



4-8824-DS-03

Surface Water Drainage Strategy

Kenyon Lane,
Moston

16th May 2023

***For Adelphi Developments
Limited***

Old Hall Chambers
31 Old Hall Street
Liverpool
L3 9SY

t: +44 (0)151 227 5300
e: enquiries@clancy.co.uk
www.clancy.co.uk

Kenyon Lane, Moston

Report Reference: 4/8824
Version 03
Date originated: 24th June 2020
Prepared by: Clancy Consulting Limited

Revision List

REVISION	REASON FOR ISSUE	DATE OF ISSUE
0	Issued for Planning	24 th June 2020
01	Revised Site Plan	31 st July 2020
02	Revised Building and Site Plan	4 th May 2023
03	Existing Building Information	16 th May 2023

Prepared by: **Olivia Blackhurst B.Eng.(Hons)**
Graduate Civil/Structural Engineer

Approved by: **Michael Dean B.Eng (Hons)**
Senior Engineer

CAVEAT

This document has been prepared for the titled project, or named part thereof, and should not be relied upon or used for any other project or part as the case may be, without an independent check being made on it. Clancy Consulting shall not be liable for the consequences of using this document other than for the purpose for which it was commissioned, and any user and any other person using or relying on this document for such other purpose, agrees and will be such use or reliance be taken to confirm this agreement to indemnify Clancy Consulting for all loss or damage resulting therefrom.

TABLE OF CONTENTS

1.0	INTRODUCTION.....	4
2.0	LOCAL POLICY	5
3.0	SITE CHARACTERISTICS	6
4.0	SUSTAINABLE URBAN DRAINAGE SYSTEMS (SUDS)	11
5.0	DRAINAGE STRATEGY	15
6.0	MAINTENANCE & CONSTRUCTION.....	18
7.0	CONCLUSIONS AND RECOMMENDATIONS	20

APPENDICES

Appendix A	Drainage Strategy Drawing
Appendix B	Initial Drainage Calculations
Appendix C	United Utilities Service Plan Record Drawings.

1.0 INTRODUCTION

1.1 General

- 1.1.1 This report has been prepared on instructions received from Adelphi Developments Limited and relates to a proposed development on Kenyon Lane, Moston.
- 1.1.2 The report outlines the initial drainage design philosophy in relation to the proposed development.
- 1.1.3 This report is prepared solely for the benefit of the Client. This report may not be assigned without prior written permission from Clancy Consulting.
- 1.1.4 This report is for Planning Application purposes only and does not constitute a construction-ready design.

1.2 Report Structure

- 1.2.1 The report has been structured to follow the general principles set out by Sefton Metropolitan Borough Council's Surface Water Management Guidance.
- 1.2.2 The drainage strategy will provide justification of the discharge method considering the following (in order of preference);
 - 1. Discharge via Use on Site
 - 2. Discharge by Infiltration
 - 3. Discharge to Watercourse
 - 4. Discharge to Surface Water Sewer
 - 5. Discharge to Combined Sewer
- 1.2.3 The drainage strategy will discuss proposed SUDs techniques and comply with the 'Non-Statutory Technical Standards for Sustainable Drainage Systems'.
- 1.2.4 Sources of information:
 - Sefton Metropolitan Borough Council Surface Water Management Guidance
 - United Utilities Public Sewer Records
 - Non-statutory technical standards for sustainable drainage systems.
 - Proposed Drawings by Falconer Chester Hall (P19-008 drawings series)
 - Environment Agency Flood Risk Mapping

2.0 LOCAL POLICY

- Vulnerability class for the proposed use should be considered. Consideration of the site area should be made together with EA flood risk maps to determine the flood zone and whether a Flood Risk Assessment is required.
- Treatment of surface water risk on EA flood maps will need to be considered (threshold levels/ compensatory storage etc (consideration should also be given to any river (fluvial) risk in discussion with the Environmental Agency).
- Drainage strategy should follow SUDS hierarchy – i.e. in preferential order – Soakaway, Watercourse, Surface Water Sewer, Combined Sewer. Infiltration tests are required to demonstrate whether soakaway is feasible. It should be noted that United Utilities also apply this strictly, and detailed consideration of the hierarchy will need to be demonstrated in supporting documentation.
- Appropriate discharge rates should be calculated for the 30 and 100 year flood events for use in drainage design. In line with NPPF this should be attenuated to greenfield rates for greenfield sites/ site area and as close as possible to greenfield rates for brownfield areas (Sefton MBC SFRA requires minimum 50% reduction from existing). Climate change should be considered appropriately.
- A conceptual drainage layout should be prepared indicating runoff areas and calculations provided including attenuation. Interceptors/ filtration may also be deemed appropriate in accordance with SUDS hierarchy/ guidance.

3.0 SITE CHARACTERISTICS

3.1 Location

3.1.1 The site is located as detailed as below.

OS X (Eastings)	387249
OS Y (Northings)	401484
Nearest Post Code	M40 9DJ
Lat (WGS84)	N53:30:36
Long (WGS84)	W2:11:38
LR	SD872014
mX	-244214
mY	7043496

Table 1 – Site Characteristics (Streemap)

3.2 Site Description



Figure 1 – Site Location (Google Maps)

- 3.2.1 The development is located on Kenyon Lane (highlighted in red in Figure 1) and represents approximately 0.278 hectares in area.
- 3.2.2 The current development consists of a three storey building which appears to have previously been a large bingo hall and been repurposed to its current use as a hardware store. A large area of concrete hardstanding is located along the East and Southern boundaries used for storage of materials associated to the hardware business.
- 3.2.3 The development is bounded along the North boundary by Kenyon Lane, Lightbowne Evangelical church along the East boundary, residential dwellings along the South boundary and a commercial development to the West boundary.
- 3.2.4 No topographical information has been made available for review.
- 3.2.5 A review of historic maps indicates that the current building has on the site since between 1949 – 1964 and it is highly likely that the any existing connections to the public sewer below Kenyon Lane remain to this day.

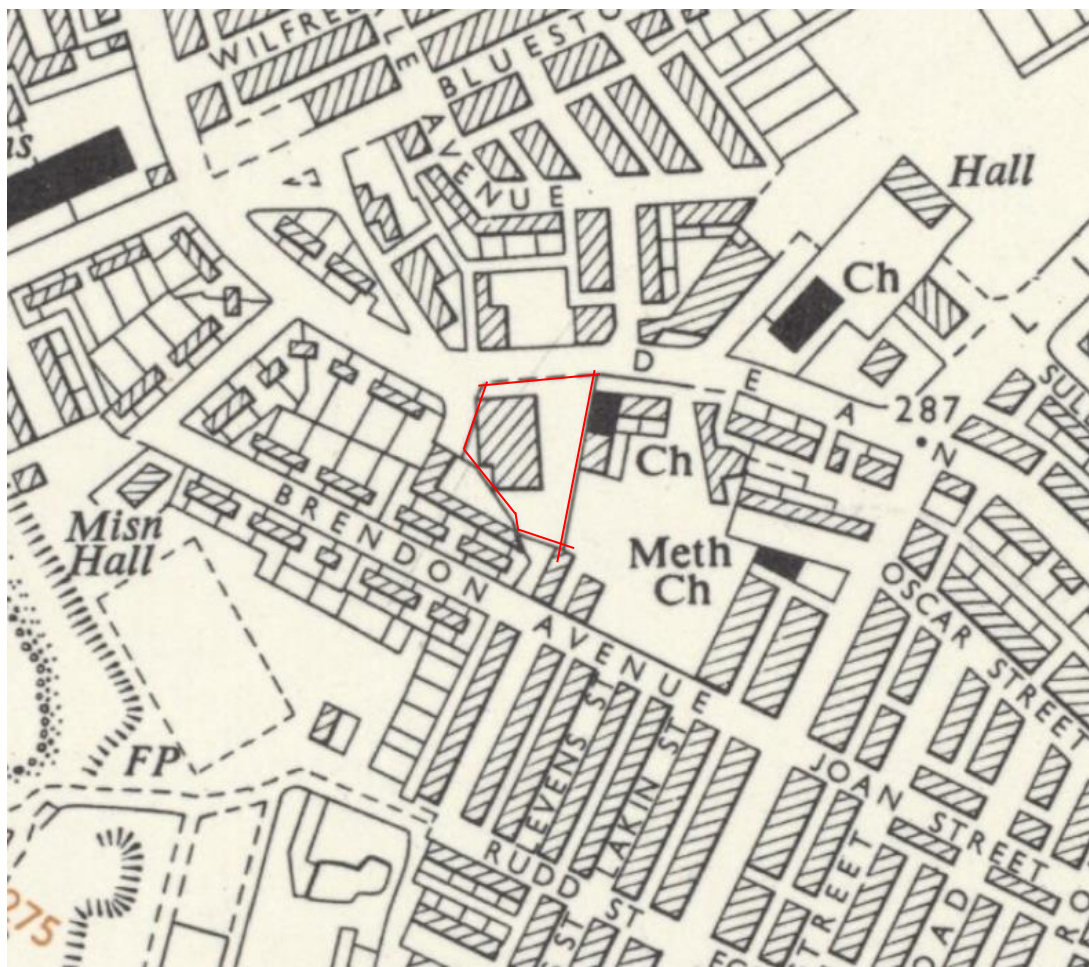


Figure 2 - Historic Mapping (1949-1964) (National Library of Scotland)

- 3.2.6 The development is approximately 500m West of Moston Brook which travels North before connecting to Rochdale Canal.

- 3.2.7 Following review of Flood Maps, the development is within Flood Zone 1 and considered at low risk of flooding due to Rivers and Seas.

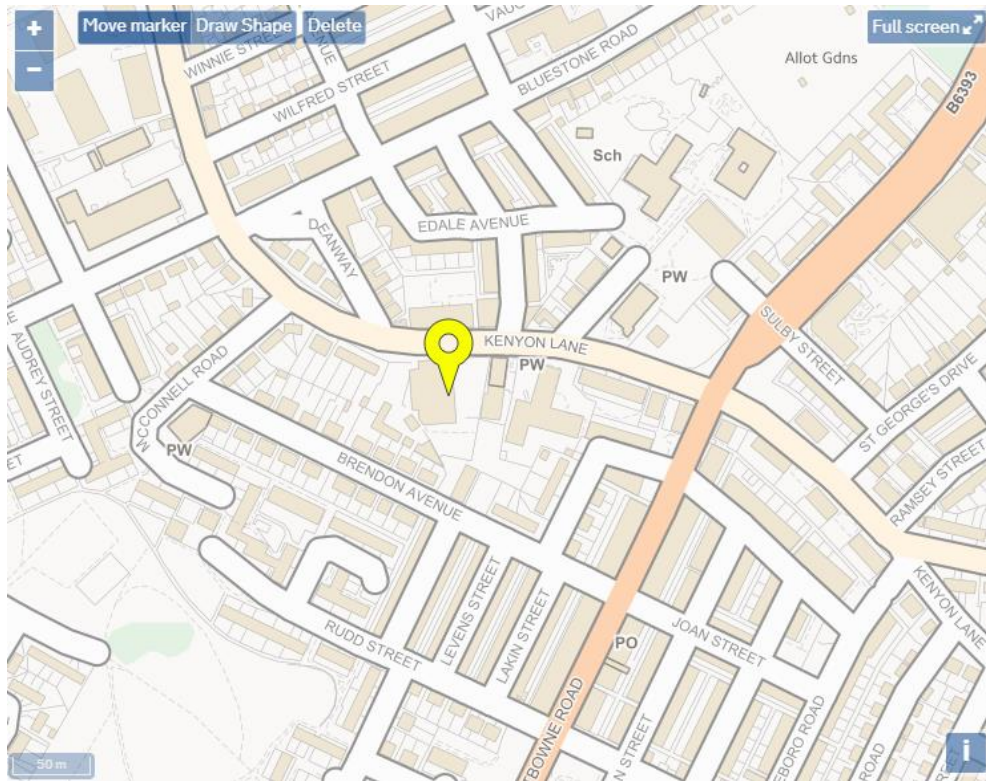


Figure 3 - Flood Risk Mapping (GOV.UK)

3.3 Development Proposals

- 3.3.1 The existing building facing onto Kenyon Lane has been demolished and will be replaced with a four storey masonry clad building providing 33No. one and two bedroom apartments.
- 3.3.2 A large area of car park will be provided at the rear of the building for residents with a large area of garden beyond the car park extending to the South boundary.
- 3.3.2 An area comparison – pre and post development is shown below;

Site Region	Pre-Development (m2)	Post Development (m2)
Building	1112	746
Hardstand/ Car Parking	1512	1189
Soft Landscaping/ Garden	112	840
Impermeable	2624	1935
Permeable	112	840

Table 2 – Pre and Post Development Detailed Figures

3.4 Existing Drainage

3.4.1 Following review of existing UU record drawings, there is a combined sewer running West to East below Kenyon Lane (Figure 2).

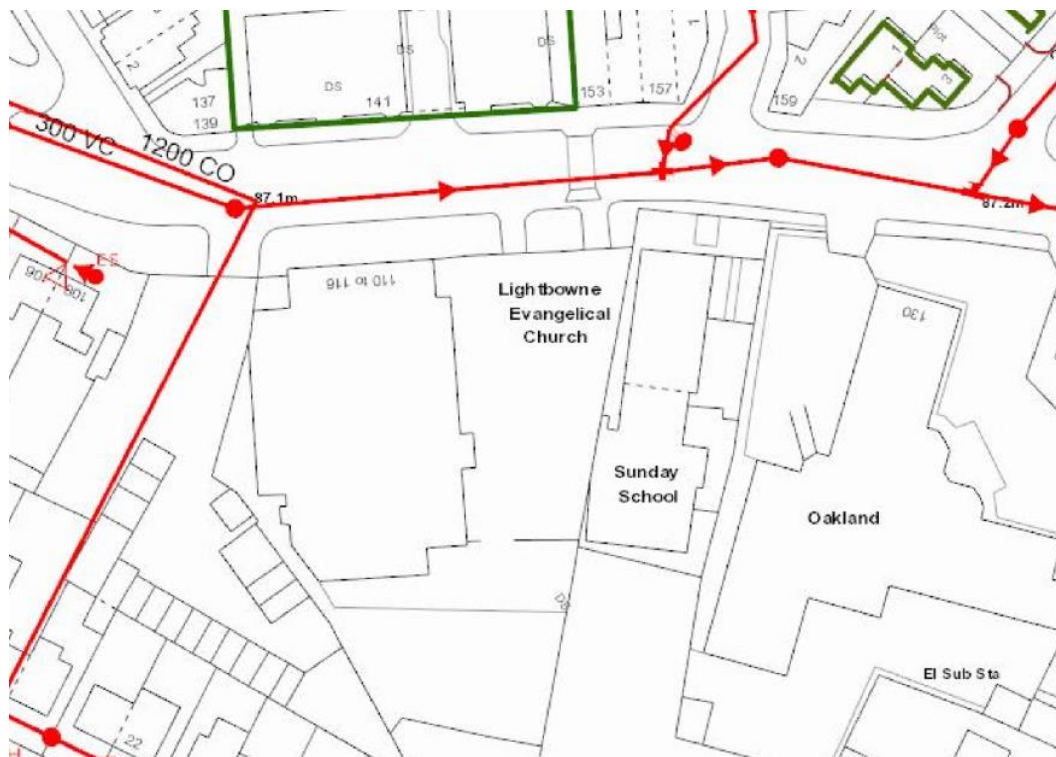


Figure 4 – Existing Infrastructure (Source: United Utilities)

3.4.2 However, in the event some of the sewers still crossing the development and being live and used, these may be subject to diversion works should they proven to be still active.

3.4.3 Unfortunately, no details regarding the depth, size, fall of manholes and/ or pipes have been provided on the maps.

- 3.4.4 However, we are assuming there is an existing connection from the existing 'live' business currently on the development to the combined sewer below Kenyon Lane.
- 3.4.5 All of the existing drainage will need to be investigated prior to connection – depth, gradients, flow rates, etc.

4.0 SUSTAINABLE URBAN DRAINAGE SYSTEMS (SUDS)

Any new drainage for the development should be designed in accordance with the non-statutory technical guidance for the design of sustainable drainage systems.

4.1 Surface Water Disposal Hierarchy

4.1.1 The disposal of surface water should be considered in the following order of priority;

1. Discharge to be used on site.
2. Infiltration into the subsoil via soakaways or permeable paving.
3. Discharge to a water course or the sea.
4. Discharge to a surface water sewer.
5. Discharge to a combined sewer.

4.1.2 If it is not possible to use discharge on site or discharge to a soakaway, then surface water should be controlled with the use of Sustainable Drainage Systems (SuDS) and considered using the SuDS Hierarchy.

Most Sustainable	SUDS technique	Flood Reduction	Pollution Reduction	Landscape & Wildlife Benefit
↑	Living roofs	✓	✓	✓
	Basins and ponds	✓	✓	✓
	- Constructed wetlands			
	- Balancing ponds			
	- Detention basins			
	- Retention ponds			
↓	Filter strips and swales	✓	✓	✓
	Infiltration devices	✓	✓	✓
	- soakaways			
	- infiltration trenches and basins			
Least Sustainable	Permeable surfaces and filter drains	✓	✓	
	- gravelled areas			
	- solid paving blocks			
	- porous paviers			
	Tanked systems	✓		
	- over-sized pipes/tanks			
	- storms cells			

Table 3 – SUDS Hierarchy (Environment Agency)

4.2 Disposal Strategy

4.2.1 Use on Site

Under the new Design and Construction Guidance document introduced at the beginning of April 2020, Use of Surface Water generated on site is now the preferred first option in the SUDS hierarchy.

This may well be a feasible option during detailed design as further guidance will be required from the Services Consultant as to how extraction is achievable (and cost effective) using greywater to flush toilets is.

The position of any greywater tanks for water extraction for irrigation need to be positioned to avoid a site covered with other services (electric. drainage, telecommunications and as proposed for use on this site – piping for ground sourced heating).

At this stage, and given the site size, layout and use, this would have to be used in conjunction with other options on the SUDS hierarchy as opposed to being the sole option and may only offer a small overall reduction into the existing infrastructure.

4.2.1 Infiltration

There is potential room for a permeable attenuation tank to be located within the car park whilst still maintaining the requirement of being located a minimum 5m away from foundations or the site boundary.

The Phase One Desktop Study undertaken by Clancy Consulting indicates the site is likely to be underlain by Made Ground deposits over bedrock. Therefore, infiltration may be minimal. Relying on infiltration alone will not allow the system to drain within 24 hours as per guidance requirements so this must be used in conjunction with one of the following should infiltration testing prove positive.

4.2.2 Discharge to a Water Course

There are no watercourses within practical distance of the development that wouldn't entail crossing third party land.

4.2.3 Discharge to a Surface Water Sewer

There are no surface water sewers adjacent to the development.

4.2.4 Combined Sewer

Discharging into the combined sewer at a controlled rate is currently the most feasible option to be considered. A combined sewer passes below Kenyon Lane and as the development was in use prior to demolition, it is highly likely there is an existing connection to the sewer already in place.

United Utilities would need to advise of current flow and capacity of the existing pipes below all nearby streets to ensure we do not take this beyond the capacity.

A CCTV drainage survey will also be required to establish if there are existing live connections up stream which may result in a localised diversion when a new connection is made.

4.3 SuDS Strategy

4.3.1 Living Roof

A significant area of the site receiving surface water is roof area.

A sustainable solution to control run-off at its source is to provide green or brown roof areas. These roof areas retain part of the rainwater, slow down the speed of run-off and also help to reduce water pollution whilst providing a habitat for nature.

Any green or brown roof system would impose additional weight onto the roof structure which would need to be designed accordingly to accommodate the additional weight.

4.3.2 Ponds/ Basins and Swales

These could be accommodated at the rear of the site although consideration would need to be given to the levels due to the residential properties in close proximity. Any flooding attributed to the ponds/ basins/ swales would need to be kept on the development.

4.3.3 Infiltration/ Permeable Surfaces

All soakaways must be situated at least 5m away from the building footprint as per building regulations which may limit the location of such soakaways.

Areas of hard landscaping have the potential to be utilised as subbase reservoirs with either full or partial filtration options to consider subject to testing or use purely as attenuation.

Further Site Investigation will need to be undertaken to assess the feasibility of using infiltration as a means of discharging surface water. Should the infiltration rate be low, this may need to be used in conjunction with a primary means of surface water discharge.

4.3.4 Landscaped Areas

The most sustainable solution to control run-off at its source would be to utilise areas of landscaping (grass and planting). There is an opportunity to make the external area to the rear of the resident's garden heavily landscaped with tree pits, areas of feature planting to assist with this option.

4.3.5 Tanked System

Typically, a tanked system would be considered as a means to provide additional attenuation storage to control rainfall up to 1 in 100 year change events with an allowance for climate change for existing sites undergoing complete redevelopment.

In this instance, an attenuation tank with a flow control downstream may be the primary SUDS option to be utilised.

4.4 Pollution

- 4.4.1 Where car parks contain a minimum of 50 car spaces or are greater than 800 square metres petrol interceptors will be installed. This is therefore not required on this project.

5.0 DRAINAGE STRATEGY

5.1 Surface Water Drainage

- 5.1.1 In accordance with the LLFA requirements, the development will be treated as a greenfield site as it has been demolished/derelict for an excess of 12 months.
- 5.1.2 The design has been undertaken in accordance with Greenfield rates which requires a Qbar assessment. Using UKSuDS online tool, Qbar for the total site area (0.2776ha) = 1.91l/s.
- 5.1.3 A design flow of 2l/s will be maintained using flow control system (Hydro-brake or similar).
- 5.1.4 This will be located in the final surface water chamber before connection to the public infrastructure to maintain flows to within agreed limits.
- 5.1.5 The peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 2 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.
- 5.1.6 The storage required has been sized for storm events up to the 1 in 100 year storm event (plus 40% allowance for climate change).
- 5.1.7 This will be provided using a combination of attenuation tanks (providing the vast majority of the volume), pipe runs and manhole chambers.
- 5.1.8 From the initial drainage model, this has been determined to be a total of 105 cubic metres of storage – with an 1320mm deep granular filled geo cellular tank located with 600mm nominal cover below the car park level providing 97 cubic metres of this storage.
- 5.1.9 Subject to client and insurer approval, it may be feasible to provide storage for the 1 in 30 year storm event and hold the additional flood water generated from the 1 in 100 year + 40% climate change allowance storm event above ground – within the car park at the back subject to level confirmation.
- 5.1.10 Should this prove not to be feasible, storage would be provided for storm events up to and including 1 in 100 year plus climate change. This is currently the design parameter worked to.
- 5.1.11 Although not used for filtration, other SUDs options may be viable to store peak flow volume on site. These include permeable paving, swales, ponds and tree pits.
- 5.1.12 This is currently a theoretical design based on the information we have been provided to date and will require confirmation of assumptions made (including invert level of the outfall of the existing sewer) – which will be undertaken during detailed design.
- 5.1.13 Currently, all car parks contain less than 50 car spaces and is less than 800 square metres and so, a petrol interceptor is not required to aid filtering out contamination.

5.1.14 Outline proposals are shown on the Drainage Strategy drawing located in Appendix A.

5.1.15 Preliminary calculations have been included in the Appendix B.

5.2 Development Foul Water Drainage

5.2.1 Foul water will be collected in a separate system to surface water. This will be collected via pipes & inspection chambers.

5.2.2 All proposed below ground foul water drainage will comply with Building Regulations Part H:2010, BS EN 12056-2:2000 and BS EN 752:2008.

5.2.3 Based upon the above, the peak foul flow rate from site is estimated to be 15.4l/s.

5.2.4 The proposed foul sewer system has been designed to handle this flow rate.

5.2.5 Salford City Council & United Utilities approval for the flow rate entering the public sewer will be required to proceed with detailed design.

SUMMARY	Discharge Unit	Totals	Total DU
Shower	0.6	37	22.2
Washbasin	0.6	38	22.8
WCs (4l - 9l cistern)	2.5	38	95
Kitchen Sink	1.3	37	48.1
Floor drains (50mm - 100mm)	2	1	2
Washing Machine (Domestic)	0.8	37	296
			486.1
Peak Flow Discharge	15.4	l/s	

Table 6 – Foul Flow Discharge Rate Estimation

5.3 Flood Risk within the Development

- 5.3.1 As per Environment Agency Flood Maps, the development is currently in Flood Zone One with a low probability of flooding.
- 5.3.2 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30 year rainfall event.
- 5.3.3 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.
- 5.3.4 The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100-year rainfall event are managed in exceedance routes that minimise the risks to people and property.
- 5.3.5 Initial levels are assumed to have been designed to be sympathetic to the existing levels with no vast areas of landscaping resulting in significant or abrupt level changes.
- 5.3.6 Levels will be designed such that in the event of a more extreme rainfall event water will discharge away from buildings.

6.0 MAINTENANCE & CONSTRUCTION

6.1 Maintenance Considerations

- 6.1.1 This section is intended to give an overview of the operation and maintenance for the drainage features included with the drainage strategy and in relation to typical details.
- 6.1.2 Where proprietary products are specified, the manufacturer's instructions and recommendations should be followed in priority to this document unless specifically noted otherwise due to project constraints.
- 6.1.3 The surface water network has been designed to accommodate the 1 in 100-year storm rainfall event plus an allowance for climate change particular to the requirements of the development.
- 6.1.4 As the flows are generally being attenuated on site, there will be a period after storm events where the network is still partially or fully surcharged and is draining down.
- 6.1.5 Where this surcharging is still present after 48hrs appropriate action should be taken.
- 6.1.6 A suitable maintenance strategy should be adopted to ensure the drainage network is cleaned regularly and the routine maintenance and cleansing regime should be documented.
- 6.1.7 No large shrubs should be planted over any geocellular tanks within 3m in all directions and 6m from small/ medium specimen tree planting. Larger trees should not be planted within 20m of the tanks.
- 6.1.8 It is advisable that above ground signage is installed detailing size and depth of any below ground structures to make any future works manageable.
- 6.1.9 It is assumed that the maintenance of the drainage network will be the responsibility of an on-site facilities management team.
- 6.1.10 A copy of the final construction drainage layout should be provided in the final Operations and Maintenance Manual.
- 6.1.11 It is recommended that the drainage system is inspected as a minimum twice a year, with the system also being inspected after any major storm event.
- 6.1.12 Significant sediment deposition is likely in areas used for storage, so a post clean-up operation may be required including the removal of litter, vegetation, sewerage debris and larger objects.
- 6.1.13 Long-term management practices include monthly sweeping of external paved areas. The sweeping program will remove sand and contaminants directly from paved surfaces before they become mobilised during storm events and transported to the drainage system.
- 6.1.14 During the winter months, drainage features such as gullies and channels should be cleared of ice, snow, debris or litter.

- 6.1.15 Sediment/material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols; especially where run-off is taken from potentially contaminated areas such as the filter drains and the upstream/downstream chambers.
- 6.1.16 Pumping should only be used to facilitate drainage for those parts of the site where it is not reasonably practicable to drain water by gravity.

6.2 Construction

- 6.2.1 Components must be designed to ensure structural integrity of the drainage system and any adjacent structures or infrastructure under anticipated loading conditions over the design life of the development taking into account the requirement for reasonable levels of maintenance.
- 6.2.2 Damage to the drainage system resulting from associated construction activities must be minimised and must be rectified before the drainage system is considered to be completed.
- 6.2.3 The materials, including products, components, fittings or naturally occurring materials, which are specified by the designer, must be of a suitable nature and quality for their intended use.
- 6.2.4 The detailed design of the system and product selection for the storage and pipe solution will be made at the detailed design stage when all the site constraints can be considered. There are numerous products available for storage of water below ground and care will be needed to ensure that the right product is chosen for the final loading conditions.

7.0 CONCLUSIONS AND RECOMMENDATIONS

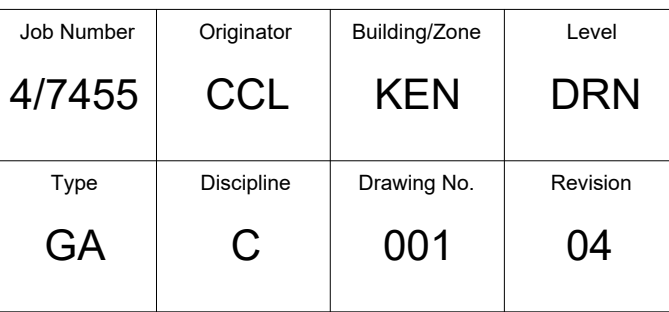
- 7.1 This report gives details of the Drainage Strategy which has been undertaken in relation to the proposed development of Kenyon Lane, Moston.
- 7.2 The development will be regenerated from the current large building and vast area of concrete hardstanding to provide a four storey residential building with car parking and large communal garden at the rear.
- 7.3 Separate foul and surface water systems will be provided on the development, only connecting at the final manhole on the development before discharge to the public sewer.
- 7.4 The development has been considered to be greenfield as it has derelict for an excess of 12 months – with assumed existing connections off the development into the mains a surface water discharge rate will be calculated based on the site Qbar value – as in accordance with the LLFA requirements.
- 7.5 This has resulted in a permitted 2l/s overall discharge rate from the site controlled on site using a flow control chamber – thereby reducing local area flood risk. This rate is still subject to confirmation from United Utilities.
- 7.6 The disposal and SUDs hierarchies have been analysed and it is currently proposed to use a combination of attenuation tanks and soft landscaping as means of disposal, with the primary means of disposal into the combined sewer below Kenyon Lane. Further detailed design and infiltration testing is required to justify the use of greywater harvesting and soakaways respectively.
- 7.7 The proposed system will be designed to control surface water run-off for all storms up to and including the 100 year plus climate change event. Water will be stored on site below ground before being discharged at the agreed flow rate.
- 7.8 A total of 105 cubic metres of storage is required for the for the entire development with 97 cubic metres of this provided in the geocellular aggregate filled attenuation tank. The remainder is provided through the use of the pipes and manhole chambers.
- 7.9 This volume considers storing all flood water including the 1 in 100 year storm event plus climate change. It may be viable subject to profiling of levels, client and insurer requirements to only provide storage for the 1 in 30 year storm event and maintain the additional flooding from the 1 in 100 year storm event (plus climate change) within the car park area until the peak storm has passed.
- 7.11 It is proposed to utilise an existing connection from the current development where possible – subject to confirmation of their integrity. New connections may be required from the development into the existing combined sewer with preliminary details shown on the Drainage Strategy drawings. These may require temporary sewer diversions and road closures to form the connection safely.
- 7.9 A Wastewater Pre-Development Enquiry was previously submitted to United Utilities for comment on the proposed drainage strategy presented within this report. It was agreed that a discharge rate of 10l/s into the 300mm diameter public combined sewer beneath Kenyon Lane was acceptable.

- 7.10 The proposed system will be designed to meet the Sustainable Drainage Systems Non-statutory technical standards for sustainable drainage systems, March 2015.

APPENDIX A

Drainage Strategy Drawing

THIS IS A THEORETICAL PRELIMINARY DESIGN AS ASSUMPTIONS MADE MUST BE CONFIRMED (I.E. LEVELS, AREAS SUPPORTED). CONSTRUCTION STAGE DESIGN IS SUBJECT TO DETAILED DESIGN. DO NOT CONSTRUCT FROM THIS DRAWING.



APPENDIX B

Initial Drainage Model Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	30	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)	18.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.360	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.047	5.00	90.000	1200	27.844	19.351	1.500
2			90.000		32.027	37.097	2.000
3	0.082	5.00	90.000	1200	35.275	51.962	2.101
4	0.028	5.00	90.000	1500	33.695	69.591	2.219
5			90.000	1200	31.996	75.978	2.263
6			90.000	1200	36.494	88.434	2.351
7	0.025	5.00	90.000	1200	1.085	50.019	1.870

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
2.000	1	2	18.232	0.600	88.500	88.378	0.122	150.0	225	5.29	50.0
1.001	3	4	17.700	0.600	87.899	87.781	0.118	150.0	225	5.81	50.0
1.002	4	5	6.609	0.600	87.781	87.737	0.044	150.0	225	5.92	50.0
1.003	5	6	13.243	0.600	87.737	87.649	0.088	150.0	225	6.12	50.0
2.001	2	3	15.216	0.600	88.000	87.899	0.101	150.0	225	5.52	50.0
1.000	7	3	34.245	0.600	88.130	87.902	0.228	150.0	225	5.54	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
2.000	1.065	42.3	6.4	1.275	1.397	0.047	0.0	58	0.768
1.001	1.065	42.3	20.9	1.876	1.994	0.154	0.0	111	1.060
1.002	1.065	42.3	24.7	1.994	2.038	0.182	0.0	123	1.105
1.003	1.065	42.3	24.7	2.038	2.126	0.182	0.0	123	1.105
2.001	1.065	42.3	6.4	1.775	1.876	0.047	0.0	58	0.768
1.000	1.065	42.3	3.4	1.645	1.873	0.025	0.0	43	0.640

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
2.000	18.232	150.0	225	Circular	90.000	88.500	1.275	90.000	88.378	1.397
1.001	17.700	150.0	225	Circular	90.000	87.899	1.876	90.000	87.781	1.994
1.002	6.609	150.0	225	Circular	90.000	87.781	1.994	90.000	87.737	2.038
1.003	13.243	150.0	225	Circular	90.000	87.737	2.038	90.000	87.649	2.126
2.001	15.216	150.0	225	Circular	90.000	88.000	1.775	90.000	87.899	1.876
1.000	34.245	150.0	225	Circular	90.000	88.130	1.645	90.000	87.902	1.873

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
2.000	1	1200	Manhole	Adoptable	2		Junction	
1.001	3	1200	Manhole	Adoptable	4	1500	Manhole	Adoptable
1.002	4	1500	Manhole	Adoptable	5	1200	Manhole	Adoptable
1.003	5	1200	Manhole	Adoptable	6	1200	Manhole	Adoptable
2.001	2		Junction		3	1200	Manhole	Adoptable
1.000	7	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	27.844	19.351	90.000	1.500	1200				
						0	2.000	88.500	225
2	32.027	37.097	90.000	2.000			1	2.000	88.378
						0	2.001	88.000	225
3	35.275	51.962	90.000	2.101	1200		1	2.001	87.899
						2	1.000	87.902	225
						0	1.001	87.899	225
4	33.695	69.591	90.000	2.219	1500		1	1.001	87.781
						0	1.002	87.781	225
5	31.996	75.978	90.000	2.263	1200		1	1.002	87.737
						0	1.003	87.737	225
6	36.494	88.434	90.000	2.351	1200		1	1.003	87.649
7	1.085	50.019	90.000	1.870	1200				
						0	1.000	88.130	225

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	18.000	Drain Down Time (mins)	240
Ratio-R	0.360	Additional Storage (m ³ /ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	1.000	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	30	0	0

Node 4 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	87.781	Product Number	CTL-SHE-0061-2000-1500-2000
Design Depth (m)	1.500	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	88.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.96	Time to half empty (mins)	

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	76.8	0.0	1.320	76.8	0.0	1.321	0.0	0.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.12%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	88.570	0.070	8.8	0.1228	0.0000	OK
180 minute winter	2	168	88.252	0.252	6.5	18.5881	0.0000	SURCHARGED
180 minute winter	3	168	88.252	0.353	5.1	0.6751	0.0000	SURCHARGED
180 minute winter	4	168	88.252	0.471	2.4	0.9513	0.0000	SURCHARGED
15 minute summer	5	60	87.767	0.030	1.6	0.0340	0.0000	OK
15 minute summer	6	60	87.678	0.029	1.6	0.0000	0.0000	OK
180 minute winter	7	168	88.252	0.122	1.2	0.1707	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	2.000	2	8.6	0.836	0.203	0.1879	
180 minute winter	2	2.001	3	-4.3	0.286	-0.102	0.6052	
180 minute winter	3	1.001	4	1.9	0.291	0.045	0.7039	
180 minute winter	4	Hydro-Brake®	5	1.6				
15 minute summer	5	1.003	6	1.6	0.506	0.037	0.0409	11.4
180 minute winter	7	1.000	3	1.2	0.189	0.028	1.0575	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.12%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	1	232	88.641	0.141	3.4	0.2471	0.0000	OK
240 minute winter	2	232	88.641	0.641	10.7	47.2299	0.0000	SURCHARGED
240 minute winter	3	232	88.641	0.742	7.7	1.4179	0.0000	SURCHARGED
240 minute winter	4	232	88.640	0.859	2.0	1.7361	0.0000	SURCHARGED
60 minute winter	5	19	87.767	0.030	1.6	0.0340	0.0000	OK
15 minute summer	6	174	87.678	0.029	1.6	0.0000	0.0000	OK
240 minute winter	7	232	88.641	0.511	1.8	0.7137	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute winter	1	2.000	2	3.4	0.642	0.080	0.6004	
240 minute winter	2	2.001	3	-7.4	-0.187	-0.176	0.6052	
240 minute winter	3	1.001	4	1.5	0.291	0.036	0.7039	
240 minute winter	4	Hydro-Brake®	5	1.6				
60 minute winter	5	1.003	6	1.6	0.506	0.037	0.0409	24.4
240 minute winter	7	1.000	3	1.5	0.191	0.036	1.3620	

Results for 100 year +30% CC Critical Storm Duration. Lowest mass balance: 99.12%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	1	352	89.266	0.766	4.3	1.3468	0.0000	SURCHARGED
360 minute winter	2	352	89.266	1.266	13.3	93.3490	0.0000	SURCHARGED
360 minute winter	3	352	89.266	1.367	10.0	2.6138	0.0000	SURCHARGED
360 minute winter	4	352	89.266	1.485	2.5	2.9993	0.0000	SURCHARGED
360 minute winter	5	352	87.771	0.034	2.0	0.0383	0.0000	OK
360 minute winter	6	352	87.682	0.033	2.0	0.0000	0.0000	OK
360 minute winter	7	352	89.266	1.136	2.3	1.5882	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute winter	1	2.000	2	3.9	0.653	0.092	0.7251	
360 minute winter	2	2.001	3	-9.7	-0.243	-0.228	0.6052	
360 minute winter	3	1.001	4	1.9	0.202	0.046	0.7039	
360 minute winter	4	Hydro-Brake®	5	2.0				
360 minute winter	5	1.003	6	2.0	0.543	0.047	0.0487	62.3
360 minute winter	7	1.000	3	2.0	0.184	0.048	1.3620	

APPENDIX C

United Utilities Service Record Drawings



SEWER RECORDS

Address or Site Reference

112 KENYON LANE,
MANCHESTER,
M40 9DH

Scale: 1:1250
Date: 19/06/2020

Printed by: Property Searches

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

Crown copyright and database rights 2017
Ordnance Survey 100022432. Unauthorised
reproduction will infringe these copyrights.

