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# **Residential Development at Finlay**

## Park, Naas, Co. Kildare

## **Engineering Services Report**

December 2022

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### 1 Introduction

This engineering services report has been prepared by Donnachadh O'Brien & Associates Consulting Engineers (DOB&A) on behalf of Westar Homes Ltd in support of a Large Residential Development (LRD) application for a new residential development at Finlay Park, Naas, Co. Kildare (see Figure 1 below).

The proposed development will consist of the construction of 134 no. apartments (comprising a mixture of 70 no. 2 storey apartments and 64 no. apartments - 22 no. 1 bedroom apartments, 77 no. 2 bedroom apartments, and 35 no. 3 bedroom apartments) with private open space provided in the form of balconies/terraces as follows:

- A) Block A (4 storey apartment block) comprising 26 no. apartments (6 no. 1 bed units, 16 no. 2 bed units & 4 no. 3 bed units); Block B (part 4 part 5 storey apartment block) comprising 66 no. apartments (10 no. 1 bed units, 33 no. 2 bed units and 23 no. 3 bed units), with a commercial/ health/medical unit (c. 247.6 sq. m) at ground floor; Block C (part 4 part 5 storey apartment block) comprising 42 no. apartments (6 no. 1 bed, 28 no. 2 bed units and 8 no. 3 bed units);
- B) Vehicular/pedestrian and cyclist access from the Old Caragh Road (in new arrangement) along with the provision of 201 no. undercroft and surface car parking spaces as well as 388 no. undercroft and surface cycle parking spaces; internal road and shared surface networks including pedestrian and cycle paths;
- C) Public Open space including central communal (courtyard) open space including outdoor playground area;
- D) Provision of foul and surface water drainage, including relocation of existing foul main in northern part of site as well as green roofs; linear greenway path, bin stores; plant rooms; public lighting and all associated landscaping and boundary treatment works, site development and infrastructural works, ESB substations, and all ancillary works necessary to facilitate the development.

The proposed site is located on a ca. 3.17 ha greenfield site directly east of the existing Finlay Park residential development. The site is bounded to the north by an existing watercourse, to south by the Grand Canal, to the east by the existing Finlay Park residential development and to the west by agricultural lands. The local topography of the application lands at Finlay Park is gently sloping from south to north towards the existing watercourse.



#### Figure 1 Site Location Map

The application site formed part of a previous Strategic Housing Development (SHD) application by the applicant – ABP ref: 310244-21. The SHD application did not proceed due to a change in land use zonings in the recent draft Naas LAP. Extensive discussions were carried out with Kildare CoCo Water Services Department and Transportation Department as part of this process. The particulars of Zone 1 (subject site of this application) have not changed significantly. As such, the previous discussions in relation to the SHD are still relative to this application and we are building on the extensive information available on the site from the previous studies undertaken in relation to the following areas:

- Surface Water Drainage
- Flooding
- Foul Water Drainage
- Water Supply
- Roads

This report should be read in conjunction with the following schedule of drawings:

C-0001 Topographical Survey C-0020 Proposed Surface Water Drainage Layout C-0025 Combined Drainage Layout

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C-0030 Proposed Foul Drainage Layout

- C-0040 Proposed Watermain Layout
- C-0045 Proposed Watermain Extension
- C-0050 Proposed Site Layout
- C-0055 Proposed Sightlines Layout
- C-0060 Proposed Road Markings Layout
- C-0070 Proposed Autotrack Analysis Sheet 1 of 2
- C-0071 Proposed Autotrack Analysis Sheet 2 of 2
- C-0100 Proposed Typical Manhole Details
- C-0110 Proposed Attenuation and SUDS Details
- C-0111 Proposed SuDS Details
- C-0120 Proposed Typical Siteworks Details Sheet 1 of 2
- C-0121 Proposed Typical Siteworks Details Sheet 2 of 2
- C-0130 to 132 Typical Watermain Details
- C-0140 Proposed Road Types
- C-0141 Proposed Foul Longitudinal Sections
- C-0142 Proposed Surface Water Long Sections
- C-0150 Proposed Road Longitudinal Sections

### 2 Surface Water Drainage

#### 2.1 Existing Surface Water Drainage

As noted above, the local topography is gently sloping from south to north towards an existing open watercourse which discharges along the northern boundary of the application site and drains the site. The open watercourse flows from south to north towards the River Liffey.

The surface water network serving the existing Finlay Park residential development to the west of the proposed LRD application site also discharges to the existing watercourse. A portion of the existing surface water network serving the existing Finlay Park development will be diverted as part of the proposed LRD site development works.

#### 2.1.2 Site Investigation

Ground Investigations Ireland were commissioned by Westar Group as part of the previous application to carry out preliminary site investigations across their entire land holding. A number of these investigations are specific to the proposed development site – TP05, TP06, TP09 and SA09, SA10, SA11 & SA12 (see Figure 2 below).

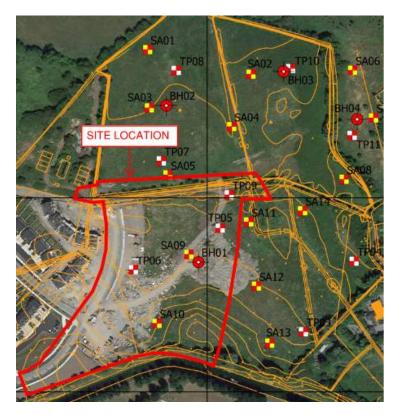


Figure 2 Extract from GII site investigation report

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**Trial Pits to 2.5m BEGL:** The ground conditions encountered in the trial pits excavated were generally consistent across the site. Made Ground was encountered in a number of trial pits to a maximum depth of 0.40m. Cohesive soils described as brown sandy slightly gravelly CLAY were encountered in the shallow soils overlying granular soils described as grey brown clayey gravelly SAND overlying slightly clayey sandy fine to coarse subangular to subrounded GRAVEL.

**BRE Digest 365 soakaway tests:** Infiltration tests in accordance with BRE Digest 365 were carried out on the site to a depth of up to 1.5m. Reasonable infiltration rates between  $7 \times 10^{-6}$  m/s and  $7 \times 10^{-5}$  m/s were noted in locations SA09, SA10 and SA12 within the proposed development site. Deeper infiltration SuDS techniques may be suitable in these locations. The water levels in the tests at SA11 dropped too slowly to record an infiltration rate. As such, unlined tree pits and permeable paving beneath private car parking areas may be suitable to utilise high level planar infiltration in this area.

**Groundwater monitoring:** GII installed a standpipe, BH01, in the site in August 2021 with a data logger to monitor ground water levels for over a 12 month period (including a summer and winter period). Groundwater has been recorded at approx. +84.50m. The results of the site investigations are included in the appendices of the SW audit information attached in Appendix B.

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#### 2.2 Proposed Surface Water Drainage

The design and management of surface water for the proposed development will comply with the policies and guidelines outlined in the Greater Dublin Strategic Drainage Study (GDSDS), the CIRIA SuDS Manual and the KCC Draft Sustainable Drainage Explanatory Design & Evaluation Guide. A 30% climate change factor and a 10% urban creep factor will be included for the design of the surface water network in accordance with the requirements of Kildare Co. Co.

#### 2.2.1 KCC Opinion Responses

The following section addresses the relevant items from the KCC Notice of LRD Opinion document:

Environment Item 3:

- Applicant to clarify their proposals regarding the incorporation of Nature Based SuDS into their proposed surface water management plans in terms of:
  - Swales,
  - Porous paving (roads and pathways),
  - Tree pits,
  - Rain gardens,
  - Roof gardens,
  - etc

A SuDS hierarchy table and description is included in Section 2.2.2 below.

Environment Item 4:

4. Applicant to clarify if their intention is to raise the level of the site in any way as part of the proposed development works. If so, they need to clarify their proposals regarding regularising this in accordance with Section 39 of the Waste Management Act.

The applicant is not intending to raise the site levels significantly.

Water Services Item 2:

 The SuDS and Drainage Strategy for the proposed development shall comply with the attached WSD SuDS and Drainage Strategy Guidance Document for Large Developments, GDSDS, CIRIA SuDS Manual, Water Sensitive Urban Design Interim Best Practice Guidance Document and surface water drainage policies and objectives of Naas LAP and CDP.

The SuDS and drainage strategy has been designed in compliance with the WSD SuDS and drainage guidance document for Large Developments and GDSDS and is described in Sections 2.2.2 and 2.2.3 below.

Water Services Item 3:

 OPW Section 50 consent will be required for any changes ie diversions, bridging, culverting or piping to the site watercourse.

No diversion, bridging, culverting or piping of the site watercourse is proposed as part of this development. Water Services Item 4:

4 Where required, consent to discharge runoff to the site watercourse shall be submitted. Condition and capacity of the site watercourse to cater for runoff from the proposed development should also be addressed.

The existing discharge to the watercourse serving the existing Finlay Park development is to be resued with slight amendments to the outfall to include a new headwall (see drawing C-0110). Any works adjacent to the watercourse will be agreed with Inland Fisheries prior to commencement on site (see Section 2.3 below for correspondence with Inland Fisheries). The capacity of the watercourse to cater for runoff from the proposed development is accounted for in the SSFRA prepared by JBA.

Water Services Item 5:

5 Stage 1 Preliminary Design Surface Water Audit to be undertaken by independent, impartial, accredited and competent consulting engineer shall be submitted with any planning application

A Stage 1 Surface Water Audit has been carried out by JBA Consulting on the proposed surface water drainage design. The design and drawings have been amended following the comments raised during the audit process and JBA have accepted the design responses. The audit report and supporting documents are attached in Appendix B.

Water Services Item 6

6 SuDS and Drainage Design shall comply with GDSDS and other relevant standards and consider utilising 30% climate change factor and 10% urban creep factor.

30% climate change and 10% urban creep have been included in the design calculations and this has been addressed in the Stage 1 SW Audit. The calculations are included in Appendix B.

Water Services Item 7:

7 Proposed re-location of attenuation for Finlay Park phase 1 should be addressed in any planning application.

The attenuation storage serving the existing Finlay Park development is being relocated to the north of the proposed development. The flows from the existing development have been accounted for in the SW design for the proposed new development. The existing attenuation and the new SW design were addressed in the Stage 1 SW Audit included in Appendix B.

#### 2.2.2 Proposed SuDS Measures

Infiltration measures are considered in areas where favourable infiltration rates were identified in the site investigation results. Groundwater monitoring indicates a winter water table level approximately 2.00m below ground level at a level of approx. +84.50m. As such, infiltration measures have been designed with a min. 1m separation between the base of the infiltration system and the groundwater level.

The following SuDS hierarchy has been considered for this site in accordance with the requirements of KCC Water Services Department and is illustrated on drawing C-0020:

#### Petrol / oil interceptors are proposed on the surface water outfall prior to discharge to the watercourse on the northern boundary of the part of this Constructed wetlands have not been selected on this project and instead the SuDS design has opted to use Retention Ponds Filter Drains are proposed as source control SuDS measures for this project in combination with the retention basin / pond relocated as Julined infiltration trenches are proposed where favourable infiltration rates were identified during the site investigation. podium Julined permeable paving is proposed where favourable infiltration rates were identified during the site investigations Julined tree pit renches are proposed where favourable infiltration rates were identified during the site investigations The runoff from the apartment building roof will discharge to a Blue Roof on the podium prior to discharge off site I discharge to a Blue Roof residential development is to be SuDS as the roof areas discharge to a Blue Roof Green walls are not proposed as part of the proposed development. A green embankment is included Bioswales are proposed along the road edge as source control NBS SuDS measures for this project ined Permeable Paving systems are not proposed as a source control SuDS measure measures for this project will for this project ilter Strips are not proposed as source control SuDS measures for this project roof areas ree Pits are proposed as source control NBS SuDS measures for this project Rationale for the provision or otherwise of proposed SuDS measures Park min. 60% of the proposed roof area will be a green roof. The green source control NBS SuDS measures Rainwater harveting is not proposed as part of this development Over-sized pipes are not proposed as part of this development Retention ponds are proposed as regional control NBS SuDS A Detention basin is not proposed as part of this development An existing underground attenuation tank serving the existing Raingardens are not proposed as source control NBS Bioswalws are proposed as site (N/J) amanod • • • • • • • • . • • for the Proposed • Ofher Control • • • 9jiS **Proprietary Treatment Systems** Control • • • • ٠ • • • • • • • • • Source Nature Based SuDS (NBS) SudS **Detention Systems SuDS** Control • • Filtration System SuDS Regional Sustainable Urban Drainag∈ **Jnlined tree pits-trenches** paving Lined Permeable Paving Infiltration System Constructed Wetlands Rainwater Harvesting Petrol/ oil separators Julined permeable Infiltration trenches ined Underground **Bioretention Areas** Attenuation Tank Over-sized pipes Detention Basin Retention Pond Rain Gardens **Breen Roofs** Green Walls Filter Strips lue Roofs Filter Drain Bioswales ree Pits System 15 19 ŝ ω 9 ÷ 2 3 4 15 16 18 20 2 ო 4 σ

#### Figure 3 Proposed SuDS Hierarchy

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Project No.: DOBA2110

#### Issue 3 Client: Westar Homes Ltd Date: December 2022

## DONNACHADH O'BRIEN

& ASSOCIATES CONSULTING ENGINEERS

A summary of the above table is included below:

- Nature Based Solutions on this development will include:
  - Min. 60 % of the roof areas of the apartment blocks are to be green roof and the podium of the apartment block is to be a blue roof;
  - Bio retention swales and tree pits are proposed adjacent to the internal access road;
  - o Bio retention basins within the proposed public green areas (where suitable);
- Infiltration solutions on this development will include:
  - Road gullies discharging to infiltration trenches where it is not feasible to introduce direct runoff to tree pits and swales;
  - Permeable paving in the private parking spaces with infiltration trenches beneath along the proposed development access road. The permeable pavement will be left unsealed to utilise any infiltration which may be available;
  - Infiltration trenches are proposed beneath the bio retention swales to discharge runoff to ground;
  - The existing underground attenuation structure is to be relocated as part of the proposed development and is to be left unsealed to avail of any infiltration. The existing outfall to the watercourse will be reused as part of the proposed development;

Additional measures included in the surface water strategy for the proposed development include the following:

- A bypass petrol interceptor will intercept flows prior to discharge from the site to the existing stream as a final level of treatment for rainfall runoff;
- A non-return valve will be placed on the outfall headwall along with a high-level overflow for rainfall events exceeding a 1 in 100 year rainfall event and will discharge to the watercourse above the 1 in 1,000 year flood level (identified as +84.93m in the JBA SSFRA). See drawing C-0110 for details of the overflow.;

#### 2.2.3 GDSDS Summary of Design Criterion

GDSDS summarises the design criteria for the design of drainage systems under four criteria in Section 6.3.4 as follows:

- 1. Criterion 1 River water quality protection
- 2. Criterion 2 River regime protection
- 3. Criterion 3 Level of service (Flooding) for the site
- 4. Criterion 4 River flood protection

#### Criterion 1 – River water quality protection

The first 5mm rainfall runoff from the impermeable areas on site will be intercepted without discharging to the public system via a combination of SuDS measures including green roof, blue roof, bio retention swales, bio retention tree pits, bio retention ponds and permeable paving. The total treatment volume required on site was calculated at 70m3 and the total treatment volume provided is 367m3. The individual treatment interception volume calculations are included in Appendix B as part of the SW audit and are in accordance with the CIRIA SuDS Manual.

#### Criterion 2 – River regime protection

Discharge from the site will be via a Hydrobrake to the existing watercourse adjacent to the site. The greenfield run off rate, Qbar = 5.41 l/s, has been calculated in accordance with GDSDS based on the following calculation:

The SOIL type has been conservatively assumed as Type 2 (as noted in the SW audit responses) based on the infiltration characteristics of the existing subsoils outlined in the site investigation.

#### Criterion 3 - Level of service (Flooding) for the site

The SuDS features on site have been designed to store volumes up to a 1 in 100 year rainfall event + 30% climate change + 10% urban creep in a combination of blue roof, infiltration trenches beneath the swales, unlined underground attenuation and overground bio retention areas with 500mm freeboard provided to the finished floor levels of the properties. The overland surface water flow route for the development, in emergency scenarios, will direct water along the internal road network towards the watercourse (see Section 3.1).

#### **Criterion 4 – River flood protection**

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The site will discharge to the existing watercourse with a restricted flow, using a Hydrobrake, to the greenfield runoff rate. The storage systems will be designed to store volumes up to a 1% AEP (1 in 100 year rainfall event) + 30% climate change + 10& urban creep at greenfield runoff rates.

#### 2.3 Discussions with Inland Fisheries

2.3.1 During pre-planning discussions with Kildare County Council Water Services Department as part of the previous SHD application, we were advised to consult with Inland Fisheries in the context of the open watercourse running along the northern boundary of the application site. This watercourse is served by a 375mm surface water pipe extending from the Naas town centre public surface water drainage network. This pipe is located beneath the canal and discharges to the open watercourse in the canal harbour area before flowing northwards adjacent to the application site. Within the catchment of the watercourse, there is a small ditch at the bottom of the canal tow path which connects internally to the main watercourse. The watercourse also drains the surrounding agriculture lands as part of the natural existing catchment.

2.3.2 Over the years it is apparent that there has been extensive cleaning, diversion and channel widening carried out by Kildare County Council over the northern section of the lands in particular - this is extensively "over engineered" for the flows in the steam with large flat channels sections, low flows or stagnant water in places and almost vertical banks. There is little or no riparian vegetation and large section are bare earth vertical banks, as illustrated in Figure 4 below.



#### Figure 4 Typical view of existing open watercourse

2.3.3 As part of the previous SHD application for the overall lands, some amendments to the existing watercourse were proposed. The existing watercourse is to be maintained along its current route adjacent to the development site for this current LRD application.

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2.3.4 DOB&A consulted with Roisin O'Callaghan of Inland Fisheries as part of the consultations associated with the previous SHD application on the overall lands. Roisin has visited the site and confirmed that the watercourse is not of particular importance to Inland Fisheries as it is non Salmonid and their acceptance of our proposals for improvement and alteration of the watercourse as following by email on 15/04/2021 (Refer to Appendix C):

"IFI's policy is to maintain watercourses in their open natural state in order to prevent habitat loss, preserve and enhance biological diversity and aid in pollution detection. Because this watercourse is non Salmonid we feel that an 8-10 buffer strip to enhance biological diversity while providing open space and recreational amenity will be acceptable. Natural heritage objectives should include maintenance of buffer zones along both banks of the watercourse. An 1:3 side slope is also reasonable as long as the stream channel itself is not over widened. Disturbance of in-stream habitats should be minimised and it also should be noted that a method statement for all riparian / in-stream works must first be submitted to IFI for approval if planning is granted."

"In principal we could support a small realignment subject to approved design and method statement."

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### 3 Flood Risk

JBA Consulting has been appointed to undertake a Flood Risk Assessment for the proposed Finlay Park residential development in Naas, Co Kildare. As part of the FRA process a thorough review of the available information regarding potential flood risk to the site and proposed development was undertaken. From this review it was found that the site was shown to be in Flood Zone C and at low risk of flooding therefore is suitable for residential developments. To account for any uncertainty within the CFRAM model and associated flood maps, JBA built a site-specific hydraulic model to confirm the flood risk to the site by ensuring that the that the surrounding watercourses including the Grand Canal were appropriately represented.

From this detailed modelling it was confirmed that the site was shown to be in Flood Zone C and at low risk of fluvial flooding. Additional assessment was undertaken to appraise the impact of climate change and residual risks (blockages) and review of the results confirm that the site will not be impacted by any of the modelled flood events. A stormwater system has also been included (designed by others) that will manage surface water flows within the site and will minimise the risk of fluvial flooding. This system has incorporated an allowance for climate change within its design.

In summary, the FRA has been undertaken in accordance with the FRA guidelines and confirms that the development is located within Flood Zone C and appropriate for a residential development.

#### 3.1 Pluvial Flood Risk

Pluvial flooding is the result of rainfall generated overland flows which arise before runoff can enter any watercourse or sewer. It is usually associated with high intensity rainfall events. Provision of adequate storm water drainage systems will minimise the risk from pluvial flooding sources. As noted in Section 2.2 above, the proposed surface water network has been designed to mitigate against the potential for pluvial flooding for rainfall events up to and including a 1% AEP + 30% climate change + 10% urban creep factors. A high level overflow has been included at the outfall headwall to allow a discharge to the watercourse in extreme storm events in excess of a 1% AEP + 30% CC + 10% UC or in cases of a blocked outfall due to high water levels in the receiving watercourse (see drawing C-0110). Overland flows from the developed site will discharge towards the watercourse as per the existing scenario is case of failure of the proposed drainage system (see Figure 5 below).

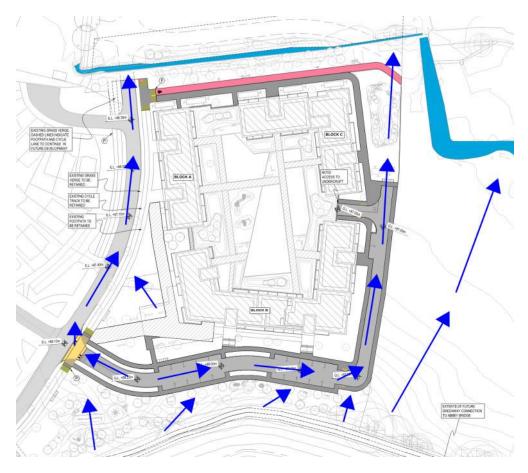


Figure 5 Overland flow path post development

### 4 Foul Drainage

#### 4.1 Existing Foul Drainage

Existing 750mm diameter and 1050mm diameter foul sewers traverse the proposed development site. The crown of the existing 1050mm pipe is currently above ground level through the site. The 750mm and 1050mm pipes discharge into a large concrete chamber adjacent to the Phase 1 Finlay Park development prior to discharging to Osberstown treatment plant via an existing 750mm pipe. The Irish Water and Kildare Co. Co. public maps are included in Appendix A.

#### 4.1.1 Consultation with Kildare County Council and Irish Water

DOB&A have held preliminary discussions with Kildare Co. Co. and Irish Water in relation to construction adjacent to the existing foul drainage networks as part of the previous SHD application on the site. A confirmation of feasibility was issued by Irish Water for connection to the existing wastewater infrastructure (see Figure 6 and Appendix D). A diversion application to relocate the existing 1050mm wastewater pipe was submitted as part of the previous SHD application and a confirmation of feasibility was issued by Irish Water for the diversion (Ref: DIV21046). DOB&A have had subsequent consultations with Irish Water for the LRD application and have received an updated CoF letter and Design Statement of Acceptance. See Appendix D for the confirmation of feasibility letters and the design statement of acceptance.

Wastewater - Feasible without infrastructure upgrade by Irish
 Water

Irish Water has reviewed your submission for the proposed diversion of the 1050 mm Concrete wastewater sewer in the vicinity of Finlay Park, Naas, Co. Kildare.

Based upon the details you have provided in your drawings FINLAY-DOB-00-SI-DR-C-0003-S2-P03 and FINLAY-DOB-XX-SI-DR-C-0002-D2-P03 and as assessed by Irish Water, we wish to advise you that, subject to valid agreements being put in place, the proposal can be facilitated.

Figure 6 Extracts from Irish Water response to pre connection enquiry and diversion application

#### 4.2 Proposed Foul Drainage

#### 4.2.1 KCC Opinion Responses

Irish Water Item 1:

 New Pre Connection Enquiry application submitted to Irish Water and they confirm Confirmation of Feasibility (CoF) is imminent. The prospective applicant should continue their dialogue with Irish Water on any required network infrastructure upgrades identified in CoF and the proposed foul infrastructure diversion and maximise the certainty on these issues in any planning application, particularly on timelines for delivery of upgrades and diversions.

A new confirmation of feasibility (CoF) has been issued for the proposed LRD application. The new CoF is included in Appendix D.

Irish Water Item 2:

Water services designs and layouts will be subject to a Statement of Design Acceptance which should be submitted with any planning application.

A design statement of acceptance has been issued by Irish Water for the proposed foul layout and is included in Appendix D.

#### 4.2.2 Proposed Foul Drainage

The proposed foul network will collect effluent from the new dwellings via a local piped network and discharge into a new public foul piped network located within the internal access roads of the proposed development prior to discharging to the existing 300mm diameter network adjacent to Finlay Park Phase 1.

The proposed discharge from the development connecting into the existing foul public network has been calculated using a peak flow factor of 6DWF.

No. of dwellings	150 (Assume the commercial unit is equivalent to 2 residential units)
Hydraulic Load per house	450 l/dwelling/day (IW CoP Section 3.6)
D.W.F	0.78 l/s
6D.W.F	4.68 l/s

The Microdrainage calculations for the proposed development are included in Appendix E.

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### 5 Water Supply

#### 5.1 Existing Watermain

An existing 225mm watermain is located along the R409 Caragh Road to the west of the development which reduces to a 100mm watermain to serve the existing dwellings in Caragh Court and Finlay Park Phase 1. An existing 180mm watermain is located along the Old Caragh Road to the south west of the development. The Irish Water and Kildare Co. Co. public maps are included in Appendix A.

#### 5.1.1 Consultation with Irish Water

Irish Water have issued a confirmation of feasibility (CoF) letter for the previous SHD application in relation to the connection of 431 units to the existing water supply, subject to some local upgrade works being carried out on lands in the ownership of Westar Homes Ltd. and ownership of KCC. The applicant would like to carry out the upgrade works suggested in the CoF letter for the 431 unit application in order to future proof future development adjacent to the current Zone 1 application site. A new 200mm watermain is required to link the existing 225mm watermain along the R409 and the existing 180mm watermain along the Old Caragh Road in order to serve the proposed LRD development and also future connections. The extension of the existing networks will be included in the connection offer at connection application stage. The confirmation of feasibility letters are included in Appendix D.

Water Connection	Feasible Subject to upgrades	
	SITE SPECIFIC COMMENTS	
	The Development can be supplied from existing 180mm PVCA main in Old Caragh Road. Approximately 150m of new 200mm ID pipe main has to be laid to connect the Site to the existing main. A bulk meter with associated telemetry system, along the connection main, will be required.	
Water Connection	Additionally, approx. 300m of new 200mm ID pipe main has to be laid to work in parallel with the existing 4" uPVC in Old Caragh Road. This 200mm ID main will connect the 225mm HPPE and the 180mm PVC-A mains together for a supply line which can handle the capacity required for this Development.	
	Should you wish to progress with the connection, you have to fund the upgrade works and the fee will be calculated at a connection application stage.	

Figure 7 Extract from Irish Water Confirmation of Feasiblity for 431 unit application

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#### 5.2 **Proposed Watermain**

A new 200mm diameter watermain will be installed to serve the proposed development and also future development as noted in Section 5.1.1 above. A 150mm watermain network will be installed to serve the LRD development which will also provide capacity for future development adjacent to the LRD development. An air valve will be installed at the high point of the watermain with a scour valves located at the low point for maintenance. A bulk flow meter will be installed for each apartment block with facilities to measure each individual unit provided in a publicly accessible location in the under croft car parking area for each block. Refer to DOB&A drawings C-0040 & C-0045 for the proposed watermain drawings.

### 6 Roads Infrastructure

#### 6.1 Existing Roads Infrastructure

An existing access road with segregated footpath and cycle track facilities serving the existing Finlay Park residential development has been constructed to the west of the proposed LRD development. A portion of the existing roads serving the existing Finlay Park will be used to serve the proposed development. The extent of existing roads is shown on DOB&A drawings C-0001.

#### 6.2 **Proposed Roads Infrastructure**

As noted above, the proposed development site will be accessed off the existing road serving the existing Finlay Park development. Westar Homes Ltd have appointed Systra to provide transport planning advice in respect to the application lands.

#### 6.2.1 KCC Opinion Response

• Traffic and Transportation Issue 1 (f) & (g)

(f) Road widths for local streets within the development to be a minimum of 5.5 metres in widths. All associated footpaths to be a minimum of 2.0 metres in width. g. Longitudinal gradients of the roads and lines of sight and corner radii at the junctions within the application site to be in accordance with the Design Manual for Urban Roads and Streets (DMURS) 2019.

The local street hierarchy serving the development includes a 6.50m wide street which will serve as a future link street and a 5.50m wide local street to access the under croft car park beneath the apartment unit. 2m footpaths are proposed throughout the development. Longitudinal sections through the proposed roads are included on drawings C-0150. Gradients of the road, lines of sight and corner radii are in accordance with DMURS.

• Traffic and Transportation Issue 1 (h)

(h) The manner in which surface water is collected and not discharged onto the existing public road network.

Surface water runoff from the proposed roads is to be collected via a combination of permeable paving, bio retention swales and road gullies. Refer to drawing C-0020.

• Traffic and Transportation Issue 1 (i)

(i) Details of 30 km/h Slow Zones signage and their respective locations (having consideration to overall landholding of the applicant) in the residential development in accordance with the Department of Transport, Tourism and Sport's (DTTAS) traffic signs advice note TSAN2016-02.

Slow zone signage has been erected along the existing access road serving the existing Finlay Park residential development. See Figure 8 below.

• Traffic and Transportation Issue 1 (j)

(j) Mitigation measures on the local streets in order to prevent speeding in 30 km/h zones.

Straight sections of the proposed access road are less than 70m in length to reduce speeding. A raised speed table is proposed at the junction between the proposed access road and the existing access road to provide pedestrian priority and reduce speeds.

• Traffic and Transportation Issue 1 (k)

(k) All signage and road markings to be in accordance with the Department of Transport, Tourism and Sport's (DTTAS) Traffic Signs Manual.

All signage will be in accordance with DTTAS Traffic Signs Manual.

• Traffic and Transportation Issue 1 (I):

(I) Cycle lanes within the development to be in accordance with the National Transport Authority (NTA) National Cycle Manual.

An existing cycle lane has been constructed along the existing access road serving the existing Finlay Park development. The new cycle lanes within the development are in accordance with the National Cycle Manual.

• Traffic and Transportation Issue 1 (m):

(m) Pedestrian crossing points to be dished with the incorporation of tactile paving providing connectivity within the footpath network of the proposed development.

Dished kerbs and tactile paving have been included at pedestrian crossing points within the footpath network.

Engineering Services Report Project: Housing development at Finlay Park, Naas, Co. Kildare Project No.: DOBA2110

• Traffic and Transportation Issue 1 (n):

(n)Surface water attenuation within the application site and surface water disposal arrangements. This shall be in accordance with the Greater Dublin Strategic Drainage Study (GDSDS) and the recommendations pertaining to Sustainable Urban Drainage Systems (SUDs).

The surface water attenuation within the application site has been designed in accordance with GDSDS and SuDS. Refer to Section 2.1 and Section 2.2 above.

• Traffic and Transportation Issue 1 (o):

(o) Critical Swept Path Analyses for a 3 axle Refuse Lorry 9.86 metres by 2.5 metres in dimension and a fire tender demonstrating access and egress to and from the site and manoeuvrability on the site.

A swept path analysis has been carried out for a refuse and fire tender vehicle. Refer to drawings C-0070 & C-0071.

- Traffic and Transportation Issue 2:
  - The applicant should submit a Traffic and Transport Impact Assessment (TTA) in accordance with the NRA (TII) Traffic and Transport Assessment Guidelines May 2014.

Systra have been appointed by the applicant to prepare a transport assessment for the proposed development. The transport assessment has been prepared in accordacne with the TII's Traffic and Transport Guidelines.

- Traffic and Transportation Issue 3:
- The applicant will be required to submit a Mobility Management Plan that is to contain:
  - (a) Full details of all existing public transport links and timetables serving Naas and links to commuter rail timetables at Sallins. This is also to list all public transport links to prominent employment centres in order to reduce car borne journeys.
  - (b) Existing and proposed walking and cycling routes in Naas. The applicant will be required to have consideration to the Naas Sallins Transport Strategy and the Naas Sallins Greenway project.
  - (c) The manner in which the Mobility Management Plan will be made available to future residents.
  - (d) During the lifetime of this Mobility Management Plan, the developer shall submit annual survey results of the modal splits and origin of trips of staff of the crèche and future residents of the development.

Systra have been appointed by the applicant to prepare a Mobility Management Plan for the proposed development. The Mobility Management Plan is included in the Transport Assessment report.

- Traffic and Transportation Issue 4:
- 4. The applicant should submit a Lighting Report and Site Lighting Layout drawings at scales of 1:500 demonstrating the development will not be a source of light pollution to adjacent lands, property, the canal and the public road network. The applicant will be required to review the existing public lighting arrangements on the existing adjacent public road network and submit proposals for the upgrade of public lighting (as deemed required) at this location.

Rexel have been appointed by the applicant to prepare a site lighting layout and lighting report for the development.

- Traffic and Transportation Issue 5:
- The applicant should submit to a draft Construction Management Plan that is to contain:
  - (a) A Construction Traffic Management Plan indicating all haul routes to and from the site. Delivery times for plant and materials and waste collection shall have consideration to morning and evening peak school times in the area and peak traffic periods. Construction related traffic is not permitted to travel through Naas Town Centre. This plan is also to contain mitigation measures to minimize the effects the proposed development would have on the immediate public road network and existing traffic movements.
  - (b) Wheelwash arrangements and locations for the construction phase.
  - (c) Location of the construction compound, use of cranes, parking and storage areas during the construction phase. (This is in the interest of the existing residential amenity of properties in the area).
  - (d) Relevant construction site warning signs shall be in accordance with the Department of Transport, Tourism and Sport (DTTAS) Traffic Signs Manual.
  - (e) A draft Construction Waste Management Plan. This is to contain final destination of each waste stream generated on site.
  - (f) Hours of operation during the construction phase to be 08.00 hours to 18.00 hours Monday to Friday and 0.800 hours to 14.00 hours Saturday. No work permitted on the Sundays and public holidays. (This is in the interest of the existing residential amenity of properties in the area)

DOB&A have prepared a draft Construction Management Plan and it is submitted as a standalone document with the application.

- Traffic and Transportation Issue 6:
- The applicant will be required to submit a stage 1 and 2 Road Safety Audit / Assessment (RSA) by an independent approved and certified auditor. The RSA is to assess:
  - (a) The internal areas of the proposed residential and crèche development.
  - (b) The interface with the existing public road / foot path network.

The applicant is required to make the necessary changes to the design proposals following the stage 1 and 2 RSA. The applicant is requested to note that if the application is subsequently granted, then the applicant will be required to carry out a stage 3 audit / assessment.

A Stage 1 / 2 Road Safety Audit was carried out by Roadplan Consulting and is attached as a standalonw report. See Section 6.2.5 below.

- Traffic and Transportation Issue 7:
- Status of the Bus Only Route and cross section (6.5m c/w width) should be confirmed and clarity provided as to whether this be used by other vehicular and HGV Traffic.

The bus only route is not part of the current application site. The bus only route will form part of a future planning application on lands to the north of the application site as agreed with KCC Transportation Department. Please see attached correspondence between DOB&A and KCC in Appendix F.

- Traffic and Transportation Issue 8:
- Details of proposed pedestrian/ cyclist permeability links to be submitted which should provide passive surveillance and public lighting and should be a minimum of 4m in width.

Pederstrian and cyclist permeability links are a minimum of 4m in width and are shown on drawing C-0050.

- Traffic and Transportation Issue 9:
- Details of proposed pedestrian/ cyclist route along the Canal should be submitted to provide passive surveillance and public lighting and should be a minimum of 4m in width.

The proposed pedestrian / cyclist route along the Canal is not part of the current LRD application site. The route along the Canal will form part of a future planning application as agreed with KCC Transportation Dept. See Appendix F.

- Traffic and Transportation Issue 10:
  - Indicative design details of the proposed pedestrian/ cyclist footbridges to be submitted which should be a minimum of 5m in width.

The pedestrian / cyclist footbridges are not part of the current LRD application site. The bridges will form part of a future planning application as agreed with KCC Transportation Dept. See Appendix F.

- Traffic and Transportation Issue 11:
- Design details of the connection into the Naas Sallins Greenway to be submitted as part of future development on the site.

The connection to the Naas Sallins Greenway is not part of the current LRD application site. The connection will form part of a future planning application as agreed with KCC Transportation Dept. See Appendix F.

- Traffic and Transportation Issue 12:
- 12. Cycle parking spaces 222 in CDP and 148 being provided with shortfall of 74 spaces. Car parking spaces 259 in CDP and 208 being provided with shortfall of 51 spaces. Vehicular parking to be in accordance with Table 17.9 of Chapter 17 of the Kildare County Development Plan 2017 – 2023. A rationale for the shortfall in spaces is to be provided.

The car parking provision is included in the architect's documentation.

- Traffic and Transportation Issue 13:
- 13. The site is located adjacent to Public Roads and the applicant is requested to submit an Acoustic Design Statement by a suitably qualified acoustic specialist to ensure the proposed development including external areas will not be exposed to noise levels in excess of the Kildare County Third Noise Action Plan Lden threshold of 70 dB (A) and Lnight threshold of 57 dB (A). (Mitigation measures are to be included as deemed required).
  - (a) A noise monitoring survey conducted midweek during school-term that is to contain a full set of noise monitoring results. These results are to include the Time Run Duration, LAeqT (1 hour), LAeqT (15min), LAFmax, LAF10, LAF90, calculated Lden noise levels and measured Lnight noise levels.
  - (b) Calculated Lden and measured Lnight values at the façades of the proposed development at levels not less than 1.5 metres above each of the respective floor level. The useability of balconies (If applicable) are to be subject of this assessment.
  - (c) The predicted internal noise levels to be in accordance with the recommended indoor ambient noise levels as prescribed under the British Standards BS 8233:2014. This is also to have an assessment with regard to opening windows at night (in summer months) and the impact on internal ambient noise levels. This assessment shall have consideration to the number of LAFmax events from 11 pm to 7.00 am having regard to potential sleep disturbance.
  - (d) Concluding statement with regard to the compliance with the Kildare County Council Third Noise Action Plan 2019 – 2023 and the British Standards BS 8233:2014.

An Acoustic Design Statement has been prepared by Redkite Environmental.

- Traffic and Transportation Issue 14:
- 14. Surface water runoff to be collected and disposed of at the vehicular entrance and not discharged onto the public road network. Finished ground levels and falls to be indicated on a drawing.

Surface water runoff is being collected via a combination of perbeable paving, bio swales and road gullies. Refer to Section 2.2.2 of this report.

- Traffic and Transportation Issue 15:
- 15. Surface water to be collected, attenuated and disposed of to a suitable outfall with petrol interceptors to be installed (in view of the HGV traffic) to protect the existing outfalls and water courses. This should be in accordance with the Greater Dublin Strategic Drainage Study (GDSDS) and the recommendations pertaining to Sustainable Urban Drainage Systems (SUDs).

Surface water is being collected, attenuated and disposed to a suitable outfall with petrol interceptors installed. Refer to Section 2.2.2 of this report.

#### 6.2.2 Autotrack

A turning area has been provided at the entrance to the undercroft car park for a refuse vehicle to collect bins at this location. An Autotrack analysis has been carried out for a turning manoeuvre for a 9.93m refuse vehicle. An autotrack exercise has also been carried out for a fire tender accessing the perimeter of the building. Refer to drawings C-0070 and C-0071.

#### 6.2.3 Statement of Consistency with DMURS

The internal carriageway hierarchy within the proposed development has been designed in accordance with Section 4.4.1 in DMURS as follows:

- <u>Arterial Streets</u>: The main arterial road through the development is an existing road which serves the existing Finlay Park residential development. This existing road has been designed with a width of 6.5m to serve the proposed future development of the Northwest Quadrant as part of the Naas Sallins Transport Strategy;
- Local Streets: The local street in the proposed development has been designed with a width of 5.5m;
   Psychological and physical measures have been adopted in the proposed site layout to balance the functional needs of different carriageway users. The following measures have been included:
- Footpaths (minimum 2m wide) are provided throughout the development with frequent crossing points including a raised speed table at the junction with the arterial street;
- With the objective of encouraging low vehicle speeds, regular changes of direction have been included across the local street network with long straight sections <70m in length;
- Reduced corner radii of 6m have been included at junctions to encourage lower speeds;
- Slow Zone signage has been erected on the access road to the existing Finlay Park residential development (see Figure 8 below)



Figure 8 Slow Zone Signage on existing Finlay Park access road

• Exit sightlines of 23m (Slow Zone speed limit is 30 km/h) at 2.4m setback from the edge of the existing Finlay Park access road have been provided in accordance with the DMURS Table 4.2 (see drawing C-0055).

#### 6.2.4 Transport Assessment

Systra have been appointed by the applicant to prepare a transport assessment for the proposed development and this report is submitted as part of the planning pack.

#### 6.2.5 Road Safety Audit

Roadplan were commissioned by the applicant to carry out a Stage 1 / 2 road safety audit for the proposed development. The comments from the audit have been accepted and the drawings have been amended to reflect the comments. The audit feedback sheet has been signed by the auditor, designer and the applicant.

#### 6.2.6 Mobility Management Plan

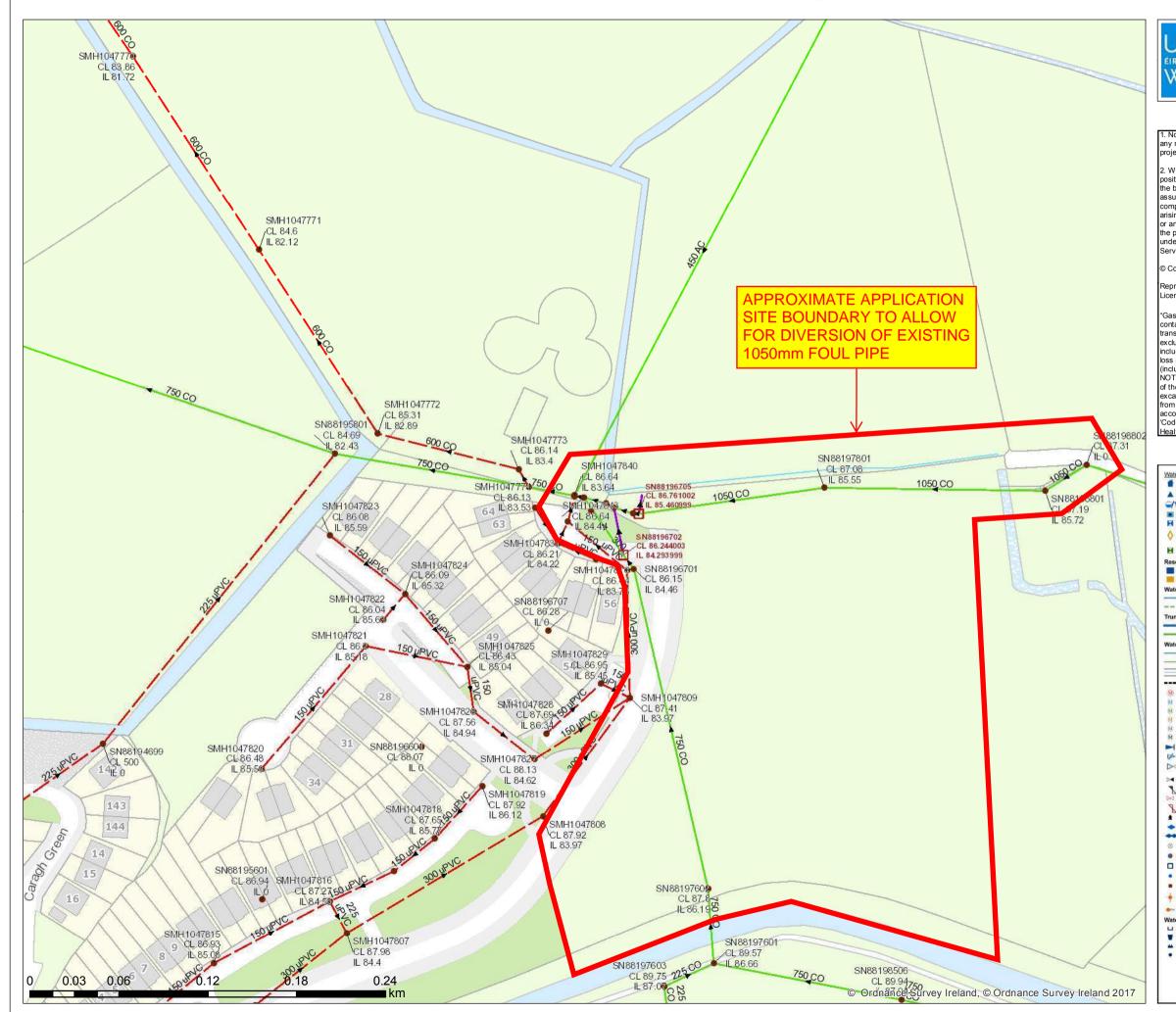
Roadplan were commissioned by the applicant to carry out a Mobility Management Plan for the proposed development. The MMP is included with the planning documents.

Appendix A

Kildare County Council / Irish Water Maps

Engineering Services Report Project: Housing development at Finlay Park, Naas, Co. Kildare Project No.: DOBA2110 Issue 3 Client: Westar Homes Ltd Date: December 2022

## **Irish Water Web Map**





Print Date: 09/03/2021

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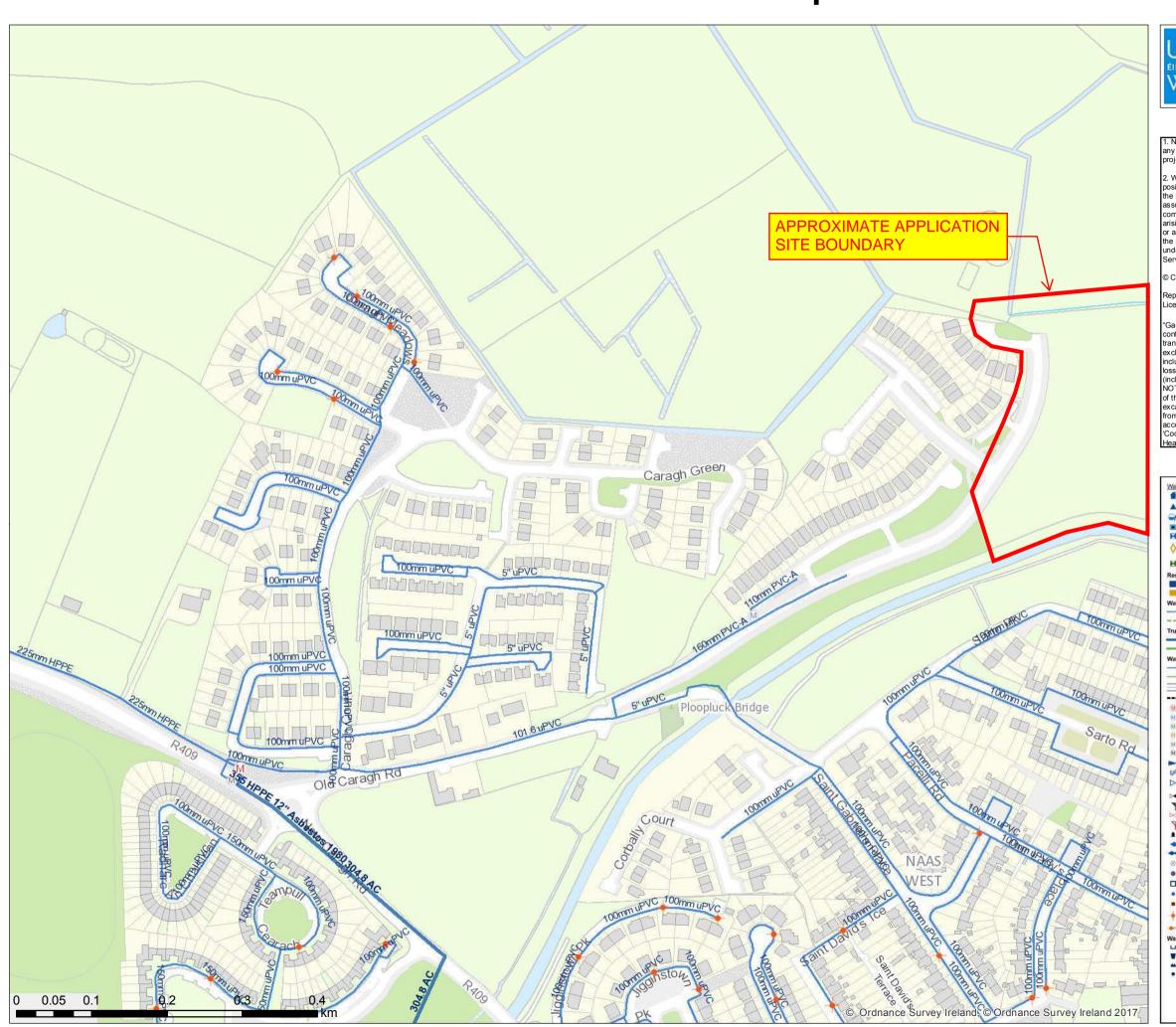
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Code of Practice For Avoiding Danger From Underground Services' which is available from the Health and Safety Authority (1890 28 93 89) or can be downloaded free of charge at www.hsa.le.

ter Distribution Network	Sewer Foul Combined Network	Storm Water Network
Water Treatment Plant	Waste Water Treatment Plant	Surface Water Mains
Water Pump Station	Waste Water Pump station	- Surface Gravity Mains
T Storage Cell/Tower	Sewer Mains Irish Water	<ul> <li>Surface Gravity Mains Private</li> </ul>
Dosing Point	- Gravity - Combined	Surface Water Pressurised Mains
Meter Station	Gravity - Foul	Surface Water Pressurised Mains Private
and the second second	Gravity - Unknown	Inlet Type
Abstraction Point	Pumping - Combined	Gully
Telemetry Kiosk	Pumping - Foul	Standard
servoir	Pumping - Unknown	Other, Unknown
Potable	Syphon - Combined	Storm Manholes
Raw Water	Syphon - Foul	Standard
ter Distribution Mains	- Overflow	O Backdrop
- Irish Water	Sewer Mains Private	Cascade <sup>CP</sup> Catchpit
Private	Gravity - Combined	
	Gravity - Foul	Bifurcation
ink Water Mains Irish Water	Gravity - Unknown	Hatchbox
Private	= Pumping - Combined	Lamphole
	Pumping - Foul	Hydrobrake
ter Lateral Lines	Pumping - Unknown	<ul> <li>Other; Unknown</li> </ul>
- Irish Water	Syphon - Combined	Storm Culverts
- Non IW	Syphon - Foul	Storm Clean Outs
Water Casings	- Overflow	Stormwater Chambers
<ul> <li>Water Abandoned Lines</li> </ul>	Sewer Lateral Lines	Discharge Type
Boundary Meter	Sewer Casings	
Bulk/Check Meter	Sewer Manholes	-) Outfall
Group Scheme	<ul> <li>Standard</li> </ul>	Overflow
Source Meter	O Backdrop	Soakaway
Waste Meter	Cascade	or des Other, Unknown
Unknown Meter ; Other Meter	Catchpit Catchpit	Gas Networks Ireland
Non-Return	O Bifurcation	— Transmission High Pressure Gasline
PRV	[ <sup>‡</sup> ] Hatchbox	Distribution Medium Pressure Gasline
PSV	Lamphole	Distribution Low Pressure Gasline
		ESB Networks
Sluice Line Valve Open/Closed	Hydrobrake	ESB HV Lines
Butterfly Line Valve Open/Closed	<ul> <li>Other; Unknown</li> </ul>	HV Underground
Sluice Boundary Valve Open/Closed	Discharge Type	HV Overhead
Butterfly Boundary Valve Open/Closed	Outfall	HV Abandoned
Scour Valves	Overflow	ESB MVLV Lines
<ul> <li>Single Air Control Valve</li> </ul>	Soakaway	
<ul> <li>Double Air Control Valve</li> </ul>		MV Overhead Single Phase
Water Stop Valves	Standard Outlet	LV Overhead Three Phase
Water Service Connections	°™é <sup>s ≈</sup> Other; Unknown	LV Overhead Single Phase
Water Distribution Chambers	Cleanout Type	
Water Network Junctions	Rodding Eye	Abandoned
	O Flushing Structure	Non Service Categories
Pressure Monitoring Point	order Other; Unknown	Proposed
Fire Hydrant	Sewer Inlets	<ul> <li>Under Construction</li> </ul>
Fire Hydrant/Washout	E Catchpit	<ul> <li>Out of Service</li> </ul>
ter Fittings	# Gully	<ul> <li>Decommissioned</li> </ul>
Cap	Standard	Water Non Service Assets
Reducer	oter: Unknown	Water Point Feature
Тар	Sewer Fittings	Water Pipe
Other Fittings	Vent/Col	Water Structure
and the second	A CONTRACTOR OF A CONTRACTOR O	Waste Non Service Assets
	o Ter Other; Unknown	Waste Point Feature
		····· Sewer
		Waste Structure







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ter Distribution Network	Sewer Foul Combined Network	Storm Water Network
Water Treatment Plant	Waste Water Treatment Plant	Surface Water Mains
Water Pump Station	🔺 Waste Water Pump station	- Surface Gravity Mains
T Storage Cell/Tower	Sewer Mains Irish Water	<ul> <li>Surface Gravity Mains Private</li> </ul>
Dosing Point	Gravity - Combined	Surface Water Pressurised Mains
Meter Station	Gravity - Foul	Surface Water Pressurised Mains Private
Abstraction Point	- Gravity - Unknown	Gully
	Pumping - Combined Pumping - Foul	<ul> <li>Standard</li> </ul>
Telemetry Kiosk	Pumping - Unknown	<ul> <li>Other, Unknown</li> </ul>
ervoir	Syphon - Combined	Storm Manholes
Potable	Syphon - Foul	<ul> <li>Standard</li> </ul>
Raw Water	Overflow	O Backdrop
er Distribution Mains	Sewer Mains Private	TTT Cascade
Irish Water	Gravity - Combined	Catchpit
Private	Gravity - Foul	Bifurcation
nk Water Mains	Gravity - Unknown	[보] Hatchbox
Irish Water	= Pumping - Combined	Lamphole
Private	= Pumping - Foul	▲ Hydrobrake
er Lateral Lines	= Pumping - Unknown	<ul> <li>Other; Unknown</li> </ul>
- Irish Water	Syphon - Combined	Storm Culverts
Non IW	Syphon - Foul	Storm Clean Outs
Water Casings	- Overflow	Stormwater Chambers
Water Abandoned Lines	Sewer Lateral Lines	Discharge Type
Boundary Meter	Sewer Casings	-) Outfall
Bulk/Check Meter	Sewer Manholes	or Overflow
Group Scheme	Standard	Soakaway
Source Meter	O Backdrop	or and Other, Unknown
Waste Meter	Cascade	
Unknown Meter ; Other Meter	Catchpit	Gas Networks Ireland —— Transmission High Pressure Gasline
Non-Return	Bifurcation	
PRV	[ <sup>性</sup> ] Hatchbox	Distribution Medium Pressure Gasline
PSV	Lamphole	Distribution Low Pressure Gasline
Sluice Line Valve Open/Closed	Hydrobrake	ESB Networks
Butterfly Line Valve Open/Closed	O Other; Unknown	ESB HV Lines
Sluice Boundary Valve Open/Closed	Discharge Type	
Butterfly Boundary Valve Open/Closed	-) Outfall	HV Overhead HV Abandoned
Scour Valves	2.2	
Single Air Control Valve	C.A.	ESB MVLV Lines
Double Air Control Valve	Soakaway	
Water Stop Valves	Standard Outlet	MV Overhead Single Phase
	° ™ Sther; Unknown	LV Overhead Three Phase     LV Overhead Single Phase
Water Service Connections	Cleanout Type	
Water Distribution Chambers	Rodding Eye	Abandoned
Water Network Junctions	O Flushing Structure	
Pressure Monitoring Point	order Other; Unknown	Non Service Categories     Proposed
Fire Hydrant	Sewer Inlets	<ul> <li>Under Construction</li> </ul>
Fire Hydrant/Washout	E Catchpit	Out of Service
er Fittings	t Gully	<ul> <li>Decommissioned</li> </ul>
Cap	<ul> <li>Standard</li> </ul>	Water Non Service Assets
Reducer	<sup>o t</sup> e <sup>s a</sup> Other; Unknown	Water Point Feature
Тар	Sewer Fittings	Water Pipe
Other Fittings	Yent/Col	Water Structure
	o Ter Other; Unknown	Waste Non Service Assets
	Date and a second second	3 Waste Point Feature.
		····· Sewer
		<ul> <li>Waste Structure</li> </ul>

# **Irish Water Web Map**





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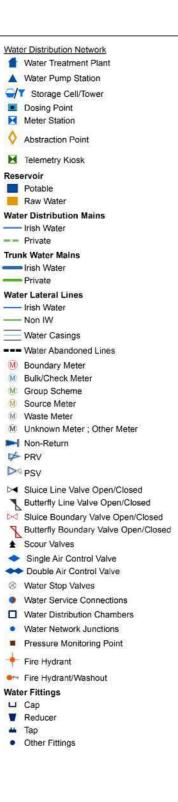
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Sewer Foul Combined Network Storm Water Network Surface Water Mains Waste Water Treatment Plant - Surface Gravity Mains A Waste Water Pump station Sewer Mains Irish Water ---- Gravity - Combined - Gravity - Foul Inlet Type --- Gravity - Unknown Gully Pumping - Combined Standard Pumping - Foul Pumping - Unknown Storm Manholes Syphon - Combined Standard Svphon - Foul O Backdrop - Overflow TT Cascade Sewer Mains Private CP Catchpit - Gravity - Combined O Bifurcation - Gravity - Foul Hatchbox -Gravity - Unknown = Pumping - Combined Lamphole Pumping - Foul ▲ Hydrobrake = Pumping - Unknown Syphon - Combined Svphon - Foul Overflow Discharge Type ----- Sewer Casings -) Outfall Sewer Manholes Overflow Standard O Backdrop III Cascade CP Catchpit O Bifurcation Hatchbox Lamphole ESB Networks Hydrobrake ESB HV Lines Other: Unknown **Discharge Type** -) Outfall Overflow ESB MVLV Lines Soakaway Standard Outlet OTĕER Other; Unknown Cleanout Type RE Rodding Eye ---- Abandoned O Flushing Structure OTHER Other: Unknown Proposed Sewer Inlets Out of Service Catchpit Standard \* Water Point Feature OT 6 ER Other; Unknown Sewer Fittings Water Structure Vent/Col Waste Non Service Assets OT Cother; Unknown \*\*\*\*\* Sewer Waste Structure

# Gully

- Surface Gravity Mains Private Surface Water Pressurised Mains Surface Water Pressurised Mains Private Other; Unknown Other; Unknown --- Storm Culverts Storm Clean Outs Stormwater Chambers Soakaway o ™ de R Other; Unknown Gas Networks Ireland ----- Transmission High Pressure Gasline --- Distribution Medium Pressure Gasline — Distribution Low Pressure Gasline ----- HV Underground -HV Overhead ----- HV Abandoned MV Overhead Three Phase --- MV Overhead Single Phase -- LV Overhead Single Phase Non Service Categories

- Under Construction
- Decommissioned
- Water Non Service Assets
- --- Water Pipe
- 🗶 Waste Point Feature

Appendix B

Stage 1 Surface Water Audit Report & Calculations

JBA Project Code2022s1082ContractFinlay Park, Naas, Co KildareClientWestar Homes Ltd.Prepared byChris Wason & Leanne LeonardSubjectStormwater Audit Stage 1 Report



## **Revision History**

Issue	Date	Status	Issued to
S3-P01	3 Oct 2022	First issue	DOBA
S3-P02	4 Nov 2022	Final issue	DOBA

### 1 Introduction

JBA Consulting have been contracted to undertake a Stage 1 SW Audit of the surface water drainage design prepared by Donnachadh O'Brien & Associates (DOBA) for the proposed above housing development on behalf of Westar Homes Ltd. In the absence of a defined audit procedure by Kildare County Council (KCC) the audit has been completed generally in accordance with Dún Laoghaire Rathdown County Council's (DLRCC) Stormwater Audit Procedure (Rev 0, Jan 2012) as set out below and taking into account KCC SuDS requirements in their Development Plan, chapter 17.8 and policy objectives in Chapter 7 (SW & WDO objectives).

The subject of this Stage 1 stormwater audit is to review the proposed surface water drainage design and sustainable urban drainage system (SuDS) proposals for the proposed development. This audit was undertaken in advance of a planning submission.

**Stage 1 – Pre Planning Stage:** A Stage 1 audit shall be carried out of the Stormwater Impact Assessment (SIA) prepared by the applicant. The audit will focus on the SUDS management train and whether the applicant has carefully considered all known SUDS techniques and applied the most appropriate type(s) for the site that will ensure improved water quality, biodiversity and volume control.

### 1.1 Report Structure

The Feedback Form in Appendix A identifies queries raised in this report which are to be answered by the Design Engineers. Once an 'Acceptable' status is achieved for each query the audit is deemed to be closed out.

The results of the audit are set out hereunder, where items raised in the feedback form are shown in **bold** within this report.

### 1.2 Relevant Studies and Documents

The following documents were considered as part of this surface water audit:

- Kildare County Council Development Plan 2017-2023
- Greater Dublin Strategic Drainage Strategy (GDSDS);
- Greater Dublin Regional Code of Practice for Drainage Works;
- The SUDs Manual (CIRIA C753).
- BRE Digest 365

### 1.3 Key Considerations and Benefits of SuDS

The key benefits and objectives of SuDS considered as part of this audit and listed below include:

- Water Quantity
- Water Quality
- Amenity
- Biodiversity

Which can be achieved by;



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- Storing runoff and releasing it slowly (attenuation)
- Harvesting and using the rain close to where it falls
- Allowing water to soak into the ground (infiltration)
- Slowly transporting (conveying) water on the surface
- Filtering out pollutants
- Allowing sediments to settle out by controlling the flow of the water

### 1.3.1 SuDs Management Train

A SuDs Management Train is a robust pollutant removal strategy. The treatment train can comprise four stages:

- 1. Prevention
- 2. Source Control
- 3. Site Control
- 4. Regional control

### Proposed Development

2

The proposed development is located on a ca. 3.17 ha greenfield site directly east of the existing Phase 1 of the Finlay Park development. The site is bounded to the north by the Oldtown Stream, to south by the Grand Canal, to the east by Phase 1 of Finlay Park and to the west by agricultural lands (see Figure 1 below).



#### Figure 1 - site location map

### 2.1 Review of SW Drainage Proposals

The review is based on the following documents provided by DOBA on 23 September;



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- C-0022-Proposed Surface Water Layout.pdf
- C-0050-Proposed Site Layout.pdf
- C-0110 Attenuation and SuDS Details.pdf
- C-0111 Proposed SuDS Details.pdf
- C-0142 Surface Water Long Sections.pdf
- Finlay Park Surface Water Design Report.pdf

### 2.1.1 Site Characteristics

The local topography of the application lands at Finlay Park is gently sloping from south to north towards the Oldtown Stream. The Oldtown Stream discharges along the northern boundary of the application site towards the River Liffey. Phase 1 of the Finlay Park development has been completed to the west of the proposed development lands. The surface water network serving the existing Phase 1 development also discharges to the Oldtown Stream.

### 2.1.2 Ground Investigation

Ground investigations Ireland undertook a preliminary site investigation in October 2020 including soakaway tests and ground water monitoring. Reasonable infiltration rates between 7x10-6 m/s and 7x10-5 m/s were noted in three locations but poor infiltration noted in one location to the north of the site. A standpipe recorded seasonal GW levels 2.0m (stated as 2.3m in the report) below the ground level of 86.5m although it is noted that groundwater ingress was noted in a number of trial holes at depths of 1.5m+.

# DOBA to confirm that the base levels of infiltration tranches are at least 1m above the expected GWL.

The SI was taken across a much larger landholding and the extract below shows the relevant test pit locations.

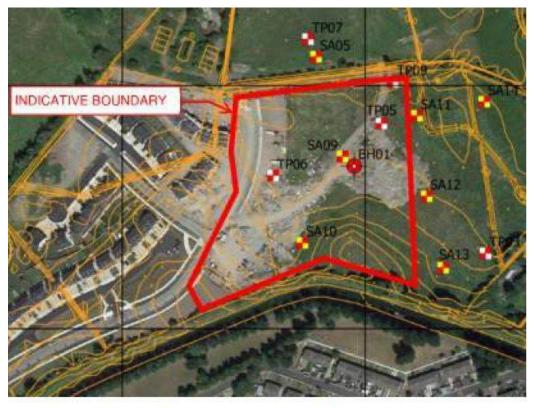


Figure 2 Extract of survey locations from GII site investigation report



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A SOIL type 2 (SPR of 0.3) has been adopted which are the same values for the site location as given in the UKSuDS website. However, the type of ground encountered in the SI would not indicate a well-drained soil and JBA would consider using a SOIL type 3 (SPR of 0.37) as being more representative.

### 2.2 Design Parameters

Rainfall parameters can be estimated using Met Eireann data, using the Flood Studies Report (FSR) values or the values in the GDSDS. The Met Eireann method can be more representative of a site if selected correctly. DOBA have adopted local values which are close enough to those arrived at by JBA from Met Eireann data.:

Rainfall parameters	Designer values	JBA Comment
M5_60	17.5	16.9 – Met Eireann
Ratio R	0.288	0.2 <b>88</b> – Met Eireann
SAAR (mm)	850	831 – Met Eireann
SPR	0.3	0.37 – from SI results
Qbar I/s	5.41	8.31

The above Qbar is based on a total site area of 2.367ha. The difference noted is due to the different assumptions of SOIL type (SPR).

An allowance of 30% for climate change has been allowed and 10% has been allowed for urban creep which exceed the requirements of GDSDS.

Phase 1 development is also draining into this site and has a pass forward flow of 5.3 l/s. Therefore, the combined pass forward flow of 5.3+5.41 = 10.71 l/s has been adopted.

Runoff factors have been applied to different surfaces but the breakdown of these surfaces is not provided and how these relate to contributing areas in the hydraulic model.

### 3 Surface Water Drainage Strategy

### 3.1.1 Site Drainage Strategy

DOBA propose a SuDs treatment train which is outlined in Appendix C with the rationale for adoption and rejection of SuDs elements.

### 3.1.2 SuDS Measures Considered

SuDS Technology	Comments
Green/Blue Roofs	Green roofs area 2022m2 and blue roofs to internal courtyard of 4244m2 are proposed.
Swale, Filter Drain, Infiltration Trench	Swales and infiltration trenches are proposed to intercept runoff from internal roads and hardstanding plaza area. Swales are referred to as bioretention swales, details to be provided by landscape architect (not provided yet). Filter systems are located below.
Tree Pits, Bioretention Areas, Rain Gardens	one tree pit is shown on the layout drawing.
Permeable Paving	permeable paving is to be provided at all car parking spaces. In the report 200mm min. of stone is to be provided but drawing 0110/P02 shows 450mm of stone <b>but also the paviours</b> are laid on 50mm of concrete bed which may not allow filtration.



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Soakaways	filter drains are proposed which will allow for infiltration to ground where this is available, but this has not been allowed for in calculations
Detention Basins, Retention Ponds, Stormwater Wetlands	Two bio retention ponds are proposed with infiltration trench beneath.
Rainwater Harvesting	non proposed.
Petrol Interceptor	A PI is proposed downstream of the flow control and prior to discharge to the watercourse.
Attenuation	An existing attenuation tank with estimated volume of 90m3 is to be relocated and reused.
	Details of this tank and confirmation of assumed design parameters should be confirmed at detailed design stage.
Other	n/a

### 3.1.3 Review of drainage drawings and SuDS drawings

The drainage drg 0022/P03 shows the connectivity of the SW network. It shows gullies and channels located on the road, which discharge to filter drains, tree pits or direct runoff to permeable paving.

### 3.1.4 Review of Hydraulic Model

The proposed surface water system has been designed using Microdrainage Design software:

- A 30% allowance for climate change has been included in the design.
- An allowance of 10% for urban creep has been provided for
- The total increase is 40% which exceeds the requirement of the GDSDS of 10%
- Default Cv values of 0.75 (summer) and 0.84 (winter) have been changed to 1 and reduced values applied to each surface type.
- M5-60 and r values are not fully representative of the local Met Eireann data (see above table of comparisons) and these should be used although it is likely that they will make little difference.
- The total impermeable area modelled is 1.044ha which is different for the site area used for the Qbar calculation of 2.367 ha. 0.4448 ha. is designed to go to ground via soakaways. This would make a total area of 1.5 ha. accounted for. CIRIA states that only areas that are contributing to the collection system should be included in the Qbar assessment so this anomaly should be clarified.
- A controlled flow of 5.3 l/s is discharged from the adjacent site but no allowance appears to have been made in the model for this flow. This could be input as a base flow (conservative) or actual area with Tc applied at the node if not allowed for.
- The podium area (blue roof) has been modelled with a ground level of 87m whereas the actual podium area GL is 90.65m. Have the flow control(s) at SMH1.01 & SMH3.01 been represented properly in the model for the actual head?
- SMH1.05 flow control has been modelled with a 500mm head to represent the filter media storage but additional storage is provided by the bio pond with a TWL of 86.1m, which





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would represent a head of approximately 0.9. In the report 200mm min. of stone is to be provided is the flow control and storage configuration represented in the model correctly? The model is based on a free-flowing outfall. DOBA should confirm that the outfall will not be surcharged.

#### 3.1.5 Infiltration trenches

Infiltration trenches are proposed at five locations across the lower half of the site adjacent tot the roadway. Soakage test across the extended land bank show variable test results. DOBA have assumed the worst of the soakage test results for the trench soakaway design of 7.2x10-6 m/s. Trenches are typically 1.5m deep so the water table should be 2.5m below ground level. Soakage test SA10 would appear to be the most closely located test hole to the majority of proposed filter drain soakaways and GW was located at 1.5m BGL. Also, the standpipe tests would indicate a GWL of 2m below ground level. BRE method of design adopted which has in built FoS due to 100% runoff used and base area excluded.

The total area draining to the soakaways is 0.4448 ha.

DOBA should confirm that the soakaways as proposed are suitably located at least 1m above the water table and that 100% of the impermeable area is used rather than a factored reduction as identified in the report.

#### 3.1.6 Interception/Treatment

Interception of runoff is intended to prevent any runoff for small rainfall events which are less than 5mm (and up to 10mm if possible). Treatment of 15mm is required if interception is not provided.

Table 24.6 of the CIRIA manual provides indication of deemed to satisfy criteria and it is considered that this should be complied with. All sources of runoff should also be intercepted where possible. A high level of Interception provided for some parts of the site is not to be considered as adequate compensation for a low degree of interception provision for other locations. Compliance is required for the whole site, or at least for road/paved areas, for it to be considered effective. Interception mechanisms are based on runoff retention. This can be achieved using rainwater harvesting or using soil storage and evaporation. Either infiltration or transpiration rates can dispose of the runoff from minor events to enable the next event to be captured.

DOBA have indicated on drg 0050/P01 in the report the areas and proposed methods of interception and a table treatment analysis based on volumetrics. A total volume of treatment provided is indicated as 367m3 and that required for 5mm of rainfall over 1.399 ha. as 70m3. However, this is not necessarily the correct analysis to use and is not based on the CIRIA C753 s 24.6 methodology but by inspection of the proposals the proposals are deemed to satisfy the guidelines for interception of flow.

### 3.2 Health & Safety and Maintenance Issues

The proposed drainage system comprises SuDS devices, traditional road gullies, manholes, attenuation systems, oil interceptors and underground pipes. These elements are considered acceptable from a Health & Safety perspective once supplier/manufacturers guides are followed and complied with during the detailed design, construction, and operation.

Optimum performance of the SUDs treatment train is subject to the frequency of maintenance provided. At detailed design stage, it is recommended that a maintenance regime be adopted.

Particular consideration is required at detailed design stage to the design, maintenance requirements and whole life plan (and replacement) of the SuDS system as a whole.

Regular maintenance of the hydrobrake will be required to remove any blockages, particularly in the wake of heavy rainfall events or local floods.

It is recommended that the oil interceptors be fitted with an audible high-level silt and oil alarm for maintenance and safety purposes. Regular inspection and maintenance is recommended for the oil





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#### interceptors.

Please note that silt and debris removed from the oil interceptor during maintenance will be classified as contaminated material and should only be handled and transported by a suitably licensed contractor and haulier and disposed of at a suitably licensed landfill only.

DOBA have outlined in s4 their proposals for an operation and maintenance regime.

### 4 Design Review Process & Audit Results

This report outlines the review of the initial submission by DOBA and JBA comments are also included in the Audit Feedback Form in Appendix A. This feedback form shows the audit trail and the responses from the designer. When answers to queries have been considered "Acceptable" then the audit is considered to be closed out. Some queries may be considered acceptable subject to Local Authority Agreement.

JBA Consulting's comments have been satisfactorily addressed, with the following items to be considered at detailed design stage:

- Two MicroDrainage scenarios have been provided, as described below:
  - Scenario 1 Models the system using the design invert level of 84.62m at the outfall. No surcharging has been applied at the outfall despite the 1% AEP flood level being 84.93m (from the SSFRA). (Note: Drawing C-0020-P07 shows an invert level of 84.50m at the outfall. This should be corrected prior to planning submission).
  - Scenario 2 Models the system using a raised invert level of 85.02m (overflow level), which mimics a blockage at the lower outfall. A flow control device has been applied, which would not be typical for an overflow.

Although the modelling approach does not explicitly represent a surcharged outfall with a high level overflow, the results are not expected to vary significantly and are considered suitable for a Stage 1 Planning submission. It is recommended that the model is updated at detailed design stage to include the surcharged depth on the lower outfall, and a weir to represent the overflow. The designer has confirmed via phone call that there is scope to increase the attenuation structures if required following this updated modelling.

- It is proposed to re-use an existing attenuation tank. Details of this tank, including a cross section through it, should be provided at detailed design stage.
- Both aerial reduction factors and Cv values have been used in the MicroDrainage model. This approach should be agreed with Kildare County Council as the approving authority.

## 4.1 Audit Report sign Off

Audit Report

Cloque

Prepared by:

Chris Wason BEng CEng MICE Principal Engineer

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JBA Project Code Contract Client Prepared by Subject 2022s1082 Finlay Park, Naas, Co Kildare Westar Homes Ltd. Chris Wason & Leanne Leonard Stormwater Audit Stage 1 Report



Pul Browne

Approved by:

Paul Browne BEng (Hons) MIEI Design Engineer

#### Note:

JBA Consulting Engineers & Scientists Ltd. role on this project is as an independent reviewer/auditor. JBA Consulting Engineers & Scientists hold no design responsibility on this project. All issues raised and comments made by JBA are for the consideration of the Design Engineer. Final design, construction supervision, with sign-off and/or commissioning of the surface water system so that the final product is fit for purpose with a suitable design, capacity and life-span, remains the responsibility of the Design Engineers.



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Appendix A – Audit Feedback Form



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JBA Consulting S	JBA Consulting Stormwater Audit - Stage 1 Feedback Form	
Project:	Stage 1 SWA, Finlay Park, Naas, Co Kildare	
Date:	04/11/2022	
JBA Reviewers	Chris Wason & Leanne Leonard	
Status	S3/P03	
Project Number:	2022s1082	

Item No.	JBA Review Comment	Comment/Clarification Request/Suggested Mitigation	Response from Client/Client Representative	Acceptable / Not Acceptable
	03/10/2022	03/10/2022	14/10/2022	
Ref Docs	see report			
1	Groundwater levels have been monitored for seasonal variation noted at 2.0m (stated as 2.3m in the report) and in tyets pits at 1.5m BGL.	DOBA to confirm that the base levels of infiltration trenches are at least 1m above the expected GWL.	The existing ground level where borehole BH01 was carried out is approx. +86.50m. As such, the groundwater level is at approx. +84.50m. The infiltration trenches have been designed to provide a minimum of 1m from the base of the trenches to the groundwater level.	Acceptable
2		DOBA to confirm that SOIL type2 (SPR 0.3) is representative for the ground conditions on site.	DOBA have taken a conservative view in relation to the SOIL type and the Qbar calculation.	Acceptable
3		Runoff factors have been applied to different surfaces but the breakdown of these surfaces is not provided and how these relate to contributing areas in the hydraulic model.	A sketch has been prepared to indicate what areas are included in the hydraulic model with the associated runoff factors and is included in the report.	Acceptable
4	Permeable paving is proposed in carparking areas	permeable paving paviours are laid on 50mm of concrete bed which may not allow filtration. DOBA to comments?	This was a typo on the section - should have read laying course. The section on drawing C-0110 has been updated.	Acceptable
5	proposed to reuse an existing attenuation tank	Can details of the existing tank be provided at detailed design stage?	The location of the existing attenuation tank is illustrated on drawing C-0001. The as-constructed drawings suggest it is a parabolic arched type system.	Acceptable. Cross section to be provided at detailed design stage.
6	<ul> <li><u>Hydraulic Model</u></li> <li>1 M5-60 value is not fully representative of the local Met Eireann data (see above table of comparisons) and these should be used although it is likely that it will make little difference.</li> <li>2 The total impermeable area modelled is 1.044ha which is different for the site area used for the Qbar calculation of 2.367 ha. 0.4448 ha. is designed to go to ground via soakaways. This would make a total area of 1.5 ha. accounted for. CIRIA states that only areas that are contributing to the collection system should be included in the Qbar assessment so this anomaly should be clarified.</li> <li>3 A controlled flow of 5.3 I/s is discharged from the adjacent site but no allowance appears to have been made in the model for this flow. This could be input as a base flow (conservative) or actual area with Tc applied at the node if not allowed for.</li> <li>4 The podium area (blue roof) has been modelled with a ground level of 87m whereas the actual podium area GL is 90.65m. Have the flow control(s) at SMH1.01 &amp; SMH3.01 been represented properly in the model for the actual head?</li> <li>•5 MH1.05 flow control has been modelled with a 500mm head to represent the filter media storage but additional storage is provided by the bio pond with a TWL of 86.1m, which would represent a head of approximately 0.9. In the report 200mm min. of stone is to be provided is the flow control and storage configuration represented in the model correctly?</li> <li>6 The model is based on a free-flowing outfall. DOBA should confirm that he outfall will not be surcharged.</li> </ul>	DOBA to comment	<ol> <li>The Met Eirann data has been updated.</li> <li>Please refer to the sketch mentioned in response to Item No. 3 above, depicting areas included in the hydraulic model and the infiltration trenches which are included in the hydraulic model as flow through structures. The entire area used for the Qbar calculation has been included in the hydraulic model. The areas have runoff factors applied to them based on the surface type.</li> <li>A catchment area and hydrobrake have been added to the model to account for the 5.3 l/s from the exisiting adjacent site.</li> <li>The design head for the blue roof assumes a depth of approx. 100mm for the attenuation build up. The blue roof has been modelled at ground level in the Microdrainage analysis.</li> <li>The model has been revised to reflect 0.9 metres of head above the hydrobrake.</li> <li>A high level overflow is included in the last hydrobrake manhole and at the headwall to allow a discharge into the watercourse above the 100 year flood level (+84.93m taken from the JBA report)</li> </ol>	1) Acceptable 2) See Notes 8 & 9 3) See Note 10 4) Acceptable 5) Acceptable 6) See Note 11

JBA Consulting Stormwater Audit - Stage 1 Feedback Form			
Project:	Project: Stage 1 SWA, Finlay Park, Naas, Co Kildare		
Date:	04/11/2022		
JBA Reviewers	Chris Wason & Leanne Leonard		
Status	S3/P03		
Project Number:	2022s1082		

Item No.	JBA Review Comment	Comment/Clarification Request/Suggested Mitigation	Response from Client/Client Representative	Acceptable / Not Acceptable
	03/10/2022	03/10/2022	14/10/2022	
7	<ul> <li><u>Soakaway Calculations</u></li> <li>1 30% climate change has been allowed for but there is no allowance for urban creep.</li> <li>2 It is not known if reduced runoff factors are accounted for in the soakaway calculations catchment areas. The BRE method assumes 100% runoff from impermeable areas as part of the in built FoS</li> </ul>	DOBA to comment 1 is UC to be included in the infiltration calculations? 2 are 100% impermeable areas allowed for in the infiltration calculations	<ol> <li>40% climate change was included in the Microdrainage design criteria to include the 10% urban creep factor.</li> <li>The runoff from the permeable and impermeable areas discharging to the infiltration trenches have been designed in accordance with GDSDS. 80% has been assumed for the impermeable areas and 30% has been included for the permeable areas.</li> </ol>	1) Acceptable 2) Acceptable subject to Kildare County Council Agreement.
	19/10/2022	19/10/2022	25/10/2022	
Ref Docs	C-0020-Surface Water Layout.pdf C-0050 Site Layout.pdf C-0110 Proposed Attenuation and SUDS Details.pdf C-0111 Proposed SuDS Details.pdf C-0142 Surface Water Long Sections.pdf Finlay Park_ Naas.msg IWM-JBAI-XX-XX-AU-C-0002-S3-P01.03-St1_SW_Audit_Feedback_Form.xlsx			
8	It is noted that runoff factors are provided in S2.3.1 of the DOBA report however, a full breakdown stating the area of each contributing surface would be helpful to explain how the contributing area of 1.512 Ha (updated from 1.044 Ha) was arrived at.	DOBA to consider providing table outlining the catchment area, the runoff factor applied and the resulting equivalent impermeable area for eachs surface type.	A table ('Drainage Catchment Areas and Runoff Factors') has been added to the report (Appendix B), summarizing the catchment areas and runoff factors for each surface type.	Acceptable
9	DOBA to confirm that areas deemed not to contribute to the network, are not includedin the Qbar calculation. Furthermore, if areas are infiltrating to ground they should not be included in the Qbar calculation.	DOBA to review and update as necessary.	The Qbar calculation has been revised to remove areas infiltrating to the ground and the release rate in the Microdrainage model has been updated accordingly.	Acceptable
10	It is noted that the catchment area in the MD model has increased from 1.044 Ha to 1.512 Ha. Does the additional 0.468 Ha represent the upstream catchment or how has the inflow been modelled? If so, is it representative of the actual site area or have reduction factors been applied?	DOBA to clarify.	The catchment areas in the Microdrainage model are representative of the site areas with the applied runoff factors. Refer to table mentioned in the response to Item No. 8 for a summary of the catchment areas and runoff factors. The Microdrainage results table show a total Imp. Area of 1.525 ha, which includes 0.021 ha from existing Finlay Park Phase 1 (Pipe 3.00), resulting in a proposed site Imp. Area of 1.50 ha, which corresoponds with table mentioned in Item No. 8.	Acceptable
11	While a high level overflow should prevent flooding within the model, if the outfall will be surcharged this should be represented within the model to ensure adequate attenuation volume is provided.	DOBA to review and clarify.	A separate high level overflow Microdrainage model was included in the report to model the condition where the watercourse level was above the normal pipe outlet level. There is a non-return valve on the normal pipe outlet level which will not allow the watercouse to surcharge back into the site surface water network. Refer to detail on Drawing C 0110.	Acceptable
12	The infiltration trenches in the MD model use a safety factor of just 2.0. Table 25.2 in CIRIA C753 recommends a safety factor of 10 when the consequence of failure is damage to buildings or structures, or major inconvenience (eg flooding of roads).	DOBA to review and update as necessary.	The infiltration trenches have been designed with a high level overflow into the piped network and there is also a high level overflow from the piped network at the outlet to the watercourse. We have designed the system for the 1 in 100 year event, plus 30% climate change and 10% urban creep and there is no flooding in the system, so there will be no flood risk to the roads and infrastructure, therefore a FOS of 2.0 is justified. In the event that the infiltration trenches are exceeded, the piped network will convey the flow to the watercourse, if this were to fail, the road network positively drains from the south of the site to the existing watercourse to the north.	Acceptable
13	Climate change has not been applied to the simulation runs.	DOBA to review and update as necessary.	A climate change factor of 30% and an urban creep factor of 10% (combined 40%) are included in the simulation runs. The design criteria in the Microdrainage models has been outlined in red in the report for clarification purposes.	Acceptable

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# JBA Consulting

# **Surface Water Design Report**

Housing Development at Finlay Park, Naas, Co. Kildare

September 2022

# **Document Control**

Document:		Surface Wa	Surface Water Design Report					
Projec	t:	Developme	Development at Finlay Park, Naas, Co. Kildare					
Client:		Westar Hor	• •	,				
Job Nu	ımber:	DOBA 2110						
File Or	igin:	File:						
		Finlay Park	Surface Water Desig	gn Report.doc				
		Location:	Location:					
			Z:\Projects\DOB&A Projets\2021 Projects\DOBA 2110 – Finlay Park\08 Reports & Specifications\8.15 SW Audit \2022.10.19 JBA Response					
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Autho	r	Steve Pa	Steve Pangburn		Star Par			
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# DONNACHADH O'BRIEN

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& ASSOCIATES CONSULTING ENGINEERS

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### Appendices

Appendix A – Site Investigation Reports Appendix B – Surface Water Calculations Appendix C – SuDS Treatment Train Appendix D –Runoff Factor Sketch

Appendix E – Blue Roof Reference Information

# 1 Introduction

Donnachadh O'Brien and Associates Consulting Engineers Ltd. (DOBA) act on behalf of Westar Homes Ltd. and provide this report and relevant surface water strategy and design information to enable an independent surface water audit to be prepared by JBA Consulting.

The proposed development is located on a ca. 3.17 ha greenfield site directly east of the existing Phase 1 of the Finlay Park development. The site is bounded to the north by the Oldtown Stream, to south by the Grand Canal, to the east by Phase 1 of Finlay Park and to the west by agricultural lands (see Figure 1 below). The local topography of the application lands at Finlay Park is gently sloping from south to north towards the Oldtown Stream.



Figure 1 Site Location Map

The following drawings are included with this report

- C-0020 Proposed Surface Water Layout
- C-0050 Proposed Site Layout
- C-0110 Proposed Attenuation and SuDS Details
- C-0111 Proposed SuDS Details
- C-0142 Surface Water Long Sections

# 2 Surface Water Design

## 2.1 Existing Storm Water Drainage

As noted above, the topography of the site slopes from south to north towards the Oldtown Stream. The Oldtown Stream discharges along the northern boundary of the application site towards the River Liffey. Phase 1 of the Finlay Park development has been completed to the west of the proposed development lands. The surface water network serving the existing Phase 1 development also discharges to the Oldtown Stream.

## 2.2 Existing Ground Conditions

Ground Investigations Ireland were commissioned by Westar Group to carry out preliminary site investigations across their entire land holding. A number of these investigations are in the vicinity of the proposed development site – namely TP05, TP06, TP09 and SA09, SA10, SA11 & SA12 (see Figure 2 below). The site investigation reports are included in Appendix A.

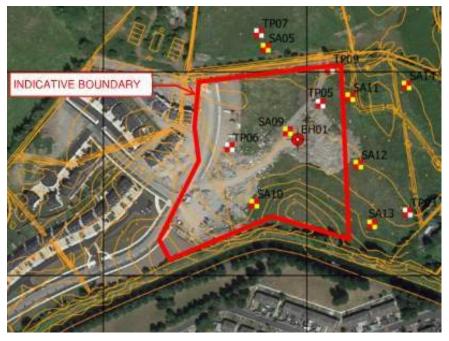


Figure 2 Extract of survey locations from GII site investigation report

**Trial Pits to 2.5m BEGL:** The ground conditions encountered in the trial pits excavated were generally consistent across the site. Made Ground was encountered in a number of trial pits to a maximum depth of 0.40m. Cohesive soils described as brown sandy slightly gravelly CLAY were encountered in the shallow soils overlying granular soils described as grey brown clayey gravelly SAND overlying slightly clayey sandy fine to coarse subangular to subrounded GRAVEL.

**BRE Digest 365 soakaway tests:** Infiltration tests in accordance with BRE Digest 365 were carried out on the site to a depth of up to 1.5m. Reasonable infiltration rates between  $7 \times 10^{-6}$  m/s and  $7 \times 10^{-5}$  m/s were noted in locations SA09, SA10 and SA12 within the proposed development site. Deeper infiltration SuDS techniques may be suitable in these locations. The water levels in the tests at SA11 dropped too slowly to record an infiltration rate. As such, unlined tree pits and permeable paving beneath private car parking areas may be suitable to utilise high level planar infiltration in this area.

**Groundwater monitoring:** GII also installed a standpipe in the site in August 2021 with a data logger to monitor ground water levels over a summer and winter period. The results are also included in Appendix B and indicate that groundwater levels rose to approx. 2.30m below existing ground level (ground level at the borehole location is approx.. +86.50m).

### 2.3 Proposed Storm Water Drainage

The design and management of surface water for the proposed development will comply with the policies and guidelines outlined in the Greater Dublin Strategic Drainage Study (GDSDS), CIRIA C753 SuDS Manual and shall be in compliance with the Kildare County Development Plan surface water and drainage policies.

"Micro Drainage", which is an industry standard tool for design and assessment of gravity sewer drainage networks, has been used to simulate the proposed storm conveyance network. Calculations for the proposed Storm Network is attached in Appendix B of this report.

The proposed surface water drainage details are indicated on the following drawings:

- C-0020 Proposed Surface Water Drainage Layout
- C-0110 Proposed Attenuation and SuDS Details
- C-0111 Proposed SuDS Details
- C-0142 Surface Water Long Sections

### 2.3.1 Key Design Parameters

The design parameters used for the proposed development are listed below.

- Minimum depth: 1.2m cover under roadways (where possible)
- Maximum depth: 5m
- Minimum pipe size for main SW drainage: 225mm
- Runoff factors:
  - o Roofs 95%
  - Blue Roofs 80%
  - Green Roofs 60%
  - Other hardstanding 80%
  - Green areas 30% (SOIL Type 2)

- Max. velocity: 3.0 m/s
- Min. velocity: 0.75 m/s
- Pipe Roughness: 0.6mm
- Max allowable discharge rate: 10.7 l/s
- Climate change allowance: 30% (Applied to Microdrainage Model and Infiltration Trenches)
- Urban Creep Allowance: 10% (Applied to Microdrainage Model)
- Cv values = 1.0

### 2.4 Proposed Sustainable Urban Drainage Systems (SuDS) Strategy

The principles of the KCC WSD draft Guidance on Drainage and SuDS Strategy treatment train approach have been adopted in the design of the proposed development surface water drainage infrastructure. The elements of the treatment train include the following:

- Nature Based Solutions:
  - Retention Pond / Bio Retention Areas
  - o Bioswales
  - o Green Roof
  - o Blue Roof
  - o Green Wall
  - o Tree Pits
- Infiltration System SuDS:
  - o Unlined Tree Pits
  - o Unlined Permeable Paving
  - o Infiltration Trenches
- Filtration System SuDS:
  - o Filter Drains
- Detention Systems SuDS:
  - Lined Underground Attenuation (relocation of an existing underground attenuation tank)
- Proprietary Treatment Systems:
  - Petrol / Oil Separator

A justification for proposing the SuDS treatment train identified above is included in Appendix C with a clear and plausible rationale provided for not considering other SuDS systems. The above SuDS systems will ensure improved water quality, reduce run off into the existing watercourses and reduce the risk of downstream flooding within the existing storm water network and receiving water course.

# 3 GDSDS Drainage Criterion

The design of sustainable drainage systems, as per Chapter 6 of the Greater Dublin Strategic Drainage Study (GDSDS), is set out below and describes the performance of the proposed surface water drainage system when measured against the relevant GDSDS drainage criterion, namely

- Criterion 1 River Quality Protection
- Criterion 2 River Regime Protection
- Criterion 3 Level of Service (flooding) for the Site
- Criterion 4 River Flood Protection

### 3.1 Criterion 1 - River Quality Protection

#### Objective

Interception storage of at least 5mm, and preferably 10mm, of rainfall where run-off to the receiving water can be prevented.

The 5mm rainfall event on site will be intercepted for most of the proposed development without discharging to the public system. A sketch is included in Appendix D of this report to identify the areas of the site which have been intercepted prior to discharge off site. A petrol interceptor has been included at the outfall to the watercourse to provide a final level of treatment prior to discharge from the site.

The interception volumes have been calculated in accordance with Table 24.6 of the CIRIA C753 SuDS manual and is described as follows:

- <u>Permeable paving</u> is proposed for all parking spaces and has been designed to intercept the runoff from the adjacent roads. The permeable paving will have a minimum depth of 200mm of granular material for storage / infiltration. As such, the interception volume available in a typical 2.5m x 6m car parking bay is:
  - 200mm depth of 40% void stone beneath permeable paving @ 15m<sup>2</sup> = 1.2m<sup>3</sup> interception storage per permeable pavement parking space;
- <u>Tree Pits</u> are proposed to intercept runoff from the road network. Allowing for 200mm depth of storage beneath the overflow pipe:
  - 1.5m (W) x 1.5m (L) x 0.2m (D) x 40% voids = 0.18m<sup>3</sup> per tree pit
- <u>Green Roofs</u> are proposed on min. 60% of the proposed apartment roof areas. All of the green roof surface areas are considered to provide interception. The Green Roof areas (and standard roof areas) will discharge to the podium Blue Roof, where additional attenuation will be provided:
  - $\circ ~~ \mbox{Total Green Roof area provided: 2022} ~m^2$

- <u>Blue Roof</u> is proposed to intercept runoff from the proposed podium level and also the green roof and standard roof areas. All blue roof areas are considered to provide interception along with 150mm depth of storage:
  - o Total Blue Roof area provided: 4244 m<sup>2</sup>
- <u>Infiltration Trenches</u> (including beneath dry bioswales and permeable paving) are proposed to intercept runoff from the internal roads and the hardstanding plaza area. Roads drained by infiltration trenches can be assumed to provide interception (Per CIRIA SuDS Manual 2015, Table 24.6). The interception storage available is (based on trench dimensions):
  - Infiltration Trench A: 1m (L) x 1.25m (W) x 1.5m (depth) x 40% voids = 0.75m<sup>3</sup> / m of infiltration trench
  - Infiltration Trench B, C: 1m (L) x 1m (W) x 1.5m (depth) x 40% voids = 0.6m<sup>3</sup> / m of infiltration trench
  - Infiltration Trench D: 1m (L) x 1.5m (W) x 1.5m (depth) x 40% voids = 0.9m<sup>3</sup> / m of infiltration trench
- <u>Bio Retention Ponds</u> are proposed to intercept runoff from portions of hardstand paved areas and attenuated runoff from the blue roof podium. There are two bio retention areas on the site with the vegetated surface areas provided of:
  - East bio retention area: 340 m<sup>2</sup>
  - West bio retention area: 126 m<sup>2</sup>

The total hard standing area within the site is 14,710 m<sup>2</sup>; for a 5mm interception storage depth, 74 m<sup>3</sup> of interception storage is required. Based on the interception treatment measures discussed above, a total interception storage of 350 m<sup>3</sup> is provided. Interception storage calculations are included in Appendix B.

### 3.2 Criterion 2 - River Regime Protection

### Objectives

2.1 Discharge rate equal to 1-year Greenfield site peak runoff rate or 2 l/s/Ha, whichever, is the greater. Site critical duration storm to be used to assess attenuation volume.

2.2 Discharge rate equal to 1 in 100 year Greenfield site peak run off rate. Site critical duration storm to be used to assess attenuation storage volume.

### Proposals

The surface water network has been designed to comply with these sub-criterion. A portion of the existing Finlay Park surface water network is being re-routed within the proposed development site including relocation of an existing underground attenuation tank. The existing greenfield runoff flow for the existing Finlay Park development being re-routed is 5.3 l/s (taken from the planning application information Ref: 13500055).

Qbar for the proposed site has been calculated in accordance with GDSDS based on the following calculation:

QBAR<sub>rural</sub> = 0.00108AREA<sup>0.89</sup>SAAR<sup>1.17</sup>SOIL<sup>2.17</sup>

Qbar for the proposed development site is 3.45 l/s. The site boundary assumed for the Qbar calculation is highlighted below in blue.



As such, the overall discharge assumed for the design of the proposed surface water network is as follows:

- Existing Finlay Park development = 5.30 l/s
- Proposed development = 3.45 l/s
- Sum of both discharge rates = 8.75 l/s

The surface water runoff from the site to the existing watercourse will be restricted via a flow control device fitted to the discharge manhole.

## 3.3 Criterion 3 - Level of Service (flooding) for the Site

#### Objectives

3.1 No flooding on site except where specifically planned flooding is approved. Summer design storm of 15 or 30 minutes are normally critical.

3.2 No internal property flooding. Planned flood routing and temporary flood storage accommodation on site for short high intensity storms. Site critical duration events.

3.3 No internal property flooding. Floor levels at least 500mm above Maximum River level and adjacent on-site storage retention.

3.4 No flooding of adjacent urban areas. Overland flooding managed within the development.

#### Proposal

Engineering calculations included in DOBA drainage design report demonstrate that no pluvial out-of-manhole flooding of the proposed surface network occurs for storms up to and including a 1 in 100 Year plus 30% Climate Change event along with a 10% urban creep factor (both applied to the Microdrainage model). The proposed FFL for the apartment building is +87.00mOD. The highest top of water level for a 1:100 Year plus 30% Climate Change storm and 10% urban creep adjacent to the parking garage is +85.9 mOD. As such, a minimum of 1m freeboard has been provided to the FFL.

A high-level overflow is to be installed in the discharge manhole from the development to mitigate the risk of a storm exceeding a 1:100-year event plus 30% Climate Change and 10% urban creep event / the outfall becoming blocked. The internal road network will provide an overland flow path towards the watercourse.

The south part of the site will be intercepted by swales or permeable paving with infiltration trenches beneath, as depicted on the Proposed Surface Water Layout drawing (C-0020). Infiltration calculations are included in Appendix B which show sufficient infiltration capacity for the 1:100 year event plus 30% Climate Change. A high-level overflow will be provided for the infiltration system in the event of a storm exceeding the 1:100 year event plus 30% climate change / the infiltration trench failing.

### 3.4 Criterion 4 - River Flood Protection

### Objectives

4.1 Long-term floodwater accommodated on site for development runoff volume is in excess of the Greenfield volume. Temporary flood storage drained by infiltration on a designated flooding area brought into operation by extreme flood events only. 100 year, 6 hour duration storm to be used for assessment of the additional volume of runoff.

4.2 Infiltration storage provided equal in volume to long term storage and usually designed to operate for all events.

4.3 Maximum discharge rate of Qbar or 2 I/s/Ha, whichever is the greater, for all attenuation storage where separate long-term storage cannot be provided.

#### Proposals

As noted above, Qbar has been calculated for the proposed development site to match the greenfield runoff rate. As such, there is no requirement for long-term storage to limit the impact on the receiving watercourse.

## 4 Proposed Management & Maintenance of SuDS Features

The management and maintenance of the proposed surface water system and associated SuDS features for the entire site is the responsibility of the proposed development's Management Company. The regular maintenance and cleaning of the SuDS features shall ensure adequate performance and a recommended program is outlined below in Table 1 through Table 5. A detailed maintenance schedule for each SuDS feature shall be prepared as part of the overall site management strategy.

SuDS Feature	Maintenance			
	Potential	Failure of components, blockage from debris		
	Issues	railure of components, blockage from debris		
	Period	Task	Frequency	
Attenuation Tank	Regular	Inspect and identify non-operating features. Remove sediment/ debris.	Monthly or as required.	
Attenuation fails	Remedial Work	Repair outlets, inlets, control devices	As required	
	Monitoring	Inspect all outlets, inlets, overflows, control devices, etc. Physically survey inside of tank for sediment build up and remove as necessary	Annually or after severe storms	

Table 1 Attenuation	Tank Maintenance Programme

Table 2 Permeable Paving Maintenance Programme

SuDS Feature	Maintenance			
	Potential Issues	Failure of components, blockage from debris		
	Period	Task	Frequency	
Permeable Paving	Regular	Brushing/ sweeping of surfaces and cleaning of joints	Monthly or as required.	
Paving	Remedial Work	Remediation work to any depressions, rutting, cracking or damaged paving slabs/ blocks	As required	
	Monitoring	Inspect silt accumulation and determine appropriate maintenance intervals	Annually	

#### Table 3 Tree Pit/ Swale - Infiltration Trench Maintenance Programme

SuDS Feature	Maintenance		
	Potential	Failure of components, blockage from debris	
	Issues	Failure of components, blockage from debris	
	Period	Task	Frequency
Tree Pit / Swale	Regular	Remove debris, manage vegetation, inspect inlets, outlets, overflows, inspect infiltration material, inspect silt accumulation	Monthly or as required.
	Remedial Work	Remove sediment build-up, repair erosion or other damage, maintain design levels	As required
	Monitoring	Inspect silt accumulation and determine appropriate maintenance intervals	Annually

Table 4 Bio Retention Maintenance Programme

SuDS Feature	Maintenance			
	Potential Issues	Failure of components, blockage from debris		
	Period	Task	Frequency	
Tree Pit / Swale	Regular	Remove debris, manage vegetation, inspect inlets, outlets, overflows, inspect infiltration material, inspect silt accumulation, maintain plants	Monthly or as required.	
Thee Pit / Swale	Remedial Work	Remove sediment build-up, repair erosion or other damage, maintain design levels, replace plants, remove and replace filter medium (> 20 years)	As required	
	Monitoring	Inspect all components, check operations of underdrains, and determine appropriate maintenance intervals	Annually	

#### Table 5 Green Roof/Blue Roof Maintenance Schedule

SuDS Feature	Maintenance			
	Potential Issues	Failure of components, blockage from debris		
	Period	Task	Frequency	
	Regular	Remove debris, manage vegetation, inspect inlets, outlets, overflows	Monthly or as required.	
Tree Pit / Swale	e Remedial Work Monitoring	Remove sediment build-up, repair erosion or other damage, maintain design levels, repair settled/cracked drain inlets, removed nuisance weeds, replace dead plants, mow grasses	As required	
		Inspect silt accumulation and determine appropriate maintenance intervals, inspect irrigation systems, membranes, and roof structure.	Annually	

# 5 Conclusion

The purpose of this report is to provide an overview of the design approach to the surface water design auditor, JBA Consulting. This report summarizes the surface water design, including the Sustainable Urban Drainage Systems (SuDS) strategy, incorporated within the proposed development.

Appendix A

Site Investigation Reports



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# **Ground Investigations Ireland**

Finlay Park

Westar Group

# **Ground Investigation Report**



Directors: Fergal McNamara (MD), James Lombard, Conor Finnerty, Aisling McDonnell & Barry Sexton Ground Investigations Ireland Limited | Registered in Ireland Company Regsitration No.: 405726



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Ground Investigations Ireland Ltd. present the results of the fieldworks and laboratory testing in accordance with the specification and related documents provided by or on behalf of the client The possibility of variation in the ground and/or groundwater conditions between or below exploratory locations or due to the investigation techniques employed must be taken into account when this report and the appendices inform designs or decisions where such variation may be considered relevant. Ground and/or groundwater conditions may vary due to seasonal, man-made or other activities not apparent during the fieldworks and no responsibility can be taken for such variation. The data presented and the recommendations included in this report and associated appendices are intended for the use of the client and the client's geotechnical representative only and any duty of care to others is excluded unless approved in writing.





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## **GROUND INVESTIGATIONS IRELAND**

**Geotechnical & Environmental** 

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### APPENDICES

Appendix 1	Site Location Plan
Appendix 2	Trial Pit Records
Appendix 3	Soakaway Records



#### 1.0 Preamble

On the instructions of Westar Group, a site investigation was carried out by Ground Investigations Ireland Ltd., in September 2020 at the site of the proposed residential development in Naas, Co. Kildare.

#### 2.0 Overview

#### 2.1. Background

It is proposed to construct a new residential development with associated services, access roads and car parking at the proposed site. The site is currently greenfield however a portion in one corner of the site is occupied by a temporary car park and site compound. The proposed construction is envisaged to consist of conventional foundations and pavement make up with some local excavations for services and plant.

### 2.2. Purpose and Scope

The purpose of the site investigation was to investigate subsurface conditions utilising a variety of investigative methods in accordance with the project specification. The scope of the work undertaken for this project included the following:

- Visit project site to observe existing conditions
- Carry out 11 No. Trial Pits to a maximum depth of 2.60m BGL
- Carry out 16 No. Soakaways to determine a soil infiltration value to BRE digest 365
- Report with recommendations

### 3.0 Subsurface Exploration

#### 3.1. General

During the ground investigation a programme of intrusive investigation specified by the Consulting Engineer was undertaken to determine the sub surface conditions at the proposed site. Regular sampling and insitu testing was undertaken in the exploratory holes to facilitate the geotechnical descriptions and to enable laboratory testing to be carried out on the soil samples recovered during excavation and drilling. The procedures used in this site investigation are in accordance with Eurocode 7 Part 2: Ground Investigation and testing (ISEN 1997 – 2:2007) and B.S. 5930:2015.

### 3.2. Trial Pits

The trial pits were excavated using a 5T tracked excavator at the locations shown in the exploratory hole location plan in Appendix 1. The locations were checked using a CAT scan to minimise the potential for encountering services during the excavation. The trial pits were sampled, logged and photographed by an

Engineering Geologist prior to backfilling with arisings. Notes were made of any services, inclusions, pit stability, groundwater encountered and the characteristics of the strata encountered and are presented on the trial pit logs which are provided in Appendix 2 of this Report.

#### 3.3. Soakaway Testing

The soakaway testing was carried out in selected trial pits at the locations shown in the exploratory hole location plan in Appendix 1. These pits were carefully excavated and filled with water to assess the infiltration characteristics of the proposed site. The pits were allowed to drain and the drop in water level was recorded over time as required by BRE Digest 365. The pits were logged prior to completing the soakaway test and were backfilled with arising's upon completion. The soakaway test results are provided in Appendix 3 of this Report.

#### 4.0 Ground Conditions

#### 4.1. General

The ground conditions encountered during the investigation are summarised below with reference to insitu and laboratory test results. The full details of the strata encountered during the ground investigation are provided in the exploratory hole logs included in the appendices of this report.

The sequence of strata encountered were variable across the site and are generally comprised;

- Topsoil
- Made Ground
- Cohesive Deposits
- Granular Deposits

**TOPSOIL:** Topsoil was encountered in the majority of the exploratory holes and was present to a maximum depth of 0.40m BGL.

**MADE GROUND:** Made Ground deposits were encountered from ground level at the location of SA10, TP02, TP03, TP05 and TP06 and were present to a maximum depth of 0.5mBGL. These deposits were described generally as *brown sandy slightly gravelly CLAY with frequent cobbles and boulders and contained occasional fragments of red brick, grass, concrete and tar.* 

**COHESIVE DEPOSITS:** Cohesive deposits were encountered beneath the Made Ground at the location of SA02, SA08, SA10, SA12, SA13, SA14, SA16, TP01, TP03, TP06, TP07, TP08, TP09 and TP10 and were described typically as *brown sandy gravelly CLAY with occasional cobbles and boulders*. The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the cohesive matrix. The strength of the cohesive deposits were typically soft or firm

in the majority of the exploratory holes. These deposits had some, occasional or frequent cobble and boulder content where noted on the exploratory hole logs.

**GRANULAR DEPOSITS:** The granular deposits were encountered at the base of the Topsoil or cohesive deposits to a maximum depth of 1.90m BGL and were typically described as Grey brown clayey gravelly fine to coarse SAND with occasional cobbles and rare boulders. The secondary sand/gravel and silt/clay constituents varied across the site and with depth while occasional or frequent cobble and boulder content also present where noted on the exploratory hole logs. A lower granular deposit was encountered at the location of SA02, SA04, SA07, SA08, SA09, SA12, SA14, TP03, TP0, TP06, TP07 TP08, TP10 and TP11 to a maximum depth of 2.0m BGL and was typically described as a *brown* or *light brown slightly clayey sandy fine to coarse subangular to subrounded GRAVEL with occasional subrounded cobbles.* 

#### 4.2. Groundwater

Groundwater strikes are noted on the exploratory hole logs where they occurred and where possible drilling was suspended for twenty minutes to allow the subsequent rise in groundwater to be recorded. We would point out that these exploratory holes did not remain open for sufficiently long periods of time to establish the hydrogeological regime and groundwater levels would be expected to vary with the time of year, rainfall, nearby construction and other factors.

#### 5.0 Recommendations & Conclusions

#### 5.1. General

The recommendations given and opinions expressed in this report are based on the findings as detailed in the exploratory hole records. Where an opinion is expressed on the material between exploratory hole locations, this is for guidance only and no liability can be accepted for its accuracy. No responsibility can be accepted for conditions which have not been revealed by the exploratory holes. Limited information has been provided at the ground investigation stage and any designs based on the recommendations or conclusions should be completed in accordance with the current design codes, taking into account the variation and the specific details contained within the exploratory hole logs.

#### 5.2. Foundations

To determine the strength of the cohesive deposits and density of the granular we would recommend carrying out a sequence of cable percussion to determine a suitable depth for foundations and a sequence of rotary boreholes to determine the presence of bedrock.

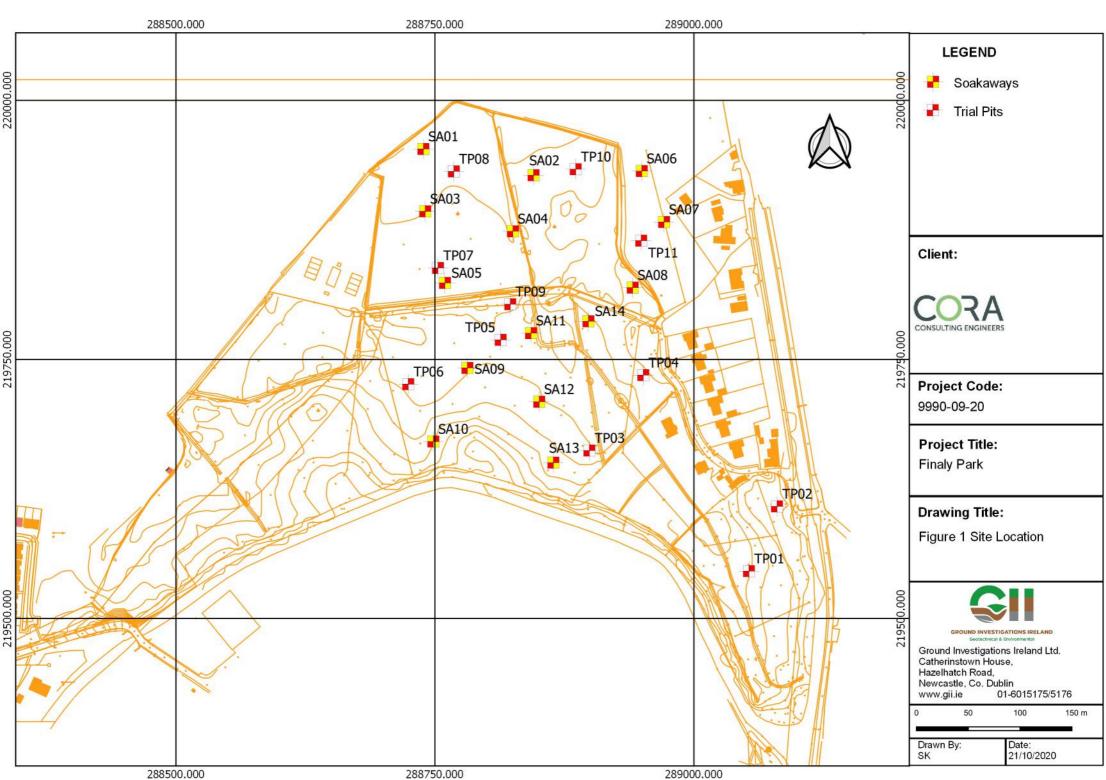
#### 5.3. Soakaway Design

Infiltration rates of f=2.106 x  $10^{-5}$  m/s, 1.98 x  $10^{-5}$  m/s, 9.246 x  $10^{-5}$  m/s, 1.804 x  $10^{-5}$  m/s, 5.974 x  $10^{-5}$  m/s, 7.176 x  $10^{-6}$  m/s, 6.947 x  $10^{-5}$  m/s respectively were calculated for the soakaway locations SA03, SA05, SA06, SA07, SA09, SA10 and SA12. At the locations of SA01, SA02, SA04, SA08, SA11, SA13, SA14, SA15 and SA16 the water level dropped too slowly to allow calculation of 'f' the soil infiltration rate. These locations are therefore not recommended as suitable for soakaway design and construction.

The recommendations provided in this report should be verified in the design of the proposed buildings, using the full details of the loading conditions and taking into consideration the allowable tolerable settlements/movements that the building can accommodate. The founding strata should be inspected and verified by a suitably qualified engineer prior to construction of the building foundations.

**APPENDIX 1** - Site Location Plan





APPENDIX 2 - Trial Pit Records



	Grou	ind In	vestigations Ire www.gii.ie	eland	Ltd	<b>Site</b> Finlay Park	Trial Pit Number SA09
Machine : Tr Method : Tr	acked Excavator ial Pit	Dimensi 1.90m ×	ons x 0.60m x 1.50m (L x W x D)	Ground	Level (mOD)	Client Westar Group	Job Number 9990-09-2
		Location 288	n 8781 E 219740.9 N	Dates 23	3/09/2020	Engineer	<b>Sheet</b> 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend
Plan						TOPSOIL: Brown slightly sandy slightly gravelly Clay with grass and rootlets. Gravel is fine to coarse subangular to subrounded GRAVEL with subrounded cobbles and boulders. Grey/brown clayey sandy fine to coarse subrounded to rounded GRAVEL with subrounded cobbles. Complete at 1.50m	
						No groundwater encountered. Spalling at 0.50m BGL. Trial pit backfilled on completion.	

	Grou	nd In	vestigations Ire www.gii.ie	land	Ltd	Site Finlay Park	Trial Pit Number SA10
Machine : Tr Method : Tr	acked Excavator ial Pit	Dimens 1.60m	<b>ions</b> x 0.60m x 1.50m (L x W x D)	Ground	Level (mOD)	Client Westar Group	Job Number 9990-09-20
		Locatio 28	<b>n</b> 8748.1 E 219669.8 N	Dates 23	3/09/2020	Engineer	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend S
0.40	в		Slow(1) at 1.50m.		(0.40) (0.50) (0.60) (0.60) (1.50)	MADE GROUND: Light brown sandy gravelly Clay with occasional subrounded cobbles, red brick and rootlets. Gravel is fine to coarse subangular to subrounded with rootlets.	
Plan .					•••	Remarks Groundwater encountered at 1.50m BGL. Trial pit stable.	
					•••	Trial pit stable. Trial pit backfilled on completion.	
· ·					· · ·		
· ·			· · · ·		 s		<b>gure No.</b> 990-09-20.SA10

		nd In	vestigations Ire www.gii.ie	eland	Ltd	Site Finlay Park	Trial Pit Numbe SA11
Machine : Tr Method : Tr	acked Excavator ial Pit	Dimens 1.50m	<b>ions</b> x 0.60m x 1.40m (L x W x D)	Ground	Level (mOD)	Client Westar Group	Job Numbe 9990-09-
		Locatio	<b>n</b> 8842.4 E 219774.5 N	Dates 23	3/09/2020	Engineer	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend
.00 .40	B		Slow(1) at 1.40m.		(0.50) (0.60) (0.60) (0.30) 1.40  	TOPSOIL: Brown slightly sandy slightly gravelly Clay with grass and rootlets. Gravel is fine to medium subrounded to rounded. Grey slightly silty fine to medium SAND. Light grey slightly silty fine to medium SAND. Complete at 1.40m	
Plan .		•		•	•••	Remarks Groundwater encountered at 1.40m BGL. Trial pit stable. Trial pit backfilled on completion.	
·					•••	I rial pit backfilled on completion.	
·		·		•	•••		
•	· ·	•			· · ·		
					<mark> </mark>	cale (approx) Logged By Figur	e No.

	Grou	ind Inv	estigations Ire www.gii.ie	land	Ltd	Site Finlay Park	Trial Pit Number SA12
lachine : ⊤ lethod :⊤	racked Excavator rial Pit	Dimensio 2.00m x 0	<b>ns</b> 0.60m x 1.50m (L x W x D)	Ground	Level (mOD)	Client Westar Group	Job Numbe 9990-09-
		Location 2888	350.3 E 219708.2 N	Dates 23	3/09/2020	Engineer	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend
					 (0.30)	TOPSOIL: Brown slightly sandy slightly gravelly Clay with grass and rootlets. Gravel is fine to medium subangular to subrounded.	
					- 0.30 - (0.20)	Soft grey slightly gravelly sandy CLAY. Gravel is fine to coarse subangular to subrounded.	
					0.50	Grey/brown slightly clayey sandy fine to coarse subrounded to rounded GRAVEL with subangular to rounded cobbles and boulders.	0
					-		<u>```````</u>
					(1.00)		<u>`````````````````````````````````````</u>
					-		
							Ŏ. ĬŎ
					1.50	Complete at 1.50m	
					 - 		
					-		
					- - -		
					- - -		
					-		
					-  -		
					-		
					-		
					-		
an .		•			•••	Remarks	
						No groundwater encountered. Collapsing at 0.45m BGL. Trial pit backfilled on completion.	
·		·		•	•••		

Westar Group     gegeo-0       Location     Dates       288813.4 E 219768 N       Deptin       Sample / Tests     Wester     Group     Engineer     Sheet       1/7       Deptin     Sample / Tests     Wester Group     Description     Legen       50     B       50     B       20     B       8     Slow(1) at 1.90m.       90     B       90     B       90     B	TRELAND		1	vestigations www.gii.ie			Site Finlay Park		Trial Pi Numbe
Depth         Sample / Tests         View         Field Records         Image: Field Records <thimage: field="" records<="" th="">         Image: Field Rec</thimage:>						l Level (mOD)			Job Numbe 9990-09
50     B     Image: Solution of the second s					Dates 2	3/09/2020	Engineer		<b>Sheet</b> 1/1
50     B </th <th>Depth (m)</th> <th>Sample / Tests</th> <th>Water Depth (m)</th> <th>Field Records</th> <th>Level (mOD)</th> <th>Depth (m) (Thickness)</th> <th>D</th> <th>escription</th> <th>Legend</th>	Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Legend
Groundwater encountered at 1.90m BGL and 2.05m BGL. Spalling at 2.10m BGL. Collapsing at 2.50m BGL. Trial pit backfilled on completion. Trial pit terminated at 2.60m BGL due to heavy groundwater and collap Trial pit terminated at 2.60m BGL due to heavy groundwater and collap	.50	В				0.50 (0.70) 1.20 2.60	Grey clayey sandy fine to GRAVEL with occasional s Grey/brown slightly clayey to rounded GRAVEL with s and boulders.	coarse subangular to roundeo subrounded cobbles.	
	•		•		•	· · ·		at 1.90m BGL and 2.05m BGL apsing at 2.50m BGL.	
.       .	•		•				Trial pit backfilled on comple Trial pit terminated at 2.60m	etion. I BGL due to heavy groundwa	er and collaps
.       .					·	•••			
	•	· ·		· · ·		· · ·			

	Grou	nd In	vestigatio www.gii		land	Ltd	Site Finlay Park	Trial Pit Number TP06
Machine : Ti Method : Ti	acked Excavator ial Pit	Dimens 2.30m	<b>ions</b> k 0.60m x 2.00m E	BGL	Ground	Level (mOD)	Client Westar Group	Job Number 9990-09-2
		Locatio	<b>n</b> 8724.2 E 219725.	.2 N	Dates 23	8/09/2020	Engineer	<b>Sheet</b> 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Red	cords	Level (mOD)	Depth (m) (Thickness)	Description	Legend
0.50 1.00 2.00	B B B		Slow(1) at 1.40m Medium(2) at 2.0			(0.30) 0.30 (0.20) 0.50 (0.90) 1.40 (0.40) 1.80 (0.20) 2.00 	MADE GROUND: Brown slightly sandy gravelly Clay with red brick fragments. Gravel is fine to coarse subrounded to firm to stiff light brown sandy gravelly CLAY. Gravel is fine to medium subangular to subrounded. Grey slightly clayey gravelly fine to medium SAND with occasional subrounded cobbles. Firm to stiff grey mottled brown sandy gravelly CLAY with subrounded to rounded cobbles. Gravel is fine to coarse subangular to rounded. Grey sandy clayey fine to coarse subangular to rounded GRAVEL with subangular to rounded cobbles and boulders. Complete at 2.00m	
Plan .		•		·			Remarks Groundwater encountered at 1.40m BGL and 2.00m BGL. Spalling at 1.20m BGL. Collapsing at 1.90m BGL.	
		•			-		Spalling at 1.20m BGL. Collapsing at 1.90m BGL. Trial pit backfilled on completion. Trial pit terminated at 2.00m BGL due to collapse.	
		•		·	-			
	· ·		· ·		• •	· · ·		
						s		r <b>e No.</b> )-09-20.TP0

$\frac{ }{ } \frac{ }$		cked Excavator	Dimens	WW	w.gii.ie	;		Level (mOD)			Job Numbe
Depth         Sample / Tests         View (m)         Field Records         MSB         Copyright (m)         Description         Leger (m)           50         8         Image: Sample / Tests         View (m)	lethod : Tria	l Pit	2.20113	x 0.00111 x	2.00111 (L X	VV X D)			Westar Group		9990-09
50     B     Image: Solution of the solutis of the solution of the solution of the solution of the solutis					219802.3 N	I	Dates 23	/09/2020	Engineer		<b>Sheet</b> 1/1
50     B     Image: Structure is a constraint of the image is a cons	Depth (m)	Sample / Tests Water Depth Field Records (m)	ds	Level (mOD)	Depth (m) (Thickness)	D	escription	Legend			
20 B Slow to Medium(1) at 240m. Slow to Medium(1) at 240m. 2	.50	В						0.40 (0.60)	Soft brown slightly sandy of coarse subrounded to roun	gravelly CLAY. Gravel is fine to nded.	
90 B 50 C 50 C	.20	В						 (0.50)	Soft grey/brown slightly sa is fine to coarse subangula	indy slightly gravelly CLAY. Gra ar to rounded.	vel
50       B       240m.       0.20       Group and get obles and builders. Gravel is fine to coarse of the subangular to rounded.         50       B       240m.       0.20       0.20         9       Complete at 2.60m.       Complete at 2.60m.       Complete at 2.60m.         9       Complete at 2.60m.       Complete at 2.60m.       Complete at 2.60m.         9       Complete at 2.60m.       Complete at 2.60m.       Complete at 2.60m.         9       Complete at 2.60m.       Complete at 2.60m.       Complete at 2.60m.         9       Complete at 2.60m.       Complete at 2.60m.       Complete at 2.60m.         9       Complete at 2.60m.       Complete at 2.60m.       Complete at 2.60m.         9       Complete at 2.60m.       Complete at 2.60m.       Complete at 2.60m.         9       Complete at 2.60m.       Complete at 2.60m.       Complete at 2.60m.         10       Complete at 2.60m.       Complete at 2.60m.       Complete at 2.60m.         11       Complete at 2.60m.       Complete at 2.60m.       Complete at 2.60m.         11       Complete at 2.60m.       Complete at 2.60m.       Complete at 2.60m.         12       Complete at 2.60m.       Complete at 2.60m.       Complete at 2.60m.         13       Complete at 2.60m.	.90	В						- - - - - - - -	Grey slightly gravelly silty fine to coarse subrounded	fine to medium SAND. Gravel to rounded.	15
Groundwater encountered at 2.40m BGL. Spalling at 1.80m BGL. Collapse at 2.50m BGL. Trial pit backfilled on completion. Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundw		В		Slow to I 2.40m.	Medium(1) a	at		(0.20) 2.60 	counded cobbles and boul subangular to rounded. Complete at 2.60m	coarse SAND with subangular ders. Gravel is fine to coarse	to
	'lan .	· ·	•	·		•	•	•		at 2.40m BGL.	
.       .				•	•	•		•	Spalling at 1.80m BGL. Colla Trial pit backfilled on comple Trial pit terminated at 2.60m	apse at 2.50m BGL. etion. BGL due to heavy groundwat	er and collaps
.       .		· ·				•		•			
.     . <td></td> <td>· ·</td> <td></td> <td></td> <td></td> <td></td> <td>• •</td> <td></td> <td></td> <td></td> <td></td>		· ·					• •				









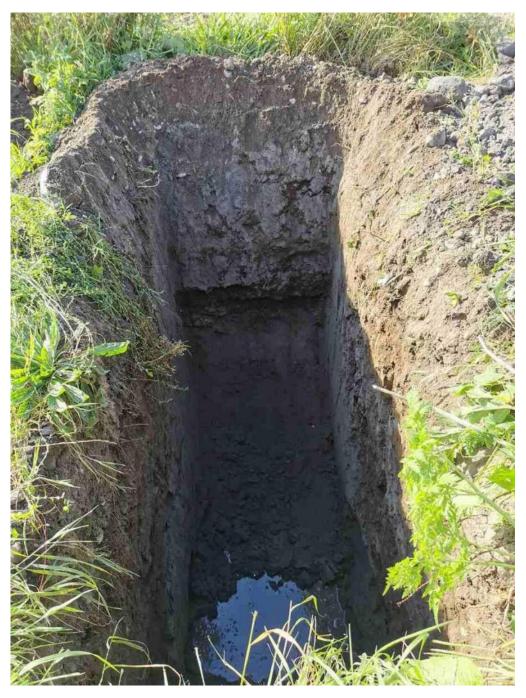
**TP06** 







TP09





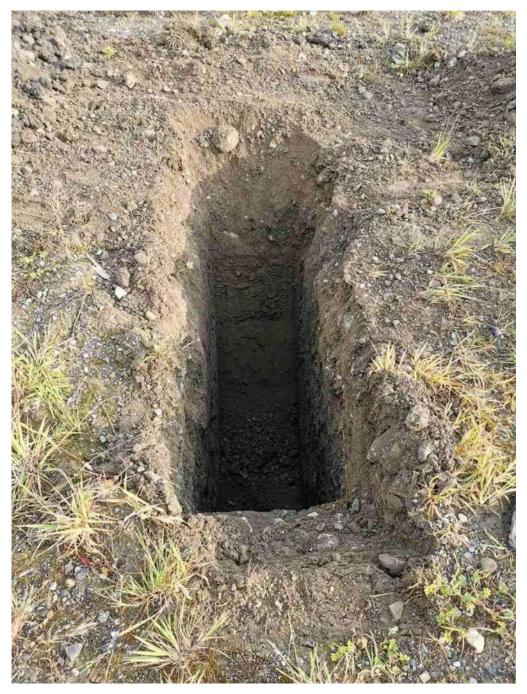


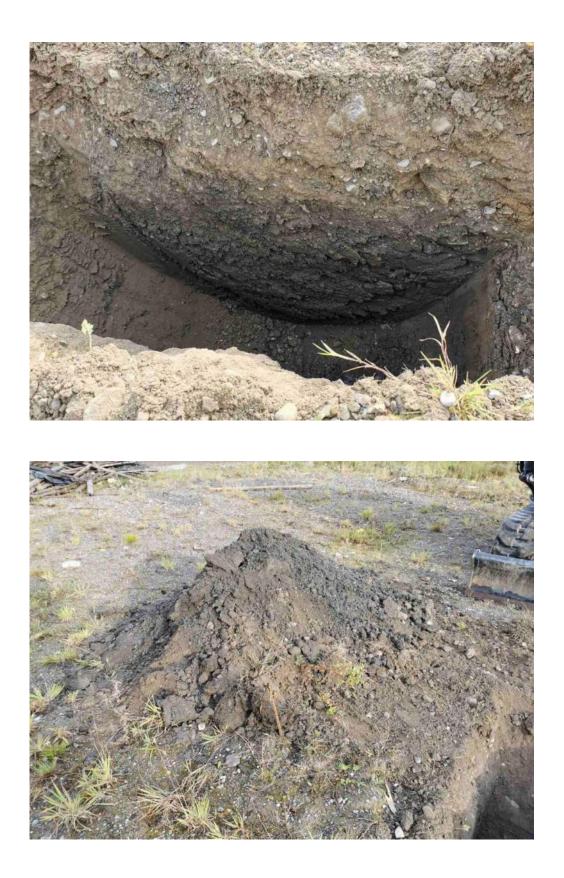


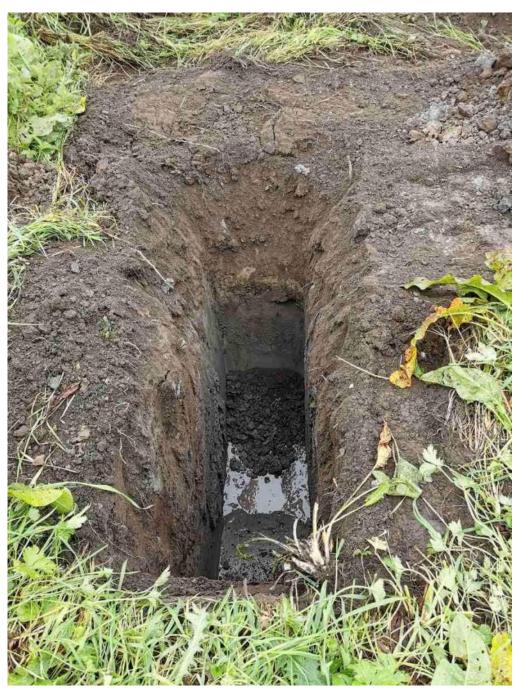




















APPENDIX 3 – Soakaway Records



	Grou	ind In	vestigations Ire www.gii.ie	eland	Ltd	<b>Site</b> Finlay Park	Trial Pit Number SA09
Machine : Tr Method : Tr	acked Excavator ial Pit	Dimensi 1.90m ×	ons x 0.60m x 1.50m (L x W x D)	Ground	Level (mOD)	Client Westar Group	Job Number 9990-09-2
		Location 288	n 8781 E 219740.9 N	Dates 23	3/09/2020	Engineer	<b>Sheet</b> 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend
Plan						TOPSOIL: Brown slightly sandy slightly gravelly Clay with grass and rootlets. Gravel is fine to coarse subangular to subrounded GRAVEL with subrounded cobbles and boulders. Grey/brown clayey sandy fine to coarse subrounded to rounded GRAVEL with subrounded cobbles. Complete at 1.50m	
						No groundwater encountered. Spalling at 0.50m BGL. Trial pit backfilled on completion.	

	Grou	nd In	vestigations Ire www.gii.ie	land	Ltd	Site Finlay Park	Trial Pit Number SA10
Machine : Tr Method : Tr	acked Excavator ial Pit	Dimens 1.60m	<b>ions</b> x 0.60m x 1.50m (L x W x D)	Ground	Level (mOD)	Client Westar Group	Job Number 9990-09-20
		Locatio 28	<b>n</b> 8748.1 E 219669.8 N	Dates 23	3/09/2020	Engineer	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend S
0.40	в		Slow(1) at 1.50m.		(0.40) (0.50) (0.60) (0.60) (1.50)	MADE GROUND: Light brown sandy gravelly Clay with occasional subrounded cobbles, red brick and rootlets. Gravel is fine to coarse subangular to subrounded with rootlets.	
Plan .					•••	Remarks Groundwater encountered at 1.50m BGL. Trial pit stable.	
					•••	Trial pit stable. Trial pit backfilled on completion.	
· ·					· · ·		
· ·			· · · ·		 s		<b>gure No.</b> 990-09-20.SA10

		nd In	vestigations Ire www.gii.ie	eland	Ltd	Site Finlay Park	Trial Pit Numbe SA11
Machine : Tr Method : Tr	acked Excavator ial Pit	Dimens 1.50m	<b>ions</b> x 0.60m x 1.40m (L x W x D)	Ground	Level (mOD)	Client Westar Group	Job Numbe 9990-09-
		Locatio	<b>n</b> 8842.4 E 219774.5 N	Dates 23	3/09/2020	Engineer	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend
.00 .40	B		Slow(1) at 1.40m.		(0.50) (0.60) (0.60) (0.30) 1.40  	TOPSOIL: Brown slightly sandy slightly gravelly Clay with grass and rootlets. Gravel is fine to medium subrounded to rounded. Grey slightly silty fine to medium SAND. Light grey slightly silty fine to medium SAND. Complete at 1.40m	
Plan .		•		•	•••	Remarks Groundwater encountered at 1.40m BGL. Trial pit stable. Trial pit backfilled on completion.	
·					•••	I rial pit backfilled on completion.	
·		·		•	•••		
•	· ·	•			· · ·		
					<mark> </mark>	cale (approx) Logged By Figur	e No.

	Grou	ind Inv	estigations Ire www.gii.ie	land	Ltd	Site Finlay Park	Trial Pit Number SA12
lachine : ⊤ lethod :⊤	racked Excavator rial Pit	Dimensio 2.00m x 0	<b>ns</b> 0.60m x 1.50m (L x W x D)	Ground	Level (mOD)	Client Westar Group	Job Numbe 9990-09-
		Location 2888	350.3 E 219708.2 N	Dates 23	3/09/2020	Engineer	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend
					 (0.30)	TOPSOIL: Brown slightly sandy slightly gravelly Clay with grass and rootlets. Gravel is fine to medium subangular to subrounded.	
					- 0.30 - (0.20)	Soft grey slightly gravelly sandy CLAY. Gravel is fine to coarse subangular to subrounded.	
					0.50	Grey/brown slightly clayey sandy fine to coarse subrounded to rounded GRAVEL with subangular to rounded cobbles and boulders.	0
					-		<u>```````</u>
					(1.00)		<u>`````````````````````````````````````</u>
					-		
							Ŏ. ĬŎ
					1.50	Complete at 1.50m	
					 - 		
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					-  -		
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an .		•			•••	Remarks	
						No groundwater encountered. Collapsing at 0.45m BGL. Trial pit backfilled on completion.	
·		·		•	•••		

Westar Group     gegeo-0       Location     Dates       288813.4 E 219768 N       Deptin       Sample / Tests     Wester     Group     Engineer     Sheet       1/7       Deptin     Sample / Tests     Wester Group     Description     Legen       50     B       50     B       20     B       8     Slow(1) at 1.90m.       90     B       90     B       90     B	TRELAND		1	vestigations www.gii.ie			Site Finlay Park		Trial Pi Numbe
Depth         Sample / Tests         View         Field Records         Image: Field Records <thimage: field="" records<="" th="">         Image: Field Rec</thimage:>						l Level (mOD)			Job Numbe 9990-09
50     B     Image: Solution of the second s					Dates 2	3/09/2020	Engineer		<b>Sheet</b> 1/1
50     B </th <th>Depth (m)</th> <th>Sample / Tests</th> <th>Water Depth (m)</th> <th>Field Records</th> <th>Level (mOD)</th> <th>Depth (m) (Thickness)</th> <th>D</th> <th>escription</th> <th>Legend</th>	Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Legend
Groundwater encountered at 1.90m BGL and 2.05m BGL. Spalling at 2.10m BGL. Collapsing at 2.50m BGL. Trial pit backfilled on completion. Trial pit terminated at 2.60m BGL due to heavy groundwater and collap Trial pit terminated at 2.60m BGL due to heavy groundwater and collap	.50	В				0.50 (0.70) 1.20 2.60	Grey clayey sandy fine to GRAVEL with occasional s Grey/brown slightly clayey to rounded GRAVEL with s and boulders.	coarse subangular to roundeo subrounded cobbles.	
	•		•		•	· · ·		at 1.90m BGL and 2.05m BGL apsing at 2.50m BGL.	
.       .	•		•				Trial pit backfilled on comple Trial pit terminated at 2.60m	etion. I BGL due to heavy groundwa	er and collaps
.       .		· ·			·	•••			
	•	· ·		· · ·		· · ·			

	Grou	nd In	vestigatio www.gii		land	Ltd	Site Finlay Park	Trial Pit Number TP06
Machine : Ti Method : Ti	acked Excavator ial Pit	Dimens 2.30m	<b>ions</b> k 0.60m x 2.00m E	BGL	Ground	Level (mOD)	Client Westar Group	Job Number 9990-09-2
		Locatio	<b>n</b> 8724.2 E 219725.	.2 N	Dates 23	8/09/2020	Engineer	<b>Sheet</b> 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Red	cords	Level (mOD)	Depth (m) (Thickness)	Description	Legend
0.50 1.00 2.00	B B B		Slow(1) at 1.40m Medium(2) at 2.0			(0.30) 0.30 (0.20) 0.50 (0.90) 1.40 (0.40) 1.80 (0.20) 2.00 	MADE GROUND: Brown slightly sandy gravelly Clay with red brick fragments. Gravel is fine to coarse subrounded to firm to stiff light brown sandy gravelly CLAY. Gravel is fine to medium subangular to subrounded. Grey slightly clayey gravelly fine to medium SAND with occasional subrounded cobbles. Firm to stiff grey mottled brown sandy gravelly CLAY with subrounded to rounded cobbles. Gravel is fine to coarse subangular to rounded. Grey sandy clayey fine to coarse subangular to rounded GRAVEL with subangular to rounded cobbles and boulders. Complete at 2.00m	
Plan .		•		·			Remarks Groundwater encountered at 1.40m BGL and 2.00m BGL. Spalling at 1.20m BGL. Collapsing at 1.90m BGL.	
		•			-		Spalling at 1.20m BGL. Collapsing at 1.90m BGL. Trial pit backfilled on completion. Trial pit terminated at 2.00m BGL due to collapse.	
		•		·	-			
	· ·		· ·		• •	· · ·		
						s		r <b>e No.</b> )-09-20.TP0

$\frac{ }{ } \frac{ }$		cked Excavator	Dimens	WW	w.gii.ie	;		Level (mOD)		Job Numbe	
Depth         Sample / Tests         View (m)         Field Records         MSB         Copyright (m)         Description         Leger (m)           50         8         Image: Sample / Tests         View (m)	lethod : Tria	l Pit	2.20113	x 0.00111 x	2.00111 (L X	VV X D)			Westar Group		9990-09
50     B     Image: Solution of the solutis of the solution of the solution of the solution of the solutis					219802.3 N	I	Dates 23	/09/2020	Engineer		<b>Sheet</b> 1/1
50     B     Image: Structure is a constraint of the image is a cons	Depth (m)	Sample / Tests	Water Depth (m)	F	ield Recor	ds	Level (mOD)	Depth (m) (Thickness)	D	escription	Legend
20 B Slow to Medium(1) at 240m. Slow to Medium(1) at 240m. 2	.50	В						0.40 (0.60)	Soft brown slightly sandy of coarse subrounded to roun	gravelly CLAY. Gravel is fine to nded.	
90 B 50 C 50 C	.20	В						 (0.50)	Soft grey/brown slightly sa is fine to coarse subangula	indy slightly gravelly CLAY. Gra ar to rounded.	vel
50       B       240m.       0.20       Group and get obles and builders. Gravel is fine to coarse of the subangular to rounded.         50       B       240m.       0.20       0.20         9       Complete at 2.60m.       Complete at 2.60m.       Complete at 2.60m.         9       Complete at 2.60m.       Complete at 2.60m.       Complete at 2.60m.         9       Complete at 2.60m.       Complete at 2.60m.       Complete at 2.60m.         9       Complete at 2.60m.       Complete at 2.60m.       Complete at 2.60m.         9       Complete at 2.60m.       Complete at 2.60m.       Complete at 2.60m.         9       Complete at 2.60m.       Complete at 2.60m.       Complete at 2.60m.         9       Complete at 2.60m.       Complete at 2.60m.       Complete at 2.60m.         9       Complete at 2.60m.       Complete at 2.60m.       Complete at 2.60m.         10       Complete at 2.60m.       Complete at 2.60m.       Complete at 2.60m.         11       Complete at 2.60m.       Complete at 2.60m.       Complete at 2.60m.         11       Complete at 2.60m.       Complete at 2.60m.       Complete at 2.60m.         12       Complete at 2.60m.       Complete at 2.60m.       Complete at 2.60m.         13       Complete at 2.60m.	.90	В						- - - - - - - -	Grey slightly gravelly silty fine to coarse subrounded	fine to medium SAND. Gravel to rounded.	15
Groundwater encountered at 2.40m BGL. Spalling at 1.80m BGL. Collapse at 2.50m BGL. Trial pit backfilled on completion. Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundwater and collapse Trial pit terminated at 2.60m BGL due to heavy groundw		В		Slow to I 2.40m.	Medium(1) a	at		(0.20) 2.60 	counded cobbles and boul subangular to rounded. Complete at 2.60m	coarse SAND with subangular ders. Gravel is fine to coarse	to
	'lan .	· ·	•	·		•	•	•		at 2.40m BGL.	
.       .		· ·		•	•	•		•	Spalling at 1.80m BGL. Colla Trial pit backfilled on comple Trial pit terminated at 2.60m	apse at 2.50m BGL. etion. BGL due to heavy groundwat	er and collaps
.       .		· ·				•		•			
.     . <td></td> <td>· ·</td> <td></td> <td></td> <td></td> <td></td> <td>• •</td> <td></td> <td></td> <td></td> <td></td>		· ·					• •				

## BH01 - 2021 - Groundwater Monitoring Results - Worst Case

Project ID	Finlay Park		
Location	BH01		
Month	October		
LEVEL	UNIT: m		
TEMPERATURE	UNIT: °C		
Date	Time	LEVEL	TEMPERATURE
28/10/2021	12:00:00	2.2245	12.126
28/10/2021	12:30:00	2.2051	12.133
28/10/2021	13:00:00	2.207	12.14
28/10/2021	13:30:00	2.2113	12.137
28/10/2021	14:00:00	2.2198	12.13
28/10/2021	14:30:00	2.2363	12.129
28/10/2021	15:00:00	2.2629	12.128
28/10/2021	15:30:00	2.2762	12.128
28/10/2021	16:00:00	2.2848	12.13
28/10/2021	16:30:00	2.294	12.127
28/10/2021	17:00:00	2.3018	12.127
28/10/2021	17:30:00	2.3171	12.126
28/10/2021	18:00:00	2.3155	12.123
28/10/2021	18:30:00	2.329	12.119
28/10/2021	19:00:00	2.33	12.112
28/10/2021	19:30:00	2.3283	12.11
28/10/2021	20:00:00	2.3309	12.105
28/10/2021	20:30:00	2.3316	12.107
28/10/2021	21:00:00	2.3377	12.11
28/10/2021	21:30:00	2.3378	12.109
28/10/2021	22:00:00	2.3401	12.105
28/10/2021	22:30:00	2.3397	12.108
28/10/2021	23:00:00	2.3356	12.117
28/10/2021	23:30:00	2.3379	12.124
29/10/2021	00:00:00	2.3374	12.126
29/10/2021	00:30:00	2.3395	12.131
29/10/2021	01:00:00	2.3408	12.14
29/10/2021	01:30:00	2.3391	12.146
29/10/2021	02:00:00	2.3418	12.153
29/10/2021	02:30:00	2.3424	12.153
29/10/2021	03:00:00	2.339	12.153
29/10/2021	03:30:00	2.3412	12.148
29/10/2021	04:00:00	2.3469	12.143
29/10/2021	04:30:00	2.3465	12.144
29/10/2021	05:00:00	2.3442	12.146
29/10/2021	05:30:00	2.3434	12.14
29/10/2021	06:00:00	2.343	12.145
29/10/2021	06:30:00	2.3457	12.151
29/10/2021	07:00:00	2.3436	12.144
29/10/2021	07:30:00	2.3483	12.144
29/10/2021	08:00:00	2.3438	12.145
29/10/2021	08:30:00	2.3464	12.158
29/10/2021	09:00:00	2.3451	12.15
29/10/2021	09:30:00	2.3443	12.152

## BH01 - 2022 Groundwater Monitoring Results - Worst Case

Project ID	Finlay Park		U
Location	BH01		
Level	-	ow groundlevel	(mBGL)
Temperature	Celsius (°C	-	< , , , , , , , , , , , , , , , , , , ,
Date	Time	Level (mBGL)	Temperature (°C)
20/02/2022	12:30:00	2.1455	9.813
20/02/2022	13:00:00	2.1306	9.8
20/02/2022	13:30:00	2.1083	9.815
20/02/2022	14:00:00	2.0878	9.812
20/02/2022	14:30:00	2.0698	9.817
20/02/2022	15:00:00	2.0518	9.82
20/02/2022	15:30:00	2.0472	9.793
20/02/2022	16:00:00	2.0502	9.806
20/02/2022 20/02/2022	16:30:00 17:00:00	2.0566 2.0643	9.818 9.829
20/02/2022	17:30:00	2.0655	9.828
20/02/2022	18:00:00	2.0763	9.849
20/02/2022	18:30:00	2.077	9.868
20/02/2022	19:00:00	2.0857	9.86
20/02/2022	19:30:00	2.0956	9.871
20/02/2022	20:00:00	2.1039	9.872
20/02/2022	20:30:00	2.1117	9.873
20/02/2022	21:00:00	2.1177	9.888
20/02/2022	21:30:00	2.1141	9.875
20/02/2022	22:00:00	2.1235	9.882
20/02/2022	22:30:00	2.1213	9.876
20/02/2022	23:00:00	2.1225	9.876
20/02/2022	23:30:00	2.1209	9.869
21/02/2022 21/02/2022	00:00:00 00:30:00	2.12 2.1183	9.861 9.872
21/02/2022	01:00:00	2.1185	9.872
21/02/2022	01:30:00	2.1154	9.873
21/02/2022	02:00:00	2.1115	9.864
21/02/2022	02:30:00	2.1101	9.873
21/02/2022	03:00:00	2.1112	9.872
21/02/2022	03:30:00	2.1098	9.873
21/02/2022	04:00:00	2.1146	9.863
21/02/2022	04:30:00	2.1122	9.863
21/02/2022	05:00:00	2.1093	9.871
21/02/2022	05:30:00	2.113	9.88
21/02/2022	06:00:00	2.1147	9.87
21/02/2022	06:30:00	2.1139	9.878
21/02/2022	07:00:00 07:30:00	2.1104	9.875 9.872
21/02/2022 21/02/2022	07:30:00	2.1203 2.1115	9.879
21/02/2022	08:30:00	2.1115	9.872
21/02/2022	09:00:00	2.1147	9.883
21/02/2022	09:30:00	2.1179	9.868
21/02/2022	10:00:00	2.1229	9.87
21/02/2022	10:30:00	2.1277	9.87
21/02/2022	11:00:00	2.1247	9.852
21/02/2022	11:30:00	2.1306	9.864
21/02/2022	12:00:00	2.1318	9.871
21/02/2022	12:30:00	2.1312	9.866
21/02/2022	13:00:00	2.133	9.879
21/02/2022	13:30:00	2.1331	9.878
21/02/2022	14:00:00	2.1377	9.855
21/02/2022 21/02/2022	14:30:00 15:00:00	2.1476 2.1372	9.872 9.873
21/02/2022	15:30:00	2.1372	9.866
21/02/2022	16:00:00	2.1445	9.866
21/02/2022	16:30:00	2.1475	9.872
21/02/2022	17:00:00	2.1482	9.863
21/02/2022	17:30:00	2.1517	9.86
21/02/2022	18:00:00	2.154	9.863
21/02/2022	18:30:00	2.1554	9.867
21/02/2022	19:00:00	2.1601	9.856

# **DONNACHADH O'BRIEN** & ASSOCIATES CONSULTING ENGINEERS

Appendix B

Surface Water Calculations

Donnachadh O'Brien & Associates		Page 0
Unit W9 E&F Ladytown BP		
Newhall Naas		
Co Kildare		Micco
Date 25/10/2022 10:35	Designed by stevep	Desinado
	Checked by	Diamaye
XP Solutions 30% Climate C	Change + 10% Urban Creep	
STORM SEWER DESIGN b	y the Modified Rational Metho	<u>d</u>
Design Criter	<u>ia for Surface Network 2</u>	
Pipe Sizes STAN	IDARD Manhole Sizes STANDARD	$\langle \rangle$
	DAND Maimole Sizes Stradand	
FSR Rainfall M	odel - Scotland and Ireland	
Return Period (years)		PIMP (%) 💙 100
M5-60 (mm)		2
Ratio R		
Maximum Rainfall (mm/hr)		
Maximum Time of Concentration (mins)		
Foul Sewage (l/s/ha)	3	- · ·
Volumetric Runoff Coeff.	1.000 Min Slope for Optimisat:	ion (1:X) 500
Designe	d with Level Soffits	

### Network Design Table for Surface Network 2

-	lope I.Area T. 1:X) (ha) (mi	.E. Base ins) Flow (l/s)	k n HYD (mm) SECT	DIA Secti (mm)	on Type Auto Design
1.000 3.517 0.020 1 1.001 22.377 0.118 1			0.600 o 0.600 o		ipe/Conduit 🔒 ipe/Conduit 🔒
2.000 55.000# 0.275 20 2.001 8.176# 0.409		5.00 0.0 0.00 0.0	$0.010 \rightarrow  _{=}  \rightarrow 0.600 \qquad \circ$		tion Trench 🍵 ipe/Conduit 🍵
1.002 9.909 0.050 1	.98.2 0.000 0	0.00 0.0	0.600 0	225 P:	ipe/Conduit 🇂
1.003 53.645 0.255 23 1.004 11.430 0.056 20 1.005 53.500# 0.268 20	04.1 0.023 0	0.00 0.0	0.600 o 0.600 o 0.600 o	225 P:	ipe/Conduit 🧂 ipe/Conduit 🌐 ipe/Conduit 🛑

#### Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)		Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.06	85.620	0.408	0.0	0.0	29.5	0.98	39.1«	103.1
1.001	50.00	5.45	85.600	0.432	0.0	0.0	31.2	0.95	37.6«	109.3
2.000	50.00	5.46	85.800	0.083	0.0	0.0	6.0	2.00	1796.6	21.0
2.001	50.00	5.52	87.000	0.083	0.0	0.0	6.0	2.26	40.0	21.0
1.002	50.00	5.70	85.482	0.515	0.0	0.0	37.2	0.93	36.8«	130.3
1.003	50.00	6.69	85.432	0.554	0.0	0.0	40.0	0.90	35.7«	140.0
1.004	50.00	6.90	85.177	0.577	0.0	0.0	41.7	0.91	36.2«	145.8
1.005	50.00	7.71	85.114	0.604	0.0	0.0	43.6	1.11	78.3«	152.7

Donnachadh O'Brien & Associates Unit W9 E&F Ladytown BP		Page 1
Newhall Naas Co Kildare		Micco
Date 25/10/2022 10:35	Designed by stevep	Dcainago
File DOBA2110 2022.10.20 Sur	Checked by	Drainage
XP Solutions	Network 2020.1.3	·
Network Design	Table for Surface Network 2	
PN Length Fall Slope I.Area T.1 (m) (m) (1:X) (ha) (min	E. Base k n HYD DIA ns) Flow (l/s) (mm) SECT (mm)	Section Type Auto Design

	20119011		orope	1 Cu								beccrom 1jp	-	11400
	(m)	(m)	(1:X)	(ha)	(mins)	Flow	(l/s)	(mm)		SECT	(mm)			Design
1.006	45.139#	0.226	199.7	0.058	0.00		0.0	0.600		0	300	Pipe/Co:	nduit	8
3.000	2.528	0.013	194.5	0.021	5.00		0.0	0.600		0	225	Pipe/Co:	nduit	8
3.001	15.540	0.081	191.9	0.000	0.00		0.0	0.600		0	225	Pipe/Co:	nduit	ē
3.002	18.832	0.249	75.6	0.000	0.00		0.0	0.600		0	225	Pipe/Co:	nduit	ē
4.000	4.001	0.050	80.0	0.337	5.00		0.0	0.600		0	225	Pipe/Co:	nduit	8
4.001	13.938	0.160	87.1	0.000	0.00		0.0	0.600		0	225	Pipe/Co:	nduit	ē
4.002	9.313	0.264	35.2	0.000	0.00		0.0	0.600		0	225	Pipe/Co:	nduit	ē
5.000	14.000#	0.070	200.0	0.011	5.00		0.0					Infiltration T		8
5.001	125.000#	0.625	200.0	0.168	0.00		0.0		0.010	$\rightarrow  _{=}   \rightarrow$		Infiltration T	rench	8
5.002	9.420#	0.047	200.0	0.000	0.00		0.0	0.600		0	150	Pipe/Co:		Ō
6.000	60.811	0.635	95.8	0.145	5.00		0.0		0.010	$\rightarrow  _{=} _{\rightarrow}$		Infiltration T	rench	٥
5.003	15.930#	0.080	199.1	0.000	0.00		0.0	0.600		0	150	Pipe/Co:	nduit	0
5.004	23.108#	0.116	199.2	0.000	0.00		0.0	0.600		0	150	Pipe/Co:	hduit	8
5.005	19.886	0.225	88.4	0.040	0.00		0.0	0.600		0	225	Pipe/Co:	nduit	۲
4.003	8.685	0.050	173.3	0.015	0.00		0.0	0.600		0	225	Pipe/Co:	nduit	8

#### Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (1/s)	Flow (1/s)	
1.006	50.00	8.39	84.846	0.662	0.0	0.0	47.8	1.11	78.4«	167.4	
3.000 3.001 3.002	50.00 50.00 50.00	5.32	85.093 85.080 84.999	0.021 0.021 0.021	0.0 0.0 0.0	0.0 0.0 0.0	1.5 1.5 1.5	0.93 0.94 1.51	37.1 37.4 59.9	5.3 5.3 5.3	
4.000 4.001	50.00 50.00	5.05 5.21	85.450 85.400	0.337	0.0	0.0	24.3 24.3	1.46	58.2« 55.7«	85.2 85.2	
4.002 5.000 5.001	50.00 50.00 50.00	5.14	85.240 86.040 85.970	0.337 0.011 0.179	0.0	0.0	24.3 0.8 12.9	2.21 1.71 1.90	87.9 997.4 1482.0	85.2 2.8 45.2	
5.002 6.000	50.00 50.00		86.843 85.930	0.179 0.145	0.0	0.0	12.9 10.5		12.5« 1491.6	45.2 36.7	
5.003 5.004 5.005	50.00 50.00 50.00	7.37	86.796 85.216 85.100	0.324 0.324 0.364	0.0 0.0 0.0	0.0 0.0 0.0	23.4 23.4 26.3	0.71 0.71 1.39	12.5« 12.5« 55.3«	81.9 81.9 92.0	
4.003	50.00	7.76	84.800	0.716	0.0	0.0	51.7	0.99	39.4«	181.1	
				©1982-	2020 Innov	vyze					

					Associa	ates						Pag	ge 2	
nit		E&F	Lac	lytow	n BP									
ewha		Naas												_
Co Ki		re 10/202	2 -	10.35		ī	Desia	ned by	, stav	- An			cro	
					.20 Su:		-	ed by	SLEV	ер		Dr	ainag	6
XP So								rk 202	20.1.3					
				Netwo	ork De:	sign T	able	for Su	ırface	e Netwoi	ck 2			
PN	Leng	gth Fa	11	Slope	I.Area	T.E.	Ва	ase	k	n HYD 1	DIA Sec	tion Typ	pe Auto	<b>,</b>
	(n	n) (r	n)	(1:X)	(ha)	(mins)	Flow	(1/s)	(mm)	SECT (	mm)		Desig	m
		019 0.0							0.600		300 Pip		-	
					0.000				0.600		300 Pip 300 Pip			
1.007	8.3	107 0.1	120	67.6	0.000	0.00	I	0.0	0.600		300 Pip		-	
						Networ	k Res	sults	Table					
P	PN	Rain (mm/hr)		T.C. mins)	US/IL (m)	Σ I.Are (ha)		Base w (l/s)		Add Flo (1/s)		Cap (1/s)	Flow (l/s)	
3.	003	50.00	C	8.04	84.750	0.86	3	0.0	0.0	62.	3 0.71	50.2«	218.2	
	004			9.25	84.725	0.86		0.0			3 0.67			
3.	005	49.30	2	9.51	84.635	0.86	_	0.0	0.0	62.	3 0.61	43.2«	218.2	
1.	007	49.19	)	9.58	84.620	1.52	.5	0.0	0.0	108.	4 1.92	135.4«	379.3	
								TOT				1 525	021 (	
														Existing A
										TE I. AR e 1 Pipe				Existing A
														Existing A
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Donnachadh O'Brien & Associates		Page 3
Unit W9 E&F Ladytown BP		
Newhall Naas		
Co Kildare		Micro
Date 25/10/2022 10:35	Designed by stevep	Dcainago
File DOBA2110 2022.10.20 Sur	Checked by	Drainage
XP Solutions	Network 2020.1.3	

#### PIPELINE SCHEDULES for Surface Network 2

#### Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	0		SMH1.0	87.000	85.620	1.155	Open Manhole	1200
1.001	0	225	SMH1.01	87.000	85.600	1.175	Open Manhole	1200
2.000	$\rightarrow  _  \rightarrow$		SMH2.00	87.300	85.800	0.000	Open Manhole	3000
2.001	0	150	SMH2.01	87.200	87.000	0.050	Open Manhole	3000
1.002	0	225	SMH1.02	86.899	85.482	1.192	Open Manhole	1200
1.003	0	225	SMH1.03	86.771	85.432	1.114	Open Manhole	1200
1.004	0	225	SMH1.04	86.621	85.177	1.219	Open Manhole	1200
1.005	0	300	SMH1.05	86.987	85.114	1.573	Open Manhole	1200
1.006	0	300	SMH1.06	86.600	84.846	1.454	Open Manhole	1200
3.000	0	225	SMH3.0	87.840	85.093	2.522	Open Manhole	1200
3.001	0	225	SMH3.01	87.840	85.080	2.535	Open Manhole	1200
3.002	0	225	SMH3.02	87.350	84.999	2.126	Open Manhole	1200
4.000	0	225	SMH4.00	87.000	85.450	1.325	Open Manhole	1200
4.001	0	225	SMH4.01	87.000	85.400	1.375	Open Manhole	1200
4.002	0	225	SMH4.02	87.000	85.240	1.535	Open Manhole	1200

# - Indicates pipe length does not match coordinates

#### Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)			
1.000	3.517	175.9	SMH1.01	87.000	85.600	1.175	Open Manhole	1200			
1.001	22.377	189.6	SMH1.02	86.899	85.482	1.192	Open Manhole	1200			
2.000	55.000#	200.0	SMH2.01	87.200	85.525	0.175	Open Manhole	3000			
2.001	8.176#	20.0	SMH1.02	86.899	86.591		Open Manhole	1200			
1.002	9.909	198.2	SMH1.03	86.771	85.432	1.114	Open Manhole	1200			
1.003	53.645	210.4	SMH1.04	86.621	85.177		Open Manhole	1200			
1.004	11.430	204.1	SMH1.05	86.987	85.121	1.641	Open Manhole	1200			
1.005	53.500#	200.0	SMH1.06	86.600	84.847	1.453	Open Manhole	1200			
1.006	45.139#	199.7	SMH1.07	86.300	84.620	1.380	Open Manhole	1200			
3.000	2.528	194.5	SMH3.01	87.840	85.080	2.535	Open Manhole	1200			
3.001	15.540	191.9	SMH3.02	87.350	84.999		Open Manhole	1200			
3.002	18.832	75.6	SMH3.03	87.100	84.750		Open Manhole	1200			
4.000	4.001	80.0	SMH4.01	87.000	85.400	1.375	Open Manhole	1200			
4.001	13.938	87.1	SMH4.02	87.000	85.240		Open Manhole	1200			
4.002	9.313		SMH4.03	87.300	84.976		Open Manhole	1200			
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ate 25/1	0/2022	10:35		D	esigned k	ov stev	лер	
'ile DOBA			.20 Sur		-	-	- 1	Urainag
P Soluti					etwork 20		3	
i boraci	5110				CONOLIN EX	20.11	·	
		PIPE	ELINE S	CHEDUL	ES for S	urface	Network 2	
					ream Man			
PN	Hyd	Diam	мн с	Level	I.Level D	-		MH DIAM., L*W
	Sect	(mm)	Name	(m)	(m)	(m)	Connection	(mm)
5.00	0 →    →	S	мн5.00	87.500	86.040	0.000 (	Open Manhole	3000
5.00	$1 \rightarrow \left  \begin{array}{c} \\ \\ \\ \\ \\ \end{array} \right  \rightarrow \left  \begin{array}{c} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	S	MH5.01	87.500	85.970	0.030 0	Open Manhole Open Manhole	3000
5.00	2 o	150 S	MH5.02	88.000	86.843		Open Manhole	3000
6.00	$0 \rightarrow  _{=} _{\rightarrow}$	S	MH6.00	87.500	85.930	0.070 (	Open Manhole	3000
5.00	3 о	150 S	мн5.03	88.000	86.796	1.054 (	Open Manhole	3000
5.00					85.216	1.634 0	Open Manhole	1050
5.00	5 о	225 S	MH5.05	87.000	85.100	1.675 (	Open Manhole	1200
4.00	3 о	225 S	MH4.03	87.300	84.800	2.275 (	Open Manhole	1200
3.00	3 о	300 S	мнз.03	87.100	84.750	2.050	Open Manhole	1200
3.00					84.725		Open Manhole	1200
3.00	5 о	300 S	MH3.05	86.254	84.635	1.319 (	Open Manhole	1200
1.00	7 0	300 S	MH1.07	86.300	84.620	1.380 (	Open Manhole	1200
				Downs	tream Ma	nhole		
PN	Length (m)	Slope (1:X)		C.Leve (m)	el I.Level (m)	D.Depth (m)	n MH Connection	MH DIAM., L*W (mm)
5.000			SMH5.01				) Open Manhol	
5.001 5.002			SMH5.02 SMH5.03				Open Manhol	
5.002	J.4∠U#	200.0	SPINJ.UJ	88.00	0 86.796	1.054	l Open Manhol	e 3000
6.000	60.811	95.8	SMH5.03	88.00	0 85.295	1.205	5 Open Manhol	e 3000
5.003			SMH5.04				l Open Manhol	
5.004 5.005			SMH5.05 SMH4.03				) Open Manhol ) Open Manhol	
4.003			SMH4.03				5 Open Manhol	
1.005	0.000	. 1,3.3	51115.05	07.10	01.100	2.12	open namor	- 1200
3.003			SMH3.04				8 Open Manhol	
3.004			SMH3.05				9 Open Manhol	
3.005	9.715	04/./	SMH1.07	86.30	0 84.620	1.380	) Open Manhol	e 1200
1.007	8.107	67.6	SMH1.08	85.92	25 84.500	1.125	5 Open Manhol	e 1200

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Donnachadh O'Brien & Associates		Page 5
Unit W9 E&F Ladytown BP		
Newhall Naas		
Co Kildare		Micco
Date 25/10/2022 10:35	Designed by stevep	MILLU
File DOBA2110 2022.10.20 Sur		Urainage
XP Solutions	Network 2020.1.3	
	NCCWOIR 2020.1.5	
Free Flowing Outfal	l Details for Surface Network 2	
Outfall Outfall C	. Level I. Level Min D,L W	
Pipe Number Name	(m) (m) I. Level (mm) (mm)	
	(m)	
1.007 SMH1.08	85.925 84.500 0.000 1200 0	
Simulation Crit	teria for Surface Network 2	
		10.000
Volumetric Runoff Coeff 1 Areal Reduction Factor 1	000 Additional Flow - % of Total Flo 000 MADD Factor * 10m³/ha Storad	
Hot Start (mins)		-
	0 Flow per Person per Day (l/per/day	
Manhole Headloss Coeff (Global) (		
Foul Sewage per hectare (1/s) 0	0.000 Output Interval (mins	s) 1
Number of Input Hydrogr	aphs 0 Number of Storage Structures 9	
	rols 6 Number of Time/Area Diagrams 0	
Number of Offline Cont	rols 0 Number of Real Time Controls 0	
Synthet	ic Rainfall Details	
Rainfall Model	FSR Profile Type Sum	
Return Period (years) Region Engla	5 Cv (Summer) 1. and and Wales Cv (Winter) 0.3	
M5-60 (mm)	16.900 Storm Duration (mins)	
Ratio R	0.288	
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	rion & 1	Associates					Page 6
	Ladytowr						- 490 0
	Lauylowi	II DF					-
Newhall Naas							
Co Kildare							Mirrn
Date 25/10/2022	2 10:35		Designe	d by stev	vep		Desinance
File DOBA2110 2022.10.20 Sur Checked by							Dialitaye
XP Solutions Network 2020.1.3							
			NCCWOIX	2020.1.	, 		
	<u>On</u>	line Conti	cols for :	Surface N	letwork 2		
Hydro-Brake	® Optim	um Manhole	e: SMH1.01	l, DS/PN:	1.001,	Volume (m	ı³): 1.7
		II	+ Defense	MD QUE 0	224 2650 10	00 2650	
			t Reference .gn Head (m		224-2650-10	1.000	
			n Flow (l/s			26.5	
		200191	Flush-Flo		Ca	lculated	
			Objectiv		e upstream		
			Application			Surface	
		Sum	np Available	e		Yes	
			ameter (mm			224	
		Inver	t Level (m	)		85.600	
		tlet Pipe Di				300 1500	
	Suggested	d Manhole Di				1300	
		Control P	oints	Head (m)	Flow (l/s)		
	Des	ign Point (			26.5		
			Flush-Flom		26.5		
		n Flow over	Kick-Flo®		22.9 22.0		
The hydrologica Hydro-Brake® Op							
Hydro-Brake® Op Hydro-Brake Opt invalidated	timum as imum® be	specified. utilised th	Should an nen these s	other type torage rou	of control ting calcul	l device ot Lations wil	her than a 1 be
Hydro-Brake® Op Hydro-Brake Opt invalidated Depth (m) Flow	otimum as imum® be (l/s) D	specified. utilised th epth (m) Flo	Should an nen these s ow (l/s) De	other type torage rou epth (m) F:	of control ting calcul Low (l/s)	l device ot lations wil Depth (m) B	ther than a l be Flow (l/s)
Hydro-Brake® Op Hydro-Brake Opt invalidated Depth (m) Flow 0.100	otimum as imum® be (1/s) D 7.5	specified. utilised th epth (m) Fla 1.200	Should an nen these s ow (1/s) De 28.9	other type torage rou epth (m) F: 3.000	of control ting calcul Low (1/s) I 44.9	l device ot lations wil Depth (m) H 7.000	ther than a 1 be Flow (1/s) 67.7
Hydro-Brake® Op Hydro-Brake Opt invalidated Depth (m) Flow 0.100 0.200	timum as imum® be (1/s) D 7.5 22.3	specified. utilised th epth (m) Flo 1.200 1.400	Should an nen these s ow (1/s) De 28.9 31.1	other type torage rou epth (m) F: 3.000 3.500	of control ting calcul Low (1/s) [1 44.9 48.4	l device ot Lations wil Depth (m) E 7.000 7.500	ther than a 1 be Flow (1/s) 67.7 70.1
Hydro-Brake® Op Hydro-Brake Opt invalidated Depth (m) Flow 0.100 0.200 0.300	timum as imum® be (1/s) D 7.5 22.3 26.3	specified. utilised th epth (m) Flo 1.200 1.400 1.600	Should an nen these s ow (1/s) De 28.9 31.1 33.2	other type torage rou epth (m) F: 3.000 3.500 4.000	of control ting calcul Low (1/s) I 44.9 48.4 51.6	l device ot Lations wil Depth (m) E 7.000 7.500 8.000	ther than a 1 be Flow (1/s) 67.7 70.1 72.3
Hydro-Brake® Op Hydro-Brake Opt invalidated Depth (m) Flow 0.100 0.200 0.300 0.400	timum as imum® be (1/s) D 7.5 22.3 26.3 26.5	specified. utilised th epth (m) Flo 1.200 1.400 1.600 1.800	Should an nen these s ow (1/s) De 28.9 31.1 33.2 35.1	other type torage rou 9pth (m) F: 3.000 3.500 4.000 4.500	of control ting calcul 44.9 48.4 51.6 54.7	l device ot Lations wil Depth (m) E 7.000 7.500 8.000 8.500	ther than a 1 be Flow (1/s) 67.7 70.1 72.3 74.5
Hydro-Brake® Op Hydro-Brake Opt invalidated <b>Depth (m) Flow</b> 0.100 0.200 0.300 0.400 0.500	timum as imum® be (1/s) D 7.5 22.3 26.3 26.3 26.5 26.1	specified. utilised th epth (m) Flo 1.200 1.400 1.600 1.800 2.000	Should an nen these s ow (1/s) De 28.9 31.1 33.2 35.1 36.9	other type torage rou 3.000 3.500 4.000 4.500 5.000	of control ting calcul 44.9 48.4 51.6 54.7 57.5	L device ot Lations wil Depth (m) E 7.000 7.500 8.000 8.500 9.000	ther than a 1 be <b>Flow (1/s)</b> 67.7 70.1 72.3 74.5 76.6
Hydro-Brake® Op Hydro-Brake Opt invalidated <b>Depth (m) Flow</b> 0.100 0.200 0.300 0.400 0.500 0.600	(1/s) D (1/s) D (1/s) D (7.5 22.3 26.3 26.3 26.5 26.1 25.4	specified. utilised th epth (m) Fla 1.200 1.400 1.600 1.800 2.000 2.200	Should an nen these s <b>ow (1/s)</b> De 28.9 31.1 33.2 35.1 36.9 38.7	other type torage rou 3.000 3.500 4.000 4.500 5.000 5.500	of control ting calcul 44.9 48.4 51.6 54.7 57.5 60.3	l device ot Lations wil Depth (m) E 7.000 7.500 8.000 8.500	ther than a 1 be Flow (1/s) 67.7 70.1 72.3 74.5
Hydro-Brake® Op Hydro-Brake Opt invalidated <b>Depth (m) Flow</b> 0.100 0.200 0.300 0.400 0.500	timum as imum® be (1/s) D 7.5 22.3 26.3 26.3 26.5 26.1	specified. utilised th epth (m) Flo 1.200 1.400 1.600 1.800 2.000	Should an nen these s ow (1/s) De 28.9 31.1 33.2 35.1 36.9	other type torage rou 3.000 3.500 4.000 4.500 5.000	of control ting calcul 44.9 48.4 51.6 54.7 57.5	L device ot Lations wil Depth (m) E 7.000 7.500 8.000 8.500 9.000	ther than a 1 be <b>Flow (1/s)</b> 67.7 70.1 72.3 74.5 76.6
Hydro-Brake® Op Hydro-Brake Opt invalidated Depth (m) Flow 0.100 0.200 0.300 0.400 0.500 0.600 0.800	timum as imum® be 7.5 22.3 26.3 26.5 26.1 25.4 23.8 26.5	specified. utilised th epth (m) Fla 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600	Should an nen these s <b>ow (1/s)</b> De 28.9 31.1 33.2 35.1 36.9 38.7 40.3 41.9	<pre>other type torage rou  pth (m) F:     3.000     3.500     4.000     4.500     5.000     5.500     6.000     6.500</pre>	of control ting calcul 44.9 48.4 51.6 54.7 57.5 60.3 62.9 65.4	L device ot Lations will Depth (m) H 7.000 7.500 8.000 8.500 9.000 9.500	ther than a 1 be Flow (1/s) 67.7 70.1 72.3 74.5 76.6 78.6
Hydro-Brake® Op Hydro-Brake Opt invalidated <b>Depth (m) Flow</b> 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000	timum as imum® be 7.5 22.3 26.3 26.5 26.1 25.4 23.8 26.5	specified. utilised the epth (m) Floo 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600 hum Manhole	Should an nen these s <b>ow (1/s)</b> De 28.9 31.1 33.2 35.1 36.9 38.7 40.3 41.9	<pre>other type torage rou  ppth (m) F:     3.000     3.500     4.000     4.500     5.000     5.500     6.000     6.500     5.00     5.00     5.500     6.500     5.00 </pre>	of control ting calcul 44.9 48.4 51.6 54.7 57.5 60.3 62.9 65.4 1.005, 5	<pre>L device ot Lations wil Depth (m) E 7.000 7.500 8.000 8.500 9.000 9.500 Volume (m</pre>	ther than a 1 be Flow (1/s) 67.7 70.1 72.3 74.5 76.6 78.6
Hydro-Brake® Op Hydro-Brake Opt invalidated <b>Depth (m) Flow</b> 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000	timum as imum® be 7.5 22.3 26.3 26.5 26.1 25.4 23.8 26.5	specified. utilised the epth (m) Floo 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600 Num Manhole Uni	Should an nen these s <b>ow (1/s) De</b> 28.9 31.1 33.2 35.1 36.9 38.7 40.3 41.9 <b>e:</b> SMH1.05	<pre>other type torage rou  ppth (m) F:     3.000     3.500     4.000     4.500     5.000     5.500     6.000     6.500     6.500     5.00     5.00     6.500     6.500     6.500     6.500     6.500     6.500 </pre>	of control ting calcul 44.9 48.4 51.6 54.7 57.5 60.3 62.9 65.4 1.005, 5	<pre>L device ot Lations wil Depth (m) E 7.000 7.500 8.000 8.500 9.000 9.500 Volume (m</pre>	ther than a 1 be Flow (1/s) 67.7 70.1 72.3 74.5 76.6 78.6
Hydro-Brake® Op Hydro-Brake Opt invalidated <b>Depth (m) Flow</b> 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000	timum as imum® be 7.5 22.3 26.3 26.5 26.1 25.4 23.8 26.5	specified. utilised th epth (m) Fla 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600 num Manhole Uni Desi	Should an nen these s <b>ow (1/s) De</b> 28.9 31.1 33.2 35.1 36.9 38.7 40.3 41.9 <b>e: SMH1.0</b> t Reference	<pre>bother type torage rou  spth (m) F:     3.000     3.500     4.000     4.500     5.000     5.500     6.000     6.500  5.500     6.500  5.500     6.500  5.500     6.500 </pre>	of control ting calcul 44.9 48.4 51.6 54.7 57.5 60.3 62.9 65.4 1.005, 5	L device ot Lations will Depth (m) E 7.000 7.500 8.000 8.500 9.000 9.500 Volume (m 000-1600	ther than a 1 be Flow (1/s) 67.7 70.1 72.3 74.5 76.6 78.6
Hydro-Brake® Op Hydro-Brake Opt invalidated <b>Depth (m) Flow</b> 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000	timum as imum® be 7.5 22.3 26.3 26.5 26.1 25.4 23.8 26.5	specified. utilised th epth (m) Fla 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600 num Manhole Uni Desi	Should an nen these s <b>ow (1/s) De</b> 28.9 31.1 33.2 35.1 36.9 38.7 40.3 41.9 <b>e:</b> SMH1.05 t Reference gn Head (m	<pre>bother type torage rou  spth (m) F:     3.000     3.500     4.000     4.500     5.000     5.500     6.000     6.500  5.500     6.500  5.500     6.500  5.500     6.500 </pre>	of control ting calcul 44.9 48.4 51.6 54.7 57.5 60.3 62.9 65.4 1.005, 5 181-1600-09	L device ot Lations will Depth (m) E 7.000 7.500 8.000 8.500 9.000 9.500 <u>Volume (m</u> 000-1600 0.900	ther than a 1 be Flow (1/s) 67.7 70.1 72.3 74.5 76.6 78.6
Hydro-Brake® Op Hydro-Brake Opt invalidated <b>Depth (m) Flow</b> 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000	timum as imum® be 7.5 22.3 26.3 26.5 26.1 25.4 23.8 26.5	specified. utilised th epth (m) Fla 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600 num Manhole Uni Desi	Should an nen these s <b>ow (1/s) De</b> 28.9 31.1 33.2 35.1 36.9 38.7 40.3 41.9 <b>e:</b> SMH1.0 t Reference on Head (m n Flow (1/s)	<pre>bother type torage rou  spth (m) F:     3.000     3.500     4.000     4.500     5.000     5.500     6.000     6.500  5.500  5.500 5.500  5.500  5.50</pre>	of control ting calcul 44.9 48.4 51.6 54.7 57.5 60.3 62.9 65.4 1.005, 5 181-1600-09	L device ot Lations will Depth (m) E 7.000 7.500 8.000 8.500 9.000 9.500 <i>Volume</i> (m 200-1600 0.900 16.0 Lculated	ther than a 1 be Flow (1/s) 67.7 70.1 72.3 74.5 76.6 78.6
Hydro-Brake® Op Hydro-Brake Opt invalidated <b>Depth (m) Flow</b> 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000	timum as imum® be 7.5 22.3 26.3 26.5 26.1 25.4 23.8 26.5	specified. utilised th epth (m) Flo 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600 num Manhole Uni Design	Should an nen these s ow (1/s) De 28.9 31.1 33.2 35.1 36.9 38.7 40.3 41.9 e: SMH1.01 t Reference gn Head (m Flush-Flov Objective Application	<pre>bother type torage rou  pth (m) F:     3.000     3.500     4.000     4.500     5.000     5.500     6.000     6.500  5.500     6.000     6.500  5.500     m     MD-SHE-0 )      M     Minimis n </pre>	of control ting calcul 44.9 48.4 51.6 54.7 57.5 60.3 62.9 65.4 1.005, 1 181-1600-09	L device ot Lations will Depth (m) E 7.000 7.500 8.000 8.500 9.000 9.500 <i>Volume</i> (m 200-1600 0.900 16.0 Lculated	ther than a 1 be Flow (1/s) 67.7 70.1 72.3 74.5 76.6 78.6
Hydro-Brake® Op Hydro-Brake Opt invalidated <b>Depth (m) Flow</b> 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000	timum as imum® be 7.5 22.3 26.3 26.5 26.1 25.4 23.8 26.5	specified. utilised th epth (m) Flo 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600 num Manhole Uni Design Sum	Should an         nen these s         ow (1/s)       De         28.9         31.1         33.2         35.1         36.9         38.7         40.3         41.9         e: SMH1.0!         ct Reference        gn Head (m         Flush-Flow         Objective         Application        p Available	<pre>other type torage rou  pth (m) F:     3.000     3.500     4.000     4.500     5.500     6.000     6.500     6.500     5.50     m e MD-SHE-0 ) m e Minimis n e</pre>	of control ting calcul 44.9 48.4 51.6 54.7 57.5 60.3 62.9 65.4 1.005, 1 181-1600-09	L device ot Lations will Depth (m) F 7.000 7.500 8.000 8.500 9.000 9.500 9.500 9.500 Volume (m 0.900 16.0 Loulated storage Surface Yes	ther than a 1 be Flow (1/s) 67.7 70.1 72.3 74.5 76.6 78.6
Hydro-Brake® Op Hydro-Brake Opt invalidated <b>Depth (m) Flow</b> 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000	timum as imum® be 7.5 22.3 26.3 26.5 26.1 25.4 23.8 26.5	specified. utilised th epth (m) Flo 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600 um Manhole Uni Design Sum Di	Should an hen these s ow (1/s) De 28.9 31.1 33.2 35.1 36.9 38.7 40.3 41.9 e: SMH1.0 t Reference on Head (m h Flow (1/s Flush-Flo <sup>0</sup> Objective Application ameter (mm	<pre>bother type torage rou  pth (m) F:     3.000     3.500     4.000     4.500     5.000     5.500     6.000     6.500     5.00     5.00     6.500     5.00     m e MD-SHE-0 ) m e Minimis n e )</pre>	of control ting calcul 44.9 48.4 51.6 54.7 57.5 60.3 62.9 65.4 1.005, 1 181-1600-09	L device ot Lations will Depth (m) F 7.000 7.500 8.000 8.500 9.000 9.500 2.5000 2.5000 2.5000 2.5000 2.5000 2.5000 2.50000000000	ther than a 1 be Flow (1/s) 67.7 70.1 72.3 74.5 76.6 78.6
Hydro-Brake® Op Hydro-Brake Opt invalidated Depth (m) Flow 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000 Hydro-Brake	timum as       imum® be       7.5       22.3       26.3       26.5       26.1       25.4       23.8       26.5       8       Optim	specified. utilised the epth (m) Floo 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600 num Manhole Uni Design Sum Di Inver	Should an nen these s ow (1/s) De 28.9 31.1 33.2 35.1 36.9 38.7 40.3 41.9 e: SMH1.0 t Reference on Head (m Flush-Flow Objective Application p Available ameter (mm	<pre>other type torage rou  pth (m) F:     3.000     3.500     4.000     4.500     5.000     5.500     6.000     6.500  5. DS/PN:     MD-SHE-0 )  M    m     m     m </pre>	of control ting calcul 44.9 48.4 51.6 54.7 57.5 60.3 62.9 65.4 1.005, 1 181-1600-09	L device ot Lations will Depth (m) F 7.000 7.500 8.000 8.500 9.000 9.500 Volume (m 000-1600 0.900 16.0 Loulated storage Surface Yes 181 85.121	ther than a 1 be Flow (1/s) 67.7 70.1 72.3 74.5 76.6 78.6
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Hydro-Brake® Op Hydro-Brake Opt invalidated <b>Depth (m) Flow</b> 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000 <u>Hydro-Brake</u>	nimum Out	specified. utilised the epth (m) Floo 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600 num Manhole Uni Design Sum Di Inver	Should an hen these s ow (1/s) De 28.9 31.1 33.2 35.1 36.9 38.7 40.3 41.9 e: SMH1.0 ct Reference on Head (m Flush-Flow Objective Application p Available ameter (mm ct Level (m	<pre>other type torage rou  pth (m) F:     3.000     3.500     4.000     4.500     5.000     5.500     6.000     6.500     5.00     5.00     6.500     5.00     m e MD-SHE-0 ) m e Minimis n e ) </pre>	of control ting calcul 44.9 48.4 51.6 54.7 57.5 60.3 62.9 65.4 1.005, 1 181-1600-09	L device ot Lations will Depth (m) F 7.000 7.500 8.000 8.500 9.000 9.500 Volume (m 000-1600 0.900 16.0 Loulated storage Surface Yes 181 85.121	ther than a 1 be Flow (1/s) 67.7 70.1 72.3 74.5 76.6 78.6
Hydro-Brake® Op Hydro-Brake Opt invalidated Depth (m) Flow 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000 <u>Hydro-Brake</u>	nimum Out	specified. utilised the epth (m) Flo 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600 Mum Manhole Uni Design Sum Di Invertiet Pipe Di	Should an hen these s ow (1/s) De 28.9 31.1 33.2 35.1 36.9 38.7 40.3 41.9 e: SMH1.0 ct Reference on Head (m Flush-Flow Objective Application p Available ameter (mm ct Level (m	<pre>other type torage rou  pth (m) F:     3.000     3.500     4.000     4.500     5.000     5.500     6.000     6.500     5.00     5.00     6.500     5.00     m e MD-SHE-0 ) m e Minimis n e ) </pre>	of control ting calcul 44.9 48.4 51.6 54.7 57.5 60.3 62.9 65.4 1.005, 1 181-1600-09 Cal	L device ot Lations will Depth (m) F 7.000 7.500 8.000 8.500 9.000 9.500 Zolume (m 000-1600 0.900 16.0 Loulated storage Surface Yes 181 85.121 225	ther than a 1 be Flow (1/s) 67.7 70.1 72.3 74.5 76.6 78.6

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? Solutions			Netwo	rk 2020.1	.3		
<u>Hydro-Bra</u>	ake® Opt:	imum Manh	ole: SMH1	.05, DS/P	N: 1.005	5, Volume	(m <sup>3</sup> ): 2.5
		Contro	ol Points	Head (r	n) Flow (1	L/s)	
	D	esign Poin	t (Calculate Flush-Fl			L6.0 L6.0	
				lo® 0.65		13.7	
	М	ean Flow o	ver Head Rar			13.4	
The hydrolog Hydro-Brake® Hydro-Brake invalidated	Optimum	as specifie	ed. Should	another ty	pe of con	trol device	other than a
Depth (m) F	low (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (1/:	s) Depth (m)	Flow (l/s)
0.100	6.4	1.200	18.3	3.000	28	.4 7.000	42.8
0.200	15.5	1.400	19.7	3.500	30	.6 7.500	44.2
0.300	16.0	1.600	21.0	4.000	32	.6 8.000	45.7
0.400	15.8	1.800	22.3	4.500	34	.6 8.500	47.0
0.500	15.4	2.000	23.4	5.000	36	.4 9.000	
0.600	14.6						49.4
0.800 1.000	15.1 16.8		25.5 26.5				
		Des	Unit Refere Design Head sign Flow (1 Flush-F Object Applicat Sump Availa Diameter ( overt Level	(m) ./s) lo™ .ive Minim .ion .ble mm)		1.000 5.3 Calculated eam storage Surface Yes 108 85.080	
	Minimum (		e Diameter (	( )		150	
		Dutlet Pipe ted Manhole	e Diameter ( e Diameter (	mm) mm)		1200	
	Suggest	Dutlet Pipe ced Manhole Contro	e Diameter ( e Diameter ( <b>DI Points</b>	(mm) (mm) Head (r	n) Flow (1	1200	
	Suggest	Dutlet Pipe ced Manhole Contro	e Diameter ( e Diameter ( <b>ol Points</b> t (Calculate	mm) mm) Head (r ed) 1.00	00	1200 L/s) 5.3	
	Suggest	Dutlet Pipe ced Manhole Contro	e Diameter ( e Diameter ( <b>bl Points</b> t (Calculate Flush-Fl	mm) mm) Head (r ed) 1.00 lo™ 0.29	)0 95	1200 L/s) 5.3 5.3	
	Suggest D	Dutlet Pipe Led Manhole <b>Contro</b> esign Poin	e Diameter ( e Diameter ( <b>ol Points</b> t (Calculate	mm) mm) Head (r ed) 1.00 lo™ 0.29 lo® 0.64	)0 95	1200 L/s) 5.3	
The hydrolog Hydro-Brake® Hydro-Brake invalidated	Suggest D M ical calc	Dutlet Pipe ted Manhole <b>Contro</b> esign Poin ean Flow o ulations ha	<pre>a Diameter ( a Diameter ( a Diameter ( bl Points t (Calculate Flush-Fi Kick-Fi ver Head Ran ave been bas ad. Should</pre>	mm) mm) Head (r ed) 1.00 lo™ 0.29 lo® 0.64 nge sed on the another ty	)0 95 41 - Head/Disc pe of con	1200 5.3 5.3 4.3 4.6 harge relati trol device	other than a
Hydro-Brake® Hydro-Brake invalidated	Suggest D ical calc Optimum Optimum	Dutlet Pipe ted Manhole <b>Contro</b> esign Poin ean Flow o ulations ha as specific pe utilised	e Diameter ( e Diameter ( ol Points t (Calculate Flush-Fi Kick-Fi ver Head Ran ave been bas ed. Should d then these	Head (r mm) mm) Head (r ed) 1.00 lo™ 0.29 lo® 0.64 nge sed on the another ty e storage r	00 95 41 - Head/Disc pe of con outing ca	1200 5.3 5.3 4.3 4.6 harge relati trol device	other than a vill be
Hydro-Brake® Hydro-Brake invalidated	Suggest D M ical calc Optimum Optimum low (1/s) 3.7	Dutlet Pipe ted Manhole Contro esign Poin ean Flow o ulations ha as specific oe utilised Depth (m) 0.300	e Diameter ( e Diameter ( ol Points t (Calculate Flush-Fi Kick-Fi ver Head Ran ave been bas ed. Should d then these	Head (r mm) mm) Head (r ed) 1.00 lo™ 0.29 lo® 0.64 nge sed on the another ty e storage r	00 95 41 - Head/Disc pe of con outing ca Flow (1/:	1200 5.3 5.3 4.3 4.6 harge relati trol device lculations w	other than a vill be <b>Flow (l/s)</b>
Hydro-Brake® Hydro-Brake invalidated Depth (m) F	Suggest D ical calc Optimum Optimum low (1/s)	Dutlet Pipe ted Manhole Contro esign Poin ean Flow o ulations ha as specific oe utilised Depth (m) 0.300	<pre>e Diameter ( e Diameter (</pre>	mm) mm) Head (r ed) 1.00 10™ 0.29 10® 0.64 nge sed on the another ty e storage r Depth (m) 0.500	00 95 41 - Head/Disc pe of con outing ca Flow (1/: 5	1200 L/s) 5.3 5.3 4.3 4.6 harge relati trol device lculations w s) Depth (m)	other than a will be <b>Flow (1/s)</b>

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<u>Hydro-Brak</u>							
Depth (m) Flo	w (1/s) D	epth (m) Flo	ow (1/s) De	epth (m) Fl	ow (1/s)	Depth (m) F	'low (l/s)
1.200	5.8	2.400	8.0	5.000	11.3	8.000	14.1
1.400	6.2	2.600	8.3	5.500	11.8	8.500	14.6
1.600	6.6	3.000	8.9	6.000	12.3	9.000	15.0
1.800	7.0	3.500	9.5	6.500	12.8	9.500	15.4
2.000 2.200	7.3	4.000 4.500	10.2	7.000 7.500	13.3 13.7		
	I		I		1		
Hydro-Brak	e® Optim	um Manhole	e: SMH4.0	1, DS/PN:	4.001,	Volume (m	<sup>3</sup> ): 1.9
				e MD-SHE-01	180-1600-1		
			gn Head (m			1.000	
		Design	Flow (l/s			16.0	
			Flush-Flo			lculated	
			-	e Minimise	e upstream	-	
			Applicatio			Surface	
			np Availabl			Yes	
			ameter (mm			180	
			t Level (m	·		85.400	
M		tlet Pipe Di				225 1500	
	Suggeste	d Manhole Di				1500	
		Control P	oints	Head (m)	Flow (1/s)	)	
	Des	ign Point (0			16.		
			Flush-Flo <sup>m</sup>	≤ 0.324	16.		
			Kick-Flo@		13.		
		n Flow over			13. 13.		
The hydrologic Hydro-Brake® O Hydro-Brake Op invalidated Depth (m) Flo	Mea cal calcul Dptimum as Dtimum® be	ations have specified. utilised th	Head Range been based Should an hen these s	on the Hea other type torage rout	13. ad/Dischar of contro ting calcu	6 ge relation l device ot lations wil	her than a l be
Hydro-Brake® O Hydro-Brake Op invalidated Depth (m) Flo 0.100	Mea cal calcul Dptimum as btimum® be ow (1/s) D 6.3	ations have specified. utilised th epth (m) Flo 1.200	Head Range been based Should an hen these s ow (1/s) Do 17.4	on the Hea other type torage rout apth (m) Fl 3.000	13. ad/Dischar of contro ting calcu .ow (1/s) 27.0	6 ge relation l device ot lations wil Depth (m) F 7.000	her than a l be <b>Clow (l/s)</b> 40.7
Hydro-Brake® O Hydro-Brake Op invalidated Depth (m) Flo 0.100 0.200	Mea cal calcul Dptimum as otimum® be ow (1/s) D 6.3 15.4	ations have specified. utilised th epth (m) Flo 1.200 1.400	Head Range been based Should an hen these s ow (1/s) De 17.4 18.8	on the Hea other type torage rout apth (m) Fl 3.000 3.500	13. ad/Dischar of contro ing calcu .ow (1/s) 27.0 29.1	6 ge relation l device ot lations wil Depth (m) F 7.000 7.500	her than a 1 be 210w (1/s) 40.7 42.1
Hydro-Brake® O Hydro-Brake Op invalidated Depth (m) Flo 0.100 0.200 0.300	Mea cal calcul Dptimum as otimum® be ow (1/s) D 6.3 15.4 16.0	ations have specified. utilised th epth (m) Flo 1.200 1.400 1.600	Head Range been based Should an hen these s ow (1/s) De 17.4 18.8 20.0	on the Hea other type torage rout apth (m) F1 3.000 3.500 4.000	13. ad/Dischar of contro ing calcu .ow (1/s) 27.0 29.1 31.0	6 ge relation l device ot lations wil Depth (m) F 7.000 7.500 8.000	her than a 1 be 210w (1/s) 40.7 42.1 43.4
Hydro-Brake® O Hydro-Brake Op invalidated Depth (m) Flo 0.100 0.200 0.300 0.400	Mea cal calcul Dptimum as otimum® be ow (1/s) D 6.3 15.4 16.0 15.9	ations have specified. utilised th epth (m) Flo 1.200 1.400 1.600 1.800	Head Range been based Should an nen these s ow (1/s) De 17.4 18.8 20.0 21.2	on the Hea other type torage rout apth (m) Fl 3.000 3.500 4.000 4.500	13. ad/Dischar of contro ing calcu .ow (1/s) 27.0 29.1 31.0 32.9	6 ge relation l device ot lations wil Depth (m) F 7.000 7.500 8.000 8.500	her than a l be <b>'low (l/s)</b> 40.7 42.1 43.4 44.7
Hydro-Brake® O Hydro-Brake Op invalidated Depth (m) Flo 0.100 0.200 0.300 0.400 0.500	Mea cal calcul Dptimum as otimum® be ow (1/s) D 6.3 15.4 16.0 15.9 15.6	ations have specified. utilised th epth (m) Flo 1.200 1.400 1.600 1.800 2.000	Head Range been based Should an hen these s ow (1/s) De 17.4 18.8 20.0 21.2 22.3		13. ad/Dischar of contro ing calcu .ow (1/s) 27.0 29.1 31.0 32.9 34.6	6 ge relation l device ot lations wil Depth (m) F 7.000 7.500 8.000 8.500 9.000	her than a l be 210w (1/s) 40.7 42.1 43.4 44.7 45.9
Hydro-Brake® O Hydro-Brake Op invalidated <b>Depth (m) Flo</b> 0.100 0.200 0.300 0.400 0.500 0.600	Mea cal calcul Dptimum as otimum® be ow (1/s) D 6.3 15.4 16.0 15.9 15.6 15.0	ations have specified. utilised th epth (m) Flo 1.200 1.400 1.600 1.800 2.000 2.200	Head Range been based Should an hen these s bw (1/s) De 17.4 18.8 20.0 21.2 22.3 23.3		13. ad/Dischar of contro ing calcu .ow (1/s) 27.0 29.1 31.0 32.9 34.6 36.2	6 ge relation l device ot lations wil Depth (m) F 7.000 7.500 8.000 8.500	her than a l be <b>'low (l/s)</b> 40.7 42.1 43.4 44.7
Hydro-Brake® O Hydro-Brake Op invalidated Depth (m) Flo 0.100 0.200 0.300 0.400 0.500 0.600 0.800	Mea cal calcul Dptimum as otimum® be ow (1/s) D 6.3 15.4 16.0 15.9 15.6 15.0 14.4	ations have specified. utilised th epth (m) Flo 1.200 1.400 1.600 1.800 2.000 2.200 2.400	Head Range been based Should an hen these s ow (1/s) De 17.4 18.8 20.0 21.2 22.3 23.3 24.3		13. ad/Dischar of contro ing calcu .ow (1/s) 27.0 29.1 31.0 32.9 34.6 36.2 37.7	6 ge relation l device ot lations wil Depth (m) F 7.000 7.500 8.000 8.500 9.000	her than a l be 210w (1/s) 40.7 42.1 43.4 44.7 45.9
Hydro-Brake® O Hydro-Brake Op invalidated <b>Depth (m) Flo</b> 0.100 0.200 0.300 0.400 0.500 0.600	Mea cal calcul Dptimum as otimum® be ow (1/s) D 6.3 15.4 16.0 15.9 15.6 15.0	ations have specified. utilised th epth (m) Flo 1.200 1.400 1.600 1.800 2.000 2.200	Head Range been based Should an hen these s bw (1/s) De 17.4 18.8 20.0 21.2 22.3 23.3		13. ad/Dischar of contro ing calcu .ow (1/s) 27.0 29.1 31.0 32.9 34.6 36.2	6 ge relation l device ot lations wil Depth (m) F 7.000 7.500 8.000 8.500 9.000	her than a l be 210w (1/s) 40.7 42.1 43.4 44.7 45.9
Hydro-Brake® O Hydro-Brake Op invalidated <b>Depth (m) Flo</b> 0.100 0.200 0.300 0.400 0.500 0.600 0.800	Mea cal calcul Dptimum as otimum® be ow (1/s) D 6.3 15.4 16.0 15.9 15.6 15.0 14.4 16.0	ations have specified. utilised th epth (m) Flo 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600	Head Range been based Should an nen these s ow (1/s) De 17.4 18.8 20.0 21.2 22.3 23.3 24.3 25.2	<pre></pre>	13. ad/Dischar of contro ing calcu ow (1/s) 27.0 29.1 31.0 32.9 34.6 36.2 37.7 39.2	6 ge relation l device ot lations wil <b>Depth (m) F</b> 7.000 7.500 8.000 8.500 9.000 9.500	her than a l be low (1/s) 40.7 42.1 43.4 44.7 45.9 47.2
Hydro-Brake® O Hydro-Brake Op invalidated <b>Depth (m) Flo</b> 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000	Mea cal calcul Dptimum as otimum® be ow (1/s) D 6.3 15.4 16.0 15.9 15.6 15.0 14.4 16.0	ations have specified. utilised th epth (m) Flo 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600	Head Range been based Should an nen these s ow (1/s) De 17.4 18.8 20.0 21.2 22.3 23.3 24.3 25.2 e: SMH4.0	<pre></pre>	13. ad/Dischar of contro ing calcu ow (1/s) 27.0 29.1 31.0 32.9 34.6 36.2 37.7 39.2 4.003,	6 ge relation l device ot lations wil <b>Depth (m) F</b> 7.000 7.500 8.000 8.500 9.000 9.500 <u>Volume (m</u>	her than a l be low (1/s) 40.7 42.1 43.4 44.7 45.9 47.2
Hydro-Brake® O Hydro-Brake Op invalidated <b>Depth (m) Flo</b> 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000	Mea cal calcul optimum as otimum® be (1/s) D 6.3 15.4 16.0 15.9 15.6 15.0 14.4 16.0 	ations have specified. utilised th epth (m) Flo 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600	Head Range been based Should an nen these s ow (1/s) De 17.4 18.8 20.0 21.2 22.3 23.3 24.3 25.2 e: SMH4.0	<pre></pre>	13. ad/Dischar of contro ing calcu ow (1/s) 27.0 29.1 31.0 32.9 34.6 36.2 37.7 39.2 4.003,	6 ge relation l device ot lations wil <b>Depth (m) F</b> 7.000 7.500 8.000 8.500 9.000 9.500 <u>Volume (m</u>	her than a l be low (1/s) 40.7 42.1 43.4 44.7 45.9 47.2
Hydro-Brake® O Hydro-Brake Op invalidated <b>Depth (m) Flo</b> 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000	Mea cal calcul optimum as otimum® be ow (1/s) D 6.3 15.4 16.0 15.9 15.6 15.0 14.4 16.0 14.4 16.0	ations have specified. utilised th epth (m) Flo 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600 uum Manhole Unit Refere	Head Range been based Should an nen these s ow (1/s) De 17.4 18.8 20.0 21.2 22.3 23.3 24.3 25.2 e: SMH4.0	<pre></pre>	13. ad/Dischar of contro ing calcu ow (1/s) 27.0 29.1 31.0 32.9 34.6 36.2 37.7 39.2 4.003,	6 ge relation l device ot lations wil <b>Depth (m) F</b> 7.000 7.500 8.000 8.500 9.000 9.500 <u>Volume (m</u>	her than a l be low (1/s) 40.7 42.1 43.4 44.7 45.9 47.2
Hydro-Brake® O Hydro-Brake Op invalidated <b>Depth (m) Flo</b> 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000	Mea cal calcul optimum as otimum® be ow (1/s) D 6.3 15.4 16.0 15.9 15.6 15.0 14.4 16.0 14.4 16.0	ations have specified. utilised th epth (m) Flo 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600 uum Manhole Unit Refere Design Head	Head Range been based Should an nen these s ow (1/s) De 17.4 18.8 20.0 21.2 22.3 23.3 24.3 25.2 e: SMH4.0 ence MD-SHE (m) ./s)	<pre></pre>	13. ad/Dischar of contro ing calcu ow (1/s) 27.0 29.1 31.0 32.9 34.6 36.2 37.7 39.2 4.003, -0500-1000 0.500	6 ge relation l device ot lations wil <b>Depth (m) F</b> 7.000 7.500 8.000 8.500 9.000 9.500 <u>Volume (m</u>	her than a l be low (1/s) 40.7 42.1 43.4 44.7 45.9 47.2
Hydro-Brake® O Hydro-Brake Op invalidated <b>Depth (m) Flo</b> 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000	Mea cal calcul optimum as otimum® be ow (1/s) D 6.3 15.4 16.0 15.9 15.6 15.0 14.4 16.0 14.4 16.0	ations have specified. utilised th epth (m) Flo 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600 uum Manhole Unit Refere Design Head sign Flow (1	Head Range been based Should an nen these s ow (1/s) De 17.4 18.8 20.0 21.2 22.3 23.3 24.3 25.2 e: SMH4.0 ence MD-SHE (m) ./s)	<pre></pre>	13. ad/Dischar of contro ing calcu ow (1/s) 27.0 29.1 31.0 32.9 34.6 36.2 37.7 39.2 4.003, -0500-1000 0.500 10.0	6 ge relation l device ot lations wil <b>Depth (m) F</b> 7.000 7.500 8.000 8.500 9.000 9.500 <u>Volume (m</u>	her than a l be low (1/s) 40.7 42.1 43.4 44.7 45.9 47.2

Jnit W9 E&F Ladytown BP lewhall Naas jo Kildare Jate 25/10/2022 10:35 Designed by stevep Checked by (F Solutions Network 2020.1.3 Hydro-Brake® Optimum Manhole: SMH4.03, DS/PN: 4.003, Volume (m <sup>2</sup> ): 3.9 Objective Mininise upstream storage Application Surface Diameter (ma) 152 Jnvert Level (m) 84.800 Minimum Outlet Fipe Diameter (ma) 1200 Control Points Head (m) Flow (1/s) Design Foint (Calculated) 0.500 10.0 Flush-Flo® 0.225 10.0 Mean Flow over Head Range - 7.9 The hydro-Brake@ Optimum bave been based on the Head/Discharge relationship for U hydro-Brake@ Optimum be utilised then these storage routing calculations will be invalidated 0.100 5.5 1.200 15.1 3.000 23.4 7.000 35.3 0.200 10.0 11.60 Flow (1/s) Depth (m) Flow (1/s) Depth (m) Flow (1/s) Depth (m) Flow (1/s) Level (m) 13.2 0.100 5.5 1.200 15.1 3.000 23.4 7.000 35.3 0.200 10.0 1.400 16.3 3.500 22.2 7.500 36.5 0.300 9.8 1.600 17.3 4.500 22.5 8.800 33.7 0.400 9.0 1.600 15.3 4.500 22.5 8.800 33.7 0.400 9.0 1.600 15.3 4.500 22.5 8.800 33.7 0.400 9.0 1.600 17.3 4.500 22.5 8.800 33.7 0.400 9.0 1.600 17.3 4.500 22.5 8.800 33.5 0.200 10.0 2.000 15.3 5.500 33.0 9.00 Hydro-Brake@ Optimum Manhole: SMH1.07, DS/PN: 1.007, Volume (m <sup>3</sup> ): 5.6 Unit Reference MD-EUE-0126-8800-1800-8800 Design Flow (1/s) 2.400 21.1 6.500 33.6 Hydro-Brake@ Optimum Manhole: SMH1.07, DS/PN: 1.007, Volume (m <sup>3</sup> ): 5.6 Diameter (ma) 125 Junk-Flo® 1.200 12.5 1.200 12.1 1.000 3.4 Hydro-Brake@ Optimum Manhole: SMH1.07, DS/PN: 1.007, Volume (m <sup>3</sup> ): 5.6 Diameter (ma) 125 Junk-Flo® 1.200 1.200 1.20 Design Flow (1/s) 8.8 Kick-Flo@ 1.100 6.8 Flush-Flo® 1.500 8.4 Surgested Manhole Diameter (ma) 1200 Design Flow (1/s) 8.8 Kick-Flo@ 1.103 7.0 Mean Flow over Head Range - 7.7 The hydrological calculations have been based on the Head/Discharge relationship for U		'Brien &	ASSOCIALE	5				Page 9
bo Kildare parte 25/10/2022 10:35 "ile DOBA2110 2022.10.20 Sur" Pesigned by stevep Checked by Resolutions Hydro-Brake® Optimum Manhole: SMH4.03, DS/PN: 4.003, Volume (m²): 3.9 Metwork 2020.1.3 Hydro-Brake® Optimum Manhole: SMH4.03, DS/PN: 4.003, Volume (m²): 3.9 Objective Minimise upstream storage Application Surface Sump Available Yes Sump Available Yes Suggested Manhole Diameter (mm) 1220 Centrol Points Head (m) Flow (1/s) Design Point (Calculated) 0.500 10.0 Flush-Flöw 0.396 9.0 Mean Flow over Head Range - 7.9 The hydrological calculations have been based on the Head/Discharge relationship for tl Bydro-Brake@ Optimum as specified. Should another type of control device other than a 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 (1/s) Depth (m) Flow (1/s) Depth (m) Flow (1/s) Depth (m) Flow (1/s) 0.100 5.5 0.200 10.0 0.100 15.5 0.200 10.0 0.100 2.200 15.3 0.200 10.0 0.100 2.200 15.3 0.200 10.0 0.100 2.200 20.2 0.500 10.0 0.250 20.2 0.5	nit W9 E&F	Ladytow	n BP					
<pre>prime 25/10/2022 10:35 ile DOBA2110 2022.10.20 Sur P Solutions Detection Surface Application Surface Sump Available Yes Diameter (mm) 152 Invert Level (m) 84.800 Minimum Outlet Pipe Diameter (mm) 225 Suggested Manhole Diameter (mm) 1200 Control Points Head (m) Flow (1/s) Design Foint (Calculated) 0.500 10.0 Kick-Flo® 0.396 9.0 Mean Flow over Head Range - 7.9 The hydrological calculations have been based on the Head/Discharge relationship for til Hydro-Brake@ Optimum@ be utilised then these storage routing calculations will be invalidated Depth (m) Flow (1/s) Depth (m) Flow (1/s) Depth (m) Flow (1/s) Depth (m) Flow (1/s) 0.100 5.5 1.200 15.1 3.000 23.4 7.000 35.3 0.200 10.0 1.400 16.3 2.500 25.4 7.500 36.5 0.300 9.8 1.600 17.3 4.600 22.5 8.600 37.7 0.400 9.0 1.600 17.3 4.600 22.6 8.600 37.7 0.400 9.0 1.600 17.3 4.600 22.6 8.600 38.9 0.600 10.9 2.200 20.2 5.500 31.2 9.500 41.2 0.600 10.9 2.200 20.2 5.500 31.2 9.500 41.2 0.600 10.9 2.600 21.1 6.600 32.6 8.8 Flush-Flow (1/s) Depth (m) Flow (1/s) Depth (m) Flow (1/s) Design Flow (1/s) 1.600 18.3 4.500 28.6 8.600 38.7 0.400 9.0 1.600 12.3 1.500 32.6 7.500 33.2 9.500 41.2 0.600 10.9 2.200 20.2 5.500 31.2 9.500 41.2 0.600 12.5 2.400 21.1 6.500 34.0 1.42 Hydro-Brake@ Optimum Manhole: SMH1.07, DS/PN: 1.007, Volume (m<sup>3</sup>): 5.6 Unit Reference MD-SHE-0126-8800-1800-8800 Design Flow (1/s) 1.600 8.8 Flush-Flow (1/s) 1.600 8.8 Flush-Flow 1.601 1.200 1.200 Control Foints Head (m) Flow (1/s) Design Flow (1/s) 1.200 Control Foints Head (m) Flow (1/s) Enderet (mn) 1.200 Control Foints Head (m) Flow (1/s) Design Flow (1/s) 8.8 Flush-Flow 0.541 8.8 Kick-Flo@ 1.133 7.0 Hean Flow over Head Range - 7.7 Ender Head Range - 7.7</pre>	whall Naa	as						
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P Solutions         Network 2020.1.3           Hydro-Brake@ Optimum Manhole: SMH4.03, DS/FN: 4.003, Volume (m³): 3.9 Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (rm) 152 Invert Level (m) 84.800 Minimum Outlet Pipe Diameter (rm) 225 Suggested Manhole Diameter (rm) 1200           Control Points Head (m) Flow (l/s) Design Point (Calculated) 0.500 10.0 Kick-Flo@ 0.235 9.0 Mean Flow over Head Range - 7.9           The hydrological calculations have been based on the Head/Discharge relationship for tl Hydro-Brake@ Optimum & specified. Should another type of control device other than a Hydro-Brake@ Optimum & specified. Should another type of control device other than a Hydro-Brake@ Optimum & specified. Should another type of control device other than a Hydro-Brake@ Optimum & 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/e)           0.100         5.5           0.200         10.0           1.200         15.1           3.000         23.4           7.000         35.3           0.200         10.20           0.100         5.5           1.200         15.1           3.000         23.4           7.000         35.3           0.200         10.2           0.100         2.200           2.200         2.2				_	-	-1-		Urainag
Hydro-Brake@ Optimum Manhole: SMH4.03, D5/PN: 4.003, Volume (m³): 3.9         Objective Minimise upstream storage Sump Available       Surface Sump Available         Paneter (mm)       152 Invert Level (m)       84.800         Minimum Outlet Pipe Diameter (mm)       225         Design Foint (Calculated)       0.500       10.0         Flush-Flor       0.225       10.0         Kick-Flor       0.300       9.0         Mean Flow over Head Range       -       7.9         The hydrological calculations have been based on the Head/Discharge relationship for tl       14         hydro-brake Optimum as specified. Should another type of control device other than a       19/dro-brake Optimum as specified. Should another type of control device other than a         0.100       5.5       1.200       15.1       3.000       23.4         0.200       10.2       1.400       16.3       3.500       23.4         0.200       10.2       1.200       15.1       3.000       3.000       3.6.5         <		2022.10	.20 541					
Objective Minimise upstream storage ApplicationSurface Surface SurgavilableSump AvailableYes Diameter (mm)153 Livert Level (m)84.800Minimum Outlet Ploameter (mm)225 Suggested Manhole Diameter (mm)1200Corrol Point (Calculated)0.50010.0 Flush-Flo@Design Point (Calculated)0.50010.0 Flush-Flo@0.325Mean Flow over Head Range-7.9The hydrological calculations have been based on the Head/Discharge relationship for thy hydro-Brake@ Optimum@ be utilised then these storage routing calculations will be invalidatedDepth (m) Flow (1/s)Depth (m) Flow (1/s) ( 1.400Depth (m) Flow (1/s) ( 1.400Depth (m) Flow (1/s)Depth (m) Flow (1/s) ( 1.400Outlet (1.51 3.0003.0000.1005.5 0.3001.60017.3 0.2004.000.1005.5 0.3001.60017.3 0.2004.000.50010.0 1.0002.002.5 0.003.000.50010.0 0.2002.002.5 0.003.000.50010.0 0.2002.002.003.00.50010.9 0.2002.002.5 0.003.00Minimise upstream CalculatedNote the feat (m) 0.500Colspan=10Lister Flow 0.500Colspan=10Lister Flow 0.500Colspan=10								

Donnachadh O'Brien & Associates		Page 10
Unit W9 E&F Ladytown BP		
Newhall Naas		
Co Kildare		Mirro
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XP Solutions	Network 2020.1.3	

Hydro-Brake® Optimum Manhole: SMH1.07, DS/PN: 1.007, Volume (m<sup>3</sup>): 5.6

 $\tt Hydro-Brake Optimum {\ensuremath{\mathbb B}}$  be utilised then these storage routing calculations will be invalidated

Depth (m) 1	Flow (l/s)	Depth (m) F	[low (l/s)	Depth (m) F	low (l/s)	Depth (m)	Flow (l/s)
0.100	4.5	1.200	7.3	3.000	11.2	7.000	16.7
0.200	7.5	1.400	7.8	3.500	12.0	7.500	17.3
0.300	8.3	1.600	8.3	4.000	12.8	8.000	17.9
0.400	8.7	1.800	8.8	4.500	13.6	8.500	18.4
0.500	8.8	2.000	9.2	5.000	14.3	9.000	18.9
0.600	8.8	2.200	9.7	5.500	14.9	9.500	19.4
0.800	8.5	2.400	10.1	6.000	15.6		
1.000	7.8	2.600	10.5	6.500	16.2		

Donnachadh O'Brien & Associates       Page         Unit W9 E&F Ladytown BP       Newhall Naas         Co Kildare       Image: Co Kildare         Date 25/10/2022 10:35       Designed by stevep         File DOBA2110 2022.10.20 Sur       Checked by         XP Solutions       Network 2020.1.3         Storage Structures for Surface Network 2         Tank or Pond Manhole: SMH1.0, DS/PN: 1.000         Invert Level (m) 85.620         Depth (m) Area (m <sup>2</sup> )	ro nage
Newhall Naas Co Kildare Date 25/10/2022 10:35 File DOBA2110 2022.10.20 Sur XP Solutions Storage Structures for Surface Network 2 Tank or Pond Manhole: SMH1.0, DS/PN: 1.000 Invert Level (m) 85.620	ro nage
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Storage Structures for Surface Network 2 Tank or Pond Manhole: SMH1.0, DS/PN: 1.000 Invert Level (m) 85.620	
Tank or Pond Manhole: SMH1.0, DS/PN: 1.000 Invert Level (m) 85.620	
Invert Level (m) 85.620	
Depth (m) Area (m <sup>2</sup> ) Depth (m) Area (m <sup>2</sup> ) Depth (m) Area (m <sup>2</sup> )	
0.000 2007.0 0.150 2007.0 0.151 0.0	
Infiltration Trench Pipe: 2.000	
Manning's N0.010Trench Width (m)1.5Infiltration Coefficient Base (m/hr)0.02592Trench Length (m)55.0Infiltration Coefficient Side (m/hr)0.02592Slope (1:X)200.0Safety Factor2.0Cap Volume Depth (m)1.500Porosity0.40Cap Infiltration Depth (m)1.500Invert Level (m)85.800	0 0 0
Tank or Pond Manhole: SMH1.04, DS/PN: 1.004	
Invert Level (m) 85.177	
Depth (m) Area (m <sup>2</sup> ) Depth (m) Area (m <sup>2</sup> ) Depth (m) Area (m <sup>2</sup> )	
0.000 340.0 0.500 340.0 0.501 0.0	
Tank or Pond Manhole: SMH4.00, DS/PN: 4.000	
Invert Level (m) 85.450	
Depth (m) Area (m <sup>2</sup> ) Depth (m) Area (m <sup>2</sup> ) Depth (m) Area (m <sup>2</sup> )	
0.000 2022.0 0.150 2022.0 0.151 0.0	
Infiltration Trench Pipe: 5.000	
Manning's N 0.010 Trench Width (m) 1.0 Infiltration Coefficient Base (m/hr) 0.02592 Trench Length (m) 14.0 Infiltration Coefficient Side (m/hr) 0.02592 Slope (1:X) 200.0 Safety Factor 2.0 Cap Volume Depth (m) 1.500 Porosity 0.40 Cap Infiltration Depth (m) 1.500 Invert Level (m) 86.040	0 0 0
Infiltration Trench Pipe: 5.001	
Manning's N0.010Invert Level (m)85.970Infiltration Coefficient Base (m/hr)0.02592Trench Width (m)1.3Infiltration Coefficient Side (m/hr)0.02592Trench Length (m)125.0Safety Factor2.0Slope (1:X)200.0Porosity0.40Cap Volume Depth (m)1.500	
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Donnachadh O'Brien & Associates		Page 12
Unit W9 E&F Ladytown BP		
Newhall Naas		
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Date 25/10/2022 10:35	Designed by stevep	Drainage
File DOBA2110 2022.10.20 Sur		brainage
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Infiltrati	ion Trench Pipe: 5.001	
Cap Infil	tration Depth (m) 1.500	
Infiltrati	ion Trench Pipe: 6.000	
Infiltration Coefficient Base ( Infiltration Coefficient Side ( Safety Fa Porc Invert Level		) 60.8 ) 95.8 ) 1.500
	rt Level (m) 85.100	
	pth (m) Area (m <sup>2</sup> ) Depth (m) Area (m <sup>2</sup> )	
0.000 104.0		
Tank or Pond Mar	nhole: SMH1.07, DS/PN: 1.007	
Inve	rt Level (m) 84.620	
Depth (m) Area (m <sup>2</sup> ) Dep	pth (m) Area (m <sup>2</sup> ) Depth (m) Area (m <sup>2</sup> )	
0.000 130.0	1.000 130.0 1.010 0.0	
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Jnit W9 E&F	Ladytown	RP	-			-	
Newhall Naa:	-						
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Marc	M5-60 in for Floo	d Risk Wa Analysi		nm) cep 2.5 Secor cus	v (Winter) 1. nd Increment	50.0	
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WARNING: F US/MH PN Name 1.000 SMH1.0 1.001 SMH1.01 2.000 SMH2.00	Duration(s) A Period(s) Climate Cha lalf Drain T Storm 1440 Summe: 15 Summe: 1440 Summe: 1440 Summe: 1440 Summe:	<pre>file(s) (mins) (years) nge (%) ime has n Return Period f 100 f 100 f 100 f 100 f 100 f 100</pre>	15, 3 720 not been Climate Change +0% +0% +0% +0%	<pre>sus 30, 60, 120, 0, 960, 1440, calculated a First (X)</pre>	180, 240, 360 2160, 2880, 7200, as the structu First (Y) Flood	ON e and Winte 0, 480, 600 4320, 5760 8640, 1008 1, 30, 10 0, 0, hre is too First (Z)	full.
WARNING: F US/MH PN Name 1.000 SMH1.01 1.001 SMH1.01 2.000 SMH2.00 2.001 SMH2.01	Duration(s) A Period(s) Climate Cha lalf Drain T Storm 1440 Summe: 1440 Summe: 1440 Summe: 1440 Summe: 1440 Summe: 1440 Summe:	file(s) (mins) (years) nge (%) ime has n Return Period 100 100 100 100 100	15, 3 720 not been Climate Change +0% +0% +0% +0% +0%	<pre>30, 60, 120, 30, 960, 120, 0, 960, 1440, calculated a First (X) Surcharge</pre>	180, 240, 360 2160, 2880, 7200, as the structu First (Y) Flood	ON e and Winte 0, 480, 600 4320, 5760 8640, 1008 1, 30, 10 0, 0, hre is too First (Z)	full.
WARNING: F US/MH PN Name 1.000 SMH1.01 2.000 SMH2.00 2.001 SMH2.01 1.002 SMH1.02	Duration(s) A Period(s) Climate Cha lalf Drain T Storm 1440 Summe: 1440 Summe: 1440 Summe: 1440 Summe: 1440 Summe: 1440 Summe: 1440 Summe:	file(s) (mins) (years) nge (%) ime has n Return Period 100 100 100 100 100 100 100	15, 3 720 not been Climate Change +0% +0% +0% +0% +0%	<pre>30, 60, 120, 30, 960, 120, 0, 960, 1440, calculated a First (X) Surcharge 100/960 Summ</pre>	180, 240, 360 2160, 2880, 7200, as the structu First (Y) Flood	ON e and Winte 0, 480, 600 4320, 5760 8640, 1008 1, 30, 10 0, 0, hre is too First (Z)	full.
WARNING: F US/MH PN Name 1.000 SMH1.01 2.000 SMH2.00 2.001 SMH2.01 1.002 SMH1.02 1.003 SMH1.03	Duration(s) A Period(s) Climate Cha lalf Drain T Storm 1440 Summe: 1440 Summe: 1440 Summe: 1440 Summe: 1440 Summe: 1440 Summe: 1440 Summe: 1440 Summe: 1440 Summe:	file(s) (mins) (years) nge (%) ime has n Return Period 100 100 100 100 100 100 100 100 100	15, 3 720 not been Climate Change +0% +0% +0% +0% +0% +0%	200, 60, 120, 30, 60, 120, 0, 960, 1440, calculated a First (X) Surcharge 100/960 Summ 100/480 Summ	180, 240, 360 2160, 2880, 7200, as the structu First (Y) Flood	ON e and Winte 0, 480, 600 4320, 5760 8640, 1008 1, 30, 10 0, 0, hre is too First (Z)	full.
WARNING: F US/MH PN Name 1.000 SMH1.01 2.000 SMH1.01 2.001 SMH2.01 1.002 SMH1.02 1.003 SMH1.03 1.004 SMH1.04	Duration(s) A Period(s) Climate Cha lalf Drain T Storm 1440 Summe: 1440 Summe	file(s) (mins) (years) nge (%) ime has n Return Period 100 100 100 100 100 100 100 100 100 10	15, 3 720 not been Climate Change +0% +0% +0% +0% +0% +0% +0%	<pre>20.20.20.20.20.20.20.20.20.20.20.20.20.2</pre>	180, 240, 360 2160, 2880, 7200, as the structu First (Y) Flood	ON e and Winte 0, 480, 600 4320, 5760 8640, 1008 1, 30, 10 0, 0, hre is too First (Z)	full. Overflow
WARNING: F           US/MH           PN         Name           1.000         SMH1.01           2.000         SMH2.00           2.001         SMH2.01           1.002         SMH1.02           1.003         SMH1.03           1.004         SMH1.04           1.005         SMH1.05	Duration(s) A Period(s) Climate Cha lalf Drain T Storm 1440 Summe: 1440 Summe	file(s) (mins) (years) nge (%) ime has n Return Period 100 100 100 100 100 100 100 100 100 10	15, 3 720 not been Climate Change +0% +0% +0% +0% +0% +0% +0% +0% +0%	<pre>20.20.20.20.20.20.20.20.20.20.20.20.20.2</pre>	180, 240, 360 2160, 2880, 7200, as the structu First (Y) Flood	ON e and Winte 0, 480, 600 4320, 5760 8640, 1008 1, 30, 10 0, 0, hre is too First (Z)	full.
WARNING: F US/MH PN Name 1.000 SMH1.01 2.000 SMH1.01 2.000 SMH2.00 2.001 SMH2.01 1.002 SMH1.02 1.003 SMH1.03 1.004 SMH1.04 1.005 SMH1.05 1.006 SMH1.06	Duration(s) A Period(s) Climate Cha Climate Cha Idlf Drain T Storm 1440 Summe: 1440 Summe	file(s) (mins) (years) nge (%) ime has n Return Period 100 100 100 100 100 100 100 100 100 10	15, 3 720 not been Climate Change +0% +0% +0% +0% +0% +0% +0% +0% +0%	<pre>20.20.20.20.20.20.20.20.20.20.20.20.20.2</pre>	180, 240, 360 2160, 2880, 7200, as the structu First (Y) Flood	ON e and Winte 0, 480, 600 4320, 5760 8640, 1008 1, 30, 10 0, 0, hre is too First (Z)	full.
WARNING: F           US/MH           PN         Name           1.000         SMH1.01           2.000         SMH2.00           2.001         SMH2.01           1.002         SMH1.02           1.003         SMH1.03           1.004         SMH1.03           1.005         SMH1.05           1.006         SMH1.06           3.000         SMH3.0	Duration(s) A Period(s) Climate Cha Climate Cha Clima	file(s) (mins) (years) nge (%) ime has n Return Period 100 100 100 100 100 100 100 100 100 10	15, 3 720 not been Climate Change +0% +0% +0% +0% +0% +0% +0% +0% +0% +0%	20. 30, 60, 120, 30, 960, 1440, 30, 960, 1440, 30, 30, 1440, 30, 30, 1440, 30, 30, 30, 30, 30, 30, 30, 30, 30, 3	180, 240, 360 2160, 2880, 7200, as the structu First (Y) Flood	ON e and Winte 0, 480, 600 4320, 5760 8640, 1008 1, 30, 10 0, 0, hre is too First (Z)	full.
WARNING: F           US/MH           PN         Name           1.000         SMH1.01           2.000         SMH2.00           2.001         SMH2.01           1.002         SMH2.01           1.003         SMH1.02           1.004         SMH1.03           1.005         SMH1.04           1.005         SMH1.05           1.006         SMH1.06           3.000         SMH3.01	Duration(s) A Period(s) Climate Cha Climate Cha Clima	file(s) (mins) (years) nge (%) ime has n Return Period 100 100 100 100 100 100 100 100 100 10	15, 3 720 not been Climate Change +0% +0% +0% +0% +0% +0% +0% +0% +0% +0%	<pre>20.2.2.3.3.3.3.3.3.3.3.3.3.3.3.3.3.3.3.3</pre>	<pre>180, 240, 360 2160, 2880, 7200, as the structu First (Y) Flood ner ner ner ner ner ner ner ner</pre>	ON e and Winte 0, 480, 600 4320, 5760 8640, 1008 1, 30, 10 0, 0, hre is too First (Z)	full.
WARNING: F           US/MH           PN         Name           1.000         SMH1.01           2.000         SMH2.00           2.001         SMH2.01           1.002         SMH1.02           1.003         SMH1.03           1.004         SMH1.03           1.005         SMH1.04           1.005         SMH1.05           1.006         SMH1.06           3.000         SMH3.01           3.002         SMH3.02	Duration(s) A Period(s) Climate Cha Climate Cha Clima	file(s) (mins) (years) nge (%) ime has n Return Period 100 100 100 100 100 100 100 100 100 10	15, 3 720 not been Climate Change +0% +0% +0% +0% +0% +0% +0% +0% +0% +0%	<pre>20.20.20.20.20.20.20.20.20.20.20.20.20.2</pre>	<pre>180, 240, 360 2160, 2880, 7200, as the structu First (Y) Flood ner ner ner ner ner ner ner ner ner</pre>	ON e and Winte 0, 480, 600 4320, 5760 8640, 1008 1, 30, 10 0, 0, hre is too First (Z)	full.
WARNING: F US/MH PN Name 1.000 SMH1.01 1.001 SMH1.01 2.000 SMH2.00 2.001 SMH2.01 1.002 SMH1.02 1.003 SMH1.03 1.004 SMH1.04 1.005 SMH1.05 1.006 SMH1.05 1.006 SMH1.06 3.000 SMH3.01 3.001 SMH3.01 3.002 SMH3.02 4.000 SMH4.00	Duration(s) A Period(s) Climate Cha Climate Cha Clima	file(s) (mins) (years) nge (%) ime has n Return Period 100 100 100 100 100 100 100 100 100 10	15, 3 720 not been Climate Change +0% +0% +0% +0% +0% +0% +0% +0% +0% +0%	200, 60, 120, 30, 60, 120, 0, 960, 1440, calculated a First (X) Surcharge 100/960 Sum 100/480 Sum 30/240 Sum 30/240 Sum 30/240 Sum 30/25 Sum 30/15 Sum 30/15 Sum 30/15 Sum	<pre>180, 240, 360 2160, 2880, 7200, as the structu First (Y) Flood ner ner ner ner ner ner ner ner ner ner</pre>	ON e and Winte 0, 480, 600 4320, 5760 8640, 1008 1, 30, 10 0, 0, hre is too First (Z)	full. Overflow

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Unit W9 E&F Ladytown BP		
Newhall Naas		
Co Kildare		Micro
Date 25/10/2022 10:35	Designed by stevep	Dcainago
File DOBA2110 2022.10.20 Sur	Checked by	Diamage
XP Solutions	Network 2020.1.3	

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)		Flow / Cap.	Overflow (1/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	SMH1.0	85.761	-0.084	0.000	0.42			10.9	OK
1.001	SMH1.01	85.777	-0.048	0.000	0.33			11.2	OK
2.000	SMH2.00	87.006	-0.294	0.000	0.00		1323	1.4	OK
2.001	SMH2.01	87.006	-0.144	0.000	0.01			0.3	OK
1.002	SMH1.02	85.760	0.053	0.000	0.38			11.5	SURCHARGED
1.003	SMH1.03	85.761	0.104	0.000	0.37			12.7	SURCHARGED
1.004	SMH1.04	85.761	0.359	0.000	0.21			6.4	SURCHARGED
1.005	SMH1.05	85.760	0.346	0.000	0.10			7.6	SURCHARGED
1.006	SMH1.06	85.753	0.607	0.000	0.11			7.9	SURCHARGED
3.000	SMH3.0	86.068	0.750	0.000	0.30			8.4	SURCHARGED
3.001	SMH3.01	86.065	0.760	0.000	0.16			5.3	SURCHARGED
3.002	SMH3.02	85.770	0.546	0.000	0.01			0.7	SURCHARGED
4.000	SMH4.00	85.913	0.238	0.000	0.20			6.3	SURCHARGED
4.001	SMH4.01	85.911	0.286	0.000	0.13			6.3	SURCHARGED
4.002	SMH4.02	85.861	0.396	0.000	0.08			6.0	SURCHARGED

PN	US/MH Name	Level Exceeded
1.000 1.001 2.000 2.001 1.002	SMH1.01 SMH2.00 SMH2.01	
1.003 1.004 1.005 1.006 3.000	SMH1.04 SMH1.05	
3.001 3.002 4.000 4.001 4.002	SMH3.02 SMH4.00 SMH4.01	

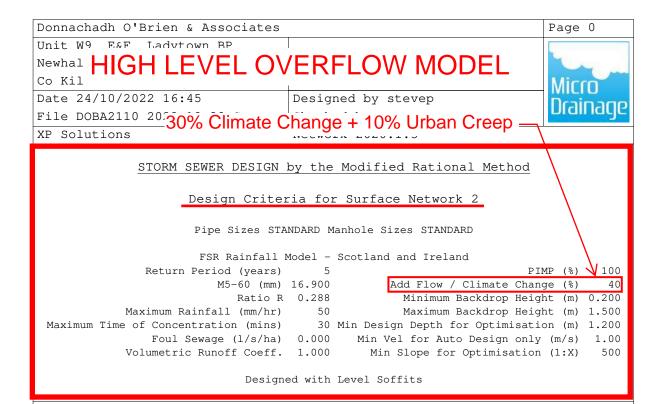
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Unit W9 E&F Ladytown BP		
Newhall Naas		
Co Kildare		Mirro
Date 25/10/2022 10:35	Designed by stevep	Dcainago
File DOBA2110 2022.10.20 Sur	Checked by	Diamaye
XP Solutions	Network 2020.1.3	1

PN	US/MH Name	St	corm		Climate Change	First Surch	: (X) harge	First Flood	• •	First Overf	• •	Overflow Act.
5.000	SMH5.00	600	Summer	100	+0읭							
5.001	SMH5.01	600	Summer	100	+0%							
5.002	SMH5.02	600	Summer	100	+0%							
6.000	SMH6.00	120	Summer	100	+0%							
5.003	SMH5.03	120	Summer	100	+0%	100/60	Summer					
5.004	SMH5.04	2160	Summer	100	+0%	30/120	Summer					
5.005	SMH5.05	2160	Summer	100	+0%	30/120	Summer					
4.003	SMH4.03	2160	Summer	100	+0%	1/30	Summer					
3.003	SMH3.03	2160	Summer	100	+0%	30/15	Summer					
3.004	SMH3.04	2160	Summer	100	+0%	30/15	Summer					
3.005	SMH3.05	2160	Summer	100	+0%	1/480	Summer					
1.007	SMH1.07	2160	Summer	100	+0%	1/360	Summer					

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)		Flow / Cap.	Overflow (1/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
5.000	SMH5.00	86.930	-0.570	0.000	0.00		788	0.4	OK
5.001	SMH5.01	86.930	-0.540	0.000	0.00		836	5.3	OK
5.002	SMH5.02	86.925	-0.068	0.000	0.47			5.2	OK
6.000	SMH6.00	87.041	-0.389	0.000	0.02			21.7	OK
5.003	SMH5.03	87.016	0.070	0.000	1.40			16.2	SURCHARGED
5.004	SMH5.04	85.866	0.500	0.000	0.50			5.9	SURCHARGED
5.005	SMH5.05	85.860	0.535	0.000	0.14			6.8	SURCHARGED
4.003	SMH4.03	85.857	0.832	0.000	0.19			5.9	SURCHARGED
3.003	SMH3.03	85.770	0.720	0.000	0.36			11.6	SURCHARGED
3.004	SMH3.04	85.765	0.740	0.000	0.26			11.5	SURCHARGED
3.005	SMH3.05	85.756	0.821	0.000	0.38			11.5	SURCHARGED
1.007	SMH1.07	85.752	0.832	0.000	0.10			8.8	SURCHARGED

	US/MH	Level
PN	Name	Exceeded
5.000	SMH5.00	
5.001	SMH5.01	
5.002	SMH5.02	
6.000	SMH6.00	
5.003	SMH5.03	
5.004	SMH5.04	
5.005	SMH5.05	
4.003	SMH4.03	
3.003	SMH3.03	
3.004	SMH3.04	
3.005	SMH3.05	
1.007	SMH1.07	
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#### Network Design Table for Surface Network 2

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	ase (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design	
1.000	3.517	0.020	175.9	0.408	5.00	0.0	0.600		0	225	Pipe/Cond		
1.001	22.377	0.118	189.6	0.024	0.00	0.0	0.600		0	225	Pipe/Conc	luit 🧂	
2.000	55.000#	0.275	200.0	0.083	5.00	0.0		0.010	$\rightarrow  _{=} _{\rightarrow}$		Infiltration Tre	ench 🍵	
2.001	8.176#	0.409	20.0	0.000	0.00	0.0	0.600		0	150	Pipe/Conc	luit 🧂	
1.002	9.909	0.050	198.2	0.000	0.00	0.0	0.600		0	225	Pipe/Conc	luit 🧂	
1.003	53.645	0.255	210.4	0.038	0.00	0.0	0.600		0	225	Pipe/Conc	luit 🧂	
1.004	11.430	0.056	204.1	0.023	0.00	0.0	0.600		0	225	Pipe/Cond	luit 🧂	
1.005	53.500#	0.268	200.0	0.027	0.00	0.0	0.600		0	300	Pipe/Conc	luit 🧂	

#### Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)		Add Flow (1/s)	Vel (m/s)	Cap (1/s)	Flow (l/s)
1.000	50.00	5.06	85.620	0.408	0.0	0.0	29.5	0.98	39.1«	103.1
1.001	50.00	5.45	85.600	0.432	0.0	0.0	31.2	0.95	37.6«	109.3
2.000	50.00	5.46	85.800	0.083	0.0	0.0	6.0	2.00	1796.6	21.0
2.001	50.00	5.52	87.000	0.083	0.0	0.0	6.0	2.26	40.0	21.0
1.002	50.00	5.70	85.482	0.515	0.0	0.0	37.2	0.93	36.8«	130.3
1.003	50.00	6.69	85.432	0.554	0.0	0.0	40.0	0.90	35.7«	140.0
1.004	50.00	6.90	85.177	0.577	0.0	0.0	41.7	0.91	36.2«	145.8
1.005	50.00	7.71	85.114	0.604	0.0	0.0	43.6	1.11	78.3«	152.7

					0.00	0.0	0.600			300	Pipe/Cond	uit 🦰
PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)		Base Flow (l/s)		n	HYD SECT	DIA (mm)	Section Type	Auto Design
		1	letwor	k Desi	gn Tak	ble for Su	urface	Netw	ork 2			
XP So	lutions				Ne	etwork 202	20.1.3					
File	DOBA211	0 2022	2.10.2	20 Sur.	Ch	necked by					Drainacje	
Date	24/10/2	022 1	6 <b>:</b> 45		De	esigned by	v steve	р			Drainage	
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Newha	ll Na	as										
Unit	W9 E&F	Lad	ytown	BP								
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3.000	2.528	0.013	194.5	0.021	5.00	0.0 0	0.600	0	225	Pipe/Conduit
3.001	15.540	0.081	191.9	0.000	0.00	0.0 0	0.600	0	225	Pipe/Conduit
3.002	18.832	0.249	75.6	0.000	0.00	0.0 0	0.600	0	225	Pipe/Conduit
4.000	4.001	0.050	80.0	0.337	5.00	0.0 0	0.600	0	225	Pipe/Conduit
4.001	13.938	0.160	87.1	0.000	0.00	0.0 0	0.600	0	225	Pipe/Conduit
4.002	9.313	0.264	35.2	0.000	0.00	0.0 0	0.600	0	225	Pipe/Conduit
5.000	14.000#	0.070	200.0	0.011	5.00	0.0		0.010 → _ →		Infiltration Trench
5.001	125.000#	0.625	200.0	0.168	0.00	0.0		0.010 →		Infiltration Trench
5.002	9.420#	0.047	200.0	0.000	0.00	0.0 0	0.600	0	150	Pipe/Conduit
6.000	60.811	0.635	95.8	0.145	5.00	0.0		$0.010 \rightarrow  _{=} _{\rightarrow}$		Infiltration Trench
5.003	15.930#	0.080	199.1	0.000	0.00	0.0 0	0.600	0	150	Pipe/Conduit
5.004	23.108#	0.116	199.2	0.000	0.00	0.0 0	0.600	0	150	Pipe/Conduit
5.005	19.886	0.225	88.4	0.040	0.00	0.0 0	0.600	0	225	Pipe/Conduit
4.003	8.685	0.050	173.3	0.015	0.00	0.0 0	0.600	0	225	Pipe/Conduit

### Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (1/s)	Flow (l/s)	
1.006	50.00	8.39	84.846	0.662	0.0	0.0	47.8	1.11	78.4«	167.4	
3.000 3.001 3.002	50.00 50.00 50.00	5.32	85.093 85.080 84.999	0.021 0.021 0.021	0.0 0.0 0.0	0.0 0.0 0.0	1.5 1.5 1.5	0.93 0.94 1.51	37.1 37.4 59.9	5.3 5.3 5.3	
4.000 4.001 4.002	50.00 50.00 50.00	5.21	85.450 85.400 85.240	0.337 0.337 0.337	0.0 0.0 0.0	0.0 0.0 0.0	24.3 24.3 24.3	1.46 1.40 2.21	58.2« 55.7« 87.9	85.2 85.2 85.2	
5.000 5.001 5.002	50.00 50.00 50.00	6.23	86.040 85.970 86.843	0.011 0.179 0.179	0.0 0.0 0.0	0.0 0.0 0.0	0.8 12.9 12.9	1.71 1.90 0.71	1482.0	2.8 45.2 45.2	
6.000	50.00	5.41	85.930	0.145	0.0	0.0	10.5	2.49	1491.6	36.7	
5.003 5.004 5.005	50.00 50.00 50.00	7.37	86.796 85.216 85.100	0.324 0.324 0.364	0.0 0.0 0.0	0.0 0.0 0.0	23.4 23.4 26.3	0.71 0.71 1.39	12.5« 12.5« 55.3«	81.9 81.9 92.0	
4.003	50.00	7.76	84.800	0.716	0.0	0.0	51.7	0.99	39.4«	181.1	
				©1982-	2020 Innov	vyze					

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				16:45			-	-	steve	ep			rainage
File KP Sc				22.10	.20 Sui		Checke Networ		0 1 2				
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				Netwo	ork Des	sign I	able	for Sı	irface	Networ	<u>k 2</u>		
PN	Leng (m	-	Fall (m)	Slope (1:X)	I.Area (ha)		Ba ) Flow	ise (1/s)	kr (mm)		IA Sec nm)	tion Ty	ype Auto Design
				480.8		0.0			0.600		300 Pip		
				539.9 647.7	0.000 0.000	0.0			0.600 0.600		300 Pip 300 Pip		
1 007	8 1	107	0 020	1 105 3	0.000	0.0	0	0 0	0.600	0	- 300 Pip	e/Condu	_
1.007	0.1		0.020	403.3						0		e/condt	
		_			-		rk Res					-	
	PN		ain /hr)	T.C. (mins)	US/IL (m)	۱.Ar (ha)		Base w (l/s)	foul (l/s)	Add Flo (l/s)		Cap (1/s)	Flow (l/s)
	.003		0.00		84.750	0.8		0.0			3 0.71		
	.004		0.00 9.36		84.725 84.635	0.8 0.8		0.0			3 0.67 3 0.61	47.3« 43.2«	
1	.007	4	8.94	9.69	85.020	1.5	525	0.0	0.0	107.	8 0.77	54.8«	377.4
										Pipe 3	.00)–1	.50 114	

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Unit W9 E&F Ladytown BP		
Newhall Naas		
Co Kildare		Micro
Date 24/10/2022 16:45	Designed by stevep	Dcainago
File DOBA2110 2022.10.20 Sur	Checked by	Drainage
XP Solutions	Network 2020.1.3	1

#### PIPELINE SCHEDULES for Surface Network 2

#### Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	0		SMH1.0	87.000	85.620	1.155	Open Manhole	1200
1.001	0	225	SMH1.01	87.000	85.600	1.175	Open Manhole	1200
2.000	$\rightarrow  _  \rightarrow$		SMH2.00	87.300	85.800	0.000	Open Manhole	3000
2.001	0	150	SMH2.01	87.200	87.000	0.050	Open Manhole	3000
1.002	0	225	SMH1.02	86.899	85.482	1.192	Open Manhole	1200
1.003	0	225	SMH1.03	86.771	85.432	1.114	Open Manhole	1200
1.004	0	225	SMH1.04	86.621	85.177	1.219	Open Manhole	1200
1.005	0	300	SMH1.05	86.987	85.114	1.573	Open Manhole	1200
1.006	0	300	SMH1.06	86.600	84.846	1.454	Open Manhole	1200
3.000	0	225	SMH3.0	87.840	85.093	2.522	Open Manhole	1200
3.001	0	225	SMH3.01	87.840	85.080	2.535	Open Manhole	1200
3.002	0	225	SMH3.02	87.350	84.999	2.126	Open Manhole	1200
4.000	0	225	SMH4.00	87.000	85.450	1.325	Open Manhole	1200
4.001	0	225	SMH4.01	87.000	85.400	1.375	Open Manhole	1200
4.002	0	225	SMH4.02	87.000	85.240	1.535	Open Manhole	1200

# - Indicates pipe length does not match coordinates

#### Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	3.517	175.9	SMH1.01	87.000	85.600	1.175	Open Manhole	1200
1.001	22.377	189.6	SMH1.02	86.899	85.482	1.192	Open Manhole	1200
2.000	55.000#	200.0	SMH2.01	87.200	85.525	0.175	Open Manhole	3000
2.001	8.176#	20.0	SMH1.02	86.899	86.591		Open Manhole	1200
1.002	9.909	198.2	SMH1.03	86.771	85.432	1.114	Open Manhole	1200
1.003	53.645	210.4	SMH1.04	86.621	85.177		Open Manhole	1200
1.004	11.430	204.1	SMH1.05	86.987	85.121	1.641	Open Manhole	1200
1.005	53.500#	200.0	SMH1.06	86.600	84.847	1.453	Open Manhole	1200
1.006	45.139#	199.7	SMH1.07	86.300	84.620	1.380	Open Manhole	1200
3.000	2.528	194.5	SMH3.01	87.840	85.080	2.535	Open Manhole	1200
3.001	15.540	191.9	SMH3.02	87.350	84.999		Open Manhole	1200
3.002	18.832	75.6	SMH3.03	87.100	84.750		Open Manhole	1200
4.000	4.001	80.0	SMH4.01	87.000	85.400	1.375	Open Manhole	1200
4.001	13.938	87.1	SMH4.02	87.000	85.240		Open Manhole	1200
4.002	9.313		SMH4.03	87.300	84.976		Open Manhole	1200
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Soluti			•20 Dui		etwork 20		•	
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		DTD	FTTNE C		re for e	urfago	Network 2	
		<u> </u>			101 0	urrace	Network 2	
				Upsti	ream Man	hole		
PN	Hyd	Diam	мн с	.Level	I.Level D	.Depth	мн и	MH DIAM., L*W
	Sect	(mm)	Name	(m)	(m)	(m)	Connection	(mm)
5.00	0 →    →	ç	SMH.5.00	87.500	86.040	0.000 0	)pen Manhole	3000
5.00	$1 \rightarrow   \rightarrow  $	5	SMH5.01	87.500	85.970	0.030 0	)pen Manhole )pen Manhole	3000
5.00	2 0	150 \$	SMH5.02	88.000	86.843		)pen Manhole	3000
<i>c c</i> -	0			07 500	05 000	0 070		2000
6.00	$\cup \rightarrow  _{=}  \rightarrow$	5	ычню.00	ø/.500	85.930	U.U/U C	)pen Manhole	3000
5.00	3 о	150 5	SMH5.03	88.000	86.796	1.054 0	)pen Manhole	3000
					85.216		) pen Manhole	1050
5.00	5 о	225 \$	SMH5.05	87.000	85.100	1.675 0	)pen Manhole	1200
4.00	3 о	225 \$	SMH4.03	87.300	84.800	2.275 0	)pen Manhole	1200
3.00	3 0	300 5	MH3 03	87 100	84.750	2 050 0	)pen Manhole	1200
3.00					84.725		)pen Manhole	1200
3.00					84.635		) pen Manhole	1200
1.00	7 о	300 S	SMH1.07	86.300	85.020	0.980 0	)pen Manhole	1200
					tream Ma		-	
PN	Length (m)	(1:X)		C.Leve (m)	l I.Level (m)	D.Deptn (m)		MH DIAM., L*W (mm)
5.000	14.000	⊭ 200 C	SMH5.01	87.50	0 85.970	0 070	Open Manhole	e 3000
			SMH5.02				Open Manhole	
5.002			SMH5.03				Open Manhole	
c	60 01					1 0 0 5		
6.000	60.81	1 95.8	SMH5.03	8 88.00	0 85.295	1.205	Open Manhole	e 3000
5.003	15.930	# 199 <b>.</b> 1	SMH5.04	87.00	0 86.716	0.134	Open Manhole	e 1050
5.004	23.108	¥ 199.2	SMH5.05	87.00			Open Manhole	
5.005	19.88	6 88.4	SMH4.03	87.30	0 84.875	2.200	Open Manhole	e 1200
4.003	8.68	5 173.3	SMH3.03	8 87.10	0 84.750	2.125	Open Manhole	e 1200
3.003	12 01	9 4 8 N 9	SMH3.04	86.84	8 84.725	1 823	Open Manhole	e 1200
3.004			SMH3.05				) Open Manhole	
3.005			SMH1.07				Open Manhole	
1.007	0 10'	7 / 1 1 5 7	SMH1.08	8 85.92	5 85.000	0 625	Open Manhole	e 1200
1.00/	0.10	1 400.3	5 SPH1.08	03.72	00.000	0.023	open mannoite	; 1200

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Donnachadh O'Brien & Associates		Page 5
Unit W9 E&F Ladytown BP		
Newhall Naas		
Co Kildare		Micco
Date 24/10/2022 16:45	Designed by stevep	
File DOBA2110 2022.10.20 Sur	Checked by	Diamaye
XP Solutions	Network 2020.1.3	
Free Flowing Outfal	l Details for Surface Network 2	
Outfall Outfall C Pipe Number Name	C. Level I. Level Min D,L W (m) (m) I. Level (mm) (mm) (m)	
1.007 SMH1.08	85.925 85.000 0.000 1200 0	
Simulation Crit	teria for Surface Network 2	
Areal Reduction Factor 1 Hot Start (mins) Hot Start Level (mm) Manhole Headloss Coeff (Global) ( Foul Sewage per hectare (l/s) ( Number of Input Hydrogr Number of Online Cont	0 Inlet Coeffiecier 0 Flow per Person per Day (l/per/day 0.500 Run Time (mins	ge 2.000 nt 0.800 y) 0.000 s) 60
Synthet	ic Rainfall Details	
Rainfall Model Return Period (years) Region Engla M5-60 (mm) Ratio R	FSR Profile Type Sum 5 Cv (Summer) 1.4 and and Wales Cv (Winter) 0.3 16.900 Storm Duration (mins) 0.288	000 840
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Donnachadh O'	Brien &	Associates					Page	<u>ہ</u>
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Date 24/10/20	22 16:4	5	Designed	by stev	ер		Dca	inago
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XP Solutions			Network 2	2020.1.3				
	<u>0</u>	nline Contro	ols for Su	irface Ne	etwork 2	2		
Hydro-Brał	ke® Opti	mum Manhole:	SMH1.01,	DS/PN:	1.001,	Volume	(m³):	1.7
		Unit	Reference	MD-SHE-02	24-2650-3	1000-2650		
		Desig	n Head (m)			1.000		
		Design	Flow (l/s)			26.5		
			Flush-Flo™			alculated		
		-	Objective	Minimise	upstream	n storage		
			pplication Available			Surface		
		1	Available meter (mm)			Yes 224		
			Level (m)			85.600		
į	Minimum O	utlet Pipe Dia				300		
		ed Manhole Dia				1500		
		Control Po	ints	Head (m)	Flow (l/s	•)		
	De	esign Point (Ca	alculated)	1.000	26.	5		
		E	flush-Flo™	0.367	26.			
			Kick-Flo®		2.2	0		
	Me	ean Flow over H		0.739	22. 22.			
The hydrologi		ean Flow over H	lead Range	-	22.	0	ionshir	for th
Hydro-Brake®	cal calcu Optimum a	ean Flow over H lations have b s specified. we utilised the	Head Range Deen based of Should anot	- n the Hea her type	22. d/Discha: of contro	0 rge relat: ol device	other	than a
Hydro-Brake® Hydro-Brake O invalidated	cal calcu Optimum a ptimum® b	lations have b s specified.	Head Range Been based of Should anot In these sto	- n the Hea her type rage rout	22. d/Discha: of contro ing calco	0 rge relat: ol device ulations v	other vill be	than a
Hydro-Brake® Hydro-Brake O invalidated	cal calcu Optimum a ptimum® b ow (l/s) 7.5	lations have b s specified. e utilised the Depth (m) Flow 1.200	Head Range een based of Should anot n these sto (1/s) Dep 28.9	- n the Hea her type rage rout	22. d/Discha: of contro ing calco ow (1/s) 44.9	0 rge relat: ol device ulations v Depth (m) 7.000	other will be <b>Flow</b>	than a
Hydro-Brake® Hydro-Brake O invalidated Depth (m) Flo 0.100 0.200	cal calcu Optimum a ptimum® b ow (1/s) 7.5 22.3	lations have b s specified. e utilised the <b>Depth (m) Flow</b> 1.200 1.400	Head Range eeen based of Should anot in these sto (1/s) Dep 28.9 31.1	- n the Hea her type rage rout <b>th (m) Fl</b> 3.000 3.500	22. d/Dischar of contro ing calco ow (1/s) 44.9 48.4	0 rge relat: ol device ulations v Depth (m) 7.000 7.500	other will be Flow	(1/s) 67.7 70.1
Hydro-Brake® Hydro-Brake O invalidated Depth (m) Flo 0.100 0.200 0.300	cal calcu Optimum a ptimum® b ow (1/s) 7.5 22.3 26.3	lations have b s specified. e utilised the <b>Depth (m) Flow</b> 1.200 1.400 1.600	Head Range Head Range Should anot In these sto (1/s) Dep 28.9 31.1 33.2	- n the Hea her type rage rout th (m) Fl 3.000 3.500 4.000	22. d/Discha: of contro ing calco ow (1/s) 44.9 48.4 51.6	0 rge relat: ol device ulations v Depth (m) 7.000 7.500 8.000	other will be Flow	(1/s) 67.7 70.1 72.3
Hydro-Brake® Hydro-Brake O invalidated Depth (m) Flo 0.100 0.200 0.300 0.400	cal calcu Optimum a ptimum® b ow (1/s) 7.5 22.3 26.3 26.5	lations have b s specified. e utilised the <b>Depth (m) Flow</b> 1.200 1.400 1.600 1.800	Head Range eeen based of Should anot in these stor (1/s) Dep 28.9 31.1 33.2 35.1	- n the Hea her type rage rout th (m) Fl 3.000 3.500 4.000 4.500	22. d/Discha: of contro ing calco ow (1/s) 44.9 48.4 51.6 54.7	0 rge relat: ol device ulations v Depth (m) 7.000 7.500 8.000 8.500	other vill be Flow	(1/s) 67.7 70.1 72.3 74.5
Hydro-Brake® Hydro-Brake O invalidated <b>Depth (m) Fl</b> 0.100 0.200 0.300 0.400 0.500	cal calcu Optimum a ptimum® b ow (1/s) 7.5 22.3 26.3 26.5 26.1	lations have b s specified. e utilised the <b>Depth (m) Flow</b> 1.200 1.400 1.600 1.800 2.000	Head Range eeen based of Should anot in these store (1/s) Dep 28.9 31.1 33.2 35.1 36.9	- n the Hea her type rage rout th (m) Fl 3.000 3.500 4.000 4.500 5.000	22. d/Dischar of contro ing calco ow (1/s) 44.9 48.4 51.6 54.7 57.5	0 rge relat: ol device ulations v Depth (m) 7.000 7.500 8.000 8.500 9.000	other vill be Flow	(1/s) 67.7 70.1 72.3 74.5 76.6
Hydro-Brake® Hydro-Brake O invalidated <b>Depth (m) Fl</b> 0.100 0.200 0.300 0.400 0.500 0.600	cal calcu Optimum a ptimum® b ow (1/s) 7.5 22.3 26.3 26.3 26.5 26.1 25.4	lations have b s specified. e utilised the <b>Depth (m) Flow</b> 1.200 1.400 1.600 1.800 2.000 2.200	Head Range eeen based of Should anot in these store (1/s) Dep 28.9 31.1 33.2 35.1 36.9 38.7	- n the Hea her type rage rout th (m) Fl 3.000 3.500 4.000 4.500 5.000 5.500	22. d/Dischar of contro ing calco ow (1/s) 44.9 48.4 51.6 54.7 57.5 60.3	0 rge relat: ol device ulations v Depth (m) 7.000 7.500 8.000 8.500	other vill be Flow	(1/s) 67.7 70.1 72.3 74.5
Hydro-Brake® Hydro-Brake O invalidated <b>Depth (m) Fl</b> 0.100 0.200 0.300 0.400 0.500	cal calcu Optimum a ptimum® b ow (1/s) 7.5 22.3 26.3 26.5 26.1	lations have b s specified. e utilised the <b>Depth (m) Flow</b> 1.200 1.400 1.600 1.800 2.000	Head Range eeen based of Should anot in these store (1/s) Dep 28.9 31.1 33.2 35.1 36.9	- n the Hea her type rage rout th (m) Fl 3.000 3.500 4.000 4.500 5.000	22. d/Dischar of contro ing calco ow (1/s) 44.9 48.4 51.6 54.7 57.5	0 rge relat: ol device ulations v Depth (m) 7.000 7.500 8.000 8.500 9.000	other vill be Flow	(1/s) 67.7 70.1 72.3 74.5 76.6
Hydro-Brake® Hydro-Brake O invalidated <b>Depth (m) Fl</b> 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000	cal calcu Optimum a ptimum® b 7.5 22.3 26.3 26.5 26.1 25.4 23.8 26.5	lations have b s specified. e utilised the <b>Depth (m) Flow</b> 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600	Head Range Head Range Should anot In these store (1/s) Dep 28.9 31.1 33.2 35.1 36.9 38.7 40.3 41.9	- n the Hea her type rage rout th (m) Fl 3.000 3.500 4.000 4.500 5.000 5.500 6.000 6.500	22. d/Discha: of contro ing calcu ow (1/s) 44.9 48.4 51.6 54.7 57.5 60.3 62.9 65.4	0 rge relat: ol device ulations v Depth (m) 7.000 7.500 8.000 8.500 9.500	other will be Flow	(1/s) 67.7 70.1 72.3 74.5 76.6 78.6
Hydro-Brake® Hydro-Brake O invalidated <b>Depth (m) Fl</b> 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000	cal calcu Optimum a ptimum® b 7.5 22.3 26.3 26.5 26.1 25.4 23.8 26.5	lations have b s specified. e utilised the <b>Depth (m) Flow</b> 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600 mum Manhole:	Head Range eeen based of Should anot in these store (1/s) Dep 28.9 31.1 33.2 35.1 36.9 38.7 40.3 41.9 : SMH1.05,	- n the Hea her type rage rout th (m) Fl 3.000 3.500 4.000 4.500 5.500 6.000 6.500 DS/PN:	22. d/Dischar of contro ing calcu ow (1/s) 44.9 48.4 51.6 54.7 57.5 60.3 62.9 65.4 1.005,	0 rge relat: ol device alations w <b>Depth (m)</b> 7.000 7.500 8.000 8.500 9.000 9.500 Volume	other will be Flow	(1/s) 67.7 70.1 72.3 74.5 76.6 78.6
Hydro-Brake® Hydro-Brake O invalidated <b>Depth (m) Fl</b> 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000	cal calcu Optimum a ptimum® b 7.5 22.3 26.3 26.5 26.1 25.4 23.8 26.5	lations have b s specified. e utilised the <b>Depth (m) Flow</b> 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600 mum Manhole:	Head Range eeen based of Should anot in these store (1/s) Dep 28.9 31.1 33.2 35.1 36.9 38.7 40.3 41.9 : SMH1.05, Reference	- n the Hea her type rage rout th (m) Fl 3.000 3.500 4.000 4.500 5.500 6.000 6.500 DS/PN:	22. d/Dischar of contro ing calcu ow (1/s) 44.9 48.4 51.6 54.7 57.5 60.3 62.9 65.4 1.005,	0 rge relat: ol device llations v <b>Depth (m)</b> 7.000 7.500 8.000 8.500 9.000 9.500 <u>Volume</u> 0900-1600	other will be Flow	(1/s) 67.7 70.1 72.3 74.5 76.6 78.6
Hydro-Brake® Hydro-Brake O invalidated <b>Depth (m) Fl</b> 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000	cal calcu Optimum a ptimum® b 7.5 22.3 26.3 26.5 26.1 25.4 23.8 26.5	lations have b s specified. e utilised the Depth (m) Flow 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600 mum Manhole: Unit Desig	Head Range Head Range Should anot n these sto (1/s) Dep 28.9 31.1 33.2 35.1 36.9 38.7 40.3 41.9 SMH1.05, Reference n Head (m)	- n the Hea her type rage rout th (m) Fl 3.000 3.500 4.000 4.500 5.500 6.000 6.500 DS/PN:	22. d/Dischar of contro ing calcu ow (1/s) 44.9 48.4 51.6 54.7 57.5 60.3 62.9 65.4 1.005,	0 rge relat: ol device llations v <b>Depth (m)</b> 7.000 7.500 8.000 8.500 9.000 9.500 <u>Volume</u> 0900-1600 0.900	other will be Flow	(1/s) 67.7 70.1 72.3 74.5 76.6 78.6
Hydro-Brake® Hydro-Brake O invalidated <b>Depth (m) Fl</b> 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000	cal calcu Optimum a ptimum® b 7.5 22.3 26.3 26.5 26.1 25.4 23.8 26.5	lations have b s specified. e utilised the Depth (m) Flow 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600 mum Manhole: Unit Desig Design	Head Range eeen based of Should anot in these store (1/s) Dep 28.9 31.1 33.2 35.1 36.9 38.7 40.3 41.9 : SMH1.05, Reference	- n the Hea her type rage rout th (m) Fl 3.000 3.500 4.000 4.500 5.500 6.000 6.500 DS/PN:	22. d/Dischar of contro ing calcu ow (1/s) 44.9 48.4 51.6 54.7 57.5 60.3 62.9 65.4 1.005, 81-1600-6	0 rge relat: ol device llations v <b>Depth (m)</b> 7.000 7.500 8.000 8.500 9.000 9.500 <u>Volume</u> 0900-1600	other will be Flow	(1/s) 67.7 70.1 72.3 74.5 76.6 78.6
Hydro-Brake® Hydro-Brake O invalidated <b>Depth (m) Fl</b> 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000	cal calcu Optimum a ptimum® b 7.5 22.3 26.3 26.5 26.1 25.4 23.8 26.5	lations have b s specified. e utilised the Depth (m) Flow 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600 mum Manhole: Unit Desig Design	Head Range Head Range Should anot n these sto (1/s) Dep 28.9 31.1 33.2 35.1 36.9 38.7 40.3 41.9 SMH1.05, Reference n Head (m) Flow (1/s)	- n the Hea her type rage rout th (m) Fl 3.000 3.500 4.000 4.500 5.500 6.000 6.500 DS/PN: MD-SHE-01	22. d/Dischar of contro ing calco ow (1/s) 44.9 48.4 51.6 54.7 57.5 60.3 62.9 65.4 1.005, 81-1600-6 Calcological controls (1) 81-1600-6	0 rge relat: ol device lations v Depth (m) 7.000 7.500 8.000 8.500 9.000 9.500 Volume 0900-1600 0.900 16.0	other will be Flow	(1/s) 67.7 70.1 72.3 74.5 76.6 78.6
Hydro-Brake® Hydro-Brake O invalidated <b>Depth (m) Fl</b> 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000	cal calcu Optimum a ptimum® b 7.5 22.3 26.3 26.5 26.1 25.4 23.8 26.5	lations have b s specified. e utilised the Depth (m) Flow 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600 mum Manhole: Unit Desig Design	Head Range Head Range Head Range Should anot n these sto (1/s) Dep 28.9 31.1 33.2 35.1 36.9 38.7 40.3 41.9 SMH1.05, Reference n Head (m) Flow (1/s) Flush-Flo <sup>m</sup>	- n the Hea her type rage rout th (m) Fl 3.000 3.500 4.000 4.500 5.500 6.000 6.500 DS/PN: MD-SHE-01	22. d/Dischar of contro ing calco ow (1/s) 44.9 48.4 51.6 54.7 57.5 60.3 62.9 65.4 1.005, 81-1600-6 Calcological controls (1) 81-1600-6	0 rge relat: ol device lations v Depth (m) 7.000 7.500 8.000 8.500 9.000 9.500 Volume 0900-1600 0.900 16.0 alculated	other will be Flow	(1/s) 67.7 70.1 72.3 74.5 76.6 78.6
Hydro-Brake® Hydro-Brake O invalidated <b>Depth (m) Fl</b> 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000	cal calcu Optimum a ptimum® b 7.5 22.3 26.3 26.5 26.1 25.4 23.8 26.5	lations have b s specified. e utilised the Depth (m) Flow 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600 mum Manhole: Unit Desig Design	Head Range Head Range Should anot n these sto (1/s) Dep 28.9 31.1 33.2 35.1 36.9 38.7 40.3 41.9 SMH1.05, Reference n Head (m) Flow (1/s) Flush-Flo <sup>m</sup> Objective	- n the Hea her type rage rout th (m) Fl 3.000 3.500 4.000 4.500 5.500 6.000 6.500 DS/PN: MD-SHE-01	22. d/Dischar of contro ing calco ow (1/s) 44.9 48.4 51.6 54.7 57.5 60.3 62.9 65.4 1.005, 81-1600-6 Calcological controls (1) 81-1600-6	0 rge relat: ol device lations v Depth (m) 7.000 7.500 8.000 8.500 9.500 Volume Volume 0900-1600 0.900 16.0 alculated n storage	other will be Flow	(1/s) 67.7 70.1 72.3 74.5 76.6 78.6
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Hydro-Brake® Hydro-Brake O invalidated Depth (m) Flo 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000 Hydro-Brak	cal calcu Optimum a ptimum® b ow (1/s) 7.5 22.3 26.3 26.5 26.1 25.4 23.8 26.5 26.5 26.5 26.5 26.5	lations have b s specified. e utilised the Depth (m) Flow 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600 mum Manhole: Unit Design Design A Sump Dia Invert utlet Pipe Dia	Head Range Head Range Should anot n these sto (1/s) Dep 28.9 31.1 33.2 35.1 36.9 38.7 40.3 41.9 SMH1.05, Reference n Head (m) Flow (1/s) Flush-Flo™ Objective pplication Available meter (mm) Level (m) meter (mm)	- n the Hea her type rage rout th (m) Fl 3.000 3.500 4.000 4.500 5.500 6.000 6.500 DS/PN: MD-SHE-01	22. d/Dischar of contro ing calco ow (1/s) 44.9 48.4 51.6 54.7 57.5 60.3 62.9 65.4 1.005, 81-1600-6 Calcological controls (1) 81-1600-6	0 rge relat: 1 device 1 ations v Depth (m) 7.000 7.500 8.000 8.500 9.000 9.500 Volume Volume 0900-1600 0.900 16.0 alculated n storage Surface Yes 181 85.121 225	other will be Flow	(1/s) 67.7 70.1 72.3 74.5 76.6 78.6
Hydro-Brake® Hydro-Brake O invalidated Depth (m) Fl 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000 Hydro-Brak	cal calcu Optimum a ptimum® b ow (1/s) 7.5 22.3 26.3 26.5 26.1 25.4 23.8 26.5 26.5 26.5 26.5 26.5	lations have b s specified. e utilised the Depth (m) Flow 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600 mum Manhole: Unit Desig Design A Sump Dia Invert	Head Range Head Range Should anot n these sto (1/s) Dep 28.9 31.1 33.2 35.1 36.9 38.7 40.3 41.9 SMH1.05, Reference n Head (m) Flow (1/s) Flush-Flo™ Objective pplication Available meter (mm) Level (m) meter (mm)	- n the Hea her type rage rout th (m) Fl 3.000 3.500 4.000 4.500 5.500 6.000 6.500 DS/PN: MD-SHE-01	22. d/Dischar of contro ing calco ow (1/s) 44.9 48.4 51.6 54.7 57.5 60.3 62.9 65.4 1.005, 81-1600-6 Calcological controls (1) 81-1600-6	0 rge relat: pl device plations w Depth (m) 7.000 7.500 8.000 8.500 9.000 9.500 Volume Volume 0900-1600 0.900 16.0 alculated n storage Surface Yes 181 85.121	other will be Flow	(1/s) 67.7 70.1 72.3 74.5 76.6 78.6
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DOTUC							1100110	11 20.						
Hydro	>−Bi	rake®	) Opt	imum M	lanh	ole:	SMH1	.05, I	DS/P	'N: 1.	.005,	Volume (	(m³):	2.5
				Co	ntro	l Poi	nts	Hea	ad (r	n) Flo	w (l/s	3)		
			D	esign F	Point		lculat lush-F		0.90		16. 16.			
							Kick-F		0.65		13			
			М	ean Flo	ow ov	ver He	ead Rai	nge		-	13.	. 4		
Hydro-B:	rake rake	e® Opt e Opti	imum a	as spec	ifie	ed. S	Should	anothe	r ty	rpe of	contr	rge relatio ol device o ulations w	other	than a
Depth	(m)	Flow	(l/s)	Depth	(m)	Flow	(l/s)	Depth	(m)	Flow	(l/s)	Depth (m)	Flow	(l/s)
0.1	00		6.4	1.	200		18.3	3	.000		28.4	7.000		42.8
	200		15.5		400		19.7		.500		30.6			44.2
	300		16.0		600		21.0		.000		32.6			45.7
0.4			15.8		800		22.3		.500		34.6			47.0
0.5			15.4		000		23.4		.000		36.4			48.3
0.6			14.6		200		24.5	-	.500		38.1	9.500		49.4
0.8			15.1 16.8		400 600		25.5 26.5		.000		39.7 41.3			
					Des	Design F F Ap Sump Diam	Head low (l lush-F	(m) ./s) Tlom tive M tion able (mm)			С	1000-5300 1.000 5.3 alculated m storage Surface Yes 108 85.080		
		Min	imum (	Dutlet	Pipe	e Diam	eter (	(mm)				150		
		S	luggest	ed Man	hole	e Diam	eter (	(mm)				1200		
				Co	ntro	l Poi	nts	Hea	ad (r	n) Flo	w (1/s	3)		
			D	esign F	Point				1.00			.3		
							lush-F. Kick-F.		0.29			.3 .3		
			М	ean Flo	יס שכ				0.0.	-	4.			
Hydro-B:	rake rake	e® Opt e Opti	. calcu imum a	ulation as spec	s ha ifie	ave be ed. S	een bas Should	sed on anothe	r ty	rpe of	contr	rge relatio ol device o ulations w	other	than a
	(m)	Flow	(l/s)	Depth	(m)	Flow	(l/s)	Depth	(m)	Flow	(1/s)	Depth (m)	Flow	(l/s)
Depth								1						
0.1	00		3.7	0.	300		5.3	0	.500		5.0	0.800		4.8
			3.7 5.2		300 400		5.3 5.2		.500 .600		5.0 4.6			4.8 5.3

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IP Solutions			Network	2020.1.3			
<u>Hydro-Brake</u>							
Depth (m) Flow	w (l/s) D	epth (m) Flo	ow (1/s) De	epth (m) Fl	.ow (1/s)	Depth (m) F	'low (l/s)
1.200	5.8	2.400	8.0	5.000	11.3	8.000	14.1
1.400	6.2	2.600	8.3	5.500	11.8	8.500	14.6
1.600	6.6	3.000	8.9	6.000	12.3	9.000	15.0
1.800	7.0	3.500	9.5	6.500	12.8	9.500	15.4
2.000	7.3	4.000	10.2	7.000	13.3		
2.200	7.7	4.500	10.7	7.500	13.7		
Hydro-Brake	e® Optim	um Manhole	e: SMH4.0	1, DS/PN:	4.001,	Volume (m	<sup>3</sup> ): 1.9
				e MD-SHE-01	180-1600-1	000-1600	
			.gn Head (m			1.000	
		Design	1 Flow (l/s			16.0	
			Flush-Flo			lculated	
			-	e Minimise	e upstream	-	
			Applicatio			Surface	
			np Availabl			Yes	
			ameter (mm			180	
			t Level (m	·		85.400	
M		tlet Pipe Di				225	
	Suggeste	d Manhole Di	ameter (mm	)		1500	
		Control P	oints	Head (m)	Flow (l/s)		
		ign Point (C	Calculated)	1.000	16.0		
	Des	2					
	Des	<u> </u>	Flush-Flo		16.0		
		n Flow over	Kick-Flo@	0.706	16.0 13.0 13.0	6	
The hydrologica Hydro-Brake® 0	Mea al calcul ptimum as	n Flow over ations have specified.	Kick-Flo@ Head Range been based Should an	0.706 0.706 0.706 0.706 0.706	13.0 13.0 ad/Dischar of contro	5 5 ge relation 1 device ot	her than a
Hydro-Brake® Op Hydro-Brake Op invalidated	Mea al calcul ptimum as timum® be	n Flow over ations have specified. utilised th	Kick-Flo@ Head Range been based Should an hen these s	o 0.706 on the Hea other type torage rout	13.0 13.0 ad/Dischar of contro ting calcu	6 6 ge relation l device ot lations wil	her than a l be
Hydro-Brake® Op Hydro-Brake Op invalidated Depth (m) Flow	Mea al calcul ptimum as timum® be w (l/s) D	n Flow over ations have specified. utilised th epth (m) Flo	Kick-Flo@ Head Range been based Should an hen these s <b>Dw (1/s)</b>	o 0.706 o on the Heat other type torage rout	13.( 13.( ad/Dischar of contro ting calcu	5 5 1 device ot lations wil Depth (m) F	her than a l be <b>low (l/s)</b>
Hydro-Brake® Op Hydro-Brake Op invalidated Depth (m) Flow 0.100	Mea al calcul ptimum as timum® be w (1/s) D 6.3	n Flow over ations have specified. utilised th epth (m) Flo 1.200	Kick-Flo@ Head Range been based Should an hen these s <b>Dw (1/s)</b> De 17.4	o 0.706 o on the Heat other type torage rout apth (m) Fl 3.000	13. 13. ad/Dischar of contro cing calcu .ow (1/s) 27.0	ge relation 1 device ot 1ations wil Depth (m) F 7.000	her than a l be <b>Clow (l/s)</b> 40.7
Hydro-Brake® Op Hydro-Brake Op invalidated Depth (m) Flow 0.100 0.200	Mea al calcul ptimum as timum® be w (1/s) D 6.3 15.4	n Flow over ations have specified. utilised th epth (m) Flo 1.200 1.400	Kick-Flo@ Head Range been based Should an hen these s ow (1/s) Do 17.4 18.8	o 0.706 o . on the Heat other type torage rout apth (m) F1 3.000 3.500	13. 13. ad/Dischar of contro ing calcu .ow (1/s) 27.0 29.1	ge relation 1 device ot 1ations wil Depth (m) F 7.000 7.500	her than a 1 be 210w (1/s) 40.7 42.1
Hydro-Brake® Op Hydro-Brake Op invalidated Depth (m) Flow 0.100 0.200 0.300	Mea al calcul ptimum as timum® be w (1/s) D 6.3 15.4 16.0	n Flow over ations have specified. utilised th epth (m) Flo 1.200 1.400 1.600	Kick-Flo@ Head Range been based Should an hen these s ow (1/s) Do 17.4 18.8 20.0	o 0.706 o 0.706 o - other type torage rout apth (m) F1 3.000 3.500 4.000	13. 13. ad/Dischar of contro ing calcu .ow (1/s) 27.0 29.1 31.0	5 ge relation l device ot lations wil Depth (m) F 7.000 7.500 8.000	her than a 1 be 210w (1/s) 40.7 42.1 43.4
Hydro-Brake® Op Hydro-Brake Op invalidated Depth (m) Flow 0.100 0.200 0.300 0.400	Mea al calcul ptimum as timum® be w (1/s) D 6.3 15.4 16.0 15.9	n Flow over ations have specified. utilised th epth (m) Flo 1.200 1.400 1.600 1.800	Kick-Flo@ Head Range been based Should an hen these s ow (1/s) De 17.4 18.8 20.0 21.2	0.706 . on the Head other type torage rout apth (m) F1 3.000 3.500 4.000 4.500	13.( 13.( ad/Dischar of contro ting calcu .ow (1/s) 27.0 29.1 31.0 32.9	5 ge relation l device ot lations wil Depth (m) F 7.000 7.500 8.000 8.500	her than a l be <b>'low (l/s)</b> 40.7 42.1 43.4 44.7
Hydro-Brake® Op Hydro-Brake Op invalidated <b>Depth (m) Flow</b> 0.100 0.200 0.300 0.400 0.500	Mea al calcul ptimum as timum® be w (1/s) D 6.3 15.4 16.0 15.9 15.6	n Flow over ations have specified. utilised th epth (m) Flo 1.200 1.400 1.600 1.800 2.000	Kick-Flo@ Head Range been based Should an hen these s DW (1/s) De 17.4 18.8 20.0 21.2 22.3	<pre>0.706 0.70 0.70</pre>	13.( 13.( ad/Dischar of contro ing calcu .ow (1/s) 27.0 29.1 31.0 32.9 34.6	5 ge relation l device ot lations wil Depth (m) F 7.000 7.500 8.000 8.500 9.000	her than a l be 210w (1/s) 40.7 42.1 43.4 44.7 45.9
Hydro-Brake® Op Hydro-Brake Op invalidated <b>Depth (m) Flow</b> 0.100 0.200 0.300 0.400 0.500 0.600	Mea al calcul ptimum as timum® be w (1/s) D 6.3 15.4 16.0 15.9 15.6 15.0	n Flow over ations have specified. utilised th epth (m) Flo 1.200 1.400 1.600 1.800 2.000 2.200	Kick-Flo@ Head Range been based Should an hen these s <b>bw (1/s)</b> De 17.4 18.8 20.0 21.2 22.3 23.3	<pre>0.706 0.70 0.70</pre>	13.( 13.( ad/Dischar of contro ing calcu .ow (1/s) 27.0 29.1 31.0 32.9 34.6 36.2	5 ge relation l device ot lations wil Depth (m) F 7.000 7.500 8.000 8.500	her than a l be <b>'low (l/s)</b> 40.7 42.1 43.4 44.7
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Hydro-Brake® Op Hydro-Brake Op invalidated <b>Depth (m) Flow</b> 0.100 0.200 0.300 0.400 0.500 0.600	Mea al calcul ptimum as timum® be w (1/s) D 6.3 15.4 16.0 15.9 15.6 15.0	n Flow over ations have specified. utilised th epth (m) Flo 1.200 1.400 1.600 1.800 2.000 2.200	Kick-Flo@ Head Range been based Should an hen these s <b>bw (1/s)</b> De 17.4 18.8 20.0 21.2 22.3 23.3	<pre>0.706 0.70 0.70</pre>	13.( 13.( ad/Dischar of contro ing calcu .ow (1/s) 27.0 29.1 31.0 32.9 34.6 36.2	5 ge relation l device ot lations wil Depth (m) F 7.000 7.500 8.000 8.500 9.000	her than a l be 210w (1/s) 40.7 42.1 43.4 44.7 45.9
Hydro-Brake® Op Hydro-Brake Op invalidated Depth (m) Flow 0.100 0.200 0.300 0.400 0.500 0.600 0.800	Mea al calcul ptimum as timum® be w (1/s) D 6.3 15.4 16.0 15.9 15.6 15.0 14.4 16.0	n Flow over ations have specified. utilised th epth (m) Flo 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600	Kick-Flo@ Head Range been based Should an hen these s ow (1/s) De 17.4 18.8 20.0 21.2 22.3 23.3 24.3 25.2	<pre>0 0.706 0 .706 0 - 0 .706 0</pre>	13.( 13.( 13.( ad/Dischar of contro ing calcu .ow (1/s) 27.0 29.1 31.0 32.9 34.6 36.2 37.7 39.2	5 5 ge relation 1 device ot lations wil Depth (m) F 7.000 7.500 8.000 8.500 9.000 9.500	her than a l be low (1/s) 40.7 42.1 43.4 44.7 45.9 47.2
Hydro-Brake® Op Hydro-Brake Op invalidated <b>Depth (m) Flow</b> 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000	Mea al calcul ptimum as timum® be w (1/s) D 6.3 15.4 16.0 15.9 15.6 15.0 14.4 16.0 we Optim	n Flow over ations have specified. utilised th epth (m) Flo 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600 uum Manhole Unit Refere	Kick-Flo@ Head Range been based Should an nen these s ow (1/s) De 17.4 18.8 20.0 21.2 22.3 23.3 24.3 25.2 e: SMH4.0	<pre>0 0.706 0.70 0.70</pre>	13.4 13.4 13.4 13.4 13.4 13.4 13.4 13.4	ge relation 1 device ot 1ations wil Depth (m) F 7.000 7.500 8.000 8.500 9.000 9.500	her than a l be low (1/s) 40.7 42.1 43.4 44.7 45.9 47.2
Hydro-Brake® Op Hydro-Brake Op invalidated <b>Depth (m) Flow</b> 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000	Mea al calcul ptimum as timum® be w (1/s) D 6.3 15.4 16.0 15.9 15.6 15.0 14.4 16.0 20 20 20 20 20 20 20 20 20 20 20 20 20	n Flow over ations have specified. utilised th epth (m) Flo 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600 um Manhole Unit Refere Design Head	Kick-Flo@ Head Range been based Should an nen these s ow (1/s) De 17.4 18.8 20.0 21.2 22.3 23.3 24.3 25.2 e: SMH4.0	<pre>0 0.706 0.70 0.70</pre>	13.4 13.4 13.4 13.4 13.4 13.4 13.4 13.4	ge relation 1 device ot 1ations wil Depth (m) F 7.000 7.500 8.000 8.500 9.000 9.500	her than a l be low (1/s) 40.7 42.1 43.4 44.7 45.9 47.2
Hydro-Brake® Op Hydro-Brake Op invalidated Depth (m) Flow 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000	Mea al calcul ptimum as timum® be w (1/s) D 6.3 15.4 16.0 15.9 15.6 15.0 14.4 16.0 20 20 20 20 20 20 20 20 20 20 20 20 20	n Flow over ations have specified. utilised th epth (m) Flo 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600 um Manhole Unit Refere Design Head sign Flow (1	Kick-Flo@ Head Range been based Should an nen these s ow (1/s) De 17.4 18.8 20.0 21.2 22.3 23.3 24.3 25.2 e: SMH4.0 ence MD-SHE (m) ./s)	<pre>0.706 0.706 0.706 0.706 0.706 0.706 0.706 0.706 0.706 0.706 0.706 0.700 0.500 0</pre>	13.4 13.4 13.6 13.6 13.6 13.6 13.6 13.6 27.0 29.1 31.0 32.9 34.6 36.2 37.7 39.2 4.003, -0500-1000 0.500 10.0	5 5 9 relation 1 device ot 1ations wil <b>Depth (m) F</b> 7.000 7.500 8.000 8.500 9.000 9.500 <u>Volume (m</u>	her than a l be low (1/s) 40.7 42.1 43.4 44.7 45.9 47.2
Hydro-Brake® Op Hydro-Brake Op invalidated Depth (m) Flow 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000	Mea al calcul ptimum as timum® be w (1/s) D 6.3 15.4 16.0 15.9 15.6 15.0 14.4 16.0 20 20 20 20 20 20 20 20 20 20 20 20 20	n Flow over ations have specified. utilised th epth (m) Flo 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600 um Manhole Unit Refere Design Head	Kick-Flo@ Head Range been based Should an nen these s ow (1/s) De 17.4 18.8 20.0 21.2 22.3 23.3 24.3 25.2 e: SMH4.0 ence MD-SHE (m) ./s)	<pre>0.706 0.706 0.706 0.706 0.706 0.706 0.706 0.706 0.706 0.706 0.706 0.700 0.500 0</pre>	13.4 13.4 13.4 13.4 13.4 13.4 13.4 13.4	5 5 9 relation 1 device ot 1ations wil <b>Depth (m) F</b> 7.000 7.500 8.000 8.500 9.000 9.500 <u>Volume (m</u>	her than a l be low (1/s) 40.7 42.1 43.4 44.7 45.9 47.2
Hydro-Brake® Op Hydro-Brake Op invalidated <b>Depth (m) Flow</b> 0.100 0.200 0.300 0.400 0.500 0.600 0.800 1.000	Mea al calcul ptimum as timum® be w (1/s) D 6.3 15.4 16.0 15.9 15.6 15.0 14.4 16.0 20 20 20 20 20 20 20 20 20 20 20 20 20	n Flow over ations have specified. utilised th epth (m) Flo 1.200 1.400 1.600 1.800 2.000 2.200 2.400 2.600 um Manhole Unit Refere Design Head sign Flow (1 Flush-F	Kick-Flo@ Head Range been based Should an nen these s ow (1/s) De 17.4 18.8 20.0 21.2 22.3 23.3 24.3 25.2 e: SMH4.0 ence MD-SHE (m) ./s)	<pre>0 0.706 0 .706 0 - 0 0.706 0 - 0 0.706 0 - 0 0.706 0 - 0 0.706 0 - 0 0.706 0 - 0 0 0 0.50</pre>	13.4 13.4 13.6 13.6 13.6 13.6 13.6 13.6 27.0 29.1 31.0 32.9 34.6 36.2 37.7 39.2 4.003, -0500-1000 0.500 10.0	5 5 9 relation 1 device ot 1ations wil <b>Depth (m) F</b> 7.000 7.500 8.000 8.500 9.000 9.500 <u>Volume (m</u>	her than a l be low (1/s) 40.7 42.1 43.4 44.7 45.9 47.2

Jnit W9 E&F Newhall Naa Co Kildare Date 24/10/20	Ladytown BP					age 9
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acc 21/10/20	22 16:45	Designe	d by steve	n	<u>I</u> V	
110 DODA2110	2022.10.20 Sur	-	-	P		rainaq
ITE DOBAZITO	2022.10.20 Sul		2020.1.3			
P SOLUCIOUS		Network	2020.1.3			
Hydro-Brał	ce® Optimum Manh	nole: SMH4.0	3, DS/PN:	4.003, Voi	lume (m³)	): 3.9
		Objectiv Applicatio	ve Minimise 1	-	orage rface	
		Sump Availab		50.	Yes	
		Diameter (mr			152	
	]	Invert Level (r	n)	8.	4.800	
	Minimum Outlet Pip	pe Diameter (mr	n)		225	
	Suggested Manhol	le Diameter (mr	n)		1200	
	Contr	ol Points	Head (m) F	low (l/s)		
	Design Poir	nt (Calculated)	0.500	10.0		
	2	Flush-Flo <sup>T</sup>		10.0		
		Kick-Flo@	0.396	9.0		
	Mean Flow c	over Head Range	è –	7.9		
Depth (m) Fl	ow (l/s) Depth (m)	Flow (l/s) De	epth (m) Flo	w (l/s) Dep	th (m) Flo	ow (l/s)
0.100	5.5 1.200	15.1	3.000	23.4	7.000	35.3
0.200	10.0 1.400		3.500	25.2	7.500	36.5
0.300	9.8 1.600		4.000	26.9	8.000	37.7
0.400 0.500	9.0 1.800 10.0 2.000		4.500 5.000	28.5 30.0	8.500 9.000	38.9 40.1
0.600	10.0 2.000		5.500	31.2	9.500	41.2
0.800	12.5 2.400		6.000	32.6		
1.000	13.9 2.600	21.9	6.500	34.0		
Hydro-Brał	ce® Optimum Manł	nole: SMH1.0	7, DS/PN:	1.007, Vo	lume (m³)	): 5.2
		Unit Referenc	e MD-SHE-012	6-8800-1800	-8800	
		Design Head (m			1.800	
	De	sign Flow (l/s Flush-Flo		Color	8.8 lated	
		Objectiv		upstream st		
		Applicatio		-	rface	
		Sump Availabl			Yes	
		Diameter (mm	.)		126	
	I	nvert Level (m	)	8	5.020	
1	Minimum Outlet Pip				150 1200	
	Suggested Manhol				1200	
	Contro	ol Points	Head (m) F			
		+ 10-1		8.8		
	Design Poir	nt (Calculated)				
	Design Poir	Flush-Flo <sup>T</sup>	м 0.541	8.8		
	-		M 0.541 € 1.103			

Donnachadh O'Brien & Associates		Page 10
Unit W9 E&F Ladytown BP		
Newhall Naas		
Co Kildare		Mirro
Date 24/10/2022 16:45	Designed by stevep	Dcainago
File DOBA2110 2022.10.20 Sur	Checked by	Diamage
XP Solutions	Network 2020.1.3	

Hydro-Brake® Optimum Manhole: SMH1.07, DS/PN: 1.007, Volume (m<sup>3</sup>): 5.2

 $\tt Hydro-Brake Optimum {\tt B}$  be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m) H	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.5	1.200	7.3	3.000	11.2	7.000	16.7
0.200	7.5	1.400	7.8	3.500	12.0	7.500	17.3
0.300	8.3	1.600	8.3	4.000	12.8	8.000	17.9
0.400	8.7	1.800	8.8	4.500	13.6	8.500	18.4
0.500	8.8	2.000	9.2	5.000	14.3	9.000	18.9
0.600	8.8	2.200	9.7	5.500	14.9	9.500	19.4
0.800	8.5	2.400	10.1	6.000	15.6		
1.000	7.8	2.600	10.5	6.500	16.2		

Donnachadh O'Brien & Associates Unit W9 E&F Ladytown BP Newhall Naas Co Kildare Date 24/10/2022 16:45 File DOBA2110 2022.10.20 Sur Checked by XP Solutions Network 2020.1.3	Page 11
Newhall Naas Co Kildare Date 24/10/2022 16:45 File DOBA2110 2022.10.20 Sur Checked by	
Co Kildare Date 24/10/2022 16:45 Designed by stevep File DOBA2110 2022.10.20 Sur Checked by	and a second
File DOBA2110 2022.10.20 Sur Checked by	Micco
File DOBA2110 2022.10.20 Sur Checked by	MILIU
	Urainage
XP SOLUTIONS NETWORK ZUZU.1.3	
Storage Structures for Surface Network 2	
Tank or Pond Manhole: SMH1.0, DS/PN: 1.000	
Invert Level (m) 85.620	
Depth (m) Area (m <sup>2</sup> ) Depth (m) Area (m <sup>2</sup> ) Depth (m) Area (m <sup>2</sup> )	
0.000 2007.0 0.150 2007.0 0.151 0.0	
Infiltration Trench Pipe: 2.000	
Manning's N0.010Trench Width (m)Infiltration Coefficient Base (m/hr)0.02592Trench Length (m)Infiltration Coefficient Side (m/hr)0.02592Slope (1:X)Safety Factor2.0Cap Volume Depth (m)Porosity0.40Cap Infiltration Depth (m)Invert Level (m)85.800	55.0 200.0 1.500
Tank or Pond Manhole: SMH1.04, DS/PN: 1.004	
Invert Level (m) 85.177	
Depth (m) Area (m <sup>2</sup> ) Depth (m) Area (m <sup>2</sup> ) Depth (m) Area (m <sup>2</sup> )	
0.000 340.0 0.500 340.0 0.501 0.0	
Tank or Pond Manhole: SMH4.00, DS/PN: 4.000	
Invert Level (m) 85.450	
Depth (m) Area (m <sup>2</sup> ) Depth (m) Area (m <sup>2</sup> ) Depth (m) Area (m <sup>2</sup> )	
0.000 2022.0 0.150 2022.0 0.151 0.0	
Infiltration Trench Pipe: 5.000	
Manning's N0.010Trench Width (m)Infiltration Coefficient Base (m/hr)0.02592Trench Length (m)Infiltration Coefficient Side (m/hr)0.02592Slope (1:X)Safety Factor2.0Cap Volume Depth (m)Porosity0.40Cap Infiltration Depth (m)Invert Level (m)86.040	) 14.0 ) 200.0 ) 1.500
Infiltration Trench Pipe: 5.001	
Manning's N 0.010 Invert Level (m) 85 Infiltration Coefficient Base (m/hr) 0.02592 Trench Width (m) Infiltration Coefficient Side (m/hr) 0.02592 Trench Length (m) 1 Safety Factor 2.0 Slope (1:X) 2 Porosity 0.40 Cap Volume Depth (m) 1	1.3 25.0 200.0
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Donnachadh O'Brien & Associates		Page 12
Unit W9 E&F Ladytown BP		
Newhall Naas		
Co Kildare		Mirro
Date 24/10/2022 16:45	Designed by stevep	Drainage
File DOBA2110 2022.10.20 Sur	_	brainage
XP Solutions	Network 2020.1.3	
Infiltrati	ion Trench Pipe: 5.001	
Cap Infil	tration Depth (m) 1.500	
Infiltrati	ion Trench Pipe: 6.000	
Infiltration Coefficient Base (m Infiltration Coefficient Side (m Safety Fa Porc Invert Level		) 60.8 ) 95.8 ) 1.500
	rt Level (m) 85.100	
	oth (m) Area (m²) Depth (m) Area (m²)	
0.000 104.0		
Tank or Pond Mar	nhole: SMH1.07, DS/PN: 1.007	
Inve	rt Level (m) 85.020	
Depth (m) Area (m <sup>2</sup> ) Dep	oth (m) Area (m <sup>2</sup> ) Depth (m) Area (m <sup>2</sup> )	
0.000 130.0	1.000 130.0 1.010 0.0	
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onnachadh O'	Brien & As	sociates					P	age 13
Jnit W9 E&F	Ladytown	BP						-
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ile DOBA2110	2022.10.2	0 Sur	Chec	ked by				Jan age
KP Solutions			Netw	ork 202	20.1.3		· · · ·	
Summary of Cr	itical Res	ults by	Maxim	um Leve	l (Ran	k 1) for	Surface	Network
30%	Climate (	Change	+ 10	% Urba	an Cro	eep —		
An Manhole Hea	eal Reductio	<u>S</u> on Factor ct (mins) evel (mm) (Global)	<u>imulati</u> 1.000 0 0 0.500 F	<u>on Crite</u> Additic MAI	<u>ria</u> onal Flo DD Facto	ow - % of 1 or * 10m³/h Inlet Coe	na Storage effiecient	2.000 0.800
1	Number of Ing Number of C Number of Of	Online Con	trols 6	Number	of Time	e/Area Diag	grams O	
	Rainfall R R M5-60	Model egion Sco		nd Irela	SR nd Cv (	Ratio R 0. Summer) 1. Winter) 1.	000	
Maro	gin for Flood	Analysis I I	-	ep 2.5 s us us	Second I	Increment	50.0 (Extended) OFF ON ON	
Retur	Pro: Duration(s) n Period(s)					), 240, 360 60, 2880,	and Winte 480, 600 4320, 5760 8640, 1008 1, 30, 10	, ;0
	Climate Char						0, 0,	
WARNING: 1 US/MH PN Name	Half Drain T: Storm	ime has no Return C Period	Climate	calculat First Surch	(X)		First (Z) Overflow	
1.000 SMH1.0	1440 Summer	100	+0%	100/960	Summer			
1.001 SMH1.01				100/960				
			+0%	,				
2.000 SMH2.00	1440 Summer	200						
2.000 SMH2.00 2.001 SMH2.01			+0%					
	1440 Summer	100		100/600	Summer			
2.001 SMH2.01	1440 Summer 1440 Summer	100 100 100	+0%	100/600 100/360				
2.001 SMH2.01 1.002 SMH1.02	1440 Summer 1440 Summer 1440 Summer	100 100 100	+0%	100/360				
2.001 SMH2.01 1.002 SMH1.02 1.003 SMH1.03 1.004 SMH1.04 1.005 SMH1.05	1440       Summer	100 100 100 100 100 100	+0응 +0응	100/360 30/120	Summer			
2.001 SMH2.01 1.002 SMH1.02 1.003 SMH1.03 1.004 SMH1.04	1440       Summer	100 100 100 100 100 100	+0응 +0응 +0응	100/360 30/120 30/180	Summer Summer			
2.001 SMH2.01 1.002 SMH1.02 1.003 SMH1.03 1.004 SMH1.04 1.005 SMH1.05 1.006 SMH1.06 3.000 SMH3.0	1440Summer1440Summer1440Summer1440Summer1440Summer1440Summer30Summer	100 100 100 100 100 100 100	+0% +0% +0% +0% +0%	100/360 30/120 30/180 1/60 30/15	Summer Summer Summer Summer			
2.001 SMH2.01 1.002 SMH1.02 1.003 SMH1.03 1.004 SMH1.04 1.005 SMH1.05 1.006 SMH1.06 3.000 SMH3.01 3.001 SMH3.01	1440Summer1440Summer1440Summer1440Summer1440Summer1440Summer30Summer30Summer	100 100 100 100 100 100 100 100	+0% +0% +0% +0% +0% +0%	100/360 30/120 30/180 1/60 30/15 30/15	Summer Summer Summer Summer Summer			
2.001 SMH2.01 1.002 SMH1.02 1.003 SMH1.03 1.004 SMH1.04 1.005 SMH1.04 1.006 SMH1.06 3.000 SMH3.01 3.001 SMH3.01 3.002 SMH3.02	1440Summer1440Summer1440Summer1440Summer1440Summer1440Summer30Summer30Summer1440Summer	100 100 100 100 100 100 100 100 100	+0% +0% +0% +0% +0% +0% +0%	100/360 30/120 30/180 1/60 30/15 30/15 1/360	Summer Summer Summer Summer Summer Summer			
2.001 SMH2.01 1.002 SMH1.02 1.003 SMH1.03 1.004 SMH1.04 1.005 SMH1.04 1.006 SMH1.06 3.000 SMH3.01 3.001 SMH3.01 3.002 SMH3.02 4.000 SMH4.00	1440         Summer           30         Summer           30         Summer           1440         Summer           1440         Summer	100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100	+0% +0% +0% +0% +0% +0% +0% +0%	100/360 30/120 30/180 1/60 30/15 30/15 1/360 100/480	Summer Summer Summer Summer Summer Summer			
2.001 SMH2.01 1.002 SMH1.02 1.003 SMH1.03 1.004 SMH1.04 1.005 SMH1.04 1.006 SMH1.06 3.000 SMH3.01 3.001 SMH3.01 3.002 SMH3.02 4.000 SMH4.00	1440         Summer           30         Summer           30         Summer           1440         Summer           1440         Summer           1440         Summer	100         100	+0% +0% +0% +0% +0% +0% +0% +0% +0%	100/360 30/120 30/180 1/60 30/15 30/15 1/360 100/480 100/180	Summer Summer Summer Summer Summer Summer Summer			
2.001 SMH2.01 1.002 SMH1.02 1.003 SMH1.03 1.004 SMH1.04 1.005 SMH1.04 1.006 SMH1.06 3.000 SMH3.01 3.001 SMH3.01 3.002 SMH3.02 4.000 SMH4.00	1440         Summer           30         Summer           30         Summer           1440         Summer           1440         Summer           1440         Summer	100         100	+0% +0% +0% +0% +0% +0% +0% +0%	100/360 30/120 30/180 1/60 30/15 30/15 1/360 100/480 100/180	Summer Summer Summer Summer Summer Summer			

	Page 14
	Mirro
Designed by stevep	Dcainago
Checked by	Drainage
Network 2020.1.3	
	Checked by

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)		Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	SMH1.0	85.987	0.142	0.000	0.38			9.9	SURCHARGED
1.001	SMH1.01	85.986	0.161	0.000	0.32			10.9	SURCHARGED
2.000	SMH2.00	87.006	-0.294	0.000	0.00		1323	1.4	OK
2.001	SMH2.01	87.006	-0.144	0.000	0.01			0.3	OK
1.002	SMH1.02	85.941	0.234	0.000	0.35			10.7	SURCHARGED
1.003	SMH1.03	85.937	0.280	0.000	0.35			12.2	SURCHARGED
1.004	SMH1.04	85.925	0.523	0.000	0.21			6.5	SURCHARGED
1.005	SMH1.05	85.919	0.505	0.000	0.09			6.5	SURCHARGED
1.006	SMH1.06	85.857	0.711	0.000	0.09			6.5	SURCHARGED
3.000	SMH3.0	86.205	0.887	0.000	0.30			8.4	SURCHARGED
3.001	SMH3.01	86.202	0.897	0.000	0.16			5.3	SURCHARGED
3.002	SMH3.02	85.864	0.640	0.000	0.02			1.0	SURCHARGED
4.000	SMH4.00	86.042	0.367	0.000	0.17			5.4	SURCHARGED
4.001	SMH4.01	86.039	0.414	0.000	0.11			5.4	SURCHARGED
4.002	SMH4.02	85.960	0.495	0.000	0.07			5.4	SURCHARGED

PN	US/MH Name	Level Exceeded
1.000		
1.001	SMH1.01	
2.000	SMH2.00	
2.001	SMH2.01	
1.002	SMH1.02	
1.003	SMH1.03	
1.004	SMH1.04	
1.005	SMH1.05	
1.006	SMH1.06	
3.000	SMH3.0	
3.001	SMH3.01	
3.002	SMH3.02	
4.000	SMH4.00	
4.001	SMH4.01	
4.002	SMH4.02	

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Unit W9 E&F Ladytown BP		
Newhall Naas		
Co Kildare		Mirro
Date 24/10/2022 16:45	Designed by stevep	Dcainago
File DOBA2110 2022.10.20 Sur	Checked by	Diamaye
XP Solutions	Network 2020.1.3	1

PN	US/MH Name	St	orm		Climate Change	First Surch	: (X) harge	First Floo	• •	First Overf	• •	Overflow Act.
5.000	SMH5.00	600	Summer	100	+0읭							
5.001	SMH5.01	600	Summer	100	+0%							
5.002	SMH5.02	600	Summer	100	+0%							
6.000	SMH6.00	120	Summer	100	+0%							
5.003	SMH5.03	120	Summer	100	+0%	100/60	Summer					
5.004	SMH5.04	1440	Summer	100	+0%	30/60	Summer					
5.005	SMH5.05	1440	Summer	100	+0%	1/2160	Summer					
4.003	SMH4.03	1440	Summer	100	+0%	1/15	Summer					
3.003	SMH3.03	1440	Summer	100	+0%	1/15	Summer					
3.004	SMH3.04	1440	Summer	100	+0%	1/15	Summer					
3.005	SMH3.05	1440	Summer	100	+0%	1/15	Summer					
1.007	SMH1.07	1440	Summer	100	+0%	30/60	Summer					

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)		Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
5.000	SMH5.00	86.930	-0.570	0.000	0.00		788	0.4	OK
5.001	SMH5.01	86.930	-0.540	0.000	0.00		836	5.3	OK
5.002	SMH5.02	86.925	-0.068	0.000	0.47			5.2	OK
6.000	SMH6.00	87.041	-0.389	0.000	0.02			21.7	OK
5.003	SMH5.03	87.016	0.070	0.000	1.40			16.2	SURCHARGED
5.004	SMH5.04	85.976	0.610	0.000	0.67			7.9	SURCHARGED
5.005	SMH5.05	85.961	0.636	0.000	0.18			9.2	SURCHARGED
4.003	SMH4.03	85.954	0.929	0.000	0.31			9.8	SURCHARGED
3.003	SMH3.03	85.864	0.814	0.000	0.41			13.0	SURCHARGED
3.004	SMH3.04	85.860	0.835	0.000	0.29			12.9	SURCHARGED
3.005	SMH3.05	85.854	0.919	0.000	0.42			12.9	SURCHARGED
1.007	SMH1.07	85.851	0.531	0.000	0.25			8.8	SURCHARGED

	US/MH	Level
PN	Name	Exceeded
5.000	SMH5.00	
5.001	SMH5.01	
5.002	SMH5.02	
6.000	SMH6.00	
5.003	SMH5.03	
5.004	SMH5.04	
5.005	SMH5.05	
4.003	SMH4.03	
3.003	SMH3.03	
3.004	SMH3.04	
3.005	SMH3.05	
1.007	SMH1.07	
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Tekla.	Tedd	S Project		FINLA		Job no. 2110					
Donnachadh O'B	Brien and	Calcs for						Start page no./Revision			
Associate	es		South Road - Southern Infiltration Trench A						1		
Unit 5C Elm Ho Millennium Pa		Calcs by SP		cs date 2/10/2022	Checked by	y Check	ked date	Approved	d by	Approved dat	
SOAKAWAY DE	SIGN										
In accordance w	ith BRE Dig	gest 365 - So	akaway	design							
								Tedds	calculation	n version 2.0	
Design rainfall in	-										
Location of catch				Other	_						
Impermeable are	a drained to	the system		A = <b>1675.0</b> m <sup>2</sup>							
Return period				Period = <b>100</b> yr							
Ratio 60 min to 2	-	-	-	r = 0.288							
5-year return peri				—							
Increase of rainfa	all intensity c	lue to global v	varming	p <sub>climate</sub> = <b>30</b>	%						
Soakaway / infilt	tration tren	ch details									
Soakaway type				Rectangula	ar						
Minimum depth o	of pit (below	incoming inve	ert)	d = <b>1500</b> mm							
Width of pit				w = <b>1250</b> mm							
Length of pit				l = <b>125000</b> mm							
Percentage free v				V <sub>free</sub> = <b>40</b> %							
Soil infiltration rat				f = 7.20×10 <sup>-6</sup> m/s							
Wetted area of pi	it 50% full			a <sub>s50</sub> = I × d + w × d = <b>189375000</b> mm <sup>2</sup>							
Table equations	i										
Inflow (cl.3.3.1)				I = M100 ×	A						
Outflow (cl.3.3.2)				$O = a_{s50} \times f$	×D						
Storage (cl.3.3.3)	)			S = I - O							
Duration, G	Browth	M5	Grow	rth 100	) year	Inflow	Out	tflow	Stora	ge	

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m³)	Outflow (m³)	Storage required (m³)
5	0.34;	7.4;	1.91;	14.1;	23.65;	0.41;	23.24
10	0.49;	10.7;	1.97;	21.0;	35.26;	0.82;	34.44
15	0.59;	12.9;	1.98;	25.4;	42.61;	1.23;	41.38
30	0.77;	16.8;	1.96;	33.0;	55.30;	2.45;	52.84
60	1.00;	22.0;	1.91;	42.1;	70.44;	4.91;	65.53
120	1.26;	27.6;	1.87;	51.7;	86.52;	9.82;	76.70
240	1.60;	35.1;	1.81;	63.5;	106.39;	19.63;	86.75
360	1.82;	40.0;	1.77;	70.8;	118.55;	29.45;	89.10
600	2.17;	47.6;	1.73;	82.5;	138.17;	49.09;	89.08
1440	2.94;	64.7;	1.66;	107.5;	179.98;	117.81;	62.17

S<sub>req</sub> = **89.10** m<sup>3</sup>

 $S_{act} = I \times d \times w \times V_{free} = \textbf{93.75} \ m^3$ 

 $t_{s50}$  =  $S_{req} \times 0.5$  /  $(a_{s50} \times f)\,$  = 9hr 4min 34s

PASS - Soakaway storage volume

Time for emptying soakaway to half volume

Tekla Ted	ds Project		Job no	Job no. 2110						
Donnachadh O'Brien and	Calcs for		Start p	Start page no./Revision						
Associates		South Roa	id - Norther	n Infiltration	Trench B		1			
Unit 5C Elm House Millennium Park	Calcs by SP	Calcs 12	date /10/2022	Checked by	Checked c	late Approv	ved by	Approved dat		
SOAKAWAY DESIGN										
In accordance with BRE	Digest 365 - So	akaway d	esign							
						Ted	ds calcula	ation version 2.0		
Design rainfall intensity										
Location of catchment are			Other							
Impermeable area drained	d to the system		$A = 1448.0 \text{ m}^2$							
Return period			Period = <b>100</b> yr							
Ratio 60 min to 2 day rain	•	•	r = <b>0.288</b> M5_60min = <b>16.9</b> mm							
5-year return period rainfa			-							
Increase of rainfall intensi		warming p	Oclimate = 30	%						
Soakaway / infiltration to	rench details									
Soakaway type			Rectangula							
Minimum depth of pit (bel	ow incoming inve	,	d = <b>1500</b> mm							
Width of pit			w = <b>1000</b> mm							
Length of pit			l = <b>127000</b> mm							
Percentage free volume			V <sub>free</sub> = <b>40</b> %							
Soil infiltration rate			f = <b>7.20×10</b> <sup>-6</sup> m/s							
Wetted area of pit 50% fu	II	á	a <sub>s50</sub> = I × d + w × d = <b>19200000</b> mm <sup>2</sup>							
Table equations										
Inflow (cl.3.3.1)		I	= M100 × /	4						
Outflow (cl.3.3.2)		(	$O = a_{s50} \times f \times D$							
Storage (cl.3.3.3)		5	S = I - O							
Duration, Growth	M5 rainfalls	Growtl factor 7		year l	nflow (m <sup>3</sup> )	Outflow	Sto	orage		

Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m³)	Outflow (m³)	Storage required (m³)
0.34;	7.4;	1.91;	14.1;	20.44;	0.41;	20.03
0.49;	10.7;	1.97;	21.0;	30.48;	0.83;	29.65
0.59;	12.9;	1.98;	25.4;	36.83;	1.24;	35.59
0.77;	16.8;	1.96;	33.0;	47.80;	2.49;	45.32
1.00;	22.0;	1.91;	42.1;	60.90;	4.98;	55.92
1.26;	27.6;	1.87;	51.7;	74.79;	9.95;	64.84
1.60;	35.1;	1.81;	63.5;	91.97;	19.91;	72.06
1.82;	40.0;	1.77;	70.8;	102.49;	29.86;	72.63
2.17;	47.6;	1.73;	82.5;	119.44;	49.77;	69.68
2.94;	64.7;	1.66;	107.5;	155.59;	119.44;	36.15
	factor Z1 0.34; 0.49; 0.59; 0.77; 1.00; 1.26; 1.60; 1.82; 2.17;	factor Z1         rainfalls (mm)           0.34;         7.4;           0.49;         10.7;           0.59;         12.9;           0.77;         16.8;           1.00;         22.0;           1.26;         27.6;           1.60;         35.1;           1.82;         40.0;           2.17;         47.6;	factor Z1rainfalls (mm)factor Z20.34;7.4;1.91;0.49;10.7;1.97;0.59;12.9;1.98;0.77;16.8;1.96;1.00;22.0;1.91;1.26;27.6;1.87;1.60;35.1;1.81;1.82;40.0;1.77;2.17;47.6;1.73;	factor Z1rainfalls (mm)factor Z2rainfall, M100 (mm)0.34;7.4;1.91;14.1;0.49;10.7;1.97;21.0;0.59;12.9;1.98;25.4;0.77;16.8;1.96;33.0;1.00;22.0;1.91;42.1;1.26;27.6;1.87;51.7;1.60;35.1;1.81;63.5;1.82;40.0;1.77;70.8;2.17;47.6;1.73;82.5;2.94;64.7;1.66;107.5;	factor Z1rainfalls (mm)factor Z2rainfall, M100 (mm)(m³)0.34;7.4;1.91;14.1;20.44;0.49;10.7;1.97;21.0;30.48;0.59;12.9;1.98;25.4;36.83;0.77;16.8;1.96;33.0;47.80;1.00;22.0;1.91;42.1;60.90;1.26;27.6;1.87;51.7;74.79;1.60;35.1;1.81;63.5;91.97;1.82;40.0;1.77;70.8;102.49;2.17;47.6;1.73;82.5;119.44;2.94;64.7;1.66;107.5;155.59;	factor Z1rainfalls (mm)factor Z2rainfall, M100 (mm)(m³)(m³)0.34;7.4;1.91;14.1;20.44;0.41;0.49;10.7;1.97;21.0;30.48;0.83;0.59;12.9;1.98;25.4;36.83;1.24;0.77;16.8;1.96;33.0;47.80;2.49;1.00;22.0;1.91;42.1;60.90;4.98;1.26;27.6;1.87;51.7;74.79;9.95;1.60;35.1;1.81;63.5;91.97;19.91;1.82;40.0;1.77;70.8;102.49;29.86;2.17;47.6;1.73;82.5;119.44;49.77;2.94;64.7;1.66;107.5;155.59;119.44;

S<sub>req</sub> = **72.63** m<sup>3</sup>

 $S_{act} = I \times d \times w \times V_{free} = \textbf{76.20} \ m^3$ 

 $t_{s50}$  =  $S_{req} \times 0.5$  /  $(a_{s50} \times f)\,$  = 7hr 17min 50s

PASS - Soakaway storage volume

Time for emptying soakaway to half volume

Tekla. Tedds	Project	Finla	y Park		Job no.	110		
Donnachadh O'Brien and	Calcs for		·		Start page no./Revision			
Associates	S	E Corner Infil	tration Trench	C		1		
Unit 5C Elm House Millennium Park	Calcs by C SP	Calcs date 12/10/2022	Checked by	Approved by	Approved date			
SOAKAWAY DESIGN								
In accordance with BRE Diges	st 365 - Soakawa	y design			Tedds calcula	ation version 2.0.		
Design rainfall intensity								
Location of catchment area		Other						
Impermeable area drained to the	e system	A = 106.0 m <sup>2</sup>						
Return period	Period = <b>100</b> yr							
Ratio 60 min to 2 day rainfall of	5 yr return period	r = <b>0.288</b>						
5-year return period rainfall of 60	) minutes duratior	າ M5_60min = <b>16.9</b> mm						
Increase of rainfall intensity due	to global warming	g p <sub>climate</sub> = 30	%					
Soakaway / infiltration trench	details							
Soakaway type		Rectangula	r					
Minimum depth of pit (below inc	oming invert)	d = <b>1500</b> m	m					
Width of pit		w = <b>1000</b> m	ım					
Length of pit		l = <b>14000</b> n	nm					
Percentage free volume	V <sub>free</sub> = <b>40</b> %							
Soil infiltration rate	f = <b>7.20×10</b> <sup>-6</sup> m/s							
Wetted area of pit 50% full	a <sub>s50</sub> = I × d + w × d = <b>22500000</b> mm <sup>2</sup>							
Table equations								
Table equations Inflow (cl.3.3.1)		$I = M100 \times$	A					
-		$I = M100 \times O = a_{s50} \times f$						

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m³)	Outflow (m³)	Storage required (m³)
5	0.34;	7.4;	1.91;	14.1;	1.50;	0.05;	1.45
10	0.49;	10.7;	1.97;	21.0;	2.23;	0.10;	2.13
15	0.59;	12.9;	1.98;	25.4;	2.70;	0.15;	2.55
30	0.77;	16.8;	1.96;	33.0;	3.50;	0.29;	3.21
60	1.00;	22.0;	1.91;	42.1;	4.46;	0.58;	3.87
120	1.26;	27.6;	1.87;	51.7;	5.48;	1.17;	4.31
240	1.60;	35.1;	1.81;	63.5;	6.73;	2.33;	4.40
360	1.82;	40.0;	1.77;	70.8;	7.50;	3.50;	4.00
600	2.17;	47.6;	1.73;	82.5;	8.74;	5.83;	2.91
1440	2.94;	64.7;	1.66;	107.5;	11.39;	14.00;	0.00

S<sub>req</sub> = **4.40** m<sup>3</sup>

 $S_{act} = I \times d \times w \times V_{free} = \textbf{8.40} \ m^3$ 

 $t_{s50}$  =  $S_{req} \times 0.5$  /  $(a_{s50} \times f)\,$  = 3hr 46min 21s

PASS - Soakaway storage volume

Time for emptying soakaway to half volume

Tekla Teda	ds Project	Project Finlay Park					2110	
Donnachadh O'Brien and	Calcs for			Start page no./Revision				
Associates		Eastern Infiltration Trench D					1	
Unit 5C Elm House Millennium Park	Calcs by SP	Calcs date 12/10/		y Checked	d date	Approved by	Approved da	
		1	I.	I	I		-1	
SOAKAWAY DESIGN								
In accordance with BRE	Digest 365 - Soal	away desig	in			Toddo oploui	ation version 2.	
Design reinfall intensity						Teuus calcul		
Design rainfall intensity Location of catchment area		Othe	r					
Impermeable area drained			Other A = <b>832.0</b> m <sup>2</sup>					
Return period	to the system		Period = <b>100</b> yr					
Ratio 60 min to 2 day rainfa	all of 5 vr return pe							
5-year return period rainfal			60min = <b>16.9</b> mı	m				
Increase of rainfall intensity			<sub>te</sub> = <b>30</b> %					
Soakaway / infiltration tre								
Soakaway type		Rec	angular					
Minimum depth of pit (belo	w incoming invert		1 <b>500</b> mm					
Width of pit	0 /		<b>1500</b> mm					
Length of pit		= 5	5000 mm					
Percentage free volume		V <sub>free</sub>	= <b>40</b> %					
Soil infiltration rate		f = 7	<b>.20×10</b> ⁻⁰ m/s					
Wetted area of pit 50% full		<b>a</b> s50	$= I \times d + w \times d =$	84750000 mn	n²			
Table equations								
Inflow (cl.3.3.1)		I = N	1100 × A					
Outflow (cl.3.3.2)		O =	$a_{s50} \times f \times D$					
. ,		S =						

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m³)	Outflow (m³)	Storage required (m <sup>3</sup> )
5	0.34;	7.4;	1.91;	14.1;	11.75;	0.18;	11.56
10	0.49;	10.7;	1.97;	21.0;	17.51;	0.37;	17.15
15	0.59;	12.9;	1.98;	25.4;	21.16;	0.55;	20.61
30	0.77;	16.8;	1.96;	33.0;	27.47;	1.10;	26.37
60	1.00;	22.0;	1.91;	42.1;	34.99;	2.20;	32.79
120	1.26;	27.6;	1.87;	51.7;	42.98;	4.39;	38.58
240	1.60;	35.1;	1.81;	63.5;	52.84;	8.79;	44.06
360	1.82;	40.0;	1.77;	70.8;	58.89;	13.18;	45.71
600	2.17;	47.6;	1.73;	82.5;	68.63;	21.97;	46.66
1440	2.94;	64.7;	1.66;	107.5;	89.40;	52.72;	36.68

S<sub>req</sub> = **46.66** m<sup>3</sup>

 $S_{act} = I \times d \times w \times V_{free} = \textbf{49.50} \ m^3$ 

 $t_{s50}$  =  $S_{req} \times 0.5$  / ( $a_{s50} \times f)\,$  = 10hr 37min 14s

PASS - Soakaway storage volume

Time for emptying soakaway to half volume

<b>DONNACHADH O'BRIE</b> & ASSOCIATES CONSULTING ENGINEER	N IS	,	Finlay Pari DOBA2110	•				
		Title: Calcs By	Phase 1 SP	Date:	21/10/2022	2		
<u>PRELIM</u> Catchment Characteristics	INARY QBAR TOT			E OUTFLO	denotes Input	Value		
Standard Average Annual Rainfal (SAAR) =			831 0.3	mm		cation for Ru		otential
Total Site Area = Storm Return Period =			1.5500 100	Hectares (ha) Years	Soil 1 Soil 2	0	% %	tion
Permissible Outflow per hectare, QBAR =  * Total Permissible Outflow=			2.2 3.45	l/s/ha l/s	Soil 3 Soil 4 Soil 5	0 0 0	% % %	Infiltration

NNACHADH O'BRIEN SOCIATES CONSULTING ENGINEERS		Project Project No. Title: Calcs By	Finlay Park DOBA2110 Total Site SP	Date:	24/10/
otion Storage - Surface Water Treatment	<u>Analysis</u>				
Total Treatment Volume Required	_				
Total Site Hard Standing Area:	14,710 m <sup>2</sup>				
Treatment Volume Required (5mm over treated are	ea):	74 m <sup>3</sup>	]		
Treatment Measures and Volumes Provided					
Permeable Pavement: Treatment Volume = Permea	ble Pavement Area x	200mm Depth x 40% Vo	oid Space		
Permeable Pavement Area:	288 m <sup>2</sup>				
Treatment Volume:	23 m <sup>3</sup>				
Tree Pits: Treatment Volume = Tree Pit Volume (1.5		% Void Space			
Treatment Volume Per Tree Pit:	0.2 m <sup>3</sup>				
Total Number of Tree Pits:	1 ea <b>0.2 m<sup>3</sup></b>				
Treatment Volume:	0.2 m				
Infiltration Trench/Swales: Treatment Volume = Infi	iltration Trench Volur	ne x 40% Void Space			
Infiltration Trench A (1m x 1.25m x 1.5m)	0.75 m <sup>3</sup> /m				
Treatment Volume Per Meter: Total Length:	0.75 m /m 125 m				
Treatment Volume:	94 m <sup>3</sup>				
Infiltration Trench B, C (1m x 1m x 1.5m)	54 11				
Treatment Volume Per Meter:	0.6 m <sup>3</sup> /m				
Total Length:	141 m				
Treatment Volume:	85 m <sup>3</sup>				
Infiltration Trench D (1m x 1.5m x 1.5m)					
Treatment Volume Per Meter:	0.9 m <sup>3</sup> /m				
Total Length:	55 m				
Treatment Volume:	50 m <sup>3</sup>				
Total Infiltration Trench Treatment Volume:	228 m <sup>3</sup>				
Green Roof/Blue Roof: Treatment Volume = Green	Roof/Blue Roof Area	x 5mm Depth			
Green Roof Area	2,022 m <sup>2</sup>				
Blue Roof Area	4,244 m <sup>2</sup>				
Treatment Volume:	31 m <sup>3</sup>				
Filter Drain/Retention Pond: Treatment Volume = T	French Volume x 40%	Void Space			
Trench Area:	280 m <sup>2</sup>				
Trench Depth	0.5 m				
Treatment Volume:	56 m <sup>3</sup>				
Attenuation System: Treatment Volume = Tank Area	a x 150mm Depth x 40	0% Void Space			
Tank Area:	194 m <sup>2</sup>				
Treatment Volume:	12 m <sup>3</sup>				
Total Treatment Volume Provided					
Volume					
Permeable Pavement 23 m	1 <sup>3</sup>				
Tree Pits 0.2 m					
Infiltration Trench/Swales 228 m					
Green Roof/Blue Roof 31 m	1 <sup>3</sup>				
Filter Drain/Retention Pond 56 m	1 <sup>3</sup>				
Attenuation System 12 m	1 <sup>3</sup>				
350 m	1 <sup>3</sup>				
Total Tractmont Values - Dravidade		250 m <sup>3</sup>	7		
Total Treatment Volume Provided:		350 m <sup>°</sup>			

## Finlay Park Drainage Catchment Areas and Runoff Factors Date: 24/10/2022

Surface Type	Catchment Area (m <sup>2</sup> )	<b>Runoff Factor Applied</b>	Equiv. Imp. Area (m <sup>2</sup> )
Green Roof	1490	60%	894
Blue Roof	4245	80%	3396
Standard Roof	3318	95%	3152
Hardstanding	6391	80%	5113
Green Areas	8254	30%	2476
Total	23698		15031
Total	2.370 Ha		1.50 Ha

TOTAL SITE I. AREA IN MICRODRAINAGE MODEL

# **DONNACHADH O'BRIEN** & ASSOCIATES CONSULTING ENGINEERS

Appendix C

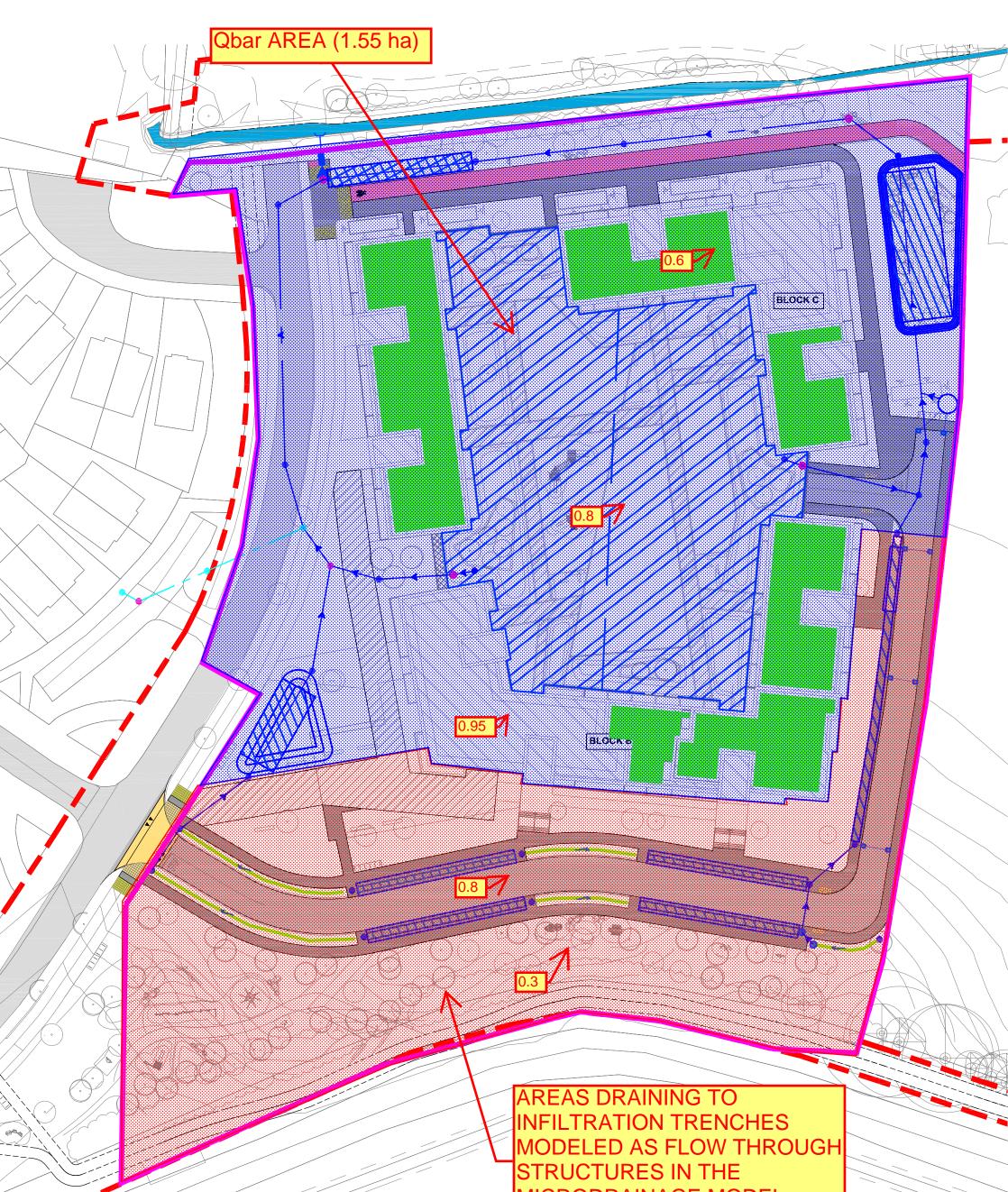
SuDS Treatment Train

Sust Syst	ainable Urban Drainage em	Regional Control	Source Control	Site Control	Other	Proposed for the Scheme (Y/N)	Rationale for the provision or otherwise of proposed SuDS measures
#	Nature Based SuDS (	NBS)					
1	Constructed Wetlands	٠					Constructed wetlands have not been selected on this project and instead the SuDS design has opted to use Retention Ponds
2	Retention Pond	•				•	Retention ponds are proposed as regional control NBS SuDS measures for this project.
3	Bioretention Areas		•			•	Bioretention areas are proposed as source control NBS SuDS measures for this project.
4	Bioswales		•			•	Bioswales are proposed as source control NBS SuDS measures for this project.
5	Rain Gardens		•				Raingardens are not proposed as source control NBS SuDS measures for this project as the roof areas discharge to the Blue Roof podium.
6	Green Roofs		•			•	The proposed scheme is a Large Scale Residential apartment development with min. 60% of the proposed flat roof areas intended to be areen roof.
7	Blue Roofs		•			•	The proposed scheme is a Large Scale Residential apartment development with a large podium which is intended to incorprate a blue roof. The runoff from the apartment roof areas will discharge to the blue roof podium prior to discharge off site.
8	Green Walls		•			•	A green wall is proposed along the western elevation of the apartment development.
9	Tree Pits		•			•	Tree Pits are proposed as source control NBS SuDS measures for this project.
	Infiltration System Su	IDS					
10	Unlined tree pits-trenches		•			•	Unlined tree pit renches are proposed where favourable infiltration rates were identified during the site investigations
11	Unlined permeable paving		•			•	Unlined permeable paving is proposed where favourable infiltration rates were identified during the site investigations
12	Infiltration trenches		•			•	Unlined infiltration trenches are proposed where favourable infiltration rates were identified during the site investigations
	Filtration System Sul	)S					
13	Filter Drains		•			•	Filter Drains are proposed as source control SuDS measures for this project in combination with the retention basin / pond.
14	Filter Strips		٠				Filter Strips are proposed as source control SuDS measures for this project.
15	Lined Permeable Paving		•				Lined Permeable Paving systems are not proposed as source control SuDS measures for this project.
	Detention Systems S	uDS					
16	Detention Basin			•			A Detention basin is not proposed as part of this development
15	Lined Underground Attenuation Tank			•		•	An existing underground attenuation tank serving the existing Finlay Park residential development is to be relocated as part of this development
18	Over-sized pipes			•			Over-sized pipes are not proposed as part of this development
	Proprietary Treatmen	t Sys	tems				
19	Petrol/ oil separators				•	•	Petrol/ oil interceptors are proposed for us on the surface water outfall prior to discharge to the watercourse on the northern boundary of the site
20	Rainwater Harvesting		•				Rainwater Harvesting is not proposed as part of this development

# **DONNACHADH O'BRIEN** & ASSOCIATES CONSULTING ENGINEERS

Appendix D

Runoff Factor Sketch



MICRODRAINAGE MODEL (NOT INCLUDED IN Qbar AREA)

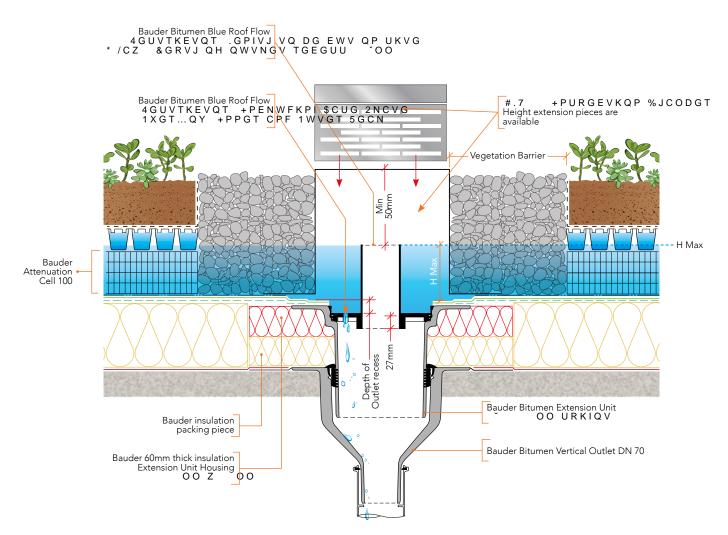
# FINLAY PARK SURFACE WATER SKETCH WITH RUNOFF FACTORS

# **DONNACHADH O'BRIEN** & ASSOCIATES CONSULTING ENGINEERS

Appendix E

Blue Roof Reference Information

# GENERAL DETAILING Blue roofs for SuDS

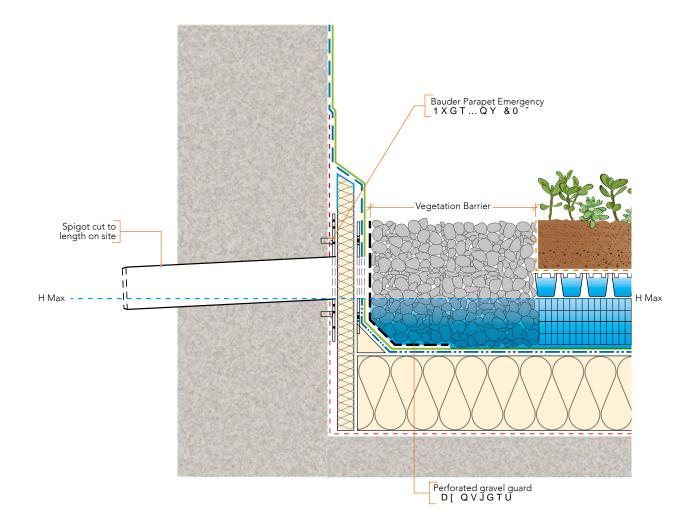


The cross section above shows the BauderBLUE Roof 5 [UV GG O GEN Q4YG UV TUK KEUWGEDETWYTKGWWEKE GEW VNG V CPRTGEKEUQGPIV[VO GEL QTYC VQGFTCKPYGC WHATG TQQGHCEGUVTKKDEGWQCTTQQUGGQQGGSWKTGOGPVU

The Attenuation Cell 100 provides an open void for JQNF BOEIETMCKPYEQFJQVGTGJKYKKORN[ UVCVTQMKNBGCM/VQEQPFKV/KQPJJGGUVTKEVGF ...QKYGZEGG&CVFTCBGCM/VQVOGCVDGWVKNFU WRCCOCZKOVFQTOCCCCM/VQVOGCVDGWVKNFU HQITNQDYCONTOKPPVJGCXGQWVJKOUGKPI exceeded the water is safely discharged through the QXGT...QYKPVJGEGPVTGQHVJG...QYTGUVTKEVQT

2 T K 12 ODE P C N K 12 JKOPOLOFKE U K 13 P W FEGOT TOCK 13 V F G V C KENCON FE W NOODEKU OV POUNIKEUQJP ‡ I W T Q M K Q P V J G G U V T KC P VAQITGUKK FFFKXK K FOW YOCON RON W U G maximum depth of water allowed to build up on the T Q Q H \* / C Z

6 J G N C [ GCT D Q X/GJ G# V V G P W % \GKNONP & 5 ' F T C K PDOQ G TIFW D U YC POK VGG G V C Y K/GJ FET G G P roof elements, and whilst they greatly help with the attenuation of water on the roof they are separate to the D N W G T Q Q H G N G O G P V U



NFRC guildelines for blue roofs recommend that a RCTCROCT.KOCTNYCK[PUUVC/NODGROFDCNZCEGUU YCVGT VQ FTCKP QHH VJG TQQH

6 J C\$ C W F O C T I G PIE [G T ...KOD) 6 U K I PIOC EC/UC J K I J XN K U K VDONNGNQ MICINIC X QOMINC V CO FIV J C Q Q HV provides a useful indicator should water build up to the \* / C ZR Q K \$ Q W F (G NT Q W/G U V T K) E W CO FF EJ K V K Q P C N X G T V Q E C NT ... VQQR UT G X Q PIOF / C Z G X CDTG K P I G Z E G G F G F

# **DONNACHADH O'BRIEN** & ASSOCIATES CONSULTING ENGINEERS

Appendix C

Correspondence with Inland Fisheries

## Alan Lambe

From:	Donnachadh O'Brien <donnachadh@dobrien-engineers.ie> on behalf of Donnachadh O'Brien</donnachadh@dobrien-engineers.ie>
Sent:	12 May 2021 11:43
То:	Alan Lambe
Subject:	FW: Lands at Finlay Park Naas
Follow Up Flag: Flag Status:	Follow up Flagged
riay status.	гаууеч

**Kindest Regards** 

### Donnachadh O' Brien Director & Chartered Engineer

Mobile +353 87 2231452



UNIT 5C ELM HOUSE MILLENNIUM PARK NAAS CO. KILDARE

PHONE +353 45 984 042

INFO@DOBRIEN-ENGINEERS.IE WWW.DOBRIEN-ENGINEERS.IE

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## Please think of the Environment before printing this E-Mail.

From: Roisin O'Callaghan <<u>Roisin.OCallaghan@fisheriesireland.ie</u>>
Sent: Tuesday 20 April 2021 08:30
To: Donnachadh O'Brien <<u>donnachadh@dobrien-engineers.ie</u>>
Subject: RE: Lands at Finlay Park Naas

Hi Donnachadh,

In principal we could support a small realignment subject to approved design and method statement.

Regards

Roisin

Roisin O'Callaghan Fisheries Environmental Officer

### Iascach Intíre Éireann

## **Inland Fisheries Ireland**

 Tel
 +353 (0)1 8842651

 Fax
 +353 (0)1 8360060

 Email
 roisin.ocallaghan@fisheriesireland.ie

 Web
 www.fisheriesireland.ie

3044 Lake Drive, Citywest Business Campus, Dublin 24, Ireland.

From: Donnachadh O'Brien [mailto:donnachadh@dobrien-engineers.ie]
Sent: 15 April 2021 13:50
To: Roisin O'Callaghan
Subject: RE: Lands at Finlay Park Naas

Hi Roisin,

Many thanks for your comments and for getting back to me. That all seems fine and I don't see any issues complying with the general guidance below. My only other question relates to whether there would be any objection to realigning the watercourse in places (see below for rough outline) to allow it to meander more naturally through the proposed open space and to remove some of the sharp corners where the watercourse may have been rediverted in the past? I think it would enhance the watercourse and the improved riparian buffer as part of an integrated biodiverse landscaped area.



**Kindest Regards** 

Donnachadh O' Brien Director & Chartered Engineer

Mobile +353 87 2231452



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From: Roisin O'Callaghan <<u>Roisin.OCallaghan@fisheriesireland.ie</u>>
Sent: Thursday 15 April 2021 11:19
To: Donnachadh O'Brien <<u>donnachadh@dobrien-engineers.ie</u>>
Subject: RE: Lands at Finlay Park Naas

Dear Donnachadh,

IFI's policy is to maintain watercourses in their open natural state in order to prevent habitat loss, preserve and enhance biological diversity and aid in pollution detection. Because this watercourse is non Salmonid we feel that an 8-10 buffer strip to enhance biological diversity while providing open space and recreational amenity will be acceptable. Natural heritage objectives should include maintenance of buffer zones along both banks of the watercourse. An 1:3 side slope is also reasonable as long as the stream channel itself is not over widened. Disturbance of in-stream habitats should be minimised and it also should be noted that a method statement for all riparian / in-stream works must first be submitted to IFI for approval if planning is granted.

IFI have recently published the following guidelines which can be accessed on our website <u>www.fisheriesireland.ie</u> :

Revised "Planning for watercourses in the urban environment" which can provide guidance on site specific measures to enhance, protect, rehabilitate or establish riparian and aquatic habitats.

"River Restoration Works - Science based Guidance centred on Hydromorphological Principles in an Era of Climate Change – 2020" has also been

published by IFI and describes a framework to plan, design, implement and monitor river restoration projects. A list of best practice riparian and instream measures are presented alongside measures to address channel connectivity and invasive species that are compliant with the EU Water Framework Directive (WFD), other EU Directives and State regulations.

Please contact me if you want to discuss this element of the planning application further.

Kind Regards,

Roisin

Roisin O'Callaghan Fisheries Environmental Officer

## Iascach Intíre Éireann Inland Fisheries Ireland

 Tel
 +353 (0)1 8842651

 Fax
 +353 (0)1 8360060

 Email
 roisin.ocallaghan@fisheriesireland.ie

 Web
 www.fisheriesireland.ie

3044 Lake Drive, Citywest Business Campus, Dublin 24, Ireland.

From: Donnachadh O'Brien [mailto:donnachadh@dobrien-engineers.ie] Sent: 01 April 2021 12:25 To: Roisin O'Callaghan Subject: Lands at Finlay Park Naas

Hello Roisin,

Thank you for taking my call yesterday. As discussed, we are in the process of preparing a SHD planning application for the site indicated in red on the attached map and are in pre-planning consultation with Kildare County Council. David Hall in KCC Water Services Dept mentioned to us to liaise with Inland Fisheries in the context of the recently published guidelines "Planning for Watercourses in the Urban Environment".

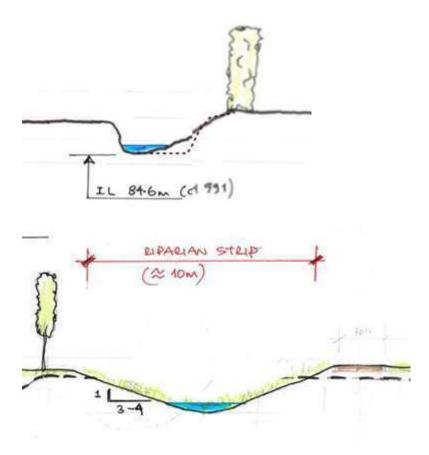
A small watercourse passes through our site and also other lands near the canal harbour, which are also in the same client ownership. So a large extent of the watercourse is located on our clients lands.

The watercourse is served by a 375mm surface water pipe extending from Naas town centre which is located under the canal. Within the site there is a small ditch at the bottom of the canal tow path which connects internally to the main watercourse. There is one other connection which is a dry ditch at certain times of the year. The watercourse also drains the agriculture; lands generally and there is likely to be some groundwater. The attached map has photos of the channel included.

Over the years it is apparent that there has been extensive cleaning and channel widening over the northern section of the lands in particular - this is extensively "over engineered" for the flows in the steam with large flat channels sections, low flows or stagnant water in places and almost vertical banks. There is little or no riparian vegetation and large section are bare earth vertical banks.

As the channel is fed by a piped surface water flow form Naas, and the channels have been extensively altered we are of the opinion that stream does not fall into the category of the type of watercourse identified in the guidelines and would be grateful if you might confirm this.

Notwithstanding this we propose to maintain the open channel through the site as an integral part of the overall landscaping and make some alterations to its path but incorporating 1 in 3 -4 side slopes and design a riparian buffet either side of the channel which will merge into the overall landscaping. While we don't envisage the width of riparian butter identified in the guidelines, we would hope to provide something in the order of 8 to 10m. Typical sections through the existing and proposes channel are below:



Look forward the receiving your comments on the above, and I am happy to meet you on site if required, or take a call to discuss.

In our opinion

**Kindest Regards** 

Donnachadh O' Brien Director & Chartered Engineer

Mobile +353 87 2231452

**DONNACHADH O'BRIEN** & ASSOCIATES CONSULTING ENGINEERS

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D'fhéadfaí go bhfuil an ríomhphost seo agus ceangaltáin ar bith atá in éineacht leis faoi rún agus iad beartaithe d'úsáid an duine a bhfuil a s(h)eoladh air amháin. Dearcthaí nó tuairimí ar bith atá curtha in iúl ann, baineann siad leis an údar amháin, agus ní chaithfidh go n-aontaíonn lascaigh Intíre Éireann leo. Mura tusa faighteoir beartaithe an ríomhphoist seo, ná déan rud ar bith mar gheall ar an méid atá ann, ná é a chóipeáil ná é a thaispeáint do dhuine ar bith eile. Déan teagmháil leis an seoltóir, le do thoil, má chreideann tú go bhfuair tú an ríomhphost seo trí earráid.

# **DONNACHADH O'BRIEN** & ASSOCIATES CONSULTING ENGINEERS

Appendix D

Confirmation of Feasibility Letters from Irish Water and Design Statement of Acceptance

Alan Lambe Donnachadh O' Brien & Associates Consulting Engineers Unit 5C Elm House Millenium Park Naas Co. Kildare W91P9P8

26 October 2022

# Re: Design Submission for Finlay Park, Naas, Kildare (the "Development") (the "Design Submission") / Connection Reference No: CDS22004436

Dear Alan Lambe,

Many thanks for your recent Design Submission.

We have reviewed your proposal for the connection(s) at the Development. Based on the information provided, which included the documents outlined in Appendix A to this letter, Irish Water has no objection to your proposals.

This letter does not constitute an offer, in whole or in part, to provide a connection to any Irish Water infrastructure. Before you can connect to our network you must sign a connection agreement with Irish Water. This can be applied for by completing the connection application form at <u>www.water.ie/connections</u>. Irish Water's current charges for water and wastewater connections are set out in the Water Charges Plan as approved by the Commission for Regulation of Utilities (CRU)(<u>https://www.cru.ie/document\_group/irish-waters-water-charges-plan-2018/</u>).

You the Customer (including any designers/contractors or other related parties appointed by you) is entirely responsible for the design and construction of all water and/or wastewater infrastructure within the Development which is necessary to facilitate connection(s) from the boundary of the Development to Irish Water's network(s) (the "**Self-Lay Works**"), as reflected in your Design Submission. Acceptance of the Design Submission by Irish Water does not, in any way, render Irish Water liable for any elements of the design and/or construction of the Self-Lay Works.

If you have any further questions, please contact your Irish Water representative: Name: Antonio Garzón Email: antonio.garzon@water.ie

Yours sincerely,

Monne Massis

Yvonne Harris Head of Customer Operations



Uisce Éireann Beita OP 448 Orlig Sheachaidta Ha Cathrach Theas Cathrair Chorrai

Inish Water PO Box 448, South City Delivery Office, Cor8 City

www.water.le

## Appendix A

## **Document Title & Revision**

- C-0031 Proposed Foul and Surface Water Layout P03
- C-0040 Proposed Watermain Layout P05
- C-0141 Proposed Long Sections P03

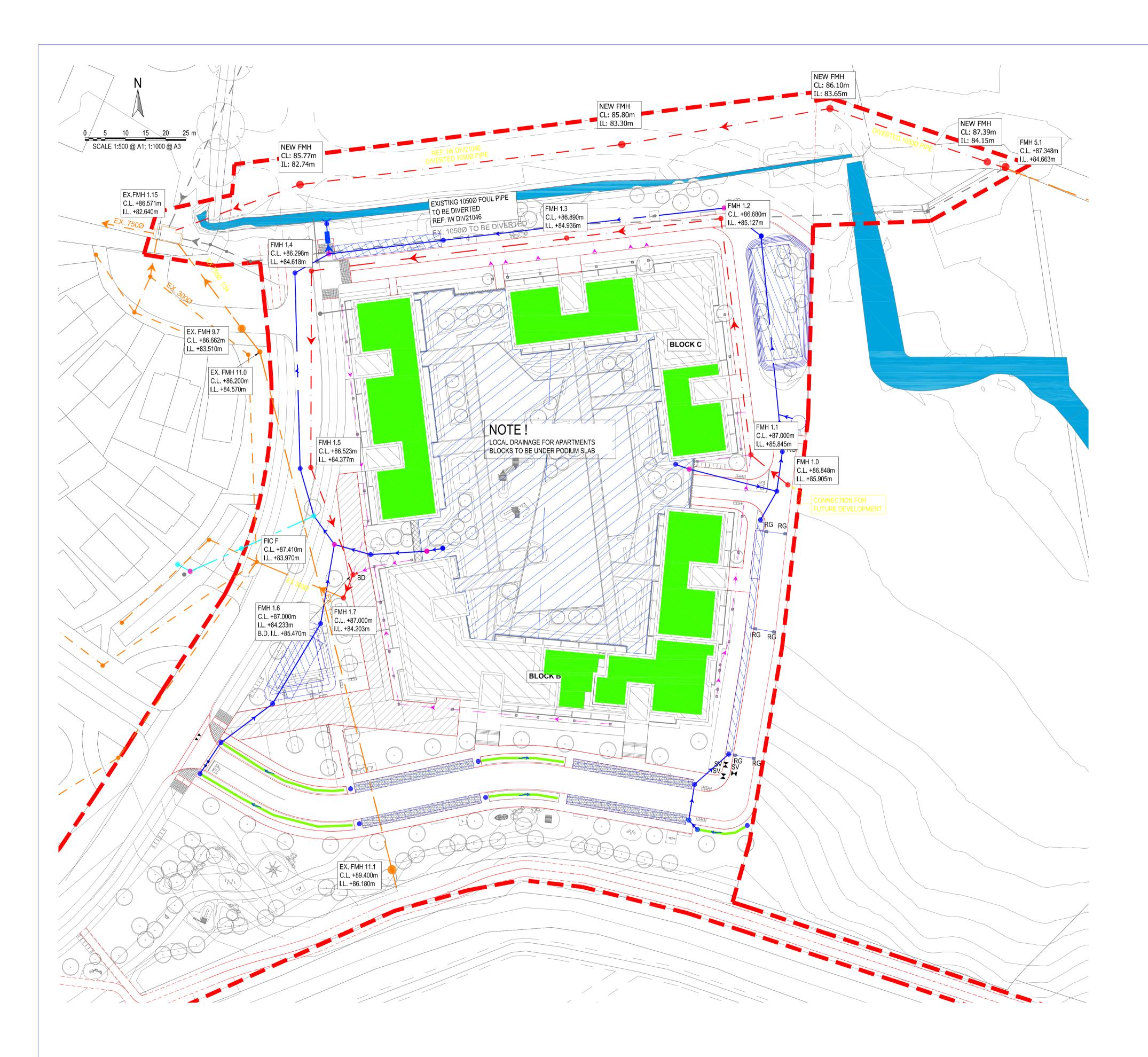
### **Additional Comments**

The design submission will be subject to further technical review at connection application stage.

Irish Water cannot guarantee that its Network in any location will have the capacity to deliver a particular flow rate and associated residual pressure to meet the requirements of the relevant Fire Authority, see Section 1.17 of Water Code of Practice.

For further information, visit www.water.ie/connections

<u>Notwithstanding any matters listed above, the Customer (including any appointed</u> <u>designers/contractors, etc.) is entirely responsible for the design and construction of the Self-Lay</u> <u>Works.</u> Acceptance of the Design Submission by Irish Water will not, in any way, render Irish Water liable for any elements of the design and/or construction of the Self-Lay Works.

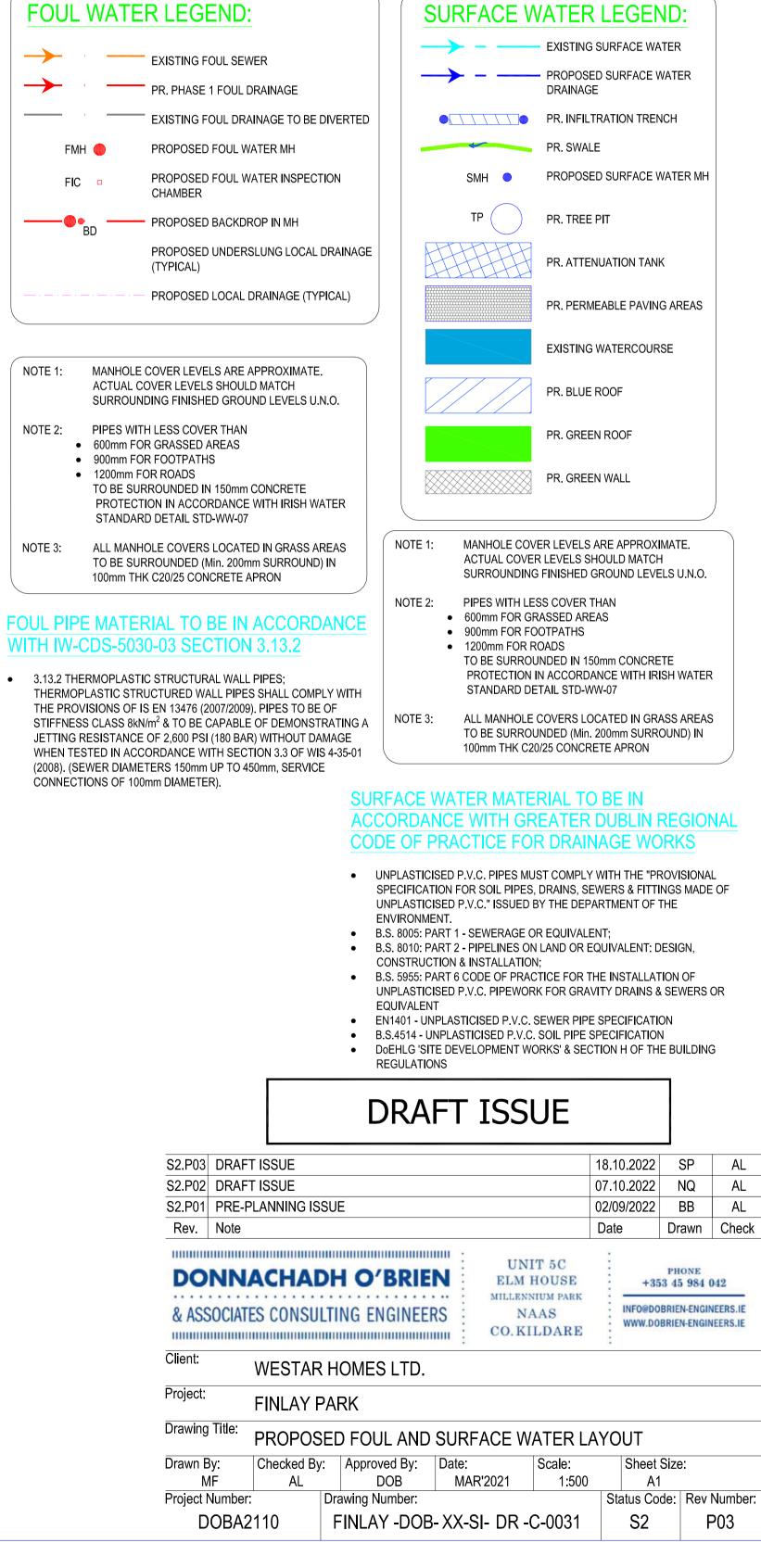




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NOTE 2:	PIPE 600r 900r 1200 TO E PRO STA	
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- 6. CONTRACTOR TO ALLOW FOR SCANNING AND GPR SURVEY OF THE SITE FOR ANY UNDERGROUND SERVICES PRIOR TO WORKS, REFER TO PUBLIC UTILITIES DRAWINGS FOR APPROXIMATE LOCATION OF EXISTING SERVICES





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WATERMAI	N LEGEND:
	EXISTING WATERMAIN
	- PROPOSED WATERMAIN
H	PROPOSED HYDRANT
M	PROPOSED BOUNDARY BOX
BM	PROPOSED BULK WATER METER
AV X	PROPOSED AIR VALVE
sv X	PROPOSED SLUICE VALVE
SCV X	PROPOSED SCOUR VALVE
SCCH $_{\odot}$	SCOUR CHAMBER
	THRUST BLOCKS OMITTED FOR CLARITY, TO BE INSTALLED AS PER I.W. TYPICAL DETAILS

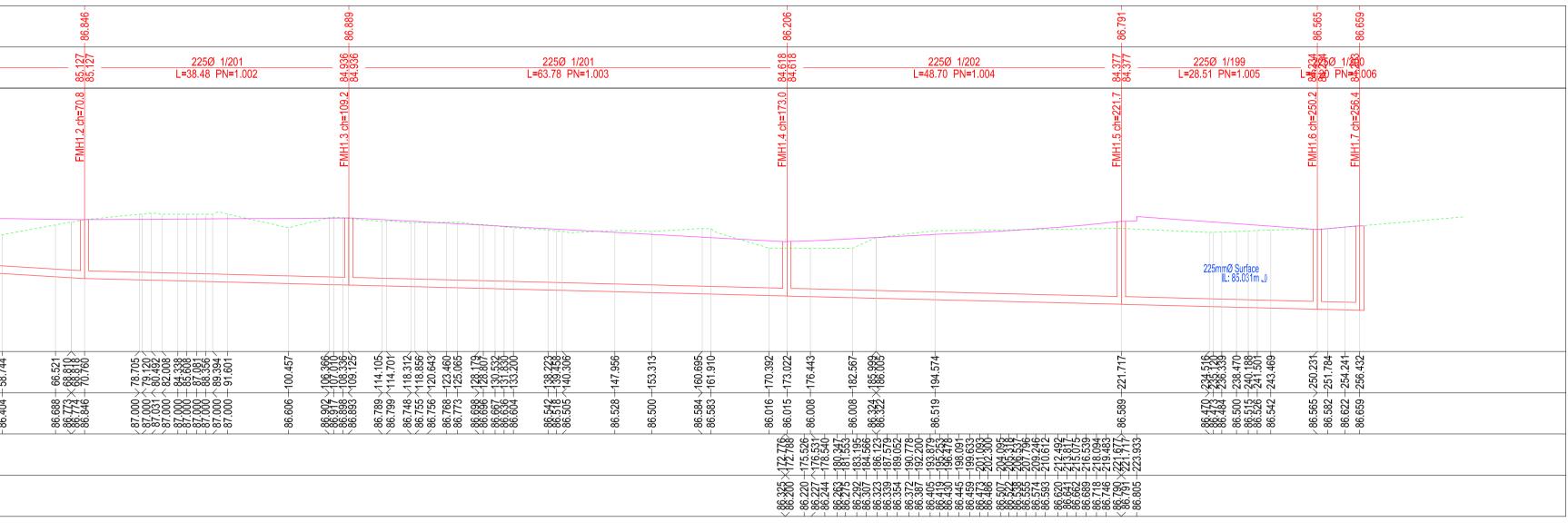
# WATERMAIN MATERIAL TO BE IN ACCORDANCE WITH IW-CDS-5020-03 SECTION 3.9.2

- 3.9.2 MDPE & HDPE PIPES SHALL BE OF A TYPE PE-80 & HAVE AN SDR-11 OR SDR-17 RATING. THEY SHALL CONFORM TO IS EN 12201:PART 1 & PART 2 (PLASTIC SYSTEMS FOR WATER SUPPLY, DRAINAGE & SEWERAGE UNDER PRESSURE - PART 1, GENERAL, & PART 2, PIPES) & I.S. EN 12201-3 (PLASTIC SYSTEMS FOR WATER SUPPLY, DRAINAGE & SEWERAGE UNDER PRESSURE -PART 3: FITTINGS).
- PROTECTION OF WATERMAIN TO BE IN ACCORDANCE WITH IRISH WATER STANDARD DETAIL STD-W-12A AND SECTION 3.26 OF THE IRISH WATER CODE OF PRACTICE

# DRAFT ISSUE

S2.P05	DRAF	TISSUE						18/1	0/2022	SP	AL
S2.P04	DRAF	T ISSUE						11/1	0/2022	NQ	AL
S2.P03	DRAF	T ISSUE						07/1	0/2022	NQ	AL
S2.P02	DRAF	T ISSUE						06/1	0/2022	NQ	AL
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MANHOLE COVER LEVELS APPROX (m)	86.848 -		- 87.000 -							
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Datum: 83.000M AOD										
EXISTING CHAINAGE (m)	- 0.000 - 1.667	- 6.382 -	- 11.795 - - 13.234 - - 14.868 -	-18.430 - - 22.963 -	-28.509	- 34.512 -	- 38.587 -	- 46.061-	-48.666	- 57.610 - - 58.744 -
EXISTING LEVELS (m)	- 86,488 - 86,488	- 86.474 86.472	- 86.469 - 86.460 - 86.460 - 86.450	- 86.427 - 86.414	-86.386	- 86.394 -	-86.399	-86.410	-86.393	86.406 41 - 86.404 4
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LEGEND:	
	PROPOSED SURFACE WATER
	PROPOSED FOUL WATER
	PROPOSED GROUND/ ROAD LEVEL
	EXISTING GROUND PROFILE

# DRAFT ISSUE

S2.P03         DRAFT ISSUE         18.10.20           S2.P02         DRAFT ISSUE         07.10.20		AL
	2 NO	
		AL
S2.P01 DRAFT ISSUE 02.09.20	2 SP	AL
Rev. Note Date	Drawr	n Check
& ASSOCIATES CONSULTING ENGINEERS NAAS	PHONE 353 45 98 DOBRIEN-EN DOBRIEN-EN	4 042 GINEERS.IE
Client: WESTAR HOMES LTD.		
Project: FINLAY PARK		
Drawing Title: PROPOSED FOUL LONG SECTIONS		
Drawn By: SPChecked By: ALApproved By: DOBDate: SEP'2022Scale: (H)1:500, (V)1:100	et Size: A1	
Project Number: Drawing Number: Status	Code: Re	ev Number:
DOBA2110 FINLAY -DOB- XX-SI- DR -C-0141 S		P03



# **CONFIRMATION OF FEASIBILITY**

Alan Lambe

Unit 5C Elm House Millenium Park Naas Co. Kildare W91P9P8

3 August 2022

# Our Ref: CDS22004436 Pre-Connection Enquiry Finlay Park, Naas, Kildare

Dear Applicant/Agent,

# We have completed the review of the Pre-Connection Enquiry.

Irish Water has reviewed the pre-connection enquiry in relation to a Water & Wastewater connection for a Housing Development of 148 unit(s) at Finlay Park, Naas, Kildare, (the **Development**).

Based upon the details provided we can advise the following regarding connecting to the networks;

Water - Feasible Subject to upgrades

In order to facilitate the connection of the proposed Development two new water main sections will be required. A connection main of approximately 150m of new 150mm ID pipe (green line) main to be laid to connect the site development (yellow section) to the 160mm PVC on Old Caragh Road. Approximately 80m of new 100mm ID pipe (red line) to link the existing 160mm PVC main in Old Caragh Road and the existing 100mm uPVC main in Caragh Court. The green valve will need to be opened and red valve to be closed.

The required upgrade connecting the system in Old Caragh Road and Caragh Court connects via private lands. Please be advised that at connection application stage you have to provide evidence of consent of the Uisce Éireann Bosca OP 448 Oifig Sheachadta na Cathrach Theas Cathair Chorcaí

Irish Water PO Box 448, South City Delivery Office, Cork City.

www.water.ie

Stlürthöiri / Directors: Cathal Marley (Chairman), Niall Gleeson, Eamon Gallen, Yvonne Harris, Brendan Murphy, Dawn O'Driscoll, Maria O'Dwyer Oifig Chláraithe / Registered Office: Teach Colvill, 24-26 Sráid Thalbóid, Baile Átha Cliath 1, D01 NP86 / Colvill House, 24-26 Talbot Street, Dublin 1 D01 NP86 Is cuideachta ghníomhaíochta ainmnithe atá faoi theorainn scaireanna é Uisce Éireann / Irish Water is a designated activity company, limited by shares. Uimhír Chláraithe in Éirinn / Registered in Ireland No.: 530363

Third Party Landowner/s. A wayleave in favour of Irish Water will be required to be provided by the Customer in order for the works to be carried out in the Third Party Land/s

These extension works are not currently on Irish Water investment plan therefore, the applicant will be required to fund these local network upgrades. The fee will be calculated at a connection application stage.



# Wastewater Connection

Feasible without infrastructure upgrade by Irish Water

The proposed development will involve the diversion of existing foul sewers. For design submissions and queries related to diversion/build near or over, please contact IW Diversion Team via email address <u>diversions@water.ie</u>

For further information related to diversion please visit www.water.ie/connections/developer-services/diversions

Separation distances between the Irish Water infrastructure and proposed structures, other services, trees, etc. have to be in accordance with the Irish Water Codes of Practice and Standard Details. Prior to submitting your planning application, you are required to submit these detailed design proposals to Irish Water Diversion Team via email address <u>diversions@water.ie</u> for review and approval. Wayleave/s in favour of Irish Water over the infrastructure will be required.

This letter does not constitute an offer, in whole or in part, to provide a connection to any Irish Water infrastructure. Before the Development can be connected to

our network(s) you must submit a connection application <u>and be granted and sign</u> a connection agreement with Irish Water.

As the network capacity changes constantly, this review is only valid at the time of its completion. As soon as planning permission has been granted for the Development, a completed connection application should be submitted. The connection application is available at <a href="http://www.water.ie/connections/get-connected/">www.water.ie/connections/get-connected/</a>

## Where can you find more information?

- Section A What is important to know?
- Section B Details of Irish Water's Network(s)

This letter is issued to provide information about the current feasibility of the proposed connection(s) to Irish Water's network(s). This is not a connection offer and capacity in Irish Water's network(s) may only be secured by entering into a connection agreement with Irish Water.

For any further information, visit <u>www.water.ie/connections</u>, email <u>newconnections@water.ie</u> or contact 1800 278 278.

Yours sincerely,

Nonne Massis

Yvonne Harris Head of Customer Operations

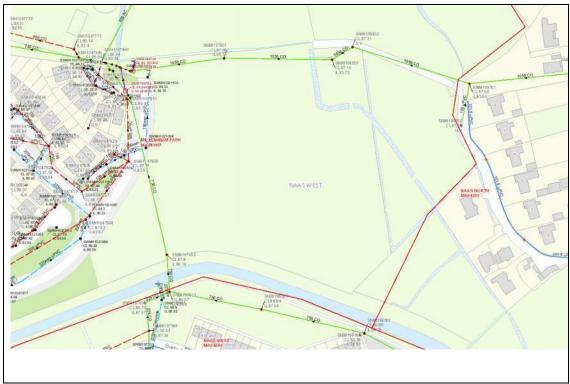
# Section A - What is important to know?

What is important to know?	Why is this important?
Do you need a contract to connect?	• Yes, a contract is required to connect. This letter does not constitute a contract or an offer in whole or in part to provide a connection to Irish Water's network(s).
	<ul> <li>Before the Development can connect to Irish Water's network(s), you must submit a connection application <u>and</u> <u>be granted and sign</u> a connection agreement with Irish Water.</li> </ul>
When should I submit a Connection Application?	<ul> <li>A connection application should only be submitted after planning permission has been granted.</li> </ul>
Where can I find information on connection charges?	Irish Water connection charges can be found at: <u>https://www.water.ie/connections/information/charges/</u>
Who will carry out the connection work?	<ul> <li>All works to Irish Water's network(s), including works in the public space, must be carried out by Irish Water*.</li> </ul>
	*Where a Developer has been granted specific permission and has been issued a connection offer for Self-Lay in the Public Road/Area, they may complete the relevant connection works
Fire flow Requirements	• The Confirmation of Feasibility does not extend to fire flow requirements for the Development. Fire flow requirements are a matter for the Developer to determine.
	What to do? - Contact the relevant Local Fire Authority
Plan for disposal of storm water	The Confirmation of Feasibility does not extend to the management or disposal of storm water or ground waters.
	<ul> <li>What to do? - Contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges.</li> </ul>
Where do I find details of Irish Water's network(s)?	<ul> <li>Requests for maps showing Irish Water's network(s) can be submitted to: <u>datarequests@water.ie</u></li> </ul>

What are the design requirements for the connection(s)?	<ul> <li>The design and construction of the Water &amp; Wastewater pipes and related infrastructure to be installed in this Development shall comply with <i>the Irish Water</i> <i>Connections and Developer Services Standard Details</i> <i>and Codes of Practice,</i> available at <u>www.water.ie/connections</u></li> </ul>
Trade Effluent Licensing	<ul> <li>Any person discharging trade effluent** to a sewer, must have a Trade Effluent Licence issued pursuant to section 16 of the Local Government (Water Pollution) Act, 1977 (as amended).</li> </ul>
	<ul> <li>More information and an application form for a Trade Effluent License can be found at the following link: <u>https://www.water.ie/business/trade-effluent/about/</u></li> </ul>
	**trade effluent is defined in the Local Government (Water Pollution) Act, 1977 (as amended)

# Section B – Details of Irish Water's Network(s)

The map included below outlines the current Irish Water infrastructure adjacent the Development: To access Irish Water Maps email datarequests@water.ie



Reproduced from the Ordnance Survey of Ireland by Permission of the Government. License No. 3-3-34

**Note:** The information provided on the included maps as to the position of Irish Water's underground network(s) is provided as a general guide only. The information is based on the best available information provided by each Local Authority in Ireland to Irish Water.

Whilst every care has been taken in respect of the information on Irish Water's network(s), Irish Water assumes no responsibility for and gives no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided, nor does it accept any liability whatsoever arising from or out of any errors or omissions. This information should not be solely relied upon in the event of excavations or any other works being carried out in the vicinity of Irish Water's underground network(s). The onus is on the parties carrying out excavations or any other works to ensure the exact location of Irish Water's underground network(s) is identified prior to excavations or any other works being carried out. Service connection pipes are not generally shown but their presence should be anticipated.



William Fadden

Dublin Road Clane Kildare E91FPW2

8 October 2020

Uisce Éireann Bosca OP 448 Oifig Sheachadta na Cathrach Theas Cathair Chorcaí

Irish Water PO Box 448, South City Delivery Office, Cork City.

www.water.ie

# Re: CDS20003696 pre-connection enquiry - Subject to contract | Contract denied

## Connection for Multi/Mixed Use Development of 431 units at Finlay Park (Phase 2), Naas, Kildare

Dear Sir/Madam,

Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Finlay Park (Phase 2), Naas, Kildare (the **Premises**). Based upon the details you have provided with your pre-connection enquiry and on our desk top analysis of the capacity currently available in the Irish Water network(s) as assessed by Irish Water, we wish to advise you that your proposed connection to the Irish Water network(s) can be facilitated at this moment in time.

SERVICE	OUTCOME OF PRE-CONNECTION ENQUIRY <u>THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A</u> <u>CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH</u> <u>TO PROCEED.</u>
Water Connection	Feasible Subject to upgrades
Wastewater Connection	Feasible without infrastructure upgrade by Irish Water
	SITE SPECIFIC COMMENTS
	The Development can be supplied from existing 180mm PVCA main in Old Caragh Road. Approximately 150m of new 200mm ID pipe main has to be laid to connect the Site to the existing main. A bulk meter with associated telemetry system, along the connection main, will be required.
Water Connection	Additionally, approx. 300m of new 200mm ID pipe main has to be laid to work in parallel with the existing 4" uPVC in Old Caragh Road. This 200mm ID main will connect the 225mm HPPE and the 180mm PVC-A mains together for a supply line which can handle the capacity required for this Development.
	Should you wish to progress with the connection, you have to fund the upgrade works and the fee will be calculated at a connection application stage.

Stiúrthóirí / Directors: Cathal Marley (Chairman), Niall Gleeson, Eamon Gallen, Yvonne Harris, Brendan Murphy, Maria O'Dwyer

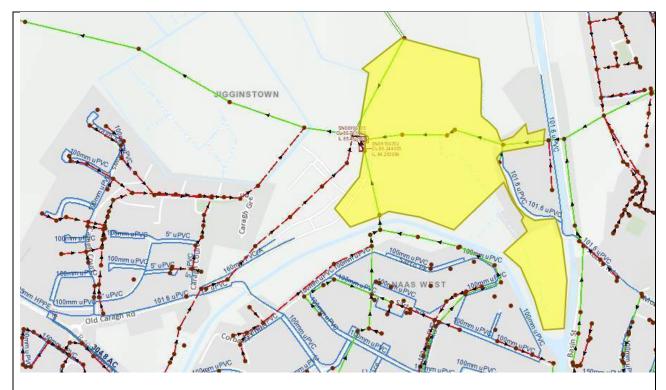
Oifig Chláraithe / Registered Office: Teach Colvill, 24-26 Sráid Thalbóid, Baile Átha Cliath 1, D01 NP86 / Colvill House, 24-26 Talbot Street, Dublin 1, D01 NP86 Is cuideachta ghníomhaíochta ainmnithe atá faoi theorainn scaireanna é Uisce Éireann / Irish Water is a designated activity company, limited by shares. Uimhir Chláraithe in Éirinn / Registered in Ireland No.: 530363

W-HP-BUS

|--|

The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement.

## The map included below outlines the current Irish Water infrastructure adjacent to your site:



Reproduced from the Ordnance Survey of Ireland by Permission of the Government. License No. 3-3-34

Whilst every care has been taken in its compilation Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland to Irish Water. Irish Water can assume no responsibility for and give no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided and does not accept any liability whatsoever arising from any errors or omissions. This information should not be relied upon in the event of excavations or any other works being carried out in the vicinity of the Irish Water underground network. The onus is on the parties carrying out excavations or any other works to ensure the exact location of the Irish Water underground network is identified prior to excavations or any other works being carried out. Service connection pipes are not generally shown but their presence should be anticipated.

### **General Notes:**

- 1) The initial assessment referred to above is carried out taking into account water demand and wastewater discharge volumes and infrastructure details on the date of the assessment. The availability of capacity may change at any date after this assessment.
- 2) This feedback does not constitute a contract in whole or in part to provide a connection to any Irish Water infrastructure. All feasibility assessments are subject to the constraints of the Irish Water Capital Investment Plan.
- 3) The feedback provided is subject to a Connection Agreement/contract being signed at a later date.
- 4) A Connection Agreement will be required to commencing the connection works associated with the enquiry this can be applied for at <a href="https://www.water.ie/connections/get-connected/">https://www.water.ie/connections/get-connected/</a>
- 5) A Connection Agreement cannot be issued until all statutory approvals are successfully in place.
- Irish Water Connection Policy/ Charges can be found at https://www.water.ie/connections/information/connection-charges/
- 7) Please note the Confirmation of Feasibility does not extend to your fire flow requirements.
- 8) Irish Water is not responsible for the management or disposal of storm water or ground waters. You are advised to contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges
- 9) To access Irish Water Maps email <u>datarequests@water.ie</u>
- 10) All works to the Irish Water infrastructure, including works in the Public Space, shall have to be carried out by Irish Water.

If you have any further questions, please contact Marina Zivanovic Byrne from the design team on via email mzbyrne@water.ie For further information, visit **www.water.ie/connections.** 

Yours sincerely,

M Buye

Maria O'Dwyer Connections and Developer Services



Mr. Alan Lambe, Chartered Engineer, Donnachadh O'Brien & Associates, Unit 5C, Elm House, Millennium Park, Naas, Co. Kildare.

Uisce Éireann Bosca OP 448 Oifig Sheachadta na Cathrach Theas Cathrach Theas

Irish Water PO Box 448, South City Delivery Office, Cork City.

www.water.ie

15 March 2021

Dear Mr. Lambe,

# Re: Proposed development at Finlay Park, Naas, Co Kildare / Irish Water Diversion reference DIV21046. Subject to contract | Contract denied

Irish Water has reviewed your submission for the proposed diversion of the 1050 mm Concrete wastewater sewer in the vicinity of Finlay Park, Naas, Co. Kildare.

Based upon the details you have provided in your drawings FINLAY-DOB-00-SI-DR-C-0003-S2-P03 and FINLAY-DOB-XX-SI-DR-C-0002-D2-P03 and as assessed by Irish Water, we wish to advise you that, subject to valid agreements being put in place, the proposal can be facilitated.

You are advised that this correspondence does not constitute an agreement in whole or in part to build near any Irish Water infrastructure and is provided subject to an associated Diversion and/or Self Lay Connection Agreement being executed at a later date. Please engage with Irish Water again in relation to this matter at such time planning permission has been granted for the proposed development at the site.

If you have any further questions, please contact Brendan Kearney from the diversions team on 0871016233 or email <u>brkearney@water.ie</u>. For further information, visit <u>www.water.ie/connections.</u>

Yours sincerely,

Monne Maesis

Yvonne Harris Head of Customer Operations

Stiurthoiri / Directors: Cathal Marley (Chairman), Niall Gleeson, Eamon Gallen, Brendan Murphy, Michael G. O'Sullivan

Oifig Chláraithe / Registered Office: Teach Colvill, 24-26 Sráid Thalbóid, Baile Átha Cliath 1, D01 NP86 / Colvill House, 24-26 Talbot Street, Dublin 1, D01 NP86 Is cuideachta ghníomhaíochta ainmnithe atá faoi theorainn scaireanna é Uisce Éireann / Irish Water is a designated activity company, limited by shares. Uimhir Chláraithe in Éirinn / Registered in Ireland No.: 530363



Appendix E

**Foul Calculations** 

Engineering Services Report Project: Housing development at Finlay Park, Naas, Co. Kildare Project No.: DOBA2110 Issue 3 Client: Westar Homes Ltd Date: December 2022

Donnachadh O'Brien & Associates		Page 0	
Unit W9 E&F Ladytown BP			
Newhall Naas			
Co Kildare		Micro	
Date 08/12/2022 10:42	Designed by stevep	Dcainago	
File DOBA2110 2022.10.06 FOU	Checked by	Diamage	
XP Solutions	Network 2020.1.3	•	

### FOUL SEWERAGE DESIGN

### Design Criteria for Foul Network 3

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (1/s/ha)0.00Add Flow / Climate Change (%)0Industrial Peak Flow Factor0.00Minimum Backdrop Height (m)0.200Flow Per Person (1/per/day)150.00Maximum Backdrop Height (m)1.500Persons per House3.00Min Design Depth for Optimisation (m)1.200Domestic (1/s/ha)0.00Min Vel for Auto Design only (m/s)0.75Domestic Peak Flow Factor6.00Min Slope for Optimisation (1:X)500

Designed with Level Soffits

### Network Design Table for Foul Network 3

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	ise (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	11.795	0.060	196.6	0.000	38	0.0	1.500	0	225	Pipe/Conduit	8
1.001	58.965	0.718	82.1	0.000	0	0.0	1.500	0	225	Pipe/Conduit	Ā
1.002	38.482	0.191	201.5	0.000	0	0.0	1.500	0	225	Pipe/Conduit	8
1.003	63.780	0.318	200.6	0.000	30	0.0	1.500	0	225	Pipe/Conduit	8
1.004	48.696	0.241	202.1	0.000	0	0.0	1.500	0	225	Pipe/Conduit	8
1.005	28.514	0.143	199.4	0.000	0	0.0	1.500	0	225	Pipe/Conduit	8
1.006	6.200	0.031	200.0	0.000	80	0.0	1.500	0	225	Pipe/Conduit	8

### Network Results Table

PN	US/IL (m)		Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)			Cap (1/s)	Flow (1/s)	
1.000	85.905	0.000	0.0	38	0.0	30	0.38	0.82	32.5	1.2	
1.001	85.845	0.000	0.0	38	0.0	24	0.52	1.27	50.4	1.2	
1.002	85.127	0.000	0.0	38	0.0	30	0.38	0.81	32.1	1.2	
1.003	84.936	0.000	0.0	68	0.0	39	0.46	0.81	32.2	2.1	
1.004	84.618	0.000	0.0	68	0.0	39	0.45	0.81	32.0	2.1	
1.005	84.377	0.000	0.0	68	0.0	39	0.46	0.81	32.3	2.1	
1.006	84.234	0.000	0.0	148	0.0	58	0.57	0.81	32.2	4.6	

# **DONNACHADH O'BRIEN** & ASSOCIATES CONSULTING ENGINEERS

Appendix F

Correspondence between DOBA and KCC Transportation Dept

From: Stephen Deegan <<u>sdeegan@kildarecoco.ie</u>>
Sent: Thursday 27 October 2022 11:24
To: Donnachadh O'Brien <<u>d.obrien@doba.ie</u>>
Cc: Frank O'Rourke <<u>frankoroufrank@gmail.com</u>>; George Willoughby <<u>gwilloughby@kildarecoco.ie</u>>
Subject: RE: Finlay Park LRD

Hi Donnacha,

It is agreed that the bus priority street and the harbour bridge itself, as part of the current masterplan, can be held back until the next phase of development however it is the Council's preference that the "Greenway" infrastructure / pathway within the application area is proceeded with during this phase. Whilst it may "go nowhere" yet I would suggest it is returned into the development to encourage usage and provide both a passive and active use that will discourage the suggested anti-social behaviour. By including it at this stage it will allow the associated landscaping to mature and also set the standard which can be followed though each phase.

Regards

Stephen