

TC/L9523/2020/04

FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY

AT

**Lakeside School
Naylor's Road
Liverpool
L27 2YA**

FOR

The Witherslack Group



Lakeside School, Naylor's Road, Liverpool, L27 2YA

REPORT VERIFICATION

Site Address	Lakeside School, Naylor's Road, Liverpool, L27 2YA
--------------	--

Document Reference	TC/L9523/2020/04 Flood Risk Assessment & Drainage Strategy
Version	04
Date released	03 September 2021
Originator	Julian Pearson BSc (Hons) CEng MICE
Checked	Kieron Hounslow BEng (Hons) CEng MIStructE
Verified	Kieron Hounslow BEng (Hons) CEng MIStructE

Issue no	Date	Status	Report version	Issued by
01	31/07/2020	Final	01	JP
02	07/04/2021	Final	02	JP
03	29/04/2021	Final	03	JP
04	03/09/2021	Updated	04	JP

CONTENTS

1	INTRODUCTION	1
1.1	Project Scope / Client Brief	1
1.2	Site Location & Topography	1
1.3	Development Class in terms of Planning	2
1.4	Planning Policy	2
1.5	Environment Agency Flood Map for Planning	2
1.6	Proposed Development in context of Planning	5
2	SITE CHARACTERISTICS	6
2.1	Site Geology & Hydrogeology	6
2.2	Existing Watercourses	8
2.3	Existing Sewers	8
2.4	Ground Conditions	8
3	ASSESSMENT OF FLOOD RISK	9
3.1	Flood Risk Terminology	9
3.2	Fluvial Flood Risk	9
3.3	Surface Water Flood Risk	10
3.4	Groundwater Flood Risk	13
3.5	Flooding from Artificial Sources	13
3.6	Flooding from Sewers	14
4	FLOOD MITIGATION	15
4.1	Summary of Flood Risk	15
5	SURFACE WATER DRAINAGE STRATEGY	16
5.1	Site Areas	16
5.2	Rate of Runoff Assessment	16
5.3	Surface Water Disposal	16
5.4	Surface Water Drainage Design Parameters	17
5.5	Consideration of SuDS Components	18
5.6	Surface Water Drainage Proposals	19
5.7	Designing for Local Drainage System Failure	19
5.8	Blockage & Exceedance	19
5.9	Treatment Processes	20
6	FOUL WATER DRAINAGE STRATEGY	21
7	CONCLUSIONS	22
8	REFERENCES	23

Lakeside School, Naylor's Road, Liverpool, L27 2YA

APPENDICES

APPENDIX A: UU SEWER RECORDS

APPENDIX B: PEAK RUNOFF RATE AND SURFACE WATER NETWORK CALCULATIONS

APPENDIX C: DEVELOPMENT PROPOSALS - LAYOUT PLAN

APPENDIX D: DRAINAGE LAYOUT PLAN

APPENDIX E: KNOWSLEY SUDS PRO-FORMA

APPENDIX F: DRAIN DOCTOR – DRAINAGE SURVEY REPORT

APPENDIX G: FALLING HEAD TEST RESULTS

Lakeside School, Naylor's Road, Liverpool, L27 2YA

1 INTRODUCTION

1.1 Project Scope / Client Brief

Thomas Consulting has been commissioned by The Witherslack Group to carry out a site-specific flood risk assessment and drainage strategy report in accordance with the National Planning Policy Framework (NPPF) to support a planning application that fulfils the requirements of the Local Planning Authority, Lead Local Flood Authority, and the Local Water Authority.

1.2 Site Location & Topography

The site is located at the Lakeside School, Naylor's Road, Liverpool, L27 2YA and the report is to support the upgrading, demolition and redevelopment of the barns surrounding the existing school. The approximate Ordnance Survey (OS) grid reference for the site is SJ 43770 89318 and the location of the site is shown on Figure 1.



Figure 1: Site location plan (Source: OS Maps, 2020)

The development area covers a total area of approximately 1.12ha and comprises Wheathill Farm and House to the Southeast and Riding School/Barns to the north. The site is located approximately 1.15km east of the suburb Belle Vale and 0.8km north of Netherley. The site is generally flat with levels ranging between 19-20mAD. The site is currently made up of a mixture of hardstanding surfaces and landscaped areas, and is bound to the north, east and west by agricultural farm/green fields, and to the south by Naylor's Road. The architectural development proposals can be found in Appendix C of this report.

Lakeside School, Naylor's Road, Liverpool, L27 2YA

1.3 Development Class in terms of Planning

The NPPF and its Planning Practice Guidance (PPG) states any development other than the following outlined below is classed as a major development.

- Minor non-residential extensions: industrial/commercial/leisure etc extensions with a footprint less than 250 square meters.
- Alterations: development that does not increase the size of buildings e.g. alterations to external appearance.
- Householder development: For example, sheds, garages, games rooms etc within the curtilage of the existing dwelling, in addition to physical extensions to the existing dwelling itself. This definition excludes any proposed development that would create a separate dwelling within the curtilage of the existing dwelling e.g. subdivision of houses into flats.

1.4 Planning Policy

The NPPF and its PPG follows on to state a site-specific flood risk assessment is required for the following site proposals.

- A site proposed in Flood Zone 2 or 3 including minor development and change of use in development type to a more vulnerable class.
- More than 1 hectare (ha) in Flood Zone 1
- Less than 1 ha in Flood Zone 1, including a change of use in development type to a more vulnerable class (for example from commercial to residential), where they could be affected by sources of flooding other than rivers and the sea (for example surface water drains, reservoirs)
- In an area within Flood Zone 1 which has critical drainage problems as notified by the Environment Agency

1.5 Environment Agency Flood Map for Planning

National Planning Policy Framework (NPPF) Flood Zones comprise Flood Zone 1, Flood Zone 2, and Flood Zone 3. The Environment Agency's Indicative Flood Map for Planning (Figure 2) shows that the site is located within the NPPF defined Flood Zone 1.

Flood Zones are based on an areas Annual Exceedance Probability (AEP) of River or Sea Flooding. For example, Flood Zone 1 has a 'Low Probability' of flooding as it has an AEP of <0.1% (Less than 1 in 1000 year) of occurring in any one year. Flood Zone 2 has a 'Medium Probability' having an AEP of 0.1-1.0% (1 in 1000 – 1 in 100 year) chance of river flooding, or 0.1-0.5% (1 in 1000 – 1 in 200 year) chance of tidal/sea flooding.

Flood Zones 3 is split between 'a' and 'b' classifications. Flood Zone 3a has a 'High Probability' of flooding as it has an AEP of >1.0% (More than 1 in 100 year) chance of river flooding, or >0.5% (More than 1 in 200 year) chance of sea/tidal flooding. Flood Zone 3b (The Functional Floodplain) comprises land where water has to flow or be stored in times of flooding. Local planning authorities should identify in the Strategic Flood Risk Assessments areas of function floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map for Planning).

The extent of the flood zones does not take into account the presence of any formal flood defences, or other features which also act as informal flood defences.

Lakeside School, Naylor's Road, Liverpool, L27 2YA

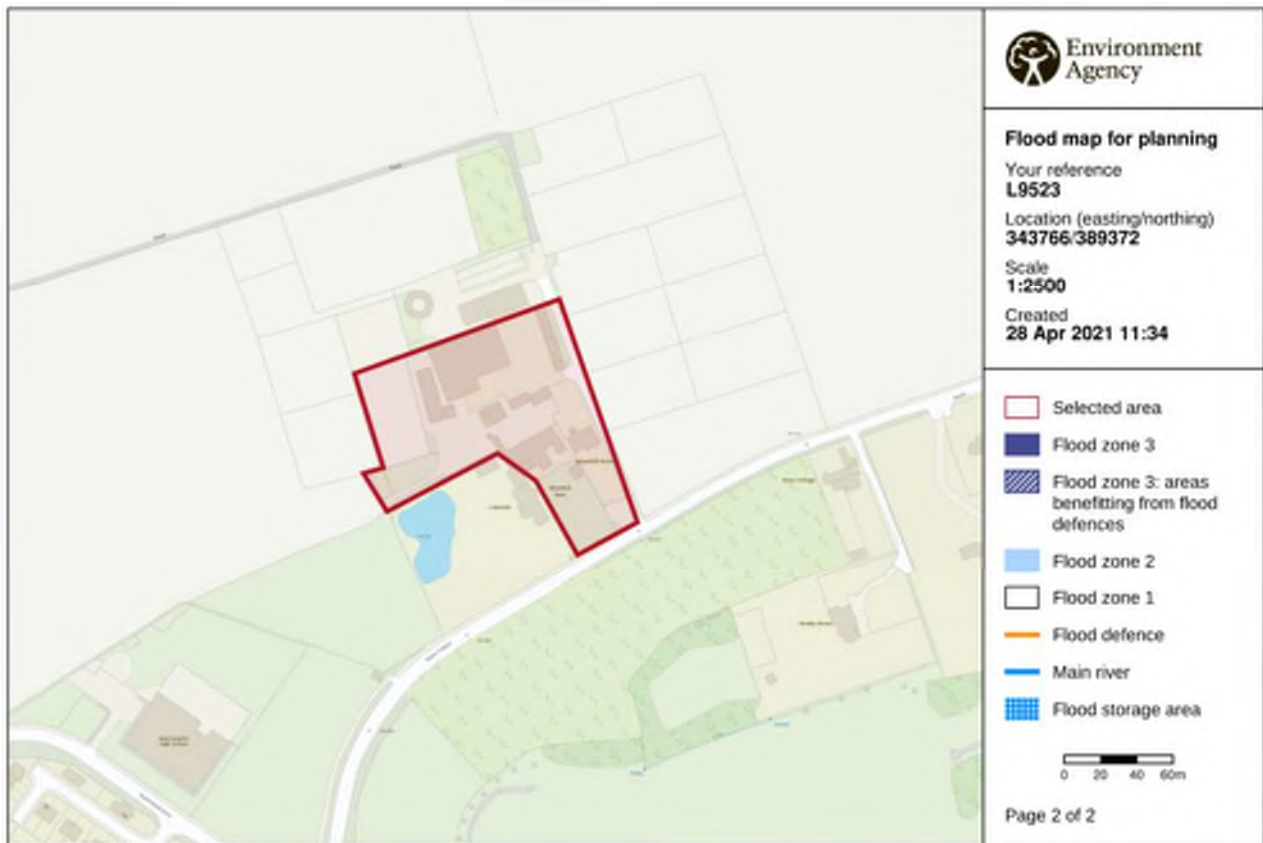


Figure 2: Environment Agency Flood Map for Planning (Source: Environment Agency, 2021, GOV.UK)

The NPPF is accompanied by the Planning Practice Guidance (PPG) documents which classifies each development into a vulnerability class, depending on the type of development, which are outlined in Figure 3. According to the PPG a School would fall under the “More Vulnerable” class. “More Vulnerable” developments are acceptable in Flood Zone 1 as shown in Figure 4.

Lakeside School, Naylor's Road, Liverpool, L27 2YA

Vulnerability Classification	Development
Essential Infrastructure	- Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk - Essential utility infrastructure, which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood - Wind turbines
Highly Vulnerable	- Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operation during flooding. - Emergency dispersal points - Basement dwellings - Caravans, mobile homes and park homes intended for permanent residential use - Installations requiring hazardous substances consent
More Vulnerable	- Hospitals - Residential institutions such as residential care homes, children's homes, prisons and hostels. - Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. - Non-residential uses for health services, nurseries and education establishments. - Landfill and sites used for waste management facilities for hazardous waste. - Sites used for holiday or short let caravans and camping, subject to a specific warning and evacuation plan
Less Vulnerable	- Police, ambulance and fire stations which are NOT required to be operational during flooding. - Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distributions; non-residential institutions not included in the 'more vulnerable' class; and assemble and leisure. - Land and buildings used for agriculture and forestry - Waste treatment (except landfill & hazardous waste facilities) - Minerals working & processing (except for sand & gravel working) - Water treatment works which do not need to remain operational during times of flood - Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place
Water-Compatible Development	- Flood control infrastructure - Water transmission infrastructure & pumping stations - Sewage transmission infrastructure & pumping stations - Sand & gravel working - Docks, marinas and wharves - Navigation facilities - Ministry of Defence installations - Ship building, repairing & dismantling, dockside fish processing & refrigeration & compatible activities requiring a waterside location - Water based recreation (excluding sleeping accommodation) - Lifeguard and coastguard stations - Amenity open space, nature conservation & biodiversity, outdoor sports and recreation and essential facilities such as changing rooms - Essential ancillary sleeping or residential accommodation for staff required by uses in this category subject to a specific warning & evacuation plan.

Figure 3: NPPF Flood Risk Vulnerability Classification (Source: National Planning Practice Guidance, 2014)

Lakeside School, Naylor's Road, Liverpool, L27 2YA

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	✗	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	✗	✗	✗	✓*

Key:

✓ Development is appropriate

✗ Development should not be permitted.

Figure 4: NPPF Flood Risk Vulnerability Classification (Source: National Planning Practice Guidance, 2014)

1.6 Proposed Development in context of Planning

The site is located within Flood Zone 1 but is classed as a Major Development due to being over 1ha in size. As this is the case a brief flood risk assessment is required with more emphasis based on the drainage strategy.

Lakeside School, Naylor's Road, Liverpool, L27 2YA

2 SITE CHARACTERISTICS

2.1 Site Geology & Hydrogeology

British Geological Survey (BGS) and Land Information Systems (LandIS) mapping indicates the site is underlain by the geology sequences outlined in Table 1.

Geological Layer	Classification	Description	Aquifer Class
Soil	Soilscape 18	Loamy and Clayey	Impeded Drainage
Superficial (Drift)	Till	Devensian – Diamicton	Secondary (Undifferentiated)
Bedrock (Solid)	Wilmslow Sandstone Formation	Sandstone	Principle

Table 1: Site Geological Summary

Principal Aquifers - These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as a major aquifer.

Secondary A Aquifers - permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

Secondary B Aquifers - predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons, and weathering. These are generally the water-bearing parts of the former non-aquifers.

Secondary (Undifferentiated) Aquifers - has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

Magic Maps document DEFRA/EA information on Drinking Water, Source Protections and Groundwater Vulnerability. The maps indicate the following:

- Drinking Water Protected Area = N/A
- Drinking Water Safeguard Zone (Surface Water) = N/A
- Drinking Water Safeguard Zone (Groundwater) = N/A
- Source Protection Zone = Located within Zone 3 (Total Catchment)
- Groundwater Vulnerability Map = Medium – Low

Drinking Water Protected Areas (Surface Water) are, within the Water Framework Directive, where raw water is abstracted from rivers and reservoirs. Raw water needs to be protected to ensure that it is not polluted which could lead to additional purification treatment. To do this water companies and the Environment Agency identify raw water sources that are 'at risk' of deterioration which would result in the need for additional treatment. These zones are areas where the land use is causing pollution of the raw

Lakeside School, Naylor's Road, Liverpool, L27 2YA

water. Action is targeted in these zones to address pollution so that extra treatment of raw water can be avoided. This data includes what substances are causing the drinking water protected area to be 'at risk'.

Drinking Water Safeguard Zones (Surface Water) are catchment areas that influence the water quality for their respective Drinking Water Protected Area (Surface Water), which are at risk of failing the drinking water protection objectives. These non-statutory Safeguard Zones are where action to address water contamination will be targeted, so that extra treatment by water companies can be avoided. Safeguard Zones are a joint initiative between the Environment Agency and water companies. Safeguard Zones are one of the main tools for delivering the drinking water protection objectives of the Water Framework Directive. This data includes what substances are causing the drinking water protected area to be 'at risk'.

Drinking Water Groundwater Safeguard Zones (SgZs) are established around public water supplies where additional pollution control measures are needed. The Water Framework Directive requires that Drinking Water Protected Areas are identified (WFD Article 7.1) and that they are given the necessary protection (WFD Article 7.3) with the aim of avoiding deterioration in their quality in order to reduce the level of purification treatment required in the production of drinking water.

The geometry of Groundwater Safeguard Zones are based on Groundwater Source Protection Zones (SPZs), usually the SPZ 2, and use additional assessment to identify areas, which may or may not coincide with the SPZ, where additional measures are required to ensure that abstraction waters meet Article 7.3 of the WFD. SgZs can be large or small depending on the pollution problem and may not cover the whole of a catchment or sub-catchment.

Source Protection Zones have been created as public facing outlines where common boundaries and overlaps (based on zone number) have been removed. Source Protection Zones (SPZs) are defined around large and public potable groundwater abstraction sites. The purpose of SPZs is to provide additional protection to safeguard drinking water quality through constraining the proximity of an activity that may impact upon a drinking water abstraction. This is part of an initial screening process in assessing impacts to groundwater resources. Zones around location sites are defined by groundwater travel time to an abstraction. This is determined through applying Environment Agency groundwater flow models run at the location of abstractions, inputting parameters such as flow direction, geology type, rainfall, and hydrological boundaries. SPZs provide a visual representation of the increased risks as you get closer to the abstraction.

The following subdivisions are defined within SPZs:

Zone 1: (Inner Protection Zone) - This zone is defined by a travel time of 50-days or less from any point within the zone at, or below, the water table. Additionally, the zone has as a minimum a 50-metre radius. It is based principally on biological decay criteria and is designed to protect against the transmission of toxic chemicals and water-borne disease.

Zone 2: (Outer Protection Zone) - This zone is defined by the 400-day travel time from a point below the water table. Additionally, this zone has a minimum radius of 250 or 500 metres, depending on the size of the abstraction. The travel time is derived from consideration of the minimum time required to provide delay, dilution, and attenuation of slowly degrading pollutants.

Zone 3: (Total catchment) - This zone is defined as the total area needed to support the abstraction or discharge from the protected groundwater source.

Some zones have been extended to include areas where there is protective geology cover, such as clay. This is because activities below the surface, such as deep drilling, could create pathways for pollutants to enter the groundwater. The SPZ maps show them as zones 1c, 2c and 3c.

Lakeside School, Naylor's Road, Liverpool, L27 2YA

A further Zone 4, or 'Zone of Special Interest' is occasionally defined for some groundwater sources. These zones highlight areas (mainly on non-aquifers) where known local conditions mean that potentially polluting activities could impact on a groundwater source, even though the area is outside the normal catchment of that source.

As the site is located in a source protection zone and is in a Medium – Low Groundwater Vulnerability location the EA should be consulted following a planning decision to determine any additional treatment methods required to surface water drainage leaving the site which may potentially impact natural stratus. The EA may provide these comments/conditions as a statutory consultant at the planning application stage.

2.2 Existing Watercourses

According to the EA Main River Maps the closest known watercourse is 0.5km west from the site. This watercourse is unnamed. Netherley Beck is also situated 0.75km east of the site. Neither are close enough to utilise as a discharge point, as there is an adopted highway and private 3rd party assets between the site and the watercourse. A private gravity connection is therefore not achievable and a surface water rising main of that length is not feasible.

2.3 Existing Sewers

Reference to the detailed United Utilities (UU) sewer records (included in Appendix A), indicates that there are numerous sewers within Naylor's Road to the south of the adjacent site, with no sewers directly crossing the site boundary.

- 150mm Surface Water Sewer – Located directly south of the school pond. Running in a westerly direction. Condition captured by Drainage Survey found in Appendix F of this report.
- 225mm Surface Water Sewer – Located within Naylor's Road to the south of the site running in a southerly direction. Sewer is a private asset owned by Highways.
- 300mm Foul Water Sewer – Located directly south of the school pond. Running in a westerly direction.

It is clear that the existing UU records are incomplete, as some of the sewers have not been surveyed through their full extents. However, as detailed records have been obtained, connection levels have been made available.

2.4 Ground Conditions

A Phase 2 - Ground investigation was completed on site and as part of these works falling head tests were completed across the site prior to any trial pits to determine if infiltration methods were achievable. As can be seen in Appendix G of this report, the results indicated that very low infiltration values were reported and would not be suitable for a development of this scale and size to protect the site across the range of storm scenarios required to appease the statutory authorities.

Lakeside School, Naylor's Road, Liverpool, L27 2YA

3 ASSESSMENT OF FLOOD RISK

3.1 Flood Risk Terminology

Flood risk considers both the probability and consequence of flooding. Flood events are often described in terms of their probability of recurrence or probability of occurring in any one year. The threshold between a medium flood and a large flood is often regarded as the 1 in 100-year event. This is an event which statistical analysis suggests will occur on average once every hundred years. However, this does not mean that such an event will not occur more than once every hundred years. Table 2 shows the event return periods expressed in years and annual exceedance probabilities as a fraction and a percentage. For example, a 1 in 100-year event has a 1% probability of occurring in any one year, i.e. a 1 in 100 probability. A 1000-year event has a 0.1% probability of occurring in any one year, i.e. a 1 in 1000 probability.

Return Period (Years)	Annual Exceedance Probability (AEP)	
	Fraction	Percentage
2	0.5	50%
10	0.1	10%
25	0.04	4%
50	0.02	2%
100	0.01	1%
200	0.005	0.5%
500	0.002	0.2%
1000	0.001	0.1%

Table 2: Flood return periods and exceedance probabilities

3.2 Fluvial Flood Risk

The site is not located in proximity to a main river. The nearest main river/watercourse is 0.5km west from the site and possesses no flood risk to the site. The Flood Zone 1 outline in Figure 2 and the Fluvial Flood Map in Figure 5 indicates the site is not at risk of fluvial flooding.

The fluvial flood map in Figure 4 shows areas that may be at risk of fluvial flooding from rivers or the sea. High risk is a >3.3% Annual Exceedance Probability (AEP) event, meaning this area has a chance of flooding of greater than 1 in 30 years (dark blue). This takes into account the effect of any flood defences in the areas. However, these defences reduce but do not completely stop the chance of flooding as they can be overtopped or fail. Medium risk is an AEP event of between 3.3-1% (1 in 30 - 1 in 100 - year, blue) chance of flooding. Low risk is an AEP event of between 1-0.1% (1 in 100 – 1 in 1000 year, light blue) chance of flooding. Very Low risk is an AEP event of <0.1% (Less than 1 in 1000 year, white) chance of flooding.

Lakeside School, Naylor's Road, Liverpool, L27 2YA

The Flood Map shows the current best information on the extent of the extreme flood from rivers or the sea that would occur without the presence of flood defences. The potential impact of climate change is not considered by the mapping.

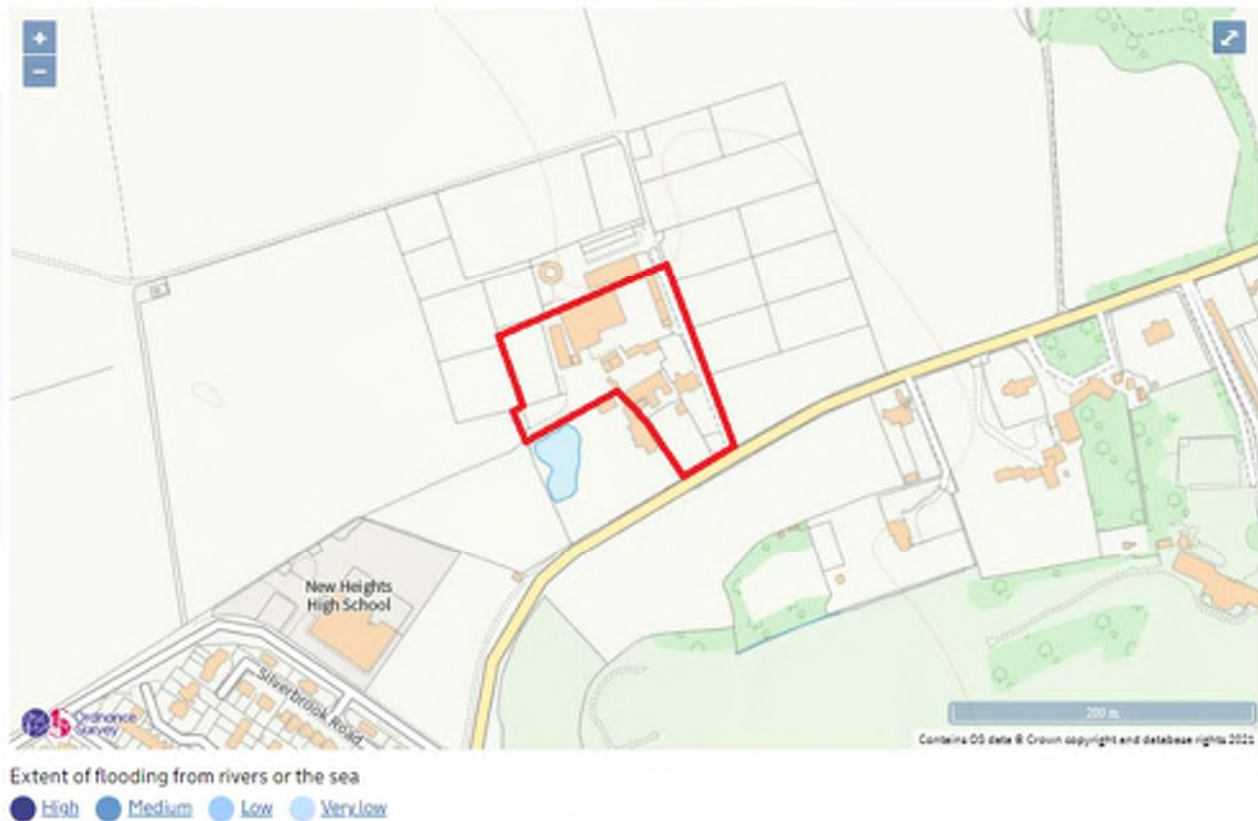


Figure 5: Environment Agency Fluvial Flood Map (Source: Environment Agency, 2020, GOV.UK)

3.3 Surface Water Flood Risk

The EA have mapped areas prone to surface water flooding based on historic flooding information received from the lead local flood authorities and modelling based on a LiDAR/IfSAR digital terrain model, Ordnance Survey information on urban areas and a direct rainfall approach using Flood Estimation Handbook (FEH) methodology. The critical (worst case) of the 1,3 and 6-hour storm durations have been mapped with no areal reduction factor applied. No allowance is made for climate change, the mapping therefore indicates the current predicted flood risk.

The maps work in the same colour coding as described above for the fluvial maps where High Risk AEP events are displayed in Dark Blue, Medium Risk in Blue, Low Risk in Light Blue and Very Low Risk in White. The maps do not account for culverts/underground drainage and due to digital terrain model resolutions may also underestimate or omit small drainage channels/ditches. Figure 6 shows the resulting predicted flood risk from surface water.

Lakeside School, Naylor's Road, Liverpool, L27 2YA

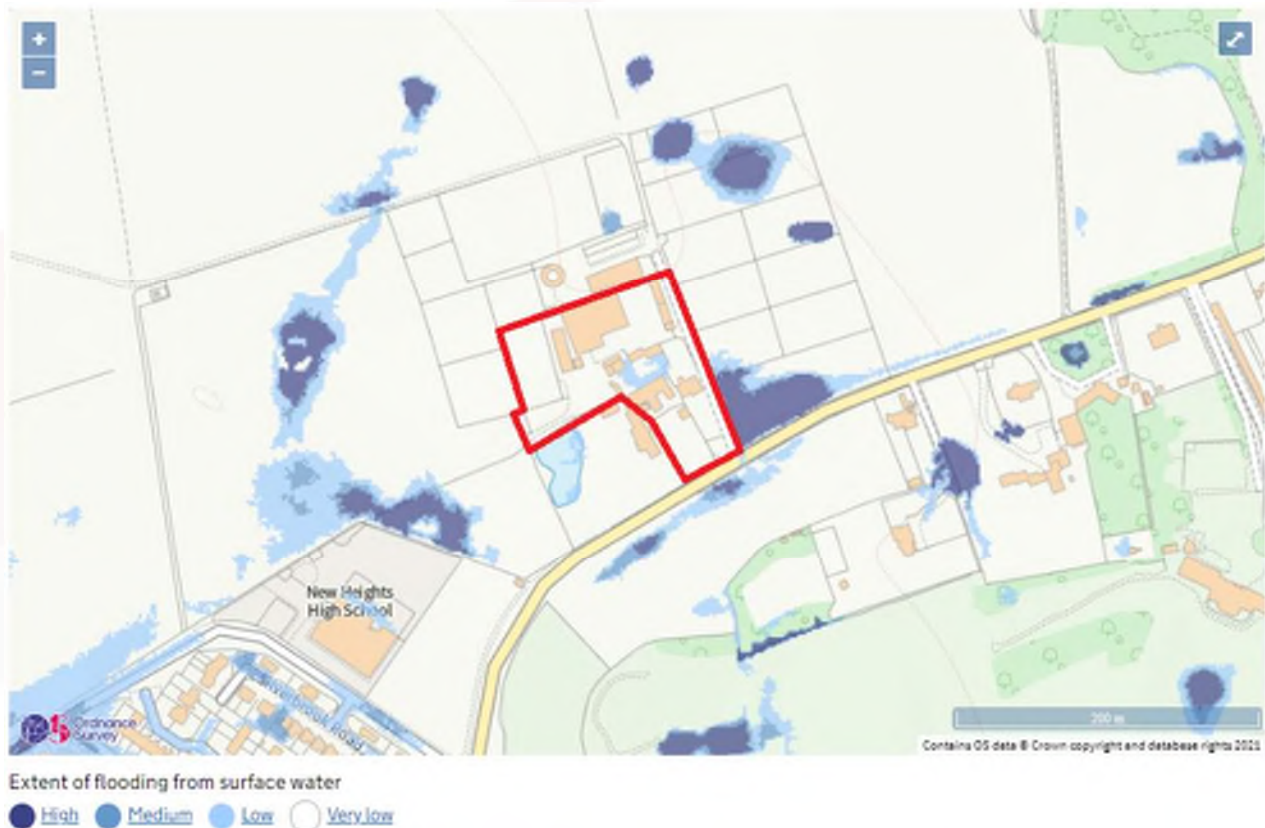


Figure 6: Environment Agency Surface Water Flood Map (Source: Environment Agency, 2020, GOV.UK)

The EA surface water flood map indicates the site is predominantly not at risk of surface water flooding. A small area of the site which is currently unused and backs onto the existing school is shown to be at 'Low' risk with a predicted chance of flooding of between 1 in 1000 year (0.1% AEP) and 1 in 100 year (1% AEP). This area is likely to be affected due to lack of existing drainage therefore the general redevelopment of this area and the inclusion of drainage should provide a betterment.

Figure 7 & Figure 8 show the low risk depth is between 900mm - <300mm with the direction of flow heading into the existing pond and away from the existing school building. Figure 9 shows the area of high risk adjacent to boundary has a direction of flow away from the site.

Lakeside School, Naylor's Road, Liverpool, L27 2YA

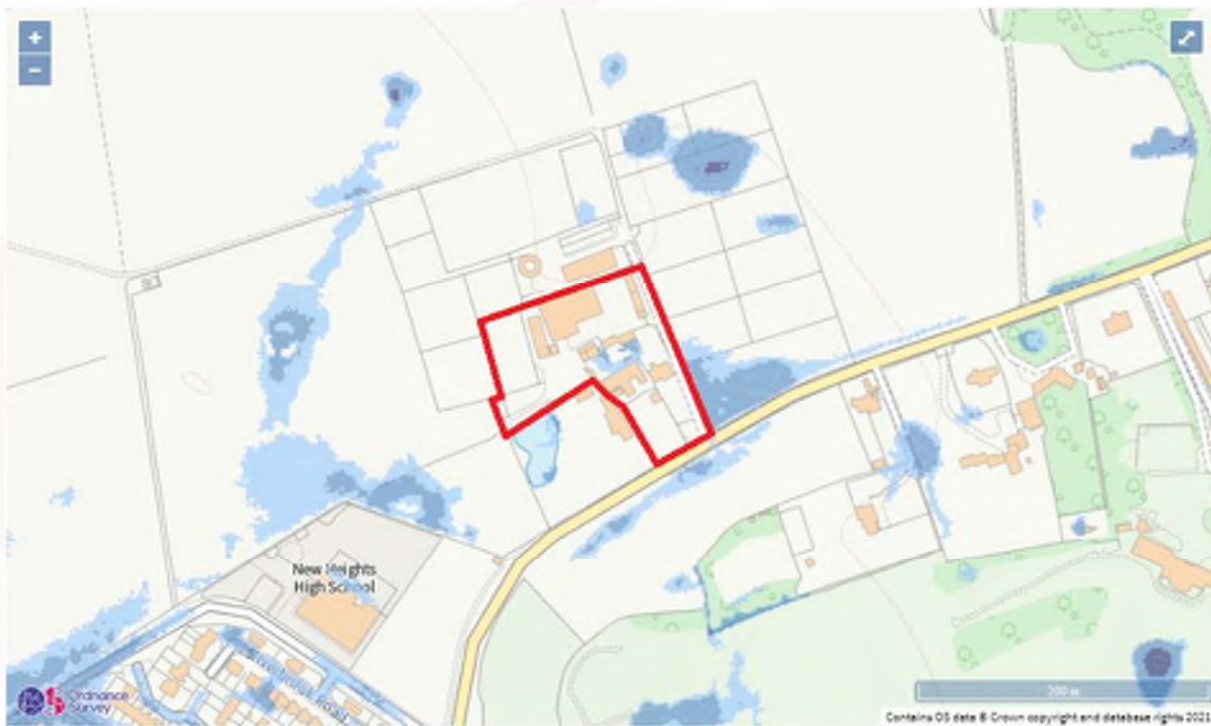


Figure 7: Environment Agency Surface Water Flood Risk: Low Risk Flood Depth Map (Source: Environment Agency, 2020, GOV.UK)

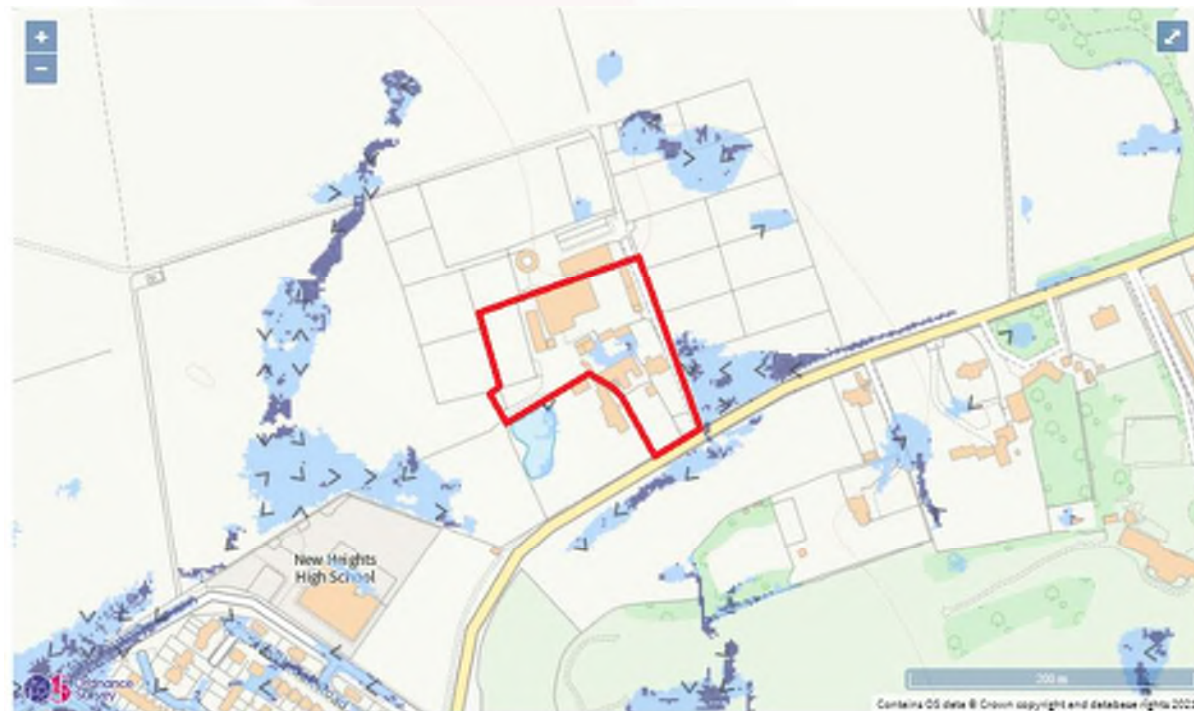


Figure 8: Environment Agency Surface Water Flood Risk: Low Risk Flood Velocity Map (Source: Environment Agency, 2020, GOV.UK)

Lakeside School, Naylor's Road, Liverpool, L27 2YA



Figure 9: Environment Agency Surface Water Flood Risk: High Risk Flood Velocity Map (Source: Environment Agency, 2020, GOV.UK)

3.4 Groundwater Flood Risk

A Level 1 Strategic Flood Risk Assessment (SFRA) was completed by JBA Consulting for Liverpool City Council in January 2018 this report states in section 5.4 (Page 39) that Liverpool has no records of historic groundwater flooding.

A Level 1 SFRA was completed by Atkins for Knowsley and Sefton Metropolitan Borough Councils in June 2009 this report in section 3.6.5 (Page 32) refers to Groundwater Emergence Maps in Appendix E of their report, which is also referenced by the Level 2 SFRA completed by Capita Symonds in October 2012, who goes on to states that in exceptionally wet winters, groundwater may be expected to rise close to the ground surface. This is most likely to happen in areas of low-lying areas such as Knowsley Brook, Kirkby Brook and Croxteth Brook. The River Alt, Netherly Brook and Bowring Park are also areas of concern.

As per Section 2.2 of this report states the site is located 0.75km west of Netherly Beck which has associated flood risk not affecting the site. Therefore, it is assumed groundwater flood risk would be in continuity of this fluvial risk. It is recommended that when boreholes are conducted across the site that groundwater strikes are identified and recorded if applicable.

3.5 Flooding from Artificial Sources

The Reservoir Flood Map which can be seen in Figure 10, indicates the maximum extend of flooding from reservoirs highlighted in light blue. As can be seen the site is not at risk of flooding from reservoirs and has no other canals or artificial sources nearby that pose any risk of flooding.

Lakeside School, Naylor's Road, Liverpool, L27 2YA

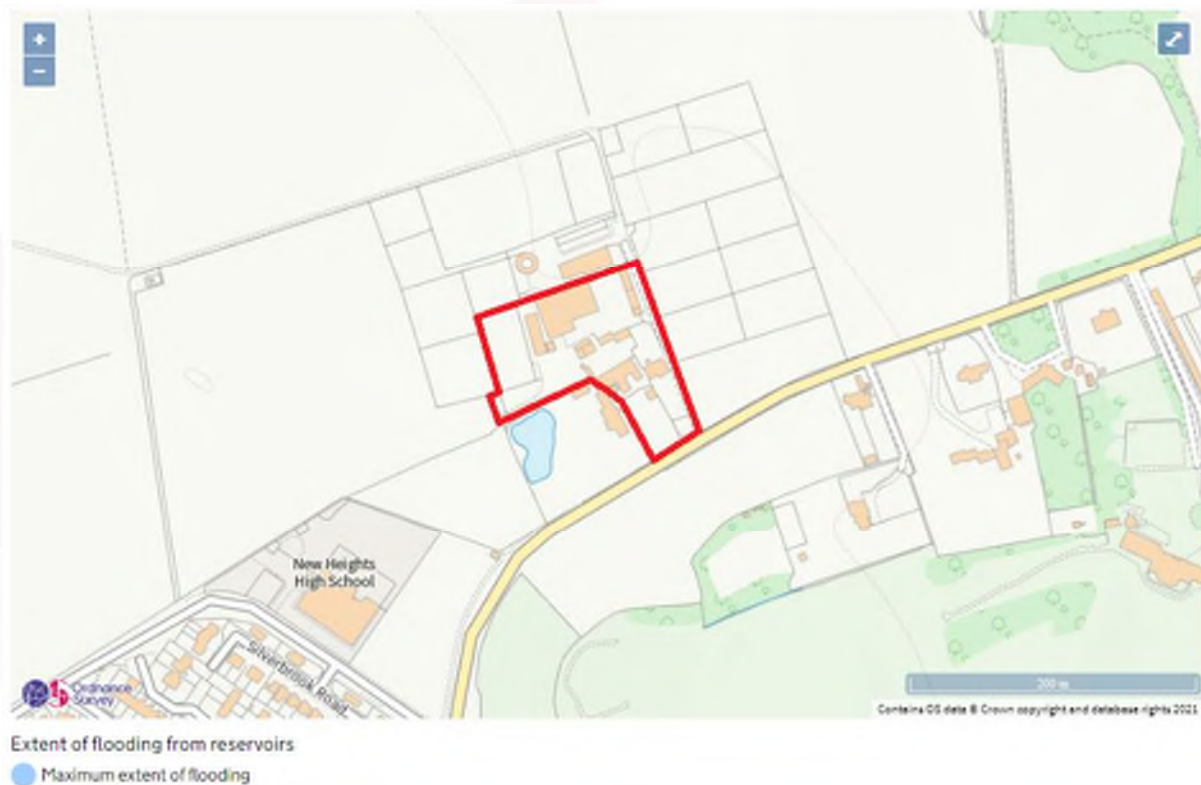


Figure 10: Environment Agency Reservoir Flood Map (Source: Environment Agency, 2020, GOV.UK)

3.6 Flooding from Sewers

UU do not provide information on flood risk from their assets. As discussed in Section 2.3, UU Sewers records (included in Appendix A) indicate that there are no sewers crossing the site.

Lakeside School, Naylor's Road, Liverpool, L27 2YA

4 FLOOD MITIGATION

4.1 Summary of Flood Risk

There is no known risk of flooding from fluvial sources, groundwater, sewers or artificial sources and reservoirs. It is considered there is to be a low risk of flooding from surface water sources and therefore it is recommended that mitigation measures are not necessary in this respect for the proposed development. However, with the low threat of surface water flooding near the pond and to the rear of the school careful consideration of the use of drainage in this area will mitigate the issues most likely associated the existing lack of drainage.

Source of Flood Risk	Predicted Flood Risk (AEP, %)	Interpreted Risk Classification	Justification
Fluvial	<0.1%	Very Low	As predicted by EA
Tidal	<0.1%	Very Low	As predicted by EA
Surface Water	0.1 – 1%	Low	As predicted by EA
Groundwater	N/A	Very Low	SFRA's and continuity of Fluvial Risk
Artificial Sources	N/A	Very Low	As predicted by EA and observation of sources on OS Maps
Sewer	N/A	Very Low	Review of Sewer Maps

Table 3: Flood return periods and exceedance probabilities

Lakeside School, Naylor's Road, Liverpool, L27 2YA

5 SURFACE WATER DRAINAGE STRATEGY

5.1 Site Areas

The total development area is 1.12ha (11,225m²). To prepare the exploration of options for site drainage, the spatial extent of existing approximate land cover and proposed estimated land cover area on the site have been assessed in Table 4 and Table 5. As can be seen, resulting from the proposed development is a 16% increase in impermeable area therefore, a 50% betterment over the pre-development QBar runoff shall be made and restricted across all post-development return periods as can be seen in Table 6 and report in the SuDS Pro-Forma required for Knowsley Council approval (Appendix E)

Table 4: Existing Approximate Land Cover Areas

Land Cover	Area		Percentage of total site area
	m ²	Ha	
Total impermeable area	3,465	0.347	31%
Remaining permeable area	7,760	0.776	69%

Table 5: Proposed Estimated Land Cover Areas

Land Cover	Area		Percentage of total site area
	m ²	Ha	
Total impermeable area	5,295	0.530	47%
Remaining permeable area	5,930	0.593	53%

5.2 Rate of Runoff Assessment

Full details of the calculations and the methodology for deriving the Peak Rate of Runoff are included in Appendix B. A summary of the results is included in Table 6 below.

Table 6: Surface Water Rate of Runoff

Peak Rate of Runoff (l/s)				
Event	Greenfield	Pre-Development Brownfield	Un-Restricted Post-Development Brownfield	Proposed Restricted 50% Reduction on Pre-Dev Brownfield QBar
Q1	5.9	37.1	56.7	27.3
QBAR	6.7	54.7	83.6	27.3
Q10	9.3	74.2	113.4	27.3
Q30	11.5	91.1	139.2	27.3
Q100	14.0	117.9	180.2	27.3
Q100 + 40% CC	18.2	165.1	252.3	27.3

5.3 Surface Water Disposal

Surface water disposal has been considered in line with the SuDS Hierarchy outlined in CIRIA Report 753 - The SuDS Manual_V6. The approach considers infiltration drainage in preference to disposal to a

Lakeside School, Naylor's Road, Liverpool, L27 2YA

watercourse (not achievable for this site as no watercourse in close proximity with an available connection from the site), in preference to a positive discharge to the public sewer network.

5.4 Surface Water Drainage Design Parameters

The surface water drainage system will be designed considering the following parameters using the modified rational method and a generated rainfall profile:

5.4.1 Rainfall Model

The calculations will use the most up to date available catchment descriptors (2013) provided by the Centre for Ecology and Hydrology Flood Estimation Handbook (FEH) web service.

5.4.2 Volumetric Runoff Coefficient (Cv)

The volumetric runoff coefficient describes the volume of surface water which runs off an impermeable surface following loss due to infiltration, depression storage, initial wetting, and evaporation. The coefficient is dimensionless. Default industry standard volumetric runoff coefficients are 0.75 for summer and 0.84 for winter.

5.4.3 Percentage Impermeability (PIMP)

The percentage impermeability (PIMP) for all impermeable areas is modelled as 100%. The entirety of the impermeable areas is therefore assumed to be positively drained.

5.4.4 Design Infiltration Rate

As stated in Section 2.4 ground investigations were completed and found that infiltration methods are not viable for this site.

5.4.5 Climate Change

Projections of future climate change indicate that more frequent short-duration, high intensity rainfall and more frequent periods of long-duration rainfall are likely to occur over the next few decades in the UK. These future changes will have implications for river flooding and local flash flooding. These factors will lead to increased and new risks of flooding within the lifetime of planned developments.

In February 2016, new climate change guidance issued by the Environment Agency came into effect outlining the anticipated changes in extreme rainfall intensity.

Table 7 shows anticipated changes in extreme rainfall intensity in small and urban catchments. Guidance states that for site-specific flood risk assessments and strategic flood risk assessments, both the central and upper end allowances should be assessed to understand the range of impacts. A climate change allowance of 40% has been selected for the purpose of drainage design based on the 100-year anticipated design life of the proposed development. This intermediate figure has been selected as the development is based on a pre-developed brownfield site. No properties are located immediately downstream of the site and therefore the site poses low risk to neighbouring property.

Lakeside School, Naylor's Road, Liverpool, L27 2YA

Table 7: Peak Rainfall Intensity Allowance in Small and Urban Catchments (use 1961 to 1990 baseline)

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	40%
Central	5%	10%	20%

5.5 Consideration of SuDS Components

A full range of SuDS components and techniques have been considered for the development of the site and their applicability to the site is discussed below.

- **Green Roofs** - Discounted due to limited of water volume retention on an existing brownfield site.
- **Soakaways** – Ground investigation reports infiltration methods are not viable. BGS records and soil values also indicate the ground conditions are not suitable for infiltration-based SuDS and the presence of the natural pond to the southwest of the site indicates there are protective clay layers, therefore soakaway systems would not be effective.
- **Water Butts** – Not suitable for a site of this size or occupation. A school is not always occupied and therefore, water butts could over spill and cause localised flooding if not emptied regularly.
- **Permeable Paving** – As explained above, the ground investigations reported infiltration methods are not viable. and therefore widely used permeable block paving systems would not be effective.

The car park located to the north of the site is proposed to be formed with a grasscrete product. Although it is not confirmed if infiltration will be viable. If not, this area will be allowed to pond if necessary as it will only be used as an overflow car park and can be formed so to contain water during heavy rainfall periods and closed off to public use.

The remaining access road and parking bays leading to the overflow on the eastern side of the site could utilise a sub-base replacement system or granular storage method which could be positively drained whilst providing initial storage. If infiltration methods are proven viable this can be re-evaluated so that the same permeable paving system is utilised but rather than being positively drained can be designed so that surface water is directed to the underlying sub-strata.

- **Ponds** – Discounted to due increased maintenance requirements. There is already a pond located on the existing lakeside site to the west, providing surface water storage and ecological benefits.
- **Geocellular Storage Tanks** – Will be considered as a primary storage feature for roof runoff and a possible secondary storage option for paved/road area in either open spaces or as a sub-base replacement device for a permeable paving system.

Lakeside School, Naylor's Road, Liverpool, L27 2YA

5.6 Surface Water Drainage Proposals

Based on the above assessment the following SuDS techniques are to be investigated:

- Geocellular Storage Tanks
- Hydro-Brake/Restricted Outfall

The SuDS are to be designed and sized to contain a future 1% AEP event of critical duration with a future climate change (40%) allowance accounted for. As outlined in Section 5.1, impermeable areas are to increase by 16% following the completion of the proposed development. Therefore, it has been proposed that runoff leaving the site is to be restricted to a 50% reduction of the pre-development brownfield QBar runoff rate across all post-development return periods, providing a significant betterment to site runoff.

Ground investigations reported infiltration methods are not viable. This is reinforced by the presence of an existing on-site pond and numerous surface water public sewers within the vicinity of the site.

Two points to be noted are as follows:

- 1) The existing school area to the southwest is to remain as existing. Therefore, the drainage properties/methods associated with this area will not be altered.
- 2) The car park located to the north of the site is to act as an overflow carpark and will be constructed from grasscrete. If infiltration methods are not proven viable a kerb will be associated with this car park to contain any ponding that may occur during heavy rainfall events, with public/staff access being disallowed during such events.

Therefore, it is proposed that the entirety of the remaining proposed roof areas are to be positively drained via rainwater downpipes, whilst the runoff from newly formed paved areas are to be collected via a combination of gullies and channel drains into a below ground drainage network.

The newly formed access road and associated parking bays to the east of the site will also be drained via either a combination of gullies and channel drains or via a Type C (Impermeable/Positively Drained) Permeable Paving system directed into a below ground drainage system providing initial sediment control.

Runoff will be directed by the below ground drainage system towards the south of the site, where it will be restricted and stored via SuDS devices prior to it being sent off site to the public sewer network. An initial storage estimate has been completed and between 135-225m³ of storage will be required on site. Although this is a broad figure, it can easily be stored within the grounds of the site. The targeted UU manhole is referenced 7201 which can be seen on UU sewer records in Appendix A of this report.

5.7 Designing for Local Drainage System Failure

In accordance with the general principles discussed in CIRIA Report C635 – Designing for Exceedance in Urban Drainage, the proposed surface water drainage, where practical, should be designed to ensure there is no increased risk of flooding to the buildings on the site or elsewhere as a result of extreme rainfall, lack of maintenance, blockages, or other causes.

5.8 Blockage & Exceedance

The site drainage will be designed to store a 100-year design storm including a 40% allowance for climate change. The drainage systems will also provide capacity for lower probability (greater design storm events) which are not of critical duration. Exceedance flows shall be retained on site within the drainage system as

Lakeside School, Naylor's Road, Liverpool, L27 2YA

far as practical however for storms of a greater return period it may be necessary to pass forward more flow or spill flows. In this unlikely event, exceedance flows from the flow control chambers would be routed down the access road leading to Naylor's Road so that it would be picked up by the existing highway drainage or towards the surrounding greenfield land.

5.9 Treatment Processes

Treatment of the surface water run-off will come from the possible use of permeable paving and/or the use of advance silt traps upstream of the SuDS features.

Lakeside School, Naylor's Road, Liverpool, L27 2YA

6 FOUL WATER DRAINAGE STRATEGY

Foul water from the site shall be connected to an existing on-site foul water manhole shown in the drainage layout plans in Appendix D of this report..

Under Section 106 of The Water Industry Act 1991, 'the owner / occupier of any premises shall be entitled to have his drain or sewer communicate with the public sewer of any sewerage undertaker and thereby to discharge foul water and surface water from those premises or that private sewer.' Unless 'the making of the communication would be prejudicial to the undertaker's sewerage system'. The proposed foul drainage system shall be constructed to standards outlined in Part H of the Building Regulations and will remain private.

Lakeside School, Naylor's Road, Liverpool, L27 2YA

7 CONCLUSIONS

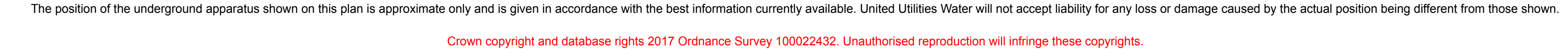
- The site is located within Flood Zone 1.
- The proposed development is classed as a major development and according to the NPPF's PPG as a school the site is classed as more vulnerable to flood risk. More vulnerable developments are deemed acceptable in Flood Zone 1.
- The site is at very low risk of flooding from fluvial sources, tidal sources, groundwater, sewers, and artificial sources.
- The site is at a low risk of surface water flooding within a small area behind the main existing school building. As explained in Section 3.3 the surface water issues can be controlled with the inclusion of a positive drainage solution in this area which does not currently exist.
- Surface water drainage for the site shall be drained via a combination of methods. The existing school site to the southwest shall remain as it is. The new overflow carpark to the north of the site will be formed from a grasscrete solution and remain independent. The remaining proposed impermeable areas will be drained into a proposed new SuDS device which will have a restricted outfall prior to runoff leaving the site boundary. A 50% betterment to the pre-development brownfield QBar runoff rate has been proposed across all post-development return periods, providing a significant betterment to the existing runoff produced from the site.
- The discharge point for surface water has been determined and a connection to UU manhole 7201 is proposed. The foul water is to discharge to an existing on-site foul water manhole.

Lakeside School, Naylor's Road, Liverpool, L27 2YA

8 REFERENCES

- [1] Ministry of Housing, Communities and Local Government, *National Planning Policy Framework*, July 2018.
- [2] Ministry of Housing, Communities and Local Government, *Planning Practice Guidance to the National Planning Policy Framework*, October 2019. (Some parts of the guidance backdate)
- [3] GOV.UK, DEFRA/Environment Agency Portal.
- [4] British Geological Survey (BGS), Superficial Deposits and Bedrock Geology Viewer.
- [5] Land Information System (LANDIS), Soilscales Viewer
- [6] Natural England, DEFRA Magic Maps Viewer.
- [7] Environment Agency, Main River Map Viewer.
- [8] United Utilities Sewer Records
- [9] Marshall & Bayliss, *Flood Estimation for Small Catchments, Report No. 124 (IoH 124)*, Institute of Hydrology, June 1994.
- [10] D.B Boorman, J.M. Hollis & A. Lilly, 1995. *Hydrology of soil types, Report No. 126. (IoH126) Institute of Hydrology*, November 1995.
- [11] The Modified Rational Method, Volume 4, *Design and analysis of urban storm drainage, The Wallingford Procedure*, 1983.
- [12] UK SuDS Online Tool in accordance with Environment Agency report SC030419, *Rainfall Runoff Management for Developments*, October 2013
- [13] CIRIA, *The SUDS Manual Version 6, Report C753*, 2015.
- [14] CIRIA, *Designing for Exceedance in Urban Drainage – Good Practice, Report C635*, 2006.
- [15] DEFRA, *Sustainable Drainage Systems – Non-statutory technical standards for sustainable drainage systems*, March 2015.
- [16] LASOO, *Non-statutory SUDS technical standards guidance*, 2016.

APPENDIX A
UU SEWER RECORDS



5012	17.7	FO	0	225	VC	25.58319	
5103	17.08	SW	0	225	VC	79.43585	
7206	61.75	SW	56.66	0		36.1156	1 in 46
6105	57.84	SW	53.4	300		60.06923	1 in 88

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	Change of Characteristic
Drop Shaft	
Orifice Plate	

FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	HorseShoe
RE	Rectangular	UN	Unspecified
SQ	Square		

AC	Asbestos Cement
BR	Brick
PE	Polyethylene
RP	Reinforced Plastic Matrix
CO	Concrete
CSB	Concrete Segment Bolted
CSU	Concrete Segment Unbolted
CB	Concrete Box Culverted
PS	Plastic / Steel Composite
GRC	Glass Reinforced Plastic
DI	Ductile Iron
PVC	Polyvinyl Chloride
CI	Cast Iron
SI	Spun Iron
ST	Steel
VC	Vitrified Clay
PP	Polypropylene
PF	Pitch Fibre
MAC	Masonry, Coursed
MR	Masonry, Random
U	Unspecified

LAKESIDE NAYLORS ROAD,
LIVERPOOL,
L27 2YA

Printed by: Property Searches



United Utilities
Water for the North West

APPENDIX B

PEAK RUNOFF RATE AND SURFACE WATER NETWORK CALCULATIONS

Job	Lakeside School	Job No.	L9523	Initial	JP
	Naylors Road	Date	Jul-21	Checked	KH
	Liverpool	Page	1 of 8	Revision	Rev C
Title	Peak Rate of Run-Off Calculation				

Calculation Brief

This spreadsheet has been produced to calculate the peak rate of run-off for surface water. The calculation helps determine changes in peak flow resulting from the development of a greenfield or brownfield site.

Baseline Information & References

For greenfield sites this calculation is to be used when the site area is less than 50ha and subsequently follows methodology outlined in IoH Report 124 to derive QBar. Using regional growth curves originally published in FSSR 14 this calculation then interpolates runoff rates for greater storm return periods.

For Brownfield sites this calculation follows methodology outlined in The Wallingford Procedure Volume 4 and uses the Modified Rational Method. Using this method the pre-development brownfield and post-development brownfield runoff rates are calculated and a post-development restriction documented.

The below references have been used in the preparation of these calculations:

- Marshall & Bayliss, IoH Report No. 124, Flood Estimation for Small Catchments, 1994.
- D.B. Boorman et al, Institute of Hydrology, Report No. 126, Hydrology of Soil Types, 1995.
- DEFRA/EA Report No. SC030219, Rainfall Runoff Management for Developments, 2013.
- The Walling Procedure, Design and Analysis of Urban Storm Drainage, V4, The Modified Rational Method, 1983.
- IoH, Flood Estimation Handbook (FEH)
- IoH, Flood Studies Report (FSR)
- CIRIA, Report C753, The SuDS Manual Version 6, 2015.
- The UK SuDS Online Tool.
- NERC, FSSR 2, The Estimation of Low Return Period Flows, IoH, 1977.
- NERC, FSSR 14, Review of Regional Growth Curves, IoH, 1983.

Proposed Land Use Changes

Changes to the existing site are as follows:

Brownfield Site to Brownfield Site

Results Summary

Rate of Run-Off (l/s)

Event	Greenfield	Pre-Development Brownfield	Un-Restricted Post-Development Brownfield	Proposed Restricted 50% Reduction on Pre-Dev Brownfield Qbar
Q1	5.9	37.1	56.7	27.3
QBAR	6.7	54.7	83.6	27.3
Q10	9.3	74.2	113.4	27.3
Q30	11.5	91.1	139.2	27.3
Q100	14.0	117.9	180.2	27.3
Q100 + 40% CC	18.2	165.1	252.3	27.3

Job	Lakeside School	Job No.	L9523	Initial	JP
	Naylor's Road	Date	Jul-21	Checked	KH
	Liverpool	Page	2 of 8	Revision	Rev C
Title	Peak Rate of Run-Off Calculation				

SITE AREAS

Existing Impermeable & Permeable Land Cover

Total Site Area: **1.1225** ha **11225** m²

Existing Impermeable & Permeable Land Cover

Land Cover	Area		Percentage of total site area
	m ²	ha	
Total impermeable area	3465.0	0.347	31%
Remaining permeable area	7760.0	0.776	69%

Proposed Land Cover Areas

Land Cover	Area		Percentage of total site area
	m ²	ha	
Roof Areas	1145.0	0.115	10%
Paved Areas	1325.0	0.133	12%
Road Areas	2825.0	0.283	25%
Landscaped Areas	5930.0	0.593	53%

Proposed Impermeable & Permeable Land Cover

Land Cover	Area		Percentage of total site area
	m ²	ha	
Total impermeable area	5295.0	0.530	47%
Remaining permeable area	5930.0	0.593	53%

Job	Lakeside School	Job No.	L9523	Initial	JP
	Naylor's Road	Date	Jul-21	Checked	KH
	Liverpool	Page	3 of 8	Revision	Rev C
Title	Peak Rate of Run-Off Calculation				

ESTIMATION OF QBAR (GREENFIELD RUNOFF RATE)

IoH Report No. 124 is based on the research of small catchments < 25 km²

Their methodology is based on regression analysis of response times using catchments from 0.9 to 22.9 km²

QBAR is mean annual flood on rural catchment
 QBAR depends on SOIL, SAAR and AREA most significantly

$$QBAR = 0.00108 \times AREA^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}$$

For SOIL refer to IoH Report No. 126

Contributing watershed area

Area, A	=	500000	m ²	insert 50 ha for EA
	=	0.500	km ²	small catchment method
	=	50.000	ha	

SAAR	=	843	mm	From UKSuds website (point data)
------	---	------------	----	----------------------------------

Soil index based on soil type, SOIL	=	$\frac{(0.1S1+0.3S2+0.37S3+0.47S4+0.53S5)}{(S1+S2+S3+S4+S5)}$
-------------------------------------	---	---

Where:	S1	=		%
	S2	=		%
	S3	=		%
	S4	=	100	%
	S5	=		%
			100	%

UK Suds website provides a value of 4.

So,	SOIL	=	0.47
-----	------	---	-------------

Note: for very small catchments it is far better to rely on local site investigation information.

QBAR _{rural}	=	0.300	m ³ /s
	=	300.0	l/s

Small rural catchments less than 50 ha

The Environment Agency recommends that this method should be used for development sizes from 0 to 50 ha and should linearly interpolate the formula to 50 ha.

So, catchment size	=	11225	m ²
	=	0.011	km ²
	=	1.123	ha

Excluding significant open space which would remain disconnected from the positive drainage system during flood events.

QBAR _{rural site}	=	0.00674	m ³ /s
	=	6.74	l/s

Job	Lakeside School	Job No.	L9523	Initial	JP
	Naylors Road	Date	Jul-21	Checked	KH
	Liverpool	Page	4 of 8	Revision	Rev C
Title	Peak Rate of Run-Off Calculation				

GREENFIELD RETURN PERIODS

QBAR can be factored by the UK FSR regional growth curves for return periods <2 years and for all other return periods to obtain peak flow estimates for required return periods.

These regional growth curves are constant throughout a region, whatever the catchment type and size.

See Figure A.1.2 of the DEFRA/EA 2013 guide for UK growth curves from FSSR 14

Region

= **10**

Use Figure A1.1 of the DEFRA/EA 2013 guide to determine region

GREENFIELD RETURN PERIOD FLOW RATES

Return Period	Ordinate	Q (l/s)
1	0.87	5.86
2	0.93	6.26
5	1.19	8.02
10	1.38	9.30
25	1.64	11.05
30	1.7	11.45
50	1.85	12.46
100	2.08	14.01
200	2.32	15.63
500	2.73	18.39
1000	3.04	20.48

Interpolation taken from Figure 24.2 (Page 515) SuDS Manual with derives the FSSR14 ordinates

Job	Lakeside School	Job No.	L9523	Initial	JP
	Naylor's Road	Date	Jul-21	Checked	KH
	Liverpool	Page	5 of 8	Revision	Rev C
Title	Peak Rate of Run-Off Calculation				

ESTIMATE OF BROWNFIELD RETURN PERIODS

Total site impermeable area, A = **3465** m²

M5-60 rainfall depth **20** mm
Ratio M5-60/M5-2Day, r **0.40**

Data obtained via the UK SuDS Website or MicroDrainage using the FSR database.

Storm Duration **15** mins

Anticipated critical duration for the site = 15 minutes

Duration factor, Z1 0.63

Data obtained from The Wallingford Procedure 1983 document Figure A.3b, Page 17

M5-15 rainfall depth = 12.7 mm

Return period ratio, Z2

M1-15	0.62
M10-15	1.23
M30-15	1.51
M100-15	1.96

Data obtained from The Wallingford Procedure 1983 document Table 1A, Page 9.

Rainfall

	Depth (mm)	Intensity, i (mm/hr)
M1-15	7.8	31
M10-15	15.6	62
M30-15	19.2	77
M100-15	24.8	99

Peak discharge, $Q_p = C_v C_r i A$

Where:

C_v = Volumetric Runoff Coefficient
 C_r = Routing Coefficient
 i = Rainfall intensity (mm/hour)

C_v = **0.95**
 C_r = **1.3**

Data obtained from the Wallingford Procedure 1983 document, Chapter 4, Page 5

Peak Runoff

	l/s
Q1	37.1
Q10	74.2
Q30	91.1
Q100	117.9

Job	Lakeside School	Job No.	L9523	Initial	JP
	Naylor's Road	Date	Jul-21	Checked	KH
	Liverpool	Page	6 of 8	Revision	Rev C
Title	Peak Rate of Run-Off Calculation				

ESTIMATION OF QBAR (BROWNFIELD RUNOFF RATE)

See Figure A.1.2 of the DEFRA/EA 2013 guide for UK growth curves from FSSR 14

Region = **10**

Use Figure A1.1 of the DEFRA/EA 2013 guide to determine region

Return Period	Ordinate
1	0.87
2	0.93
5	1.19
10	1.38
25	1.64
30	1.70
50	1.85
100	2.08
200	2.32
500	2.73
1000	3.04

Interpolation taken from Figure 24.2 (Page 515) SuDS Manual with derives the FSSR14 ordinates

Qbar	
Ordinate used	l/s
10 year	53.8
30 year	53.6
100 year	56.7

Proposed Brownfield Runoff, Qbar = 54.68 l/s

Using the average Qbar derived from three ordinates.

Job	Lakeside School	Job No.	L9523	Initial	JP
	Naylors Road	Date	Jul-21	Checked	KH
	Liverpool	Page	7 of 8	Revision	Rev C
Title	Peak Rate of Run-Off Calculation				

ESTIMATE OF BROWNFIELD RETURN PERIODS

Total site impermeable area, A = **5295** m²

M5-60 rainfall depth **20** mm
 Ratio M5-60/M5-2Day, r **0.40**

Data obtained via the UK SuDS Website or MicroDrainage using the FSR database.

Storm Duration **15** mins

Anticipated critical duration for the site = 15 minutes

Duration factor, Z1 0.63

Data obtained from The Wallingford Procedure 1983 document Figure A.3b, Page 17

M5-15 rainfall depth = 12.7 mm

Return period ratio, Z2

M1-15	0.62
M10-15	1.23
M30-15	1.51
M100-15	1.96

Data obtained from The Wallingford Procedure 1983 document Table 1A, Page 9.

Rainfall

	Depth (mm)	Intensity, i (mm/hr)
M1-15	7.8	31
M10-15	15.6	62
M30-15	19.2	77
M100-15	24.8	99

Peak discharge, Qp = Cv Cr i A

Where:

Cv = Volumetric Runoff Coefficient
 Cr = Routing Coefficient
 i = Rainfall intensity (mm/hour)

Cv = **0.95**
 Cr = **1.3**

Data obtained from the Wallingford Procedure 1983 document, Chapter 4, Page 5

Peak Runoff

	l/s
Q1	56.7
Q10	113.4
Q30	139.2
Q100	180.2

Job	Lakeside School	Job No.	L9523	Initial	JP
	Naylor's Road	Date	Jul-21	Checked	KH
	Liverpool	Page	8 of 8	Revision	Rev C
Title	Peak Rate of Run-Off Calculation				

ESTIMATION OF QBAR (BROWNFIELD RUNOFF RATE)

See Figure A.1.2 of the DEFRA/EA 2013 guide for UK growth curves from FSSR 14

Region = **10**

Use Figure A1.1 of the DEFRA/EA 2013 guide to determine region

Return Period	Ordinate
1	0.87
2	0.93
5	1.19
10	1.38
25	1.64
30	1.70
50	1.85
100	2.08
200	2.32
500	2.73
1000	3.04

Interpolation taken from Figure 24.2 (Page 515) SuDS Manual with derives the FSSR14

Qbar	
Ordinate used	l/s
10 year	82.2
30 year	81.9
100 year	86.6

Proposed Brownfield Runoff, Qbar = 83.55 l/s

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S100	0.045	5.00	19.720	1200	97172.591	115438.651	1.470
S101	0.045	5.00	19.750	1500	162082.122	106827.384	1.745
S102	0.045	5.00	19.680	1500	166019.415	98256.154	1.724
STORAGE 1	0.035	5.00	19.750		166027.978	69914.924	1.950
S103	0.060	5.00	19.750	1800	162382.981	69014.944	1.966
S104	0.080	5.00	19.650	1500	160651.706	55558.452	2.014
S105	0.060	5.00	19.400	1500	156222.009	21649.391	1.916
S106	0.050	5.00	19.250	1800	156750.041	3137.606	1.845
STORAGE 2	0.040	5.00	19.400		140351.616	10367.717	2.030
S107	0.060	5.00	19.350	2100	140351.616	3075.529	2.087
OUTFALL MH	0.000		18.970	1500	113616.499	-18221.615	1.970

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Slope (1:X)	Dia (mm)	Rain (mm/hr)
S1.000	S100	S101	39.204	0.600	18.250	18.005	160.0	225	50.0
S1.001	S101	S102	7.880	0.600	18.005	17.956	160.0	225	50.0
S1.002	S102	S103	27.516	0.600	17.956	17.784	160.0	225	50.0
S2.000	STORAGE 1	S103	3.800	0.600	17.800	17.784	237.5	225	50.0
S1.003	S103	S104	11.617	0.600	17.784	17.711	160.0	225	50.0
S1.004	S104	S105	32.697	0.600	17.636	17.484	215.0	300	50.0
S1.005	S105	S106	17.019	0.600	17.484	17.405	215.0	300	50.0
S1.006	S106	S107	14.449	0.600	17.405	17.338	215.0	300	50.0
S3.000	STORAGE 2	S107	7.200	0.600	17.370	17.338	225.0	300	50.0
S1.007	S107	OUTFALL MH	90.000	0.600	17.263	17.000	342.2	375	50.0

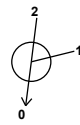
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)
S1.000	1.031	41.0	6.1	1.245	1.520	0.045
S1.001	1.031	41.0	12.2	1.520	1.499	0.090
S1.002	1.031	41.0	18.3	1.499	1.741	0.135
S2.000	0.844	33.6	4.7	1.725	1.741	0.035
S1.003	1.031	41.0	31.2	1.741	1.714	0.230
S1.004	1.068	75.5	42.0	1.714	1.616	0.310
S1.005	1.068	75.5	50.1	1.616	1.545	0.370
S1.006	1.068	75.5	56.9	1.545	1.712	0.420
S3.000	1.044	73.8	5.4	1.730	1.712	0.040
S1.007	0.974	107.5	70.5	1.712	1.595	0.520

Pipeline Schedule

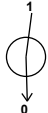
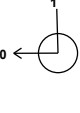
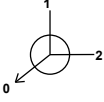
Link	Length (m)	Slope (1:X)	Dia (mm)	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
S1.000	39.204	160.0	225	19.720	18.250	1.245	19.750	18.005	1.520
S1.001	7.880	160.0	225	19.750	18.005	1.520	19.680	17.956	1.499
S1.002	27.516	160.0	225	19.680	17.956	1.499	19.750	17.784	1.741
S2.000	3.800	237.5	225	19.750	17.800	1.725	19.750	17.784	1.741
S1.003	11.617	160.0	225	19.750	17.784	1.741	19.650	17.711	1.714
S1.004	32.697	215.0	300	19.650	17.636	1.714	19.400	17.484	1.616
S1.005	17.019	215.0	300	19.400	17.484	1.616	19.250	17.405	1.545
S1.006	14.449	215.0	300	19.250	17.405	1.545	19.350	17.338	1.712
S3.000	7.200	225.0	300	19.400	17.370	1.730	19.350	17.338	1.712
S1.007	90.000	342.2	375	19.350	17.263	1.712	18.970	17.000	1.595

Link	US Node	DS Node
S1.000	S100	S101
S1.001	S101	S102
S1.002	S102	S103
S2.000	STORAGE 1	S103
S1.003	S103	S104
S1.004	S104	S105
S1.005	S105	S106
S1.006	S106	S107
S3.000	STORAGE 2	S107
S1.007	S107	OUTFALL MH

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S100	97172.591	115438.651	19.720	1.470	1200				
						0	S1.000	18.250	225
S101	162082.122	106827.384	19.750	1.745	1500		1	S1.000	18.005
						0	S1.001	18.005	225
S102	166019.415	98256.154	19.680	1.724	1500		1	S1.001	17.956
						0	S1.002	17.956	225
STORAGE 1	166027.978	69914.924	19.750	1.950					
						0	S2.000	17.800	225
S103	162382.981	69014.944	19.750	1.966	1800		1	S2.000	17.784
						2	S1.002	17.784	225
						0	S1.003	17.784	225
S104	160651.706	55558.452	19.650	2.014	1500		1	S1.003	17.711
						0	S1.004	17.636	300

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S105	156222.009	21649.391	19.400	1.916	1500		1 S1.004	17.484	300
S106	156750.041	3137.606	19.250	1.845	1800		0 S1.005	17.484	300
							1 S1.005	17.405	300
							0 S1.006	17.405	300
STORAGE 2	140351.616	10367.717	19.400	2.030			0 S3.000	17.370	300
S107	140351.616	3075.529	19.350	2.087	2100		1 S3.000	17.338	300
							2 S1.006	17.338	300
							0 S1.007	17.263	375
OUTFALL MH	113616.499	-18221.615	18.970	1.970	1500		1 S1.007	17.000	375

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Detailed
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

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

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

Node S107 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Downstream Link	S1.007	Sump Available	✓
Replaces Downstream Link	✓	Product Number	CTL-SHE-0225-2740-1200-2740
Invert Level (m)	17.263	Min Outlet Diameter (m)	0.300
Design Depth (m)	1.200	Min Node Diameter (mm)	1800
Design Flow (l/s)	27.4		

Node S103 Online Orifice Control

Flap Valve	x	Invert Level (m)	17.784	Diameter (m)	0.119
Downstream Link	S1.003	Design Depth (m)	1.200	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	32.0		

Node STORAGE 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	17.800
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	41

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	65.0	0.0	1.200	65.0	0.0	1.201	0.0	0.0

Node STORAGE 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	17.370
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	60

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	80.0	0.0	1.200	80.0	0.0	1.201	0.0	0.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.86%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S100	10	18.317	0.067	8.2	0.1162	0.0000	OK
15 minute winter	S101	11	18.117	0.112	16.1	0.2568	0.0000	OK
15 minute winter	S102	11	18.082	0.126	23.5	0.2883	0.0000	OK
30 minute winter	STORAGE 1	25	17.996	0.196	21.2	12.1896	0.0000	OK
30 minute winter	S103	25	17.996	0.212	27.0	0.6685	0.0000	OK
15 minute winter	S104	11	17.748	0.112	23.1	0.2867	0.0000	OK
15 minute winter	S105	11	17.638	0.154	33.5	0.3690	0.0000	OK
15 minute winter	S106	11	17.578	0.173	41.9	0.5336	0.0000	OK
30 minute winter	STORAGE 2	25	17.514	0.144	22.1	10.9851	0.0000	OK
30 minute winter	S107	25	17.513	0.250	43.0	1.0095	0.0000	OK
15 minute summer	OUTFALL MH	1	17.000	0.000	26.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute winter	S100	S1.000	8.0	0.549	0.194	0.5798
15 minute winter	S101	S1.001	15.8	0.750	0.386	0.1682
15 minute winter	S102	S1.002	23.9	0.921	0.582	0.7401
30 minute winter	STORAGE 1	S2.000	-16.3	-0.895	-0.485	0.1436
30 minute winter	S103	Orifice	11.5			
15 minute winter	S104	S1.004	22.9	0.763	0.303	0.9877
15 minute winter	S105	S1.005	33.3	0.849	0.441	0.6680
15 minute winter	S106	S1.006	41.9	1.054	0.554	0.5940
30 minute winter	STORAGE 2	S3.000	-16.5	-0.853	-0.223	0.2736
30 minute winter	S107	Hydro-Brake®	26.4			

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.86%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S100	10	18.344	0.094	15.6	0.1642	0.0000	OK
15 minute winter	S101	12	18.302	0.297	30.9	0.6772	0.0000	SURCHARGED
15 minute winter	S102	12	18.272	0.316	41.4	0.7242	0.0000	SURCHARGED
30 minute winter	STORAGE 1	26	18.202	0.402	41.6	24.9641	0.0000	SURCHARGED
30 minute winter	S103	26	18.201	0.417	47.6	1.3166	0.0000	SURCHARGED
30 minute winter	S104	30	17.824	0.188	35.4	0.4815	0.0000	OK
30 minute winter	S105	30	17.815	0.331	51.0	0.7927	0.0000	SURCHARGED
30 minute winter	S106	30	17.805	0.400	62.3	1.2351	0.0000	SURCHARGED
30 minute winter	STORAGE 2	31	17.796	0.426	56.3	32.5099	0.0000	SURCHARGED
30 minute winter	S107	31	17.795	0.532	75.9	2.1494	0.0000	SURCHARGED
15 minute summer	OUTFALL MH	1	17.000	0.000	27.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute winter	S100	S1.000	15.3	0.606	0.372	1.0838
15 minute winter	S101	S1.001	25.8	0.766	0.629	0.3134
15 minute winter	S102	S1.002	37.9	1.031	0.925	1.0943
30 minute winter	STORAGE 1	S2.000	-32.3	-0.914	-0.962	0.1511
30 minute winter	S103	Orifice	17.7			
30 minute winter	S104	S1.004	35.2	0.810	0.466	1.9106
30 minute winter	S105	S1.005	49.0	0.866	0.648	1.1985
30 minute winter	S106	S1.006	60.0	1.051	0.794	1.0175
30 minute winter	STORAGE 2	S3.000	-45.7	-1.007	-0.620	0.5070
30 minute winter	S107	Hydro-Brake®	27.4			

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.86%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S100	12	19.130	0.880	28.3	1.5332	0.0000	SURCHARGED
15 minute winter	S101	12	19.052	1.047	48.5	2.3909	0.0000	SURCHARGED
15 minute winter	S102	12	18.967	1.011	68.7	2.3143	0.0000	SURCHARGED
60 minute winter	STORAGE 1	50	18.743	0.943	50.7	58.5431	0.0000	SURCHARGED
60 minute winter	S103	50	18.742	0.958	56.9	3.0234	0.0000	SURCHARGED
60 minute winter	S104	58	18.479	0.843	41.2	2.1588	0.0000	SURCHARGED
60 minute winter	S105	58	18.467	0.983	57.9	2.3524	0.0000	SURCHARGED
60 minute winter	S106	59	18.458	1.053	71.9	3.2508	0.0000	SURCHARGED
60 minute winter	STORAGE 2	59	18.449	1.079	71.4	82.4323	0.0000	SURCHARGED
60 minute winter	S107	59	18.449	1.186	88.5	4.7894	0.0000	SURCHARGED
15 minute summer	OUTFALL MH	1	17.000	0.000	27.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute winter	S100	S1.000	21.8	0.629	0.532	1.5592
15 minute winter	S101	S1.001	42.8	1.077	1.045	0.3134
15 minute winter	S102	S1.002	63.8	1.604	1.556	1.0943
60 minute winter	STORAGE 1	S2.000	-39.6	-0.997	-1.182	0.1511
60 minute winter	S103	Orifice	17.1			
60 minute winter	S104	S1.004	38.4	0.812	0.509	2.3025
60 minute winter	S105	S1.005	55.7	0.832	0.738	1.1985
60 minute winter	S106	S1.006	69.0	0.980	0.914	1.0175
60 minute winter	STORAGE 2	S3.000	-58.4	-0.830	-0.792	0.5070
60 minute winter	S107	Hydro-Brake®	27.4			

Lakeside School, Naylor's Road, Liverpool, L27 2YA

APPENDIX C
DEVELOPMENT PROPOSALS – LAYOUT PLAN

Parking Schedule	
Description	Count
Standard car parking bay	76
Disabled parking bay	3
Electric charging bay	4
TOTAL	83

Proposed New Building GIA	
Building Number	Area
B3	
First Floor Level	448.96 m ²
Ground Floor Level	1020.48 m ²
Loft Level	214.88 m ²
Grand total	1684.31 m ²

Drawing Status
PLANNING

This drawing is © C4 Projects and is not to be copied, reproduced or re-distributed either in whole or in part without the prior written permission of the originator.

The originator shall have no responsibility for any liability, loss, cost, damage or expense arising from or relating to any use of this document other than for its intended purpose on this project.

This drawing shall be read in conjunction with all other relevant drawings, specifications and associated documentation. Any discrepancies, errors or omissions are to be reported to the originator before proceeding with work.

All dimensions are to be checked on site by the contractor prior to proceeding with any work. This drawing shall not be scaled to ascertain any dimensions, work to figured dimensions only.

DISCLAIMER
When this drawing is issued in CAD, it is an uncontrolled version issued for information only, to enable the recipient to prepare their own documents/ drawings for which they are solely responsible.

SOFTWARE INTEROPERABILITY
C4 Projects prepared this drawing using Autodesk REVIT Architecture.

C4 Projects does not accept liability for any loss or degradation of any information held in the drawing resulting from the translation from the original file format to any other file format or from the recipient's reading of it in any other programme.

Hazard Identification		
ref	hazard	date

- DEVELOPMENT KEY**
- Ownership
 - Development Boundary
 - Grasscrete
 - Tarmac Road
 - Block Paving
 - Pick up/Drop off Area
 - Paving Flags
 - Tarmac Road
 - Tarmac Path
 - Soft Landscaping
 - Hardstanding
 - Existing Primary School Building
 - 2.4m High Anticlimb Fence PPC Green
 - Bin Store
 - Bicycle shelter. Provision for 8 long stay bicycles
 - Double entrance gates to yard
 - Electric vehicle charging

Note: Soft Landscaping shown indicatively, refer to Landscape Architect scheme drawing for detailed proposals

P8	GIA Area and Volume Identification Schedules Amended	AW	16.04.21	JP
P7	Tactile Paving Area Amended	AW	15.04.21	JP
P6	Bike Store Relocated, Fencing and Bike Store Specification Amended, Red Line Boundary Amended, Traffic Hump Added, Paving near the Main Entrance Extended, Tarmac Area near the Main Entrance to the Site Extended	AW	14.04.21	JP
P5	Landscape Design Amended, Path around Football Pitch Added, Fencing Line Amended, Gates to the Primary School Relocated, Paving near the South-West Entrance to the Existing Primary School Building Added, Trees and Trees Protection Zone Amended	AW	07.04.21	JP
P4	Parking Grasscrete Area Amended	AW	30.03.21	JP
P3	Red Line Amended, Secondary School Drop off Area Amended, Roundabout Added, Electric Charging Bays Area Added	AW	26.03.21	JP
P2	Amended Following Comments	AW	26.03.21	JP
P1	First Issue of Drawing	AW	25.03.21	JP
Rev	Revision Details	Drawn	Date	Checked

C4 Projects
Quayside, Wilderspool Business Park, Stockton Heath, Warrington, Cheshire, WA4 6HL
t: 01852 751 852
e: info@c4projects.co.uk
www.c4projects.co.uk

Project Management • Architecture • Building Surveying • Cost Consultancy

Client
Witherslack Group

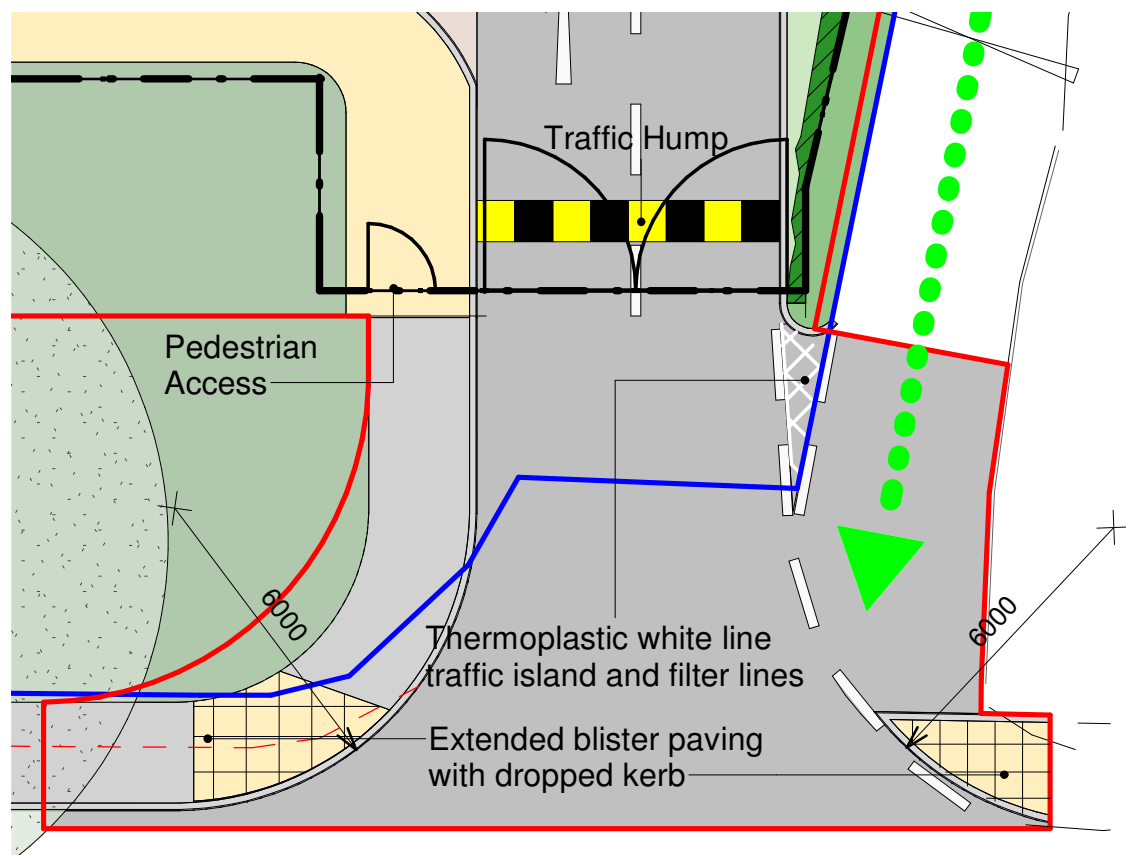
Project
Lakeside School
Liverpool

Drawing Title
Site Plan As Proposed

Status Purpose of Issue
S2 SUITABLE FOR INFORMATION

Drawn by JEP **Created** 18.06.20
C4 Job no. 20-034 **Scale** As indicated **@** A1

Drg no. 20034-C4P-AV-ZZ-DR-A-0510 **Rev** P8



05-ZZ_Entrance Detail_Site Plan as Proposed
1:150

Rotavate existing ground and lay new top soil and grass seed

Timber knee rails

MUGA
442.000m²

Hard Play Area

Play Area

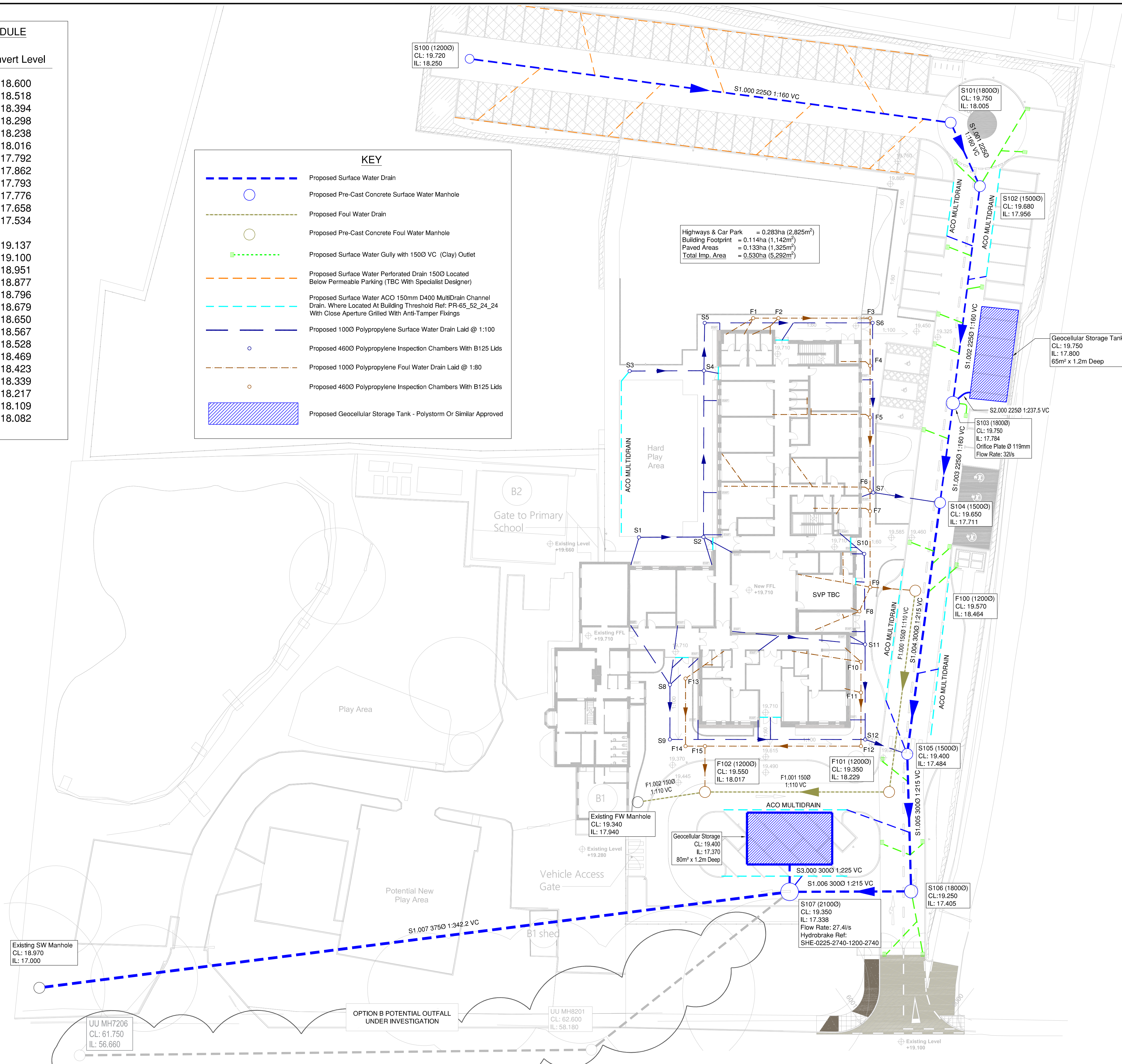
Potential New Play Area

Existing Right of Way

APPENDIX D
DRAINAGE LAYOUT PLAN

Chamber No.	Cover Level	Invert Level
S1	19.600	18.600
S2	19.700	18.518
S3	19.600	18.394
S4	19.700	18.298
S5	19.600	18.238
S6	19.500	18.016
S7	19.675	17.792
S8	19.550	17.862
S9	19.475	17.793
S10	19.675	17.776
S11	19.670	17.658
S12	19.475	17.534
F1	19.650	19.137
F2	19.680	19.100
F3	19.510	18.951
F4	19.600	18.877
F5	19.650	18.796
F6	19.675	18.679
F7	19.675	18.650
F8	19.700	18.567
F9	19.680	18.528
F10	19.640	18.469
F11	19.600	18.423
F12	19.475	18.339
F13	19.575	18.217
F14	19.450	18.109
F15	19.425	18.082

F1	19.650	19.137
F2	19.680	19.100
F3	19.510	18.951
F4	19.600	18.877
F5	19.650	18.796
F6	19.675	18.679
F7	19.675	18.650
F8	19.700	18.567
F9	19.680	18.528
F10	19.640	18.469
F11	19.600	18.423
F12	19.475	18.339
F13	19.575	18.217
F14	19.450	18.109
F15	19.425	18.082



DO NOT SCALE THIS DRAWING

A1

GENERAL NOTES:

- Before construction commences, the setting out Engineer shall ensure that all setting out information is mutually compatible with all the drawings and documents provided by the designers. Where there is any discrepancy or ambiguity, the setting out Engineer and/or the Architect is to be informed immediately. Thomas Consulting will accept no liability for setting out errors where work is conducted in accordance with the setting out information work commenced.
- All drawings and documents are to be read in conjunction with one another, are mutually compatible and shall be read as such. All documents are to be read in conjunction with one another, are mutually compatible and shall be read as such. All documents are to be read in conjunction with one another, are mutually compatible and shall be read as such. In the event of apparent ambiguity or contradiction the engineer and/or architect shall be notified immediately. Thomas Consulting accept no liability in the event of any discrepancy or ambiguity in the setting out work commenced.
- In accordance with CDM regulations 2015 this drawing has been prepared with due attention to identifying any unusual design hazards that may exist. Unusual design hazards are hazards that a reasonably competent contractor, experienced in this type of work and who has been alerted to the hazards, is unlikely to identify. The designers have adopted the "ERIC" principle and where possible eliminated (E) the hazard at design stage, if it has not been possible to eliminate (E) the hazard, then they have endeavoured to reduce (R) it. Where it has not been possible to eliminate these hazards (E), the hazard is noted on the drawing with appropriate information (I) in order that the hazard can be controlled (C) during construction. It is the contractor's responsibility to ensure that the hazard is controlled. All construction drawings before commencing construction and it is down to anybody that matter to ask for clarification from the designer.
- All drawings issued electronically for this scheme are provided for the sole purpose of assisting the design, procurement or construction of the structures for which Thomas Consulting have been appointed the designers/Consultants. The drawings are not to be used for any other purpose, nor may they be amended, copied, redistributed or issued to third parties without the written agreement of Thomas Consulting. All drawings remain under copyright to, and the intellectual property of, Thomas Consulting. Where electronic copies of the project, all drawings are to be deleted from your computer systems and all other electronic copies destroyed. Where electronic copies of the drawings are to be retained, then they shall be provided in digital only format by Thomas Consulting (no other copies may be retained). By opening and using this drawing, it is assumed that you agree to abide by these Terms and Conditions.
- Unless expressly agreed with a director of Thomas Consulting Ltd, for the purposes of the CDM regulations 2015 Thomas Consulting are not the Principal Designer. The client has been advised that they are not to appoint a Principal Designer. For further information see <http://www.hse.gov.uk/>

IN ADDITION TO THE HAZARDS/RISKS ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, PLEASE NOTE THE FOLLOWING SIGNIFICANT RESIDUAL RISKS:

TEM	HAZARD IDENTIFICATION

REVISIONS

REV	DATE	DESCRIPTION	DRAWN BY	CHECKED BY

DRAWING STATUS:

TENDER ISSUE



Offices in **Chorley, Lancaster & Shrewsbury**
Tel: 01524 846022
e-mail: info@thomasconsulting.co.uk

CLIENT:

THE WITHERSLACK GROUP

PROJECT:

LAKESIDE SCHOOL
LIVERPOOL

DRAWING TITLE:

DRAINAGE LAYOUT PLAN

DATE CREATED: 26/07/21	DRAWING SCALE: 1:250	DRAWN BY: JP	CHECKED BY: KH	QA CATEGORY: 1
---------------------------	-------------------------	-----------------	-------------------	-------------------

RAWING REF;	REV;
-------------	------

TC / L9523 / 21 / 104

APPENDIX E
KNOWSLEY SUDS PRO-FORMA

PRO-FORMA 1: Sustainable Drainage System: Planning Permission

This pro-forma is a requirement of the Planning Validation Checklist. You **must complete all white boxes in full** and submit this pro-forma along with your supporting evidence to the Local Planning Authority for any application which seeks planning permission for major development (as defined in section 2 of [Statutory Instrument 2015 No. 595](#)).

This pro-forma supports developers and regulators in **summarising and confirming** how surface water from a development will be managed sustainably under current and future conditions. It should be completed in conjunction with the Council's 'Completing your Pro Forma' document and your sustainable drainage system should be designed in accordance with [CIRIA The SuDS Manual C753](#).

The pro-forma follows Policy CS24 of [Knowsley MBC's Local Plan](#), [National Planning Policy Framework](#), [House of Commons Written Statement \(HWSW 161\) on SuDS](#), [Planning Practice Guidance](#) and [Defra's Non-Statutory Technical Standards for Sustainable Drainage Systems](#). It is supported by the [Defra/EA Guidance on Rainfall Runoff Management](#) and can be completed using freely available tools such as [Tools for Sustainable Drainage Systems](#) or approved Industry Standard surface water management design software. The Council's [Sustainable Drainage & Surface Water Management Technical Guidance document](#) also provides further information.

Section 1: Development Details

Development Name		Lakeside School Development			
Development Address (including postcode)		Lakeside School, Naylor's Road, Liverpool, L27 2YA		Planning Application Reference (if available)	
Development Grid Reference	Northings	43770		Expected lifetime of development (years)	100
	Eastings	89318		Have you submitted a Flood Risk Assessment?	Yes ☒ No ☐
Total Development Site Area (Ha)		1.1225		Type of Planning Application (✓)	Outline ☐
Site area served by proposed drainage system (excluding open space) (Ha)*		0.5295			Full ☐
Is your surface water drainage system designed to a (tick all that apply):					Hybrid ☐
Greenfield Standard		- Site is undeveloped and a new drainage system will be installed; OR - Site is already developed and a new surface water drainage system will be installed to serve the new development.			Reserved Matters ☐
Previously Developed Standard		Site is already developed and the <u>entirety</u> of the existing surface water drainage system will be used to serve the new development.			

PRO-FORMA 1: Sustainable Drainage System: Planning Permission

Section 2: Impermeable Area and Existing Drainage For outline or reserved matters applications, go to Section 3

	Existing (E)	Proposed (P)	Difference (P – E)	Evidence Checklist	
Impermeable Area (Ha)	0.347	0.530	+0.183	☒	Plans showing development layout of site with existing and proposed impermeable areas.
State Drainage Method	Mains	Mains	N/A	☒	Plans showing current and proposed locations of sustainable drainage system.
Are there existing sewers, watercourses, water bodies, highway drains, soakaways or filter drains on the site?			Yes ☒ No ☐	☒	Plans showing existing layout to include: • Watercourses, open or culverted • Water bodies – ponds, swales etc. • Sewers, including manholes • Highway drains, include manholes • Soakaways, filter drains

Section 3: Surface Water Discharge Hierarchy – Planning Practice Guidance

Surface Water Discharge Method	Proposed?	If YES - Evidence Checklist		If NO - Evidence Checklist	
1. Infiltration to ground	Yes ☐ No ☒	☐	Completed Infiltration Checklist from CIRIA The SuDS Manual C753 Appendix B <i>An editable version of this form is available on SusDrain website.</i>	☒	Geotechnical Survey, including Soil Permeability Testing stating Percolation Coefficient, in accordance with BRE 365 AND Statement providing justification in your Sustainable Drainage Strategy
2. Discharge to watercourse or surface water body (Main River or Ordinary)	Yes ☐ No ☒	☐	Watercourse and/or Water Body Survey Report	☒	Plan showing nearby watercourses and water bodies AND Statement providing justification in your Sustainable Drainage Strategy
3. Discharge to surface water sewer	Yes ☒ No ☐	☐	Water and Sewerage Company written agreement for the Right to Connect.	☒	Plan showing nearby sewers AND
4. Discharge to combined sewer	Yes ☐ No ☐				Statement providing justification in your Sustainable Drainage Strategy

PRO-FORMA 1: Sustainable Drainage System: Planning Permission

Section 4: Calculate Peak Discharge Rates – Technical Standards S2 and S3 (unless S1 applies)

Rainfall Event	Existing Rate (l/s)	Greenfield Rate (l/s)	Proposed Rate (l/s) <i>Brownfield sites must reduce discharge rates by 50%</i>	Evidence Checklist	
Qbar	54.7	6.7	27.35	☒	MicroDrainage (or equivalent) calculations
1:1 Year Event	37.1	5.9	27.35		
1:30 Year Event	91.1	11.5	27.35		
1:100 Year Event	117.9	14	27.35		

Section 5: Calculate Discharge Volume – Technical Standards S4 and S6 (unless S1 applies)

Rainfall Event	Existing Volume (m ³)	Greenfield Volume (m ³)	Proposed Volume (m ³)	Evidence Checklist	
1:100 Year 6 Hour Event	110		169	☐	MicroDrainage (or equivalent) calculations

Section 6: Infiltration

Site Information	✓	Evidence Checklist	
Do your sustainable drainage proposals include any infiltration?	Yes ☐ No ☒ <i>If NO, please move on to Section 7</i>	☐	Proposed sustainable drainage plans
You should submit an alternative 'Plan B' sustainable drainage design utilising an alternative discharge method if site specific ground conditions are unknown at this stage. This will become the default design in the event infiltration proposals are not feasible upon site specific ground investigation. Have you submitted an alternative 'Plan B' sustainable drainage design?	Yes ☒ No ☐	☐	'Plan B' conceptual sustainable drainage plans and statement of approach

PRO-FORMA 1: Sustainable Drainage System: Planning Permission

Section 7: Storage – Technical Standards S7, S8 and S9

Storage Details	Details	Evidence Checklist	
State climate change allowance used (%)	40	☒	State / use in MicroDrainage
State storage volume provided (m ³) (excluding non-void spaces) <i>Must include an allowance for climate change and urban creep.</i>	135-225	☒	Drainage plans showing location of attenuation and all flow control devices and any supporting calculations
Summarise how storage will be provided for 1:30 year event on site. <i>Storage must be designed to ensure that at no flooding occurs onsite in a 1 in 30 year event except in designed areas and no flooding occurs offsite in a 1 in 100 year (+ climate change allowance) event.</i>	SuDS sized to contain 100 + 40. No flooding for 30.	☒	Plans showing size and location of storage and supporting calculations
Summarise how storage will be provided for 1:100 year (+ climate change) 6 hour event on site. <i>Where storage above the 1:30 year rainfall event is provided in designated areas designed to accommodate excess surface water volumes, plans showing storage locations and surface water depths and supported by MicroDrainage (or equivalent) calculations.</i>	Refer to FRA & DS	☒	Plans showing size and location of storage and supporting calculations

Section 8: Operation and Maintenance – Technical Standard S12 and HCWS161

Consideration	Select <u>ALL</u> that apply (✓)		Evidence Checklist
State how <u>ALL</u> components of the sustainable drainage system will be maintained for the design life of the development.	Sustainable drainage features are at property level	☒	☒ Statement provided within your Sustainable Drainage Strategy
	Sustainable drainage system to be adopted by Water and Sewerage Company through a Section 104 agreement (Water Industry Act 1991)	☐	
	Applicant to secure maintenance of sustainable drainage features by entering into a Section 106 agreement (Town and Country Planning Act 1990)	☐	

PRO-FORMA 1: Sustainable Drainage System: Planning Permission

Declaration and Submission

This pro-forma has been completed using evidence from information which has been submitted with my planning application.

The information submitted in the Sustainable Drainage Strategy and site-specific Flood Risk Assessment (FRA), where submitted, is proportionate to the site conditions, flood risks and magnitude of development and I agree that this information can be used as evidence to this sustainable drainage approach.

Submitter Details

Form <u>completed</u> by	Julian Pearson	Email Address	julian.pearson@thomasconsulting.co.uk
		Daytime Telephone	01524 846022
Form <u>signed off</u> by	Kieron Hounslow	Accreditation(s) and/or Qualification(s) of Signatory	B.Eng (Hons) C.Eng M.I.Struct.E
Date (dd/mm/yyyy)	25/06/21	Company	Thomas Consulting

Client Details

Name	Jonathan Halfpenny	Company	Witherslack Group Ltd
------	--------------------	---------	-----------------------

APPENDIX F
DRAIN DOCTOR – DRAINAGE SURVEY REPORT

Project

Project Name: 2021-05-15532 Thomas Consulting Lakeside School Liverpool

Project Date: 15/06/2021

Inspection Standard: MSCC4 Sewers & Drainage GB (SRM4 Scoring)



Table of Contents

Project Name	Project Number	Project Date
2021-05-15532 Thomas Consulting Lakeside School Liverpool		15/06/2021

Project Information	P-1
Scoring Summary	P-4
Project Pictures	P-5
Section: 1; FWMH1 > FWMH2 (FWMH1X)	1
Section: 2; US > FWMH1 (USX)	7
Section: 3; Branch > FWMH1 (BranchX)	12
Section: 4; FWMH2 > FWMH3 (FWMH2X)	14
Section: 5; Gully > FWMH2 (GullyX)	17
Section: 6; FWMH3 > Trap (FWMH3X)	18
Section: 7; FWMH4 > ds (FWMH4X)	20
Section: 8; US > FWMH4 (USX)	22
Section: 9; SWMH1 > SWMH2 (SWMH1X)	24
Standard Notes and Conditions	26

Project Information

Project Name	Project Number	Project Date
2021-05-15532 Thomas Consulting Lakeside School Liverpool		15/06/2021

Client

Company: Thomas Consulting
Town or City: Preston

Site

Company: Lakeside School
Town or City: Liverpool

Contractor

Company: Drain Doctor
Email: reports@draindoctornw.co.uk

Project Information

Project Name	Project Number	Project Date
2021-05-15532 Thomas Consulting Lakeside School Liverpool		15/06/2021

Project Notes**CCTV survey report & recommendations.**

The CCTV survey highlighted multiple defects including broken pipes, fractures and root ingress.

To restore the structural integrity of the drains the following remedial works are necessary

Remedial works

Survey section 1 FWMH1 - FWMH2

Remove roots with Warthog

Reline drain with a structural sleeve

Open up laterals with robotic cutter

Survey section 2 US - FWMH1

Remove all settled deposits with Warthog

Reline drain with a structural sleeve from manhole to 4.5m upstream

Insert a 150mm x 600mm localised structural repair sleeve @8.35m

Survey section 3 Branch - FWMH1

Remove roots with Warthog

Insert a 100mm x 600mm localised structural repair sleeve

Survey section 4 FWMH2 - FWMH3

Remove mass roots with Warthog

Reline drain with a structural sleeve from MH2 to 7m downstream

Insert a 100mm x 600mm localised structural repair sleeve @19.4m

Survey section 9 SWMH1 - SWMH2

Carry out HPWJ with Warthog to remove all settled deposits

Project Information

Project Name	Project Number	Project Date
2021-05-15532 Thomas Consulting Lakeside School Liverpool		15/06/2021

Project Drawing



Scoring Summary

Project Name 2021-05-15532 Thomas Consulting Lakeside School Liverpool	Project Number	Project Date 15/06/2021
--	-----------------------	-----------------------------------

Structural Defects

- Grade 3: Best practice suggests consideration should be given to repairs in the medium term.
- Grade 4: Best practice suggests consideration should be given to repairs to avoid a potential collapse.
- Grade 5: Best practice suggests that this pipe is at risk of collapse at any time. Urgent consideration should be given to repairs to avoid total failure.

Section	PLR	Grade	Description
1	FW MH 1X	4	Multiple defects

Service / Operational Condition

- Grade 3: Best practice suggests consideration should be given to maintenance activities in the medium term.
- Grade 4: Best practice suggests consideration should be given to maintenance activity to avoid potential blockages.
- Grade 5: Best practice suggests that this pipe is at a high risk of backing up or causing flooding.

Section	PLR	Grade	Description
2	USX	4	Settled deposits, fine, 65% cross-sectional area loss
3	BranchX	3	Roots, mass at joint, 5% cross-sectional area loss
4	FW MH 2X	4	Roots, tap at joint
9	SW MH 1X	4	Settled deposits, coarse, 30% cross-sectional area loss, finish

Abandoned Surveys

Section	PLR	Description
2	USX	Survey abandoned

Information

These scoring summaries are based on the SRM grading from the WRc.

Project Pictures

Project Name	Project Number	Project Date
2021-05-15532 Thomas Consulting Lakeside School Liverpool		15/06/2021



Blockage cleared



FW MH1 blocked



Hpwj



Hpwj

Project Pictures

Project Name	Project Number	Project Date
2021-05-15532 Thomas Consulting Lakeside School Liverpool		15/06/2021



Hpwj



Location of uu drain overgrown



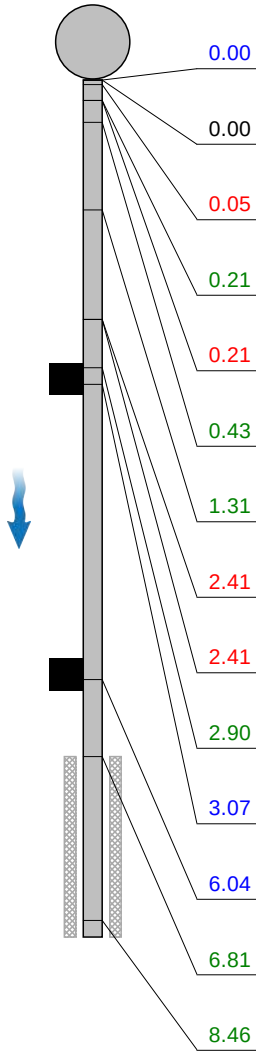
SWMH2

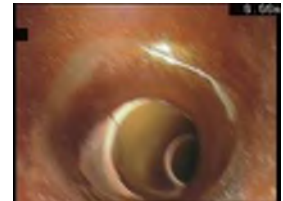
Section Inspection - 16/06/2021 - FW MH 1X

Section 1	Inspection 1	Date 16/06/21	Time 10:55	Client's Job Ref Not Specified	Weather No Rain Or Snow	Pre Cleaned Not Known	PLR FW MH 1X
Operator Not Specified		Vehicle Not Specified		Camera Not Specified	Preset Length Not Specified	Legal Status Not Specified	Alternative ID Not Specified

Town or Village:	Liverpool	Inspection Direction:	Downstream	Upstream Node:	FW MH 1
Road:	Lakeside School	Inspected Length:	15.71 m	Upstream Pipe Depth:	1.140 m
Location:	Property with buildings	Total Length:	15.71 m	Downstream Node:	FW MH 2
Surface Type:		Joint Length:	0.00 m	Downstream Pipe Depth:	
Use:	Foul	Pipe Shape:	Circular		
Type of Pipe:		Dia/Height:	150 mm		
Year Constructed:		Pipe Material:	Vitrified clay pipe (i.e. all clayware)		
Flow Control:	No flow control	Lining Type:	No Lining		
Inspection Purpose:	Routine inspection of condition	Lining Material:	No Lining		

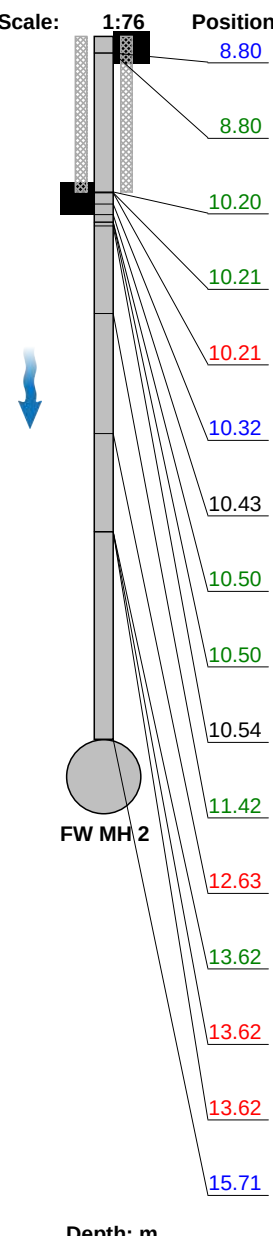
Comments:
Recommendations:

Scale:	1:76	Position [m]	Code	Observation	Grade
Depth: 1.14 m FW MH 1					
		0.00	MH	Start node type, manhole, reference number: FW MH 1	
		0.00	WL	Water level, 0% of the vertical dimension	
		0.05	CC	Crack, circumferential from 11 o'clock to 3 o'clock	2
		0.21	RFJ	Roots, fine at joint	2
		0.21	OJM	Open joint, medium	1
		0.43	LR	Line deviates right	
		1.31	DER	Settled deposits, coarse, 10% cross-sectional area loss	3
		2.41	FCJ	Fracture, circumferential at joint from 11 o'clock to 1 o'clock	3
		2.41	CCJ	Crack, circumferential at joint from 12 o'clock to 3 o'clock	2
		2.90	DER	Settled deposits, coarse, 10% cross-sectional area loss	3
		3.07	JN	Junction at 1 o'clock, diameter: 100mm	
		6.04	JN	Junction at 1 o'clock, diameter: 100mm	
		6.81	S01 DES	Settled deposits, fine, 10% cross-sectional area loss, start	
		8.46	DER	Settled deposits, coarse, 5% cross-sectional area loss	2



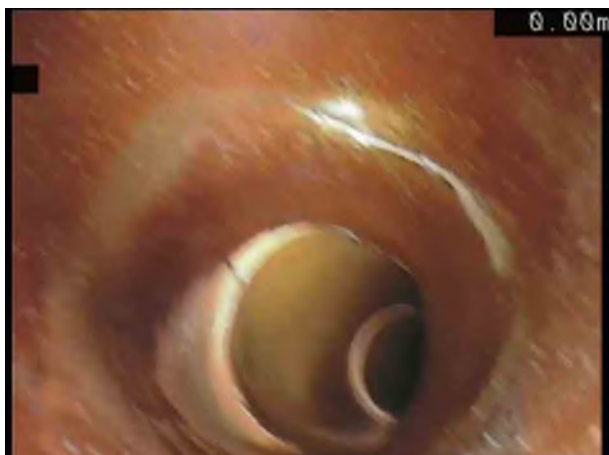
Section Inspection - 16/06/2021 - FW MH 1X

Section 1	Inspection 1	Date 16/06/21	Time 10:55	Client's Job Ref Not Specified	Weather No Rain Or Snow	Pre Cleaned Not Known	PLR FW MH 1X
Operator Not Specified		Vehicle Not Specified		Camera Not Specified	Preset Length Not Specified	Legal Status Not Specified	Alternative ID Not Specified

	Scale: 1:76	Position [m]	Code	Observation	Grade				
		8.80	JXZ	Defective junction, other at 10 o'clock, diameter: 100mm: Roots					
		8.80	RM	Roots, mass, 10% cross-sectional area loss	3				
		10.20	F01 DES	Settled deposits, fine, 10% cross-sectional area loss, finish	3				
		10.21	RMJ	Roots, mass at joint, 10% cross-sectional area loss	3				
		10.21	JDL	Joint displaced, large	1				
		10.32	JN	Junction at 1 o'clock, diameter: 100mm					
		10.43	WL	Water level, 20% of the vertical dimension					
		10.50	RMJ	Roots, mass at joint, 15% cross-sectional area loss	3				
		10.50	DER	Settled deposits, coarse, 30% cross-sectional area loss	4				
		10.54	CUW	Loss of vision, camera under water					
		11.42	RMJ	Roots, mass at joint, 15% cross-sectional area loss	3				
		12.63	SS	Surface damage, spalling from 8 o'clock to 4 o'clock	2				
		13.62	RFJ	Roots, fine at joint	2				
		13.62	HJ	Hole in drain or sewer at a joint from 11 o'clock to 1 o'clock	4				
		13.62	B	Broken pipe from 11 o'clock to 1 o'clock	4				
	15.71	MHF	Finish node type, manhole, reference number: FW MH 2						
FW MH 2									
Depth: m									
Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
8	160.0	15.5	243.0	4.0	11	11.0	2.3	36.0	5.0

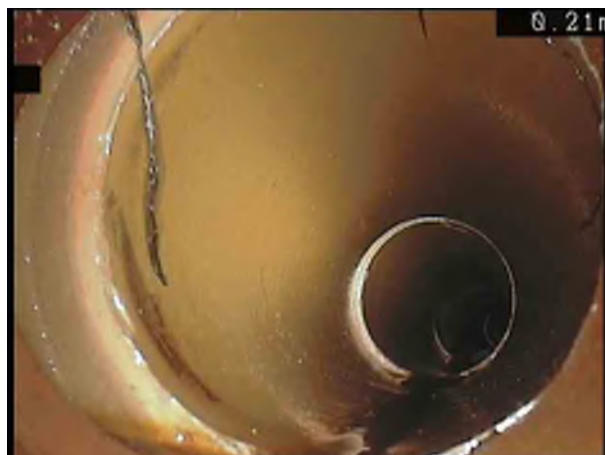
Section Pictures - 16/06/2021 - FW MH 1X

Section	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
1	Downstream	FW MH 1X		



FW MH

1X_73218fdb-2c09-4d55-a696-f64fac5ee58d_20210616_1105
 20_013.jpg, 00:00:13, 0.05 m
 Crack, circumferential from 11 o'clock to 3 o'clock



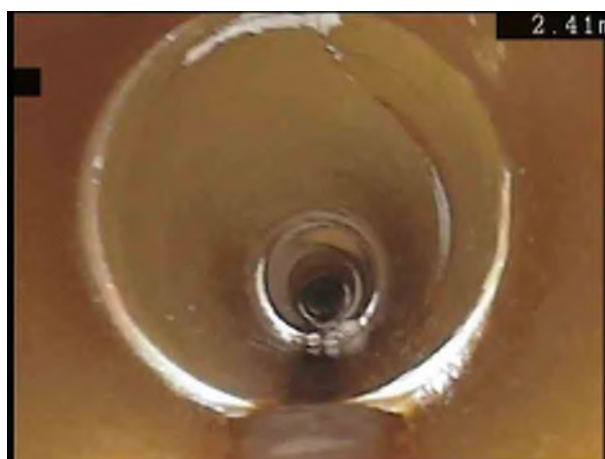
FW MH

1X_e493e9b8-6753-47f7-9f84-8c6e529aea45_20210616_110
 542_926.jpg, 00:00:15, 0.21 m
 Open joint, medium



FW MH

1X_51589a05-3edd-463a-9ca9-0a6cec873bf8_20210616_111
 018_161.jpg, 00:00:21, 1.31 m
 Settled deposits, coarse, 10% cross-sectional area loss



FW MH

1X_2434a178-3076-4d46-a31d-6842bcbda71c_20210616_13
 3234_701.jpg, 00:00:26, 2.41 m
 Fracture, circumferential at joint from 11 o'clock to 1 o'clock

Section Pictures - 16/06/2021 - FW MH 1X

Section	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
1	Downstream	FW MH 1X		



FW MH

1X_96e6f74d-0085-4924-a400-24aa898ddd7b_20210616_134024_378.jpg, 00:00:29, 2.90 m
 Settled deposits, coarse, 10% cross-sectional area loss



FW MH

1X_05f0625c-7144-4976-967b-63d0c4468839_20210616_134122_205.jpg, 00:00:50, 6.81 m
 Settled deposits, fine, 10% cross-sectional area loss, start



FW MH

1X_9dfb2daa-45f9-4613-b522-83ebc2b071a6_20210616_134128_597.jpg, 00:00:50, 6.81 m
 Settled deposits, fine, 10% cross-sectional area loss, start



FW MH

1X_c1dab73b-1d4e-4dc9-84d5-07ebdf0c6080_20210616_143013_775.jpg, 00:00:59, 8.46 m
 Settled deposits, coarse, 5% cross-sectional area loss

Section Pictures - 16/06/2021 - FW MH 1X

Section	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
1	Downstream	FW MH 1X		



FW MH

1X_49a23b46-80c6-4896-99b5-2f04e414eb6c_20210616_142
 316_761.jpg, 00:01:02, 8.80 m
 Roots, mass, 10% cross-sectional area loss



FW MH

1X_ecc8749b-0b5d-4560-b2c2-f598ac11b332_20210616_143
 135_329.jpg, 00:01:13, 10.21 m
 Roots, mass at joint, 10% cross-sectional area loss



FW MH

1X_90d911cc-de53-4a2b-b400-0bc737496cd6_20210616_14
 3332_641.jpg, 00:01:36, 10.50 m
 Settled deposits, coarse, 30% cross-sectional area loss



FW MH

1X_57721712-d903-45e8-8fe1-bb8616590cf0_20210616_143
 531_459.jpg, 00:01:40, 11.42 m
 Roots, mass at joint, 15% cross-sectional area loss

Section Pictures - 16/06/2021 - FW MH 1X

Section	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
1	Downstream	FW MH 1X		



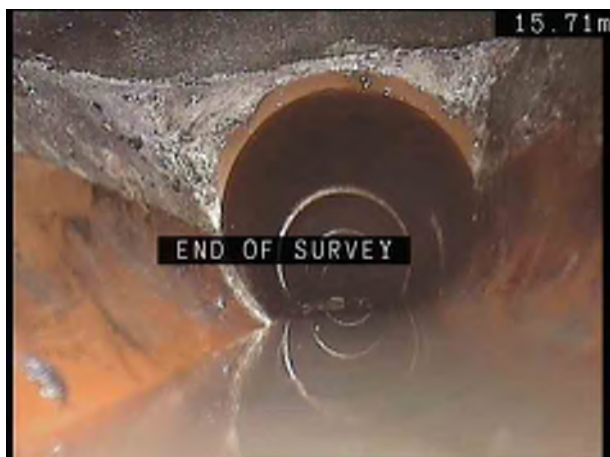
FW MH

1X_820044ce-260e-4b71-a857-7502a8eb560f_20210616_143617_280.jpg, 00:01:45, 12.63 m
 Surface damage, spalling from 8 o'clock to 4 o'clock



FW MH

1X_45714bd1-7a53-4d52-a8b1-2c37a8c65142_20210617_085101_313.jpg, 00:01:50, 13.62 m
 Broken pipe from 11 o'clock to 1 o'clock



FW MH

1X_c7a80e1c-36d8-4c98-a392-cc6242627dab_20210617_085038_942.jpg, 00:02:05, 15.71 m
 Finish node type, manhole, reference number: FW MH 2

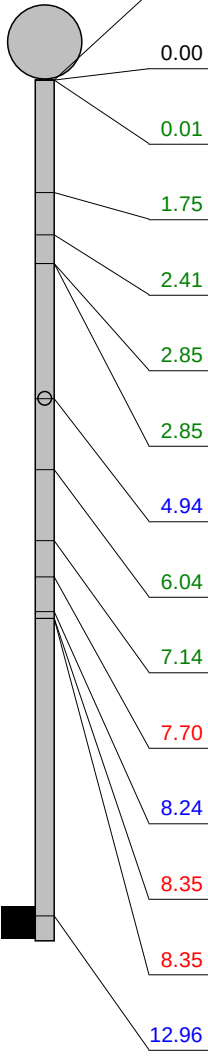
Section Inspection - 16/06/2021 - USX

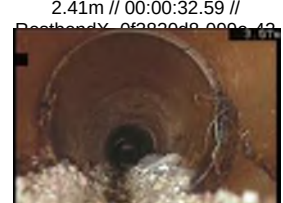
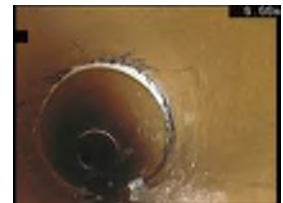
Section 2	Inspection 2	Date 16/06/21	Time 14:37	Client's Job Ref Not Specified	Weather No Rain Or Snow	Pre Cleaned Not Known	PLR USX
Operator Not Specified		Vehicle Not Specified		Camera Not Specified	Preset Length Not Specified	Legal Status Not Specified	Alternative ID Not Specified

Town or Village:	Liverpool	Inspection Direction:	Upstream	Upstream Node:	US
Road:	Lakeside School	Inspected Length:	14.06 m	Upstream Pipe Depth:	
Location:	Property with buildings	Total Length:	14.06 m	Downstream Node:	FW MH 1
Surface Type:		Joint Length:	0.00 m	Downstream Pipe Depth:	1.140 m
Use:	Foul	Pipe Shape:	Circular		
Type of Pipe:		Dia/Height:	150 mm		
Year Constructed:		Pipe Material:	Vitrified clay pipe (i.e. all clayware)		
Flow Control:	No flow control	Lining Type:	No Lining		
Inspection Purpose:	Routine inspection of condition	Lining Material:	No Lining		

Comments:

Recommendations:

Scale: 1:117	Position [m]	Code	Observation	Grade
Depth: 1.14 m FW MH 1				
	0.00	MH	Start node type, manhole, reference number: FW MH 1	
	0.00	WL	Water level, 0% of the vertical dimension	
	0.01	RFJ	Roots, fine at joint	2
	1.75	RFJ	Roots, fine at joint	2
	2.41	DES	Settled deposits, fine, 15% cross-sectional area loss	3
	2.85	RFJ	Roots, fine at joint	2
	2.85	DER	Settled deposits, coarse, 15% cross-sectional area loss	3
	4.94	CXP	Connection defective, position incorrect at 12 o'clock, diameter: 100mm	
	6.04	DER	Settled deposits, coarse, 10% cross-sectional area loss	3
	7.14	LL	Line deviates left	
	7.70	JDL	Joint displaced, large	1
	8.24	SC	Size changes, new size(s), 100mm high	
	8.35	CC	Crack, circumferential from 11 o'clock to 2 o'clock	2
	8.35	CL	Crack, longitudinal at 1 o'clock	2
	12.96	JXD	Defective junction, damaged at 2 o'clock, diameter: 100mm: Crack	



Section Inspection - 16/06/2021 - USX

Section 2	Inspection 2	Date 16/06/21	Time 14:37	Client's Job Ref Not Specified	Weather No Rain Or Snow	Pre Cleaned Not Known	PLR USX
Operator Not Specified		Vehicle Not Specified		Camera Not Specified	Preset Length Not Specified	Legal Status Not Specified	Alternative ID Not Specified

Scale:	1:117	Position [m]	Code	Observation	Grade
		13.73	LL	Line deviates left	
		14.06	DES	Settled deposits, fine, 65% cross-sectional area loss	4
		14.06	SA	Survey abandoned: Unable to pass	

Section Pictures - 16/06/2021 - USX

Section	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
2	Upstream	USX		



RestbendX_27f34987-24cf-470e-85e7-e43a7974c5d0_20210616_144016_834.jpg, 00:00:12, 0.01 m
 Roots, fine at joint



RestbendX_670773db-ba24-4e70-a202-ff0ea71a3075_20210616_144039_985.jpg, 00:00:25, 1.75 m
 Roots, fine at joint



RestbendX_0f3820d8-099e-425e-9139-fdf29d5a9806_20210616_144256_545.jpg, 00:00:32, 2.41 m
 Settled deposits, fine, 15% cross-sectional area loss



RestbendX_e97dd8f5-d18d-47f9-9da7-c47fa0386f7b_20210616_144309_657.jpg, 00:00:34, 2.85 m
 Roots, fine at joint

Section Pictures - 16/06/2021 - USX

Section	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
2	Upstream	USX		



RestbendX_a1255de8-41b1-417e-bfa2-59b1900ebc1c_20210616_144324_703.jpg, 00:00:38, 2.85 m
 Settled deposits, coarse, 15% cross-sectional area loss



RestbendX_4feb9845-e82f-488f-ba6b-d6561b4100a5_20210616_144353_230.jpg, 00:00:48, 4.94 m
 Connection defective, position incorrect at 12 o'clock, diameter: 100mm



RestbendX_e1ae03dc-fa62-48d0-9cdb-468770a53eb2_20210616_144414_588.jpg, 00:00:53, 6.04 m
 Settled deposits, coarse, 10% cross-sectional area loss



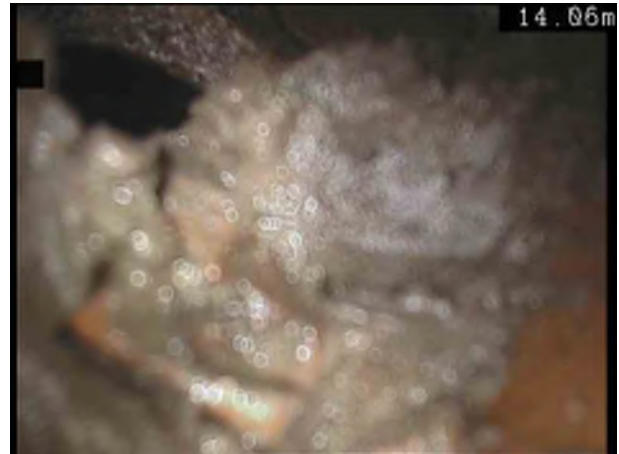
RestbendX_551fc0bd-cb36-4e11-816e-89f571abec55_20210616_144448_579.jpg, 00:01:01, 7.70 m
 Joint displaced, large

Section Pictures - 16/06/2021 - USX

Section	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
2	Upstream	USX		



RestbendX_9fea196c-3957-46a2-a91d-e2bb84135b2c_20210616_144522_065.jpg, 00:01:13, 8.35 m
 Crack, circumferential from 11 o'clock to 2 o'clock



RestbendX_b4d4670a-45e0-405c-9c89-a76769afa0cd_20210616_144757_752.jpg, 00:01:58, 14.06 m
 Settled deposits, fine, 65% cross-sectional area loss

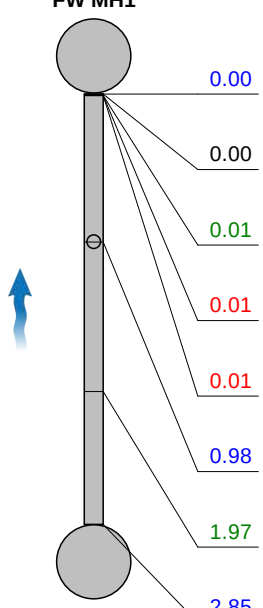
Section Inspection - 16/06/2021 - BranchX

Section 3	Inspection 3	Date 16/06/21	Time 14:48	Client's Job Ref Not Specified	Weather No Rain Or Snow	Pre Cleaned Not Known	PLR BRANCHX
Operator Not Specified		Vehicle Not Specified		Camera Not Specified	Preset Length Not Specified	Legal Status Not Specified	Alternative ID Not Specified

Town or Village:	Liverpool	Inspection Direction:	Upstream	Upstream Node:	BRANCH
Road:	Lakeside School	Inspected Length:	2.85 m	Upstream Pipe Depth:	
Location:	Property with buildings	Total Length:	2.85 m	Downstream Node:	FW MH1
Surface Type:		Joint Length:	0.00 m	Downstream Pipe Depth:	1.140 m
Use:	Foul	Pipe Shape:	Circular		
Type of Pipe:		Dia/Height:	150 mm		
Year Constructed:		Pipe Material:	Vitrified clay pipe (i.e. all clayware)		
Flow Control:	No flow control	Lining Type:	No Lining		
Inspection Purpose:	Routine inspection of condition	Lining Material:	No Lining		

Comments:

Recommendations:

Scale:	1:50	Position [m]	Code	Observation	Grade																																				
Depth: 1.14 m FW MH1  Depth: m <table><tr><th>Position [m]</th><th>Code</th><th>Observation</th><th>Grade</th></tr><tr><td>0.00</td><td>MH</td><td>Start node type, manhole, reference number: FW MH1a</td><td></td></tr><tr><td>0.00</td><td>WL</td><td>Water level, 0% of the vertical dimension</td><td></td></tr><tr><td>0.01</td><td>RMJ</td><td>Roots, mass at joint, 5% cross-sectional area loss</td><td>3</td></tr><tr><td>0.01</td><td>JDM</td><td>Joint displaced, medium</td><td>1</td></tr><tr><td>0.01</td><td>CCJ</td><td>Crack, circumferential at joint from 9 o'clock to 4 o'clock</td><td>2</td></tr><tr><td>0.98</td><td>JN</td><td>Junction at 12 o'clock, diameter: 100mm</td><td></td></tr><tr><td>1.97</td><td>LL</td><td>Line deviates left</td><td></td></tr><tr><td>2.85</td><td>OCF</td><td>Finish node type, other special chamber, reference number: Restbend</td><td></td></tr></table>  0.01m // 00:00:20.16 // Depth: 0.67125m 2022 4h						Position [m]	Code	Observation	Grade	0.00	MH	Start node type, manhole, reference number: FW MH1a		0.00	WL	Water level, 0% of the vertical dimension		0.01	RMJ	Roots, mass at joint, 5% cross-sectional area loss	3	0.01	JDM	Joint displaced, medium	1	0.01	CCJ	Crack, circumferential at joint from 9 o'clock to 4 o'clock	2	0.98	JN	Junction at 12 o'clock, diameter: 100mm		1.97	LL	Line deviates left		2.85	OCF	Finish node type, other special chamber, reference number: Restbend	
Position [m]	Code	Observation	Grade																																						
0.00	MH	Start node type, manhole, reference number: FW MH1a																																							
0.00	WL	Water level, 0% of the vertical dimension																																							
0.01	RMJ	Roots, mass at joint, 5% cross-sectional area loss	3																																						
0.01	JDM	Joint displaced, medium	1																																						
0.01	CCJ	Crack, circumferential at joint from 9 o'clock to 4 o'clock	2																																						
0.98	JN	Junction at 12 o'clock, diameter: 100mm																																							
1.97	LL	Line deviates left																																							
2.85	OCF	Finish node type, other special chamber, reference number: Restbend																																							

Construction Features

Structural Defects

Miscellaneous Features

Service & Operational Observations

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
2	11.0	3.9	11.0	2.0	1	2.0	0.7	2.0	3.0

Section Pictures - 16/06/2021 - BranchX

Section	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
3	Upstream	BRANCHX		



RestbendX_067135e8-2877-4bd1-905c-283d61ee4e34_2021
 0616_145103_454.jpg, 00:00:20, 0.01 m
 Crack, circumferential at joint from 9 o'clock to 4 o'clock

Section Inspection - 16/06/2021 - FW MH 2X

Section 4	Inspection 4	Date 16/06/21	Time 14:52	Client`s Job Ref Not Specified	Weather No Rain Or Snow	Pre Cleaned Not Known	PLR FW MH 2X
Operator Not Specified		Vehicle Not Specified		Camera Not Specified	Preset Length Not Specified	Legal Status Not Specified	Alternative ID Not Specified

Town or Village:	Liverpool	Inspection Direction:	Downstream	Upstream Node:	FW MH 2
Road:	Lakeside School	Inspected Length:	20.21 m	Upstream Pipe Depth:	1.400 m
Location:	Property with buildings	Total Length:	20.21 m	Downstream Node:	FW MH 3
Surface Type:		Joint Length:	0.00 m	Downstream Pipe Depth:	
Use:	Foul	Pipe Shape:	Circular		
Type of Pipe:		Dia/Height:	150 mm		
Year Constructed:		Pipe Material:	Vitrified clay pipe (i.e. all clayware)		
Flow Control:	No flow control	Lining Type:	No Lining		
Inspection Purpose:	Routine inspection of condition	Lining Material:	No Lining		

Comments:

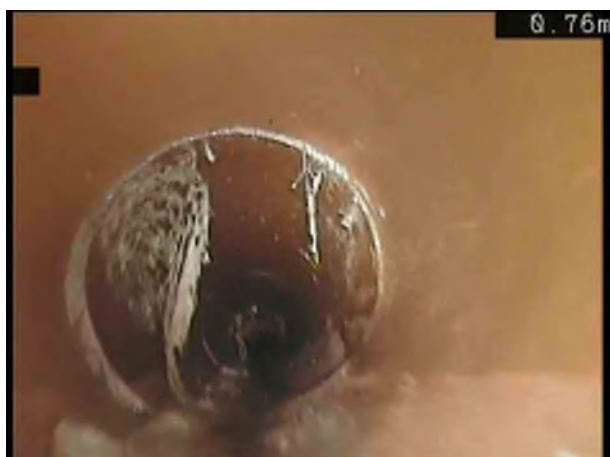
Recommendations:

Scale:	1:176	Position [m]	Code	Observation	Grade
Depth: 1.40 m FW MH 2					
		0.00	MH	Start node type, manhole, reference number: FW MH 2	
		0.00	WL	Water level, 0% of the vertical dimension	
		0.76	RTJ	Roots, tap at joint	4
		1.30	DES	Settled deposits, fine, 5% cross-sectional area loss	2
		1.97	RMJ	Roots, mass at joint, 5% cross-sectional area loss	3
		2.52	RMJ	Roots, mass at joint, 10% cross-sectional area loss	3
		3.51	DES	Settled deposits, fine, 15% cross-sectional area loss	3
		5.93	DEX	Settled deposits, other, 10% cross-sectional area loss: Unknown	3
		6.26	RFJ	Roots, fine at joint	2
		19.40	CC	Crack, circumferential from 9 o'clock to 5 o'clock	2
		20.21	MHF	Finish node type, manhole, reference number: FW MH 3	
FW MH 3 Depth: m					

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
1	10.0	0.5	10.0	2.0	7	5.0	0.8	17.0	4.0

Section Pictures - 16/06/2021 - FW MH 2X

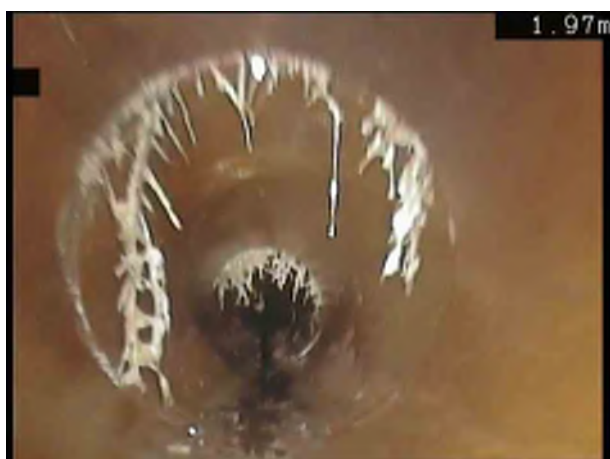
Section	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
4	Downstream	FW MH 2X		



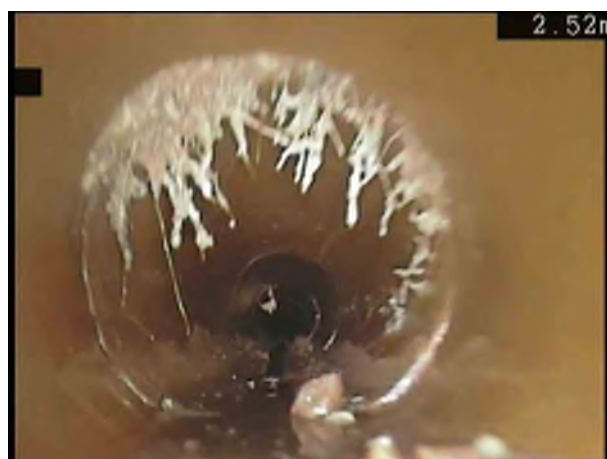
FW MH
 2X_10002a2a-bffe-43e7-a922-b5fba4e5e33_20210616_145
 323_071.jpg, 00:00:14, 0.76 m
 Roots, tap at joint



FW MH
 2X_61acc3db-996a-45e3-88f1-30c915e0c56e_20210616_145
 351_966.jpg, 00:00:16, 1.30 m
 Settled deposits, fine, 5% cross-sectional area loss



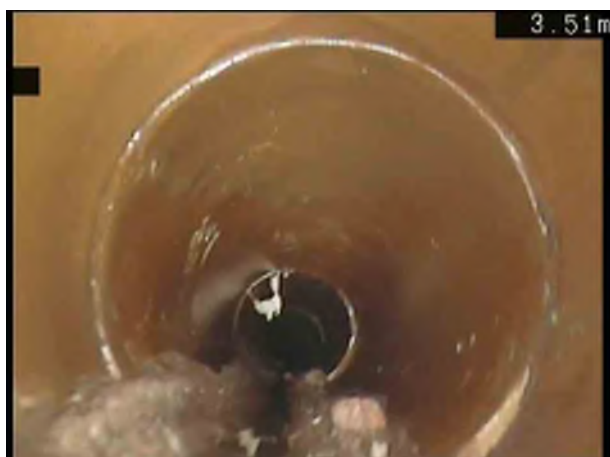
FW MH
 2X_179a5e52-7722-4a34-97ef-8234e1c67960_20210616_145
 336_070.jpg, 00:00:18, 1.97 m
 Roots, mass at joint, 5% cross-sectional area loss



FW MH
 2X_0c2e9adc-ab45-4226-89dc-6fc96b918889_20210616_145
 415_796.jpg, 00:00:20, 2.52 m
 Roots, mass at joint, 10% cross-sectional area loss

Section Pictures - 16/06/2021 - FW MH 2X

Section	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
4	Downstream	FW MH 2X		



FW MH
 2X_a554a18d-4754-4358-8e39-2d71be0120e8_20210616_145440_394.jpg, 00:00:22, 3.51 m
 Settled deposits, fine, 15% cross-sectional area loss



FW MH
 2X_97f0604e-9ab9-4ad3-ad8c-4b991e199cdc_20210616_145525_912.jpg, 00:00:30, 5.93 m
 Settled deposits, other, 10% cross-sectional area loss, Unknown



FW MH
 2X_05b45c54-ffbf-4ed0-804f-946edd881bd0_20210616_145501_401.jpg, 00:00:31, 6.26 m
 Roots, fine at joint



FW MH
 2X_dcd94b59-a7b6-49b7-a00d-1049417c1517_20210616_145901_468.jpg, 00:01:15, 19.40 m
 Crack, circumferential from 9 o'clock to 5 o'clock

Section Inspection - 16/06/2021 - GullyX

Section 5	Inspection 5	Date 16/06/21	Time 14:59	Client's Job Ref Not Specified	Weather No Rain Or Snow	Pre Cleaned Not Known	PLR GULLYX
Operator Not Specified		Vehicle Not Specified		Camera Not Specified	Preset Length Not Specified	Legal Status Not Specified	Alternative ID Not Specified

Town or Village:	Liverpool	Inspection Direction:	Upstream	Upstream Node:	GULLY
Road:	Lakeside School	Inspected Length:	4.17 m	Upstream Pipe Depth:	
Location:	Property with buildings	Total Length:	4.17 m	Downstream Node:	FW MH 2
Surface Type:		Joint Length:	0.00 m	Downstream Pipe Depth:	1.400 m
Use:	Foul	Pipe Shape:	Circular		
Type of Pipe:		Dia/Height:	100 mm		
Year Constructed:		Pipe Material:	Polyvinyl chloride		
Flow Control:	No flow control	Lining Type:	No Lining		
Inspection Purpose:	Routine inspection of condition	Lining Material:	No Lining		

Comments:

Recommendations:

Scale: 1:50 Position [m] Code Observation Grade

 Depth: 1.40 m
FW MH 2


0.00

MH

Start node type, manhole, reference number: FW MH 2

0.00

WL

Water level, 0% of the vertical dimension

0.10

LR

Line deviates right

4.17

GYF

Finish node type, gully, reference number: Gully


 Gully
Depth: m

Construction Features

Structural Defects

Miscellaneous Features

Service & Operational Observations

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

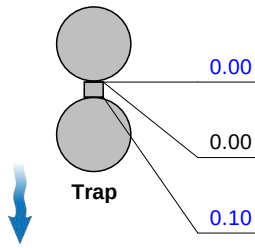
Section Inspection - 16/06/2021 - FW MH 3X

Section 6	Inspection 6	Date 16/06/21	Time 15:01	Client's Job Ref Not Specified	Weather No Rain Or Snow	Pre Cleaned Not Known	PLR FW MH 3X
Operator Not Specified		Vehicle Not Specified		Camera Not Specified	Preset Length Not Specified	Legal Status Not Specified	Alternative ID Not Specified

Town or Village:	Liverpool	Inspection Direction:	Downstream	Upstream Node:	FW MH 3
Road:	Lakeside School	Inspected Length:	0.10 m	Upstream Pipe Depth:	1.770 m
Location:	Property with buildings	Total Length:	0.10 m	Downstream Node:	TRAP
Surface Type:		Joint Length:	0.00 m	Downstream Pipe Depth:	
Use:	Foul	Pipe Shape:	Circular		
Type of Pipe:		Dia/Height:	150 mm		
Year Constructed:		Pipe Material:	Vitrified clay pipe (i.e. all clayware)		
Flow Control:	No flow control	Lining Type:	No Lining		
Inspection Purpose:	Routine inspection of condition	Lining Material:	No Lining		

Comments:

Recommendations:

Scale:	1:50	Position [m]	Code	Observation	Grade
Depth: 1.77 m FW MH 3  Depth: m 0.00 0.00 0.10 ↓					
MH	Start node type, manhole, reference number: FW MH 3	 0.10m // 00:00:18.74 // FW MH 2V 60041604 7124 4506 3894			
WL	Water level, 5% of the vertical dimension				
OCF	Finish node type, other special chamber, reference number: Trap: unable to pass trap				

Construction Features

Structural Defects

Miscellaneous Features

Service & Operational Observations

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

Section Pictures - 16/06/2021 - FW MH 3X

Section	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
6	Downstream	FW MH 3X		



FW MH

3X_69041c9d-7124-4596-a884-982ce0a25065_20210617_09
 1117_498.jpg, 00:00:18, 0.10 m

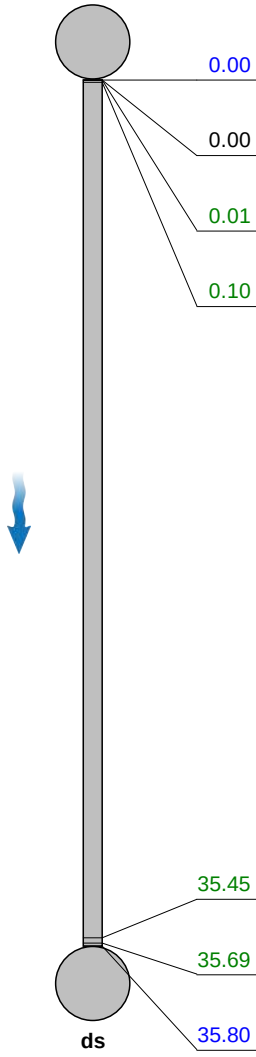
Finish node type, other special chamber, reference number:
 Trap, unable to pass trap

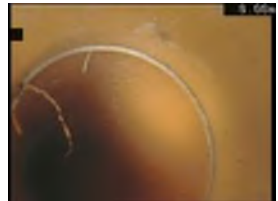
Section Inspection - 16/06/2021 - FW MH 4X

Section 7	Inspection 7	Date 16/06/21	Time 15:02	Client's Job Ref Not Specified	Weather No Rain Or Snow	Pre Cleaned Not Known	PLR FW MH 4X
Operator Not Specified		Vehicle Not Specified		Camera Not Specified	Preset Length Not Specified	Legal Status Not Specified	Alternative ID Not Specified

Town or Village:	Liverpool	Inspection Direction:	Downstream	Upstream Node:	FW MH 4
Road:	Lakeside School	Inspected Length:	35.80 m	Upstream Pipe Depth:	0.515 m
Location:	Property with buildings	Total Length:	35.80 m	Downstream Node:	DS
Surface Type:		Joint Length:	0.00 m	Downstream Pipe Depth:	
Use:	Foul	Pipe Shape:	Circular		
Type of Pipe:		Dia/Height:	100 mm		
Year Constructed:		Pipe Material:	Polyvinyl chloride		
Flow Control:	No flow control	Lining Type:	No Lining		
Inspection Purpose:	Routine inspection of condition	Lining Material:	No Lining		

Comments:
Recommendations:

Scale: 1:312	Position [m]	Code	Observation	Grade
Depth: 0.52 m FW MH 4				
0.00		MH	Start node type, manhole, reference number: FW MH 4	
0.00		WL	Water level, 0% of the vertical dimension	
0.01		RFJ	Roots, fine at joint	2
0.10		LL	Line deviates left	
				
35.45		LD	Line deviates down	
35.69		LR	Line deviates right	
35.80		OFF	Finish node type, outfall, reference number: Outfall	
ds Depth: m				

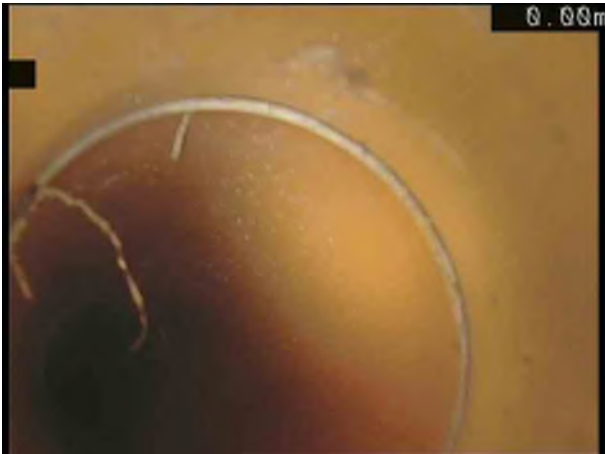


0.01m // 00:00:10.31 // FW MH 4V 0450442h 1204 1416 0224

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	1	1.0	0.0	1.0	2.0

Section Pictures - 16/06/2021 - FW MH 4X

Section	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
7	Downstream	FW MH 4X		



FW MH

4X_8b504d3b-1384-4a46-833d-9b4a7c8a5a1b_20210616_15
 0338_030.jpg, 00:00:10, 0.01 m

Roots, fine at joint

Section Inspection - 16/06/2021 - USX

Section 8	Inspection 8	Date 16/06/21	Time 15:08	Client's Job Ref Not Specified	Weather No Rain Or Snow	Pre Cleaned Not Known	PLR USX
Operator Not Specified		Vehicle Not Specified		Camera Not Specified	Preset Length Not Specified	Legal Status Not Specified	Alternative ID Not Specified

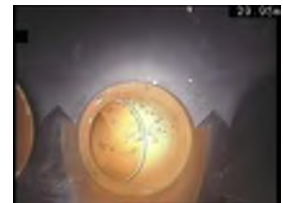
Town or Village:	Liverpool	Inspection Direction:	Upstream	Upstream Node:	US
Road:	Lakeside School	Inspected Length:	0.22 m	Upstream Pipe Depth:	
Location:	Property with buildings	Total Length:	29.95 m	Downstream Node:	FW MH 4
Surface Type:		Joint Length:	0.00 m	Downstream Pipe Depth:	0.515 m
Use:	Foul	Pipe Shape:	Circular		
Type of Pipe:		Dia/Height:	100 mm		
Year Constructed:		Pipe Material:	Polyvinyl chloride		
Flow Control:	No flow control	Lining Type:	No Lining		
Inspection Purpose:	Routine inspection of condition	Lining Material:	No Lining		

Comments:

Recommendations:

Scale: 1:261 Position [m] Code Observation

Grade

 Depth: 0.52 m
FW MH 4

 29.95m // 00:01:21.77 //
USX 077060F2 b6d5 4b40 200

 US
Depth: m

29.95

ICF

Finish node type, inspection chamber, reference number: US: buried chamber

30.17

MH

Start node type, manhole, reference number: FW MH 4

30.17

WL

Water level, 0% % of the vertical dimension

Construction Features

Structural Defects

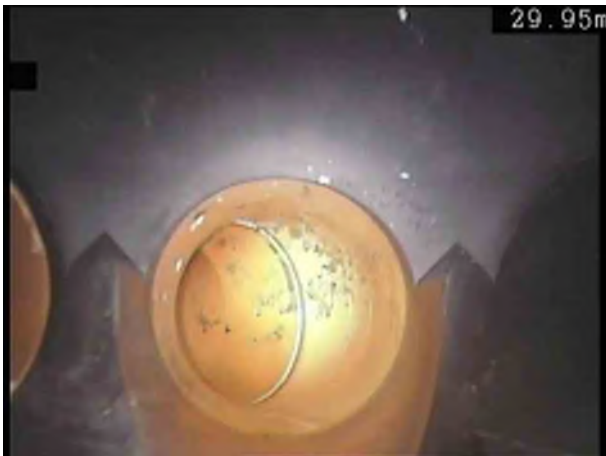
Miscellaneous Features

Service & Operational Observations

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

Section Pictures - 16/06/2021 - USX

Section	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
8	Upstream	USX		



USX_077069f3-bfd5-4b40-aea2-c1f214a8953d_20210617_09
 1528_926.jpg, 00:01:21, 29.95 m
 Finish node type, inspection chamber, reference number: US,
 buried chamber

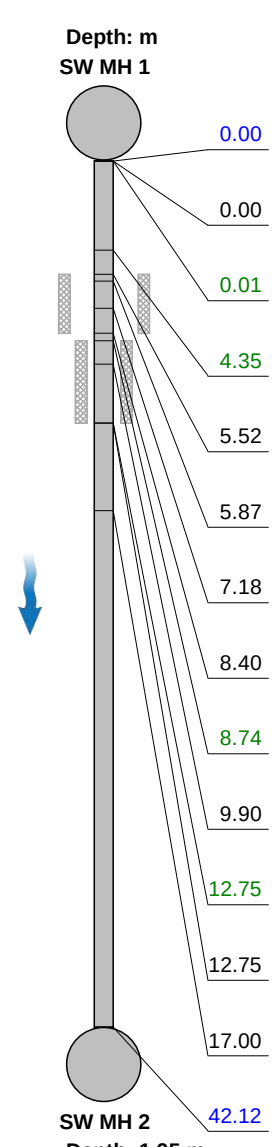
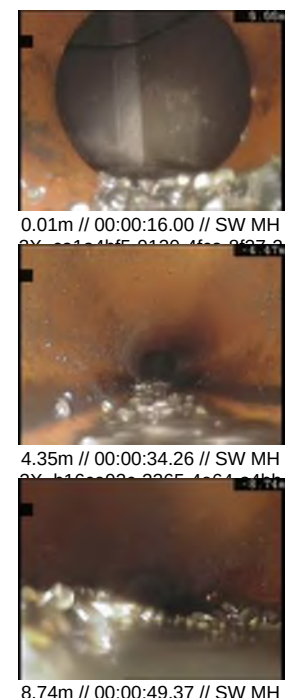
Section Inspection - 16/06/2021 - SW MH 1X

Section 9	Inspection 9	Date 16/06/21	Time 15:25	Client's Job Ref Not Specified	Weather No Rain Or Snow	Pre Cleaned Not Known	PLR SW MH 1X
Operator Not Specified		Vehicle Not Specified		Camera Not Specified	Preset Length Not Specified	Legal Status Not Specified	Alternative ID Not Specified

Town or Village:	Liverpool	Inspection Direction:	Downstream	Upstream Node:	SW MH 1
Road:	Lakeside School	Inspected Length:	42.12 m	Upstream Pipe Depth:	
Location:	Property with buildings	Total Length:	42.12 m	Downstream Node:	SW MH 2
Surface Type:		Joint Length:	0.00 m	Downstream Pipe Depth:	1.950 m
Use:	Surface water	Pipe Shape:	Circular		
Type of Pipe:		Dia/Height:	150 mm		
Year Constructed:		Pipe Material:	Polyvinyl chloride		
Flow Control:	No flow control	Lining Type:	No Lining		
Inspection Purpose:	Routine inspection of condition	Lining Material:	No Lining		

Comments:

Recommendations:

Scale:	1:367	Position [m]	Code	Observation	Grade																																																									
Depth: m SW MH 1  <table><tr><td>0.00</td><td>MH</td><td>Start node type, manhole, reference number: SW MH 2: Reverse</td><td></td></tr><tr><td>0.00</td><td>WL</td><td>Water level, 0% of the vertical dimension</td><td></td></tr><tr><td>0.01</td><td>DER</td><td>Settled deposits, coarse, 5% cross-sectional area loss</td><td>2</td></tr><tr><td>4.35</td><td>DER</td><td>Settled deposits, coarse, 10% cross-sectional area loss</td><td>3</td></tr><tr><td>5.52</td><td>S01</td><td>CUW</td><td>Loss of vision, camera under water, start</td></tr><tr><td>5.87</td><td>WL</td><td>Water level, 20% of the vertical dimension</td><td></td></tr><tr><td>7.18</td><td>CUW</td><td>Loss of vision, camera under water</td><td></td></tr><tr><td>8.40</td><td>F01</td><td>CUW</td><td>Loss of vision, camera under water, finish</td></tr><tr><td>8.74</td><td>S02</td><td>DER</td><td>Settled deposits, coarse, 30% cross-sectional area loss, start</td></tr><tr><td>9.90</td><td>WL</td><td>Water level, 5% of the vertical dimension</td><td></td></tr><tr><td>12.75</td><td>F02</td><td>DER</td><td>Settled deposits, coarse, 30% cross-sectional area loss, finish</td><td>4</td></tr><tr><td>12.75</td><td>WL</td><td>Water level, 15% of the vertical dimension</td><td></td></tr><tr><td>17.00</td><td>WL</td><td>Water level, 5% of the vertical dimension</td><td></td></tr><tr><td>42.12</td><td>MHF</td><td>Finish node type, manhole, reference number: SW MH 1</td><td></td></tr></table>  0.01m // 00:00:16.00 // SW MH 2X 1206070 0145 4000 h0h0 4.35m // 00:00:34.26 // SW MH 2X 1206070 0145 4000 h0h0 8.74m // 00:00:49.37 // SW MH 2X 1206070 0145 4000 h0h0						0.00	MH	Start node type, manhole, reference number: SW MH 2: Reverse		0.00	WL	Water level, 0% of the vertical dimension		0.01	DER	Settled deposits, coarse, 5% cross-sectional area loss	2	4.35	DER	Settled deposits, coarse, 10% cross-sectional area loss	3	5.52	S01	CUW	Loss of vision, camera under water, start	5.87	WL	Water level, 20% of the vertical dimension		7.18	CUW	Loss of vision, camera under water		8.40	F01	CUW	Loss of vision, camera under water, finish	8.74	S02	DER	Settled deposits, coarse, 30% cross-sectional area loss, start	9.90	WL	Water level, 5% of the vertical dimension		12.75	F02	DER	Settled deposits, coarse, 30% cross-sectional area loss, finish	4	12.75	WL	Water level, 15% of the vertical dimension		17.00	WL	Water level, 5% of the vertical dimension		42.12	MHF	Finish node type, manhole, reference number: SW MH 1	
0.00	MH	Start node type, manhole, reference number: SW MH 2: Reverse																																																												
0.00	WL	Water level, 0% of the vertical dimension																																																												
0.01	DER	Settled deposits, coarse, 5% cross-sectional area loss	2																																																											
4.35	DER	Settled deposits, coarse, 10% cross-sectional area loss	3																																																											
5.52	S01	CUW	Loss of vision, camera under water, start																																																											
5.87	WL	Water level, 20% of the vertical dimension																																																												
7.18	CUW	Loss of vision, camera under water																																																												
8.40	F01	CUW	Loss of vision, camera under water, finish																																																											
8.74	S02	DER	Settled deposits, coarse, 30% cross-sectional area loss, start																																																											
9.90	WL	Water level, 5% of the vertical dimension																																																												
12.75	F02	DER	Settled deposits, coarse, 30% cross-sectional area loss, finish	4																																																										
12.75	WL	Water level, 15% of the vertical dimension																																																												
17.00	WL	Water level, 5% of the vertical dimension																																																												
42.12	MHF	Finish node type, manhole, reference number: SW MH 1																																																												

Construction Features

Structural Defects

Miscellaneous Features

Service & Operational Observations

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	3	5.0	0.7	28.0	4.0

Section Pictures - 16/06/2021 - SW MH 1X

Section	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
9	Downstream	SW MH 1X		



SW MH

2X_ca1a4bf5-9120-4fca-8f37-212b961f0b97_20210616_153032_145.jpg, 00:00:16, 0.01 m

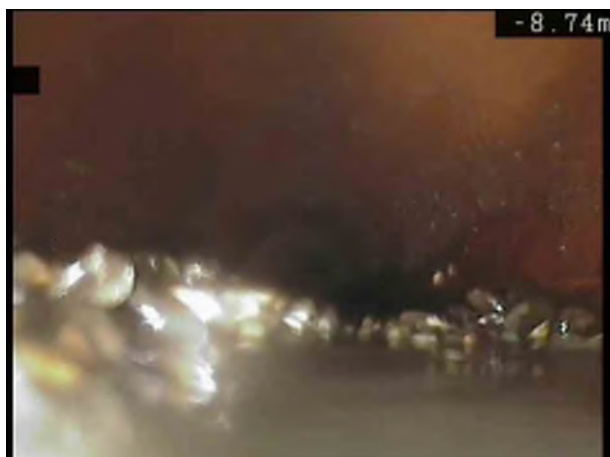
Settled deposits, coarse, 5% cross-sectional area loss



SW MH

2X_b16ce02c-2365-4e64-a4bb-6dcd96b44eaa_20210616_153111_591.jpg, 00:00:34, 4.35 m

Settled deposits, coarse, 10% cross-sectional area loss



SW MH

2X_129fa07e-e1d6-49ec-bcb0-8b64e328e656_20210616_153434_263.jpg, 00:00:49, 8.74 m

Settled deposits, coarse, 30% cross-sectional area loss, start

Standard Notes and Conditions

Thank you for choosing to Drain Doctor to carry out your drainage investigation works. The results and views carried in this report are those of the engineer(s) appointed to carry out the investigation and are considered relevant on the day of the survey. Drain and sewer performance is known to alter over time, so liability cannot be accepted for differences between the recorded data and the actual data at a time after this report was generated. This survey has been created in accordance with the Manual of Sewer Condition Classification (4th Ed, WRc, 2004), the Sewer Rehabilitation Manual (WRc) and BS EN13508:2.

If a DVD has been supplied with this report, please note that it can only be used in a Windows based PC. Please browse the DVD and navigate to the PDF folder to find project-based documents such as drawings, engineer's site notes and survey specifications amongst others. CCTV subsidence investigations do not account for the water tightness of the pipes and are merely a visual inspection of inside of the drains. CCTV drainage engineers are generally not qualified to comment on the causes of subsidence, and can only suggest required remedial actions for the pipes, and not the affected buildings.

Subsidence is a building structural failure, which can occur for many reasons. Although drainage failures can contribute to subsidence problems, other causes should always be investigated as part of a considered approach. In order to eliminate drains from suspicion, Drain Doctor suggests that all pipes within at least 10m of the subsidence area be pressure tested over and above a CCTV inspection, and remedial suggestions considered based on the findings.

Unless otherwise specified in an associated task order (or similar), the data gathered in this report may not be suitable for use as a pre-lining investigation. Drain Doctor are happy to carry out such surveys, but this must be agreed prior to the commencement of the works, and the client must specify the data they wish to capture and the acceptable tolerances.

Survey meterage is used as a guide for the issuing of a report only and should not be used as an accurate distance for excavation.

If an excavation is needed the defect should be pinpointed using a sonde.

APPENDIX G
FALLING HEAD TEST RESULTS

Our Ref: BEK/20730/210510/TC

10th May 2021

Land at Lakeside School, Witherslack – Falling Head Test

Thomas Consulting have been commissioned by C4 Projects to carry out a two falling head tests in two of the window sample probes installed as part of previous site investigation at the Lakeside School, Witherslack site. The work is required to support a drainage design scheme.

An engineer visited the site on 15th April 2021 and carried out the tests in Borehole No WS1 and WS2. The locations of the boreholes within which the tests were carried out on are presented on the 'Site Investigation Layout Plan' present in Annex C.

The exploratory logs for window sample boreholes WS1 and WS2 are presented in Annex A and the data relating to the falling head tests are presented in Annex B.

ANNEX A

Borehole Records



Window Sample Logs

PROJECT NUMBER 20730	DATE 13th April 2021
PROJECT Lakeside, Witherslack	EXCAVATION METHOD Window Sample Boreholes
CLIENT Jonathan Halfpenny	BOREHOLE NO WS1
	SHEET 1/2

COMMENTS Slight Hydrocarbon Odour from 0.0 to 1.0 m. Standing Water at 3.0 m

Depth (m)	Depth	Samples/Test	Field Records	Water	Well Install	Graphic Log	Material Description
0.5	0.5	D=0.5 m					Grey/dark orange/brown very sandy clay with occasional fine to medium gravel, occasional brick, occasional sand lenses, rare shells and rare plastic (Made Ground)
0.7	0.7	D=0.7 m					Pink fine to coarse sand with rare coarse gravel of sandstone (Made Ground)
1	1 - 1.45	SPT (C) N=10	4,3/3,3,2,2				Firm yellow very sandy clay with rare coarse gravel of sandstone
1.5	1.5	D=1.5 m					Firm to stiff brown sandy silty clay with rare subrounded gravel
2	2 - 2.45	SPT (C) N=8	1,2/2,2,2,2				Loose to Medium red brown fine to medium silty sand (becoming medium dense from 4 m)
2.5							
3	3 - 3.45	SPT (C) N=6	1,1/1,1,1,3				
3.5							
4	4 - 4.45	SPT (C) N=18	3,4/4,4,5,5				
4.5							
5	5 - 5.45	SPT (C) N=19	4,4/4,5,5,5				Stiff red/brown clay
5.5							Termination Depth at: 5.45 m



Window Sample Logs

PROJECT NUMBER 20730
PROJECT Lakeside, Witherslack
CLIENT Jonathan Halfpenny

DATE 13th April 2021
EXCAVATION METHOD Window Sample Boreholes
BOREHOLE NO WS2
SHEET 2/2

COMMENTS

Depth (m)	Depth	Samples/Test	Field Records	Water	Well Install	Graphic Log	Material Description
0.5	0.3	D=0.3 m					Black/red fine to coarse ashy clayey sand with occasional fine to coarse gravel of brick, ash, rare slate, rare wood (Made Ground)
1	1 - 1.45 1.3	SPT (C) N=6 D=1.3 m	2,1/1,1,2,2				Loose to medium cream/light brown clayey silt
1.5	1.6-2.0	B=1.6-2.0 m					Firm red/brown/orange mottled sandy clay
2	2 - 2.45	SPT (C) N=8	1,2/2,2,2,2				Loose yellow fine to coarse sand with fine gravels
2.5	2.7	D=2.7 m					Firm brown slightly silty clay
3	3 - 3.45	SPT (C) N=7	1,1/2,1,2,2				Loose red/brown fine to coarse sand with rare fine to medium subrounded gravel (becoming medium dense from 4 m)
3.5							
4	4.0	D=4.0 m					
4	4 - 4.45	SPT (C) N=15	3,3/3,4,4,4				
4.5							
5	5 - 5.45	SPT (C) N=18	3,3/4,4,5,5				
5.5							Termination Depth at: 5.45 m

ANNEX B

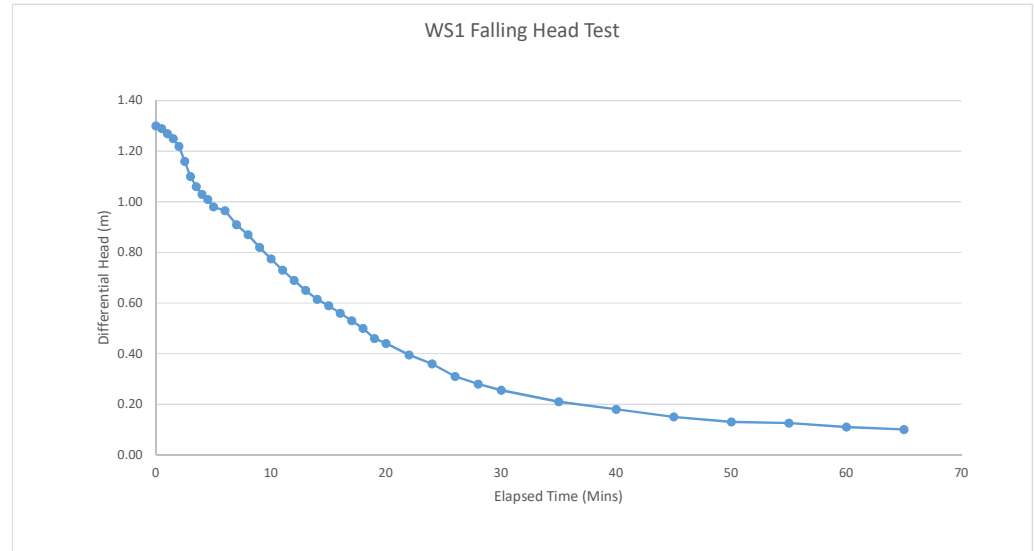
Falling Head Data

Lakeside - WS1

Time (minutes)	Depth to water (m)	Differential Head, Ht (m)	Ht/h0
0	0.16	1.30	0.89
0.5	0.17	1.29	0.88
1	0.19	1.27	0.87
1.5	0.21	1.25	0.86
2	0.24	1.22	0.84
2.5	0.3	1.16	0.79
3	0.36	1.10	0.75
3.5	0.4	1.06	0.73
4	0.43	1.03	0.71
4.5	0.45	1.01	0.69
5	0.48	0.98	0.67
6	0.495	0.97	0.66
7	0.55	0.91	0.62
8	0.59	0.87	0.60
9	0.64	0.82	0.56
10	0.685	0.78	0.53
11	0.73	0.73	0.50
12	0.77	0.69	0.47
13	0.81	0.65	0.45
14	0.845	0.62	0.42
15	0.87	0.59	0.40
16	0.9	0.56	0.38
17	0.93	0.53	0.36
18	0.96	0.50	0.34
19	1	0.46	0.32
20	1.02	0.44	0.30
22	1.065	0.40	0.27
24	1.1	0.36	0.25
26	1.15	0.31	0.21
28	1.18	0.28	0.19
30	1.205	0.26	0.17
35	1.25	0.21	0.14
40	1.28	0.18	0.12
45	1.31	0.15	0.10
50	1.33	0.13	0.09
55	1.335	0.13	0.09
60	1.35	0.11	0.08
65	1.36	0.10	0.07

Date of Test: 15th April 2021

Diameter of Standpipe (m)	Depth to Water at 0 seconds (m)	Initial Groundwater Level (m)	Area (m ²)	Top of Response Zone(m bgl)	Bottom of Response Zone (m bgl)	Length of Filter Zone(m)
0.05	0.16	1.46	0.001963	0.5	3	2.5

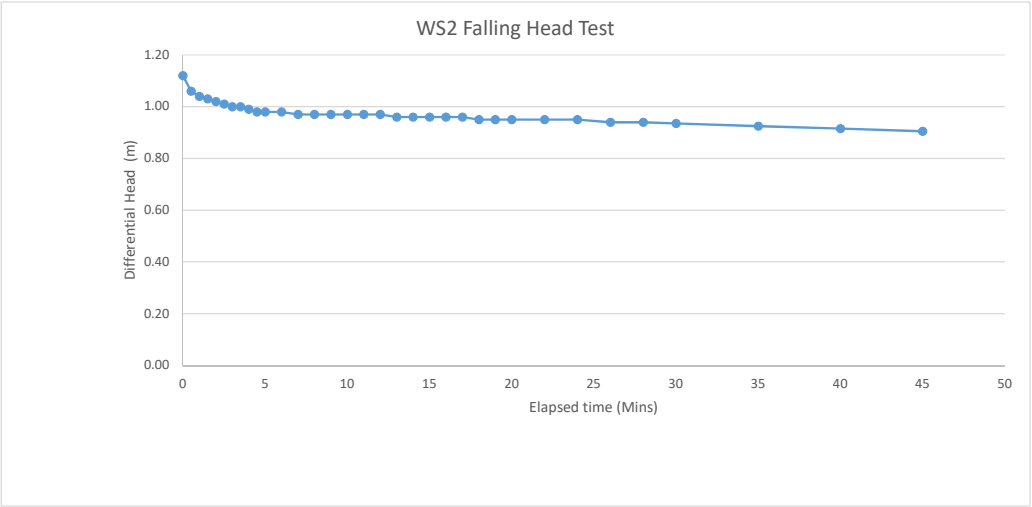


Lakeside WS2

Time (minutes)	Depth to water (m)	Differential Head, Ht (m)	Ht/h0
0	0.1	1.12	0.92
0.5	0.16	1.06	0.87
1	0.18	1.04	0.85
1.5	0.19	1.03	0.84
2	0.2	1.02	0.84
2.5	0.21	1.01	0.83
3	0.22	1.00	0.82
3.5	0.22	1.00	0.82
4	0.23	0.99	0.81
4.5	0.24	0.98	0.80
5	0.24	0.98	0.80
6	0.24	0.98	0.80
7	0.25	0.97	0.80
8	0.25	0.97	0.80
9	0.25	0.97	0.80
10	0.25	0.97	0.80
11	0.25	0.97	0.80
12	0.25	0.97	0.80
13	0.26	0.96	0.79
14	0.26	0.96	0.79
15	0.26	0.96	0.79
16	0.26	0.96	0.79
17	0.26	0.96	0.79
18	0.27	0.95	0.78
19	0.27	0.95	0.78
20	0.27	0.95	0.78
22	0.27	0.95	0.78
24	0.27	0.95	0.78
26	0.28	0.94	0.77
28	0.28	0.94	0.77
30	0.285	0.94	0.77
35	0.295	0.93	0.76
40	0.305	0.92	0.75
45	0.315	0.91	0.74

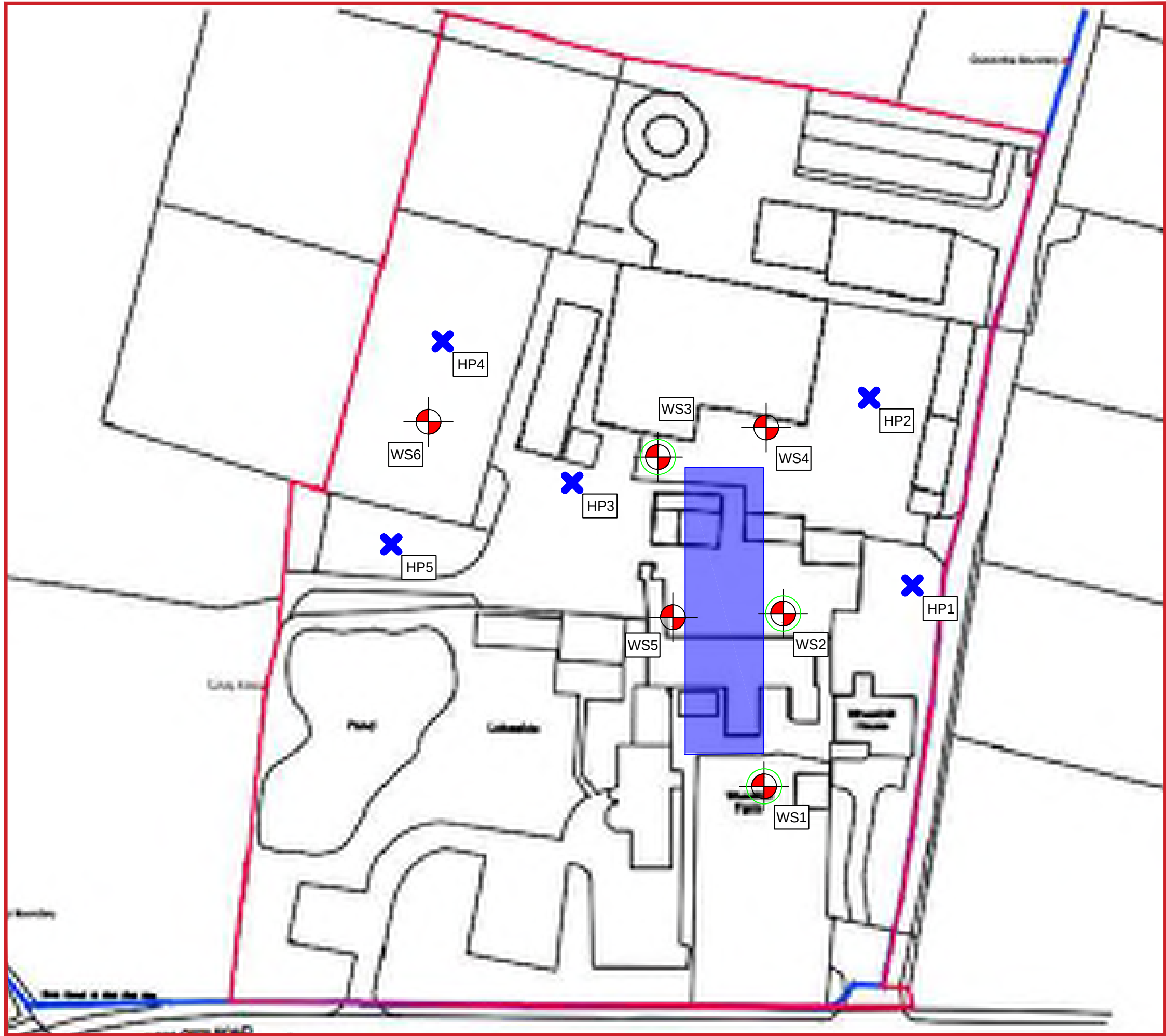
Date of Test: 15th April 2021

Diameter of Standpipe (m)	Depth to Water at 0 seconds (m)	Initial Groundwater Level (m)	Area (m ²)	Top of Response Zone (m bgl)	Bottom of Response Zone (m bgl)	Length of Filter Zone (m)
0.05	0.100000	1.22	0.0019625	0.5	3	2.5



ANNEX C

Drawings



LEGEND

-  HAND AUGER LOCATIONS (SHALLOW SOIL SAMPLING)
-  WINDOW SAMPLE BOREHOLE LOCATION
-  WINDOW SAMPLE BOREHOLE LOCATION (WITH GAS/GROUNDWATER MONITORING PROBE)
-  APPROXIMATE LOCATION OF NEW BUILD

REV	DESCRIPTION	DATE	BY

Thomas Consulting

CIVIL, STRUCTURAL, GEOTECHNICAL AND
CONTAMINATION ENGINEERS

32 EATON AVENUE, MATRIX PARK,
BUCKSHAW VILLAGE, CHORLEY, PR7 7NA.

Tel: 01772 299040
Fax: 01772 457860



CLIENT.

JOB TITLE.

WITHERSLACK, LAKESIDE

DRAWING TITLE.

SITE INVESTIGATION
LAYOUT PLAN

SCALE @ A3. NTS	DRAWN BY. D.E.	APPROVED BY. M.B.	DATE. 10/05/21
DRAWING No.			REV. -

ANNEX D

Calculations



Calculations Document

$$\text{Area} = 0.001963 \text{ m}^2$$

$$2.5 \text{ m Deep} \quad \text{WS1} = 1.3 \text{ m}$$

$$75\% - 25\% = 50\%$$

$$0.975 \text{ m} = 75\%$$

$$0.325 \text{ m} = 25\% \quad (650 \text{ mm})$$

$$15.5 \text{ minutes}$$

$$V_{p75-25} = 0.001963 \times (0.975 - 0.325) = 0.000622 \text{ m}^3$$

$$a_{s50} = (0.025 \times 0.65 \times 2) + (0.025 \times 0.65 \times 2) + 0.001963 = 0.067 \text{ m}^2$$

$$t_{p75-25} = 16$$

$$f = \frac{0.000622}{0.067 \times 16 \times 60} = 9.67 \times 10^{-6} \text{ m/s}$$