# Advice Note on contents of a Surface Water Drainage Statement

***London Borough of Camden***

## 1. Introduction

1.1 The Government has strengthened planning policy on the provision of sustainable drainage and new consultation arrangements for 'major' planning applications will come into force from 6 April 2015 as defined in the Written Ministerial Statement (18th Dec 2014).

1.2 The new requirements make Lead Local Flood Authorises statutory consultees with respect to flood risk and SuDS for all major applications. Previously the Environment Agency had that statutory responsibility for sites above 1ha in flood zone 1.

1.3 Therefore all 'major' planning applications submitted from 6 April 2015 are required demonstrate compliance with this policy and we'd encourage this is shown in a **Surface Water Drainage Statement**.

1.4 The purpose of this advice note is to set out what information should be included in such statements.

## 2. Requirements

2.1 It is essential that the type of Sustainable Drainage System (SuDS) for a site, along with **details of its extent and position**, is identified within the planning application to clearly demonstrate that the proposed SuDS can be accommodated within the development.

2.2 It will now not be acceptable to leave the design of SuDs to a later stage to be dealt with by planning conditions.

2.3 The NPPF paragraph 103 requires that developments do not increase flood risk elsewhere, and gives priority to the use of SuDS. Major developments must include SuDS for the management of run-off, unless demonstrated to be inappropriate. The proposed minimum standards of operation must be appropriate and as such, a **maintenance plan** should be included within the Surface Water Drainage Statement,clearly demonstrating that the SuDS have been designed to ensure that the maintenance and operation requirements are economically proportionate Planning Practice Guidance suggests that this should be considered by reference to the costs that would be incurred by consumers for the use of an effective drainage system connecting directly to a public sewer.

2.4 Camden Council will use planning conditions or obligations to ensure that there are clear arrangements in place for ongoing maintenance over the lifetime of the development.

2.5 Within Camden, SuDS systems must be designed in accordance with London Plan policy 5.13. This requires that developments should utilise sustainable urban drainage systems (SUDS) unless there are practical reasons for not doing so, and should aim to achieve **greenfield run-off rates** and ensure that surface water run-off is managed as close to its source as possible in line with the following **drainage hierarchy**:

**1 store rainwater for later use**
**2 use infiltration techniques, such as porous surfaces in non-clay areas**
**3 attenuate rainwater in ponds or open water features for gradual release**
**4 attenuate rainwater by storing in tanks or sealed water features for gradual release**
**5 discharge rainwater direct to a watercourse**
**6 discharge rainwater to a surface water sewer/drain**
**7 discharge rainwater to the combined sewer.**

2.6 The hierarchy above seeks to ensure that surface water run-off is controlled as near to its source as possible to mimic natural drainage systems and retain water on or near to the site, in contrast to traditional drainage approaches, which tend to pipe water off-site as quickly as possible.

2.7 Before disposal of surface water to the public sewer is considered all other options set out in the drainage hierarchy should be exhausted. When no other practicable alternative exists to dispose of surface water other than the public sewer, the Water Company or its agents should confirm that there is adequate spare capacity in the existing system taking future development requirements into account.

2.8 Best practice guidance within the non-statutory technical standards for the design, maintenance and operation of sustainable drainage systems will also need to be followed. Runoff volumes from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the **greenfield runoff volume** for the same event.

2.9 Camden Development Policy 23 (Water) requires developments to reduce pressure on combined sewer network and the risk of flooding by limiting the rate of run-off through sustainable urban drainage systems. This policy also requires that developments in areas known to be at risk of surface water flooding are designed to cope with being flooded. Camden's SFRA surface water flood maps, updated SFRA figures 6 (LFRZs), and 4e (increased susceptibility to elevated groundwater) , as well as the Environment Agency updated flood maps for surface water (ufmfsw), should be referred to when determining whether developments are in an area at risk of flooding.

2.10 Camden Planning Guidance 3 (CPG3) requires developments to achieve a greenfield run off rate once SuDS have been installed. Where it can be demonstrated that this is not feasible, a minimum 50% reduction in run off rate across the development is required. Further guidance on how to reduce the risk of flooding can be found in CPG3 paragraphs 11.4-11.8.

2.11 Where an application is part of a larger site which already has planning permission it is essential that the new proposal does not compromise the drainage scheme already approved.

## 3. Further information and guidance

3.1 Applicants are strongly advised to discuss their proposals with the Lead Local Flood Authority at the pre-application stage to ensure that an acceptable SuDS scheme is submitted.

3.2 For general clarification of these requirements please Camden's Local Planning Authority or Lead Local Flood Authority

# Surface Water Drainage Pro-forma for new developments

This pro-forma accompanies our advice note on surface water drainage. Developers should complete this form and submit it to the Local Planning Authority, referencing from where in their submission documents this information is taken. The pro-forma is supported by the Defra/EA guidance on Rainfall Runoff Management and uses the storage calculator on www.UKsuds.com. This pro-forma is based on current industry best practice and focuses on ensuring surface water drainage proposals meet national and local policy requirements. The pro-forma should be considered alongside other supporting SuDS Guidance.

## 1. Site Details

| | |
|---|---|
| **Site** | Bewlay House |
| **Address & post code or LPA reference** | Bewlay House, 32 Jamestown Road, Camden, NW1 7BY |
| **Grid reference** | TQ2857283992 |
| **Is the existing site developed or Greenfield?** | Developed |
| **Is the development in a LFRZ or in an area known to be at risk of surface or ground water flooding?** | No |
| **Total Site Area served by drainage system (excluding open space) (Ha)*** | Approx 0.135 Ha |

***** The Greenfield runoff off rate from the development which is to be used for assessing the requirements for limiting discharge flow rates and attenuation storage from a site should be calculated for the area that forms the drainage network for the site whatever size of site and type of drainage technique. Please refer to the Rainfall Runoff Management document or CIRIA manual for detail on this.

## 2. Impermeable Area

| | **Existing** | **Proposed** | **Difference (Proposed-Existing)** | **Notes for developers** |
|---|---|---|---|---|
| **Impermeable area (ha)** | 0.135 Ha | 0.135 Ha | 0 Ha | If proposed > existing, then runoff rates and volumes will be increasing. Section 6 must be filled in. If proposed ≤ existing, then section 6 can be skipped & section 7 filled in. |
| **Drainage Method** (infiltration/sewer/watercourse) | Sewer | Sewer | N/A | If different from the existing, please fill in section 3. If existing drainage is by infiltration and the proposed is not, discharge volumes may increase. Fill in section 6. |

### 3. Proposing to Discharge Surface Water via

| | Yes | No | Evidence that this is possible | Notes for developers |
|---|---|---|---|---|
| **Infiltration** | | | | e.g. soakage tests. Section 6 (infiltration) must be filled in if infiltration is proposed. |
| **To watercourse** | | | | e.g. Is there a watercourse near by? |
| **To surface water sewer** | Y | | Confirmation received via email from TW of sufficient capacity on 18/08/14. | Confirmation from sewer provider that sufficient capacity exists for this connection. |
| **Combination of above** | | | | e.g. part infiltration part discharge to sewer or watercourse. Provide evidence above. |

### 4. Peak Discharge Rates – This is the maximum flow rate at which storm water runoff leaves the site during a particular storm event.

| | Existing Rates (l/s) | Proposed Rates (l/s) | Difference (l/s) (Proposed-Existing) | % Difference (difference /existing x 100) | Notes for developers |
|---|---|---|---|---|---|
| **Greenfield QBAR** | N/A - no additional surface water volumes leaving the development site. Peak runoff rates will be reduced from current with the specification of green roofs on approximately 11% of the roof and terraces area. As surface water discharges from the building will be slightly reduced from current and there is only a nominal increase in foul discharges, there will be no significant impact on the TW combined Public Sewer. A pre-Development Enquiry has been submitted to Thames Water and we have received confirmation that the proposed discharges are acceptable. | N/A | N/A | N/A | QBAR is approx. 1 in 2 storm event. Provide this if Section 6 (QBAR) is proposed. |
| **1 in 1** | | | | | Proposed discharge rates (with mitigation) should aim to be equivalent to greenfield rates for all corresponding storm events. As a minimum, peak discharge rates must be reduced by 50% from the existing sites for all corresponding rainfall events. |
| **1 in 30** | | | | | |
| **1in 100** | | | | | |
| **1 in 100 plus climate change** | | | | | The proposed 1 in 100 +CC peak discharge rate (with mitigation) should aim to be equivalent to greenfield rates. As a minimum, proposed 1 in 100 +CC peak discharge rate must be reduced by 50% from the existing 1 in 100 runoff rate sites. |

**5. Calculate additional volumes for storage** –The total volume of water leaving the development site. New hard surfaces potentially restrict the amount of stormwater that can go to the ground, so this needs to be controlled so not to make flood risk worse to properties downstream.

| | Existing Volume ($m^3$) | Proposed Volume ($m^3$) | Difference ($m^3$) (Proposed-Existing) | Notes for developers |
|---|---|---|---|---|
| GREENFIELD RUN OFF VOLUME | N/A - no additional surface water volumes leaving the development site. Refurbishment of existing building and he proposed development works are not altering the existing building roof area, the building foot print or connection to the public sewer.<br><br>The confined nature of the existing site means that there is no feasible location for any soakaways and there is limited scope to introduce any attenuation storage within the building. | | | |
| 1 in 1 | | | | Proposed discharge volumes (with mitigation) should be constrained to a value as close as is reasonably practicable to the greenfield runoff volume wherever practicable and as a minimum should be no greater than existing volumes for all corresponding storm events. Any increase in volume increases flood risk elsewhere. Where volumes are increased section 6 must be filled in. |
| 1 in 30 | | | | |
| 1in 100 6 hour | | | | |
| 1 in 100 6 hour plus climate change | | | | The proposed 1 in 100 +CC discharge volume should be constrained to a value as close as is reasonably practicable to the greenfield runoff volume wherever practicable. As a minimum, to mitigate for climate change the proposed 1 in 100 +CC volume discharge from site must be no greater than the existing 1 in 100 storm event. If not, flood risk increases under climate change. |

**6. Calculate attenuation storage –** Attenuation storage is provided to enable the rate of runoff from the site into the receiving watercourse to be limited to an acceptable rate to protect against erosion and flooding downstream. The attenuation storage volume is a function of the degree of development relative to the greenfield discharge rate.

| | | Notes for developers |
|---|---|---|
| **Storage Attenuation volume (Flow rate control) required to meet greenfield run off rates ($m^3$)** | N/A - no additional surface water volumes leaving the development site. Refurbishment of existing building and he proposed development works are not altering the existing building roof area, the building foot print or connection to the public sewer. | Volume of water to attenuate on site if discharging at a greenfield run off rate. Can't be used where discharge volumes are increasing |
| **Storage Attenuation volume (Flow rate control) required to reduce rates by 50% ($m^3$)** | | Volume of water to attenuate on site if discharging at a 50% reduction from existing rates. Can't be used where discharge volumes are increasing |
| **Storage Attenuation volume (Flow rate control) required to meet [OTHER RUN OFF RATE (as close to greenfield rate as possible] ($m^3$)** | | Volume of water to attenuate on site if discharging at a rate different from the above – please state in 1st column what rate this volume corresponds to. On previously developed sites, runoff rates should not be more than three times the calculated greenfield rate. Can't be used where discharge volumes are increasing |
| **Storage Attenuation volume (Flow rate control) required to retain rates as existing ($m^3$** | | Volume of water to attenuate on site if discharging at existing rates. Can't be used where discharge volumes are increasing |

## 7. How is Storm Water stored on site?

Storage is required for the additional volume from site but also for holding back water to slow down the rate from the site. This is known as attenuation storage and long term storage. The idea is that the additional volume does not get into the watercourses, or if it does it is at an exceptionally low rate. You can either infiltrate the stored water back to ground, or if this isn't possible hold it back with on site storage. Firstly, can infiltration work on site?

| | | | **Notes for developers** |
|---|---|---|---|
| **Infiltration** | **State the Site's Geology and known Source Protection Zones (SPZ)** | N/A - Existing Building with no available space witihin site footprint to infiltrate | Avoid infiltrating in made ground. Infiltration rates are highly variable and refer to Environment Agency website to identify and source protection zones (SPZ) |
| | **Are infiltration rates suitable?** | | Infiltration rates should be no lower than $1x10^{-6}$ m/s. |
| | **State the distance between a proposed infiltration device base and the ground water (GW) level** | | Need 1m (min) between the base of the infiltration device & the water table to protect Groundwater quality & ensure GW doesn't enter infiltration devices. Avoid infiltration where this isn't possible. |
| | **Were infiltration rates obtained by desk study or infiltration test?** | | Infiltration rates can be estimated from desk studies at most stages of the planning system if a back up attenuation scheme is provided.. |
| | **Is the site contaminated? If yes, consider advice from others on whether infiltration can happen.** | | Advice on contaminated Land in Camden can be found on our supporting documents webpage Water should not be infiltrated through land that is contaminated. The Environment Agency may provide bespoke advice in planning consultations for contaminated sites that should be considered. |
| **In light of the above, is infiltration feasible?** | **Yes/No? If the answer is No, please identify how the storm water will be stored prior to release** | No - There will be no increases in storm water discharges as there is no overall change in proposed roof area or impermeable surfaces surrounding the building. Thames Water have confirmed that the local combined sewer has sufficient capacity and that the proposed discharges are acceptable. | If infiltration is not feasible how will the additional volume be stored?. The applicant should then consider the following options in the next section. |

## Storage requirements

The developer must confirm that either of the two methods for dealing with the amount of water that needs to be stored on site.

**Option 1 Simple** – Store both the additional volume and attenuation volume in order to make a final discharge from site at the greenfield run off rate. This is preferred if no infiltration can be made on site. This very simply satisfies the runoff rates and volume criteria.

**Option 2 Complex** – If some of the additional volume of water can be infiltrated back into the ground, the remainder can be discharged at a very low rate of 2 l/sec/hectare. A combined storage calculation using the partial permissible rate of 2 l/sec/hectare and the attenuation rate used to slow the runoff from site.

| | | **Notes for developers** |
|---|---|---|
| **Please confirm what option has been chosen and how much storage is required on site.** | N/A | The developer at this stage should have an idea of the site characteristics and be able to explain what the storage requirements are on site and how it will be achieved. |

## 8. Please confirm

| | | **Notes for developers** |
|---|---|---|
| **Which Drainage Systems measures have been used?** | N/A - Confirmation received via email from TW of sufficient capacity on 18/08/14. The capacity of the building drainage system is limited by the existing outgoing connection to the public sewer and has been designed for very occasional pressurised operation during extreme flood events. Calculations carried out check no building flooding occurs for various storm events up to the 1 in 100 year + 30% cc event. | SUDS can be adapted for most situations even where infiltration isn't feasible e.g. impermeable liners beneath some SUDS devices allows treatment but not infiltration. See CIRIA SUDS Manual C697. |
| **Drainage system can contain in the 1 in 30 storm event without flooding** | | This a requirement for sewers for adoption & is good practice even where drainage system is not adopted. |
| **Drainage system can contain in the 1 in 100 storm event without flooding** | | National standards require that the drainage system is designed so that 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. |
| **Drainage system can contain in the 1 in 100 +CC storm event without flooding** | | |
| **Any flooding between the 1 in 30 & 1 in 100 plus climate change storm events will be safely contained on site.** | | **Safely:** not causing property flooding or posing a hazard to site users i.e. no deeper than 300mm on roads/footpaths. Flood waters |

| | | |
|---|---|---|
| | | must drain away at section 6 rates. Existing rates can be used where runoff volumes are not increased. |
| **How are rates being restricted (hydrobrake etc)** | N/A | Hydrobrakes to be used where rates are between 2l/s to 5l/s. Orifices not be used below 5l/s as the pipes may block. Pipes with flows < 2l/s are prone to blockage. |
| **Please confirm the owners/adopters of the entire drainage systems throughout the development. Please list all the owners.** | London & Regional | If these are multiple owners then a drawing illustrating exactly what features will be within each owner's remit must be submitted with this Proforma. |
| **How is the entire drainage system to be maintained?** | By client with regular maintenance checks and servicing of all drainage elements | If the features are to be maintained directly by the owners as stated in answer to the above question please answer yes to this question and submit the relevant maintenance schedule for each feature. If it is to be maintained by others than above please give details of each feature and the maintenance schedule.<br>Clear details of the maintenance proposals of all elements of the proposed drainage system must be provided. Details must demonstrate that maintenance and operation requirements are economically proportionate. Poorly maintained drainage can lead to increased flooding problems in the future. |

**9. Evidence** Please identify where the details quoted in the sections above were taken from. i.e. Plans, reports etc. Please also provide relevant drawings that need to accompany your proforma, in particular exceedance routes and ownership and location of SuDS (maintenance access strips etc

| Pro-forma Section | Document reference where details quoted above are taken from | Page Number |
|---|---|---|
| **Section 2** | | |
| **Section 3** | Email from Thames Water Developer Services dated 18/08/14 | |
| **Section 4** | | |
| **Section 5** | | |
| **Section 6** | | |
| **Section 7** | | |
| **Section 8** | In-ground drainage calculations to verify capacity of existing system for no building flooding for events up to the 1:100year + 30% CC. | |

The above form should be completed using evidence from the Flood Risk Assessment and site plans. It should serve as a summary sheet of the drainage proposals and should clearly show that the proposed rate and volume as a result of development will not be increasing. If there is an increase in rate or volume, the rate or volume section should be completed to set out how the additional rate/volume is being dealt with.

This form is completed using factual information from the Flood Risk Assessment and Site Plans and can be used as a summary of the surface water drainage strategy on this site

Form Completed By……………………………………………………………………………………………......................

Qualification of person responsible for signing off this pro-forma .... Senior Engineer - Ceng MICE .......

Company… Expedition Engineering ……………………………………………………………,................................................

On behalf of (Client's details) .. London & Regional ........................................................................................

Date:… 03/06/15 ………………………………..........................

## Fiona Wyatt

**From:** DEVELOPER.SERVICES@THAMESWATER.CO.UK
**Sent:** 18 August 2014 10:14
**To:** Fiona Wyatt
**Subject:** RE: RE: IRef:1011995104 RE: Application of a new sewer adoption

Fiona,

Yes I do confirm the proposed discharges are acceptable.

Best regards

Shaun Picart

Thames Water - Development Engineer

0845 850 2777

Original Text

**From:** fiona.w@expedition.uk.com
**To:** DEVELOPER.SERVICES@THAMESWATER.CO.UK
**CC:**
**Sent:** 11.08.14 11:27:23
**Subject:** RE: IRef:1011995104 RE: Application of a new sewer adoption

Shaun,

Thank you for your email to confirm our discussions. To clarify, can you confirm therefore based on the below that the discharges within our application are acceptable to Thames Water.

Kind Regards

Fiona

---

**From:** DEVELOPER.SERVICES@THAMESWATER.CO.UK [mailto:DEVELOPER.SERVICES@THAMESWATER.CO.UK]
**Sent:** 11 August 2014 11:18
**To:** Fiona Wyatt
**Subject:** IRef:1011995104 RE: Application of a new sewer adoption

Hi Fiona,

Further to our phone conversation, to reiterate; you have explained you are not altering the existing buildings roof area/ building footprint. In light of this your site is treated more as a conversion of an existing dwelling as opposed to a new site.

In conclusion the 50% reduction in surface water cannot apply to your site.

Best regards

Shaun Picart

Thames Water - Development Engineer

0845 850 2777

CALCULATIONS

JOB NO. 348 | ELEMENT SW Drainage flows | CHD
JOB Bewlay House | PAGE 01
BY AW | DATE 10/09/14

expedition

# Bewlay House Surface Water Drainage

Surface water drainage in RWP designed for 1:50 2min storm. For inground drainage as there is no overflow system needs to be able to take drainage from 1:50yr storm. However to reach the basement and inground drainage system there will be a longer time of concentration and therefore the critical storm duration can be taken as 5 minutes and the system should be designed on this basis. It is intended to reuse the outgoing connection to the public sewer which is a 150Ø pipe. Therefore the capacity of the system is limited by the capacity of this pipe and the system has been designed for occasional pressurised operation. To understand the system a range of storm events shall be examined to determine the impact. The intensities of the 5min duration for the following storm events have been calculated as:

| | | |
|---|---|---|
| 1:1 year | 5 min storm | i = 0.016 l/s/m² |
| 1:2 year | 5 min storm | i = |
| 1:5 year | 5 min storm | i = 0.024 l/s/m² |
| 1:10 year | 5 min storm | i = 0.031 l/s/m² |
| 1:30 year | 5 min storm | i = 0.037 l/s/m² |
| 1:50 year | 5 min storm | i = 0.041 l/s/m² |
| 1:100 yr + CC) | x 1.3 climate change 30% | 5min storm |

1:100yr i = 0.044 x 1.3 ⇒ i = 0.059 l/s/m²

Method used to calculate intensities based on 5min duration.

The existing system constraints/details are:

Upstream MH: 730mm depth SSL existing 28.155m ∴ IL: ~ 27.425m OD

Outfall MH: 1250mm depth SSL existing 28.155m ∴ IL: 26.905m OD

∴

Gradient internally in building = 1:66 (total run length = 34.26m, fall over length = 520mm)

IL of TW sewer is 24.59m based on info from Thames Water Asset records. Expected length from MH T to sewer is ~ 11.72m

Based on method in BS 12056 NB 2.2

2min MS = 4.0mm (NB.6)

MS rainfall depth corresponding to 5min MS ⇒ 1.86 (NB.1)

fraction of 2min MS ∴ 1.86 x 4.0 = 7.5mm depth = 5min MS

$\frac{5min\ MT}{5min\ MS}$ taken from graph NB.7 for each return period

5min MT = figure from NB.7 graph x 7.5mm

$r = \frac{5min\ MT}{T \times 60}$ $r = \frac{5min\ MT}{300}$

5 in this case

## CALCULATIONS

JOB NO. 348 ELEMENT Foul flow discharge CHD fw
JOB BEWLAY HOUSE PAGE 01a
BY CK DATE 01/10/14

expedition

## Flow Calculation for Pumping station in Basement – MH PS1

1. Capped off connection : $\Sigma DU = 2.1$
2. Toilets : $\Sigma DU = 3.6$
3. Office WC : $\Sigma DU = 1.8$
4. 4x TFG : $\Sigma DU = 0$
5. Shower : $\Sigma DU = 2.0$

$K_{DU} = 0.5$ for office buildings

Total $\Sigma DU = 9.5$

$Q = K_{DU}\sqrt{\Sigma DU} \Rightarrow Q = 0.5\sqrt{9.5}$
$\Rightarrow Q = 1.54\ L/s.$

## Discharge flow in EXPIC5

SVP-4 : $\Sigma DU = 13.1. \Rightarrow Q = K_{DU}\sqrt{\Sigma DU} \Rightarrow Q = 0.5\sqrt{13.1} = 1{,}81\ L/s$

## Discharge flow in EXMH2

SVP-4 : $\Sigma DU = 13.1$
SVP-5 : $\Sigma DU = 14.2$
SVP-1 : $\Sigma DU = 113.4$

Total $\Sigma DU = 140.7$

$Q = 0.5\sqrt{140.7} = 5.93\ L/s$

## Discharge flow in EXMH1

SVP-4 : $\Sigma DU = 13.1$
SVP-5 : $\Sigma DU = 14.2$
SVP-1 : $\Sigma DU = 113.4$
SVP-7 : $\Sigma DU = 3.6$

Total $\Sigma DU = 144.3$

$Q = 0.5\sqrt{144.3} = 6\ L/s$

CALCULATIONS

JOB NO. 348  ELEMENT In ground drainage capacity check  CHD

JOB Bewlay House  PAGE 02

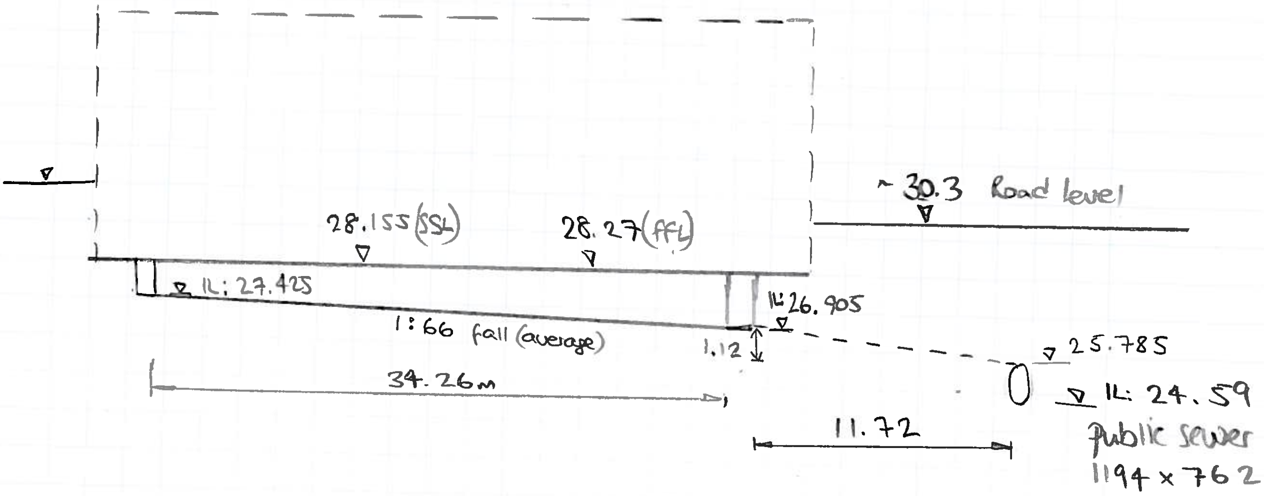
BY FW  DATE 13/10/14

expedition

# Bewlay House - In Ground Drainage

## Capacity Check & Compliance with Building Regulations

M&E Engineer has designed the system for 1:50 2min storm
In-ground drainage designed for 1:50 5min storm




Total roof area : 1280 $m^2$ (base on M&E sketch NDY-SK-PH-001 dated 26/09/14)

1:50 year 5 min storm intensity = 0.041 l/s/$m^2$

∴ 1280 x 0.041 = 52.48 l/s.

Total aggregated foul flows 6 l/s (as per calculations attached) based on M&E sketch NDY-SK-PH001 dated 26/09/14)

∴ Total foul & surface water flows = 58.48 l/s.

For a 150 ø pipe with a pipe roughness of 0.6mm to achieve a flow of 58.48 requires a gradient of 1:9.

Over 11.72m length the fall ∴ equates to 1.3m

∴ Level to which hydraulic gradient would reach if sewer was surcharged in the 1:50 yr 5min storm

⇒ 25.785 + 1.3 = 27.087m

∴ as basement floor is 28.27 and IL of lowest internal MH = 26.905, flows would pressurise to 1.18m below finished floor level.

**Pipe Hydraulics Using Colebrook-White equation in simplified usage mode**

*(water at 15 degrees celcius, kinematic viscosity 1.141x10-6 m²/s)*

| | | | | |
|---|---|---|---|---|
| **Pipe diameter** | 150 mm | D = | *0.15 m* | |
| **Gradient - 1 in** | 9 | S = | *0.111111* | *5.555556* |
| **Pipe Roughness - ks** | 0.6 mm | ks = | *0.0006 m* | |

<u>Results for Full Bore Conditions:</u>

| | | |
|---|---|---|
| Velocities | **3.378** m/s | |
| Discharge | **59.70** litres/sec | 11.66667 |
| Discharge | **0.0597** m³/sec | |

<u>Part-Full Conditions:</u>

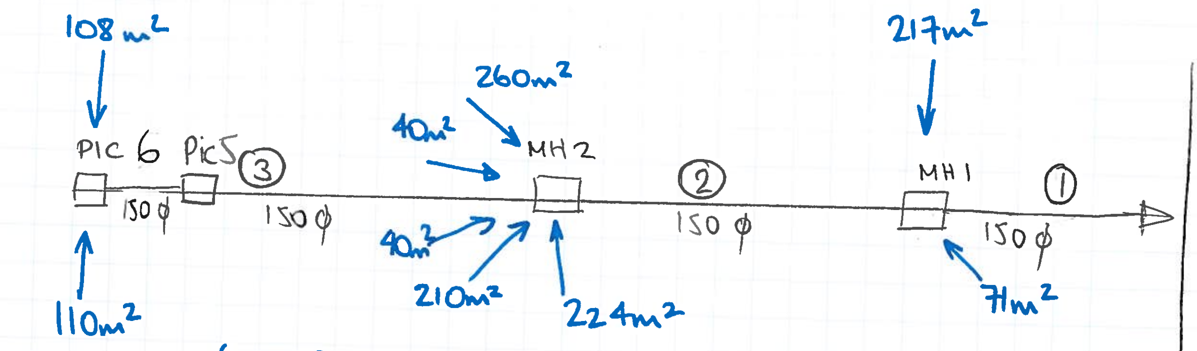
| | |
|---|---|
| Proportion depth | 1.00 (between 0 and 1) |
| Actual depth | **150** mm |
| Velocity | **3.378** m/s |
| Discharge | **59.70** litres/sec |
| Discharge | **0.0597** m³/sec |

**CALCULATIONS**

JOB NO. 348 | ELEMENT Inground drainage capacity check | CHD
JOB BEWLAY HOUSE | PAGE 03
BY RW. | DATE 13/10/14

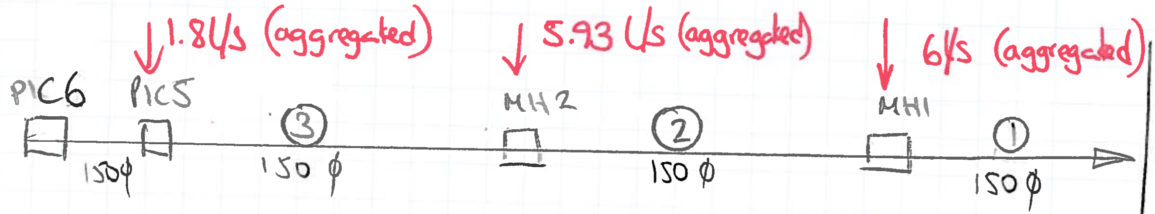
expedition

## Rainwater loading




Total @ pics 6 - 218m²    Total @ MH2 = 992 m²    Total MH1 = 1280m²

## Foul loading




## Scenarios to check

Pipe 1 for surcharge heads for:

| | | |
|---|---|---|
| 1 : 5 year | 5min storm | (i = 0.024 l/s/m²) |
| 1 : 10 year | 5min storm | (i = 0.031 l/s/m²) |
| 1 : 50year | 5min storm | (i = 0.041 l/s/m²) |
| 1 : 100y, +CC | 5min storm | (i = 0.059 l/s/m²) |

1s Plus design event that generates no surcharge in pipes

Pipe 2 for same events as above
2s plus design event that generates no surcharge in pipes

Pipe 3 for same events as above
3s plus design event that generates no surcharge in pipes

Start with 1:100yr and if no problems with surcharge by inspection other smaller events will be ok.

Check design events that generate no surcharge in pipes.

Capacity of a 150 ϕ pipe laid at a gradient of 1:66 using a pipe roughness of 0.6 (as predominantly surface water flows) = 21.9 l/s.

↖ capacity of pipes ② + ③

Capacity of a 150 ϕ pipe laid @ a gradient of 1:10.5 using a roughness of 0.6 = 55.25 l/s

↖ capacity of pipe ①

**Pipe Hydraulics Using Colebrook-White equation in simplified usage mode**

*(water at 15 degrees celcius, kinematic viscosity 1.141x10-6 m²/s)*

| | | | | | |
|---|---|---|---|---|---|
| **Pipe diameter** | 150 | mm | D = | *0.15* | *m* |
| **Gradient - 1 in** | 66 | | S = | *0.015152* | *0.757576* |
| **Pipe Roughness - ks** | 0.6 | mm | ks = | *0.0006* | *m* |

<u>Results for Full Bore Conditions:</u>

| | | | |
|---|---|---|---|
| Velocities | **1.238** | m/s | |
| Discharge | **21.88** | litres/sec | 1.590909 |
| Discharge | **0.0219** | m³/sec | |

<u>Part-Full Conditions:</u>

| | | |
|---|---|---|
| Proportion depth | 1.00 | (between 0 and 1) |
| Actual depth | **150** | mm |
| Velocity | **1.238** | m/s |
| Discharge | **21.88** | litres/sec |
| Discharge | **0.0219** | m³/sec |

**Pipe Hydraulics Using Colebrook-White equation in simplified usage mode**

*(water at 15 degrees celcius, kinematic viscosity 1.141x10-6 m²/s)*

| | | | | | |
|---|---|---|---|---|---|
| **Pipe diameter** | 150 | mm | D = | *0.15* | *m* |
| **Gradient - 1 in** | 11 | | S = | *0.095238* | *4.761905* |
| **Pipe Roughness - ks** | 0.6 | mm | ks = | *0.0006* | *m* |

Results for Full Bore Conditions:

| | | | |
|---|---|---|---|
| Velocities | **3.126** | m/s | |
| Discharge | **55.25** | litres/sec | 10 |
| Discharge | **0.0552** | m³/sec | |

Part-Full Conditions:

| | | |
|---|---|---|
| Proportion depth | 1.00 | (between 0 and 1) |
| Actual depth | **150** | mm |
| Velocity | **3.126** | m/s |
| Discharge | **55.25** | litres/sec |
| Discharge | **0.0552** | m³/sec |

**1s** Determine a design event up to which the system will not surcharge from the connection to the public sewer ie pipe (1).

Capacity of pipe (1) = 55.25 l/s.

Assume that aggregated foul flows peak at the same time

∴ remaining capacity of pipe ⇒ 55.25 − 6 l/s = 49.25 l/s

Total surface water catchment entering MH 1 from all connections upstream = 1280 m²

$1280\,m^2 \times i = 49.25\ l/s$

$\therefore\ i = 0.39\ l/s/m^2$.

This i relates to a 1:30 year 5 min storm ∴ the pipework downstream of MH 1 should not surcharge for any events up to 1:30 yr.

**2s** Determine a design event up to which the system will not surcharge for the internal connection from MH2 to MH1 ie pipe (2)

Capacity of pipe (2) = 21.9 l/s

Assume that aggregated foul flows peak @ same time

∴ remaining capacity = 21.9 − 5.9 l/s = 16 l/s.

Total surface water catchment entering MH2 from all connections upstream = 992 m²

$992 \times i = 16\ l/s$

$i = 0.016\ l/s/m^2$ ∴ i relates to 1:2 year 5 min storm

Therefore the pipework from MH1 to MH2 is likely to surcharge for any event greater than 1:2 years.

If pipe was upgraded to 225 Ø with 1:66 gradient capacity would increase to 64.0 l/s

$\therefore\ 64 - 5.9 = 58.1\ l/s$

$992 \times i = 58.1\ l/s$

$i = 0.059\ l/s$ which would equate to a 1:100 yr + C.C event with no surcharge of that element of pipework in which case system would be governed by connection to public sewer.

3s Pipe 3 capacity = 21.9 l/s

aggregated foul flows = 1.8 l/s ∴ remaining capacity = 20.1 l/s

Total SW catchment area entering upstream = 218 $m^2$

∴ $218 m^2 \times i = 20.1$ l/s

$i = 0.0922$

∴ Pipework will not surcharge for events exceeding 1:100yr + CC and ∴ pipework is not an issue.

∴ Pipe number ② from MH2 to MH1 is the governing parameter for design as majority of rainwater flows enter the system at MH2.

There will be no surcharge of any of the pipework up to the 1:2 year event (based on 5 min entry/duration time).

For any events > 1:2 years the pipework within the basement is likely to surcharge.

Now check surcharge levels for different events.

Start with worst case 1:100yr + C.C.

expedition

Check for 1:100 year+cc 5min storm.

For pipe 1 ⇒ total surface area catchment = 1280m²
total foul flow (aggregated) 6 l/s.

i = 0.059 l/s/m²

1280×0.059 = 75.52 l/s + 6 l/s = 81.52 l/s.

Hydraulic gradient = 1:5 ∴ over 11.72m length
head = 2.344m

level of surcharged public sewer = 25.785 = 28.129m.

for pipe 2 ⇒ SW catchment = 992 l/s
foul = 5.93 l/s

i = 0.059

992 × 0.059 = 58.53 l/s + 5.93 l/s = 64.46

Hydraulic gradient = 1:8 over length of pipe 12.85m
head = 1.606 m

∴ 28.129 + 1.61m = 29.735 m

for pipe 3 SW catchment = 218m²
foul flows = 1.8 l/s

218 × 0.059 = 12.862 + 1.8 = 14.662 l/s.
Hydraulic gradient = 1:150 over 21.41 m length
head = 0.14 m
29.735 + 0.14 = 29.877m

Street level = 29.87 with 29.91 kerb to building curtilage
Open area at rear by canal level = 30.99m.

See sketch for how surcharge levels relate to building levels.

Maximum surcharge levels for 1:100yr+cc are at external street levels ∴ pipework in the basement is likely to pressurise to this level for this event. During such an event the public sewer is likely to be surcharged up to street level and the surrounding road flooded in any case.

## Pipe Hydraulics Using Colebrook-White equation in simplified usage mode

*(water at 15 degrees celcius, kinematic viscosity 1.141x10-6 m²/s)*

| | | | | | | |
|---|---|---|---|---|---|---|
| **Pipe diameter** | 150 | mm | D = | *0.15* | *m* | |
| **Gradient - 1 in** | 5 | | S = | *0.2* | | *10* |
| **Pipe Roughness - ks** | 0.6 | mm | ks = | *0.0006* | *m* | |

Results for Full Bore Conditions:

| | | | |
|---|---|---|---|
| Velocities | **4.537** | m/s | |
| Discharge | **80.18** | litres/sec | 21 |
| Discharge | **0.0802** | m³/sec | |

Part-Full Conditions:

| | | |
|---|---|---|
| Proportion depth | 1.00 | (between 0 and 1) |
| Actual depth | **150** | mm |
| Velocity | **4.537** | m/s |
| Discharge | **80.18** | litres/sec |
| Discharge | **0.0802** | m³/sec |

**Pipe Hydraulics Using Colebrook-White equation in simplified usage mode**

*(water at 15 degrees celcius, kinematic viscosity 1.141x10-6 m²/s)*

| | | | | | |
|---|---|---|---|---|---|
| **Pipe diameter** | 150 | mm | D = | *0.15* | *m* |
| **Gradient - 1 in** | 8 | | S = | *0.131579* | *6.578947* |
| **Pipe Roughness - ks** | 0.6 | mm | ks = | *0.0006* | *m* |

Results for Full Bore Conditions:

| | | | |
|---|---|---|---|
| Velocities | **3.677** | m/s | |
| Discharge | **64.99** | litres/sec | 13.81579 |
| Discharge | **0.0650** | m³/sec | |

Part-Full Conditions:

| | | |
|---|---|---|
| Proportion depth | 1.00 | (between 0 and 1) |
| Actual depth | **150** | mm |
| Velocity | **3.677** | m/s |
| Discharge | **64.99** | litres/sec |
| Discharge | **0.0650** | m³/sec |

**Pipe Hydraulics Using Colebrook-White equation in simplified usage mode**

*(water at 15 degrees celcius, kinematic viscosity 1.141x10-6 m²/s)*

| | | | | | |
|---|---|---|---|---|---|
| **Pipe diameter** | 150 | mm | D = | *0.15* | *m* |
| **Gradient - 1 in** | 150 | | S = | *0.006684* | *0.334225* |
| **Pipe Roughness - ks** | 0.6 | mm | ks = | *0.0006* | *m* |

Results for Full Bore Conditions:

| | | | |
|---|---|---|---|
| Velocities | **0.818** | m/s | |
| Discharge | **14.45** | litres/sec | 0.701872 |
| Discharge | **0.0145** | m³/sec | |

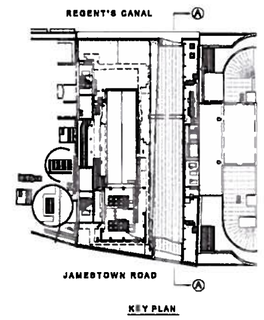
Part-Full Conditions:

| | | |
|---|---|---|
| Proportion depth | 1.00 | (between 0 and 1) |
| Actual depth | **150** | mm |
| Velocity | **0.818** | m/s |
| Discharge | **14.45** | litres/sec |
| Discharge | **0.0145** | m³/sec |

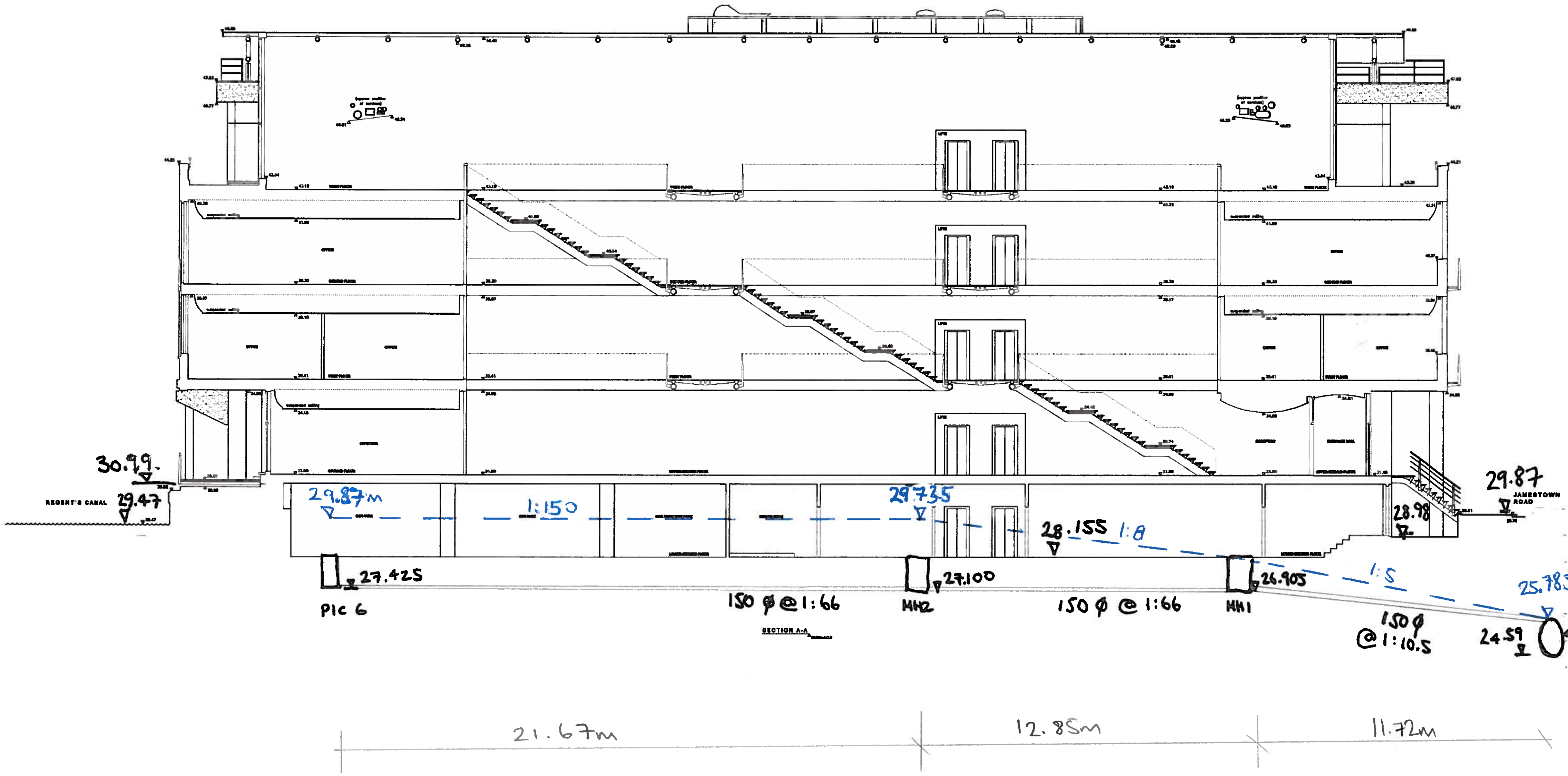
## Notes

THIS SURVEY HAS BEEN PREPARED WITH A SCALING ACCURACY FOR A PLOT AT A SCALE OF 1:100.

ALL LEVELS ARE IN METRES RELATED TO AN ORDNANCE SURVEY DATUM LOCATED ON HAMPSTEAD ROAD BRIDGE, SOUTH-WEST SIDE OF CHALK FARM ROAD, NORTH-WEST SIDE OF THE CANAL (value 31.26m).




KEY PLAN




SECTION A-A

- - - Hydraulic gradient for 1:100year + cc storm event (level to which flows within pipework will surcharge)

NOTE: FOR THE 1:100yr + c.c event it is likely that the public sewer will be surcharged to street level and that the water will flood the surrounding streets. In this case surcharged levels may be greater

2.0 0.0 5.0 10.0 15.0

Scale = 1 : 100



ACAD

| | |
|---|---|
| job | BEWLAY HOUSE<br>32 JAMESTOWN ROAD<br>CAMDEN<br>NW1 7BY |
| client | LONDON & REGIONAL PROPERTIES |
| title: SECTION A-A | dwg no.: 21083A-2 |
| scale: 1:100 | date: MARCH 2013 |


ON CENTRE SURVEYS LTD.
LAND & BUILDING SURVEYORS
GEODETIC ENGINEERS
Satchwell Granary, New Street, Leamington Spa CV31 1HP
TEL: 01926 336239 FAX: 01926 316606
E-MAIL: info@oncentre.co.uk
A member of The Survey Association