



Site-Specific Flood Risk Modelling

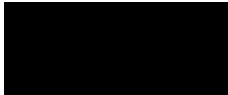
Project: Oaklands Blossom and Oaklands College
St. Albans

Client: Taylor Wimpey and Oaklands College

Reference: BR31287-JNP-XX-XX-RP-C-1001

Date: October 2025

DOCUMENT CONTROL SHEET

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Document Issue Record

Rev	Date	Description	Prepared	Checked	Approved
P01	14/10/2025	First issue.	ML	RM	RM

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Contents

1	INTRODUCTION	1
2	ENVIRONMENT AGENCY'S SURFACE WATER MAP	2
3	HYDROLOGICAL ASSESSMENT	3
4	HYDRAULIC MODEL.....	5
4.1	Method Statement.....	5
4.2	Sources of Information.....	6
4.3	Model Description	6
4.4	Model Parameters and Boundary Conditions	7
4.5	Sensitivity Tests	7
5	MODEL RESULTS	8
5.1	Stability.....	8
5.2	Critical Storm Duration.....	8
5.3	Flood Risk	8
5.4	Sensitivity Tests	9
6	CONCLUSIONS AND RECOMMENDATIONS.....	10
APPENDIX A	: FLOOD ESTIMATION REPORT	11
APPENDIX B	: SITE INFORMATION	12
APPENDIX C	: FLOOD RISK MAPS.....	13

List of Tables

Table 3.1: Hyetographs (Rain-on-Grid)	3
Table 3.2: Hydrographs (House Lane).....	3
Table 4.1: Sources of Information.....	6
Table 4.2: Existing (Pre-Development) Culverts (1D Domain)	6
Table 4.3: Proposed (Post-Development) Culverts (1D Domain)	7
Table 4.4: Sensitivity Tests	7

List of Figures

Figure 3.1: Hyetographs (1 hour Storm) (Rain-on-Grid)	4
Figure 3.2: Hydrographs (1 hour storm) (House Lane)	4
Figure 4.1: Model Extent.....	5

1 INTRODUCTION

- 1.1.1 JNP Group has been commissioned by Taylor Wimpey and Oaklands College to undertake site-specific modelling of flood risk for the Oaklands Blossom and Oaklands College development, off Sandpit Lane, St Albans, Hertfordshire.
- 1.1.2 The purpose of this modelling exercise is to establish site-specific flood extents and flow conditions more accurate than the readily available flood risk information published by the Environment Agency (EA) – which is based on large scale models that often disregard local features – and to confirm that the proposed development can be made safe without increasing flood risk elsewhere.
- 1.1.3 As agreed in principle with the Lead Local Flood Authority (LLFA), Hertfordshire County Council (HCC), the modelling exercise replicates the EA’s methodology for strategic models – as detailed in *Risk of Flooding from Surface Water: Understanding and Using the Map* (January 2025) and *NaFRA2 New National Modelling: Methodology Statement* (February 2025) – at a site-specific scale, focusing on the catchment area(s) contributing to flood risk at the site and making use of bespoke surveyed information where available.

2 ENVIRONMENT AGENCY'S SURFACE WATER MAP

2.1.1 The EA's recently updated *Surface Water Map* is based on the methodology set out in *Risk of Flooding from Surface Water: Understanding and Using the Map* (January 2025) and *NaFRA2 New National Modelling: Methodology Statement* (February 2025), with the following key features:

- The cell resolution of the models is 2 m.
- Buildings' footprints – as per Ordnance Survey's (OS) *MasterMap* – uplifted by 30 cm and given a roughness coefficient (Manning's 'n') of 0.3.
- Other roughness coefficients (Manning's 'n') attributed in accordance with OS *MasterMap* land uses, as per Appendix B of the *Methodology Statement*.
- Small drainage features (e.g., ditches, culverts, etc.) are omitted from models and deemed indirectly represented by the rainfall losses.
- Design rainfall taken from the *Flood Estimation Handbook* (FEH) 2013 rainfall frequency statistics (summer storm profile), for storm durations of 1, 6 and 18 hours and annual exceedance probabilities (AEP) of 3.3% (1 in 30-year), 1.0% (1 in 100-year) and 0.1% (1 in 1000-year).
- Runoff from all 'natural' land uses – as per OS *MasterMap* – generated using the losses model from the ReFH2.3 method (summer).
- Drainage rate of 18 mm/h (default) applied as a continuous loss to all 'manmade' land uses – as per OS *MasterMap*.

2.1.2 Results are then filtered as follows to obtain the published flood risk maps:

- Inundation depth threshold of 0.075 m used for surface water outputs.
- For each AEP, results for the 1, 6 and 18 h storm durations are merged to create a worst-case scenario.

2.1.3 The EA's *Risk of Flooding from Surface Water* is shown in Map 19 in Appendix C.

3 HYDROLOGICAL ASSESSMENT

- 3.1.1 Rainfall hyetographs for storms events with annual exceedance probabilities (AEP) of 3.3% (1 in 30-year), 1.0% (1 in 100-year) and 0.1% (1 in 1000-year) and durations of 1, 6 and 18 hours have been established for the catchment area contributing to surface water runoff at the development site based on rainfall data from the UK Centre for Ecology and Hydrology's *Flood Estimation Handbook Web Service*.
- 3.1.2 A winter storm profile is normally used to represent the temporal variation of extreme rainfall events over rural areas, while a summer storm profile is deemed more appropriate for urban areas. While the Oaklands Blossom site (c.21.6 ha) is greenfield and the Oaklands College site (c.30.67 ha) is mixed land use, the wider catchment area contributing to surface water runoff through the site (c.175.8 ha) is largely urban. Following the precautionary principle recommended for any assessment of flood risk, the more conservative summer storm profile has been used in this modelling exercise.
- 3.1.3 With the exception of small ditches near its western boundary, the development site's nearest open water feature is the Butterwick Brook, in the southeastern corner of the land owned by the college, in the continuation of the north-south 'dry valley' along House Lane – Oaklands Lane.
- 3.1.4 This 'dry valley' is thought to be a chalk stream subjected to over abstraction. The stream is a tributary of the river Colne, with a (large) catchment area of c.43 km². Evidence suggests that this 'dry valley' was once known as the river Kin ([The Kin - Harpenden's Forgotten River](#)).
- 3.1.5 Surface water is the main source of flood risk at the site. This is assessed in the modelling exercise through direct rainfall over the contributing catchment area of c.175.8 ha (i.e., rain-on-grid). Flood risk from the 'dry valley' along House Lane – Oaklands Lane, however, is fluvial in nature and modelled as an inflow hydrograph due to the very large contributing catchment area (Appendix A).
- 3.1.6 The hyetographs and hydrographs used in the modelling exercise are summarised in Table 3.1 and Table 3.2 and illustrated in Figure 3.1 and Figure 3.2.

Table 3.1: Hyetographs (Rain-on-Grid)

Storm Duration (hours)	Annual Exceedance Probability		
	3.3%	1.0%	0.1%
	Total Rainfall (mm)		
1	33.13	42.37	66.47
6	52.51	65.12	109.99
18	61.59	76.47	131.51

Table 3.2: Hydrographs (House Lane)

Storm Duration (hours)	Annual Exceedance Probability		
	3.3%	1.0%	0.1%
	Peak Flow (m ³ /s)		
1	3.76	4.77	7.61
6	6.86	8.62	15.75
18	7.35	9.26	17.63

Figure 3.1: Hyetographs (1 hour Storm) (Rain-on-Grid)

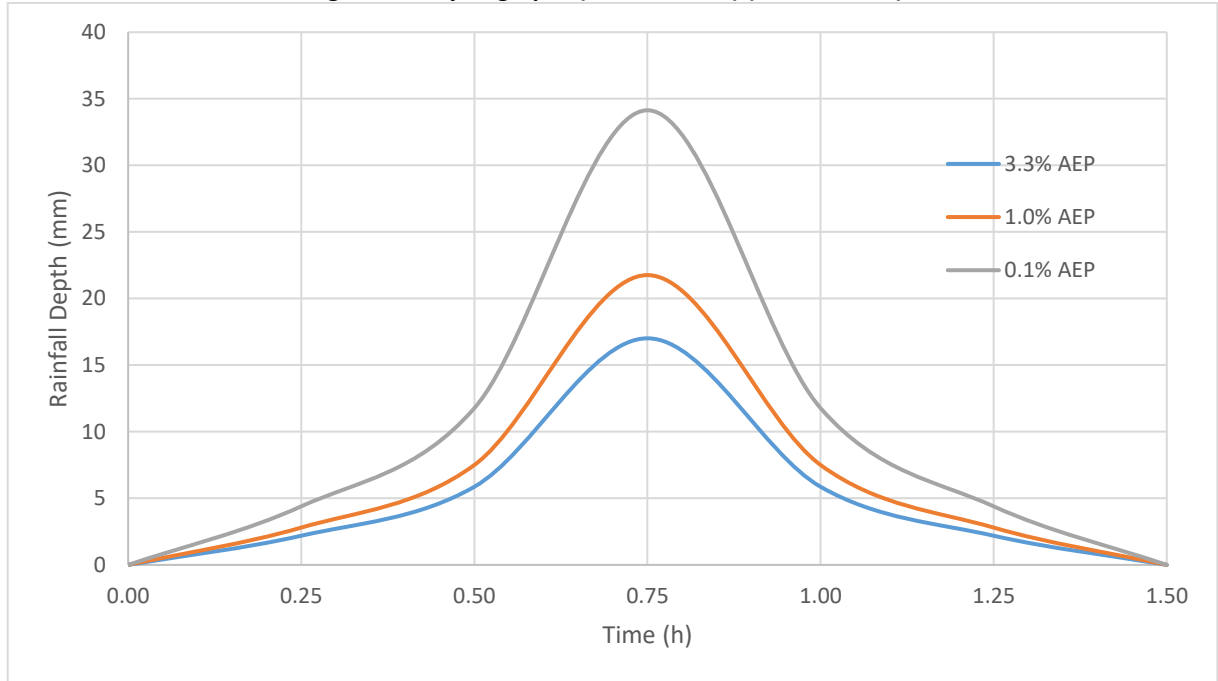
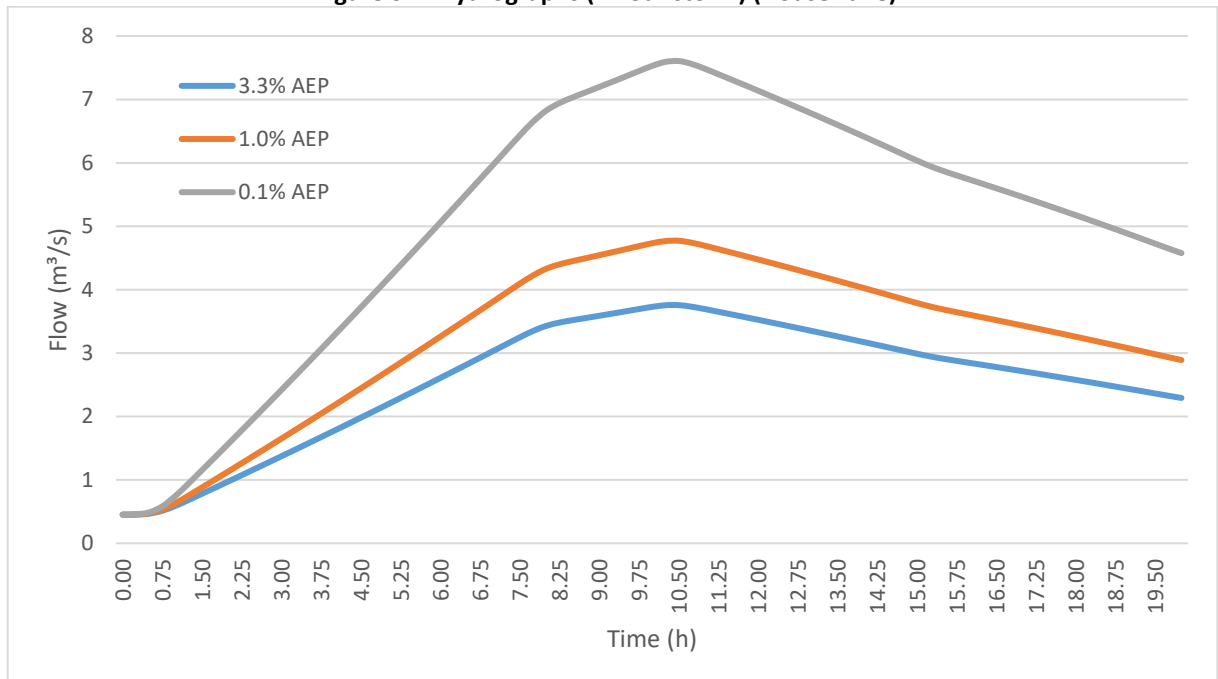


Figure 3.2: Hydrographs (1 hour storm) (House Lane)

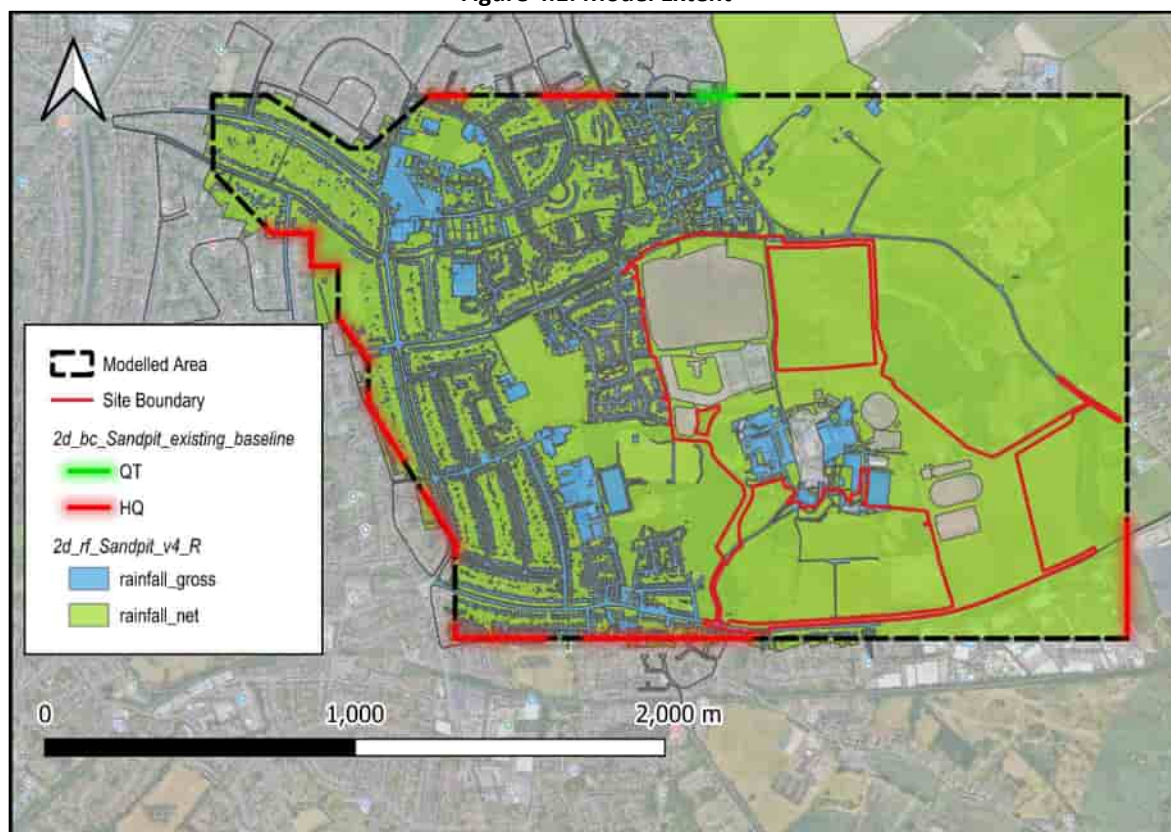


4 HYDRAULIC MODEL

4.1 Method Statement

- 4.1.1 ESTRY-TUFLOW was used to build the (1D-2D) direct rainfall (rain-on-grid) model of the catchment area contributing to overland flows through the development site.
- 4.1.2 The model extent illustrated in Figure 4.1 and Map 01 in Appendix C encompasses all areas contributing to overland flows through the development site. 'Natural' and 'manmade' land uses have been established in accordance with OS *MasterMap*.
- 4.1.3 Rainfall over areas to be made impermeable by the proposed development has been removed from the model in order to enable the comparison of pre versus post-development results. It is important to note that runoff generated within these areas will be managed by the proposed drainage strategies which, by design, will prevent any increase in flood risk on site or elsewhere.
- 4.1.4 The site-specific model was run for storm events with AEP of 3.3% (1 in 30-year), 1.0% (1 in 100-year) and 0.1% (1 in 1000-year) and durations of 1, 6 and 18 hours.

Figure 4.1: Model Extent



4.2 Sources of Information

4.2.1 The sources of information used in this site-specific hydraulic modelling exercise are summarised in Table 4.1. Bespoke surveys and designs are included in Appendix B.

Table 4.1: Sources of Information

Source	Description
DEFRA's LiDAR	Composite Digital Terrain Model (DTM) at 1 m resolution (tile TN10NE) (flown in 2021 and downloaded from DATA.GOV.UK in March 2025).
Bespoke Survey	Topographical survey of the development site undertaken by Survey Solutions (October 2024) (Appendix B).
OS MasterMap	Detailed land use information including buildings, general surfaces (manmade and natural), surface water features, natural environment areas, paths, railways, roads, and roadsides (downloaded from Promap in April 2025).
Proposed Development	Proposed site levels and ditch diversion prepared by JNP Group (October 2025) (Appendix B).

4.3 Model Description

- 4.3.1 The model extent covers the area contributing to surface water runoff through the development site, as illustrated in Figure 4.1.
- 4.3.2 The model's 2D domain uses a 2 m grid suitable to represent all the features present in the modelled extent, including the existing and proposed ditches/watercourses within and around the development site, as well as the associated culverts (represented in the dynamically linked 1D domain).
- 4.3.3 Where available, channels, bunds, roads, and etc. were 'carved' into the model based on information from the bespoke topographical survey and/or proposed designs, using TUFLOW's 'Z Shapes'. Elsewhere LiDAR topography was used.
- 4.3.4 In line with *NaFRA2 New National Modelling: Methodology Statement* (February 2025), and where detailed survey information was not available, buildings were raised by 30 cm based on OS *MasterMap* land uses.
- 4.3.5 The 1D structures (i.e., culverts) included in the models are summarised in Table 4.2 and Table 4.3 below.
- 4.3.6 The existing (pre-development) and proposed (post-development) baseline models are schematically represented in Map 02 and Map 03 in Appendix C.

Table 4.2: Existing (Pre-Development) Culverts (1D Domain)

Culvert Location	Invert (m AOD)	Soffit (m AOD)	Width (mm)	Height (mm)
North Drive	77.91	78.21	300	300
South Sandpit Lane	77.21	78.21	1000	1000
Oaklands Ditch	80.83	81.18	250	250
Oaklands College	84.02	84.25	225	225

Table 4.3: Proposed (Post-Development) Culverts (1D Domain)

Culvert Location	Invert (m AOD)	Soffit (m AOD)	Width (mm)	Height (mm)
Northwest	80.00	80.50	1500	500
Northeast	78.95	79.45	1500	500
South	88.27	88.77	1800	500

4.3.7 In order to maximise the site's development potential and achieve other wider sustainability goals, some (limited) manipulation of Flood Zones 2 and 3 along existing overland flow paths within the Oaklands Blossom part of the development is proposed through the formalization of blue/green corridors across the site compatible with the proposed master plan.

4.4 Model Parameters and Boundary Conditions

4.4.1 Roughness coefficients (Manning's 'n') were attributed in accordance with *NaFRA2 New National Modelling: Methodology Statement* based on OS *MasterMap* land uses. In the absence of more detailed information, all other coefficients (e.g., head losses at culverts' inlets/outlets) have assumed default/recommended values.

4.4.2 The model's boundary conditions include:

- Direct rainfall over the catchment area contributing to overland flows through the development site.
- Inflow hydrograph for the 'dry valley' along House Lane – Oaklands Lane.
- Normal-flow conditions where overland flow paths reach the edges of the models' extent. These are sufficiently distanced from the area of interest to have no impact on results.

4.5 Sensitivity Tests

4.5.1 Sensitivity tests have been undertaken as summarised in Table 4.4, using the 1.0% AEP and 1 hour storm event as the baseline scenario.

Table 4.4: Sensitivity Tests

Sensitivity Test	Description
Culvert Blockage	90% Blockage of culverts.
Roughness Coefficients	Manning's 'n' values increased by 20%.
Increased Inflows	Urban areas with reduced drainage rate of 13 mm/hr and 'dry valley' flow increased by 20%.

5 MODEL RESULTS

5.1 Stability

- 5.1.1 The model uses a 2D timestep of 1.50 s and 1D timestep is 0.25 s. It runs without unexpected warnings, errors or negative depths for all storm events and scenarios considered. Warnings prior to model calculations relate to discrepancies between LiDAR and surveyed levels at culvert inverts, which are expected. Cumulative mass balance errors are within the desired range of $\pm 2.0\%$, and Qi, Qo and dV values are stable throughout all simulations, indicating a healthy model.
- 5.1.2 All 1D and 2D outputs have been reviewed and are indicative of a healthy hydraulic model.

5.2 Critical Storm Duration

- 5.2.1 The model was run for storm events with annual exceedance probabilities (AEP) of 3.3% (1 in 30-year), 1.0% (1 in 100-year) and 0.1% (1 in 1000-year) and durations of 1, 6 and 18 hours.
- 5.2.2 Results show that a storm duration of 1 hour leads to the highest flood depths and largest flood extents within the development site (Map 20 in Appendix C).

5.3 Flood Risk

- 5.3.1 The estimated flood extents have been prepared using the same methodology (i.e., filtering) as the EA's published maps (see Section 2).
- 5.3.2 Existing (pre-development) maximum flood depths/extents for the 0.1%, 1.0% and 3.3% AEP storm events are shown in Map 04, Map 05 and Map 06 in Appendix C, respectively. Maximum flood depths/extents for the 1.0% AEP + 40% climate change allowance event are shown in Map 07.
- 5.3.3 Existing (pre-development) results largely confirm the EA's results (Map 19 in Appendix C), showing three (west-east) overland flow paths adjacent/through the site:
- **Northern Overland Flow Path.** Flowing west-east along the northern boundary of the development site (i.e., Sandpit Lane), this overland flow path merges with the chalk stream/'dry-valley' along House Lane – Oaklands Lane near the northeastern corner of the site. The flood risk associated with this overland flow path is mostly low (0.1% to 1.0% AEP), with higher risk (1.0% to > 3.3% AEP) seemingly limited to the channel of an existing boundary/highway ditch.
 - **Central Overland Flow Path.** This route flows west-east through the southern part of the Oaklands Blossom area and along the northern edge of the Oaklands College area, before turning south and merging with the southern overland flow path near the site's eastern boundary. The flood risk associated with this overland flow path is mostly low (0.1% to 1.0% AEP), with higher risk (1.0% to > 3.3% AEP) limited to small pockets of lower-lying ground.

- **Southern Overland Flow Path.** This route flows west-east through the central part of the Oaklands College area, before merging with the central overland flow path near the site's eastern boundary. The flood risk associated with this overland flow path is generally high (> 3.3% AEP), presumably due to the obstruction to flow posed by existing buildings and associated infrastructure.
- 5.3.4 Proposed (post-development) maximum flood depths/extents for the 0.1%, 1.0% and 3.3% AEP storm events are shown in Map 08, Map 09 and Map 10 in Appendix C, respectively. Maximum flood depths/extents for the 1.0% AEP + 40% climate change allowance event are shown in Map 11.
- 5.3.5 Changes in maximum flood depths (post versus pre-development) for the 0.1%, 1.0%, 3.3% and 1.0% AEP + 40% climate change allowance events are shown in Map 12, Map 13, Map 14 and Map 15 in Appendix C, respectively.
- 5.3.6 Results confirm that overland flows can be managed around/through the Oaklands Blossom development using the green/blue corridors built into the master plan for that specific purpose.
- 5.3.7 On the other hand, overland flows through the Oaklands College are unavoidable and refurbished/extended buildings in this area must incorporate flood resistance/resilience measures, as described in the Flood Risk Assessment.
- 5.3.8 Results also confirm that the proposed development will not increase flood risk elsewhere (i.e., in land not owned by the developers).
- 5.4 Sensitivity Tests**
- 5.4.1 Changes in maximum flood depths (post versus pre-development) for the sensitivity tests described in Section 4.5 are shown in Map 16, Map 17 and Map 18 in Appendix C. These confirm that the key findings of this report are not significantly affected by modelling assumptions, even though flood risk in absolute terms may be, as shown in Map 22, Map 23 and Map 24 (sensitivity test versus baseline).

6 CONCLUSIONS AND RECOMMENDATIONS

- 6.1.1 JNP Group has been commissioned by Taylor Wimpey and Oaklands College to undertake site-specific modelling of flood risk for the Oaklands Blossom and Oaklands College development, off Sandpit Lane, St Albans, Hertfordshire.
- 6.1.2 The purpose of this modelling exercise is to establish site-specific flood extents and flow conditions more accurate than the readily available flood risk information published by the Environment Agency (EA) – which is based on large scale models that often disregard local features – and to confirm that the proposed development can be made safe without increasing flood risk elsewhere.
- 6.1.3 ESTRY-TUFLOW was used to build the (1D-2D) direct rainfall (rain-on-grid) model of the catchment area contributing to overland flows through the development site. The site-specific model was run for storm events with AEP of 3.3% (1 in 30-year), 1.0% (1 in 100-year) and 0.1% (1 in 1000-year) and durations of 1, 6 and 18 hours.
- 6.1.4 Existing (pre-development) results largely confirm the EA's flood risk information, showing three (west-east) overland flow paths adjacent/through the site.
- 6.1.5 Proposed (post-development) results confirm that overland flows can be managed around/through the Oaklands Blossom development using the green/blue corridors built into the master plan for that specific purpose.
- 6.1.6 On the other hand, overland flows through the Oaklands College are unavoidable and refurbished/extended buildings in this area must incorporate flood resistance/resilience measures, as described in the Flood Risk Assessment.
- 6.1.7 Results for the other sensitivity tests undertaken confirm that the key findings of this report are not significantly affected by modelling assumptions.

APPENDIX A: FLOOD ESTIMATION REPORT

Flood estimation report: Sandpit Lane, St Albans.

Introduction

This report template is a supporting document to the Environment Agency’s Flood Estimation Guidelines. It provides a record of the hydrological context, the method statement, the calculations and decisions made during flood estimation and the results. This document can be used for one site or multiple sites. If only one site is being assessed, analysts should remove superfluous rows from tables.

Guidance notes (in red text) are included throughout this document in column titles or above tables. These should be deleted before finalising the document. Where relevant, references to specific sections of the Flood Estimation Guidelines document are included to indicate where further useful information can be found.

Note: Column size / page layout can be adapted, where necessary, to best present relevant information, for example, maps do not need to be within the tables if they would be better as a separate page.

Contents

1	SUMMARY OF ASSESSMENT -----	1
2	METHOD STATEMENT -----	2
3	LOCATIONS WHERE FLOOD ESTIMATES REQUIRED -----	5
4	STATISTICAL METHOD -----	7
5	REVITALISED FLOOD HYDROGRAPH 2 (REFH2) METHOD -----	9
6	DISCUSSION AND SUMMARY OF RESULTS -----	10
6	ANNEX-----	12

Approval

Revision stage	Analyst / Reviewer name & qualifications	Amendments	Date
Method statement preparation	Myles Lam	-	14/10/2025
Method statement sign-off	Rodrigo Magno CEng MICE C.WEM MCIWEM	-	14/10/2025
Initial calculations preparation	Myles Lam	-	14/10/2025
Initial calculations sign-off	Rodrigo Magno CEng MICE C.WEM MCIWEM	-	14/10/2025

Abbreviations

AEP	annual exceedance probability
AM	Annual Maximum
AREA	Catchment area (km ²)
BFI	Base Flow Index
BFIHOST	Base Flow Index derived using the HOST soil classification
CPRE	Council for the Protection of Rural England
FARL	FEH index of flood attenuation due to reservoirs and lakes
FEH	Flood Estimation Handbook
FSR	Flood Studies Report
HOST	Hydrology of Soil Types
NRFA	National River Flow Archive
OS	Ordnance Survey
POT	Peaks Over a Threshold
QMED	Median Annual Flood (with return period 2 years)
ReFH	Revitalised Flood Hydrograph method
ReFH2	Revitalised Flood Hydrograph 2 method
SAAR	Standard Average Annual Rainfall (mm)
SPR	Standard percentage runoff
SPRHOST	Standard percentage runoff derived using the HOST soil classification
Tp(0)	Time to peak of the instantaneous unit hydrograph
URBAN	Flood Studies Report index of fractional urban extent
URBEXT1990	FEH index of fractional urban extent
URBEXT2000	Revised index of urban extent, measured differently from URBEXT1990
WINFAP-FEH	Windows Frequency Analysis Package – used for FEH statistical method

1 SUMMARY OF ASSESSMENT

1.1 Summary

This table provides a summary of the key information contained within the detailed assessment in the following sections. The aim of the table is to enable quick and easy identification of the type of assessment undertaken. This should assist in identifying an appropriate reviewer and the ability to compare different studies more easily.

Catchment location	South of the intersection of Villiers Crescent and House Lane located at St Albans, Hertfordshire.
Purpose of study and scope	Aim of the moderate study to derive peak flow estimates and hydrographs for House Lane which flows near the proposed development site at Sandpit Lane.
Key catchment features	The catchment is predominantly rural with some urban influence (URBEXT2000 = 0.1106). The soils are largely permeable (BFIHOST = 0.625), suggesting a high baseflow contribution and reduced surface runoff response. There is a moderate runoff potential (SPRHOST = 36.78) with no significant flood attenuation features (FARL = 1).
Flooding mechanisms	The main mechanisms of flooding assessed will be fluvial and surface water.
Gauged / ungauged	The catchment is ungauged.
Final choice of method	REFH2.
Key limitations / uncertainties in results	Lack of an official watercourse and so it is assumed that the flood estimation point at House Lane behaves the same as on a watercourse. The catchment is ungauged and it is assumed that the REFH parameters as calculated from the catchment descriptors are representative of the flood response in the catchment.

1.2 Note on flood frequencies

The frequency of a flood can be quoted in terms of a return period, which is defined as the average time between years with at least one larger flood, or as an annual exceedance probability (AEP), which is the inverse of the return period.

Return periods are output by the Flood Estimation Handbook (FEH) software and can be expressed more succinctly than AEP. However, AEP can be helpful when presenting results to members of the public who may associate the concept of return period with a regular occurrence rather than an average recurrence interval.

The table below is provided to enable quick conversion between return periods and annual exceedance probabilities.

Annual exceedance probability (AEP) and related return period reference table

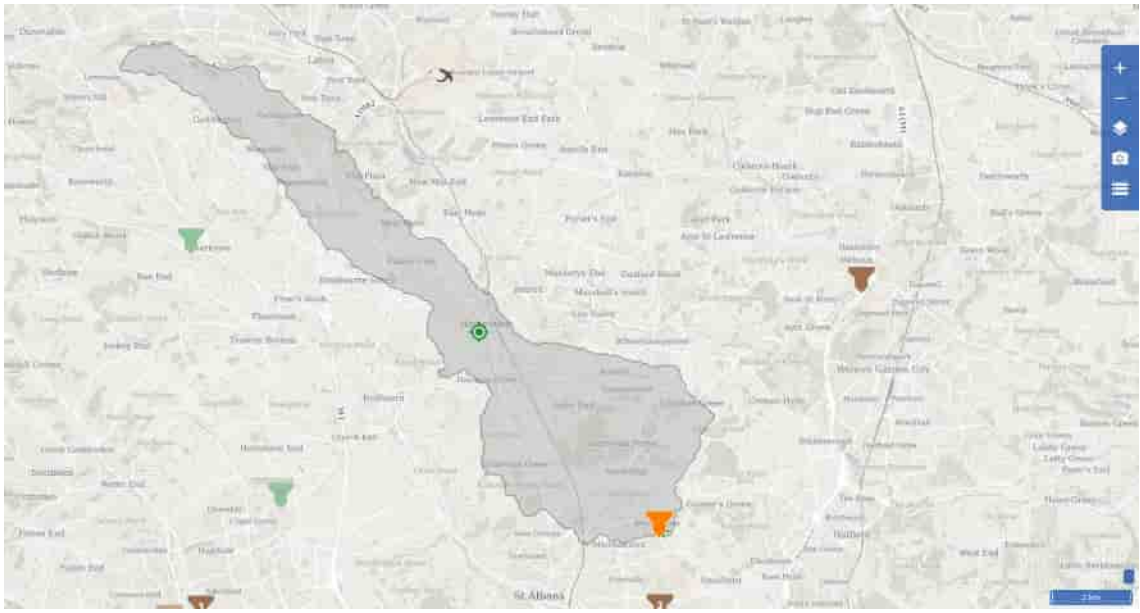
AEP (%)	50	20	10	5	3.33	2	1.33	1	0.5	0.1
AEP	0.5	0.2	0.1	0.05	0.033	0.02	0.0133	0.01	0.005	0.001
Return period (yrs)	2	5	10	20	30	50	75	100	200	1,000

2 METHOD STATEMENT

2.1 Requirements for flood estimates

Overview	The purpose of this study is to assess the large catchment identified on House Lane despite not being a formal watercourse. Hydrographs are required for 3.3%, 3.3%+21cc, 1.0%, 1.0%+21cc, and 0.1% AEP fluvial flood events and to be used as the inflow data for a hydraulic model of the catchment. Climate change allowances have been used are for the 2080s Central (21%) and Higher (25%), however for the purposes for hydrological inflows, only the Central allowance will be used. Large catchment on House Lane to be assessed and to determine which method of producing appropriate hydrographs should be used. While the catchment and flows do not enter the development site, they are significantly large and close enough to the development site to be assessed.
Project scope	A simple to moderate study. Storm events that will be considered are: 3.3%, 1.0% 0.1% (AEP) in accordance with NAFRA2 flood extents. Climate change allowances for Central (21%) and Higher (35%) allowances will be considered. The catchment will be assessed as a lumped catchment.

2.2 The catchment

	
Description	The ungauged catchment starts at the source located near Chaul End, St Albans. The catchment then extends in a southeastern direction, along the rural areas along the M1, A1081 and Luton Road. Before going through a built-up settlement of Harpenden and capturing a large rural area to the east and then reaching House Lane. The catchment is moderately sized (43 km²) and predominantly rural with some urban influence (URBEXT2000 = 0.1106). The soils are relatively permeable (BFIHOST = 0.625), suggesting a high baseflow contribution and reduced surface runoff response. The catchment exhibits moderate runoff potential with an absence of lakes or reservoirs (FARL = 1.0).

2.3 Source of flood peak data

Source	NRFA peak flows dataset, Version 13, released August 2024. This contains data up to water year 2022-2023.
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2.4 Gauging stations (flow or level)

Water-course	Station name	Gauging authority number	NRFA number	Catchment area (km ²)	Type (rated / ultrasonic / level...)	Start of record and end if station closed
Ungauged						

2.5 Other data available and how it has been obtained

Type of data	Data relevant to this study?	Data available?	Source of data	Details
Check flow gaugings	No	N/A	N/A	No flow gauges in catchment
Historical flood data	No	Yes	Environment Agency	No flooding within catchment or on site
Flow or river level data for events	Yes	No	DEFRA	Harpenden river gauge near site for a different catchment
Rainfall data for events	Yes	Yes	DEFRA	Wheathampstead Rainfall Gauge
Potential evaporation data	No	N/A	N/A	
Results from previous studies	No	N/A	N/A	
Other data or information	No	N/A	N/A	Flood Risk Assessment has been done for the site.

2.6 Hydrological understanding of catchment

Conceptual model	The model focuses on the catchment towards House Lane, where the key sites are located south of this location, on the south side of Sandpit Lane. Where flooding is caused predominantly by high intensity rainfall events that generate significant surface runoff. SPRHOST (36.78) indicates that a moderate portion of rainfall becomes quick surface runoff, while BFIHOST (0.625) shows there is still a steady baseflow from groundwater. These suggest the catchment responds quickly to rainfall, especially when the ground is already wet. There are no large-scale storage features or reservoirs in the catchment (FARL = 1), indicating that most rainfall converts directly to runoff with limited attenuation.
Unusual catchment features	The catchment is not located on a river but appears to show a large amount of surface water accumulation on the EA RoFSW maps. Urban extent is relatively low (URBEXT2000 = 0.11), and the urban development is tightly clustered (URBLOC2000 = 0.91), which may lead to localised rapid runoff during intense rainfall.

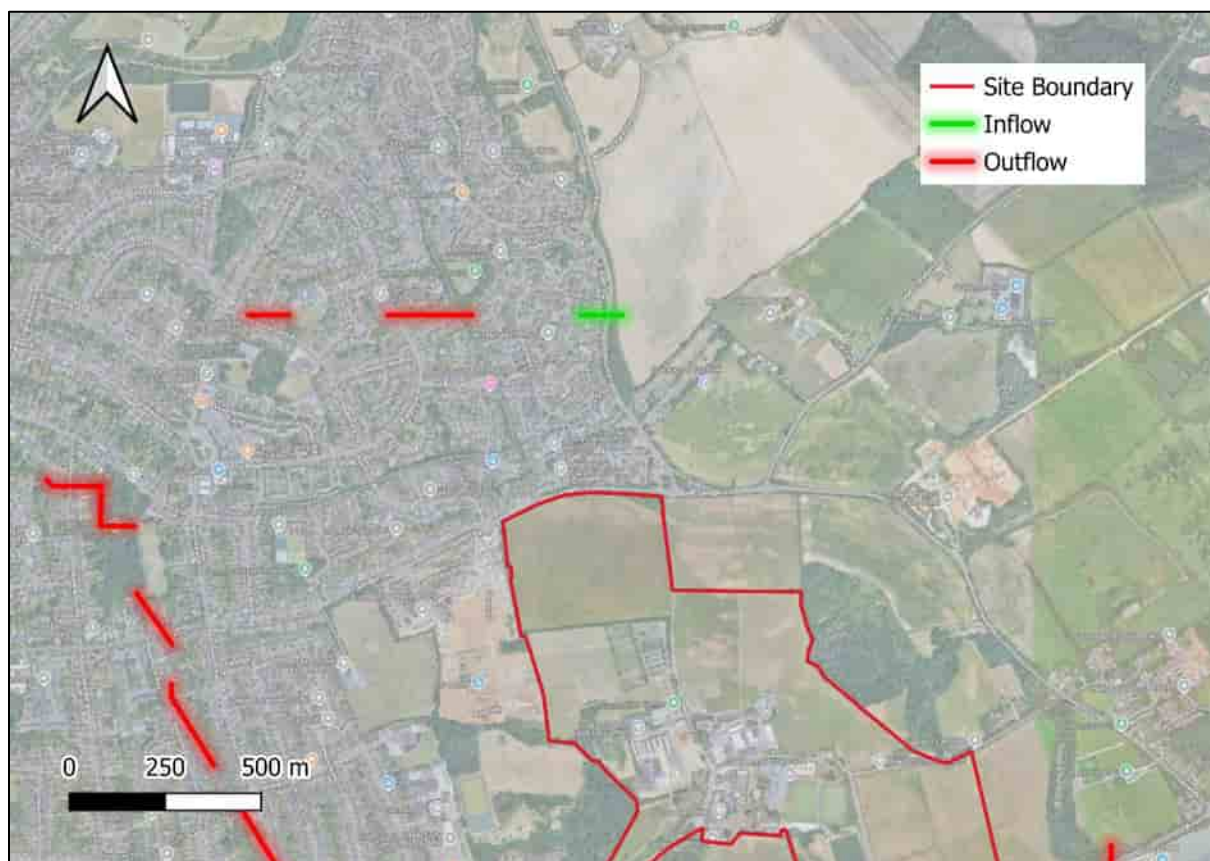
2.7 Initial choice of approach

Is FEH appropriate?	Yes
Initial choice of method(s) and reasons How will hydrograph shapes be derived if needed? Will the catchment be split into sub-catchments? If so, how?	As the catchment is ungauged, observed flow and level records are not available to support the statistical analysis. Therefore, REFH2 rainfall-runoff method has been selected to estimate design flood hydrographs using catchment descriptors. The FEH Statistical Method may be applied as a comparison for peak flow estimates. The catchment will be treated as a lumped catchment.
Software to be used (with version numbers)	FEH Web Service ¹ / FEH22 / WINFAP 5 ² / ReFH2.3

¹ CEH 2015. The Flood Estimation Handbook (FEH) Online Service, Centre for Ecology & Hydrology, Wallingford, UK.

² WINFAP 5 © Wallingford HydroSolutions Limited 2016.
Flood Estimation Report.docx

3 LOCATIONS WHERE FLOOD ESTIMATES REQUIRED



The table below lists the locations of subject sites. The site codes listed below are used in all subsequent tables to save space.

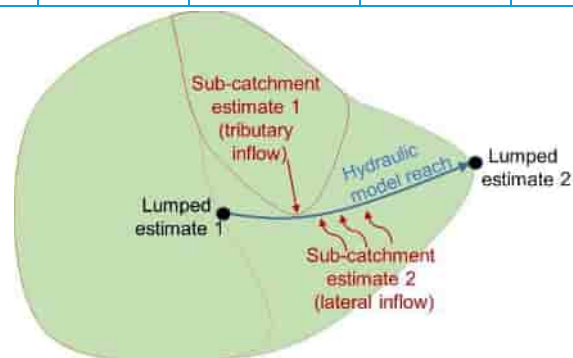
3.1 Summary of subject sites

Site code	Type of estimate L: lumped catchment S: Sub-catchment	Watercourse	Name or description of site	Easting	Northing	AREA on FEH CD-ROM (km ²)	Revised AREA if altered
House Ln	L	N/A	House Lane	517950	208949	43	N/A

Note: Lumped catchments (L) are complete catchments draining to points at which design flows are required.

Sub-catchments (S) are catchments or intervening areas that are being used as inputs to a semi-distributed model of the river system. There is no need to report any design flows for sub-catchments, as they are not relevant: the relevant result is the hydrograph that the sub-catchment is expected to contribute to a design flood event at a point further downstream in the river system. This will be recorded within the hydraulic model output files. However, catchment descriptors and ReFH model parameters should be recorded for sub-catchments so that the results can be reproduced.

The schematic diagram illustrates the distinction between lumped and sub-catchment estimates.



3.2 Important catchment descriptors at each subject site (incorporating any changes made)

Site code	FARL	PROPWET	BFIHOST	DPLBAR (km)	DPSBAR (m/km)	SAAR (mm)	URBEXT 2000	FPEXT
House Ln	1	0.3	0.625	10.5	30.8	673	0.1106	0.0728

3.3 Checking catchment descriptors

Record how catchment boundary was checked and describe any changes	No changes to the catchment boundary as it was reviewed against OS mapping and aerial imagery to confirm alignment with topographic features. No anomalies were identified.
Record how other catchment descriptors were checked and describe any changes.	FEH descriptors have been adopted without modification and are considered suitable.
Source of URBEXT	URBEXT2000.

4 STATISTICAL METHOD

4.1 Application of Statistical method

What is the purpose of applying this method?	The FEH Statistical Method is applied as a sense check to compare peak flow estimates with those generated by the REFH2 rainfall-runoff method.
--	---

4.2 Overview of estimation of QMED at each subject site

Site code	QMED (rural) from CDs (m ³ /s)	Final method	Data transfer				Urban adjustment factor UAF	Final estimate of QMED (m ³ /s)	
			NRFA numbers for donor sites used (see 4.3)	Distance between centroids d _{ij} (km)	Moderated QMED adjustment factor, (A/B) ^a	If more than one donor			
						Weight			Weighted ave. adjustment
Site 1	3.697	CD	N/A				1.184	1.731	
Are the values of QMED spatially consistent?					Yes				
Method used for urban adjustment for subject and donor sites					WINFAP v5 ³				
Parameters used for WINFAP v5 urban adjustment if applicable									
Impervious fraction for built-up areas, IF			Percentage runoff for impervious surfaces, PR _{imp}		Method for calculating fractional urban cover, URBAN				
0.3			70%		From updated URBEXT2000				
Notes									
Methods: AM – Annual maxima; POT – Peaks over threshold; DT – Data transfer (with urban adjustment); CD – Catchment descriptors alone (with urban adjustment); BCW – Catchment descriptors and bankfull channel width (add details); LF – Low flow statistics (add details).									
The QMED adjustment factor A/B for each donor site is moderated using the power term, a, which is a function of the distance between the centroids of the subject catchment and the donor catchment. The final estimate of QMED is (A/B) ^a times the initial (rural) estimate from catchment descriptors.									
Important note on urban adjustment									
The method used to adjust QMED for urbanisation published in Kjeldsen (2010) Error! Bookmark not defined. in which PRUAF is calculated from BFIHOST is not correctly applied in WINFAP-FEH v3.0.003. Significant differences occur only on urban catchments that are highly permeable. This is discussed in Wallingford HydroSolutions (2016) ³ .									

4.3 Search for donor sites for QMED (if applicable)

Comment on potential donor sites	Chosen from the default selection provided by WINFAP 5
----------------------------------	--

4.4 Donor sites chosen and QMED adjustment factors

NRFA no.	Method (AM or POT)	Adjustment for climatic variation?	QMED from flow data (A)	QMED from catchment descriptors (B)	Adjustment ratio (A/B)
38003	AM	No	1.744	4.693	0.372
38011	AM	No	0.404	3.270	0.124
39089	AM	No	0.570	2.909	0.196
39088	AM	No	1.013	5.682	0.178
38021	AM	No	6.580	8.045	0.818
33030	AM	No	8.818	6.188	1.425

³ Wallingford HydroSolutions (2016). WINFAP 4 Urban adjustment procedures.

4.5 Derivation of pooling groups

Name of group	Site code from whose descriptors group was derived	Subject site treated as gauged?	Changes made to default pooling group, with reasons	Weighted average L-moments
House Ln	House Ln	No	None	L-CL: 0.271 L-Skew: 0.215

Note: Pooling groups were derived using the procedures from Science Report SC050050 (2008).

4.6 Derivation of flood growth curves at subject sites

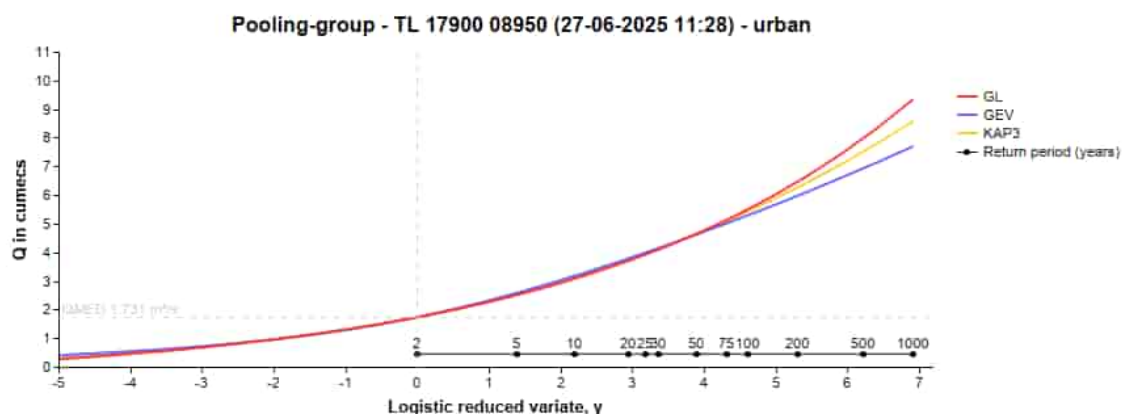
Site code	Method	If P, ESS or J, name of pooling group	Distribution used and reason for choice	Note any urban adjustment or permeable adjustment	Parameters of distribution	Growth factor for 100-year return period / 1% AEP
House Ln	P	TL 17900 08950	Kappa 3 Lowest absolute Z-Value: -0.1586	NO	Loc: 0.924 Scale: 0.333 Shape: -0.149	2.954

Notes

Methods: SS – Single site; P – Pooled; ESS – Enhanced single site; J – Joint analysis

Urban adjustments are all carried out using the method of Kjeldsen (2010).

Growth curves were derived using the procedures from Science Report SC050050 (2008).



4.7 Flood estimates from the statistical method

Site code	Flood peak (m ³ /s) for the following return periods (in years)								
	2	5	10	20	30	50	100	1000	
	Flood peak (m ³ /s) for the following AEP (%) events								
	50	20	10	5	3.3	2	1.0	0.1	
House Lane	1.731	2.536	3.124	3.746	4.134	4.649	5.413	8.574	

5 REVITALISED FLOOD HYDROGRAPH 2 (REFH2) METHOD

5.1 Application of ReFH2 method

What is the purpose of applying this method?	The ReFH2 method has been applied to generate design flood hydrographs and peak flow estimated for a range of return periods.
--	---

5.2 Catchment sub-divisions for ReFH2 model

Catchment treated as a single site with no divisions.

5.3 Parameters for ReFH2 model

Site code	Method	T _p _{rural} (hours)	T _p _{urban} (hours)	C _{max} (mm)	PR _{imp}	BL (hours)	BR
House Lane	CD	9.77	N/A	609.63	70	68.75	2.37
Brief description of any flood event analysis carried out							
Methods: OPT: Optimisation, BR: Baseflow recession fitting, CD: Catchment descriptors, DT: Data transfer (give details)							

5.4 Design events for ReFH2 method: Lumped catchments

Site code	Urban or rural	Season of design event (summer or winter)	Storm duration (hours)
House Lane	Moderately Urban	Winter	1,6,18

5.5 Flood estimates from the ReFH2 method

Site code	Flood peak (m ³ /s) for the following return periods (in years)								
	2	30	+21cc	+35cc	100	+21cc	+35cc	1000	
	Flood peak (m ³ /s) for the following AEP (%) events								
	50	3.3	+21cc	+35cc	1.0	+21cc	+35cc	0.1	
House Lane	1.59	3.76	4.54	5.07	4.77	5.81	6.52	7.61	

6 DISCUSSION AND SUMMARY OF RESULTS

5.6 Comparison of results from different methods

Site code	Ratio of peak flow to FEH Statistical peak					
	Return period 2 years / 50% AEP			Return period 100 years / 1% AEP		
	ReFH	ReFH2	Other method	ReFH	ReFH2	Other method
House Ln	N/A	1.59	1.73	N/A	4.77	5.41

5.7 Final choice of method

Choice of method and reasons.	The catchment area is 43.08 km ² , which lies within the optimal range for the ReFH2 method. For catchments below 50–100 km ² , FEH statistical estimates can be less robust due to limited gauged data influencing pooling groups.
How will the flows be applied to a hydraulic model?	TUFLOW model will use the hydrograph as an inflow for hydraulic modelling.

5.8 Assumptions, limitations and uncertainty

List the main assumptions made (specific to this study)	Assumes that the entire catchment behaves as a single, lumped unit (uniform rainfall, soil type, land use, etc.). A winter profile applied to the REHF2 method is most representative for the catchment based off soil conditions and URBEXT2000. The estimation point at House Lane behaves like a watercourse catchment and that the hydrograph produced is representative of the catchment response. To remain consistent with the following study on flood risk, and peak rainfall analysis on the development site, storm durations of 1h, 6h and 18h were chosen because they represent cases where surface water and river flood peaks occur at the same time.
Discuss any particular limitations	Lack of catchment flow data on the site to verify the peak flow estimates generated in this study. 0.1% AEP estimates have been derived and have a large degree of uncertainty.
Provide information on the uncertainty in the design peak flow estimates and the methodology used	REFH2 peak flow results do not include formal confidence intervals. Comparison with statistical estimates provided a cross-check on the robustness of the results. High degree of uncertainty is present due to lack of gauged data to verify the results.
Comment on the suitability of the results for future studies	This work has been used to inform a site-specific flood risk assessment. Future use of these flows should satisfy themselves that these parameters are appropriate for the subject site and has been considered prior to reusing the results of these estimates.
Give any other comments on the study	No additional comments

5.9 Checks

Are the results consistent, for example at confluences?	Single flow estimation and therefore consistent
What do the results imply regarding the return periods / frequency of floods during the period of record?	N/A Ungauged Catchment
What is the range of 100-year / 1% AEP growth factors? Is this realistic?	The 1% AEP event growth factors vary between 3.13 and 3. Which is within the typical range of 2.1 to 4.0.
If 1000-year / 0.1% AEP flows have been derived, what is the range of ratios for 1000-year / 0.1% AEP flow over 100-year / 1% AEP flow?	The 0.1% / 1% AEP event ratios vary between 1.58 and 1.60 which are within the typical range (1.3-1.8)
How do the results compare with those of other studies? Explain any differences and conclude which results should be preferred.	N/A.
Are the results compatible with the longer-term flood history?	N/A.
Describe any other checks on the results	No other checks have been undertaken.

5.10 Final results

Site code	Flood peak (m ³ /s) for the following return periods (in years)									
	2	30	+21cc	+35cc	100	+21cc	+35cc	1000		
	Flood peak (m ³ /s) for the following AEP (%) events									
	50	3.3	+21cc	+35cc	1.0	+21cc	+35cc	0.1		
House Lane	1.59	3.76	4.54	5.07	4.77	5.81	6.52	7.61		

5.11 Uncertainty bounds

This table reports the flows derived from the uncertainty analysis detailed in Section 5.8. The 'true' value is more likely to be near the estimate reported in Section 5.10 than the bounds. However, it is possible that the 'true' value could still lie outside these bounds.

Site code	Flood peak (m³/s) for the following return periods (in years)							
	2		20		100		1,000	
	Flood peak (m³/s) for the following AEP (%) events							
	50		5		1		0.1	
	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper
House Lane	N/A							

If flood hydrographs are needed for the next stage of the study, where are they provided? (e.g. give filename of spreadsheet, hydraulic model, or reference to table below)	BR31287 Sandpit Lane, St Albans\Rev03\2d\hydrology
---	--

6 ANNEX

Pooled Group (Pool URBEXT Limit: 0.1)

AM Data Suitability Catchment Descriptors								
	Station	Distance (SDM)	Years of data	QMED AM	L-CV Observed	L-CV Deurbanised	L-SKEW Observed	L-SKEW Deurbanised
1	38020 (Cobbins Brook @ Sewar	0.301	52	7.402	0.325	0.335	0.331	0.321
2	26015 (Driffield Canal @ Wansfo	0.332	13	2.490	0.170	0.173	0.092	0.088
3	36004 (Chad Brook @ Long Mel	0.372	56	4.799	0.301	0.302	0.181	0.180
4	26013 (Driffield Trout Stream @	0.378	13	2.700	0.269	0.270	0.281	0.280
5	39089 (Gade @ Bury Mill)	0.406	50	0.609	0.232	0.237	0.100	0.094
6	53017 (Boyd @ Bitton)	0.425	50	13.908	0.238	0.240	0.087	0.084
7	39033 (Winterbourne Stream @	0.464	61	0.399	0.337	0.337	0.378	0.377
8	30004 (Lymn @ Partney Mill)	0.503	61	7.128	0.226	0.227	0.037	0.036
9	7011 (Black Burn @ Pluscarden	0.544	11	4.298	0.495	0.495	0.581	0.580
10	30006 (Slea @ Leasingham Mill)	0.563	38	1.758	0.304	0.311	0.213	0.206
11	41020 (Bevern Stream @ Clappe	0.564	54	13.780	0.199	0.200	0.164	0.162
12	36007 (Belchamp Brook @ Bard	0.574	58	4.630	0.374	0.375	0.114	0.114
13								
14								
15								
16								

APPENDIX B : SITE INFORMATION

TOPOGRAPHICAL & MEASURED BUILDING SURVEYS

ABBREVIATIONS & SYMBOLS

[illegible]

DRAWING NOTES

Topographical Surveys

Trees are drawn to scale showing the average canopy spread. Descriptions and heights should be used as a guide only.

All building names, descriptions, number of storeys, construction type including roof line details are indicative only and taken externally from ground level.

All below ground details including drainage, voids and services have been identified from above ground and therefore all details relating to these features including; sizes, depth, description etc will be approximate only. All critical dimensions and connections should be checked and verified prior to starting work.

Detail, services and features may not have been surveyed if obstructed or not reasonably visible at the time of the survey.

Surveyed physical features may not necessarily represent the legal boundary line.

Measured Building Success

Measurements to internal walls are taken to the wall finishes at approx 1m above the floor level and the wall assumed to be vertical.

[illegible]

General

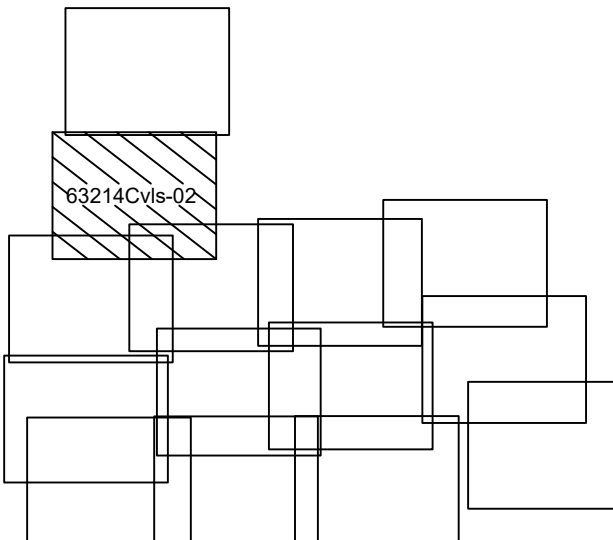
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Sheet Layout



SURVEY CONTROL CO-ORDINATES

SURVEY CONTROL CO-ORDINATES				
STATION	EASTINGS	NORTHINGS	LEVEL	DESCRIPTION
GF01	518081.760	278005.048	85.980	Nail
GF101	518121.853	27742.205	85.574	Nail
GF102	518106.511	27857.041	86.457	Nail
GF103	518049.847	27808.524	86.699	Nail
GF1000	518049.845	27808.531	86.699	Nail
BA01	518166.209	27741.703	85.169	Nail
JF02	518274.744	27775.533	81.862	Nail
AT02	518048.433	27868.149	84.573	Nail
AT03	518049.028	27786.603	85.820	Nail
S431	518245.211	27786.956	83.755	Nail

SURVEY GRID AND LEVEL DATUM

The coordinate system established for this survey is related to Ordnance Survey (OS) National Grid at multiple points using GNSS with a scale factor of 1.000.

The level datum established for this survey is related to Ordnance Survey (OS) using GPS Smartnet.

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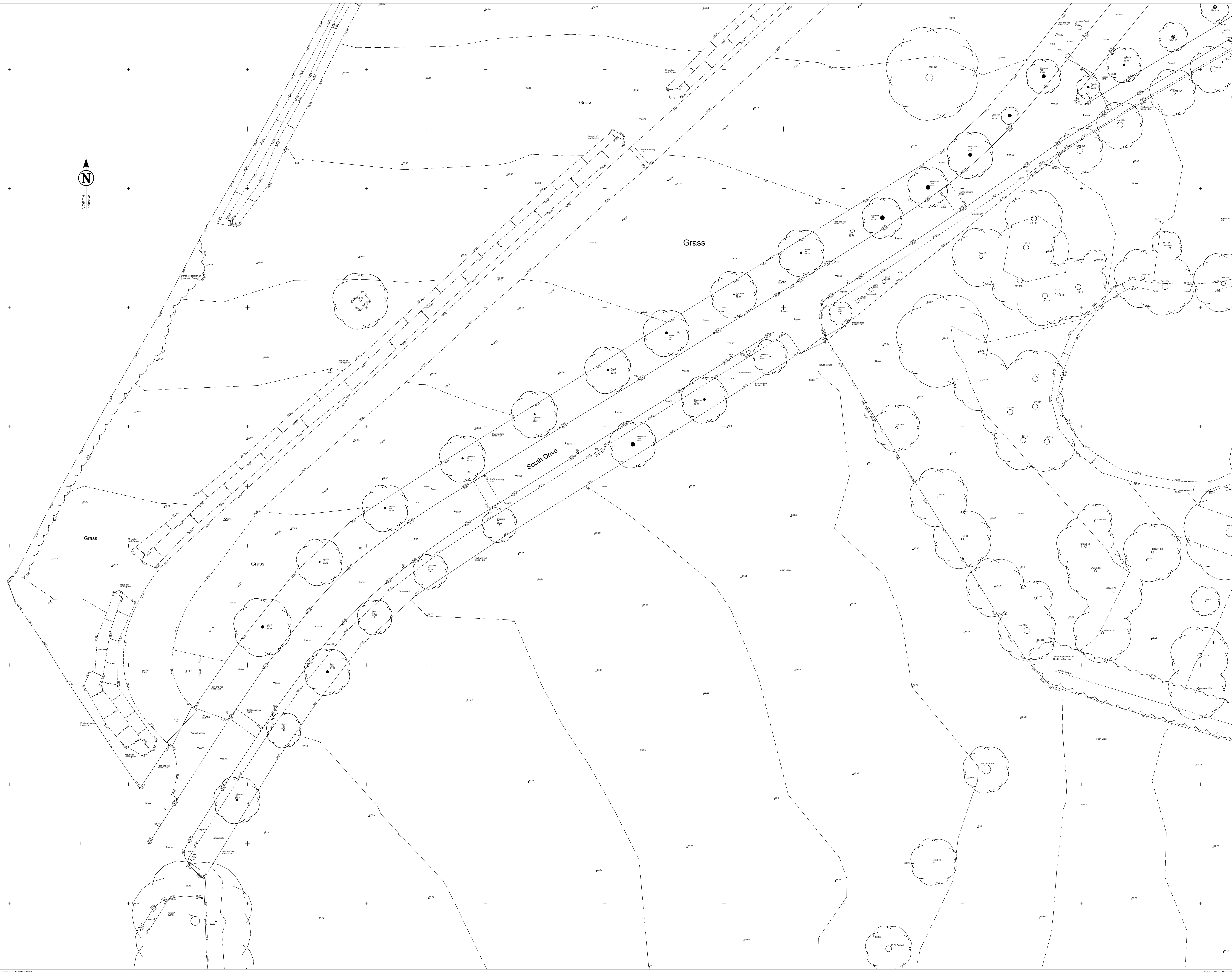
IPSWICH ECKFORD BIRMINGHAM BRISTOL COVENTRY CRAWLEY GLASGOW

PROJECT TITLE
OAKLANDS COLLEGE, Hatfield Rd, ST ALBANS

DRAWING DETAIL
TOPOGRAPHICAL SURVEY
Sheet 2 of 10

CLIENT FUSION PROJECT MANAGEMENT				SCALE 1:200
SURVEYOR DP,GF,BT	SURVEY DATE 23/10/2024	CHECKED BY BM	APPROVED BY DB	DWG STATUS FINAL
DRAWING NUMBER 63214CVLS-02			REVISION	ISSUE DATE 1/11/2024





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[illegible]

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Measured Building Surveys

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[illegible]

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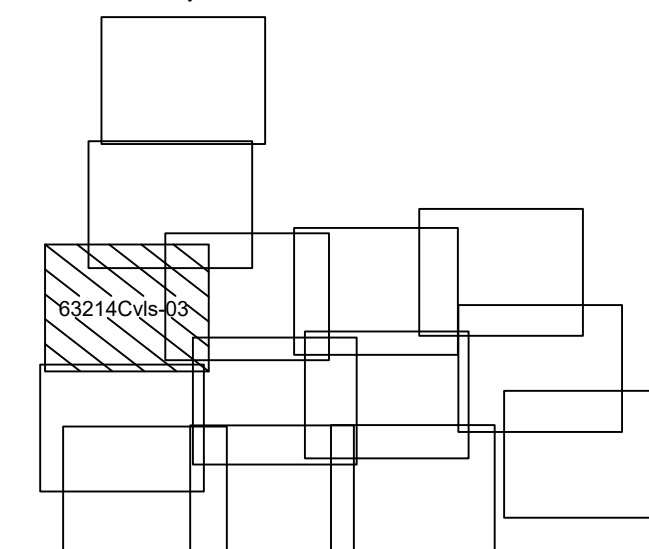
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STATIONS	EASTINGS	NORTHINGS	LEVEL	DESCRIPTION
GF01	518081.760	207805.048	85.980	Nail
GF101	518021.853	207742.205	85.574	Nail
GF102	518106.511	207857.041	86.457	Nail
GF103	518049.847	207808.524	86.699	Nail
GF1000	518049.845	207808.531	86.699	Nail
BA01	518166.209	207741.703	85.619	Nail
JF02	518274.744	207715.533	81.862	Nail
AT02	518048.433	207688.149	84.573	Nail
AT03	518049.028	207786.603	85.820	Nail
S431	518245.211	207786.956	83.755	Nail

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PROJECT TITLE
OAKLANDS COLLEGE, Hatfield Rd, ST ALBANS

HERTFORDSHIRE, AL4 0JA
DRAWING DETAIL

TOPOGRAPHICAL SURVEY
Sheet 3 of 19

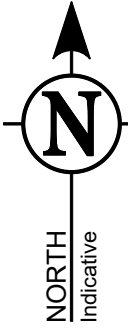
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FUSION PROJECT MANAGEMENT				1:200
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DP,GF,BT	23/10/2024	BM	DB	FINAL
DRAWING NUMBER			REVISION	ISSUE DATE

63214CVLS-03		1/11/2024
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Topographical Surveys

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General

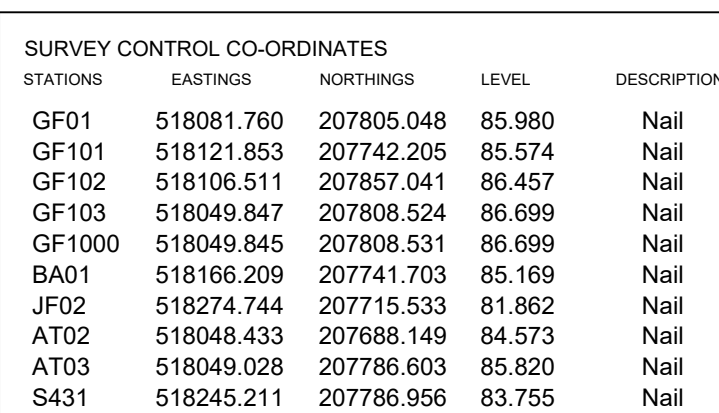
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REV	DESCRIPTION	DRAWN	APPR	DATE
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HERTFORDSHIRE AL4 0JA

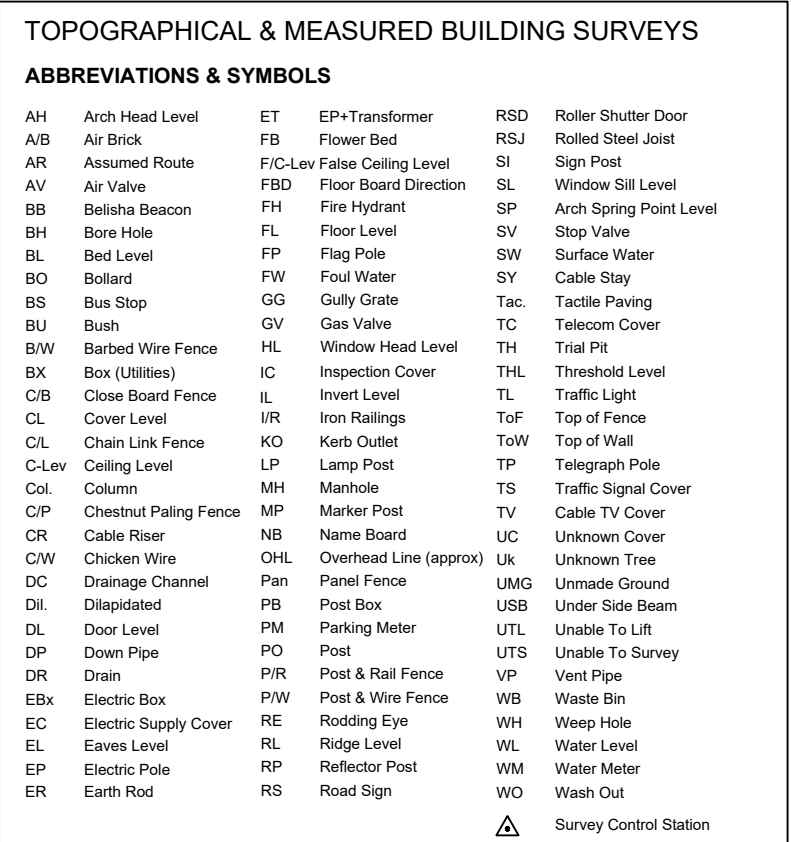
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TOPOGRAPHICAL SURVEY

Sheet 4 of 19	
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DP,GP,B1	23/10/2024	BW	DB	FINAL
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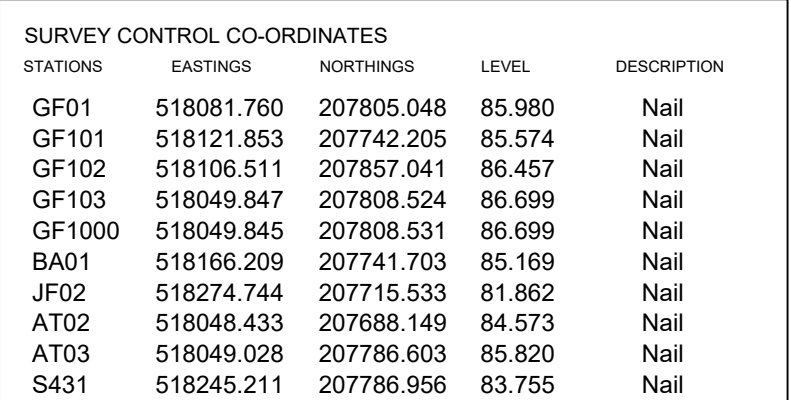




The survey control listed is only to be used for topographical surveys at the stated scale. All control must be checked and verified prior to use.

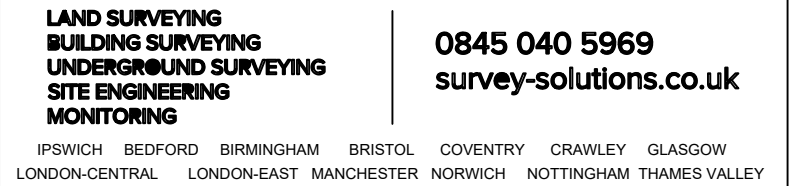
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REV	DESCRIPTION	DRAWN	APPR	DATE
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PROJECT TITLE				OAKLANDS COLLEGE, Hatfield Rd, St ALBANS HERTFORDSHIRE, AL4 0JA	
DRAWING DETAIL					
TOPOGRAPHICAL SURVEY					
Sheet 8 of 19					
CLIENT				SCALE	
FUSION PROJECT MANAGEMENT				1:200	
SURVEYOR	SURVEY DATE	CHECKED BY	APPROVED BY	DWS STATUS	
DP.GF.BT	23/10/2024	BM	DB	FINAL	
DRAWING NUMBER			REVISION	ISSUE DATE	
632146CVLS-08			1/1	1/1/2024	





DRAWING NOTES

Topographical Surveys

Trees are drawn to scale showing the average canopy spread. Descriptions and heights are drawn up as a guide only.

All building names, descriptions, number and stores, construction type including roof details are indicative only and taken externally from ground level.

All below ground details including drainage, voids and services have been taken from above ground and therefore all details relating to these features including: sizes, depth, description etc will be approximate only. All critical dimensions and connections should be checked and verified prior to starting.

Detail, services and features may not have been surveyed if obstructed or not reasonably visible at the time of the survey.

Surveyed physical features may not necessarily represent the legal boundary line.

Measured Building Surveys

Measurements to internal walls are taken to the wall finishes at approx 1m above the floor level and the wall assumed to be vertical.



REV	DESCRIPTION	DRAWN	APPR	DATE
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PROJECT TITLE OAKLANDS COLLEGE, Hatfield Rd, ST ALBANS HERTFORDSHIRE, AL4 0JA			
DRAWING DETAIL TOPOGRAPHICAL SURVEY Sheet 11 of 19			
CLIENT FUSION PROJECT MANAGEMENT			SCALE 1:200
SURVEYOR DP.GF.BT	SURVEY DATE 23/10/2024	CHECKED BY BM	APPROVED BY DB DWG STATUS FINAL
DRAWING NUMBER 63214C/CLS-11		REVISION	ISSUE DATE 1/11/2024



DRAWING NOTES

Topographical Surveys

Trees are drawn to scale showing the average canopy spread. Descriptions and heights should be used as a guide only.

All building names, descriptions, number of storeys, construction type including roof line details are indicative only and taken externally from ground level.

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Detail, services and features may not have been surveyed if obstructed or not reasonably visible at the time of the survey.

Measurements to internal walls are taken to the wall finishes at approx 1m above the floor level and the wall assumed to be vertical.

General

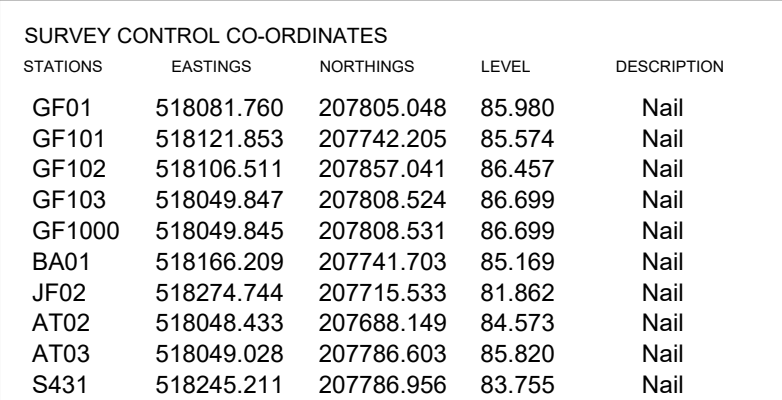
The contractor must check and verify all site and building dimensions, levels, utilities and drainage details and connections prior to commencing work. Any errors or discrepancies must be notified to Survey Solutions immediately.

The accuracy of the digital data is the same as the plotting scale implies. All dimensions are in metres unless otherwise stated.

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SURVEY GRID AND LEVEL DATUM

The coordinate system established for this survey is related to Ordnance Survey (OS) National Grid at multiple points using GNSS with a scale factor of 1.000.

The level datum established for this survey is related to Ordnance Survey (OS) using GPS Smartnet.

To avoid discrepancies within the survey, adding to the survey or setting out points from the survey, any coordinated data must be directly derived from the original survey control. Survey Solutions are not responsible for any third-party adding survey data to the existing information.



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LONDON/ESSEX LONDON/STAFF MANCHESTER NORWICH NOTTINGHAM THAMES VALLEY

PROJECT TITLE				OAKLANDS COLLEGE, Hatfield Rd, ST ALBANS HERTFORDSHIRE, AL4 0JA	
DRAWING DETAIL				SCALE	
TOPOGRAPHICAL SURVEY				1:200	
Sheet 12 of 19					
CLIENT					
FUSION PROJECT MANAGEMENT					
SURVEYOR	SURVEY DATE	CHECKED BY	APPROVED BY	DWG STATUS	
DP.GF.BT	23/10/2024	BM	DB	FINAL	
DRAWING NUMBER			REVISION	ISSUE DATE	
63214CVLS-12				1/11/2024	

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DRAWING NOTES

Topographical Surveys

Trees are drawn to scale showing the average canopy spread. Descriptions and heights should be used as a guide only.

All below ground details including drainage, voids and services have been identified from above ground and therefore all details relating to these features including; sizes, depth, description etc will be approximate only. All critical dimensions and connections should be checked and verified prior to starting work.

Detail, services and features may not have been surveyed if obstructed or not reasonably visible at the time of the survey.

Surveyed physical features may not necessarily represent the legal boundary line.

Measured Building Surveys

Measurements to internal walls are taken to the wall finishes at approx 1m above the floor level and the wall assumed to be vertical.

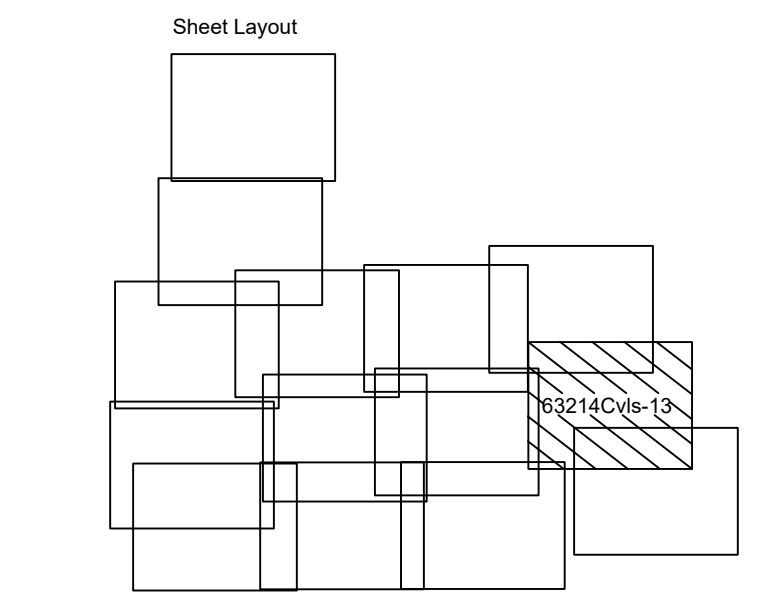
General

The contractor must check and verify all site and building dimensions, levels, utilities and drainage details and connections prior to commencing work. Any errors or discrepancies must be notified to Survey Solutions immediately.

The accuracy of the digital data is the same as the plotting scale implies. All dimensions are in metres unless otherwise stated.

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This drawing should only be scaled using digital methods.



SURVEY CONTROL CO-ORDINATES				
STATION	EASTINGS	NORTHINGS	LEVEL	DESCRIPTION
GF01	518081.760	207805.048	85.980	Nail
GF101	518121.852	207825.205	85.974	Nail
GF102	518106.511	207827.041	86.457	Nail
GF103	518049.847	207808.524	86.699	Nail
GF1000	518049.845	207808.531	86.699	Nail
BA01	518166.209	207741.703	85.189	Nail
JF02	518274.744	207715.533	81.862	Nail
AT02	518048.433	207688.149	84.573	Nail
AT04	518049.028	207786.603	85.620	Nail
S431	518245.211	207786.956	83.755	Nail

SURVEY GRID AND LEVEL DATUM

The coordinate system established for this survey is related to Ordnance Survey (OS) National Grid at multiple points using GNSS with a scale factor of 1.000.

The level datum established for this survey is related to Ordnance Survey (OS) using GPS Smartnet.

To avoid discrepancies within the survey, adding to the survey or setting out points from the survey, any coordinated data must be directly derived from the original survey control. Survey Solutions are not responsible for any third-party adding survey data to the existing information.

REV	DESCRIPTION	DRAWN	APPR	DATE
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LONDON-CENTRAL LONDON-EAST MANCHESTER NORMICH NOTTINGHAM THAMES VALLEY

PROJECT TITLE
OAKLANDS COLLEGE, Hatfield Rd, ST ALBANS

HERTFORDSHIRE, AL4 0JA

DRAWING DETAIL
TOPOGRAPHICAL SURVEY
Sheet 13 of 19

CLIENT FUSION PROJECT MANAGEMENT				SCALE 1:200
SURVEYOR DP,GF,BT	SURVEY DATE 23/10/2024	CHECKED BY BM	APPROVED BY DB	DWG STATUS FINAL
DRAWING NUMBER 63214CVLS-13			REVISION	ISSUE DATE 1/11/2024



[illegible]

Topographical Surveys

Trees are drawn to scale showing the average canopy spread. Description heights should be used as a guide only.

All building names, descriptions, number of storeys, construction type incl. roof line details are indicative only and taken externally from ground level.

All below ground details including drainage, voids and services have been identified from above ground and therefore all details relating to these features including; sizes, depth, description etc will be approximate only. All critical dimensions and connections should be checked and verified prior to start of work.

Detail, services and features may not have been surveyed if obstructed or reasonably visible at the time of the survey.

Surveyed physical features may not necessarily represent the legal boundary.

Measured Building Surveys

Measurements to internal walls are taken to the wall finishes at approx 1m above the floor level and the wall assumed to be vertical.

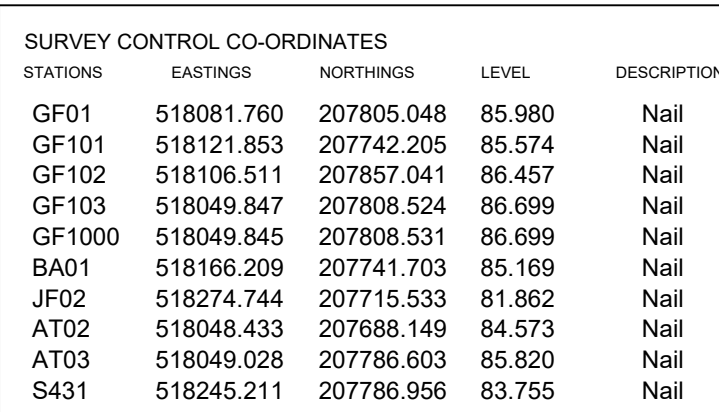
General

The contractor must check and verify all site and building dimensions, level, utilities and drainage details and connections prior to commencing work. Any errors or discrepancies must be notified to Survey Solutions immediately.

The accuracy of the digital data is the same as the plotting scale implies. All dimensions are in metres unless otherwise stated.

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SURVEY GRID AND LEVEL DATUM

The coordinate system established for this survey is related to Ordnance Survey (OS) National Grid at multiple points using GNSS with a scale factor of 1.00

The level datum established for this survey is related to Ordnance Survey (4) using GPS Smartnet.

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OAKLANDS COLLEGE, Hatfield Rd, ST ALBANS
HERTFORDSHIRE AL4 0JA

DRAWING DETAIL

TOPOGRAPHICAL SURVEY
Sheet 15 of 19

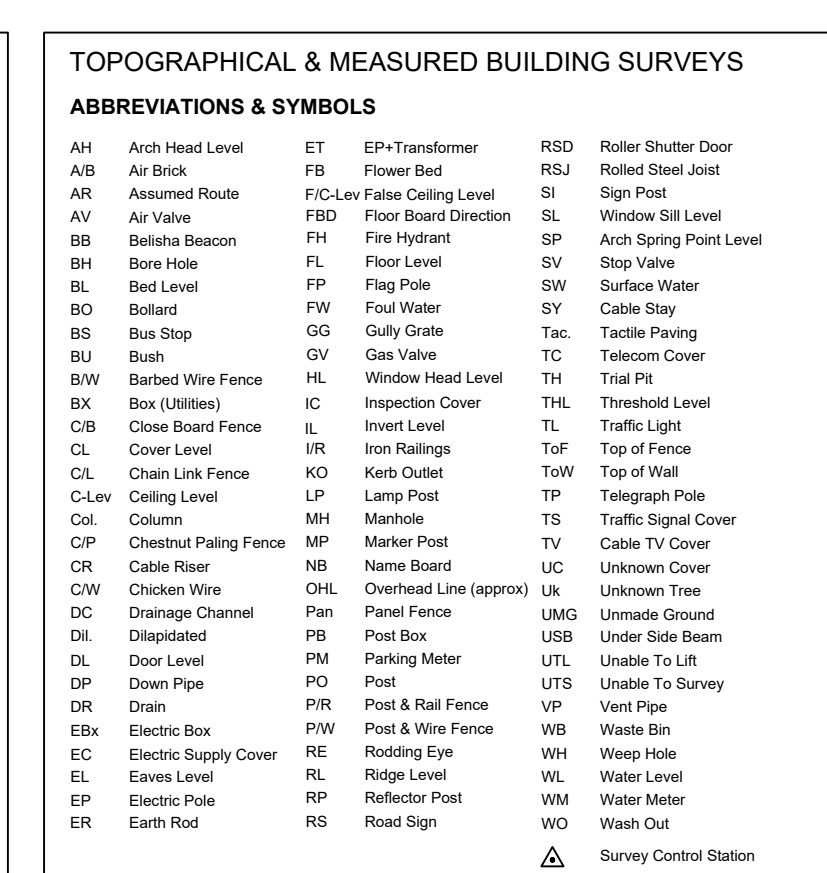
CLIENT	SCALE
FUSION PROJECT MANAGEMENT	1:200

SURVEYOR D.C.F.B.T.	SURVEY DATE 23/10/2024	CHECKED BY B.M.	APPROVED BY D.B.	DWG ST FINAL
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DWG, GP, B1	28/10/2024	BW	DB	FIRME
DRAWING NUMBER BETA-PLAN-B-17			REVISION	ISSUE D 1 (1.1.0)

63214CVLS-15		1/11/2
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Trees are drawn to scale showing the average canopy spread. Descriptions and heights should be used as a guide only.

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Measured Building Surveys

Measurements to internal walls are taken to the wall finishes at approx 1m above the floor level and the wall assumed to be vertical.

General

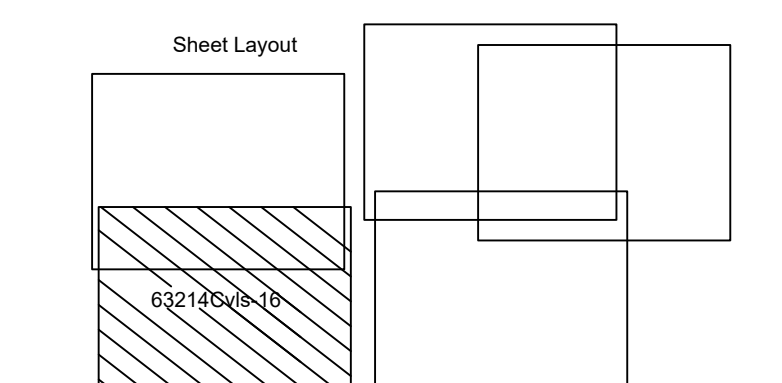
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SURVEY CONTROL CO-ORDINATES				
STATIONS	EASTINGS	NORTHINGS	LEVEL	DESCRIPTION
GF01	180801.760	207805.048	85.980	Nail
GF101	1801821.853	207742.205	85.574	Nail
GF102	1811206.511	207857.041	86.457	Nail
GF103	1801804.847	207808.524	86.699	Nail
GF1000	1801804.845	207808.531	86.699	Nail
BA01	1816616.209	207741.703	85.169	Nail
BF02	180274.744	207715.533	81.862	Nail
AT02	1801848.433	207688.149	84.573	Nail
AT03	1801848.028	207786.603	85.820	Nail
S431	180295.211	207786.956	83.755	Nail

The level datum established for this survey is related to Ordnance Survey (OS) National Grid at multiple points using GNSS with a scale factor of 1.000.

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REV	DESCRIPTION	DATE	BY	DATE
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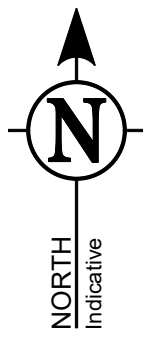
PROJECT TITLE
OAKLANDS COLLEGE, 1105 HILL BL., ST. ALBANS

ORLANDS COLLEGE, HATHERS RQ, ST ALBANS
HERTFORDSHIRE, AL4 0JA

DRAWING DETAIL
TOPOGRAPHICAL SURVEY
Sheet 16 of 19

CLIENT FUSION PROJECT MANAGEMENT				SCALE 1:200
SURVEYOR DP,GF,BT	SURVEY DATE 23/10/2024	CHECKED BY BM	APPROVED BY DB	DWG STATUS FINAL
DRAWING NUMBER 63214CVLS-16			REVISION	ISSUE DATE 1/11/2024





DRAWING NOTES

Topographical Surveys

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Measured Building Surveys

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General

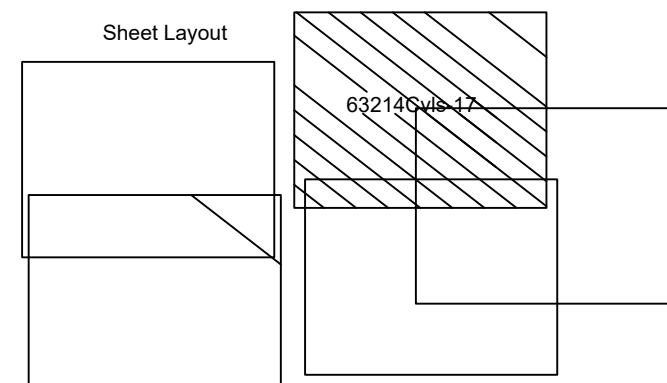
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SURVEY CONTROL CO-ORDINATES				
STATIONS	EASTINGS	NORTHINGS	LEVEL	DESCRIPTION
GF01	518081.760	207805.048	85.980	Nail
GF101	518121.853	207742.205	85.574	Nail
GF102	518102.181	207857.041	86.547	Nail
GF103	518049.847	207898.524	85.998	Nail
GF1000	518049.845	207808.531	86.699	Nail
BA01	518166.209	207741.703	85.169	Nail
JF02	518274.744	207715.533	81.862	Nail
AT02	518048.433	207688.149	84.573	Nail
AT01	518049.028	207786.603	85.820	Nail
S431	518245.211	207786.956	83.755	Nail

SURVEY GRID AND LEVEL DATUM

The coordinate system established for this survey is related to Ordnance Survey (OS) National Grid at multiple points using GNSS with a scale factor of 1.000.

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REV	DESCRIPTION	DRAWN	APPR	DATE
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PROJECT TITLE OAKLANDS COLLEGE, Hatfield Rd, ST ALBANS HERTFORDSHIRE, AL4 0JA			
DRAWING DETAIL TOPOGRAPHICAL SURVEY Sheet 17 of 19			
CLIENT FUSION PROJECT MANAGEMENT			SCALE 1:200
SURVEYOR DP/GF,BT	SURVEY DATE 23/10/2024	CHECKED BY BM	APPROVED BY DB
DRAWING NUMBER 63214CVLS-17			DWG STATUS FINAL
		REVISION	ISSUE DATE 11/11/2024