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**Planning**

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**Report**

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**08 July 2019**

# OLDLANDS FARM PHASE 1A, LIDL SITE, BOGNOR REGIS DRAINAGE STRATEGY



OLDLANDS FARM PHASE 1A, LIDL SITE, BOGNOR  
REGIS  
DRAINAGE STRATEGY

Revision **PO1**  
Date **08/ 07/ 2019**  
Made by **Brett White**  
Checked by **Chris Leigh**  
Approved by **Mark Dewson**  
Description **Planning**

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| Rev | Date     | Purpose/Status | Document Ref.         | Comments    |
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## CONTENTS

|           |                                          |          |
|-----------|------------------------------------------|----------|
| <b>1.</b> | <b>I N T R O D U C T I O N</b>           | <b>1</b> |
| <b>2.</b> | <b>D R A I N A G E S T R A T E G Y</b>   | <b>2</b> |
| 2.1       | General                                  | 2        |
| 2.2       | Proposed Surface Water Drainage Strategy | 2        |
| 2.3       | Proposed Foul Water Drainage Strategy    | 3        |
| <b>3.</b> | <b>W A T E R Q U A L I T Y</b>           | <b>3</b> |
| <b>4.</b> | <b>C O N C L U S I O N</b>               | <b>3</b> |

## APPENDICES

### **Appendix 1**

Drainage Layout Plan

### **Appendix 2**

Microdrainage Surface Water Simulatiuon Results

### **Appendix 3**

Foul Water Flow Rate Calculations

## 1. INTRODUCTION

This drainage design strategy is to support the planning submission for the Oldlands Farm Phase 1A development. This report should not be relied upon exclusively for decision making purposes and should be read in conjunction with other Engineer's reports, specifications and drawings in addition to all other relevant reports, drawings and specifications.

The site is located to the south of the A259, Bognor Regis Relief Road north of Bognor Regis, West Sussex.

The site (Phase 1A) comprises a cut to fill earthworks plateau as a result of flood compensation works completed in a previous stage of works and has a drainage ditch running along the north eastern boundary. The commercial development of Phase 1A - LIDL Site will comprise of one unit with surrounding car parking and a service yard. The unit will measure 2,125 square metres gross surrounded by a carpark for 149 car spaces. The future occupier in this development will be LIDL.

Access to the site will be provided on the western boundary and a separate access specifically for the service yard will be provided on the eastern boundary. The total area for the commercial development (Phase 1A – LIDL Site) will be 1.074 hectares.

The plan below (Figure 1) shows the boundary for Phase 1A – LIDL Site in red, service yard nib in green, and an approximate location of the drainage ditch in blue.



Figure 1: Site Plan

The topography of the site consists of 0.5m to 1.1m of made ground underlain by river and marine deposits with a chalk base at depths between 2.7m and 15m below ground level. Monitoring data has indicated that the groundwater table is standing at approximately 0.5m AOD. This area has undergone land raising associated with the building of the industrial units adjacent. Previous ground water levels are known to have been between 1.2m AOD in the north of the site and up to 3m AOD to the south.

The north-eastern ditch indicated in Figure 1 will provide the new outfall for the development drainage networks. The outfall rate into the ditch will be controlled through an attenuation pond, and an hydrobrake system which will be provided adjacent to the ditch. The use of infiltration will not be permitted due to the high ground water table present.

The maximum discharge rate from impermeable areas of the site development shall be limited to 3.7l/s as calculated from the ICP SuDS mean annual flood flow rate equation.

## **2. DRAINAGE STRATEGY**

The drainage scope of works includes the design of surface water drainage, below ground foul water drainage and the SuDS strategy and design.

### **2.1 General**

The following information has been used in the preparation of the planning proposal:

- Architect drawing 1821-LE-101.3 by LDA Chartered Architects
- Flood Risk Assessment by MJA Consulting
- Ground Investigation Report by Hydrock

The following documents have been used in the drainage design analysis:

- Building Regulations - Part H
- BS EN 752: Drain and Sewer Systems outside buildings: hydraulic design and environmental considerations
- BS EN 12056-2:2000 Gravity drainage systems inside buildings
- CIRIA C753: The SuDs Manual

### **2.2 Proposed Surface Water Drainage Strategy**

The commercial development area is to be self-contained from a surface water drainage standpoint with the exception of a single outlet into the existing Oldlands Farm ditch in the north east of the site. Source control will be used in the form of an attenuation pond and hydrobrake to manage the flow discharging to Oldlands Farm ditch so that the drainage system replicates the natural drainage regime as closely as possible, thus reducing the impact on receiving watercourses.

There will be two separate surface water drainage systems working independently for each unit within the development area. Each system will consist of gullies, linear drains and underground pipes that will direct flow towards the attenuation pond where it will combine.

#### **2.2.1 Building Surface Water Strategy**

Roof runoff will be collected by traditional guttering and downpipe systems before connecting to the subsurface piped networks which share its use with the car park drainage system.

For the building unit it is assumed that 50% of the roof runoff will be collected on the north-western side and the other 50% on south-eastern side.

#### **2.2.2 Car Park Surface Water Strategy**

The LIDL unit and associated car park will have a standalone drainage network from the eastern surrounding land, which will have future construction. Runoff from roads and parking areas will drain via gullies and linear channels that will link to their main storm systems. The individual system can be maintained with no conflict on future construction to the eastern part of the site.

### 2.2.3 Attenuation Pond

The attenuation pond has been designed as a dry landscape pond and will cater for all storm events up to and including for the 1 in 100 year + 40% climate change events in accordance with Environment Agency and West Sussex County Council requirements. The discharge from the attenuation pond will be restricted to a maximum discharge rate of 3.7l/s (QBar) to the Oldlands Farm Ditch. The pond will be sealed with an impermeable membrane to prevent site runoff infiltrating into made ground and creating stability issues.

The attenuation requirements for the site have been estimated using a hydraulic model developed using Microdrainage software. This is based on the following parameters:

- Total impermeable area: 1.074ha;
- A maximum discharge rate of 3.8 l/s;
- Return period of 100 years + 40% allowance for climate change
- Attenuation requirement of  $\approx 825 \text{ m}^3$

### 2.3 Proposed Foul Water Drainage Strategy

It is proposed that the foul water discharge will drain via gravity through a piped network before discharging into the new foul drainage network running underneath the new private estate road along the site perimeter, which in turn will discharge into the existing pumping station under adopted with Southern Water.

The foul network drainage design is based on the total flow rate calculations as supplied in Appendix 3. There is assumed to be sufficient capacity within the existing pumping station to cater for the design flows required as per the wider Oldlands Farm site drainage strategy.

## 3. WATER QUALITY

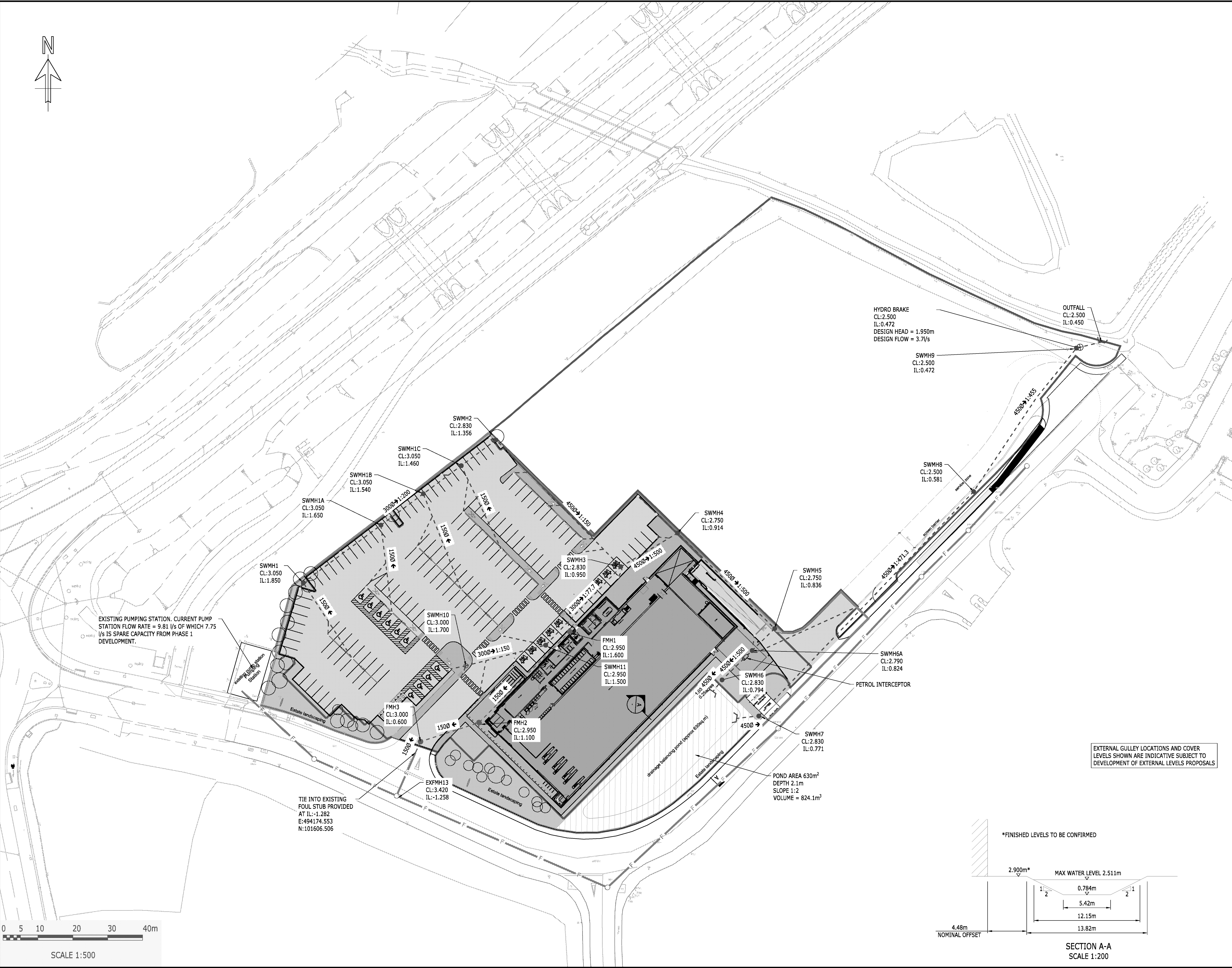
Fuel interceptors will be provided for each drainage network prior to discharging to the attenuation pond. The pond will also provide additional reduction of contaminants ensuring that the water is sufficiently clean before entering the Oldlands Farm ditch.

Gulley's and outfall manholes are to contain sumps to ensure capture of solids prior to outfall.

## 4. CONCLUSION

- The surface water network for the LIDL building, car park and service area is designed to convey and store surface water from the site for a 1 in 100-year storm plus a 40% allowance for climate change.
- An individual drainage network will be provided for the unit and its surrounding areas before out falling to the attenuation pond.
- This Greenfield runoff rate is limited to 3.8l/s and is maintained through the use of an attenuation pond and hydrobrake flow restriction system.
- The foul water network uses a gravity-based system connecting to the foul drainage network located within the private estate road and directed to the pumping station.
- Fuel separators will be used to treat against any contaminants picked up within surface water runoff from the car park areas.

## APPENDIX 1 DRAINAGE LAYOUT PLAN



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  - ALL DIMENSIONS ARE METRES UNLESS OTHERWISE STATED.
  - ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM UNLESS OTHERWISE STATED.
  - THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
  - RAIN WATER PIPE AND FOUL CONNECTIONS FROM BUILDING TO CONNECT TO NEAREST MANHOLE VIA INSPECTION CHAMBER. POSITIONS TO BE CONFIRMED AT DETAILED DESIGN STAGE.
  - ALLOWANCE TO BE MADE FOR 8NO. INSPECTION CHAMBERS (4500 POLYPROPYLENE INSPECTION CHAMBER) FOR FOUL CONNECTIONS PER BUILDING AND ASSOCIATES UNDER SLAB PIPE WORK (CAST IRON)
  - ALL SURFACE WATER PIPES TO BE MADE FROM POLYPROPYLENE TWIN WALL PLASTIC.
  - ALL FOUL WATER PIPES TO BE MADE FROM VITRIFIED CLAY.
  - ALL MANHOLE COVERS WITHIN THE CARRIAGEWAY TO BE CLASS D400 TO BS EN 124 AND ALL OTHER COVERS TO BE 8125 LOAD RATING.

- SURFACE WATER DRAINAGE  
--- FOUL WATER DRAINAGE  
● MANHOLE (SURFACE WATER)  
● MANHOLE (FOUL WATER)  
○ GULLY  
--- LINEAR CONCRETE DISHED CHANNEL  
--- PETROL INTERCEPTOR  
⊕ HYDRO-BRAKE  
--- HEADWALL  
--- EXISTING FOUL WATER DRAINAGE

|     |             |       |    |     |
|-----|-------------|-------|----|-----|
| P03 | PRELIMINARY | 30/08 | BW | MRD |
| P02 | PRELIMINARY | 02/07 | BW | MRD |
| P01 | PRELIMINARY | 28/06 | BW | MRD |
| Rev | Description | Date  | By | App |

PRELIMINARY

OLDLANDS FARM  
BOGNOR REGIS

**RAMBOLL**

tel 023 8081 7500 fax 023 8081 7600 southampton@ramboll.co.uk  
www.ramboll.co.uk

PHASE 1A - LIDL SITE  
DRAINAGE LAYOUT

|                          |              |        |        |
|--------------------------|--------------|--------|--------|
| Project No:              | Scale (@A1): | Drawn: | Date:  |
| 1620003993               | 1:500        | BW     | JUN.19 |
| Drawing No:              | Rev:         |        |        |
| RAM-0500-01A-DR-CR-20001 |              |        | P03    |

## APPENDIX 2

### MICRODRAINAGE SURFACE WATER SIMULATION RESULTS

#### Summary of results

- Total impermeable area: 1.074ha;
- 3.8l/s allowable surface water discharge rate;
- Allowance of 40% climate change in accordance with current guidance.
- Return Period (Years) 1 in 100 + 40% CC
- Attenuation pond storage volume: 824m<sup>3</sup>
- No flooding for 1 in 1, 1 in 30 and 1 in 100 storm events

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                 |                                                                                     |
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| Micro Drainage                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                 | Source Control 2018.1                                                               |
| <p style="text-align: center;"><u>ICP SUDS Mean Annual Flood</u></p> <p style="text-align: center;">Input</p> <p>Return Period (years) 100                      Soil 0.400<br/>Area (ha) 1.074                      Urban 0.000<br/>SAAR (mm) 718      Region Number Region 7</p> <p style="text-align: center;"><b>Results    1/s</b></p> <p>QBAR Rural 3.8<br/>QBAR Urban 3.8</p> <p>Q100 years 12.0</p> <p>Q1 year 3.2<br/>Q30 years 8.5<br/>Q100 years 12.0</p> |                                 |                                                                                     |
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| Micro Drainage                                | Network 2018.1    |                                                                                     |

# STORM SEWER DESIGN by the Modified Rational Method

## Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

|                                      |        |                               |       |                                       |       |
|--------------------------------------|--------|-------------------------------|-------|---------------------------------------|-------|
| Return Period (years)                | 1      | Foul Sewage (l/s/ha)          | 0.000 | Maximum Backdrop Height (m)           | 1.500 |
| M5-60 (mm)                           | 19.000 | Volumetric Runoff Coeff.      | 0.750 | Min Design Depth for Optimisation (m) | 0.900 |
| Ratio R                              | 0.350  | PIMP (%)                      | 100   | Min Vel for Auto Design only (m/s)    | 0.75  |
| Maximum Rainfall (mm/hr)             | 50     | Add Flow / Climate Change (%) | 0     | Min Slope for Optimisation (1:X)      | 500   |
| Maximum Time of Concentration (mins) | 30     | Minimum Backdrop Height (m)   | 0.200 |                                       |       |

Designed with Level Soffits

|                                                                        |                                        |                                                                                     |
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| Micro Drainage                                                         | Network 2018.1                         |                                                                                     |

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) |
|---------|-----------|--------------|---------------|--------------------|-------|---------------------------|---------------|-------|---------------------------|---------------|---------------|
| 1       | 3.650     | 1.200        | Open Manhole  | 1200               | 1.000 | 1.850                     | 300           |       |                           |               |               |
| 2       | 2.830     | 1.474        | Open Manhole  | 1350               | 1.001 | 1.356                     | 450           | 1.000 | 1.506                     | 300           |               |
| 10      | 3.000     | 1.300        | Open Manhole  | 1200               | 2.000 | 1.700                     | 300           |       |                           |               |               |
| 11      | 2.950     | 1.450        | Open Manhole  | 1200               | 2.001 | 1.500                     | 300           | 2.000 | 1.525                     | 300           | 25            |
| 3       | 2.830     | 1.880        | Open Manhole  | 1500               | 1.002 | 0.950                     | 450           | 1.001 | 0.975                     | 450           | 25            |
|         |           |              |               |                    |       |                           |               | 2.001 | 1.100                     | 300           |               |
| 4       | 2.750     | 1.836        | Open Manhole  | 1500               | 1.003 | 0.914                     | 450           | 1.002 | 0.914                     | 450           |               |
| 5       | 2.750     | 1.914        | Open Manhole  | 1500               | 1.004 | 0.836                     | 450           | 1.003 | 0.836                     | 450           |               |
| 6       | 2.830     | 2.036        | Open Manhole  | 1500               | 1.005 | 0.794                     | 450           | 1.004 | 0.794                     | 450           |               |
| POND    | 2.900     | 2.116        | Open Manhole  | 1500               | 1.006 | 0.784                     | 450           | 1.005 | 0.784                     | 450           |               |
| 7       | 2.830     | 2.059        | Open Manhole  | 1500               | 1.007 | 0.771                     | 450           | 1.006 | 0.771                     | 450           |               |
| 8       | 2.500     | 1.919        | Open Manhole  | 1500               | 1.008 | 0.581                     | 450           | 1.007 | 0.581                     | 450           |               |
| 9       | 2.500     | 2.028        | Open Manhole  | 1500               | 1.009 | 0.472                     | 450           | 1.008 | 0.472                     | 450           |               |
| Outfall | 2.500     | 2.050        | Open Manhole  | 0                  |       | OUTFALL                   |               | 1.009 | 0.450                     | 450           |               |

|                                                                        |                                        |                                                                                     |
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| Micro Drainage                                                         | Network 2018.1                         |                                                                                     |

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           | 300          | 1          | 3.050          | 1.850          | 0.900          | Open Manhole     | 1200                  |
| 1.001 | o           | 450          | 2          | 2.830          | 1.356          | 1.024          | Open Manhole     | 1350                  |
| 2.000 | o           | 300          | 10         | 3.000          | 1.700          | 1.000          | Open Manhole     | 1200                  |
| 2.001 | o           | 300          | 11         | 2.950          | 1.500          | 1.150          | Open Manhole     | 1200                  |
| 1.002 | o           | 450          | 3          | 2.830          | 0.950          | 1.430          | Open Manhole     | 1500                  |
| 1.003 | o           | 450          | 4          | 2.750          | 0.914          | 1.386          | Open Manhole     | 1500                  |
| 1.004 | o           | 450          | 5          | 2.750          | 0.836          | 1.464          | Open Manhole     | 1500                  |
| 1.005 | o           | 450          | 6          | 2.830          | 0.794          | 1.586          | Open Manhole     | 1500                  |
| 1.006 | o           | 450          | POND       | 2.900          | 0.784          | 1.666          | Open Manhole     | 1500                  |
| 1.007 | o           | 450          | 7          | 2.830          | 0.771          | 1.609          | Open Manhole     | 1500                  |
| 1.008 | o           | 450          | 8          | 2.500          | 0.581          | 1.469          | Open Manhole     | 1500                  |

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 | 68.802        | 200.0          | 2          | 2.830          | 1.506          | 1.024          | Open Manhole     | 1350                  |
| 1.001 | 57.114        | 150.0          | 3          | 2.830          | 0.975          | 1.405          | Open Manhole     | 1500                  |
| 2.000 | 26.224        | 150.0          | 11         | 2.950          | 1.525          | 1.125          | Open Manhole     | 1200                  |
| 2.001 | 31.099        | 77.7           | 3          | 2.830          | 1.100          | 1.430          | Open Manhole     | 1500                  |
| 1.002 | 18.127        | 500.0          | 4          | 2.750          | 0.914          | 1.386          | Open Manhole     | 1500                  |
| 1.003 | 39.039        | 500.0          | 5          | 2.750          | 0.836          | 1.464          | Open Manhole     | 1500                  |
| 1.004 | 21.068        | 500.0          | 6          | 2.830          | 0.794          | 1.586          | Open Manhole     | 1500                  |
| 1.005 | 9.624         | 1000.0         | POND       | 2.900          | 0.784          | 1.666          | Open Manhole     | 1500                  |
| 1.006 | 12.875        | 1000.0         | 7          | 2.830          | 0.771          | 1.609          | Open Manhole     | 1500                  |
| 1.007 | 89.540        | 471.3          | 8          | 2.500          | 0.581          | 1.469          | Open Manhole     | 1500                  |
| 1.008 | 49.597        | 455.0          | 9          | 2.500          | 0.472          | 1.578          | Open Manhole     | 1500                  |

|                                                                        |                                        |                                                                                     |
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| Micro Drainage                                                         | Network 2018.1                         |                                                                                     |

PIPELINE SCHEDULES for Storm

Upstream Manhole

| PN    | Hyd  | Diam | MH   | C.Level | I.Level | D.Depth | MH           | MH DIAM., L*W |
|-------|------|------|------|---------|---------|---------|--------------|---------------|
|       | Sect | (mm) | Name | (m)     | (m)     | (m)     | Connection   | (mm)          |
| 1.009 | o    | 450  | 9    | 2.500   | 0.472   | 1.578   | Open Manhole | 1500          |

Downstream Manhole

| PN    | Length | Slope | MH      | C.Level | I.Level | D.Depth | MH           | MH DIAM., L*W |
|-------|--------|-------|---------|---------|---------|---------|--------------|---------------|
|       | (m)    | (1:X) | Name    | (m)     | (m)     | (m)     | Connection   | (mm)          |
| 1.009 | 7.201  | 327.3 | Outfall | 2.500   | 0.450   | 1.600   | Open Manhole | 0             |

|                                               |                   |                                                                                     |
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| Micro Drainage                                | Network 2018.1    |                                                                                     |

Online Controls for Storm

Orifice Manhole: 7, DS/PN: 1.007, Volume (m³): 5.4

Diameter (m) 0.075 Discharge Coefficient 0.600 Invert Level (m) 0.771

Hydro-Brake® Optimum Manhole: 9, DS/PN: 1.009, Volume (m³): 11.2

|                   |                            |                                   |       |
|-------------------|----------------------------|-----------------------------------|-------|
| Unit Reference    | MD-SHE-0079-3700-1950-3700 | Sump Available                    | Yes   |
| Design Head (m)   | 1.950                      | Diameter (mm)                     | 79    |
| Design Flow (l/s) | 3.7                        | Invert Level (m)                  | 0.472 |
| Flush-Flo™        | Calculated                 | Minimum Outlet Pipe Diameter (mm) | 100   |
| Objective         | Minimise upstream storage  | Suggested Manhole Diameter (mm)   | 1200  |
| Application       | Surface                    |                                   |       |

| Control Points            | Head (m) | Flow (l/s) | Control Points            | Head (m) | Flow (l/s) |
|---------------------------|----------|------------|---------------------------|----------|------------|
| Design Point (Calculated) | 1.950    | 3.7        | Kick-Flo®                 | 0.702    | 2.3        |
| Flush-Flo™                | 0.343    | 2.9        | Mean Flow over Head Range | -        | 2.9        |

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) | Depth (m) | Flow (l/s) |
|-----------|------------|-----------|------------|-----------|------------|-----------|------------|-----------|------------|-----------|------------|
| 0.100     | 2.3        | 0.600     | 2.7        | 1.600     | 3.4        | 2.600     | 4.2        | 5.000     | 5.7        | 7.500     | 7.0        |
| 0.200     | 2.7        | 0.800     | 2.5        | 1.800     | 3.6        | 3.000     | 4.5        | 5.500     | 6.0        | 8.000     | 7.2        |
| 0.300     | 2.9        | 1.000     | 2.7        | 2.000     | 3.7        | 3.500     | 4.9        | 6.000     | 6.3        | 8.500     | 7.4        |
| 0.400     | 2.9        | 1.200     | 3.0        | 2.200     | 3.9        | 4.000     | 5.2        | 6.500     | 6.5        | 9.000     | 7.6        |
| 0.500     | 2.8        | 1.400     | 3.2        | 2.400     | 4.1        | 4.500     | 5.5        | 7.000     | 6.7        | 9.500     | 7.8        |

Date 02/07/2019 13:59

Designed by BWHIT

Checked by CLEIGH

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Network 2018.1



## Storage Structures for Storm

Tank or Pond Manhole: POND, DS/PN: 1.006

Invert Level (m) 0.784

| Depth (m) | Area (m <sup>2</sup> ) | Depth (m) | Area (m <sup>2</sup> ) | Depth (m) | Area (m <sup>2</sup> ) |
|-----------|------------------------|-----------|------------------------|-----------|------------------------|
| 0.000     | 184.0                  | 1.050     | 389.0                  | 2.100     | 630.0                  |

|                                               |                   |                                                                                     |
|-----------------------------------------------|-------------------|-------------------------------------------------------------------------------------|
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| London                                        |                   |                                                                                     |
| SE1 8NW                                       |                   |                                                                                     |
| Date 02/07/2019 13:59                         | Designed by BWHIT |                                                                                     |
| File OLDLANDS FARM - PHASE 1A - LIDL SITE.MDX | Checked by CLEIGH |                                                                                     |
| Micro Drainage                                | Network 2018.1    |                                                                                     |

### Summary of Critical Results by Maximum Level (Rank 1) for Storm

#### Simulation Criteria

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

Number of Input Hydrographs 0    Number of Offline Controls 0    Number of Time/Area Diagrams 0  
 Number of Online Controls 2    Number of Storage Structures 1    Number of Real Time Controls 0

#### Synthetic Rainfall Details

Rainfall Model    FSR M5-60 (mm) 19.000    Cv (Summer) 0.750  
 Region England and Wales    Ratio R 0.350    Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0    DVD Status ON  
 Analysis Timestep 2.5 Second Increment (Extended)    Inertia Status OFF  
 DTS Status ON

Profile(s) Summer and Winter  
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440  
 Return Period(s) (years) 1, 30, 100  
 Climate Change (%) 0, 40, 40

| PN    | US/MH |             | Return Period | Climate Change | First (X) Surchage | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water     |           |             | Flow / Cap. | Overflow (l/s) | Pipe       |            | Level Exceeded |
|-------|-------|-------------|---------------|----------------|--------------------|-----------------|--------------------|---------------|-----------|-----------|-------------|-------------|----------------|------------|------------|----------------|
|       | Name  | Storm       |               |                |                    |                 |                    |               | Level (m) | Depth (m) | Volume (m³) |             |                | Flow (l/s) | Status     |                |
| 1.000 | 1     | 15 Winter   | 100           | +40%           | 30/15 Winter       |                 |                    |               | 2.751     | 0.601     | 0.000       | 0.35        |                | 26.4       | FLOOD RISK |                |
| 1.001 | 2     | 15 Winter   | 100           | +40%           | 30/15 Summer       |                 |                    |               | 2.677     | 0.871     | 0.000       | 0.55        |                | 132.9      | FLOOD RISK |                |
| 2.000 | 10    | 15 Winter   | 100           | +40%           | 30/15 Summer       |                 |                    |               | 2.702     | 0.702     | 0.000       | 0.18        |                | 14.2       | FLOOD RISK |                |
| 2.001 | 11    | 15 Winter   | 100           | +40%           | 30/15 Summer       |                 |                    |               | 2.688     | 0.888     | 0.000       | 0.59        |                | 67.3       | FLOOD RISK |                |
| 1.002 | 3     | 15 Winter   | 100           | +40%           | 30/15 Summer       |                 |                    |               | 2.550     | 1.150     | 0.000       | 2.87        |                | 279.2      | FLOOD RISK |                |
| 1.003 | 4     | 1440 Winter | 100           | +40%           | 30/15 Summer       |                 |                    |               | 2.514     | 1.150     | 0.000       | 0.15        |                | 19.2       | FLOOD RISK |                |
| 1.004 | 5     | 1440 Winter | 100           | +40%           | 30/15 Summer       |                 |                    |               | 2.513     | 1.227     | 0.000       | 0.18        |                | 19.0       | FLOOD RISK |                |
| 1.005 | 6     | 1440 Winter | 100           | +40%           | 30/15 Summer       |                 |                    |               | 2.511     | 1.268     | 0.000       | 0.31        |                | 24.7       | SURCHARGED |                |
| 1.006 | POND  | 1440 Winter | 100           | +40%           | 30/15 Summer       |                 |                    |               | 2.511     | 1.277     | 0.000       | 0.09        |                | 5.5        | SURCHARGED |                |
| 1.007 | 7     | 960 Winter  | 100           | +40%           | 30/15 Summer       |                 |                    |               | 2.537     | 1.316     | 0.000       | 0.03        |                | 4.6        | FLOOD RISK |                |

|                                                                        |                                        |                                                                                     |
|------------------------------------------------------------------------|----------------------------------------|-------------------------------------------------------------------------------------|
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| Micro Drainage                                                         | Network 2018.1                         |                                                                                     |

Summary of Critical Results by Maximum Level (Rank 1) for Storm

|       |               |        |                  |                   |                        |                    |                       |                  | Water        | Surcharged   | Flooded        | Pipe           |                   |               |            |                   |
|-------|---------------|--------|------------------|-------------------|------------------------|--------------------|-----------------------|------------------|--------------|--------------|----------------|----------------|-------------------|---------------|------------|-------------------|
| 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. | Level<br>(m) | Depth<br>(m) | Volume<br>(m³) | Flow /<br>Cap. | Overflow<br>(l/s) | Flow<br>(l/s) | Status     | Level<br>Exceeded |
| 1.008 | 8 1440        | Winter | 100              | +40%              | 1/240                  | Winter             |                       |                  | 2.389        | 1.358        | 0.000          | 0.03           |                   | 3.7           | FLOOD RISK |                   |
| 1.009 | 9 1440        | Winter | 100              | +40%              | 1/120                  | Summer             |                       |                  | 2.387        | 1.465        | 0.000          | 0.03           |                   | 3.6           | FLOOD RISK |                   |

## APPENDIX 3 FOUL WATER FLOW RATE CALCULATION

## LIDL

2007 PLANNING APPLICATION ESTIMATED FOUL FLOWS

| Application Form |                                     | Suggested dry weather flow rates |                       |     | No                     | DWF   | (6 DWF + 10 %)<br>(PEAK) | Cut off - 0.03 |
|------------------|-------------------------------------|----------------------------------|-----------------------|-----|------------------------|-------|--------------------------|----------------|
|                  |                                     |                                  | Litres per day        |     |                        |       |                          |                |
| A1               | Shops                               | 1                                | General Housing       | 600 | per property           | 0.000 | 0.00                     | L/S            |
| A2               | Financial and professional services | 2                                | School                | 60  | per pupil              | 0.000 | 0.00                     | 0.00           |
| A3               | Restaurants and cafes               | 3                                | Assembly Hall         | 10  | per seat               | 0.000 | 0.00                     |                |
| A4               | Drinking Establishments             | 4                                | Cinema                | 10  | per seat               | 0.000 | 0.00                     |                |
| A5               | Hot food takeaways                  | 5                                | Theatre               | 10  | per seat               | 0.000 | 0.00                     |                |
| B1(a)            | Office (other than A2)              | 6                                | Sports Hall           | 80  | per person             | 0.000 | 0.00                     |                |
| B1(b)            | Research and Development            | 7                                | Hotel                 | 560 | per room               | 0.000 | 0.00                     |                |
| B1(c)            | Light industrial                    | 8                                | Guest House           | 200 | per room               | 0.000 | 0.00                     |                |
| B2               | General industrial                  | 9                                | Motel                 | 360 | per room               | 0.000 | 0.00                     |                |
| B3               | Storage or distribution             | 10                               | Holiday apartments    | 150 | per person             | 0.000 | 0.00                     |                |
| C1               | Hotels and halls of residence       | 11                               | Leisure park          | 220 | per person             | 0.000 | 0.00                     |                |
| C2               | Recreational facilities             | 12                               | Caravan park standard | 250 | per space              | 0.000 | 0.00                     |                |
| D1               | Non-residential institutions        | 13                               | Caravan park serviced | 400 | per space              | 0.000 | 0.00                     |                |
| D2               | Assembly and Leisure                | 14                               | Camping Site standard | 200 | per space              | 0.000 | 0.00                     |                |
| Other            |                                     | 15                               | Camping Site serviced | 350 | per space              | 0.000 | 0.00                     |                |
|                  | Nursing Care Homes                  | 16                               | Public house          | 160 | per seat               | 0.000 | 0.00                     |                |
|                  |                                     | 17                               | Restaurant            | 270 | per seat               | 0.000 | 0.00                     |                |
|                  |                                     | 18                               | Dine in restaurant    | 360 | per seat               | 0.000 | 0.00                     |                |
|                  |                                     | 19                               | Hospital              | 750 | per bed                | 0.000 | 0.00                     | Total Foul     |
|                  |                                     | 20                               | Nursing Home          | 375 | per bed                | 0.000 | 0.00                     | 0.00           |
|                  |                                     | 21                               | Offices               | 750 | per 100 m <sup>2</sup> | 0.000 | 0.00                     | FOUL           |
|                  |                                     | 22                               | Shopping centre       | 400 | per 100 m <sup>2</sup> | 0.000 | 0.00                     |                |
|                  |                                     | 23                               | Warehouse             | 150 | per 100 m <sup>2</sup> | 0.000 | 0.00                     |                |
|                  |                                     | 24                               | Commercial premises   | 350 | per 100 m <sup>2</sup> | 0.000 | 0.00                     |                |
|                  |                                     | 25                               | Manufacturing unit    | 650 | per 100 m <sup>2</sup> | 0.000 | 0.00                     |                |

SIA 7 estimation for comparison

ESTIMATIONS USED:

3sq mtrs = 1 seat in restaurant/bar

10sq mtrs = 1 hotel room