m)	8.000		

Node SIC2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	244.050
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	40.0	0.0	0.500	40.0	0.0	0.501	0.0	0.0

Other (defaults)

Entry Loss (manhole)	0.250	Entry Loss (junction)	0.000	Apply Recommended Losses	x
Exit Loss (manhole)	0.250	Exit Loss (junction)	0.000	Flood Risk (m)	0.300

Approval Settings

Node Size	✓	Minimum Full Bore Velocity (m/s)	
Node Losses	✓	Maximum Full Bore Velocity (m/s)	3.000
Link Size	✓	Proportional Velocity	✓
Minimum Diameter (mm)	150	Return Period (years)	
Link Length	✓	Minimum Proportional Velocity (m/s)	0.750
Maximum Length (m)	100.000	Maximum Proportional Velocity (m/s)	3.000
Coordinates	✓	Surcharged Depth	✓
Accuracy (m)	1.000	Return Period (years)	
Crossings	✓	Maximum Surcharged Depth (m)	0.100
Cover Depth	✓	Flooding	✓
Minimum Cover Depth (m)		Return Period (years)	30
Maximum Cover Depth (m)	3.000	Time to Half Empty	x
Backdrops	✓	Discharge Rates	✓
Minimum Backdrop Height (m)		Discharge Volume	✓
Maximum Backdrop Height (m)	1.500	100 year 360 minute (m³)	
Full Bore Velocity	✓		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 15 minute summer	90.889	25.718
2 year 15 minute winter	63.782	25.718
2 year 30 minute summer	62.086	17.568
2 year 30 minute winter	43.569	17.568
2 year 60 minute summer	44.273	11.700
2 year 60 minute winter	29.414	11.700
2 year 120 minute summer	32.996	8.720
2 year 120 minute winter	21.922	8.720
2 year 180 minute summer	28.272	7.275
2 year 180 minute winter	18.377	7.275
2 year 240 minute summer	24.061	6.359
2 year 240 minute winter	15.986	6.359
2 year 360 minute summer	20.152	5.186
2 year 360 minute winter	13.099	5.186
2 year 480 minute summer	16.758	4.429
2 year 480 minute winter	11.134	4.429
2 year 600 minute summer	14.234	3.893
2 year 600 minute winter	9.725	3.893
2 year 720 minute summer	13.026	3.491
2 year 720 minute winter	8.755	3.491
2 year 960 minute summer	11.090	2.920
2 year 960 minute winter	7.346	2.920
2 year 1440 minute summer	8.392	2.249
2 year 1440 minute winter	5.640	2.249

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 2160 minute summer	6.248	1.727
2 year 2160 minute winter	4.305	1.727
2 year 2880 minute summer	5.368	1.439
2 year 2880 minute winter	3.608	1.439
2 year 4320 minute summer	4.332	1.133
2 year 4320 minute winter	2.853	1.133
2 year 5760 minute summer	3.784	0.969
2 year 5760 minute winter	2.449	0.969
2 year 7200 minute summer	3.403	0.868
2 year 7200 minute winter	2.196	0.868
2 year 8640 minute summer	3.133	0.799
2 year 8640 minute winter	2.022	0.799
2 year 10080 minute summer	2.938	0.749
2 year 10080 minute winter	1.896	0.749
30 year +40% CC 15 minute summer	290.649	82.244
30 year +40% CC 15 minute winter	203.964	82.244
30 year +40% CC 30 minute summer	203.663	57.630
30 year +40% CC 30 minute winter	142.922	57.630
30 year +40% CC 60 minute summer	146.899	38.821
30 year +40% CC 60 minute winter	97.596	38.821
30 year +40% CC 120 minute summer	94.260	24.910
30 year +40% CC 120 minute winter	62.624	24.910
30 year +40% CC 180 minute summer	75.422	19.409
30 year +40% CC 180 minute winter	49.026	19.409
30 year +40% CC 240 minute summer	61.593	16.277
30 year +40% CC 240 minute winter	40.921	16.277
30 year +40% CC 360 minute summer	49.106	12.637
30 year +40% CC 360 minute winter	31.920	12.637
30 year +40% CC 480 minute summer	39.800	10.518
30 year +40% CC 480 minute winter	26.442	10.518
30 year +40% CC 600 minute summer	33.279	9.102
30 year +40% CC 600 minute winter	22.738	9.102
30 year +40% CC 720 minute summer	30.141	8.078
30 year +40% CC 720 minute winter	20.257	8.078
30 year +40% CC 960 minute summer	25.342	6.673
30 year +40% CC 960 minute winter	16.787	6.673
30 year +40% CC 1440 minute summer	18.975	5.085
30 year +40% CC 1440 minute winter	12.752	5.085
30 year +40% CC 2160 minute summer	14.005	3.870
30 year +40% CC 2160 minute winter	9.650	3.870
30 year +40% CC 2880 minute summer	11.964	3.206
30 year +40% CC 2880 minute winter	8.041	3.206
30 year +40% CC 4320 minute summer	9.588	2.507
30 year +40% CC 4320 minute winter	6.314	2.507
30 year +40% CC 5760 minute summer	8.336	2.134
30 year +40% CC 5760 minute winter	5.396	2.134
30 year +40% CC 7200 minute summer	7.461	1.903
30 year +40% CC 7200 minute winter	4.815	1.903
30 year +40% CC 8640 minute summer	6.843	1.746
30 year +40% CC 8640 minute winter	4.417	1.746
30 year +40% CC 10080 minute summer	6.397	1.632
30 year +40% CC 10080 minute winter	4.129	1.632

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +50% CC 15 minute summer	383.601	108.546
100 year +50% CC 15 minute winter	269.194	108.546
100 year +50% CC 30 minute summer	271.801	76.910
100 year +50% CC 30 minute winter	190.737	76.910
100 year +50% CC 60 minute summer	198.364	52.422
100 year +50% CC 60 minute winter	131.788	52.422
100 year +50% CC 120 minute summer	123.932	32.752
100 year +50% CC 120 minute winter	82.337	32.752
100 year +50% CC 180 minute summer	98.035	25.228
100 year +50% CC 180 minute winter	63.725	25.228
100 year +50% CC 240 minute summer	79.570	21.028
100 year +50% CC 240 minute winter	52.864	21.028
100 year +50% CC 360 minute summer	63.050	16.225
100 year +50% CC 360 minute winter	40.984	16.225
100 year +50% CC 480 minute summer	51.000	13.478
100 year +50% CC 480 minute winter	33.883	13.478
100 year +50% CC 600 minute summer	42.646	11.665
100 year +50% CC 600 minute winter	29.138	11.665
100 year +50% CC 720 minute summer	38.666	10.363
100 year +50% CC 720 minute winter	25.986	10.363
100 year +50% CC 960 minute summer	32.640	8.595
100 year +50% CC 960 minute winter	21.621	8.595
100 year +50% CC 1440 minute summer	24.643	6.605
100 year +50% CC 1440 minute winter	16.562	6.605
100 year +50% CC 2160 minute summer	18.292	5.055
100 year +50% CC 2160 minute winter	12.604	5.055
100 year +50% CC 2880 minute summer	15.646	4.193
100 year +50% CC 2880 minute winter	10.515	4.193
100 year +50% CC 4320 minute summer	12.469	3.260
100 year +50% CC 4320 minute winter	8.211	3.260
100 year +50% CC 5760 minute summer	10.763	2.755
100 year +50% CC 5760 minute winter	6.967	2.755
100 year +50% CC 7200 minute summer	9.568	2.441
100 year +50% CC 7200 minute winter	6.175	2.441
100 year +50% CC 8640 minute summer	8.722	2.225
100 year +50% CC 8640 minute winter	5.629	2.225
100 year +50% CC 10080 minute summer	8.109	2.069
100 year +50% CC 10080 minute winter	5.234	2.069

Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SIC1	10	248.368	0.018	2.1	0.0029	0.0000	OK
120 minute summer	SIC2	72	245.500	0.550	1.6	0.0875	0.0000	SURCHARGED
120 minute summer	S3	72	244.024	0.024	1.0	0.0268	0.0000	OK
120 minute summer	S4	74	242.018	0.018	1.0	0.0203	0.0000	OK
120 minute summer	DITCH	74	241.018	0.018	1.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SIC1	1.000	SIC2	2.1	0.754	0.072	0.0659	
120 minute summer	SIC2	Orifice	S3	1.0				
120 minute summer	S3	1.002	S4	1.0	0.813	0.112	0.1182	
120 minute summer	S4	1.003	DITCH	1.0	1.011	0.068	0.0180	3.0

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SIC1	10	248.382	0.032	6.6	0.0051	0.0000	OK
60 minute summer	SIC2	46	245.813	0.862	6.6	3.2396	0.0000	FLOOD RISK
60 minute summer	S3	47	244.027	0.027	1.2	0.0301	0.0000	OK
60 minute summer	S4	48	242.020	0.020	1.2	0.0227	0.0000	OK
60 minute summer	DITCH	48	241.020	0.020	1.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SIC1	1.000	SIC2	6.6	1.105	0.226	0.0751	
60 minute summer	SIC2	Orifice	S3	1.2				
60 minute summer	S3	1.002	S4	1.2	0.868	0.140	0.1393	
60 minute summer	S4	1.003	DITCH	1.2	1.082	0.086	0.0211	7.0

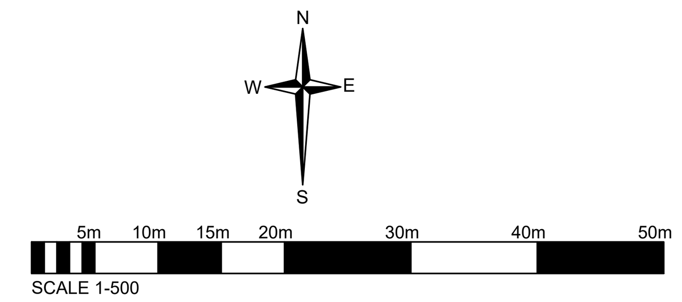
Results for 100 year +50% CC Critical Storm Duration. Lowest mass balance: 100.00%

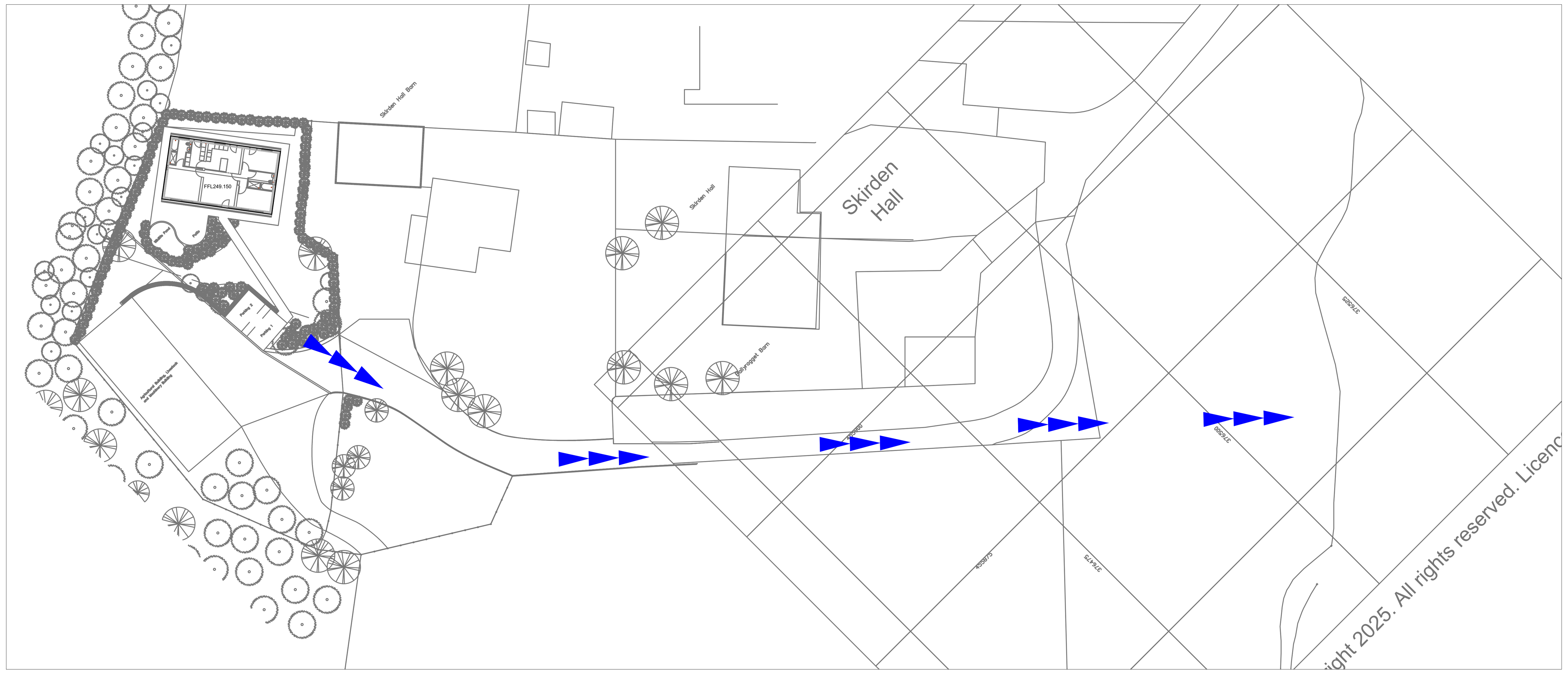
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SIC1	10	248.388	0.038	8.8	0.0060	0.0000	OK
60 minute summer	SIC2	49	245.966	1.016	8.9	5.1066	0.0000	FLOOD RISK
60 minute summer	S3	50	244.028	0.028	1.3	0.0314	0.0000	OK
60 minute summer	S4	51	242.021	0.021	1.3	0.0237	0.0000	OK
60 minute summer	DITCH	51	241.021	0.021	1.3	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SIC1	1.000	SIC2	8.8	1.417	0.301	0.0789	
60 minute summer	SIC2	Orifice	S3	1.3				
60 minute summer	S3	1.002	S4	1.3	0.889	0.152	0.1478	
60 minute summer	S4	1.003	DITCH	1.3	1.108	0.094	0.0224	9.4

Appendix E

Flood exceedance plan





NOTES

CONTRACTORS MUST VERIFY ALL DIMENSIONS ON SITE BEFORE COMMENCING ANY WORK ON SHOP DRAWINGS

DO NOT SCALE FROM THIS DRAWING

EXISTING AND PROPOSED FLOOD EXCEEDANCE ROUTE

REV	AMENDMENT	DATE	CHKD
P1	PRELIMINARY ISSUE	18.11.2025	RAC

DRAWING STATUS

PRELIMINARY

RCD

RCD CONSULTANTS LTD
EMAIL: ray@rcd-consultants.com

CLIENT

PROJECT

PROPOSED RESIDENTIAL DEVELOPMENT
SKIRDEN LODGE, WIGGLESWORTH ROAD
SLAIDBURN, BD23 4SX

DRAWING TITLE

FLOOD EXCEEDANCE PLAN

CIVILS

SCALE	DRAWN BY	CHECKED	DATE
1:500 @ A1 1:1000 @ A3	EPC	RAC	NOV 2025

DRAWING NUMBER	REVISION
1165-2501-CIV-11	P1

Appendix F

Operation and maintenance schedule

Operation and Maintenance Schedule - Porous paving		
Maintenance Schedule	**Required action**	**Typical frequency**
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduce frequency as required, based upon site-specific observations of clogging or manufacturer's recommendations - pay particular attention to areas where water runs onto pervious surface from adjacent impermeabl areas as this area is most likely to collect the most sediment.
Occassional Maintenance	Stabilise and mow contributing and adjacent areas.	As required.
	Removal of weeds or management using gylphosphate applied directly into the weeds by an applicator rather than spraying.	As required - once per year on less frequently used pavements.
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip has occurred.	As required.
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material.	As required.
	Rehabilitation of surface and upper substructure by remedial sweeping.	Every 10-15 years or as required (if infiltration performance is reduced due to significant clogging).
Monitoring	Initial inspection.	Monthly for three months after installation.
	Inspect for evidence of poor operation and/or weed growth - if required, take remdial action.	Three monthly, 48 hours after large storms in first six months.
	Inspect silt accumulation rates and establish appropriate brushing frequencies.	Annually.

Operation and Maintenance Schedule - Cellular Storage Tank		
Maintenance Schedule	**Required action**	**Typical frequency**
Regular maintenance	Clean all gutters and downpipes.	Annually.
	Check for sediment build-up or debris in the upstream chambers and the pipe running through the cellular storage tank. Remove all debris and sediment.	Annually.
Occassional Maintenance	Clean all gutters and downpipes. Check for sediment build-up or debris in the upstream chambers and the pipe running through the cellular storage tank. Remove all debris and sediment.	As required based upon inspections.
Remedial Actions	Reconstruct cellular storage tank and/or replace or clean void fill, if performace deteriorates or failure occurs.	As required based upon inspections.
	Replacement of damaged geotextile (will require reconstruction of cellular storage tank).	As required based upon inspections.
Monitoring	Inspect catch pits and note rate of sediment accumulation.	Monthly in first year and then annually, increase frequency of regular mantenancence if heavy siltation occurs more frequently.
	Check cellular storage tank to ensure emptying is occurring.	Annually.

Operation and Maintenance Schedule - Flow Control Chamber		
Maintenance Schedule	**Required action**	**Typical frequency**
Regular maintenance	Clean all gutters and downpipes.	Annually
	Inspect for sediment and debris in the chamber and remove.	Six monthly.
	Clean the orifice plate and hole.	As recommended by manufacturer
Remedial Actions	Replace malfunctioning parts or structures	As required.
Monitoring	Inspect for evidence of poor operation.	Six monthly.
	Inspect orifice plate and esablish appropriate replacement frequencies	Six monthly.
	Inspect sediment accumulation rates and establish appropriate removal frequencies.	Monthly during first half year of operation, then every six months