

WREXHAM GLYNDWR UNIVERSITY: HEIQ PHASE 2 OUTLINE DRAINAGE STRATEGY

Curtins Ref: 080457-CUR-XX-XX-T-C-92002

Revision: P01

Issue Date: 29 September 2023

Client Name: Wrexham Glyndwr University

Client Address: Wrexham Glyndwr University
Mold Road
Wrexham
LL11 2AW

Site Address: Wrexham Glyndwr University
Mold Road
Wrexham
LL11 2AW

Rev	Description	Issued by	Checked	Date
P01	Issued for full planning application.	AMB	GW	29 September 2023

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Reviewed	Signature	Date
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1 Surface Water

An outline surface water drainage strategy has been developed by Curtins, based on Welsh standards.

1.1 Relevant Guidance and Legislation

1.1.1 Wales - Statutory standards for SuDS¹

S1 Surface water runoff destination

- Priority Level 1: Surface water runoff is collected for use;
- Priority Level 2: Surface water runoff is infiltrated to ground;
- Priority Level 3: Surface water runoff is discharged to a surface water body;
- Priority Level 4: Surface water runoff is discharged to a surface water sewer, highway drain, or another drainage system;
- Priority Level 5: Surface water runoff is discharged to a combined sewer.

S2 Surface water runoff hydraulic control

1. Surface water should be managed to prevent, so far as possible, any discharge from the site for the majority of rainfall events of less than 5mm.
2. The surface water runoff rate for the 1 in 1 year return period event (or agreed equivalent) should be controlled to help mitigate the negative impacts of the development runoff on the morphology and associated ecology of the receiving surface water bodies.
3. The surface water runoff (rate and volume) for the 1% (1 in 100 year) return period event (or agreed equivalent) should be controlled to help mitigate negative impacts of the development on flood risk in the receiving water body.
4. The surface water runoff for events up to the 1% (1 in 100 year) return period (or agreed equivalent) should be managed to protect people and property on and adjacent to the site from flooding from the drainage system.
5. The risks (both on site and off site) associated with the surface water runoff for events greater than the 1% (1 in 100 year) return period should be considered. Where the consequences are excessive in terms of social disruption, damage or risk to life,

mitigating proposals should be developed to reduce these impacts.

6. Drainage design proposals should be examined for the likelihood and consequences of any potential failure scenarios (e.g. structural failure or blockage), and the associated flood risks managed where possible.

S3 Surface water quality management

Treatment for surface water runoff should be provided to prevent negative impacts on the receiving water quality and/or protect downstream drainage systems, including sewers.

S4 - Amenity

The design of the surface water management system should maximise amenity benefits.

S5 - Biodiversity

The design of the surface water management system should maximise biodiversity benefits.

S6 – Design of drainage for Construction, Operation and Maintenance

1. All elements of the surface water drainage system should be designed so that they can be constructed easily, safely, cost-effectively, in a timely manner, and with the aim of minimising the use of scarce resources and embedded carbon (energy).
2. All elements of the surface water drainage system should be designed to ensure maintenance and operation can be undertaken (by the relevant responsible body) easily, safely, cost-effectively, in a timely manner, and with the aim of minimising the use of scarce resources and embedded carbon (energy).
3. The surface water drainage system should be designed to ensure structural integrity of all elements under anticipated loading conditions over the design life of the development site, taking into account the requirement for reasonable levels of maintenance.

¹

<https://www.gov.wales/sites/default/files/publications/2>

<019-06/statutory-national-standards-for-sustainable-drainage-systems.pdf>

1.1.2 Wales – Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities in Wales²

This defines the climate change allowances that should be used for design including the increase on peak rainfall intensities.

1.2 Surface Water Management Objectives

- Flood risk not to be increased by the development.
- Water quality to be optimised in accordance with current best practice.
- Maximise the incorporation of vegetation in the design for amenity, biodiversity, and climate resilience.
- Allow for future adoption by the SAB and have a maintenance regime which meets the requirements of S6, in the previous section.
- Aim for 100% interception of surface water, given the good infiltration potential.
- Include source control where possible.
- Maximise retention of existing trees and don't prevent their addition to the design.
- Consider the use of rainwater harvesting.

1.3 Conceptual Design

This section identifies the SuDS components and linkages in developing the management trains.

1.3.1 Site Characteristics

- Topography in the development area is mostly flat at around 87.0m AOD, but the surrounding area slopes towards Crispin Lane to the east edge of the university campus.
- Much of the site runoff is believed to discharge by soakaway, as shown by survey.
- Good infiltration strata is present from 2m below existing ground level and is recorded to 2.5m deep, which makes deeper infiltration systems viable.
- No existing surface waters have been identified as infiltration is the obvious surface water disposal method.
- The 'Check your flood risk'³ webpage confirmed the development flood risk to be very low for flooding from rivers and sea, and

medium risk from surface water and small watercourses. See Appendix 2.1.

- The site is a university campus, and the proposed building will replace an existing building wing.
- The only existing infrastructure under the proposed development is existing foul drainage serving the immediately adjacent buildings.
- Existing soils include made ground, clay, and a deep layer of sand, which should be tested for suitability for re-use in the drainage design.
- Existing trees are within the development area and should be protected where possible.

1.3.2 Development Characteristics

- Proposed topography to remain largely unchanged apart from localised gradients of paving to direct surface water.
- Adoption of the drainage is likely to be by Wrexham Glyndwr University, but Curtins note that Wales now has legislation designed to allow adoption by SuDS Approving Bodies, which should be explored.

1.3.3 SuDS Design Criteria

1.3.3.1 Water Quantity

- Control peak runoff rates from the development to for critical 1:100 year event, to the calculated Q_{BAR} greenfield rate.
- Ensure that all surface water is retained within SuDS components for events up to the critical 1:30 year event and contained within appropriate exceedance routed and storage areas up to the critical 1:100 year event, with 300mm freeboard to points of potential entry to buildings.
- Ensure that no flooding occurs in the low docks for the critical 1:100 year rainfall event. This is assumed to be a developer/tenant requirement.
- Include relevant climate change allowance for peak rainfall intensity. The development lifetime is expected to go beyond 2070 so the 2080s epoch has been used. The below snapshot shows that the central and upper

²

https://www.gov.wales/sites/default/files/publications/2022-11/guidance-for-flood-and-coastal-erosion-risk-management-authorities-in-wales_0.pdf

³ <https://check-your-flood-risk.naturalresources.wales/?culture=en-GB>

allowances are 20% and 40% respectively.
The design calculations are based on 40%.

Applies across all of Wales	Total potential change anticipated for 2020s (2015-2039)	Total potential change anticipated for 2050s (2040-2069)	Total potential change anticipated for 2080s (2070-2115)
Upper estimate	10%	20%	40%
Central estimate	5%	10%	20%

Table 1 Change to extreme rainfall intensity compared to a 1961-90 baseline

1.3.3.2 Water Quality

Provide treatment of surface water runoff to meet the requirements of water quality (as defined in C753 Section 4.3.2).

1.3.3.3 Amenity & Biodiversity

Design to include some form of green SuDS at ground level to great vegetative and natural spaces.

1.3.4 Surface water runoff destination

Collecting runoff from the proposed roof for use may be feasible.

The potential yield of the proposed roof has been calculated based on CIRIA C753⁴ Box 11.2.

$$Y_R = A e AAR \eta * 0.05 = 450 * 0.80 * 779 * 0.9 * 0.05 \\ = 12619.8 l = 12.6 m^3$$

This would be equivalent to the demand of 34 building occupants with a daily non-potable water demand of 20 l, which would cover flushing of toilets with efficient cisterns.

Further consideration of a rainwater harvesting system is recommended to be undertaken following the full planning submission. It may be found that the one of the exception criteria (listed in G1.4 of the Statutory Standards for SuDS) are filled, in which case rainwater harvesting may be excluded.

Infiltration to ground was found to be feasible in the Phase 2 Ground Investigation Report (ref: 080457-CUR-XX-XX-RP-GE-00002 Rev. P02). Three soakaway tests were undertaken at each of 2 locations close to the proposed building. Rates are tabulated below in m/s. The hole locations, trial pit logs and testing report are in the Appendix.

Position ID	Test Number	Time, T_{p75-25} (seconds)	Infiltration Rate
SA01	Test 1	128	1.19×10^{-3}
	Test 2	132	1.16×10^{-3}
	Test 3	84	1.82×10^{-3}
SA02	Test 1	37	8.99×10^{-3}
	Test 2	37	8.99×10^{-3}
	Test 3	37	8.99×10^{-3}

Table 2 Infiltration test results

Both test pits were 2.5m deep from ground level 87.09 and 87.06m. The good infiltration stratum is likely to be the Brown very gravelly fine to coarse SAND, which is located below (probably) very low permeability Firm orangish brown slightly gravelly CLAY. Therefore, it is assumed that infiltration at the

above rates is only possible at elevations from 84.59m to 85.09m at SA01 and 84.56m to 85.31m at SA02

A safety factor of 10 has been used based on Table G1.1 of the Statutory Standards for SuDS, given a drainage area between 100 and 1000m² and the

⁴ CIRIA C753 The SuDS Manual

consequences of failure being damage to buildings or major inconvenience.

The design calculations use a factored **infiltration rate of 0.4176 m/hr** for near the north-east corner of the building, based on the lowest rate measured. A 3.2364 m/hr rate would be reasonable near the south-east corner of the building, but this has not been used.

Since the surrounding site only appears to drain by soakaway, there do not appear to be any other suitable points of discharge to **surface water bodies, drains or sewers**.

1.3.5 Sub-catchments and Flow Routes

The development has two catchments. The proposed HEIQ Phase 2 building extension and the bike store. Drainage to the bike store is proposed to remain as existing as the paving is not proposed to be modified.

1.4 Outline Design

An initial hydraulic model of the drainage system was developed in Causeway Flow, which was used to determine the size of the soakaway. A calculation report is appended to this report under Surface Water Drainage Calculations.

The proposed drainage drawings are in the Appendix.

All runoff from the building extension and surrounding impermeable surfacing will be dealt with by source control. The impermeable area is 0.09 hectares.

1.3.6 SuDS for the Management Train

Surface water collection to direct flows to surface of bioretention systems, via high level pipework, rills or linear drains.

Interception to be via rainwater harvesting or infiltration to the underlying sand strata.

Storage will be provided by a below soakaway tank.

A Water Quality Assessment (see Appendix) was undertaken using the Simple Index Approach, which concluded in the following treatment for each land use type.

All areas are to be treated by bioretention systems, but as noted in the Water Quality Assessment, the low pollution indices means that many SuDS types could provide the required level of surface water treatment.

2 Appendices

2.1 Appendix A – Flood Risk Check

29/09/2023, 12:22

Check your flood risk

<https://check-your-flood-risk.naturalresources.wales>

29/09/2023 11:22

Flood risk report for the area within 10 metres of:

GLYNDWR UNIVERSITY, PLAS COCH, MOLD ROAD, WREXHAM, LL11 2AW

Very low risk

Flooding from rivers

Risk less than 0.1% chance each year

Very low risk

Flooding from the sea

Risk less than 0.1% chance each year

Medium risk

Flooding from surface water and small watercourses

Risk between 1% and 3.3% chance each year

The risk levels are: High, Medium, Low and Very low.

This area:

• Does not benefit from flood defences

• Has no recorded flooding

This risk level takes into account the effect of any flood defences that may be in this area. Flood defences reduce, but do not completely stop the chance of flooding as they can be overtopped or fail.

Please note

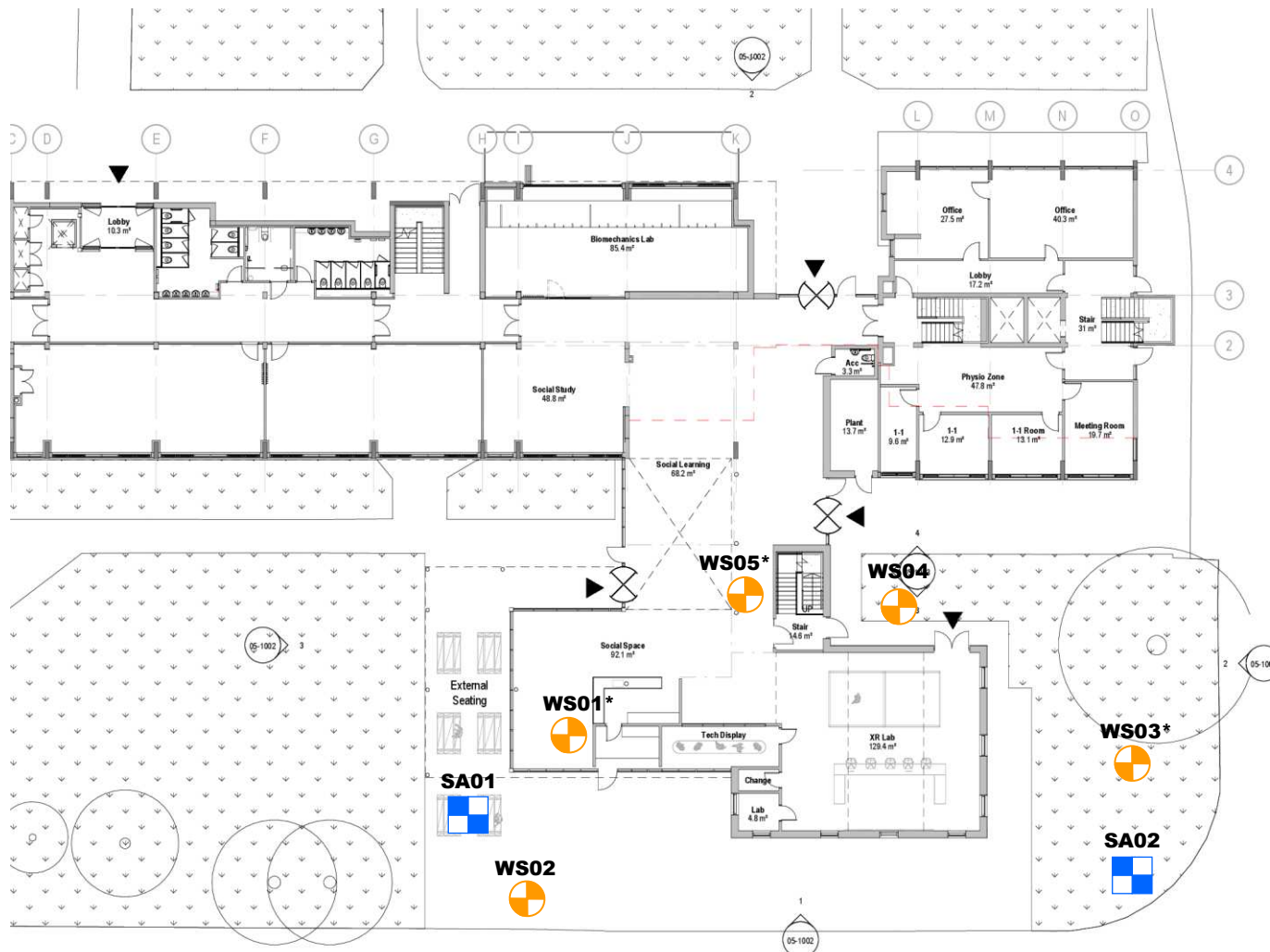
We cannot give the flood risk for individual buildings because this depends on building features and other local factors like drainage conditions.

[https://check-your-flood-risk.naturalresources.wales/home/GetRiskLevels?rnd=1695986517907&postcode=ll11 2aw&address=GLYNDWR UNIVE...](https://check-your-flood-risk.naturalresources.wales/home/GetRiskLevels?rnd=1695986517907&postcode=ll11%20aw&address=GLYNDWR%20UNIVERSITY%20PLAS%20COCH%20MOLD%20ROAD%20WREXHAM%20LL11%202AW) 1/1

080457-CUR-XX-XX-T-C-92002 Wrexham Glyndwr University: HEIQ Phase 2 Rev. P01
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5

2.2 Appendix B – Infiltration Testing



Key:



WINDOW SAMPLE BOREHOLE



SOAKAWAY TEST



DENOTES AN INSTALLED BOREHOLE

Curtins

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Civils & Structures • Transport Planning • Environmental • Infrastructure • Geotechnical • Conservation & Heritage • Principal Designer
Birmingham • Bristol • Cambridge • Cardiff • Douglas • Dublin • Edinburgh • Glasgow • Kendal • Leeds • Liverpool • London • Manchester • Nottingham

Status:

INFORMATION

Project:

WREXHAM UNIVERSITY

Drawing Title:

EXPLORATORY HOLE LOCATION PLAN

Scale:

NTS

Size:

A3

Issue:

11/09/2023

Drawn:

RBJ

Checked:

NF

Project No: Originator: Zone: Level: Type: Discipline: Category/Number: Rev:

080457-CUR-00-XX-DR-GE-80001-P03

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				Trial Pit Log			Trialpit No SA01 Sheet 1 of 1		
Project Name: Phase 2B				Project No. 080457		Co-ords: 332950.94 - 351216.45 Level: 87.09		Date 11/05/2023	
Location: Wrexham Glyndwr University				Dimensions (m): Depth 2.50		3 1.3		Scale 1:20	
Client: Wrexham Glyndwr University								Logged RBJ	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.35	86.74		TOPSOIL: Grass over topsoil of brown slightly clayey gravelly fine to coarse sand. Gravel is fine to coarse and subangular to subrounded of sandstone.		1
				0.45	86.64		MADE GROUND: Brown fine to medium SAND.		
							MADE GROUND: Brown silty slightly gravelly very clayey fine to medium sand. Gravel is fine to medium, subrounded of brick and sandstone.		
				0.90	86.19		Firm orangish brown slightly gravelly CLAY with low cobble content. Gravel is medium to coarse, subangular to subrounded of sandstone. Cobbles are subrounded of sandstone.		
				2.00	85.09		Brown very gravelly fine to coarse SAND. Gravel is fine to coarse, subrounded to rounded of sandstone, siltstone, quartz and coal.		
				2.50	84.59		End of pit at 2.50 m		2
									3
									4
Remarks: Location cleared and marked out by Safe Dig Surveys. CAT and Genny used while progressing the location. No groundwater was encountered during the excavation.									
Stability: Pit becomes unstable at 2.00m to 2.50m bgl where the sand is encountered.									





STRUCTURAL SOILS LTD
INSITU TESTING REPORT



Report No. 785414R.01(00)

Date 12-May-2023 Contract Wrexham Glyndwr University

Client Curtins Consulting Ltd
Address 51-55 TITHEBARN STREET
LIVERPOOL
L2 2SB

For the Attention of N. Farnworth

Order received	26-April-2023	Client Reference	080457
Testing Started	11-May-2023	Client Order No.	None
Testing Completed	11-May-2023	Instruction Type	Written

Tests marked 'Not UKAS Accredited' in this report are not included in the UKAS Accreditation Schedule for our Laboratory.

UKAS Accredited Tests

Not - UKAS Tests:

2no. Soakaway Tests carried out to BRE Digest 365

The results represent the ground conditions at the specified locations and depths at the time of testing.

Please Note: Remaining samples will be retained for a period of one month from today and will then be disposed of.
Test were undertaken on samples 'as received' unless otherwise stated.
Opinions and interpretations expressed in this report are outside the scope of accreditation for this laboratory.

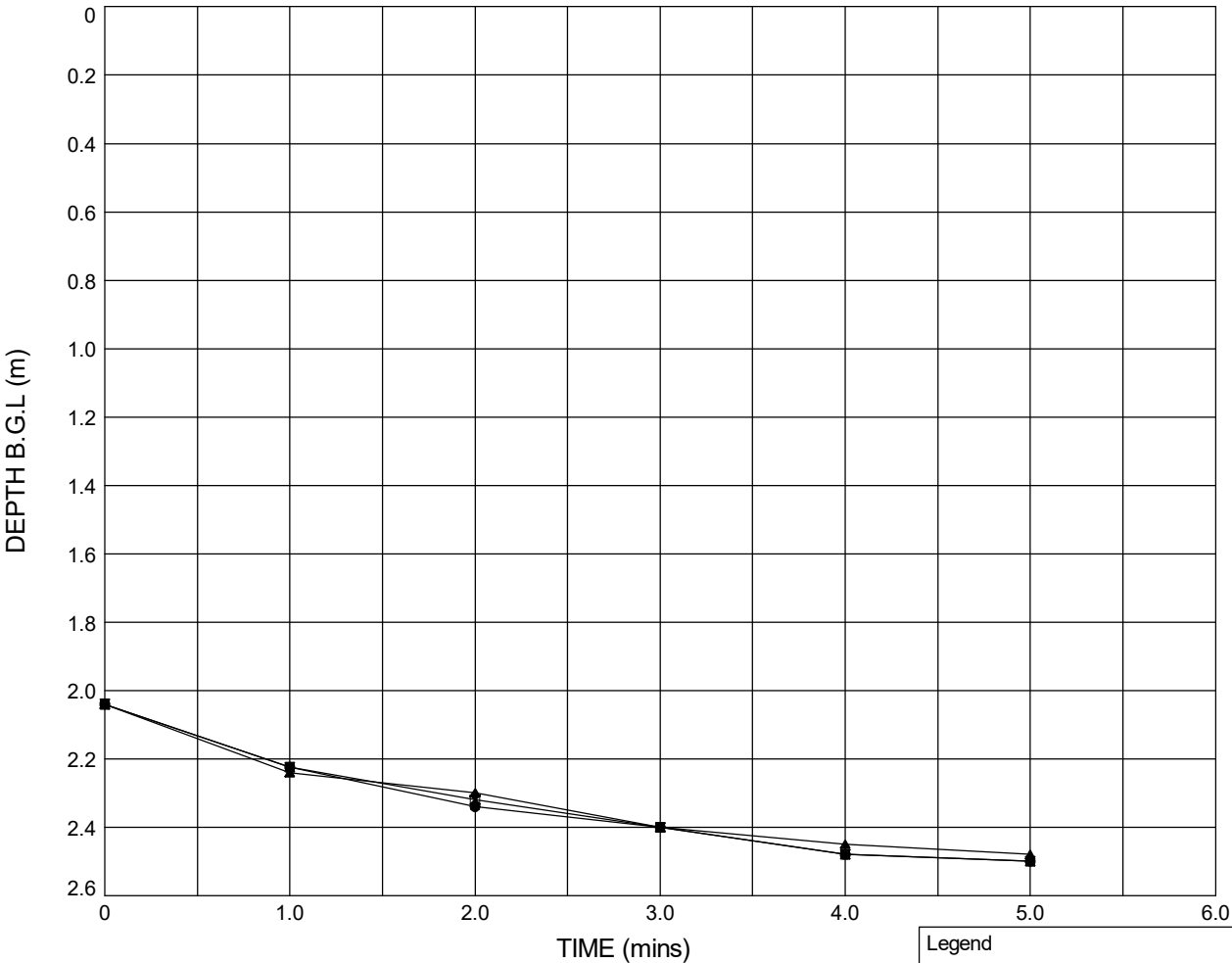
Structural Soils Ltd, The Potteries, Pottery Street, Castleford, WF10 1NJ Tel.01977552255. e-mail matthew.doran@soils.co.uk

FULL SCALE SOAKAWAY TEST

In accordance with BRE Digest 365

Soakaway Test - Position ID : SA01

PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME



		Test 1	Test 2	Test 3	
Pit start depth:	=	2.50	2.50	2.50	m
Pit final depth:	=	2.50	2.50	2.50	m
Effective depth, D_e	=	0.46	0.46	0.46	m
Effective storage volume, V_{p75-25}	=	0.8970	0.8970	0.8970	m^3
Surface area, a_{s50}	=	5.8780	5.8780	5.8780	m^2
Time, t_{p75-25}	=	128.0	132.0	84.0	secs
Infiltration rate, f	=	1.19×10^{-3}	1.16×10^{-3}	1.82×10^{-3}	m/s

Legend

Test 1

Test 2

Test 3

(11.05.23)

(11.05.23)

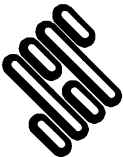
(11.05.23)

Plan (Not to scale)

3.00

1.30

No Bearing Taken



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Pottery Street
Castleford
W. Yorkshire WF10 1NJ

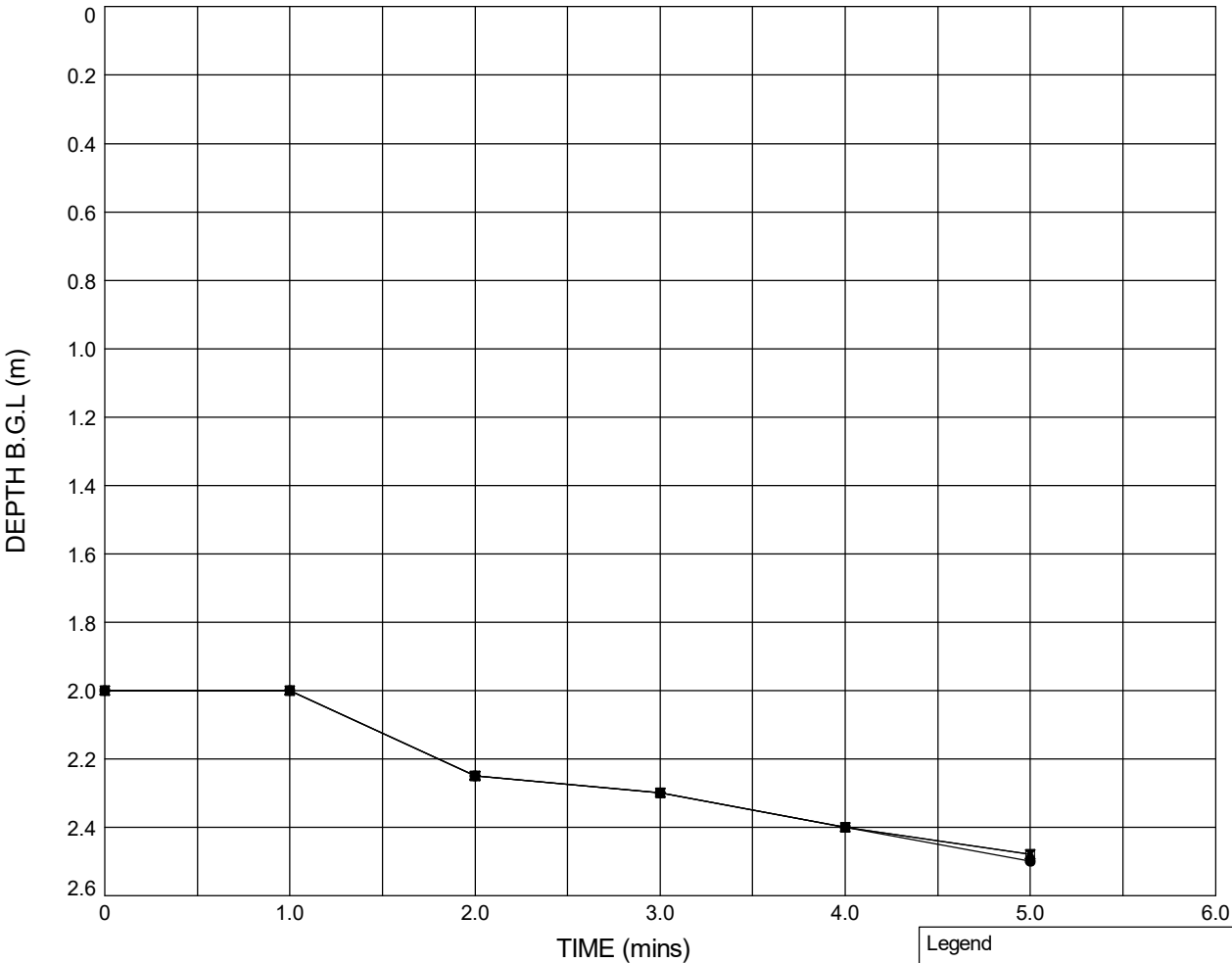
Compiled By	Date	Checked By	Date
	12/05/23		12/05/23
Contract Wrexham Glyndwr University		Contract Ref: 785414	

FULL SCALE SOAKAWAY TEST

In accordance with BRE Digest 365

Soakaway Test - Position ID : SA02

PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME



		Test 1	Test 2	Test 3	
Pit start depth:	=	2.50	2.50	2.50	m
Pit final depth:	=	2.50	2.50	2.50	m
Effective depth, D_e	=	2.50	2.50	2.50	m
Effective storage volume, V_{p75-25}	=	4.8750	4.8750	4.8750	m ³
Surface area, a_{s50}	=	14.6500	14.6500	14.6500	m ²
Time, t_{p75-25}	=	37.0	37.0	37.0	secs
Infiltration rate, f	=	8.99×10^{-3}	8.99×10^{-3}	8.99×10^{-3}	m/s

Legend

●

Test 1 (11.05.23)

⊠

Test 2 (11.05.23)

▲

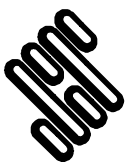
Test 3 (11.05.23)

Plan (Not to scale)

← 3.00 →

1.30

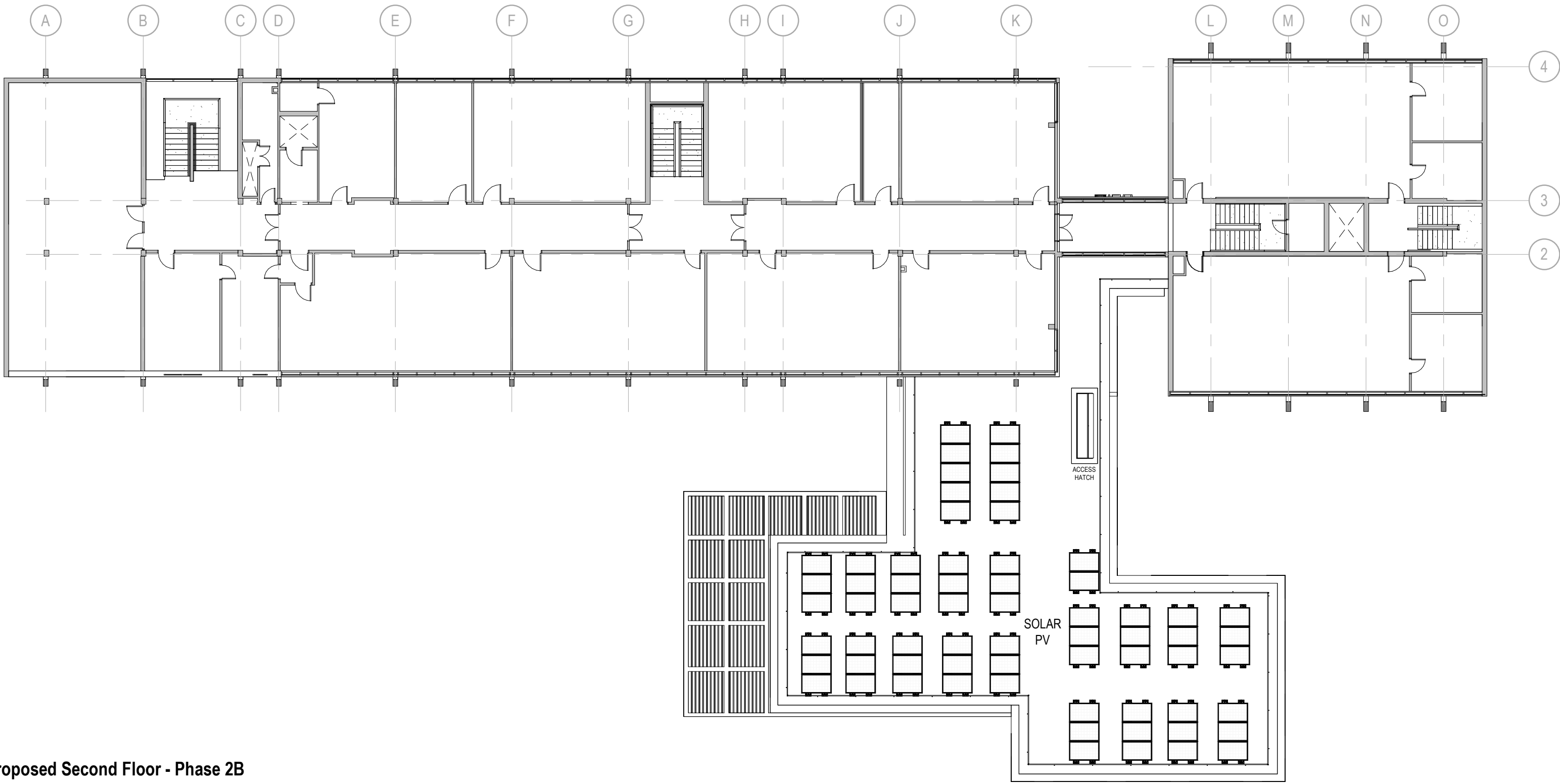
No Bearing Taken



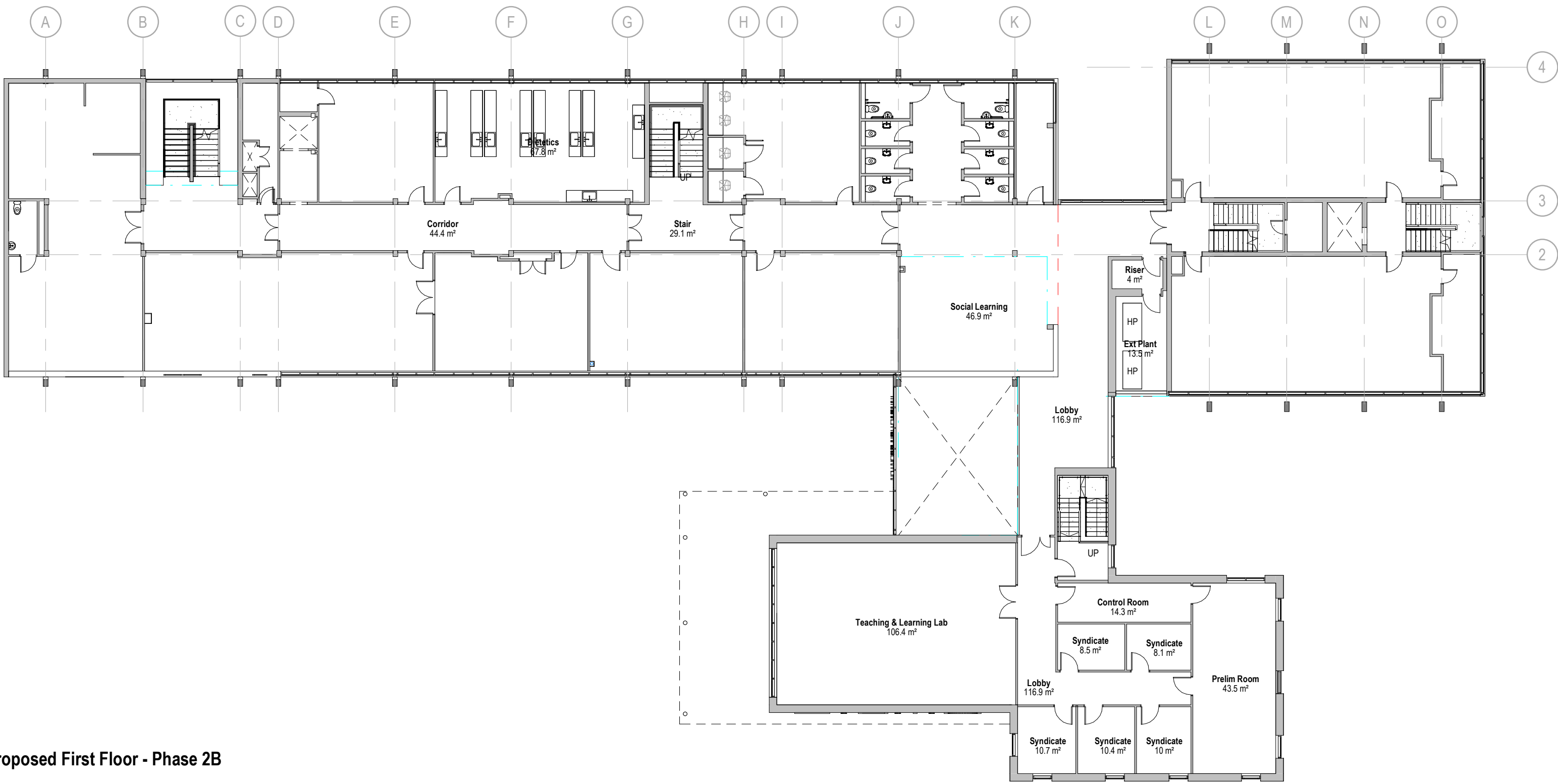
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W. Yorkshire WF10 1NJ

Compiled By	Date	Checked By	Date
	12/05/23		12/05/23
Contract Wrexham Glyndwr University		Contract Ref: 785414	

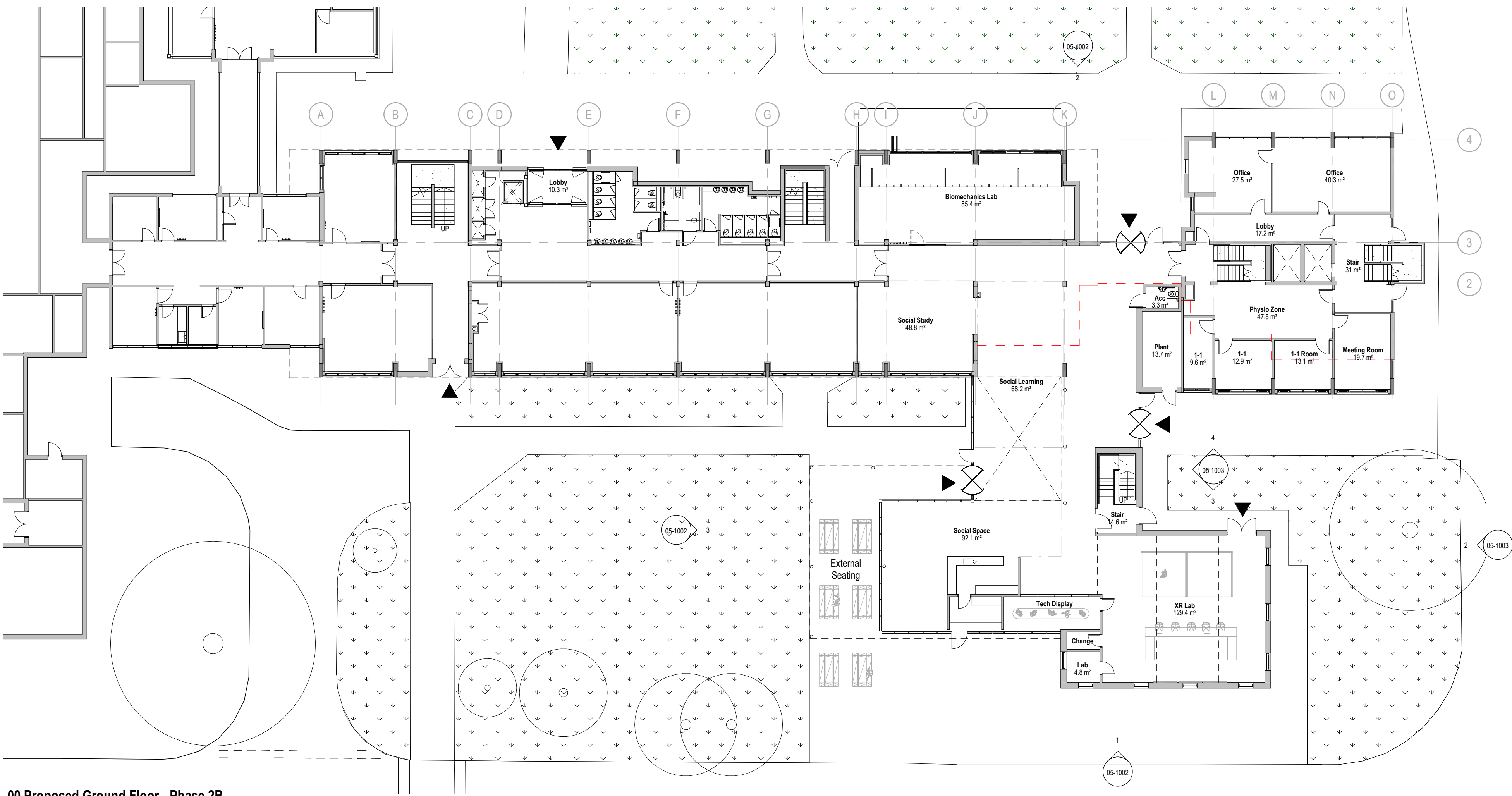
2.3 Appendix C – Architect Plans



02 Proposed Second Floor - Phase 2B
1 : 200



01 Proposed First Floor - Phase 2B
1 : 200



00 Proposed Ground Floor - Phase 2B
1 : 200

GENERAL NOTES:

1. All boundaries, dimensions and levels are to be checked on site before construction and any discrepancies reported to the Architect / Designer.
2. Partial Service: Any discrepancies with site or other information is to be advised to the Architect / Designer and direction and / or approval is to be sought before the implementation of the detail.
3. Block and site plans are reproduced under license from the Ordnance Survey.
4. Do not scale this drawing.
5. For the purpose of coordination, all relevant parties must check this information prior to implementation and report any discrepancies to the Architect / Designer.



GRAPHIC SCALE: 1:200

P3	Phase2B - Revised Planning Issue - Extent of existing soft landscaping retained, RPA added to plan (T196)	07.09.23	MDB	CB
P2	Phase2B - Revised Planning Issue	04.09.23	RPB	CB
P1	Phase2B - Planning Issue	10.08.23	RPB	CB
REV	DESCRIPTION	DATE	REV BY	CHKD BY

CLIENT
Wrexham Glyndwr University

PROJECT
HEIQ Phase 2

DRAWING
Proposed GA Plans 2B

SCALE
1 : 200 @ A1

FIRST ISSUED
10.08.23

PROJECT
1375-22

DRAWN BY
RPB

CHECKED BY
DO

ORIGIN
DAY

VOLUME
XX

LEVEL
XX

TYPE
DR

ROLE
A

NUMBER
05-0005

REVISION
P3

DRAWING
STATUS

PLANNING

DAY

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Studio 1, Lancaster Buildings
77 Queensgate, Manchester, M3
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2.4 Appendix D – Water Quality Assessment

Water Quality Assessment - Simple Index Approach

Discharges to ground water

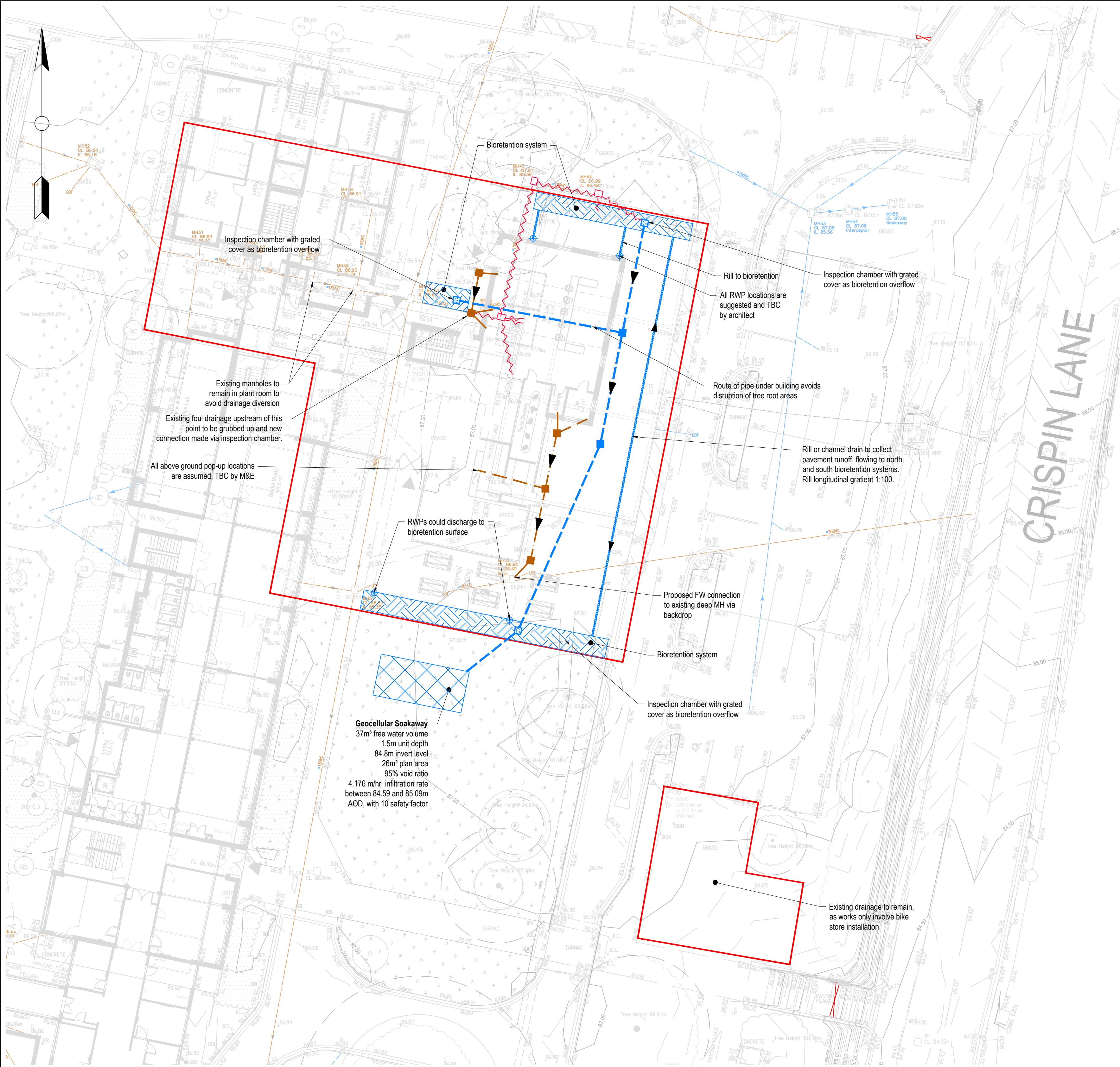
Required for events up to 1:1 year Simple index approach (SuDs Manual, Ch 26)

Land use classification	Pollution Hazard Level	Note	TSS	Metals	HCs
Residential roofs	Very Low	Residential roofs	0.2	0.2	0.05
Commercial roofs	Low	Typically commercial/ industrial roofs	0.3	0.4	0.05
Individual property driveway	Low	Driveways/car parks, low traffic access roads, schools, offices, <300 movements/day	0.5	0.4	0.4
Commercial yards	Medium	Yards and delivery areas/access	0.7	0.6	0.7
Docks	Medium	Commerical loading docks/ramps	0.7	0.6	0.7
Car parking	Medium	Non residential car parks with frequent change areas - hospital, retail	0.7	0.6	0.7
Roads	Medium	All roads except for low traffic and trunk roads/motorways	0.7	0.6	0.7
Industrial Yards	High	Haulage yards, lorry parks, highly frequent industrial estates, sites with chemicals and fuels are delivered, handled, stored, used or manufactured: industrial site, trunk roads and motorways	0.8	0.8	0.9

Surface water protection measures

Catchment	Hazard Indices				SuDS Treatment Train			Mitigation Indices		
	Hazard	TSS	metals	HCs	Step 1	Step 2	Step 3	TSS.	metals.	HCs.
Commercial roofs: Option 1	Low	0.3	0.4	0.05	Bioretention system			0.8	0.8	0.8
Commercial roofs: Option 2	Low	0.3	0.4	0.05	Filter drain			0.4	0.4	0.4
Non-vehicle areas: Option 1	Low	0.5	0.4	0.4	Bioretention system			0.8	0.8	0.8
Non-vehicle areas: Option 2	Low	0.5	0.4	0.4	Swale			0.5	0.6	0.6

2.5 Appendix E – Drainage Layout



KEY:

Existing foul water drain

Existing surface water drain

Existing pipes and manholes to be removed

Foul water private drain

Surface water private drain

Foul water pop-up

Foul water gully

Rainwater pipe

Surface water private gully

Channel drain (with Access, Outlet, and Sump boxes)

Bioretention Area

Below ground surface water soakaway

- GENERAL NOTES:
1.

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
2.

DO NOT SCALE THIS DRAWING. ANY AMBIGUITIES, OMISSIONS AND ERRORS ON DRAWINGS SHALL BE BROUGHT TO THE ENGINEERS ATTENTION IMMEDIATELY. ALL DIMENSIONS MUST BE CHECKED / VERIFIED ON SITE.
3.

ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
4.

FOR GENERAL NOTES REFER TO DRAWING.

P01

ISSUED FOR PLANNING SUBMISSION.

29/09/23

AMB

GW

Rev.

Description:

Date:

By:

Chkd:

Curtins

Units 24-25 Riverside Place K Village Lound Road Kendal LA9 7FH
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Status:

SUITABLE FOR INFORMATION

S2

Client:

Wrexham Glyndwr University

Project:

HEIQ Phase 2

Orig Title:

Drainage Layout

Drawn By

AMB

Designed By

AMB

Checked By

GW

Date

27/09/2023

Scales @ A1

1:200

Project No • Originator • Function • Spatial • Form • Discipline • Number

Revision

080457 - CUR - XX - ZZ - D - C - 92001

P01

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2.6 Appendix F – Drainage Calculations

Results for 1 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 99.02%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	Depth/Area 1	25	85.044	0.244	13.4	6.0349	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
30 minute winter	Depth/Area 1	Infiltration	3.2

Results for 30 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 99.02%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	Depth/Area 1	56	85.668	0.868	22.2	21.4411	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
60 minute winter	Depth/Area 1	Infiltration	3.7

Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 99.02%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	Depth/Area 1	94	86.065	1.265	18.6	31.2339	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
120 minute winter	Depth/Area 1	Infiltration	4.1

Results for 200 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 99.02%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	Depth/Area 1	88	87.000	2.200	21.8	37.0624	0.8839	FLOOD

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
120 minute winter	Depth/Area 1	Infiltration	4.3

Made By: AMB

Checked By: GW

Supporting Drainage Calculations

Size SuDS components at site scale

	Areas (ha)
Total site area	0.1375
Significant POS	0.0108
Area positively drained	0.1267
Impermeable area	0.0897
Drained area that is impermeable (%)	71%
Impervious area drained via infiltration	0.0445
Impervious area drained to rainwater harvesting systems	0.0452

Parameters

SAAR	779 mm
M5-60	18 mm
R ratio	0.325
Hydrological Region	9
SOIL	1
SPR	0.1
Climate change Catchment	Wales
Design rainfall event	1:100 yr
Climate change	40%
Urban creep	10%

Estimated storage volumes using Causeway Flow

Storage Estimate

Return Period (years)

100

Climate Change (%)

40

Impermeable Area (ha)

0.090

Peak Discharge (l/s)

0.000

Infiltration Coefficient (m/hr)
(leave blank if no infiltration)

0.41760

Required Storage (m³)

Calc

from

93

to

93

With infiltration (m³)

from

9

to

42

Calculated by:	Andrew Brookes
Site name:	Wrexham Glyndwr University
Site location:	Wrexham

This is an estimation of the storage volume requirements that are needed 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). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	53.05414° N
Longitude:	3.0018° W
Reference:	3462634920
Date:	Sep 29 2023 16:51

Site characteristics

Total site area (ha):	0.1375
Significant public open space (ha):	0.0108
Area positively drained (ha):	0.1267
Impermeable area (ha):	0.0897
Percentage of drained area that is impermeable (%):	71
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	100
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.13
Net impermeable area for storage volume design (ha):	0.09
Pervious area contribution to runoff (%):	30

Methodology

esti	IH124
Q _{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	1	1
SPR:	0.1	0.1

Hydrological characteristics

	Default	Edited
Rainfall 100 yrs 6 hrs:	--	61
Rainfall 100 yrs 12 hrs:	--	73.73
FEH / FSR conversion factor:	1.01	1.01
SAAR (mm):	779	779
M5-60 Rainfall Depth (mm):	17	17
'r' Ratio M5-60/M5-2 day:	0.3	0.3
Hydrological region:	9	9
Growth curve factor 1 year:	0.88	0.88
Growth curve factor 10 year:	1.42	1.42
Growth curve factor 30 year:	1.78	1.78

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

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Design criteria

Climate change allowance factor:	1.4	Growth curve factor 100 years:	2.18	2.18
Urban creep allowance factor:	1.1	Q _{BAR} for total site area (l/s):	0.03	0.03
Volume control approach	Flow control to max of 2 l/s/ha or Q _{bar}		Q _{BAR} for net site area (l/s):	0.02
Interception rainfall depth (mm):	5			
Minimum flow rate (l/s):	2			

Site discharge rates	Estimated storage volumes		Default	Edited
	Default	Edited		
1 in 1 year (l/s):	2	2	37	37
1 in 30 years (l/s):	2	2	0	0
1 in 100 year (l/s):	2	2	37	37

This report was produced using the storage estimation tool developed by HRWallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at <http://uksuds.com/terms-and-conditions.htm>. The outputs from this tool have been used to estimate storage volume requirements. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

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