



Hydrotec and Engineering Consultants

Develop Design Deliver

Drainage Strategy and SuDS

50 Amos Avenue, Manchester

June 2024

CLIENT:

Mr Hasnaat Saeed

Reference: 24/drainage/SuDS/Amos Ave/Manchester

INSTRUCTION:

Hydrotec and Engineering Consultants was commissioned by Mr Hasnaat Saeed to carry out a drainage strategy and SuDS design for the proposed residential development at 50 Amos Avenue, Manchester, M40 2RS.

SCHEME:

Erection of a detached dwelling with associated access road, car parking and landscape amenities.

REQUIREMENT:

Surface water drainage strategy and SuDS design for the proposed residential development to assist the planning application requirement.

DOCUMENT REVIEW & APPROVAL

Prepared by Dr Mahmud Ahsan BSc MSc PhD MIAHR

Reviewed by Dr Mahmud Ahsan BSc MSc PhD MIAHR

Approved by Mr Hasnaat Saeed

Executive Summary

A flood risk assessment (FRA) and surface water drainage strategy were conducted to assist the planning application requirement for the proposed development on the land at 50 Amos Avenue, Manchester, M40 2RS. The national grid reference number of the development site is SJ 88356 99760 (“the Site”). The proposed development is the erection of a four-bedroom detached dwelling with an associated access road, off-road car parking and landscape amenities.

The present FRA and surface water drainage strategy of the Site were made with the available information including the latest Environment Agency’s (EA) flood maps, the latest FEH hydrological data, topographical elevation data (LiDAR), soil map data and sewer maps data of United Utilities.

The present investigation suggests that the Site is in flood zone 1 and, therefore, the Site is considered to be out of fluvial and coastal flood risk.

The Site is at a low surface water flood risk - according to the EA’s flood map; Moreover, the hydrological and topographical elevation data suggest that the impact of the overland flow from the Site’s surroundings would be minimal. In addition, the Site is not at risk of groundwater or reservoir flows. The Site is also not considered to be a foul water flood risk.

The attenuation storage calculation was performed for the generated surface water runoff within the Site and no external flow was taken into account from the surrounding areas. The investigation was made at 20% AEP, 10% AEP, 3.3% AEP and 1% AEP including climate change allowance to assist the sustainable drainage systems (SuDS) design. The attenuation requirements for the whole site at 3.3% AEP and 1% AEP are 6m³ and 8m³; and with climate change allowance 10m³ and 15m³, respectively.

The proposed development would have some increase in the impervious surface area, however, this increment of the impermeable land would not deteriorate the surface water drainage substantially to the Site itself or its surrounding areas by the excess surface water runoff. In addition, the proposed eco-friendly layout design and landscape amenities would assist in a better drainage system. Furthermore, the proposed blue-green SuDS features, such as an underground attenuation tank, vegetated garden and plantation, would significantly improve the sustainable

drainage systems, local environmental biodiversity and water quality compared to the existing conditions. The infiltration rate of the soils beneath the Site is not good enough for soakaway design. There are no watercourses in close proximity to the Site, however, there is an existing sewer drainage network under Verona Drive and, therefore, in the proposed surface water drainage strategy - the excess surface water runoff would be attenuated on-site in addition to discharge in the existing drainage network of United Utilities, taking into control of greenfield runoff rate.

The on-site surface water attenuation requirement for the proposed development would be based on 1% AEP plus a 45% climate change allowance for the proportionate increased impervious surface area (i.e. 2.12m^3 , taking into account 2.0 litres/sec greenfield runoff rate) without deterioration of the Site itself or surrounding areas, a requirement of the LLFA. Therefore, this excess surface water runoff of 2.12m^3 would be stored on the west side in an underground attenuation tank.

The size of the attenuation crates would be 2.0m in length, 1.25m in width and 0.75m in depth. A 300mm thick gravel layer would surround the crates, and the crates' and gravel's combined attenuation storage capacity would be approximately 2.30m^3 which is more than the requirement.

In addition, there would be a green roof including a rear side vegetated garden, ACO drains and drainage pipes network to facilitate surface water drainage. The diameter of the surface water drainage pipes would be 100mm and the gradient of the pipes would be 1 in 100 or more to assist in gravity flow.

The periodic inspection and maintenance of the drainage features including the water quality of the outfalls would be maintained, and the owner of the dwelling would be responsible for these services.

The Site is not a risk to surface water drainage and therefore the finished ground floor level of the proposed dwelling would be at ground level, however, raising the finished ground floor level by an additional 150mm is highly recommended. The access and egress from the Site during any flooding incident would be at Amos Avenue and/or Verona Drive located adjacent to the Site.

The generated wastewater flow by the proposed development was estimated to be 0.05 litres/sec. The diameter of the foul water drainage pipes would be 100mm and the gradient of the pipes would be 1 in 100 or more to maintain the gravity flow.

The generated foul water flow would be discharged to the existing drainage network of the United Utilities located at Verona Drive. The general observation of the United Utilities sewer drainage network in the surrounding areas suggests that the proposed development would not make any significant impact on the existing sewer drainage network systems. However, a confirmation of consent agreement from United Utilities is required before the utilisation of the proposed development.

Table of Contents

Executive Summary.....	2
1 Introduction.....	8
1.1 Background of the project site	8
2 Potential sources of the flood risk.....	10
2.1 Fluvial and coastal flood risk.....	11
2.2 Surface water drainage	12
2.3 Sewer flood risk	17
3 Flood attenuation storage requirement.....	18
4 SuDS layout design	24
5 Management and maintenance plan of drainage infrastructures.....	26
6 Finished floor level and access/egress from the Site.....	28
7 Conclusions.....	29

List of the Figures

Figure 1.1: The location and existing condition of the proposed development site.....	9
Figure 1.2: The layout of the proposed development.....	10
Figure 2.1: The fluvial and coastal flood risk at the Site - flood zone 1, the land having flood risk less than 0.1% AEP fluvial or coastal flows (reference – EA’s flood map).....	11
Figure 2.2: Groundwater/reservoir flow at the Site – a very low flood risk against the groundwater or reservoir flows (reference – EA’s flood map).....	12
Figure 2.3: Surface water drainage at the Site – a low flood risk against the surface water flow (reference – EA’s flood map).	14
Figure 2.4: The hydrological sub-catchments at the Site (indicative overland flow paths in blue arrow lines); reference of the FEH22.	15

Figure 2.5: The LiDAR topographical elevation at the Site.	16
Figure 3.1: The photograph of the existing condition at the Site, front side.	19
Figure 3.2: The soil types beneath the Site – slowly permeable, seasonally wet and acid- loamy and clayey soils (reference - Soilsmap map data of Cranfield University).	23
Figure 4.1: The SuDS layout at the Site.	25

List of the Tables

Table 3.1: The surface area of the pre-development and post-development at the Site.....	19
Table 3.2: The cumulative depth-duration rainfall at 20% AEP, 10% AEP, 3.3% AEP and 1% AEP at the Site.	20
Table 3.3: Surface water attenuation storage requirement at 20% AEP, 10% AEP 3.3% AEP and 1% AEP including climate change allowance at the Site.	22
Table 5.1: Operation and maintenance requirements for filter drains.	27
Table 5.2: Operation and maintenance requirements for an attenuation storage tank.	27

List of the Appendices

Appendix I: The detailed layout of the proposed development.	32
Appendix II: Sewer drainage network data at the Site, reference to United Utilities.	35
Appendix III: Details of SuDS layout design at the Site.	37
Appendix IV: Details of the cross-section of the attenuation tank design at the Site.....	38
Appendix V: The scheme of the green roof system and design.....	39
Appendix VI: A sample of hydro-valve, a vortex flow control device (1-5 litres/sec).....	40
Appendix VII: Photographs of the trial pits for on-site soil percolation tests.....	41
Appendix VIII: Photograph of the UU's existing manhole at Verona Drive	42

Abbreviations

AEP	Annual Exceedance Probability
CCA	Climate Change Allowance
DWF	Dry Weather Flow
DTM	Digital Terrain Model
EA	Environment Agency
FEH	Flood Estimation Handbook
FRA	Flood Risk Assessment
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
mAOD	meter Above Ordnance Datum
NGR	National Grid Reference
OS Map	Ordnance Survey Map
SuDS	Sustainable Drainage Systems

1 Introduction

The flood risk and sustainable drainage are important aspects of any new and existing development sites. The flood, which has been enhanced in recent times due to the global climate change effects, could make vulnerable the properties, communities, and many aspects of human life. Therefore, it is important nowadays to assess the flood risk of any new developments; and the National Planning Policy Framework¹ (NPPF) guidelines have given the authority to the Environment Agency² (EA) and local planning authority (LPA) to make sure that any developments should be considered the flood risk assessment from all possible sources for the planning authorisation. These are not only securing the minimum risk at the proposed development site but also reducing the risk to the other existing developments.

Generally, a new development would provide an improvement with better facilities to the users and the communities, but it should also make a satisfaction that the proposed development would not and should not deteriorate to on-site and/or off-site other existing developments in the surrounding areas during its design life. Therefore, it has been a policy of the NPPF, lead local flood authority (LLFA), LPA, water utility companies and other relevant authorities to assess and manage the sustainable surface water drainage systems of all possible sources for a proposed development before granting the planning permission. Thus, the aim of the present flood risk assessment is to assist the planners and designers with blue-green sustainable drainage systems design for the proposed residential development as well as reduce the flood risk to the other existing developments in the surrounding areas.

1.1 Background of the project site

The proposed development (hereafter “the Site”) is the erection of a four-bedroom detached dwelling with an associated access road, off-road car parking and landscape amenities. According to the NPPF guidelines, the proposed development would therefore be classified as a more vulnerable category in terms of flood risk vulnerability classification³. The Site is located

¹ [National Planning Policy Framework - GOV.UK \(www.gov.uk\)](https://www.gov.uk)

² [Flood risk assessments if you're applying for planning permission - GOV.UK \(www.gov.uk\)](https://www.gov.uk)

³ [National Planning Policy Framework - Annex 3: Flood risk vulnerability classification - Guidance - GOV.UK \(www.gov.uk\)](https://www.gov.uk)

on the land at 50 Amos Avenue, Manchester, M40 2RS. The national grid reference number (NGR) of the Site is SJ 88356 99760. The geographical boundary of the project site lies within the Manchester Council's remit who is the lead local flood authority (LLFA), providing advice and guidance for sustainable drainage systems (SuDS) for this development site. The existing condition of the Site comprises vegetated grassland and impermeable land. The Site is located at the corner of Amos Avenue to the north and Verona Drive to the west.



Figure 1.1: The location and existing condition of the proposed development site.

There is no watercourse in close proximity to the Site, whereas River Medlock is situated in the west, approximately 260m away from the Site to the south. A railway track line is located on the south side, approximately 170m away from the Site and Southill Road is in front of the Site. Generally, the adjacent areas consist of predominantly residential areas and a large vegetated area is situated to the south.

A satellite photograph of the existing condition of the project site is shown in Figure 1.1, and the proposed layout of the development is given in Figure 1.2 in addition to the detailed layout of the proposed development in Appendix I. The total land surface of the proposed development is approximately 409m², whereas the surface area footprint of the proposed dwelling building is approximately 92m².

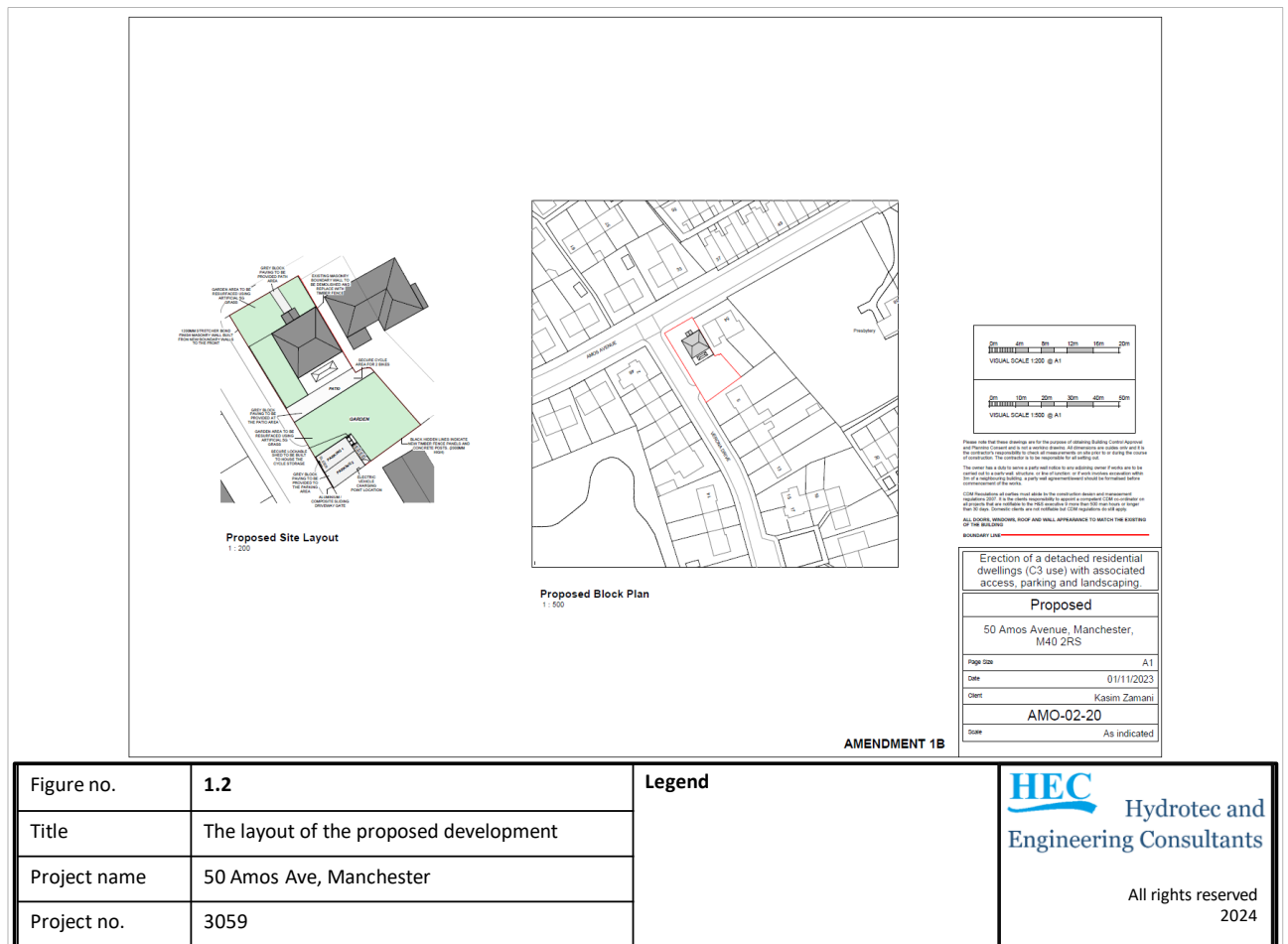


Figure 1.2: The layout of the proposed development.

2 Potential sources of the flood risk

The proposed development is the erection of a four-bedroom detached dwelling with an associated access road, car parking and landscape amenities; thus, it is a requirement by LLFA to ensure the provision of appropriate flood risk assessment and sustainable drainage of the

surface water within the development, to promote safe and resilient communities, assisting by Environment Agency⁴ (EA) and LLFA.

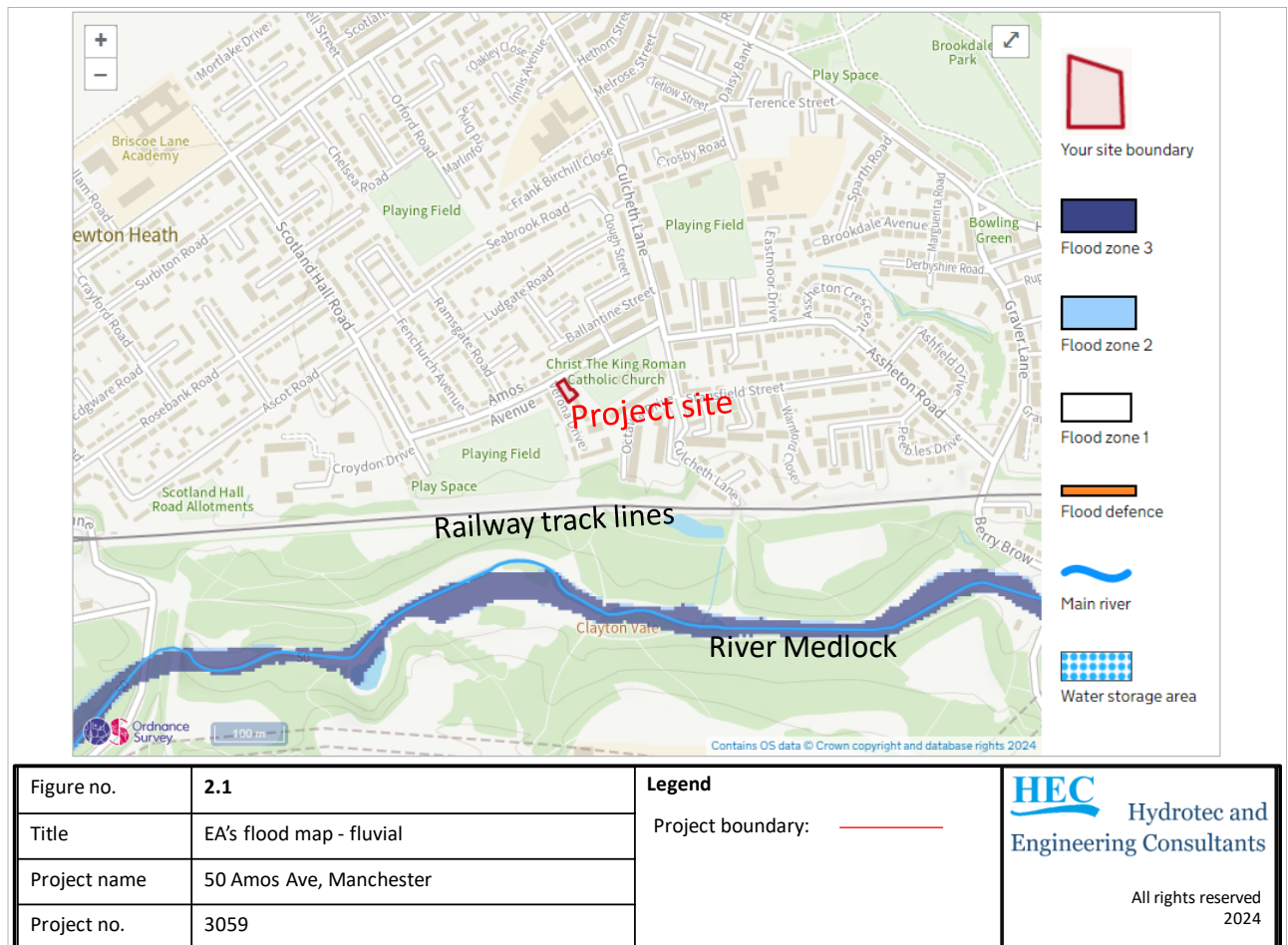


Figure 2.1: The fluvial and coastal flood risk at the Site - flood zone 1, the land having flood risk less than 0.1% AEP fluvial or coastal flows (reference – EA’s flood map⁵).

2.1 Fluvial and coastal flood risk

The Environment Agency’s flood map⁶ indicates that the Site is located in flood zone 1, a risk of flooding less than 0.1% AEP (Annual Exceedance Probability), i.e. less than 1 in 1000-year flood event for the fluvial or coastal flows (Figure 2.1). Therefore, the proposed development site is

⁴ [Flood risk assessments if you're applying for planning permission - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/publications/flood-risk-assessments-if-youre-applying-for-planning-permission)

⁵ [Flood map for planning - GOV.UK \(flood-map-for-planning.service.gov.uk\)](https://www.gov.uk/government/publications/flood-map-for-planning)

⁶ [Flood map for planning - GOV.UK \(flood-map-for-planning.service.gov.uk\)](https://www.gov.uk/government/publications/flood-map-for-planning)

considered to be out of either fluvial or coastal flows. In addition, the EA's flood map⁷ suggests that the Site is not at flood risk from the groundwater or reservoir flows (Figure 2.2).

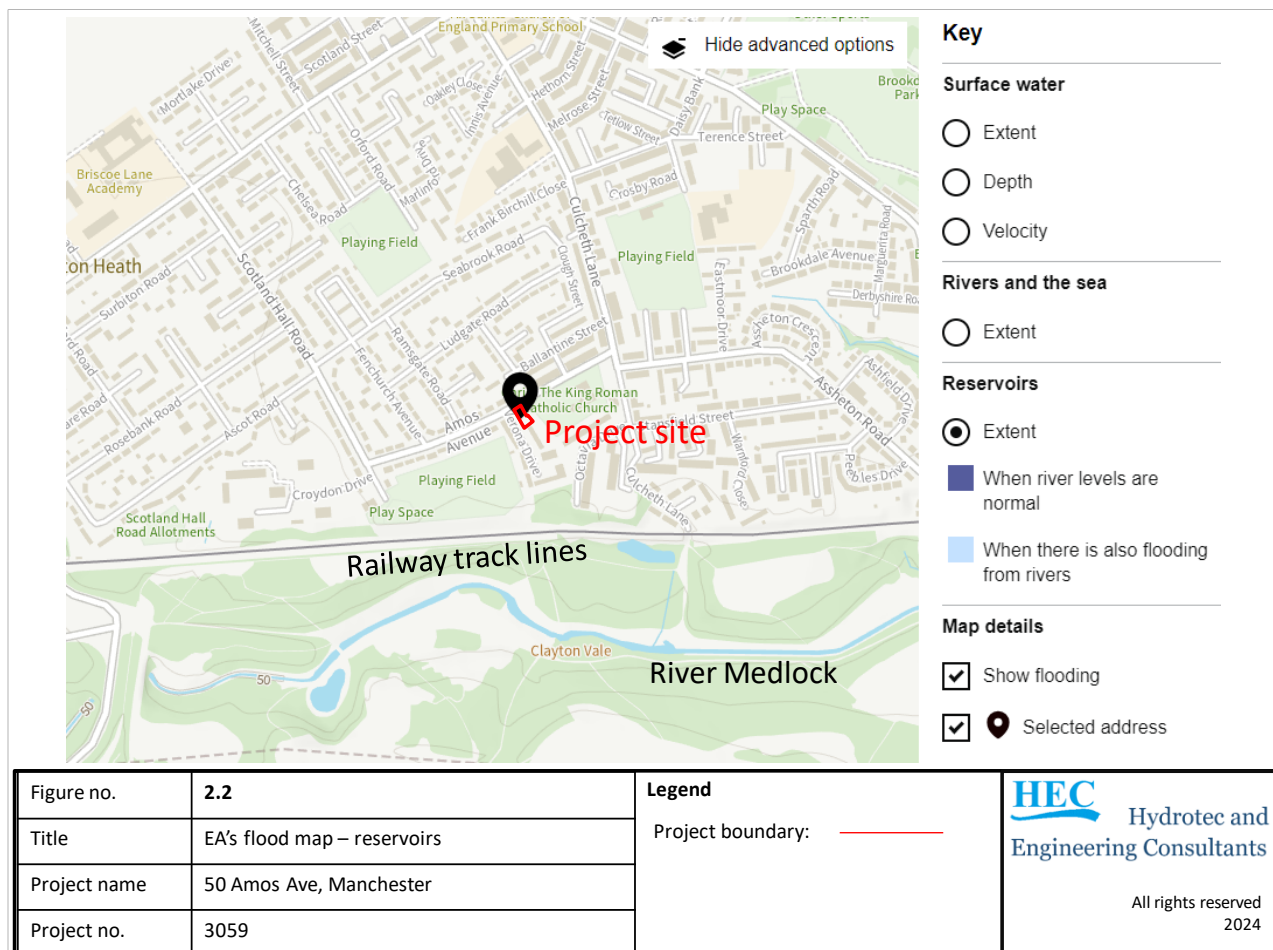


Figure 2.2: Groundwater/reservoir flow at the Site – a very low flood risk against the groundwater or reservoir flows (reference – EA's flood map⁸).

2.2 Surface water drainage

The guidance of the Environment Agency and LLFA based on the national planning policy framework⁹ (NPPF) recommends the avoidance of the increase in surface water flooding through requirements for sustainable drainage systems (SuDS) and minimising the area of impermeable surface. Moreover, the NPPF para 167 suggests that “when determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere.

⁷ [Check the long term flood risk for an area in England - GOV.UK \(flood-warning-information.service.gov.uk\)](https://www.gov.uk/flood-warning-information.service.gov.uk)

⁸ [Check the long term flood risk for an area in England - GOV.UK \(www.gov.uk\)](https://www.gov.uk)

⁹ Op. cit.

Where appropriate, applications should be supported by a site-specific flood-risk assessment.” Therefore, the surface water drainage measures should have a neutral or better effect on the risk of flooding both on and off the site, taking into account rain falling on the site and runoff from adjacent areas.

NPPF, LLFA and EA’s guidance takes a presumption against development in a 1 in 30-year hydrological event to the surface water drainage. Development should only be allowed in an area at risk from a 1 in 100-year (with climate change allowance (CCA)) if surface water drainage is manageable without any major risk to the development itself or other surrounding areas. It should be shown that in such cases surface water flows can be contained within the development and any flooding flood volumes do not affect third-party lands, flood the property, or obstruct the key access/egress routes.

Therefore, to achieve the guidance’s requirements of the surface water drainage at the Site, the surface water flooding mechanism at the on-site and off-site was assessed with appropriate consideration.

The EA’s surface water flood map¹⁰ (Figure 2.3) indicates that the Site would stay at a low flood risk to surface water drainage (i.e. a low risk means that each year this area has a chance of flooding of between 0.1% AE|P and 1% AEP). Therefore, the Site would be considered to be a low hazard to surface water drainage.

Generally, the surface water overland flow is highly affected by the topographical features which define hydrological sub-catchments. For a better understanding of the surface water runoff around the Site, the hydrological sub-catchments were obtained from the Flood Estimation Handbook¹¹ (FEH22) and the data are presented in Figure 2.4.

¹⁰ [Your long term flood risk assessment - GOV.UK \(check-long-term-flood-risk.service.gov.uk\)](https://www.gov.uk/check-long-term-flood-risk)

¹¹ [Map - FEH Web Service \(ceh.ac.uk\)](https://www.ceh.ac.uk/map)

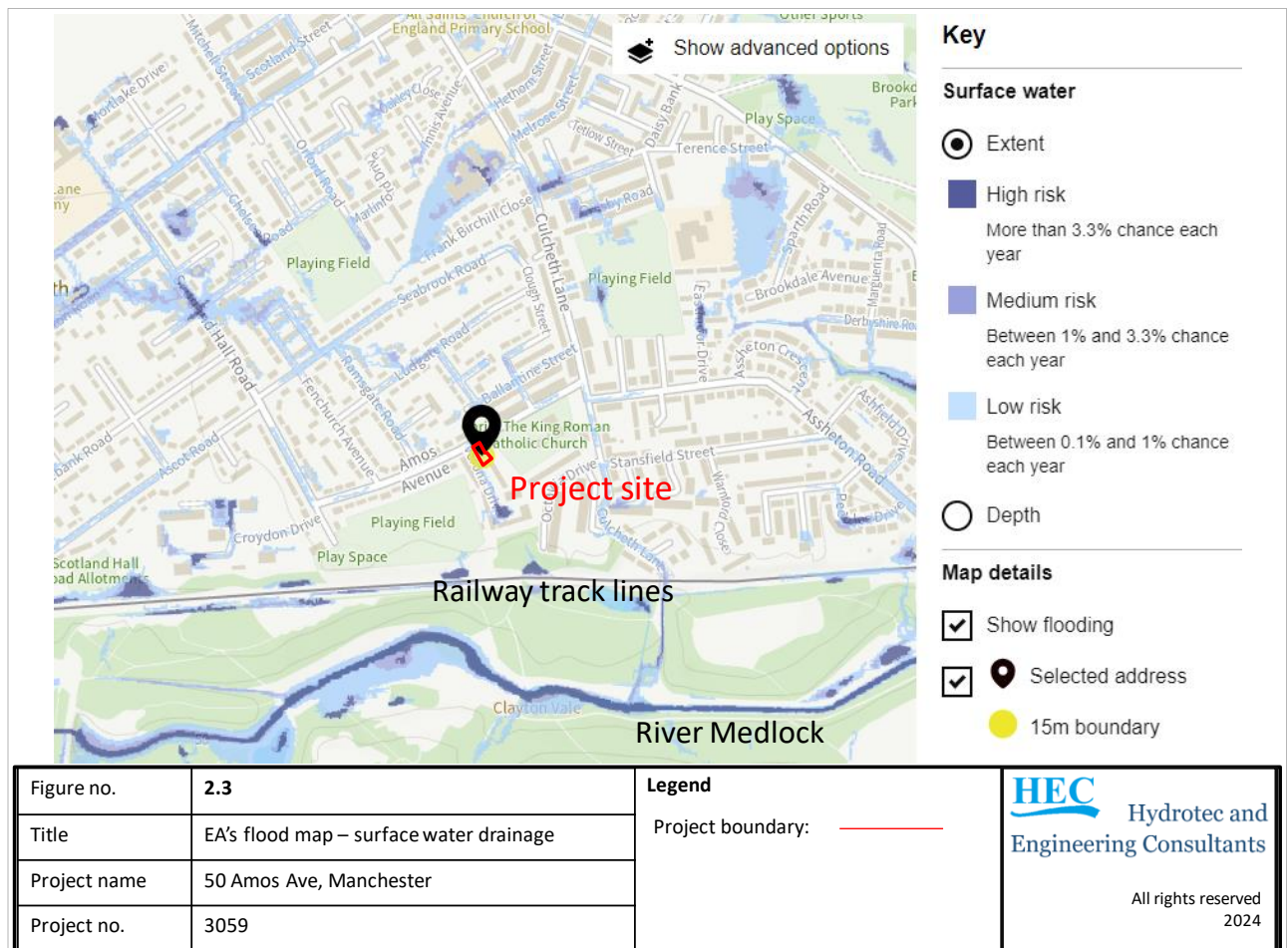


Figure 2.3: Surface water drainage at the Site – a low flood risk against the surface water flow (reference – EA's flood map¹²).

The hydrological sub-catchments that could have a possible impact on the Site are presented in Figure 2.4, and the indicative flow paths of the surface water runoff are shown in the blue arrow lines. The Site is located in a hydrological sub-catchment which drains the overland flow southerly into River Medlock. The railway track lines situated on the south side of the Site and across the flow paths of this sub-catchment would not obstruct the surface water drainage as there are underpasses, allowing southerly surface water drainage. The contributing surface area of this sub-catchment that could have a possible impact on the Site is very small, i.e. approximately 0.02km². Subsequently, the impact of the overland flow from this sub-catchment would be very minor. The adjacent sub-catchment located in the north would convey the overland flow southwesterly through local drains and discharge into River Medlock, further west of the Site

¹² [Check the long term flood risk for an area in England - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/publications/check-the-long-term-flood-risk-for-an-area-in-england)

and stay away from any overland flow contribution towards the Site. The eastern sub-catchment would drain the surface water runoff southerly into River Medlock and would not have any impact of the overland flow to the Site. Finally, the far northern sub-catchments would convey the overland westerly through local drains and would stay out of the Site. Thus, the effective overland flow contribution to the Site from the adjacent areas would be minimal.

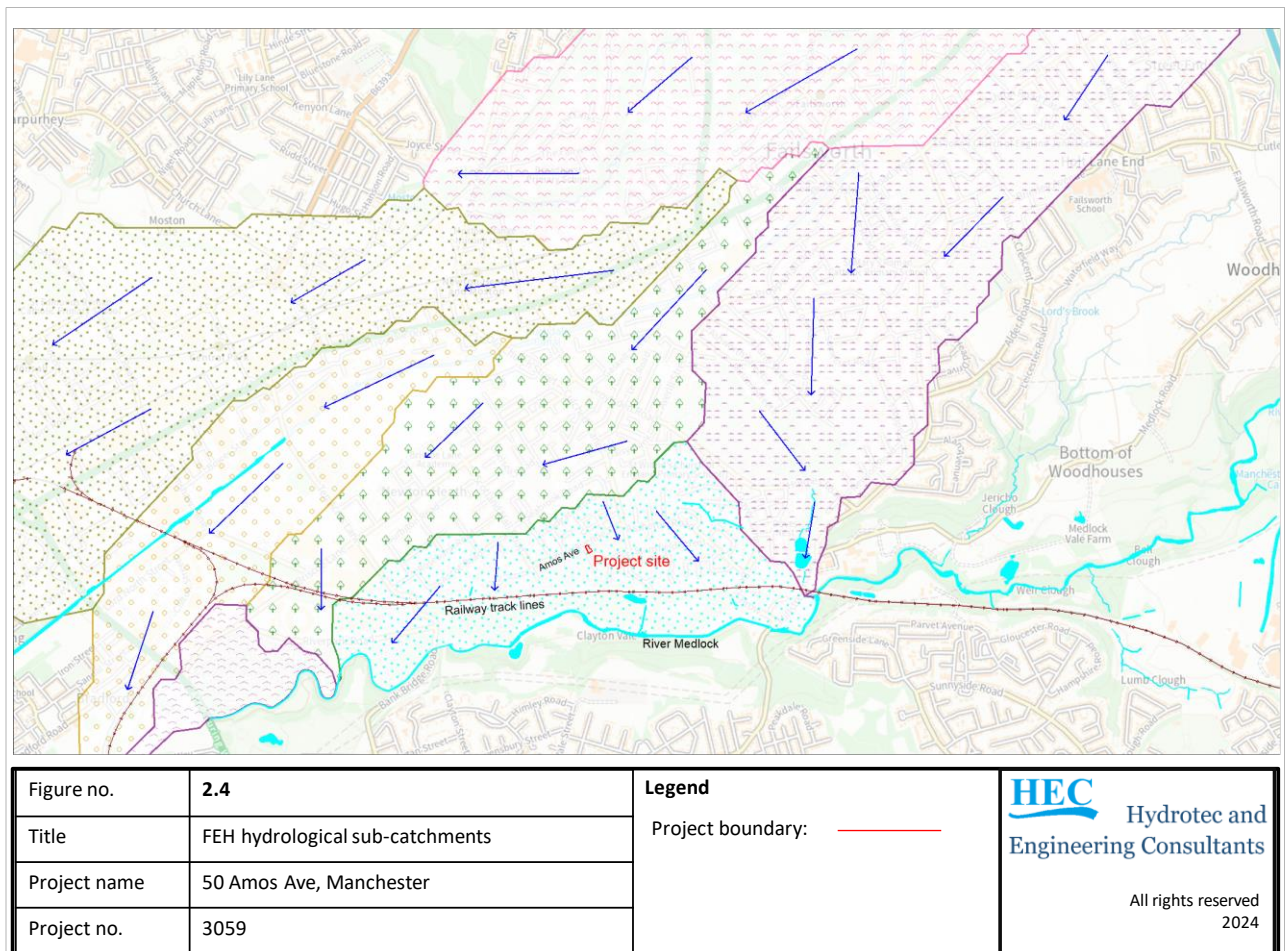


Figure 2.4: The hydrological sub-catchments at the Site (indicative overland flow paths in blue arrow lines); reference of the FEH22¹³.

¹³ op. cit.

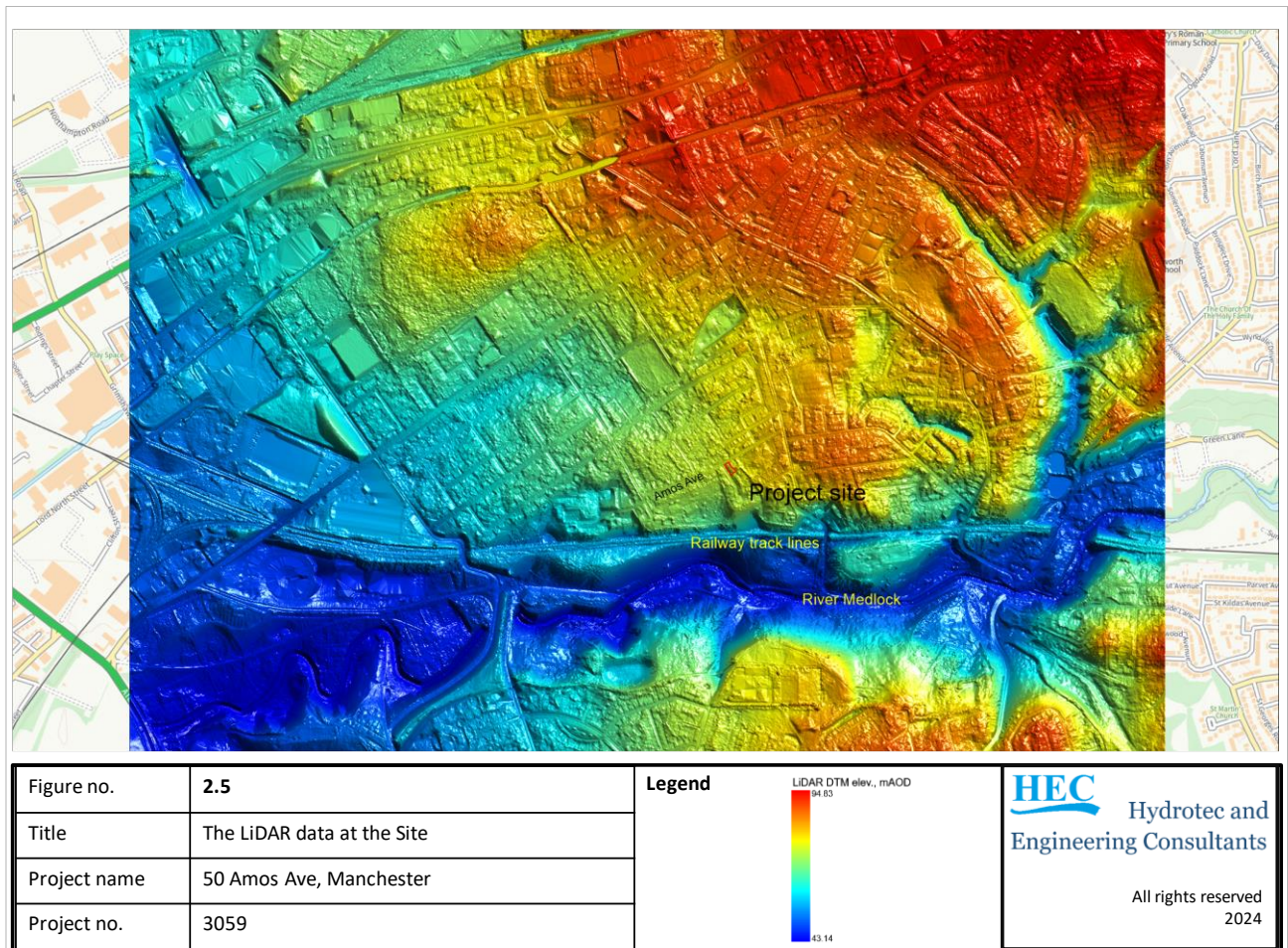


Figure 2.5: The LiDAR topographical elevation at the Site.

The intensity and magnitude of the overland flow and path on the ground surface would have a significant effect due to the ground elevation. Therefore, for an understanding of the complexity of the overland flow mechanisms, the topographical elevation at the Site was assessed based on the recent LiDAR¹⁴ (Light Detection and Ranging) DTM (Digital Terrain Model) data (Figure 2.5).

The LiDAR elevation data suggest that the ground level in the far northeastern area is relatively higher and declines to the south. However, only a small part of the overland flow from this area would flow southerly towards the Site and the overall impact of the overland flow would be minimal. Moreover, the local drainage infrastructures would intercept surface water runoff and convey it through local drainage systems. In addition, the Rochdale Canal is located to the north

¹⁴ [Defra Data Services Platform](#)

and, therefore, it is very unlikely that any overland flow from the northern part of the canal would flow across the canal to the south. Thus, most of the southerly overland flow would stay away from the Site. In addition, most of the far southern areas are relatively much lower ground levels; therefore, the overland flow from the adjacent site area would flow relatively fast to drain away. Thus, the surrounding areas including the Site would not be a surface water flood hazard.

Therefore, the contributing surface water runoff from the off-site to the Site would be very low and subsequently, the Site would not be considered any off-site surface water flood risk. Thus, the surface water runoff generated by the proposed development would mainly be from the rainfall on the Site. Subsequently, a drainage strategy for this excess generated surface water runoff would be required to be managed by sustainable drainage systems (SuDS), according to the LLFA guidance.

2.3 Sewer flood risk

The proposed development is the erection of a four-bedroom detached dwelling. Therefore, the proposed development would generate foul water flow by the occupants.

The sewer drainage network data (see also Appendix II) obtained from United Utilities indicate that the existing sewer drainage network systems around the Site are combined, i.e. conveying surface and foul water flows in the same pipe. There are existing 225mm diameter pipes under Verona Drive and Amos Avenue, and both sewer drainage pipes convey the flow westerly. There are existing manholes recorded on the United Utilities' sewer map on Amos Avenue, however, there are also existing United Utilities' manholes under Verona Drive (see Appendix VII) within close proximity to the Site. There are no records of the cover and invert levels of the existing manholes, however, the sewer connection from the proposed drainage network would be made to assist in gravity flow to the United Utilities's sewer drainage network.

The proposed drainage network would be separate, i.e. conveying surface and foul water flow through the different pipes. However, the final drainage outfall to the United Utilities' network would be combined. Therefore, it would be suitable for the proposed drainage network to utilise the existing public sewer drainage network, i.e. the final outfall would be made at the manhole located under Verona Drive.

For estimation of the generated foul water by the proposed development, the standard guidelines of foul water design were followed. The foul water generation would be highly variable during the days or nights and throughout the year. Considering the standard guidelines from the Sewer for Adoption¹⁵, the typical peak dry weather flow (DWF) for this type of catchment is considered to be 0.05 litres per sec per dwelling. Therefore, the generated peak foul water by this development would become 0.05 litres/sec.

The general observation of the sewer drainage network in the surrounding areas suggests that the proposed development would not make any significant impact on the existing sewer drainage network systems. However, a confirmation of consent agreement from United Utilities is required before the utilisation of the proposed development.

3 Flood attenuation storage requirement

The proposed development is the erection of a detached dwelling with an associated access road, off-road car parking and landscape amenities. The proposed development is therefore classified as a more vulnerable category - according to the NPPF flood risk vulnerability classification¹⁶.

At present, the ground surface on the front side is partly covered by impermeable surfaces of the previous demolished house, access road and off-road car parking; whereas the rear side is covered by vegetated surface and trees and shrubs – see also the recent photographs of the front side in Figure 3.1. The ground level at the Site has a mild slope. The proposed development would slightly modify the existing ground level, however, it would not deteriorate the flow paths of surface water runoff.

¹⁵ [Sewerage Sector Guidance-approved documents | Water UK](#)

¹⁶ [National Planning Policy Framework - Annex 3: Flood risk vulnerability classification - Guidance - GOV.UK \(www.gov.uk\)](#)



Figure no.	3.1	Legend	 All rights reserved 2024
Title	Existing ground surface at the front side		
Project name	50 Amos Ave, Manchester		
Project no.	3059		

Figure 3.1: The photograph of the existing condition at the Site, front side.

The total surface area of the proposed development site is approximately 409m². The permeable and impermeable surface areas of the pre-development and post-development are given in Table 3.1. The total impermeable surface area of the proposed development is approximately 167m², containing the proposed building, access road, off-road car parking spaces, and front and rear patios. Thus, the increased impermeable surface area due to the proposed development would be approximately 14% of the total area (i.e. 57m²). The proposed development would therefore slightly modify the existing land surface, however, it would provide better sustainable drainage systems with the proposed drainage strategy and there would not be any deterioration of the excess surface water hazard due to the proposed development.

Table 3.1: The surface area of the pre-development and post-development at the Site.

Development	Permeable area, m ²	Impermeable area, m ²
Existing	299	110
Proposed	242	167

The NPPF’s local plan policy guidance suggests that “the development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible”. The proposed development would have a very minor impact on the generated surface water runoff due to the increased impermeable land surface. Therefore, to comply with the NPPF’s local plan policy guidance – a reduction of the generated surface water runoff equivalent to the increased impermeable surface area footprint (i.e. 14%) including climate change allowance in the calculations and factoring in all flows into the sewer system including groundwater or other flows would be managed as close to its source as possible.

Table 3.2: The cumulative depth-duration rainfall at 20% AEP, 10% AEP, 3.3% AEP and 1% AEP at the Site.

Duration, mins	Rainfall depths, mm			
	20% AEP	10% AEP	3.3% AEP	1% AEP
15	11.23	13.98	18.33	23.17
30	14.61	18.36	24.21	30.98
45	16.83	21.08	27.98	36.05
60	18.44	23.18	30.75	39.68
90	21.20	26.27	34.29	43.80
120	23.41	28.58	36.84	46.68
180	26.71	32.09	40.91	51.54
240	29.20	34.79	44.09	55.48
300	31.19	37.04	46.74	58.92
360	32.88	38.98	49.07	61.99
420	34.37	40.66	51.18	64.86
480	35.70	42.16	53.12	67.51
540	36.92	43.53	54.91	69.98
600	38.03	44.80	56.58	72.30

In order to calculate the generated surface water runoff at the Site, the hydrological data were obtained from the Flood Estimation Handbook¹⁷ (FEH22). The cumulative rainfall depths were calculated and the values at 1 in 5-year (20% AEP), 1 in 10-year (10% AEP), 1 in 30-year (3.3% AEP) and 1 in 100-year (1% AEP) are provided in Table 3.2 up to 600mins (i.e. 10.0 hrs). The

¹⁷ [Map - FEH Web Service \(ceh.ac.uk\)](http://map-feh.web-service.ceh.ac.uk).

proposed development is for residential use and therefore the design life of the development would be 100 years. Thus, the NPPF's guidance suggests the upper-end allowance for peak rainfall in climate change consideration. The upper-end peak rainfall allowances at the Site in the 2070s epochs are 40% and 45% at 3.3% AEP and 1% AEP, respectively - according to the Environment Agency's climate change allowance guidelines¹⁸. Subsequently, the peak rainfall was increased for the climate change allowance (CCA) by 25%, 25%, 40% and 45% at 20% AEP, 10% AEP, 3.3% AEP and 1% AEP, respectively.

One of the main objectives of the surface water attenuation storage is that during the storm event, the generated surface water runoff within the Site would be retained on-site for some time; therefore, the peak flow in the watercourses and/or drainage networks would not be increased substantially to ease the flood risk in the downstream. However, it is an acceptable policy of the LLFA with regard to the greenfield runoff rate to allow some discharge from the development site into the nearby watercourses and/or drainage network systems to reduce the cost and land space for the attenuation storage within the development site.

In the present calculation, the greenfield runoff rates were considered based on the HR Wallingford tools¹⁹, however, the total surface area of the Site is less than the minimum area requirement (i.e. 0.10 hectares) for these tools, and therefore, the minimum greenfield runoff rate of 2.0 litres/sec was adopted. This value is also recommended by HR Wallingford tools for SuDS design and this would assist in reducing the sedimentation and blockage of the drainage pipes.

The attenuation storage requirements for the proposed development were calculated at 20% AEP, 10% AEP, 3.3% AEP and 1% AEP including climate change allowance²⁰ and the results are presented in Table 3.3. The attenuation storage requirements for the Site (i.e. surface area of 409m²) at 20% AEP, 10% AEP, 3.3% AEP and 1% AEP are 2m³, 4m³, 6m³ and 8m³; and with climate change allowance 4m³, 5m³, 10m³ and 15m³, respectively.

¹⁸ [Flood risk assessments: climate change allowances - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/616222/flood-risk-assessments-climate-change-allowances.pdf)

¹⁹ [Online tools for sustainable drainage systems \(SuDS\) \(uksuds.com\)](https://uksuds.com/)

²⁰ [Peak rainfall climate change allowances by management catchment - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/616222/flood-risk-assessments-climate-change-allowances.pdf)

Table 3.3: Surface water attenuation storage requirement at 20% AEP, 10% AEP 3.3% AEP and 1% AEP including climate change allowance at the Site.

Return periods	Storm duration, mins	Greenfield runoff rate, l/s	Volume of the surface water runoff, m ³		
			Total runoff	Attenuation req.	Attenuation req. with CCA
20% AEP	15	2.00	4	2	4
	30	2.00	5	2	3
	45	2.00	6	1	2
	60	2.00	6	-1	1
	90	2.00	7	-4	-2
	120	2.00	7	-7	-5
	180	2.00	7	-14	-12
	240	2.00	7	-22	-19
	300	2.00	7	-29	-26
	360	2.00	6	-37	-34
	420	2.00	6	-45	-41
	480	2.00	5	-53	-49
	540	2.00	4	-61	-57
	600	2.00	3	-69	-65
10% AEP	15	2.00	5	4	5
	30	2.00	7	3	5
	45	2.00	8	2	4
	60	2.00	8	1	3
	90	2.00	9	-2	1
	120	2.00	9	-5	-2
	180	2.00	9	-12	-9
	240	2.00	9	-19	-16
	300	2.00	9	-27	-23
	360	2.00	9	-35	-31
	420	2.00	8	-42	-38
	480	2.00	8	-50	-46
	540	2.00	7	-58	-53
	600	2.00	6	-66	-61
3.3% AEP	15	2.00	7	5	8
	30	2.00	9	6	10
	45	2.00	11	5	10
	60	2.00	11	4	9
	90	2.00	12	1	7
	120	2.00	13	-2	4
	180	2.00	13	-8	-2
	240	2.00	13	-16	-8
	300	2.00	13	-23	-15
	360	2.00	13	-30	-22
	420	2.00	12	-38	-30
	480	2.00	12	-46	-37
	540	2.00	12	-53	-44
	600	2.00	11	-61	-52
1% AEP	15	2.00	9	7	12
	30	2.00	12	8	14
	45	2.00	14	8	15
	60	2.00	15	8	15
	90	2.00	16	5	13
	120	2.00	17	2	11
	180	2.00	17	-4	5
	240	2.00	18	-11	-1
	300	2.00	18	-18	-7
	360	2.00	18	-25	-14
	420	2.00	18	-32	-20
	480	2.00	18	-40	-27
	540	2.00	18	-47	-34
	600	2.00	17	-55	-41



Figure 3.2: The soil types beneath the Site – slowly permeable, seasonally wet and acid-loamy and clayey soils (reference - Soilsclapes map data of Cranfield University²¹).

To assess the feasibility of the attenuation for the generated surface water runoff through underground infiltration, the soil types beneath the Site were assessed based on the Soilsclapes map data of Cranfield University²². Generally, soil types beneath the Site are slowly permeable, seasonally wet, and acid-loamy and clayey soils (Figure 3.2), and therefore the infiltration rate on the permeable area would be low and would not be suitable for soakaway design at the Site. It should be mentioned that a low infiltration rate of 5mm/hr was applied to the permeable surface in the calculation of the attenuation storage requirement (Table 3.3). It should, however, be mentioned that there were on-site in-situ soil tests and it suggests the soil types in the pits at 1m

²¹ [Soilsclapes soil types viewer - National Soil Resources Institute. Cranfield University \(landis.org.uk\)](https://landis.org.uk/)

²² Op.cit.

below the ground surface are clayey (see Appendix VII). This confirms the low permeability of the soil types at the Site.

At present, all the on-site surface water runoff is discharged either in the existing drainage network and/or nearby overground. However, to comply with the NPPF's local plan policy guidelines and to improve the sustainability of the wider drainage systems, environmental impact and local biodiversity in the surrounding areas – the equivalent increased impermeable surface area footprint by the proposed development would be attenuated on-site at 1 in 100-year plus a 45% climate change allowance, i.e. 14% of the excess generated surface water runoff (i.e. 2.12m³)

There is no existing watercourse in close proximity to the Site whereas River Medlock is situated approximately 260m away from the Site to the south. However, there is an existing sewer drainage network under Verona Drive. Therefore, in the proposed surface water drainage strategy - it would be suitable to discharge the excess surface water runoff into them, while the discharge from an underground tank would be maintained in a controlled manner by a hydro-valve vortex flow control unit (i.e. 2.0 litres/sec, see also a sample of vortex flow control device in Appendix VI) including reasonable water quality measures.

4 SuDS layout design

The proposed development is the erection of a four-bedroom detached dwelling with associated access road, car parking and landscape amenities. The surface water runoff would therefore be slightly modified by the increased impermeable land, but this increment of the impermeable land would not deteriorate the surface water drainage substantially to the Site itself or its surrounding areas. Because of the topographical condition, the runoff from the roof and other impermeable surfaces including the rear side would be attenuated in the underground storage tank. Thus, the proposed SuDS layout of the Site would rather provide positive and sustainable drainage systems.

The layout of the development is considered well-thought, eco-friendly and sustainable drainage systems including plenty of shrub plantation and grassland with permeable topsoils, assisting water quality improvement by reducing the suspended solid and silt materials. A part of the roof on the rear side of the proposed building would be flat; therefore, it would be sustainable to utilise

the top roof with a green roof feature (see a scheme of green roof in Appendix V), a further improvement of bio-diversity and surface water containment.

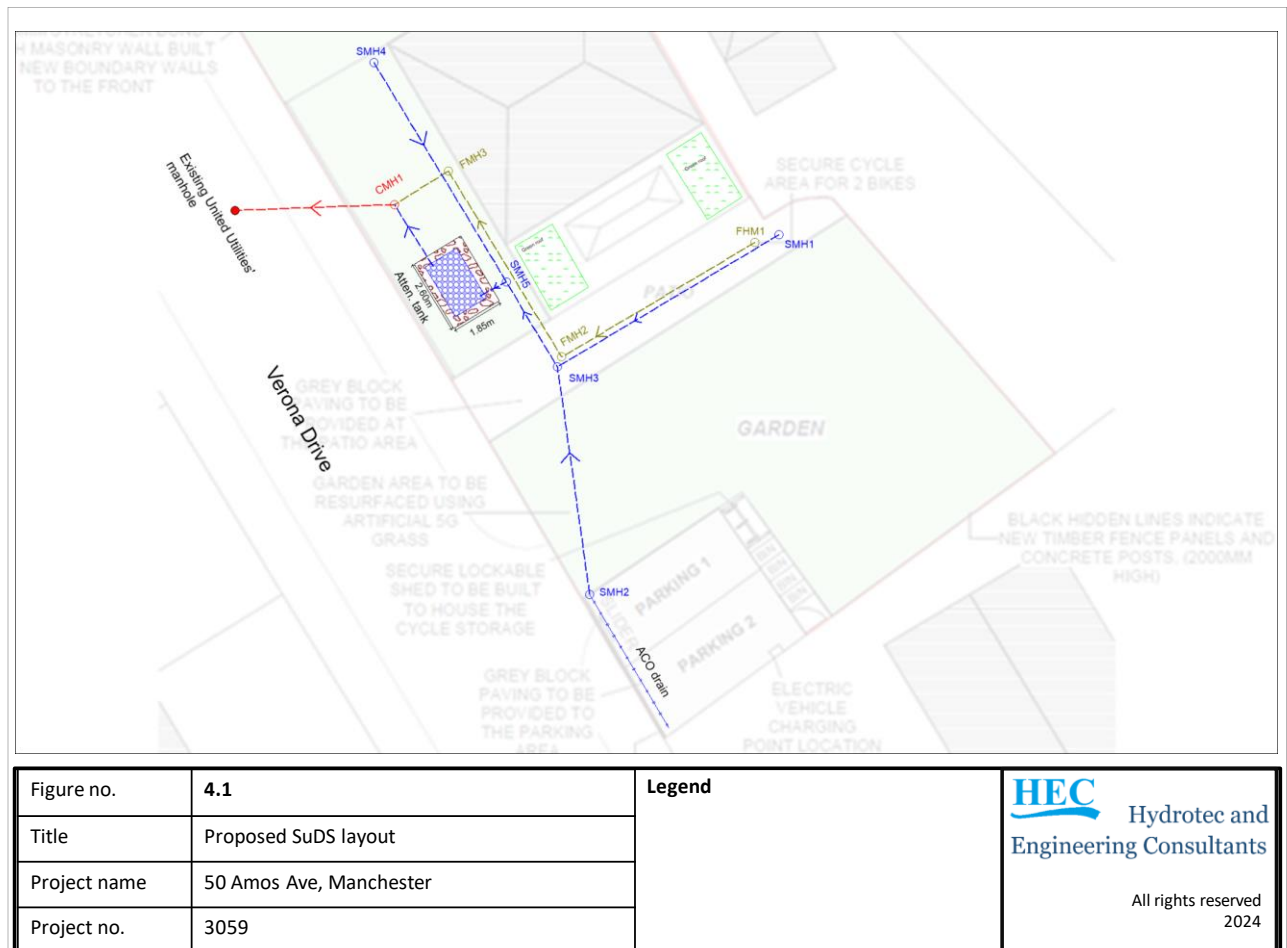


Figure 4.1: The SuDS layout at the Site.

The proposed underground attenuation tank was designed to accommodate 14% of the excess runoff, i.e. 2.12m³. The details of the cross-section of the attenuation tank are given in Appendix IV. The size of the attenuation crates would be 2.0m in length, 1.25m in width and 0.75m in depth. The porosity of the crates is 95% and, therefore, they would hold 1.78m³ of water. In addition, there are 300mm thick gravel layers around the sides and these porous materials on the sides would hold 0.52m³ of water, considering the 0.30 porosity of the gravel materials. Subsequently, the total attenuation storage capacity of the tank would become approximately 2.30m³, which is more than the requirement.

The storage water in the attenuation tank would be discharged into the existing sewer drainage network of the United Utilities with a minimum greenfield runoff rate, i.e. 2.0 litres/sec by a vortex flow control device.

Furthermore, at the top of the attenuation storage tank, there would be a 250mm thick gravel bed which would be covered by a 100mm thick sand layer, allowing a provision to store surface water runoff at a higher hydrological event. At the bottom of the storage tank (attenuation crates), there would be a 300mm thick gravel bed and this feature would allow the storage capacity of approximately 0.43m³ of surface water. In addition to that, storage water would infiltrate the underground through the bottom of the tank, whenever it would have an available capacity. Subsequently, this would assist in emptying the attenuation tank during the dry period and allowing available maximum capacity in the next rainfall event

Thus, the proposed blue-green SuDS features would significantly improve the local environmental biodiversity and sustainability of surface water drainage compared with existing conditions. Moreover, it is highly recommended to adopt rainwater harvesting and water butts for the roof water, a further reduction of surface water drainage.

The proposed drainage network would be separate, (e.g. the surface water and foul water drainage would be through the different pipes) and the layout of the drainage network at the Site is shown in Figure 4.1, see also Appendix III for details.

In the proposed surface water drainage network - the diameter of the drainage pipes would be 100mm and pipes would be connected with manholes, ACO drains and gullies. The gradient of the drainage pipes would be 1 in 100 or more to assist in gravity flow. The cover level of the manholes would be the ground level whereas the invert level would be set to provide the required gradient for the gravity flow.

5 Management and maintenance plan of drainage infrastructures

The landowner of the proposed dwelling would be legally responsible for the management of the proposed SuDS systems including a periodic inspection and maintenance of the SuDS features and drainage infrastructures within the Site for effective and efficient performance during the

design life of the development. The recommended maintenance schedules for the proposed SuDS systems are outlined below.

Table 5.1: Operation and maintenance requirements for filter drains.

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter (including leaf litter) and debris from the filter drain surface, access chambers and pre-treatment devices.	Monthly or as required
	Inspect filter drain surface, inlet/outlet pipework and control system for blockages, clogging, standing water and structural damage.	Monthly
	Inspect pre-treatment systems, inlet and perforated pipework for silt accumulation and establish appropriate silt removal frequencies.	Six monthly
	Remove the sediment from pre-treatment devices.	Six monthly or as required
Occasional maintenance	Remove or control tree roots where they are encroaching on the sides of the filter drain, using the recommended methods.	As required
	At locations with high pollution loads, remove the surface of the geotextile and replace, and replace the overlying filter medium.	Five yearly, or as required
	Clear perforated pipework of blockage.	As required

Table 5.2: Operation and maintenance requirements for an attenuation storage tank.

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause a risk to performance).	Monthly

Maintenance schedule	Required action	Typical frequency
	For systems where rainfall infiltrates into the tank from above, check the surface of the filter for blockage by sediment, algae, or matter; remove and replace the surface infiltration medium as necessary.	Annually
	Remove the sediment from pre-treatment structures and/or internal forebays.	Annually, or as required
Remedial actions	Repair/rehabilitate inlet, outlet, overflows, and vents.	As required
Monitoring	Inspect/check all inlets, outlets, vents, and overflows to ensure that they are in good condition and operating as designed.	Annually
	Survey the inside of the tank for sediment build-up and remove it if necessary.	Every 5 years, or as required

6 Finished floor level and access/egress from the Site

The proposed development, which is the erection of a four-bedroom detached dwelling with an associated access road, car parking and landscape amenities, is classified as a more vulnerable category, according to the NPPF flood risk vulnerability classification²³. The Site would not have a flood risk from fluvial flow. Moreover, the surface water drainage would have a very low risk and would have a minimal impact on the Site, taking into consideration the proposed SuDS features. The finished ground floor level of the proposed building would therefore be at the ground level, however, it is highly recommended to raise the finished ground floor level by an additional 150mm freeboard

There would not be any issues with the access and egress from the proposed development site during evacuation and emergency vehicles' movement. Amos Avenue and Verona Drive located

²³ [National Planning Policy Framework - Annex 3: Flood risk vulnerability classification - Guidance - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/61271/nppf-annex-3.pdf)

in front of the Site would be used as an access and egress during any unexpected flooding incident.

7 Conclusions

A flood risk assessment and surface water drainage strategy were conducted to assist the sustainable drainage systems (SuDS) design for the proposed development on the land at 50 Amos Avenue, Manchester, M40 2RS. The proposed development is the erection of a four-bedroom detached dwelling with an associated access road, off-road car parking and landscape amenities. The Site lies within Manchester Council's remit who is the LLFA, providing advice and guidance for sustainable drainage systems for this development site.

The present flood risk assessment and drainage strategy for SuDS which are the requirements for the planning application were made with available information including the latest EA's flood maps data, FEH hydrological data, topographical elevation data (LiDAR), soil map data, sewer network data of United Utilities.

The present investigation suggests that the Site is in flood zone 1 and, therefore, the Site is considered to be out of fluvial and coastal flood risk.

The proposed development site is a low risk from the surface water flow - according to the EA's flood map²⁴. Moreover, the hydrological and topographical elevation data around the Site indicate that the impact of the surface water runoff from the surrounding areas would be minimal. Thus, the surface attenuation requirement for the proposed development would only be the generated overland flow by impermeable area at the Site, and the overland flow from the surrounding areas was not considered. In addition, the Site is not at risk to the groundwater or reservoir flows.

The attenuation storage requirements were calculated at 20% AEP, 10% AEP, 3.3% AEP and 1% AEP including climate change allowance²⁵. The cumulative rainfall depths at these events

²⁴ Op.cit.

²⁵ Op.cit.

were estimated from the latest FEH22 rainfall-runoff model data²⁶. For the whole site, the attenuation storage requirements at 3.3% AEP and 1% AEP are 6m³ and 8m³; and with climate change allowance 10m³ and 15m³, respectively.

The soil types beneath the Site are slowly permeable, seasonally wet, and acid-loamy and clayey soils with reference to the Soilsmap map data²⁷. Moreover, in-situ soil tests at the Site confirm the clayey soils and low permeability. Therefore, it would not be suitable to attenuate the excess surface water through the soakaway.

In the proposed surface water drainage strategy, the excess generated surface water runoff by the development would be attenuated on-site up to the equivalent increased impermeable surface area footprint of the Site (i.e. 14%), a requirement of the LLFA. On the other hand, up to 2.12m³ of surface water based on 1% AEP plus a 45% climate change allowance would be attenuated in an underground tank. The storage water would be discharged in a controlled manner by a flow control vortex unit into the existing sewer drainage network of United Utilities.

There are no watercourses in close proximity to the Site whereas River Medlock is situated approximately 260m away from the Site to the south. Therefore, the remaining surface water runoff would be discharged to the existing drainage network, taking into account reasonable water quality measures.

The size of the attenuation crates would be 2.0m in length, 1.25m in width and 0.75m in depth. A 300mm thick gravel layer would surround the crates which would have a porosity of 95%. The crates' and gravel's combined attenuation storage capacity would be approximately 2.30m³, which is more than the requirement. In addition to that the top roof of the building at the rear side would be utilised for a green roof, a further reduction of surface water runoff.

The proposed drainage layout for the surface and foul water would be separate, and the diameter of the pipes would be 100mm and the gradient of the pipes would be 1 in 100 or more to assist in gravity flow.

²⁶ Op. cit.

²⁷ Op.cit.

Thus, the proposed eco-friendly layout design and landscape amenities would significantly improve the surface water drainage sustainability, environment and local biodiversity, and water quality compared to the existing conditions. The periodic inspection and maintenance of the drainage features and attenuation tank would be done, and the landowner of the proposed building would be responsible for the maintenance of the proposed SuDS features for effective and efficient operation including the water quality outfalls.

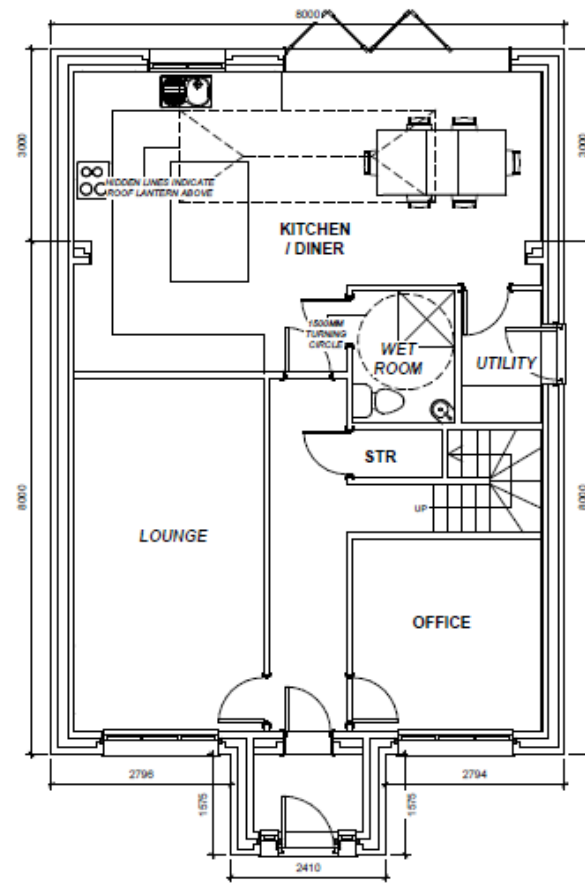
The Site is not considered to be a flood risk, and the finished ground floor level of the proposed building would be the same as the ground level, however, raising the finished ground floor level by an additional 150mm freeboard is highly recommended. The access and egress from the Site during any flooding incident would be at Amos Avenue or Verona Drive located in front of the.

The generated wastewater flow by the proposed development was estimated to be 0.05 litres/sec. The sewer drainage network data obtained from United Utilities suggest that the existing sewer drainage systems are combined, i.e. conveying the surface and foul water drainage in the same pipe.

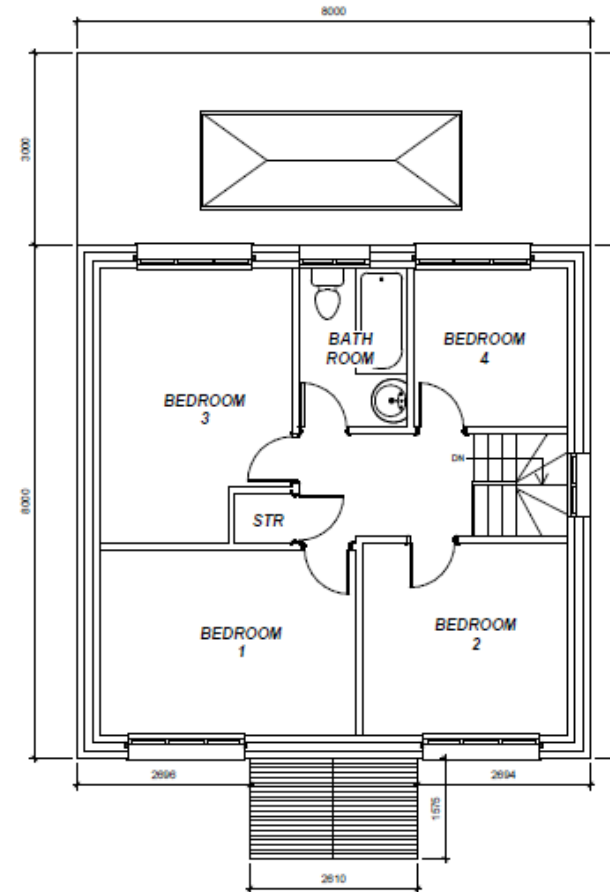
In the proposed drainage network, a new separate drainage network would be constructed to assist the proposed SuDS features. However, the final outfall to the United Utilities' drainage network at Verona Drive would be combined. The general observation of the United Utilities sewer drainage network in the surrounding areas suggests that the proposed development would not make any significant impact on the existing sewer drainage network systems. However, a confirmation of consent agreement from United Utilities is required before the utilisation of the proposed development.

Appendix I: The detailed layout of the proposed development.





Proposed Ground Floor Layout
1 : 50



Proposed First Floor Layout
1 : 50

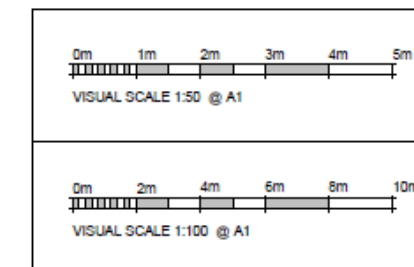
INTERNAL SPACE STANDARD:

GROUND FLOOR

LOUNGE -	16.2M ²
OFFICE -	8.85M ²
KITCHEN / DINER -	31.54M ²
SHOWER ROOM -	3.2M ²
UTILITY -	1.6M ²
STORE -	1M ²

FIRST FLOOR

BEDROOM 1 -	11.6M ²
BEDROOM 2 -	9.6M ²
BEDROOM 3 -	12.04M ²
BEDROOM 4 -	6.0M ²
BATH ROOM -	4.25M ²
STORE -	1M ²



Please note that these drawings are for the purpose of obtaining Building Control Approval and Planning Consent and is not a working drawing. All dimensions are guides only and it is the contractor's responsibility to check all measurements on site prior to or during the course of construction. The contractor is to be responsible for all setting out.

The owner has a duty to serve a party wall notice to any adjoining owner if works are to be carried out to a party wall, structure, or line of junction, or if work involves excavation within 3m of a neighbouring building. A party wall agreement/award should be formalised before commencement of the works.

CDM Regulations all parties must abide by the construction design and management regulations 2007. It is the clients responsibility to appoint a competent CDM co-ordinator on all projects that are notifiable to the H&S executive if more than 500 man hours or longer than 30 days. Domestic clients are not notifiable but CDM regulations do still apply.

ALL DOORS, WINDOWS, ROOF AND WALL APPEARANCE TO MATCH THE EXISTING OF THE BUILDING

BOUNDARY LINE

Erection of a detached residential dwellings (C3 use) with associated access, parking and landscaping.

Proposed (Floor Layouts)

50 Amos Avenue, Manchester,
M40 2RS

Page Size A1

Date 01/11/2023

Client Kasim Zamani

AMO-03-20

Scale 1 : 50

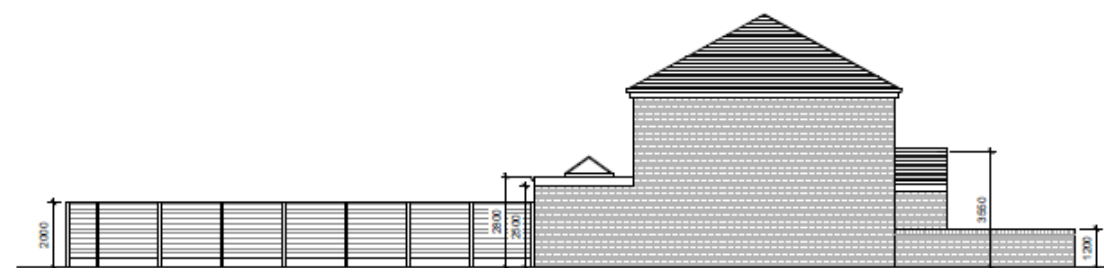
AMENDMENT 1C



Proposed Front Elevation / Street View
1 : 50



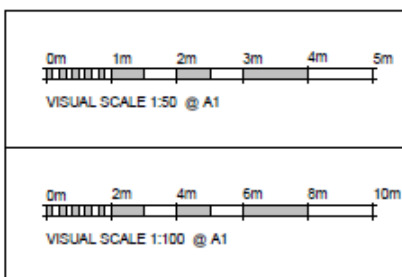
Proposed Rear Elevation
1 : 50



Proposed Side Elevation A (View From No.52)
1 : 100



Proposed Side Elevation B (View From Verona Drive)
1 : 100



Please note that these drawings are for the purpose of obtaining Building Control Approval and Planning Consent and is not a working drawing. All dimensions are guides only and it is the contractor's responsibility to check all measurements on site prior to or during the course of construction. The contractor is to be responsible for all setting out.

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ALL DOORS, WINDOWS, ROOF AND WALL APPEARANCE TO MATCH THE EXISTING OF THE BUILDING

BOUNDARY LINE

Erection of a detached residential dwellings (C3 use) with associated access, parking and landscaping.

Proposed (Elevations)

50 Amos Avenue, Manchester,
M40 2RS

Page Size	A1
Date	01/11/2023
Client	Kasim Zamani
	AMO-04-20
Scale	As indicated

AMENDMENT 1C

Appendix II: Sewer drainage network data at the Site, reference to United Utilities. .

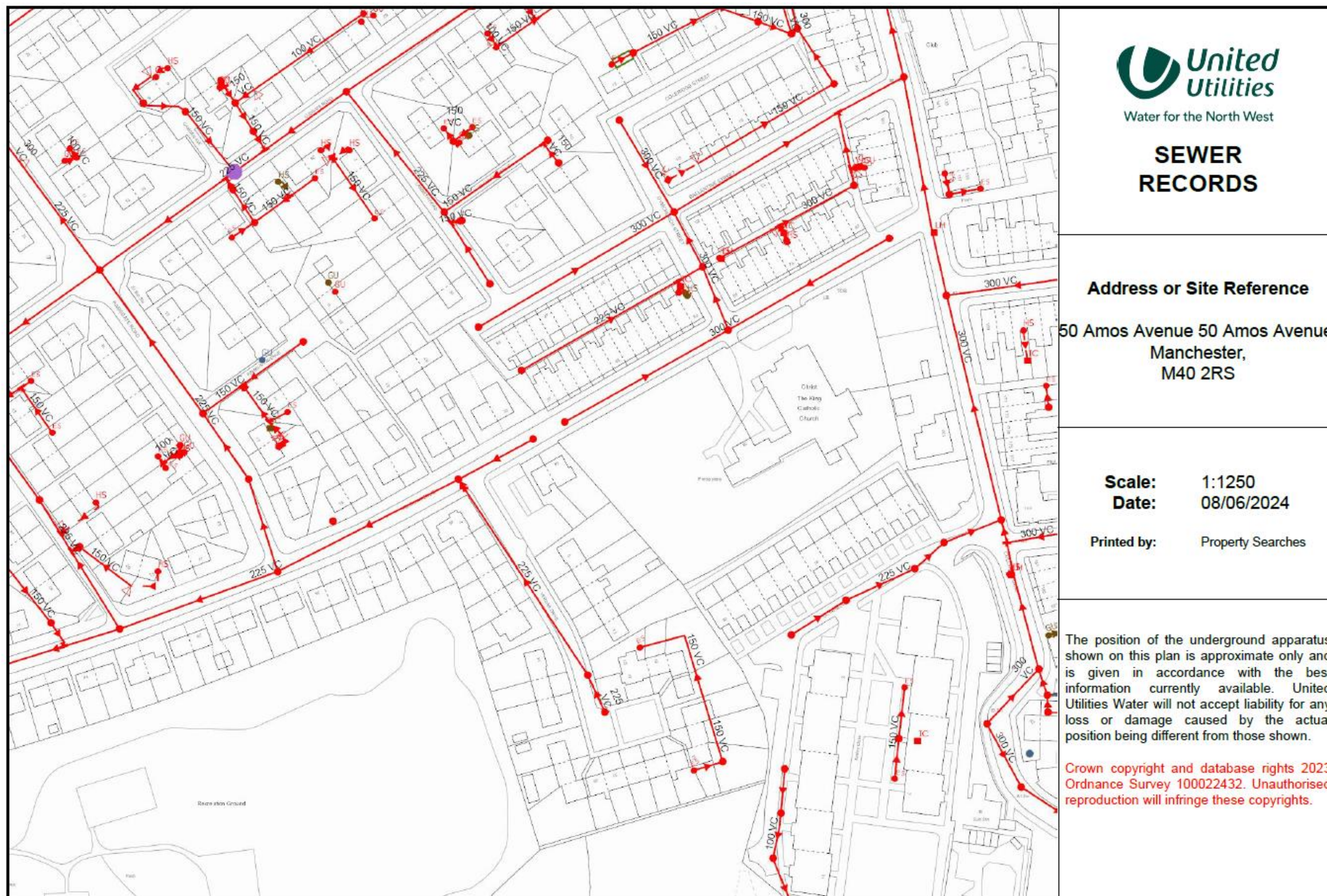


Wastewater Symbolology

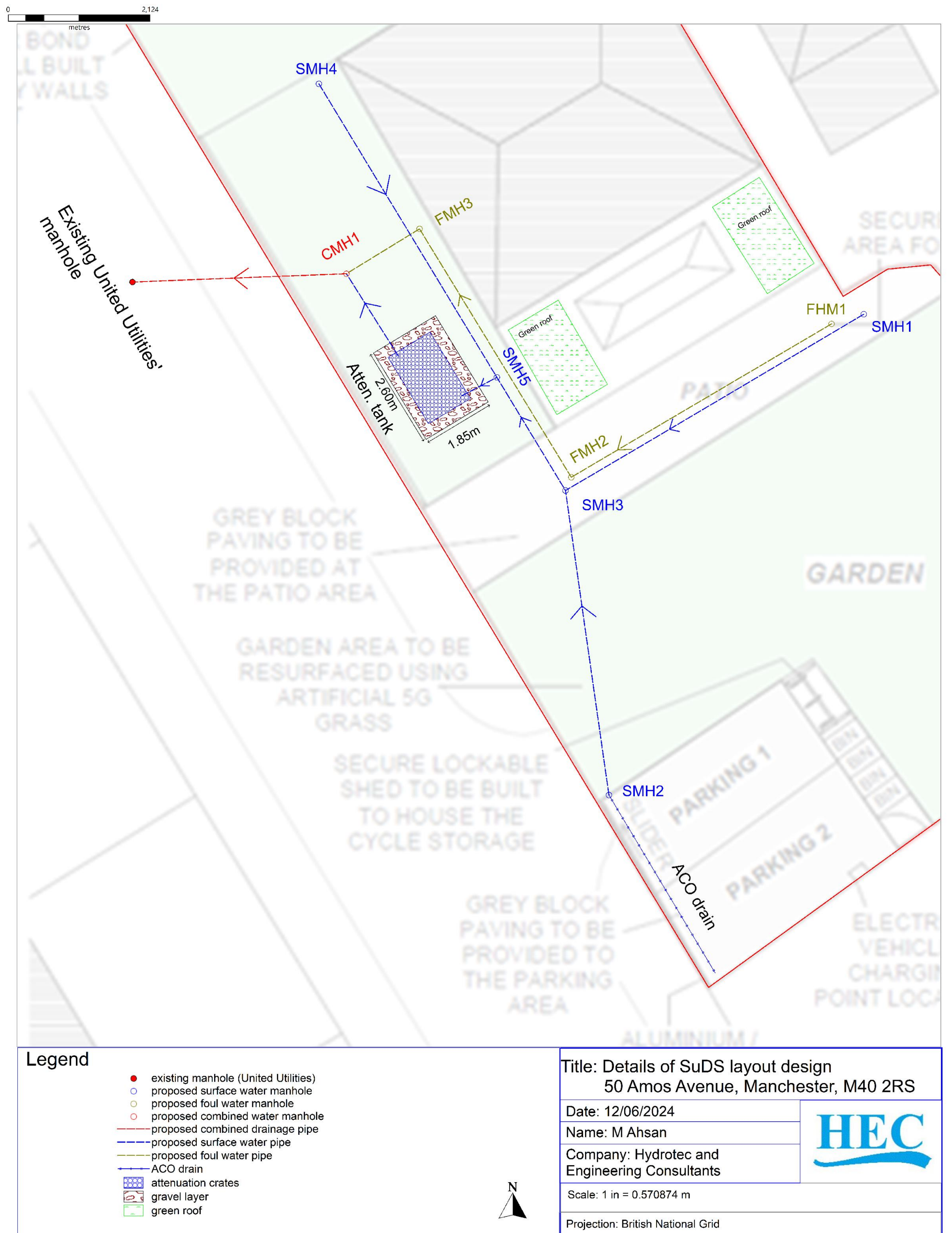
Abandoned	Foul	Surface Water	Combined	
				Public Sewer
				Private Sewer
				Section 104
				Rising Main
				Sludge Main
				Overflow
				Water Course
				Highway Drain

All point assets follow the standard colour convention: **red** – combined **brown** - foul
blue – surface water **purple** - overflow

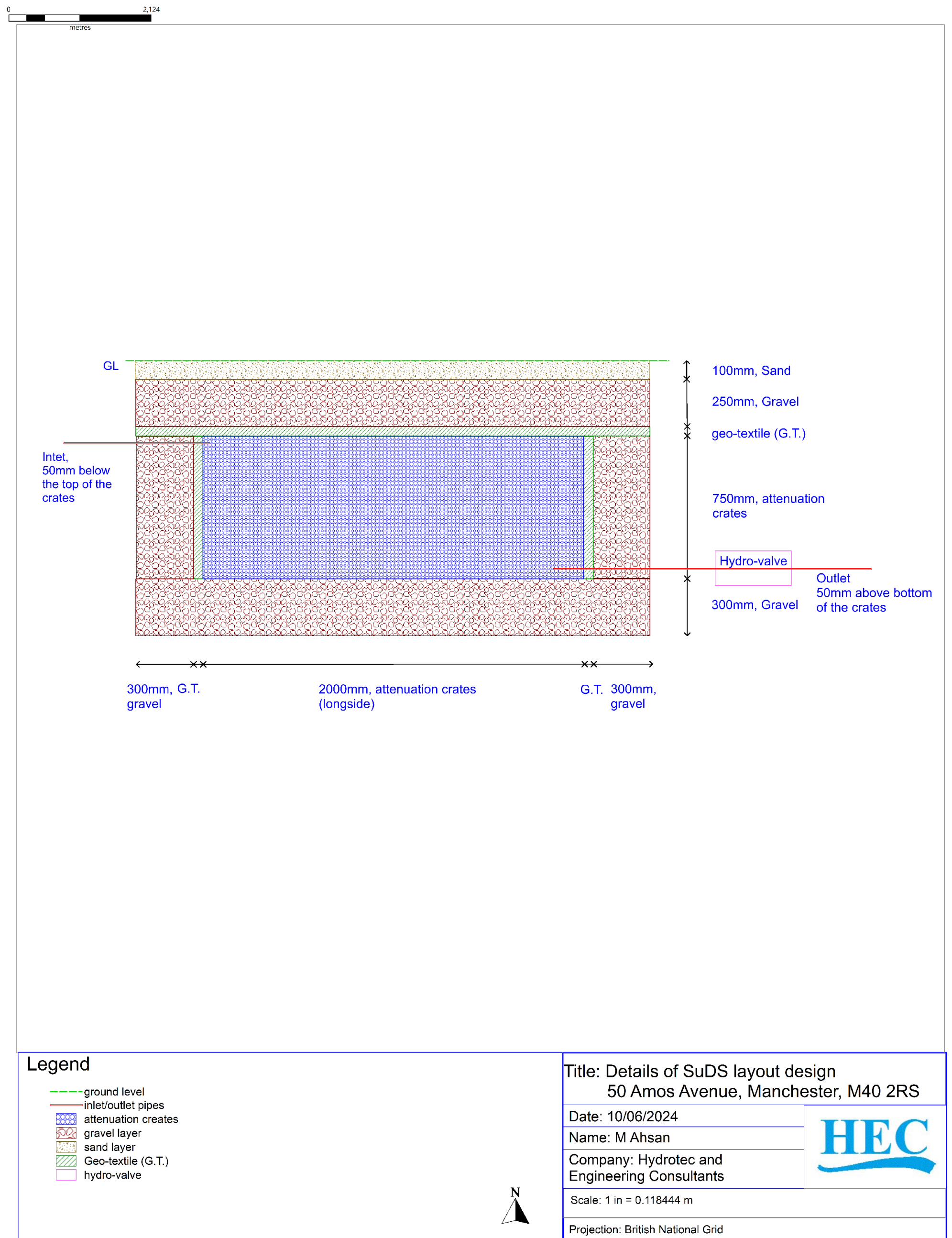
Manhole	Side Entry Manhole
Head of System	Outfall
Extent of Survey	Screen Chamber
Rodding Eye	Inspection Chamber
Inlet	Bifurcation Chamber
Discharge Point	Lamp Hole
Vortex	T Junction / Saddle
Penstock	Catchpit
Washout Chamber	Valve Chamber
Valve	Vent Column
Air Valve	Vortex Chamber
Non Return Valve	Penstock Chamber
Soakaway	Network Storage Tank
Gully	Sewer Overflow
Cascade	Ww Treatment Works
Flow Meter	Ww Pumping Station
Hatch Box	Septic Tank
Oil Interceptor	Control Kiosk
Summit	DNM Network Monitoring Point
Drop Shaft	Change of Characteristic
Orifice Plate	



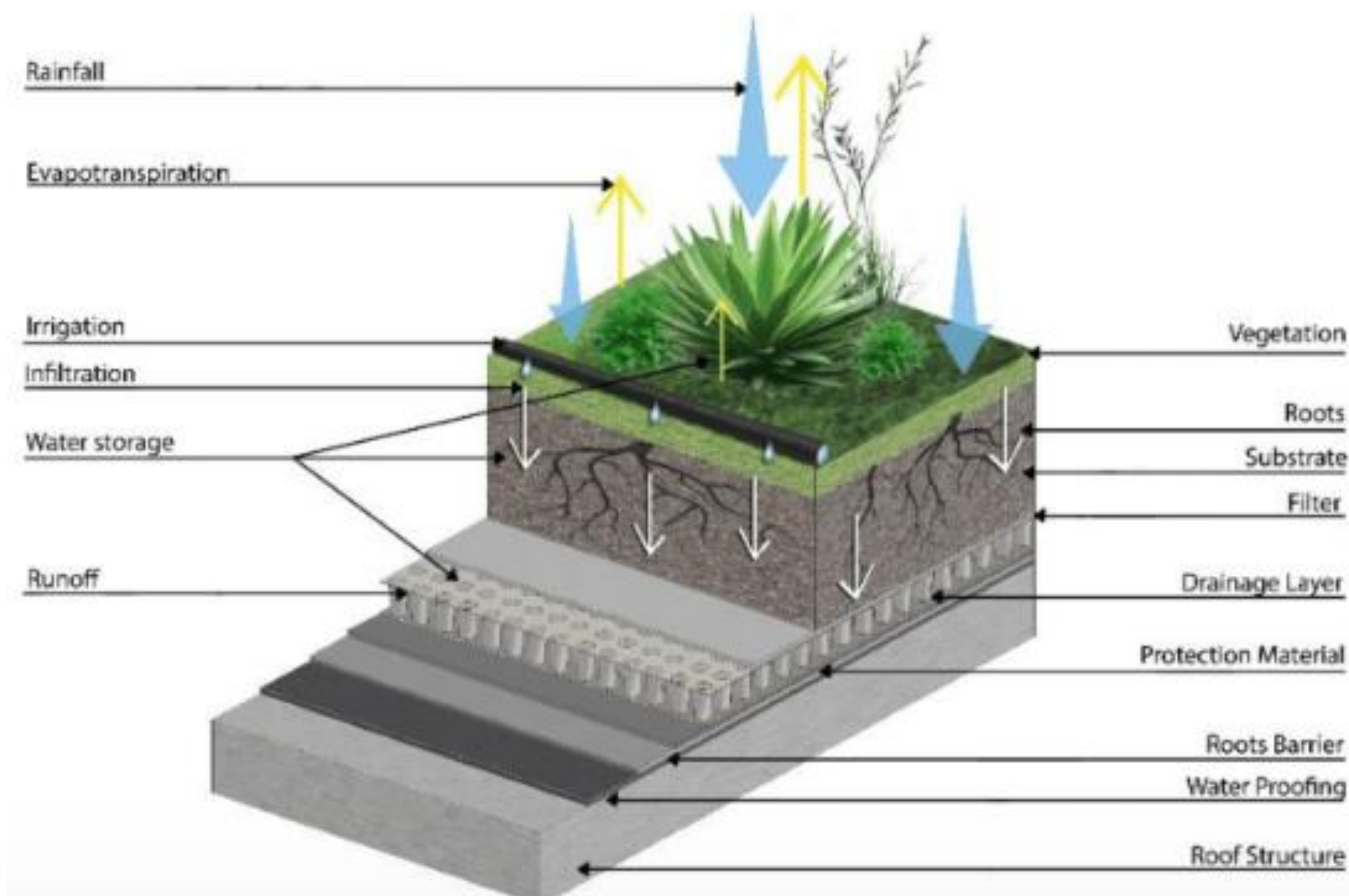
Appendix III: Details of SuDS layout design at the Site.



Appendix IV: Details of the cross-section of the attenuation tank design at the Site.



Appendix V: The scheme of the green roof system and design.



Appendix VI: A sample of hydro-valve, a vortex flow control device (1-5 litres/sec).



Appendix VII: Photographs of the trial pits for on-site soil percolation tests.



Photograph – soil trial pit1



Photograph – soil trial pit2

Appendix VIII: Photograph of the UU's existing manhole at Verona Drive

