Report Title	# Drainage Report
Property Address	Proposed Industrial Units Joe McBain Ave Moresby Parks Whitehaven CA28 8EA
Client	Metalwork Solutions Ltd
Our Reference	23-186r001
Date	April 2023
Prepared by	Colin Aimers BEng Hons CEng MICE CEnv **Kingoor Consulting Ltd** Suite 4, Atlantic House Parkhouse Business Park Carlisle CA3 0LJ

Contents

Introduction

The purpose of this report is to provide support for a planning application associated with the proposed development on land adjacent at Joe McBain Ave, Moresby Parks, Whitehaven, CA28 8EA. Research has been undertaken on the site and observations made regarding the existing site and the drainage servicing the site.

Calculations associated with the drainage have been performed by software packages from a recognised resource. Where appropriate copies of calculations are provided in the Appendices of this report.

The Site

Historic Usage

The area of the proposed development has historically been undeveloped and is part of a larger site developed in the 1990's by the North West Development Agency for industrial use. Infrastructure and some limited developments took place during the intervening years, and the site proposed for development has remained fallow with limited maintenance being undertaken on the site.

Existing Foul Network

A private sewer system is located on the site servicing the properties which discharges to the United Utilities foul drainage system located on the site boundary.

Existing Site Drainage

The site has no natural drainage and all surface water is collected and managed via a site wide surface water drainage system which leaves the site and discharges to a watercourse on the site boundary. The drainage system installed as part of the development during the 1990's has no flow controls or attenuation and the condition is to be inspected as part of this development to ensure that it is suitable for future demands on the site.

Geology

The superficial geology indicates that the site is overlain by the Diamicton Till generally consisting of clays, and silts.

The solid geology of the site is Coal Measures.

A copy of the geological mapping is appended to this report.

Drainage Strategy

Foul Drainage

Outline Strategy

It is proposed that the development shall have a connection to the adjacent foul drainage network present on the site boundary.

Detailed Design

Detailed design has been undertaken in Causeway Flow based on the anticipated arrangements for each unit. Allowances of 2500 litres per day per unit have been adopted for the site to discharge to the foul network.

Surface Water Drainage

Outline Strategy

It is proposed to discharge the surface water from the development to the existing surface water drainage present on the site boundary. This is following trial pitting undertaken on the site which indicated that the site cannot accommodate natural percolation to the superficial deposits on the site.

This follows the Hierarchy of Drainage, as stated in the National Planning Practice Guidance, the aim should be to discharge surface water run-off as high up the drainage hierarchy, as reasonably practicable:

- Into the ground (infiltration);
- To a surface water body;
- To a surface water sewer, highway drain, or another drainage system;
- To a combined sewer

At present, drainage located on the site discharges any surface water from the area of the development into the surface water system unattenuated. It would be proposed to attenuate via a

plot storage and release the surface water discharge at greenfield runoff rates to the adjacent surface water system.

The following table presents the areas and greenfield runoff rates for each plot.

Plot	Area [Square Metres]	Greenfield Runoff Rate [litres / second]
1	1953	1.82
2	974	0.93
3	1693	1.54

These have been calculated using online tools published by HR Wallingford and calculations are appended to this report.

Detailed Design

Principally the surface water drainage has been calculated on the impermeable areas of the development.

Areas of each plot are subdivided and modelled in the software to mimic realistic flows in the network. Modelling has been conducted on the following rainfall events:

- 1 in 10 years
- 1 in 30 years
- 1 in 100 years plus 40% increase due to climate change over a 6 hour period

An assessment of the proposed network has been undertaken to identify the requirements of each plot and requirements for the attenuation of water on each plot to ensure that runoff from each plot does not exceed the limits of Qbar (approx 1 in 2 year rainfall event).

The following parameters were adopted in the analysis. These were obtained from UK SUDS based on the site location and data held by HR Wallingford.

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	17.000	Drain Down Time (mins)	240
Ratio-R	0.300	Additional Storage (m³/ha)	0.0
Summer CV	0.750	Check Discharge Rate(s)	✓
Winter CV	0.840	30 year (l/s)	7.3

Simulation Settings

100 year (l/s)	9.0	100 year 360 minute (m³)	143
Check Discharge Volume	✓		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
10	0	0	0
30	0	0	0
100	40	0	0

The following rates and volumes have been calculated for the predevelopment discharge and volumes from the overall site.

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.70
Greenfield Method	IH124	Growth Factor 100 year	2.08
Positively Drained Area (ha)	0.462	Betterment (%)	0
SAAR (mm)	1230	QBar	4.3
Soil Index	4	Q 30 year (l/s)	7.3
SPR	0.47	Q 100 year (l/s)	9.0
Region	10		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)	0.462	Storm Duration (mins)	360
Soil Index	4	Betterment (%)	0
SPR	0.47	PR	0.509
CWI	125.575	Runoff Volume (m^3)	143

Engineering Elements

The detailed model presented in this report adopts the following engineering aspects specific to the site.

Attenuation

Attenuation in the form of engineered crates an attenuation pond downstream of the site shall accommodate all peak flows from the development and prevent flooding occuring within and outside the site.

The following summary is offered for each plot

Plot 1

Node 22 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	123.648	Depth (m)	1.200
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Inf Depth (m)	
Safety Factor	1.0	Pit Width (m)	5.000	Number Required	1
Porosity	0.95	Pit Length (m)	10.000		

Plot 2

Node 14 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	124.068	Depth (m)	1.200
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Inf Depth (m)	
Safety Factor	1.0	Pit Width (m)	3.000	Number Required	1
Porosity	0.95	Pit Length (m)	6.000		

Plot 3

Node 7 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	124.702	Depth (m)	1.200
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Inf Depth (m)	
Safety Factor	1.0	Pit Width (m)	4.000	Number Required	1
Porosity	0.95	Pit Length (m)	8.000		

Flow Control

Hydrobrakes are to be installed downstream of the attenuation storage on each plot and shall control flows from the site to the existing drainage network. The following summary is presented for the flow control device.

PLOT 1

Node 22 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	123.648	Product Number	CTL-SHE-0050-1500-1800-1500
Design Depth (m)	1.800	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.5	Min Node Diameter (mm)	1200

PLOT 2

Node 14 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	124.068	Product Number	CTL-SHE-0040-9000-1500-9000
Design Depth (m)	1.500	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	0.9	Min Node Diameter (mm)	1200

PLOT 3

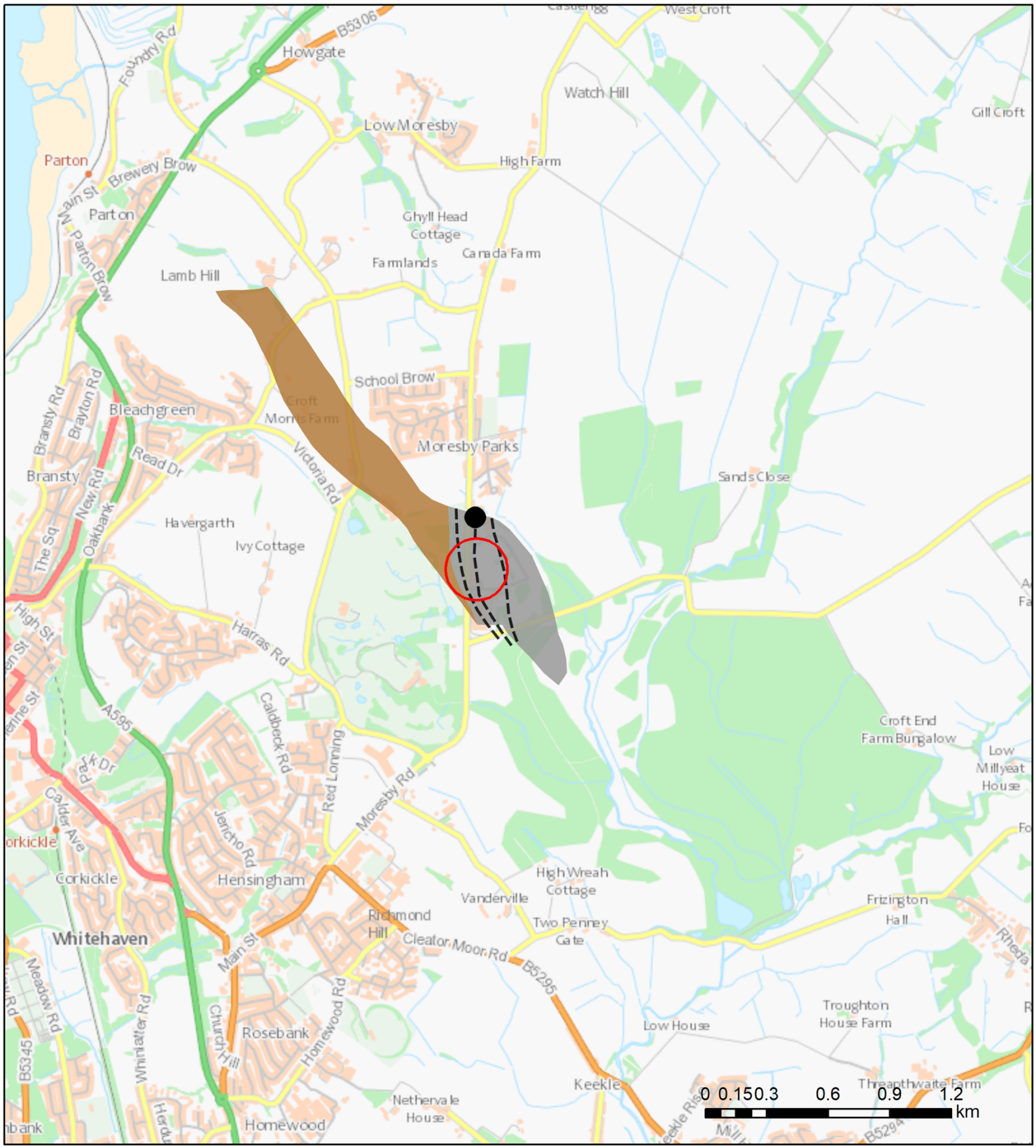
Node 7 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	124.702	Product Number	CTL-SHE-0058-1800-1500-1800
Design Depth (m)	1.500	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.8	Min Node Diameter (mm)	1200

Appendices

BGS Geological Records

Solid Geology



Map Key

Bedrock geology 1:50,000 scale

- FIRST SHALE MEMBER - SANDSTONE, SILTSTONE AND MUDSTONE
- PENNINE LOWER COAL MEASURES FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE
- FIRST LIMESTONE (CUMBRIA) - LIMESTONE
- MILLYEAT MEMBER - MUDSTONE, SANDSTONE AND LIMESTONE
- BUTTERMERE FORMATION - MUDSTONE AND SANDSTONE
- PENNINE MIDDLE COAL MEASURES FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE
- STAINMORE FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE
- ST BEES SANDSTONE MEMBER - SANDSTONE
- OREBANK SANDSTONE - SANDSTONE
- ST BEES SHALE FORMATION - SILTSTONE AND MUDSTONE, INTERBEDDED
- PENNINE LOWER COAL MEASURES FORMATION - SANDSTONE
- PENNINE MIDDLE COAL MEASURES FORMATION - SANDSTONE
- WHITEHAVEN SANDSTONE FORMATION - SANDSTONE
- ST BEES EVAPORITE FORMATION - DOLOMITIC LIMESTONE, MUDSTONE AND ANHYDRITE-STONE
- HENSINGHAM GRIT - SANDSTONE
- BROCKRAM - BRECCIA

Linear features 1:50,000 scale

- Coal_seam_Inf
- Glacial_meltwater_channel_Centre_Undiff
- Marine_band

Selection Results

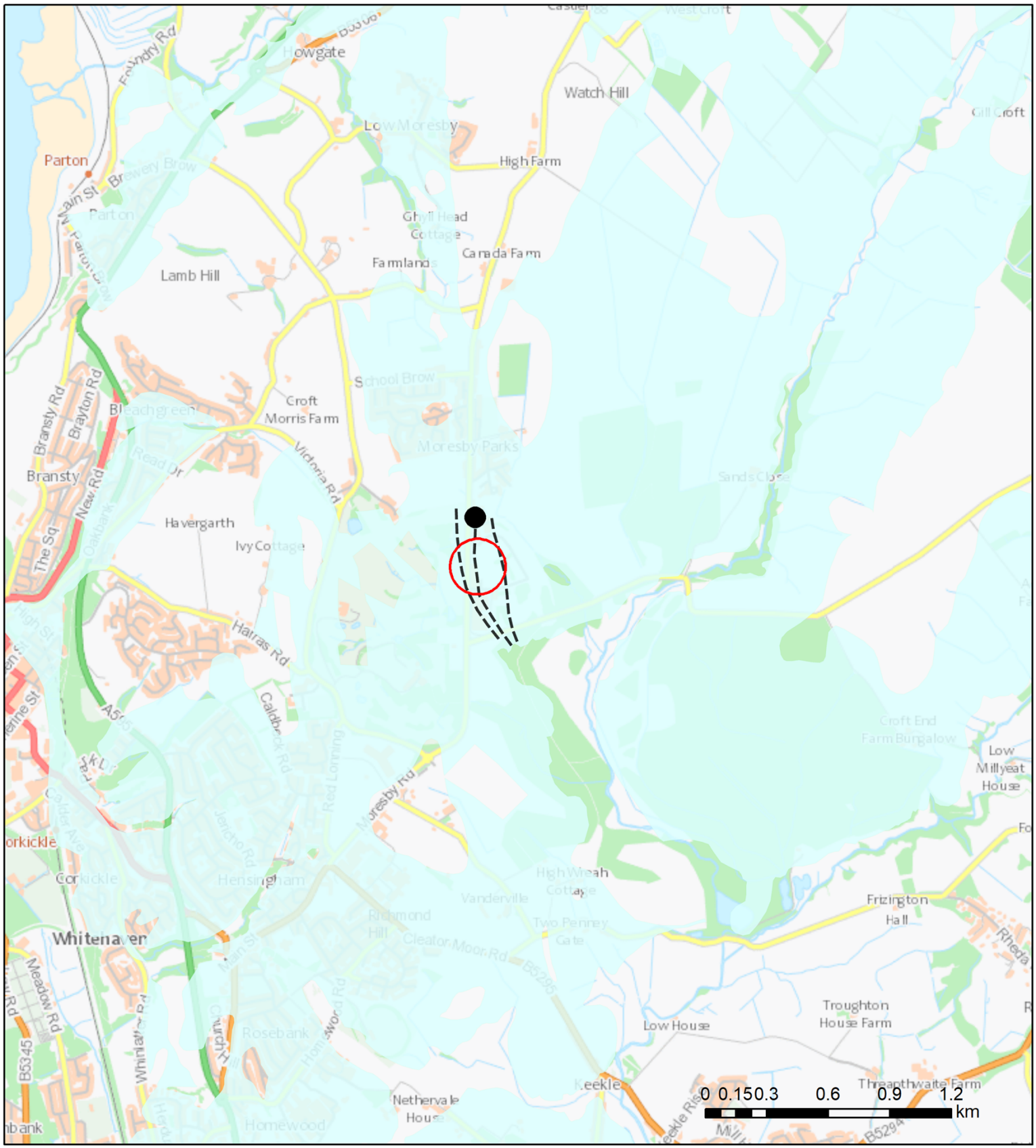
Linear features 1:50,000 scale

Feature
Coal seam, inferred
Coal seam, inferred
Coal seam, inferred

Bedrock geology 1:50,000 scale

Description	Details
PENNINE MIDDLE COAL MEASURES FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE	More Information
WHITEHAVEN SANDSTONE FORMATION - SANDSTONE	More Information

Superficial Deposits



Map Key

Superficial deposits 1:50,000 scale

- GLACIOFLUVIAL DEPOSITS, DEVENSIAN - SAND AND GRAVEL
- TILL, DEVENSIAN - DIAMICTON
- ALLUVIUM - CLAY, SILT, SAND AND GRAVEL
- RAISED MARINE DEPOSITS - CLAY AND SILT
- RIVER TERRACE DEPOSITS, 1 - CLAY, SAND AND GRAVEL
- ALLUVIAL FAN DEPOSITS - SAND AND GRAVEL
- MARINE BEACH DEPOSITS - SAND AND GRAVEL
- PEAT - PEAT
- SUPERFICIAL THEME NOT MAPPED [FOR DIGITAL MAP USE ONLY] - UNKNOWN/UNCLASSIFIED ENTRY

Linear features 1:50,000 scale

- Coal_seam_Inf
- Glacial_meltwater_channel_Centre_Undiff
- Marine_band

Selection Results

Linear features 1:50,000 scale

Feature
Coal seam, inferred
Coal seam, inferred
Coal seam, inferred

Superficial deposits 1:50,000 scale

Description	Details
TILL, DEVENSIAN - DIAMICTON	More Information

Drawings

23-186 DWG001 - SITE LAYOUT

SITE PLAN

SCALE 1:100

ENGINEER
KINGMOOR CONSULTING
SUITE 4 ATLANTIC HOUSE, PARKHOUSE
BUSINESS PARK, CARLISLE, CA3 0LJ
T: 01228 915900
E: hello@kingmoorconsulting.co.uk

CLIENT

PROJECT
INDUSTRIAL UNITS, JOE MCBAIN AVE
MORESBY PARKS, WHITEHAVEN, CA28 8EA

TITLE
FOUL AND SURFACE WATER DRAINAGE
SITE PLAN

SCALE	STATUS	
1:250	FOR PLANNING	
PAPER SIZE	DRAWN BY	CHECKED AND APPROVED
A1	S LOWES	C AIMERS
PROJECT PHASE	DATE	DATE
BUILD	APRIL 2023	APRIL 2023
DRAWING NUMBER		REVISION
23-186-DWG001		A

Calculations

- FLOW REPORT
- FLOW PLAN
- FLOW PROFILE

Print | Close Report

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Colin Aimers
Site name:	Plot 1
Site location:	Moresby Parks

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.

Site Details

Latitude:	54.55297° N
Longitude:	3.54722° W
Reference:	314397988
Date:	Apr 19 2023 19:24

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 0.1953

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics	Default	Edited
SAAR (mm):	1230	1230
Hydrological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	1.82	1.82
1 in 1 year (l/s):	1.59	1.59
1 in 30 years (l/s):	3.1	3.1
1 in 100 year (l/s):	3.79	3.79
1 in 200 years (l/s):	4.32	4.32

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Colin Aimers
Site name:	Plot 2
Site location:	Moresby Parks

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.

Site Details

Latitude:	54.55297° N
Longitude:	3.54722° W
Reference:	179141370
Date:	Apr 19 2023 19:25

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 0.1

Methodology

Q_{BAR} estimation method: Calculate from SPR and SAAR

SPR estimation method: Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics	Default	Edited
SAAR (mm):	1230	1230
Hydrological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	0.93	0.93
1 in 1 year (l/s):	0.81	0.81
1 in 30 years (l/s):	1.59	1.59
1 in 100 year (l/s):	1.94	1.94
1 in 200 years (l/s):	2.21	2.21

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Colin Aimers
Site name:	Plot 3
Site location:	Moresby Parks

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.

Site Details

Latitude:	54.55297° N
Longitude:	3.54722° W
Reference:	4036612910
Date:	Apr 19 2023 19:26

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 0.165

Methodology

Q_{BAR} estimation method: Calculate from SPR and SAAR

SPR estimation method: Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics	Default	Edited
SAAR (mm):	1230	1230
Hydrological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	1.54	1.54
1 in 1 year (l/s):	1.34	1.34
1 in 30 years (l/s):	2.62	2.62
1 in 100 year (l/s):	3.2	3.2
1 in 200 years (l/s):	3.65	3.65