



4-7455-DS-01

## Surface Water Drainage Strategy

Kenyon Lane,  
Moston

31<sup>st</sup> July 2020

***For Adelphi Developments  
Limited***

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**Kenyon Lane, Moston**

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## **1.0 INTRODUCTION**

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### **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 outline 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.
  - Topographical Survey.

## 2.0 LOCAL POLICY

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- 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

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#### 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)

- 
- A detailed street map of a residential area in London. The map shows a grid of streets including Wilfred Avenue, Blue Street, Brendon Avenue, Levens Avenue, Rudd Street, Joann Street, and Oscar Street. A red rectangle highlights a specific building on Brendon Avenue, labeled 'Meth Ch'. Other landmarks include 'Misn Hall', 'Hall', and 'Ch' (church). The map also shows various other buildings and structures, some with hatched patterns indicating specific types of buildings or land use.

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.

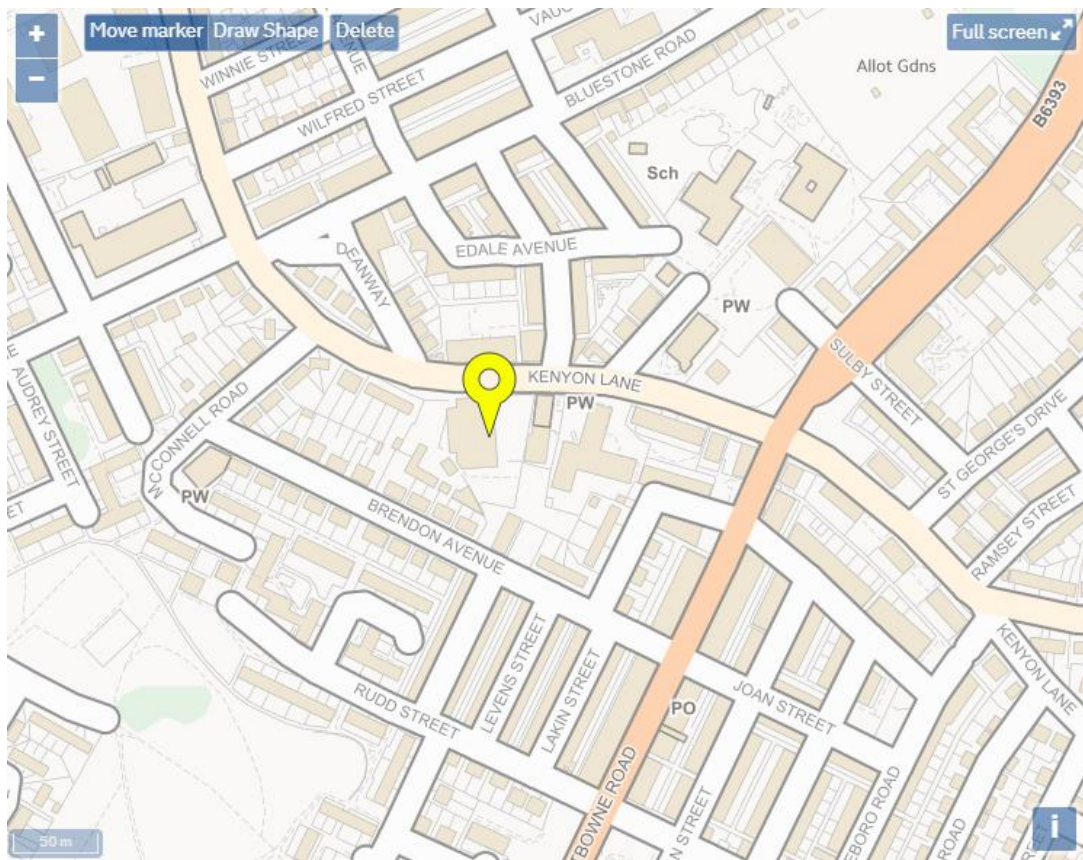


**Figure 3 - Flood Risk Mapping (GOV.UK)**

### 3.3 Development Proposals

- 3.3.1 The existing building facing onto Kenyon Lane will be demolished and 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;

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

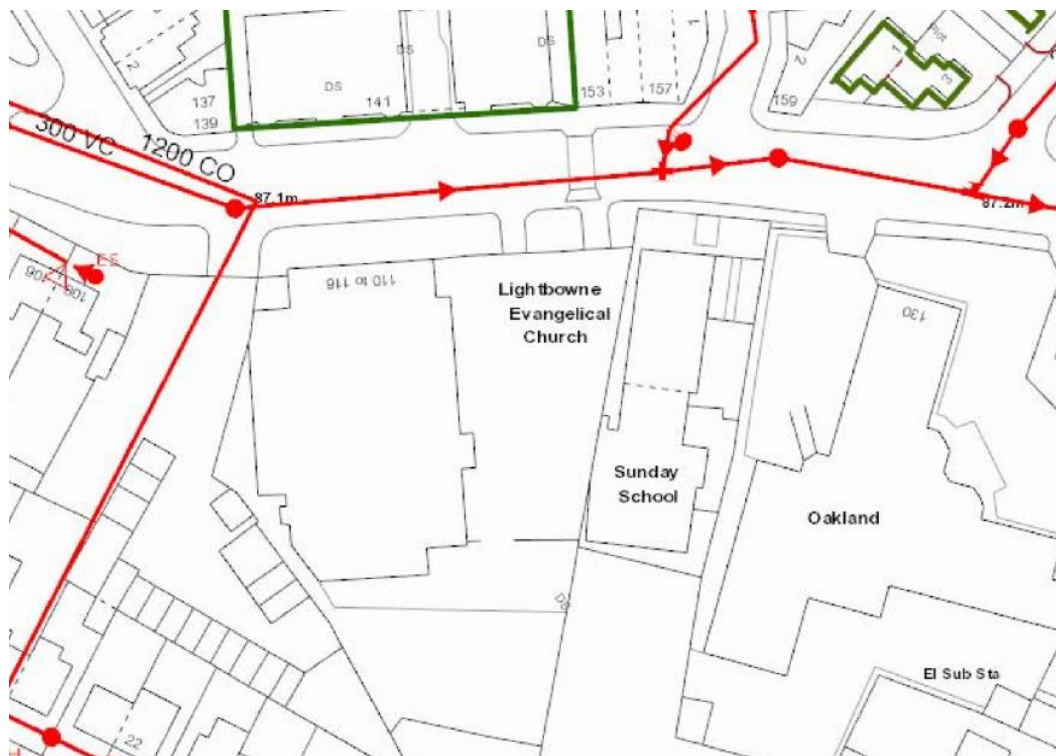


**Figure 4 – Existing Infrastructure (Source: United Utilities)**

- 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                          |                 |                     |                              |
| Least Sustainable | - infiltration trenches and basins   |                 |                     |                              |
|                   | 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 is currently used, 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 leading to the entrance to the church 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 – such as in this instance - petrol interceptors will be installed. This will be a 'Class 2' interceptor as it ultimately discharges into a combined sewer network and will be located upstream of the attenuation tank to minimise any contaminants/ residues passing through the tank and reducing its efficiency.

## 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 brownfield site as it is/ has been previously developed.

5.1.2 The table below shows the pre and post development, permeable and impermeable areas and the percentage change.

| <i>Time</i>             | Permeable Area (m <sup>2</sup> ) | Impermeable Area (m <sup>2</sup> ) |
|-------------------------|----------------------------------|------------------------------------|
| <i>Pre-Development</i>  | 112                              | 2624                               |
| <i>Post-Development</i> | 840                              | 1935                               |
| <i>Change (%)</i>       | +750%                            | -60%                               |

**Table 4 – Pre and Post Development Overview**

5.1.3 In accordance with the LLFA requirements, the table below presents the pre and post development surface water flows from the development for the various storm events noted. These figures are based on 15 minute duration storms for the impermeable areas of the pre and post developments. These figures only consider the impermeable areas and do not include the additional greenfield flow.

| <i>Storm Event</i>                | Pre-Development (l/s) | Post-Development (l/s) |
|-----------------------------------|-----------------------|------------------------|
| <i>1 in 1 year</i>                | 19.9                  | 10.3                   |
| <i>1 in 2 year</i>                | 25.8                  | 13.3                   |
| <i>1 in 30 year</i>               | 48.8                  | 25.2                   |
| <i>1 in 100 year + 30&amp; CC</i> | 83.8                  | 43.3                   |

**Table 5 – Flows for various storm events – pre and post development**

5.1.4 Based on the predevelopment impermeable area (2624m<sup>2</sup>), a 1 in 2 year pre-development flow equates to 20l/s. Offering a 50% betterment in accordance with LLFA requirements reduces this to 10l/s.

5.1.5 All flows will be maintained using flow control system.

5.1.6 This will be located in the final surface water chamber before connection to the public infrastructure to maintain flows to within agreed limits.

5.1.7 The peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 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.

- 5.1.8 The storage required has been sized for storm events up to the 1 in 100 year storm event (plus 30% allowance for climate change).
- 5.1.9 This will be provided using a combination of attenuation tanks (providing the vast majority of the volume), pipe runs and manhole chambers.
- 5.1.10 From the initial drainage model, this has been determined to be a total of 41 cubic metres of storage – with an 1200mm deep granular filled geocellular tank located 600mm below the car park level providing 32 cubic metres of this storage.
- 5.1.11 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 + 30% climate change allowance storm event above ground – within the car park at the back subject to level confirmation.
- 5.1.12 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.
- 5.1.13 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.
- 5.1.14 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.
- 5.1.15 Currently, all car parks contain less than 50 car spaces but is greater than 800 square metres and so, a petrol interceptor is required to aid filtering out contamination.
- 5.1.16 Outline proposals are shown on the Drainage Strategy drawing located in Appendix A.
- 5.1.17 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 7.9 l/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.

| <b>SUMMARY</b>                     | <b>Discharge Unit</b> | <b>Totals</b> | <b>Total DU</b> |
|------------------------------------|-----------------------|---------------|-----------------|
| <b>Bath</b>                        | 0.6                   | 33            | 42.9            |
| <b>Washbasin</b>                   | 0.6                   | 33            | 19.8            |
| <b>WCs (4l - 9l cistern)</b>       | 2.5                   | 33            | 82.5            |
| <b>Kitchen Sink</b>                | 1.3                   | 33            | 42.9            |
| <b>Dishwasher</b>                  | 0.8                   | 33            | 26.4            |
| <b>Floor drains (50mm - 100mm)</b> | 2                     | 5             | 10              |
| <b>Washing Machine (Domestic)</b>  | 1.5                   | 33            | 49.5            |
|                                    |                       |               |                 |
|                                    |                       |               | 274             |
|                                    |                       |               |                 |
| <b>Peak Flow Discharge</b>         | 8.3                   | 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 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

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- 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 brownfield as it has previously been/ is currently developed – with assumed existing connections off the development into and a 50% betterment will be offered on existing 1 in 2 year storm event flows using current impermeable surfaces – as in accordance with the LLFA requirements.
- 7.5 This has resulted in a permitted 10l/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 41 cubic metres of storage is required for the for the entire development with 32 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.
- 7.10 A Class 2 Petrol Interceptor will be required on the car park area as it is in excess of 800 square metres (including access runs). This is to be positioned upstream of the attenuation tank in order to minimise the risk of contaminants and residues settling in the tank and reducing its efficiency.
- 7.11 It is proposed to utilise 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 drawing. These may require temporary sewer diversions and road closures to form the connection safely.

- 7.9 A Wastewater Pre-Development Enquiry has been submitted to United Utilities for comment on the proposed drainage strategy presented within this report. At the time of writing, no response has been received.
- 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**

PRELIMINARY SUBJECT TO CONFIRMATION OF LANDSCAPE ARCHITECTS PROPOSED SITE LEVELS AND ALL FOUL WATER POP UP AND RAINWATER DOWNSPIPE LOCATIONS AND FLOW RATES.

PRELIMINARY SUBJECT TO CONFIRMATION  
UNITED UTILITIES AND LIVERPOOL CITY  
COUNCIL ACCEPTANCE OF DISCHARGE  
CONNECTION LOCATIONS AND FLOW  
RATES.

PRELIMINARY SUBJECT TO CONFIRMATION  
UNITED UTILITIES AND LIVERPOOL CITY  
COUNCIL ACCEPTANCE OF DISCHARGE  
CONNECTION LOCATIONS AND FLOW  
RATES.

THIS DRAWING IS FOR INFORMATION ONLY  
AND IS SUBJECT TO FURTHER DISCUSSIONS  
WITH THE RELEVANT AUTHORITIES AND  
SUBSEQUENT FURTHER DETAILED DESIGN -  
DO NOT CONSTRUCT FROM THIS DRAWING.

IT IS ASSUMED THAT THERE ARE LIVE CONNECTIONS RUNNING FROM THE SITE AS A RESULT OF THE EXISTING DEVELOPMENT. THESE WILL CONNECT TO THE PUBLIC COMBINED SEWER BELOW KENYON LANE. IT IS THE INTENTION TO USE THIS EXISTING CONNECTION SUBJECT TO FURTHER CCTV INVESTIGATIONS.

SHOULD THE RESULTS OF THIS CONCLUDE THAT THE CONNECTION IS NOT VIABLE, A NEW CONNECTION AND MANHOLE WILL BE REQUIRED RESULTING IN POTENTIAL ROAD CLOSURES.

DETAILS SHOWN ARE SUBJECT TO  
CONFIRMATION OF LAYOUTS, ABOVE  
GROUND DRAINAGE. CONFIRMATION OF  
EXISTING DRAINAGE INFRASTRUCTURE  
DETAILS AND AGREEMENTS FROM ALL  
REGULATORY BODIES.

THE SCHEME SHOWN ASSUMES THIS IS A GRAVITY DRAINAGE SYSTEM AND NO PUMP IS REQUIRED.

CCTV INVESTIGATION TO BE COMPLETED TO CONFIRM LEVELS AND DETAILS OF EXISTING UNITED UTILITIES SEWERS.

NEW MANHOLE TO BE FORMED  
OVER PROPOSED CONNECTION  
INTO EXISTING UNITED UTILITIES  
COMBINED SEWER.

FLOW CONTROL RESTRICTED TO 10l/s  
TO HOLD SURFACE WATER IN  
ACCORDANCE WITH LLFA GUIDANCE.  
DESIGN HEAD: 1.42m

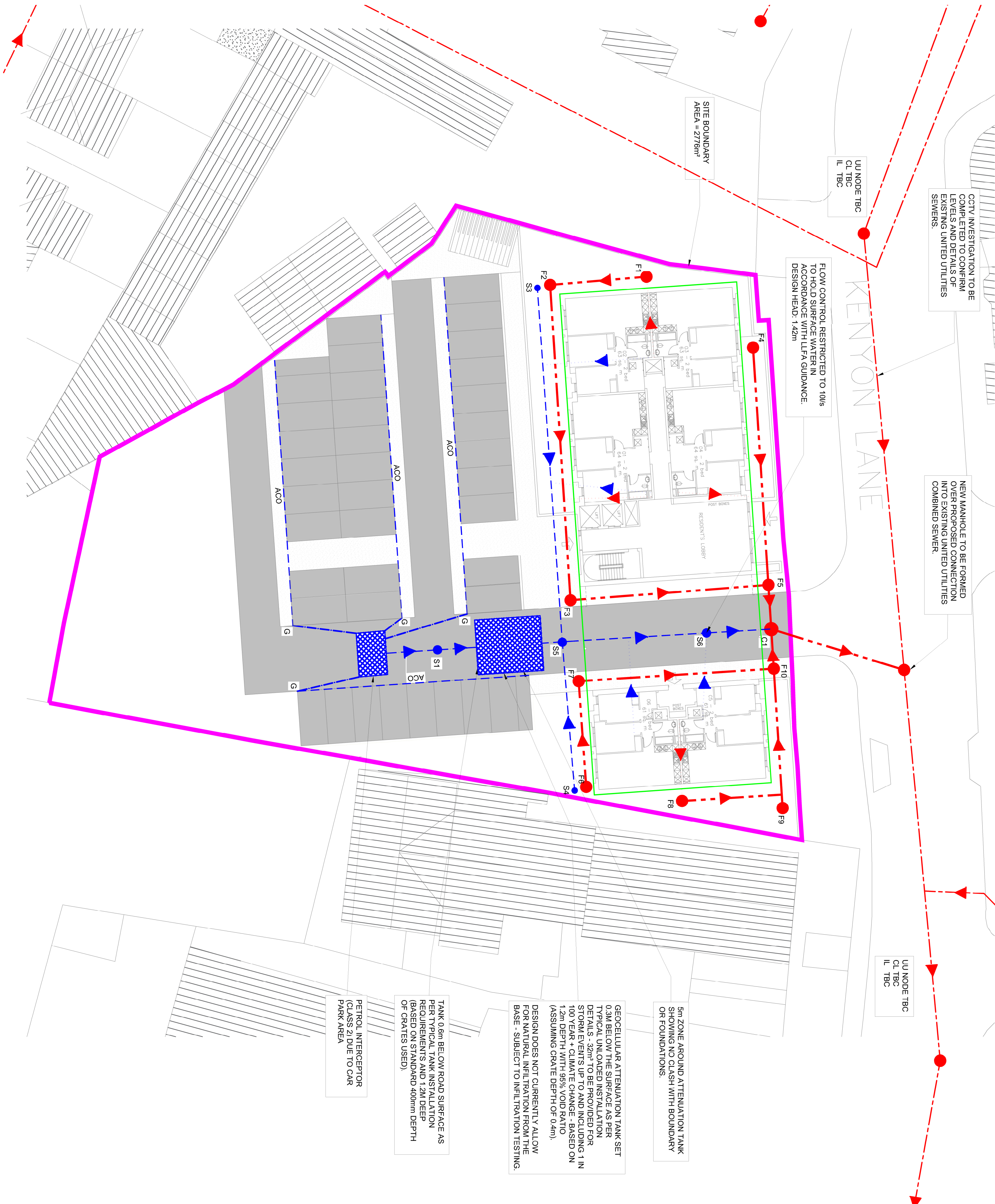
```
UU NODE TBC
CL TBC
IL TBC
```

5m ZONE AROUND ATTENUATION TANK  
SHOWING NO CLASH WITH BOUNDARY  
OR FOUNDATIONS.

DESIGN DOES NOT CURRENTLY ALLOW FOR NATURAL INFILTRATION FROM THE BASE - SUBJECT TO INFILTRATION TESTINGS

TANK 0.6m BELOW ROAD SURFACE AS  
PER TYPICAL TANK INSTALLATION  
REQUIREMENTS AND 1.2M DEEP  
(BASED ON STANDARD 400mm DEPTH  
OF CRATES USED).

PETROL INTERCEPTOR  
(CLASS 2) DUE TO CAR  
PARK AREA



THE STRATEGY SHOWN IS SUBJECT TO CONFIRMATION OF THE EXISTING DRAINAGE INFRASTRUCTURE (LEVELS, FALLS, PIPE DIAMETERS, ETC).

THE STRATEGY ASSUMES A GRAVITY FED DRAINAGE SYSTEM IS TO BE USED WITH NO PUMPING.

THE INDICATIVE DRAINAGE ARRANGEMENTS SHOWN ON EACH PLOT IS SUBJECT TO COORDINATION WITH THE ARCHITECT FOR LEVELS, M&E CONSULTANT FOR POP-UPS

## FOUL WATER STRATEGY:

THIS WILL BE COLLECTED ON SITE THROUGH A SEPARATE FOUL DRAINAGE SYSTEM WHICH COMBINES WITH THE SURFACE WATER AT THE BOUNDARY OF THE SITE - DOWNSTREAM OF THE CONTROL FLOW CHAMBER. THE ESTIMATED PEAK FOUL FLOW IS SUBJECT TO CONFIRMATION OF NUMBERS AND LAYOUTS OF ROOMS.

## SURFACE WATER STRATEGY:

THE DEVELOPMENT IS CONSIDERED TO BE BROWNFIELD IN ACCORDANCE WITH ILFA GUIDANCE. A 50% BETTERMENT ON CURRENT FLOW OFF SITE IS OFFERED. THIS GENERATE A REDUCED FLOW OF 13.7/IS AND THIS WILL DISCHARGE ONTO KENYON LANE(NORTH).

BASED ON AREAS SUPPORTED. A MAXIMUM TOTAL STORAGE VOLUME OF 41m<sup>3</sup> (OF WHICH 33m<sup>3</sup> IS THE TANK) IS REQUIRED FOR THE SYSTEM FOR ALL STORM EVENTS UP TO AND INCLUDING THE 1:100 YEAR STORM + 30% CLIMATE CHANGE.

THE 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.

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.

## NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER ENGINEERS' AND ARCHITECTS' DRAWINGS, DETAILS AND SPECIFICATIONS.
2. OWNERSHIP OF PIPE NETWORKS ARE TO BE CONFIRMED PRIOR TO ANY DIVERSION WORKS.
3. THIS DRAWING INDICATES DRAINAGE PRINCIPLES AND STRATEGY ONLY, AND FURTHER DETAIL DESIGNING SHALL BE DONE BY THE CONSULTANT. THE PROPOSED SET-OUTS, PROPOSED TIE-INS, PROPOSED INTERNAL POP UPS AND FURTHER DISCUSSIONS WITH ALL RELEVANT PARTIES REGARDING ALLOWABLE DISCHARGE.
4. THE DEVELOPMENT HAS BEEN CONSIDERED AS GREENFIELD IN ACCORDANCE WITH LFTA GUIDANCE.
5. DURING THE DETAILED DESIGN PHASE, ALL STORM EVENT DURATIONS UP TO AND INCLUDING 6 HOURS WILL BE MODELLED TO DETERMINE THE FINAL STORAGE REQUIREMENT FOR THE DEVELOPMENT.
6. ALL PROPOSED RESTRICTED FLOW RATES AND CONNECTION POINTS WILL BE SUBJECT TO UNITED UTILITIES AGREEMENT AND APPROVAL.
7. FOLI WATER FLOW RATES ARE ESTIMATED IN ACCORDANCE WITH BS EN 752:2008 AND DESIGNED FOR PEAK FLOW RATES.
8. UNITED UTILITIES CONFIRMATION OF APPROVAL FOR THE FLOW RATE ENTERING THE PUBLIC SEWER WILL BE REQUIRED TO PROCEED WITH THE DETAILED DESIGN.
9. ALL EXISTING ON-SITE DRAINAGE ABANDONED OR LINED TO BE IDENTIFIED AND TERMINATED AT SITE BOUNDARY UNDO.

### SW DISPOSAL HIERARCHY STATEMENT

1. **USE ON SITE** - SUBJECT TO DETAILED DESIGN AND INPUT FROM MAE CONSULTANTS, POSITIONING OF GREYWATER TANKS MAY PROVE DIFFICULT. MAY PROVE TO BE ONLY A USED IN CONJUNCTION WITH OTHER OPTIONS.
2. **INFILTRATION** - SITE INVESTIGATION HAS NOT BEEN COMPLETED TO SHOW WHETHER INFILTRATION MAY BE AN OPTION.
3. **DISCHARGE TO WATERCOURSE** - DISTANCE TO NEAREST WATERCOURSE IS CONSIDERABLE AND WOULD ENTAIL CROSSING THIRD PARTY LAND TO DO SO.
4. **DISCHARGE TO SURFACE WATER SEWERS** - CURRENTLY LACKING INFORMATION FROM LUU TO ASSESS FEASIBILITY OF CONNECTIONS INTO EXISTING SEWERS.
5. **DISCHARGE TO COMBINED SEWER** - THIS IS CURRENTLY THE FEASIBLE OPTION WITH COMBINED SEWERS AT DEPTH ABOVE THE NORTHERN SITE BOUNDARY.

| Rev | Date       | Description            | By  | Check | Ap |
|-----|------------|------------------------|-----|-------|----|
| 02  | 21/07/2020 | ISSUED FOR INFORMATION | OB  | MD    | E  |
| 01  | 11/06/2020 | ISSUED FOR INFORMATION | RMC | MD    | E  |

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ADELPHI DEVELOPMENTS LIMITED

KENYON LANE

Office  
LIVERPOOL

**Tim**

DRAINAGE STRATEGY



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| Job Number | Originator | Building/Zone | Level    |
|------------|------------|---------------|----------|
| 4/7/455    | CCL        | KEN           | DRN      |
| Type       | Discipline | Drawing No.   | Revision |
| GA         | C          | 001           | 02       |

DO NOT PRICE OR CONSTRUCT FROM THIS DRAWING

## **APPENDIX B**

### **Initial Drainage Model Calculations**

## **APPENDIX C**

### **United Utilities Service Record Drawings**

|                                                             |                    |                                                                                     |
|-------------------------------------------------------------|--------------------|-------------------------------------------------------------------------------------|
| Clancy Consulting                                           |                    | Page 1                                                                              |
| Old Hall Chambers<br>31 Old Hall Street<br>Liverpool L3 9SY |                    |  |
| Date 21/07/2020 12:58                                       | Designed by WinDes |                                                                                     |
| File MD model - Kenyon Lane ...                             | Checked by         |                                                                                     |
| Micro Drainage                                              |                    | Network 2020.1                                                                      |

### Manhole Schedules for Storm

| MH Name | MH CL (m) | MH Depth (m) | MH Connection | MH Diam., L*W (mm) | PN    | Pipe Out Invert Level (m) | Diameter (mm) | PN    | Pipes In Invert Level (m) | Diameter (mm) | Backdrop (mm) |
|---------|-----------|--------------|---------------|--------------------|-------|---------------------------|---------------|-------|---------------------------|---------------|---------------|
| S1      | 85.850    | 1.000        | Open Manhole  | 1200               | 1.000 | 84.850                    | 225           |       |                           |               |               |
| S2      | 85.850    | 1.800        | Open Manhole  | 300                | 1.001 | 84.050                    | 225           | 1.000 | 84.821                    | 225           | 771           |
| S3      | 85.850    | 0.690        | Open Manhole  | 600                | 2.000 | 85.160                    | 150           |       |                           |               |               |
| S4      | 85.850    | 0.600        | Open Manhole  | 600                | 3.000 | 85.250                    | 150           |       |                           |               |               |
| S5      | 85.850    | 1.800        | Open Manhole  | 600                | 1.002 | 84.050                    | 150           | 1.001 | 84.050                    | 225           |               |
|         |           |              |               |                    |       |                           |               | 2.000 | 84.943                    | 150           | 893           |
|         |           |              |               |                    |       |                           |               | 3.000 | 85.157                    | 150           | 1107          |
| S6 FC   | 85.850    | 1.800        | Open Manhole  | 1200               | 1.003 | 84.050                    | 150           | 1.002 | 84.050                    | 150           |               |
| C1      | 85.850    | 1.820        | Open Manhole  | 1200               | 1.004 | 84.030                    | 225           | 1.003 | 84.030                    | 150           |               |
| UU      | 85.600    | 1.673        | Open Manhole  | 1500               |       | OUTFALL                   |               | 1.004 | 83.927                    | 225           |               |

| MH Name | Manhole Easting (m) | Manhole Northing (m) | Intersection Easting (m) | Intersection Northing (m) | Manhole Access | Layout (North)                                                                        |
|---------|---------------------|----------------------|--------------------------|---------------------------|----------------|---------------------------------------------------------------------------------------|
| S1      | 384.113             | 328.107              | 384.113                  | 328.107                   | Required       |  |
| S2      | 384.314             | 333.904              | 384.314                  | 333.904                   | Required       |  |
| S3      | 351.820             | 339.691              | 351.820                  | 339.691                   | Required       |  |
| S4      | 397.950             | 339.853              | 397.950                  | 339.853                   | Required       |  |
| S5      | 384.320             | 339.804              | 384.320                  | 339.804                   | Required       |  |
| S6 FC   | 384.930             | 354.791              | 384.930                  | 354.791                   | Required       |  |
| C1      | 385.019             | 357.790              | 385.019                  | 357.790                   | Required       |  |
| UU      | 400.519             | 357.790              |                          |                           | No Entry       |  |

|                                                             |                                                                                     |
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| Clancy Consulting                                           | Page 2                                                                              |
| Old Hall Chambers<br>31 Old Hall Street<br>Liverpool L3 9SY |  |
| Date 21/07/2020 12:58<br>File MD model - Kenyon Lane ...    |                                                                                     |
| Micro Drainage                                              |                                                                                     |

Designed by WinDes  
Checked by  
Network 2020.1

### PIPELINE SCHEDULES for Storm

#### Upstream Manhole

| PN    | Hyd<br>Sect | Diam<br>(mm) | MH<br>Name | C.Level<br>(m) | I.Level<br>(m) | D.Depth<br>(m) | MH<br>Connection | MH DIAM., L*W<br>(mm) |
|-------|-------------|--------------|------------|----------------|----------------|----------------|------------------|-----------------------|
| 1.000 | o           | 225          | S1         | 85.850         | 84.850         | 0.775          | Open Manhole     | 1200                  |
| 1.001 | o           | 225          | S2         | 85.850         | 84.050         | 1.575          | Open Manhole     | 300                   |
| 2.000 | o           | 150          | S3         | 85.850         | 85.160         | 0.540          | Open Manhole     | 600                   |
| 3.000 | o           | 150          | S4         | 85.850         | 85.250         | 0.450          | Open Manhole     | 600                   |
| 1.002 | o           | 150          | S5         | 85.850         | 84.050         | 1.650          | Open Manhole     | 600                   |
| 1.003 | o           | 150          | S6 FC      | 85.850         | 84.050         | 1.650          | Open Manhole     | 1200                  |
| 1.004 | o           | 225          | C1         | 85.850         | 84.030         | 1.595          | Open Manhole     | 1200                  |

#### Downstream Manhole

| PN    | Length<br>(m) | Slope<br>(1:X) | MH<br>Name | C.Level<br>(m) | I.Level<br>(m) | D.Depth<br>(m) | MH<br>Connection | MH DIAM., L*W<br>(mm) |
|-------|---------------|----------------|------------|----------------|----------------|----------------|------------------|-----------------------|
| 1.000 | 5.800         | 200.0          | S2         | 85.850         | 84.821         | 0.804          | Open Manhole     | 300                   |
| 1.001 | 5.900         | 0.0            | S5         | 85.850         | 84.050         | 1.575          | Open Manhole     | 600                   |
| 2.000 | 32.500        | 149.8          | S5         | 85.850         | 84.943         | 0.757          | Open Manhole     | 600                   |
| 3.000 | 13.630        | 146.6          | S5         | 85.850         | 85.157         | 0.543          | Open Manhole     | 600                   |
| 1.002 | 15.000        | 0.0            | S6 FC      | 85.850         | 84.050         | 1.650          | Open Manhole     | 1200                  |
| 1.003 | 3.000         | 150.0          | C1         | 85.850         | 84.030         | 1.670          | Open Manhole     | 1200                  |
| 1.004 | 15.500        | 150.5          | UU         | 85.600         | 83.927         | 1.448          | Open Manhole     | 1500                  |

|                                                             |  |                                                                                     |
|-------------------------------------------------------------|--|-------------------------------------------------------------------------------------|
| Clancy Consulting                                           |  | Page 3                                                                              |
| Old Hall Chambers<br>31 Old Hall Street<br>Liverpool L3 9SY |  |  |
| Date 21/07/2020 12:58<br>File MD model - Kenyon Lane ...    |  |                                                                                     |
| Designed by WinDes<br>Checked by                            |  |                                                                                     |
| Micro Drainage                                              |  | Network 2020.1                                                                      |

Setting Out Information - Site Coordinates (Storm)

| PN    | USMH<br>Name | Dia/Len<br>(mm) | Width<br>(mm) | US<br>Easting<br>(m) | US<br>Northing<br>(m) | Intersection<br>Easting (m) | Intersection<br>Northing (m) | Layout<br>(North)                                                                     |
|-------|--------------|-----------------|---------------|----------------------|-----------------------|-----------------------------|------------------------------|---------------------------------------------------------------------------------------|
| 1.000 | S1           | 1200            |               | 384.113              | 328.107               | 384.113                     | 328.107                      |    |
| 1.001 | S2           | 300             |               | 384.314              | 333.904               | 384.314                     | 333.904                      |    |
| 2.000 | S3           | 600             |               | 351.820              | 339.691               | 351.820                     | 339.691                      |    |
| 3.000 | S4           | 600             |               | 397.950              | 339.853               | 397.950                     | 339.853                      |    |
| 1.002 | S5           | 600             |               | 384.320              | 339.804               | 384.320                     | 339.804                      |   |
| 1.003 | S6 FC        | 1200            |               | 384.930              | 354.791               | 384.930                     | 354.791                      |  |
| 1.004 | C1           | 1200            |               | 385.019              | 357.790               | 385.019                     | 357.790                      |  |

| PN    | DSMH<br>Name | Dia/Len<br>(mm) | Width<br>(mm) | DS<br>Easting<br>(m) | DS<br>Northing<br>(m) | Layout<br>(North)                                                                     |
|-------|--------------|-----------------|---------------|----------------------|-----------------------|---------------------------------------------------------------------------------------|
| 1.004 | UU           | 1500            |               |                      |                       |  |

Free Flowing Outfall Details for Storm

| Outfall<br>Pipe Number | Outfall<br>Name | C. Level<br>(m) | I. Level<br>(m) | Min<br>I. Level<br>(m) | D, L<br>(mm) | W<br>(mm) |
|------------------------|-----------------|-----------------|-----------------|------------------------|--------------|-----------|
| 1.004                  | UU              | 85.600          | 83.927          | 83.000                 | 1500         | 0         |

Simulation Criteria for Storm

|                                 |       |                                     |       |
|---------------------------------|-------|-------------------------------------|-------|
| Volumetric Runoff Coeff         | 0.750 | Additional Flow - % of Total Flow   | 0.000 |
| Areal Reduction Factor          | 1.000 | MADD Factor * 10m³/ha Storage       | 2.000 |
| Hot Start (mins)                | 0     | Inlet Coefficient                   | 0.800 |
| Hot Start Level (mm)            | 0     | Flow per Person per Day (l/per/day) | 0.000 |
| Manhole Headloss Coeff (Global) | 0.500 | Run Time (mins)                     | 60    |
| Foul Sewage per hectare (l/s)   | 0.000 | Output Interval (mins)              | 1     |

|                             |   |                              |   |                              |   |
|-----------------------------|---|------------------------------|---|------------------------------|---|
| Number of Input Hydrographs | 0 | Number of Offline Controls   | 0 | Number of Time/Area Diagrams | 0 |
| Number of Online Controls   | 1 | Number of Storage Structures | 1 | Number of Real Time Controls | 0 |

Synthetic Rainfall Details

|                       |                   |                       |        |
|-----------------------|-------------------|-----------------------|--------|
| Rainfall Model        | FSR               | Profile Type          | Summer |
| Return Period (years) | 30                | Cv (Summer)           | 0.750  |
| Region                | England and Wales | Cv (Winter)           | 0.840  |
| M5-60 (mm)            | 18.000            | Storm Duration (mins) | 30     |
| Ratio R               | 0.360             |                       |        |

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|                                                             |                    |                                                                                     |
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| Clancy Consulting                                           |                    | Page 4                                                                              |
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| Micro Drainage                                              |                    | Network 2020.1                                                                      |

### Online Controls for Storm

Hydro-Brake® Optimum Manhole: S6 FC, DS/PN: 1.003, Volume (m³): 2.3

|                                   |                            |
|-----------------------------------|----------------------------|
| Unit Reference                    | MD-SHE-0137-1000-1580-1000 |
| Design Head (m)                   | 1.580                      |
| Design Flow (l/s)                 | 10.0                       |
| Flush-Flo™                        | Calculated                 |
| Objective                         | Minimise upstream storage  |
| Application                       | Surface                    |
| Sump Available                    | Yes                        |
| Diameter (mm)                     | 137                        |
| Invert Level (m)                  | 84.050                     |
| Minimum Outlet Pipe Diameter (mm) | 150                        |
| Suggested Manhole Diameter (mm)   | 1200                       |

| Control Points            | Head (m) | Flow (l/s) | Control Points            | Head (m) | Flow (l/s) |
|---------------------------|----------|------------|---------------------------|----------|------------|
| Design Point (Calculated) | 1.580    | 10.0       | Kick-Flo®                 | 0.968    | 7.9        |
| Flush-Flo™                | 0.461    | 9.9        | Mean Flow over Head Range | -        | 8.7        |

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|-----------|------------|-----------|------------|-----------|------------|-----------|------------|-----------|------------|
| 0.100     | 4.9        | 0.800     | 9.2        | 2.000     | 11.2       | 4.000     | 15.5       | 7.000     | 20.3       |
| 0.200     | 8.9        | 1.000     | 8.1        | 2.200     | 11.7       | 4.500     | 16.4       | 7.500     | 21.0       |
| 0.300     | 9.6        | 1.200     | 8.8        | 2.400     | 12.2       | 5.000     | 17.3       | 8.000     | 21.6       |
| 0.400     | 9.9        | 1.400     | 9.4        | 2.600     | 12.6       | 5.500     | 18.1       | 8.500     | 22.3       |
| 0.500     | 9.9        | 1.600     | 10.1       | 3.000     | 13.5       | 6.000     | 18.8       | 9.000     | 22.9       |
| 0.600     | 9.8        | 1.800     | 10.6       | 3.500     | 14.6       | 6.500     | 19.6       | 9.500     | 23.5       |

|                                                             |                                  |                                                                                     |
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| Date 21/07/2020 12:58<br>File MD model - Kenyon Lane ...    | Designed by WinDes<br>Checked by |                                                                                     |
| Micro Drainage                                              | Network 2020.1                   |                                                                                     |

### Storage Structures for Storm

#### Cellular Storage Manhole: S2, DS/PN: 1.001

Invert Level (m) 84.050 Safety Factor 2.0  
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95  
Infiltration Coefficient Side (m/hr) 0.00000

| Depth (m) | Area (m <sup>2</sup> ) | Inf. Area (m <sup>2</sup> ) | Depth (m) | Area (m <sup>2</sup> ) | Inf. Area (m <sup>2</sup> ) | Depth (m) | Area (m <sup>2</sup> ) | Inf. Area (m <sup>2</sup> ) |
|-----------|------------------------|-----------------------------|-----------|------------------------|-----------------------------|-----------|------------------------|-----------------------------|
| 0.000     | 28.0                   | 28.0                        | 1.200     | 28.0                   | 54.4                        | 1.201     | 0.0                    | 54.4                        |

### Manhole Headloss for Storm

| PN    | US/MH<br>Name | US/MH<br>Headloss |
|-------|---------------|-------------------|
| 1.000 | S1            | 0.500             |
| 1.001 | S2            | 0.500             |
| 2.000 | S3            | 0.500             |
| 3.000 | S4            | 0.500             |
| 1.002 | S5            | 0.500             |
| 1.003 | S6 FC         | 0.500             |
| 1.004 | C1            | 0.500             |

### Volume Summary (Static)

Length Calculations based on Centre-Centre

| Pipe<br>Number | USMH<br>Name | Total<br>Volume (m <sup>3</sup> ) |
|----------------|--------------|-----------------------------------|
| 1.000          | S1           | 0.000                             |
| 1.001          | S2           | 0.000                             |
| 2.000          | S3           | 0.000                             |
| 3.000          | S4           | 0.000                             |
| 1.002          | S5           | 0.000                             |
| 1.003          | S6 FC        | 0.000                             |
| 1.004          | C1           | 0.000                             |
| Total          |              | 0.000                             |

### Volume Summary (Static)

Length Calculations based on True Length

| Pipe<br>Number | USMH<br>Name | Total<br>Volume (m <sup>3</sup> ) |
|----------------|--------------|-----------------------------------|
| 1.000          | S1           | 0.000                             |
| 1.001          | S2           | 0.000                             |
| 2.000          | S3           | 0.000                             |
| 3.000          | S4           | 0.000                             |
| 1.002          | S5           | 0.000                             |
| 1.003          | S6 FC        | 0.000                             |
| 1.004          | C1           | 0.000                             |
| Total          |              | 0.000                             |

|                                                             |                    |                                                                                     |
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| Date 21/07/2020 12:58                                       | Designed by WinDes |                                                                                     |
| File MD model - Kenyon Lane ...                             | Checked by         |                                                                                     |
| Micro Drainage                                              |                    | Network 2020.1                                                                      |

### 30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

#### Simulation Criteria

Areal Reduction Factor 1.000      Additional Flow - % of Total Flow 0.000  
 Hot Start (mins) 0      MADD Factor \* 10m³/ha Storage 2.000  
 Hot Start Level (mm) 0      Inlet Coefficient 0.800  
 Manhole Headloss Coeff (Global) 0.500      Flow per Person per Day (l/per/day) 0.000  
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0      Number of Offline Controls 0      Number of Time/Area Diagrams 0  
 Number of Online Controls 1      Number of Storage Structures 1      Number of Real Time Controls 0

#### Synthetic Rainfall Details

Rainfall Model      FSR M5-60 (mm) 18.000      Cv (Summer) 0.750  
 Region England and Wales      Ratio R 0.360      Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 150.0  
 Analysis Timestep 2.5 Second Increment (Extended)  
 DTS Status ON  
 DVD Status ON  
 Inertia Status ON

Profile(s) Summer and Winter  
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960,  
 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080  
 Return Period(s) (years) 30, 100  
 Climate Change (%) 0, 30

| PN    | US/MH<br>Name | Storm        | Return<br>Period | Climate<br>Change | First (X)<br>Surcharge | First (Y)<br>Flood | First (Z)<br>Overflow | Overflow<br>Act. | Water        | Surcharged   |
|-------|---------------|--------------|------------------|-------------------|------------------------|--------------------|-----------------------|------------------|--------------|--------------|
|       |               |              |                  |                   |                        |                    |                       |                  | Level<br>(m) | Depth<br>(m) |
| 1.000 | S1            | 15 Winter    | 30               | +0%               | 100/15 Summer          |                    |                       |                  | 85.027       | -0.048       |
| 1.001 | S2            | 60 Winter    | 30               | +0%               | 30/15 Summer           |                    |                       |                  | 84.701       | 0.426        |
| 2.000 | S3            | 15 Winter    | 30               | +0%               | 100/30 Winter          |                    |                       |                  | 85.226       | -0.084       |
| 3.000 | S4            | 15 Summer    | 30               | +0%               | 100/30 Winter          |                    |                       |                  | 85.250       | -0.150       |
| 1.002 | S5            | 60 Winter    | 30               | +0%               | 30/15 Summer           |                    |                       |                  | 84.696       | 0.496        |
| 1.003 | S6            | FC 60 Winter | 30               | +0%               | 30/15 Summer           |                    |                       |                  | 84.653       | 0.453        |
| 1.004 | C1            | 60 Winter    | 30               | +0%               |                        |                    |                       |                  | 84.108       | -0.147       |

| PN    | US/MH<br>Name | Flooded        |                | Half Drain      |                | Pipe          |            | Level<br>Exceeded |
|-------|---------------|----------------|----------------|-----------------|----------------|---------------|------------|-------------------|
|       |               | Volume<br>(m³) | Flow /<br>Cap. | Flow /<br>(l/s) | Time<br>(mins) | Flow<br>(l/s) | Status     |                   |
| 1.000 | S1            | 0.000          | 0.95           |                 |                | 26.2          | OK         |                   |
| 1.001 | S2            | 0.000          | 0.39           |                 | 27             | 8.9           | SURCHARGED |                   |
| 2.000 | S3            | 0.000          | 0.40           |                 |                | 5.6           | OK         |                   |
| 3.000 | S4            | 0.000          | 0.00           |                 |                | 0.0           | OK         |                   |
| 1.002 | S5            | 0.000          | 1.97           |                 |                | 9.3           | SURCHARGED |                   |
| 1.003 | S6            | FC             | 0.94           |                 |                | 9.9           | SURCHARGED |                   |
| 1.004 | C1            | 0.000          | 0.27           |                 |                | 9.9           | OK         |                   |

|                                                             |                                  |                                                                                     |
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| Date 21/07/2020 12:58<br>File MD model - Kenyon Lane ...    | Designed by WinDes<br>Checked by |                                                                                     |
| Micro Drainage                                              | Network 2020.1                   |                                                                                     |

### 100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

#### Simulation Criteria

Areal Reduction Factor 1.000    Additional Flow - % of Total Flow 0.000  
 Hot Start (mins) 0    MADD Factor \* 10m³/ha Storage 2.000  
 Hot Start Level (mm) 0    Inlet Coefficient 0.800  
 Manhole Headloss Coeff (Global) 0.500    Flow per Person per Day (l/per/day) 0.000  
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0    Number of Offline Controls 0    Number of Time/Area Diagrams 0  
 Number of Online Controls 1    Number of Storage Structures 1    Number of Real Time Controls 0

#### Synthetic Rainfall Details

Rainfall Model    FSR M5-60 (mm) 18.000    Cv (Summer) 0.750  
 Region England and Wales    Ratio R 0.360    Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 150.0  
 Analysis Timestep 2.5 Second Increment (Extended)  
 DTS Status ON  
 DVD Status ON  
 Inertia Status ON

Profile(s) Summer and Winter  
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080  
 Return Period(s) (years) 30, 100  
 Climate Change (%) 0, 30

| PN    | US/MH |              | Return Period | Climate Change | First (X) Surchage | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water     | Surcharged |
|-------|-------|--------------|---------------|----------------|--------------------|-----------------|--------------------|---------------|-----------|------------|
|       | Name  | Storm        |               |                |                    |                 |                    |               | Level (m) | Depth (m)  |
| 1.000 | S1    | 60 Winter    | 100           | +30%           | 100/15 Summer      |                 |                    |               | 85.838    | 0.763      |
| 1.001 | S2    | 60 Winter    | 100           | +30%           | 30/15 Summer       |                 |                    |               | 85.833    | 1.558      |
| 2.000 | S3    | 60 Winter    | 100           | +30%           | 100/30 Winter      |                 |                    |               | 85.835    | 0.525      |
| 3.000 | S4    | 60 Winter    | 100           | +30%           | 100/30 Winter      |                 |                    |               | 85.828    | 0.428      |
| 1.002 | S5    | 60 Winter    | 100           | +30%           | 30/15 Summer       |                 |                    |               | 85.828    | 1.628      |
| 1.003 | S6    | FC 60 Winter | 100           | +30%           | 30/15 Summer       |                 |                    |               | 85.782    | 1.582      |
| 1.004 | C1    | 60 Winter    | 100           | +30%           |                    |                 |                    |               | 84.110    | -0.145     |

| PN    | US/MH Name | Flooded     |                            | Half Drain Time (mins) | Pipe Flow (l/s) | Level Exceeded |
|-------|------------|-------------|----------------------------|------------------------|-----------------|----------------|
|       |            | Volume (m³) | Flow / Overflow Cap. (l/s) |                        |                 |                |
| 1.000 | S1         | 0.000       | 0.88                       |                        | 24.3            | FLOOD RISK     |
| 1.001 | S2         | 0.000       | 0.40                       | 54                     | 9.2             | FLOOD RISK     |
| 2.000 | S3         | 0.000       | 0.37                       |                        | 5.1             | FLOOD RISK     |
| 3.000 | S4         | 0.000       | 0.02                       |                        | 0.3             | FLOOD RISK     |
| 1.002 | S5         | 0.000       | 2.03                       |                        | 9.5             | FLOOD RISK     |
| 1.003 | S6         | 0.000       | 0.97                       |                        | 10.2            | FLOOD RISK     |
| 1.004 | C1         | 0.000       | 0.27                       |                        | 10.2            | OK             |



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## **DESIGN RAINFALL (THE WALLINGFORD PROCEDURE) – PRE DEVELOPMENT 1 IN 1 YR**

### **DESIGN RAINFALL**

**In accordance with the Wallingford Procedure**

Tedds calculation version 2.0.01

#### **Design rainfall intensity**

|                                                      |                                                        |
|------------------------------------------------------|--------------------------------------------------------|
| Location of catchment area                           | Manchester                                             |
| Storm duration                                       | D = <b>15</b> min                                      |
| Return period                                        | Period = <b>1</b> yr                                   |
| Ratio 60 min to 2 day rainfall of 5 yr return period | r = <b>0.360</b>                                       |
| 5-year return period rainfall of 60 minutes duration | M5_60min = <b>18.0</b> mm                              |
| Increase of rainfall intensity due to global warming | p <sub>climate</sub> = <b>0</b> %                      |
| Factor Z1 (Wallingford procedure)                    | Z1 = <b>0.62</b>                                       |
| Rainfall for 15min storm with 5 year return period   | M5_15min <sub>i</sub> = Z1 × M5_60min = <b>11.2</b> mm |
| Factor Z2 (Wallingford procedure)                    | Z2 = <b>0.61</b>                                       |
| Rainfall for 15min storm with 1 year return period   | M1_15min = Z2 × M5_15min <sub>i</sub> = <b>6.8</b> mm  |
| Design rainfall intensity                            | I <sub>max</sub> = M1_15min / D = <b>27.3</b> mm/hr    |

#### **Maximum surface water runoff**

|                                        |                                                                                |
|----------------------------------------|--------------------------------------------------------------------------------|
| Catchment area                         | A <sub>catch</sub> = <b>2624</b> m <sup>2</sup>                                |
| Percentage of area that is impermeable | p = <b>100</b> %                                                               |
| Maximum surface water runoff           | Q <sub>max</sub> = A <sub>catch</sub> × p × I <sub>max</sub> = <b>19.9</b> l/s |



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## **DESIGN RAINFALL (THE WALLINGFORD PROCEDURE) – PRE DEVELOPMENT 1 IN 2 YR**

### **DESIGN RAINFALL**

**In accordance with the Wallingford Procedure**

Tedds calculation version 2.0.01

#### **Design rainfall intensity**

|                                                      |                                                        |
|------------------------------------------------------|--------------------------------------------------------|
| Location of catchment area                           | Manchester                                             |
| Storm duration                                       | D = <b>15</b> min                                      |
| Return period                                        | Period = <b>2</b> yr                                   |
| Ratio 60 min to 2 day rainfall of 5 yr return period | r = <b>0.360</b>                                       |
| 5-year return period rainfall of 60 minutes duration | M5_60min = <b>18.0</b> mm                              |
| Increase of rainfall intensity due to global warming | p <sub>climate</sub> = <b>0</b> %                      |
| Factor Z1 (Wallingford procedure)                    | Z1 = <b>0.62</b>                                       |
| Rainfall for 15min storm with 5 year return period   | M5_15min <sub>i</sub> = Z1 × M5_60min = <b>11.2</b> mm |
| Factor Z2 (Wallingford procedure)                    | Z2 = <b>0.79</b>                                       |
| Rainfall for 15min storm with 2 year return period   | M2_15min = Z2 × M5_15min <sub>i</sub> = <b>8.8</b> mm  |
| Design rainfall intensity                            | I <sub>max</sub> = M2_15min / D = <b>35.4</b> mm/hr    |

#### **Maximum surface water runoff**

|                                        |                                                                                |
|----------------------------------------|--------------------------------------------------------------------------------|
| Catchment area                         | A <sub>catch</sub> = <b>2624</b> m <sup>2</sup>                                |
| Percentage of area that is impermeable | p = <b>100</b> %                                                               |
| Maximum surface water runoff           | Q <sub>max</sub> = A <sub>catch</sub> × p × I <sub>max</sub> = <b>25.8</b> l/s |



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## **DESIGN RAINFALL (THE WALLINGFORD PROCEDURE) – PRE DEVELOPMENT 1 IN 30**

**YR**

### **DESIGN RAINFALL**

**In accordance with the Wallingford Procedure**

Tedds calculation version 2.0.01

#### **Design rainfall intensity**

|                                                      |                                                         |
|------------------------------------------------------|---------------------------------------------------------|
| Location of catchment area                           | Manchester                                              |
| Storm duration                                       | D = <b>15</b> min                                       |
| Return period                                        | Period = <b>30</b> yr                                   |
| Ratio 60 min to 2 day rainfall of 5 yr return period | r = <b>0.360</b>                                        |
| 5-year return period rainfall of 60 minutes duration | M5_60min = <b>18.0</b> mm                               |
| Increase of rainfall intensity due to global warming | p <sub>climate</sub> = <b>0</b> %                       |
| Factor Z1 (Wallingford procedure)                    | Z1 = <b>0.62</b>                                        |
| Rainfall for 15min storm with 5 year return period   | M5_15min <sub>i</sub> = Z1 × M5_60min = <b>11.2</b> mm  |
| Factor Z2 (Wallingford procedure)                    | Z2 = <b>1.50</b>                                        |
| Rainfall for 15min storm with 30 year return period  | M30_15min = Z2 × M5_15min <sub>i</sub> = <b>16.7</b> mm |
| Design rainfall intensity                            | I <sub>max</sub> = M30_15min / D = <b>66.9</b> mm/hr    |

#### **Maximum surface water runoff**

|                                        |                                                                                |
|----------------------------------------|--------------------------------------------------------------------------------|
| Catchment area                         | A <sub>catch</sub> = <b>2624</b> m <sup>2</sup>                                |
| Percentage of area that is impermeable | p = <b>100</b> %                                                               |
| Maximum surface water runoff           | Q <sub>max</sub> = A <sub>catch</sub> × p × I <sub>max</sub> = <b>48.8</b> l/s |



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## **DESIGN RAINFALL (THE WALLINGFORD PROCEDURE) – PRE DEVELOPMENT 1 IN 100**

### **+30% CLIMATE CHANGE**

#### **DESIGN RAINFALL**

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

#### **Design rainfall intensity**

|                                                      |                                                                                      |
|------------------------------------------------------|--------------------------------------------------------------------------------------|
| Location of catchment area                           | Manchester                                                                           |
| Storm duration                                       | D = <b>15</b> min                                                                    |
| Return period                                        | Period = <b>100</b> yr                                                               |
| Ratio 60 min to 2 day rainfall of 5 yr return period | r = <b>0.360</b>                                                                     |
| 5-year return period rainfall of 60 minutes duration | M5_60min = <b>18.0</b> mm                                                            |
| Increase of rainfall intensity due to global warming | p <sub>climate</sub> = <b>30</b> %                                                   |
| Factor Z1 (Wallingford procedure)                    | Z1 = <b>0.62</b>                                                                     |
| Rainfall for 15min storm with 5 year return period   | M5_15min <sub>i</sub> = Z1 × M5_60min × (1 + p <sub>climate</sub> ) = <b>14.5</b> mm |
| Factor Z2 (Wallingford procedure)                    | Z2 = <b>1.98</b>                                                                     |
| Rainfall for 15min storm with 100 year return period | M100_15min = Z2 × M5_15min <sub>i</sub> = <b>28.8</b> mm                             |
| Design rainfall intensity                            | I <sub>max</sub> = M100_15min / D = <b>115.0</b> mm/hr                               |

#### **Maximum surface water runoff**

|                                        |                                                                                |
|----------------------------------------|--------------------------------------------------------------------------------|
| Catchment area                         | A <sub>catch</sub> = <b>2624</b> m <sup>2</sup>                                |
| Percentage of area that is impermeable | p = <b>100</b> %                                                               |
| Maximum surface water runoff           | Q <sub>max</sub> = A <sub>catch</sub> × p × I <sub>max</sub> = <b>83.8</b> l/s |



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## **DESIGN RAINFALL**

**In accordance with the Wallingford Procedure**

Tedds calculation version 2.0.01

### **Design rainfall intensity**

|                                                      |                                                        |
|------------------------------------------------------|--------------------------------------------------------|
| Location of catchment area                           | Manchester                                             |
| Storm duration                                       | D = <b>15</b> min                                      |
| Return period                                        | Period = <b>1</b> yr                                   |
| Ratio 60 min to 2 day rainfall of 5 yr return period | r = <b>0.360</b>                                       |
| 5-year return period rainfall of 60 minutes duration | M5_60min = <b>18.0</b> mm                              |
| Increase of rainfall intensity due to global warming | p <sub>climate</sub> = <b>0</b> %                      |
| Factor Z1 (Wallingford procedure)                    | Z1 = <b>0.62</b>                                       |
| Rainfall for 15min storm with 5 year return period   | M5_15min <sub>i</sub> = Z1 × M5_60min = <b>11.2</b> mm |
| Factor Z2 (Wallingford procedure)                    | Z2 = <b>0.61</b>                                       |
| Rainfall for 15min storm with 1 year return period   | M1_15min = Z2 × M5_15min <sub>i</sub> = <b>6.8</b> mm  |
| Design rainfall intensity                            | I <sub>max</sub> = M1_15min / D = <b>27.3</b> mm/hr    |

### **Maximum surface water runoff**

|                                        |                                                                                |
|----------------------------------------|--------------------------------------------------------------------------------|
| Catchment area                         | A <sub>catch</sub> = <b>1935</b> m <sup>2</sup>                                |
| Percentage of area that is impermeable | p = <b>70</b> %                                                                |
| Maximum surface water runoff           | Q <sub>max</sub> = A <sub>catch</sub> × p × I <sub>max</sub> = <b>10.3</b> l/s |



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## DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

### Design rainfall intensity

|                                                      |                                                        |
|------------------------------------------------------|--------------------------------------------------------|
| Location of catchment area                           | Manchester                                             |
| Storm duration                                       | D = <b>15</b> min                                      |
| Return period                                        | Period = <b>2</b> yr                                   |
| Ratio 60 min to 2 day rainfall of 5 yr return period | r = <b>0.360</b>                                       |
| 5-year return period rainfall of 60 minutes duration | M5_60min = <b>18.0</b> mm                              |
| Increase of rainfall intensity due to global warming | p <sub>climate</sub> = <b>0</b> %                      |
| Factor Z1 (Wallingford procedure)                    | Z1 = <b>0.62</b>                                       |
| Rainfall for 15min storm with 5 year return period   | M5_15min <sub>i</sub> = Z1 × M5_60min = <b>11.2</b> mm |
| Factor Z2 (Wallingford procedure)                    | Z2 = <b>0.79</b>                                       |
| Rainfall for 15min storm with 2 year return period   | M2_15min = Z2 × M5_15min <sub>i</sub> = <b>8.8</b> mm  |
| Design rainfall intensity                            | I <sub>max</sub> = M2_15min / D = <b>35.4</b> mm/hr    |

### Maximum surface water runoff

|                                        |                                                                                |
|----------------------------------------|--------------------------------------------------------------------------------|
| Catchment area                         | A <sub>catch</sub> = <b>1935</b> m <sup>2</sup>                                |
| Percentage of area that is impermeable | p = <b>70</b> %                                                                |
| Maximum surface water runoff           | Q <sub>max</sub> = A <sub>catch</sub> × p × I <sub>max</sub> = <b>13.3</b> l/s |



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## DESIGN RAINFALL

### In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

#### Design rainfall intensity

|                                                      |                                                         |
|------------------------------------------------------|---------------------------------------------------------|
| Location of catchment area                           | Manchester                                              |
| Storm duration                                       | D = <b>15</b> min                                       |
| Return period                                        | Period = <b>30</b> yr                                   |
| Ratio 60 min to 2 day rainfall of 5 yr return period | r = <b>0.360</b>                                        |
| 5-year return period rainfall of 60 minutes duration | M5_60min = <b>18.0</b> mm                               |
| Increase of rainfall intensity due to global warming | p <sub>climate</sub> = <b>0</b> %                       |
| Factor Z1 (Wallingford procedure)                    | Z1 = <b>0.62</b>                                        |
| Rainfall for 15min storm with 5 year return period   | M5_15min <sub>i</sub> = Z1 × M5_60min = <b>11.2</b> mm  |
| Factor Z2 (Wallingford procedure)                    | Z2 = <b>1.50</b>                                        |
| Rainfall for 15min storm with 30 year return period  | M30_15min = Z2 × M5_15min <sub>i</sub> = <b>16.7</b> mm |
| Design rainfall intensity                            | I <sub>max</sub> = M30_15min / D = <b>66.9</b> mm/hr    |

#### Maximum surface water runoff

|                                        |                                                                                |
|----------------------------------------|--------------------------------------------------------------------------------|
| Catchment area                         | A <sub>catch</sub> = <b>1935</b> m <sup>2</sup>                                |
| Percentage of area that is impermeable | p = <b>70</b> %                                                                |
| Maximum surface water runoff           | Q <sub>max</sub> = A <sub>catch</sub> × p × I <sub>max</sub> = <b>25.2</b> l/s |



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## DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

### Design rainfall intensity

|                                                      |                                                                                      |
|------------------------------------------------------|--------------------------------------------------------------------------------------|
| Location of catchment area                           | Manchester                                                                           |
| Storm duration                                       | D = <b>15</b> min                                                                    |
| Return period                                        | Period = <b>100</b> yr                                                               |
| Ratio 60 min to 2 day rainfall of 5 yr return period | r = <b>0.360</b>                                                                     |
| 5-year return period rainfall of 60 minutes duration | M5_60min = <b>18.0</b> mm                                                            |
| Increase of rainfall intensity due to global warming | p <sub>climate</sub> = <b>30</b> %                                                   |
| Factor Z1 (Wallingford procedure)                    | Z1 = <b>0.62</b>                                                                     |
| Rainfall for 15min storm with 5 year return period   | M5_15min <sub>i</sub> = Z1 × M5_60min × (1 + p <sub>climate</sub> ) = <b>14.5</b> mm |
| Factor Z2 (Wallingford procedure)                    | Z2 = <b>1.98</b>                                                                     |
| Rainfall for 15min storm with 100 year return period | M100_15min = Z2 × M5_15min <sub>i</sub> = <b>28.8</b> mm                             |
| Design rainfall intensity                            | I <sub>max</sub> = M100_15min / D = <b>115.0</b> mm/hr                               |

### Maximum surface water runoff

|                                        |                                                                                |
|----------------------------------------|--------------------------------------------------------------------------------|
| Catchment area                         | A <sub>catch</sub> = <b>1935</b> m <sup>2</sup>                                |
| Percentage of area that is impermeable | p = <b>70</b> %                                                                |
| Maximum surface water runoff           | Q <sub>max</sub> = A <sub>catch</sub> × p × I <sub>max</sub> = <b>43.3</b> l/s |



## 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.

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