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Residential Development at Finlay Park, Naas, Co. Kildare

Engineering Services Report

December 2022

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Contents

Appendices

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

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).

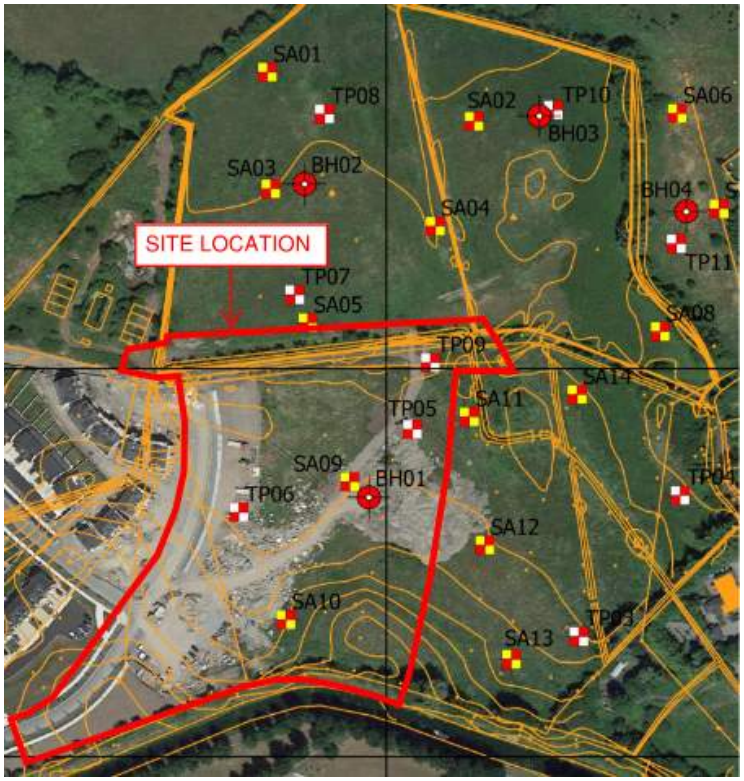


Figure 2 Extract from GII site investigation report

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 x 10^{-6} m/s and 7 x 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.

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:

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:

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:

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:

Sustainable Urban Drainage System		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	●					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		●			●	Bioswalws are proposed as source control NBS SuDS measures for this project.
4	Bioswales		●			●	Bioswales are proposed along the road edge as source control NBS SuDS measures for this project.
5	Rain Gardens		●				Raingardens are not proposed as source control NBS SuDS as the roof areas discharge to a Blue Roof
6	Green Roofs		●			●	A min. 60% of the proposed roof area will be a green roof. The green roof areas will discharge to a Blue Roof podium
7	Blue Roofs		●			●	The runoff from the apartment building roof will discharge to a Blue Roof on the podium prior to discharge off site.
8	Green Walls		●				Green walls are not proposed as part of the proposed development. A green embankment is included
9	Tree Pits		●			●	Tree Pits are proposed as source control NBS SuDS measures for this project.
	Infiltration System SuDS						
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 SuDS						
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		●				Filter Strips are not proposed as source control SuDS measures for this project.
15	Lined Permeable Paving		●				Lined Permeable Paving systems are not proposed as a source control SuDS measure
	Detention Systems SuDS						
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 Treatment Systems						
19	Petrol/ oil separators				●	●	Petrol / oil interceptors are proposed on the surface water outfall prior to discharge to the watercourse on the northern boundary of the site
20	Rainwater Harvesting		●				Rainwater harveting is not proposed as part of this development

Figure 3 Proposed SuDS Hierarchy

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;
  - 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:

$$QBAR_{rural} = 0.00108AREA^{0.89}SAAR^{1.17}SOIL^{2.17}$$

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

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.

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."

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).

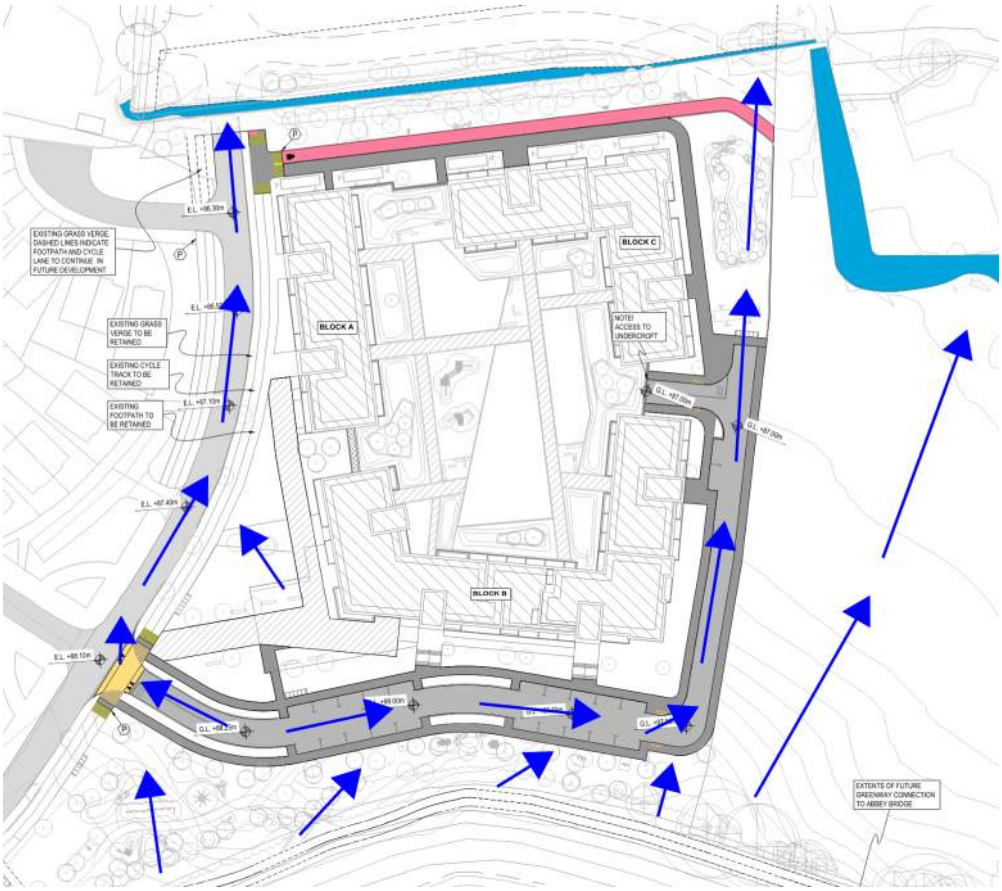


Figure 5 Overland flow path post development

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 Connection** - 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:

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:

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.

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	
Water Connection	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. 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

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 (l):

(l) 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.

- 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:

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:

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:

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:

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:

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:

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:

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:

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:

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:

- Arterial Streets: 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

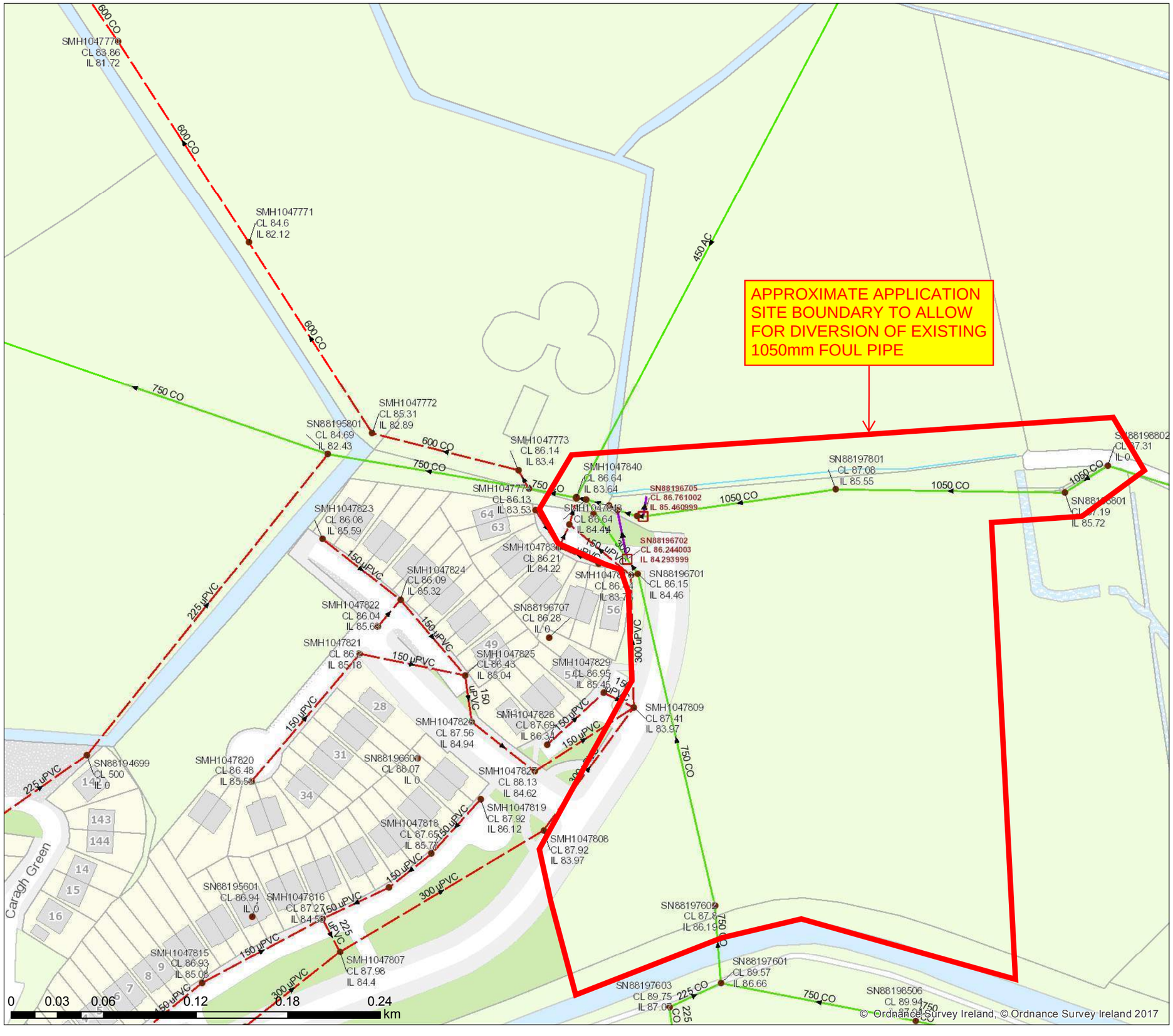
Roadplan were commissioned by the applicant to carry out a Mobility Management Plan for the proposed development. The MMP is included with the planning documents.

DONNACHADH O'BRIEN
& ASSOCIATES CONSULTING ENGINEERS

Appendix A

Kildare County Council / Irish Water Maps

Irish Water Web Map



Print Date: 09/03/2021

Printed by:Irish Water

Water Distribution Network
- Water Treatment Plant
- Water Pump Station
- Storage Cell/Tower
- Dosing Point
- Meter Station
- Abstraction Point
- Telemetry Kiosk

Reservoir
- Potable
- Raw Water

Water Distribution Mains
- Irish Water
- Private

Trunk Water Mains
- Irish Water
- Private

Water Lateral Lines
- Irish Water
- Non IW
- Water Casings
- Water Abandoned Lines
- Boundary Meter
- Bulk/Check Meter
- Group Scheme
- Source Meter
- Waste Meter
- Unknown Meter ; Other Meter
- Non-Return
- PRV
- PSV
- Sluice Line Valve Open/Closed
- Butterfly Line Valve Open/Closed
- Sluice Boundary Valve Open/Closed
- Butterfly Boundary Valve Open/Closed
- Scour Valves
- Single Air Control Valve
- Double Air Control Valve
- Water Stop Valves
- Water Service Connections
- Water Distribution Chambers
- Water Network Junctions
- Pressure Monitoring Point
- Fire Hydrant
- Fire Hydrant/Washout

Water Fittings
- Cap
- Reducer
- Tap
- Other Fittings

Sewer Foul Combined Network
- Waste Water Treatment Plant
- Waste Water Pump station

Sewer Mains Irish Water
- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow

Sewer Mains Private
- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow
- Sewer Lateral Lines
- Sewer Casings

Sewer Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown

Discharge Type
- Outfall
- Overflow
- Soakaway
- Standard Outlet
- Other; Unknown

Cleanout Type
- Rodding Eye
- Flushing Structure
- Other; Unknown

Sewer Inlets
- Catchpit
- Gully
- Standard
- Other; Unknown

Sewer Fittings
- Vent/Col
- Other; Unknown

Storm Water Network

Surface Water Mains
- Surface Gravity Mains
- Surface Gravity Mains Private
- Surface Water Pressurised Mains
- Surface Water Pressurised Mains Private

Inlet Type
- Gully
- Standard
- Other; Unknown

Storm Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown
- Storm Culverts
- Storm Clean Outs
- Stormwater Chambers

Discharge Type
- Outfall
- Overflow
- Soakaway
- Other; Unknown

Gas Networks Ireland
- Transmission High Pressure Gasline
- Distribution Medium Pressure Gasline
- Distribution Low Pressure Gasline

ESB Networks

ESB HV Lines
- HV Underground
- HV Overhead
- HV Abandoned

ESB MVLV Lines
- MV Overhead Three Phase
- MV Overhead Single Phase
- LV Overhead Three Phase
- LV Overhead Single Phase
- MVLV Underground
- Abandoned

Non Service Categories
- Proposed
- Under Construction
- Out of Service
- Decommissioned

Water Non Service Assets
- Water Point Feature
- Water Pipe
- Water Structure

Waste Non Service Assets
- Waste Point Feature
- Sewer
- Waste Structure

Irish Water Web Map

UISCE ÉIREANN : IRISH WATER

Print Date: 26/03/2021

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Irish Water Web Map

Print Date: 17/02/2021

Printed by:Irish Water

Water Distribution Network
- Water Treatment Plant
- Water Pump Station
- Storage Cell/Tower
- Dosing Point
- Meter Station
- Abstraction Point
- Telemetry Kiosk

Reservoir
- Potable
- Raw Water

Water Distribution Mains
- Irish Water
- Private

Trunk Water Mains
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- Water Abandoned Lines
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- Waste Meter
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- PSV
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- Butterfly Line Valve Open/Closed
- Sluice Boundary Valve Open/Closed
- Butterfly Boundary Valve Open/Closed
- Scour Valves
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- Water Stop Valves
- Water Service Connections
- Water Distribution Chambers
- Water Network Junctions
- Pressure Monitoring Point
- Fire Hydrant
- Fire Hydrant/Washout

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- Cap
- Reducer
- Tap
- Other Fittings

Sewer Foul Combined Network
- Waste Water Treatment Plant
- Waste Water Pump station

Sewer Mains Irish Water
- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow

Sewer Mains Private
- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
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- Sewer Casings

Sewer Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown

Discharge Type
- Outfall
- Overflow
- Soakaway
- Standard Outlet
- Other; Unknown

Cleanout Type
- Rodding Eye
- Flushing Structure
- Other; Unknown

Sewer Inlets
- Catchpit
- Gully
- Standard
- Other; Unknown

Sewer Fittings
- Vent/Col
- Other; Unknown

Storm Water Network

Surface Water Mains
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- Surface Gravity Mains Private
- Surface Water Pressurised Mains
- Surface Water Pressurised Mains Private

Inlet Type
- Gully
- Standard
- Other; Unknown

Storm Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown
- Storm Culverts
- Storm Clean Outs
- Stormwater Chambers

Discharge Type
- Outfall
- Overflow
- Soakaway
- Other; Unknown

Gas Networks Ireland
- Transmission High Pressure Gasline
- Distribution Medium Pressure Gasline
- Distribution Low Pressure Gasline

ESB Networks

ESB HV Lines
- HV Underground
- HV Overhead
- HV Abandoned

ESB MVLV Lines
- MV Overhead Three Phase
- MV Overhead Single Phase
- LV Overhead Three Phase
- LV Overhead Single Phase
- MVLV Underground
- Abandoned

Non Service Categories
- Proposed
- Under Construction
- Out of Service
- Decommissioned

Water Non Service Assets
- Water Point Feature
- Water Pipe
- Water Structure

Waste Non Service Assets
- Waste Point Feature
- Sewer
- Waste Structure

DONNACHADH O'BRIEN
& ASSOCIATES CONSULTING ENGINEERS

Appendix B

Stage 1 Surface Water Audit Report & Calculations

STORMWATER AUDIT (STAGE 1)

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

- 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*

2 Proposed Development

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;

- 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.

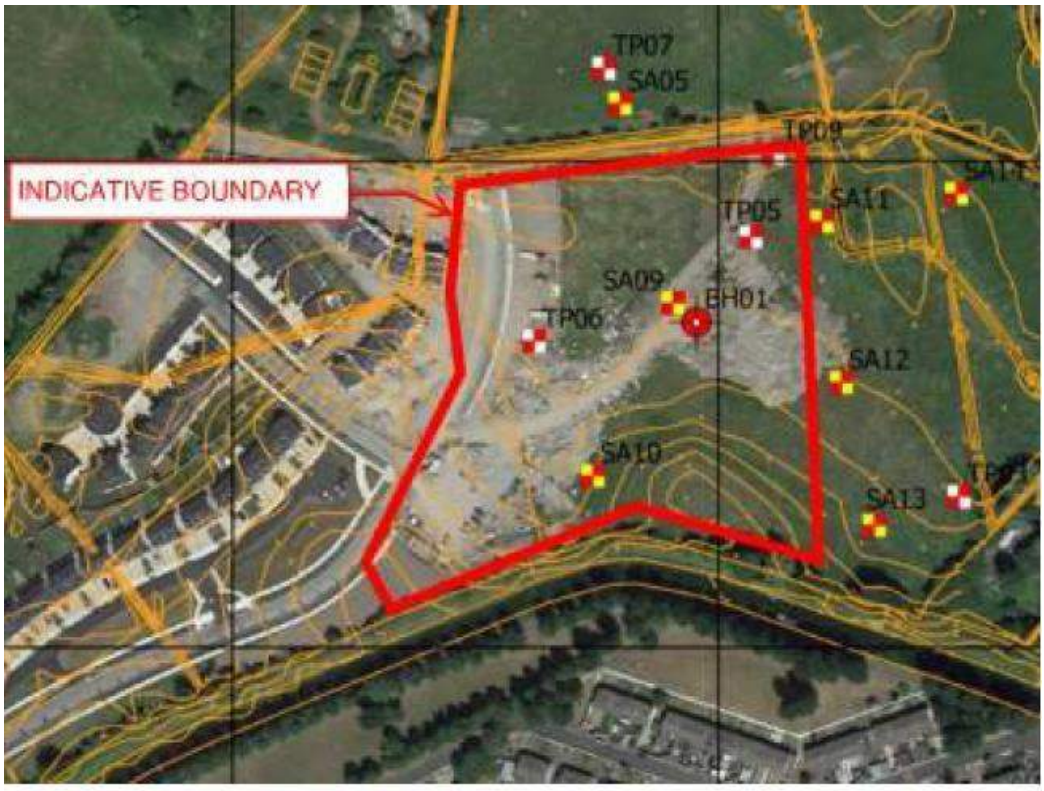

Figure 2 Extract of survey locations from GII site investigation report

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**88** – Met Eireann
SAAR (mm)	850	831 – Met Eireann
SPR	0.3	0.37 – from SI results
Qbar l/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 **but also the paviours are laid on 50mm of concrete bed which may not allow filtration.**

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**

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

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

Prepared by:

_____

Chris Wason BEng CEng MICE
Principal Engineer

Approved by:

Paul Browne

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.

Appendix A – Audit Feedback Form

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	A SOIL type of 2 (SPR 0.3) is adopted by DOBA but the SI would indicated that the soil is clayey in places and a SOIL type 3 (SPR 0.37) maybe more relevant. Use of the type 2 factore may be consiered to be more conservative and give reduced Qbar.	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 and areas applied to the hydraulic model	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	<u>Hydraulic Model</u> 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. 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. 3 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. 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 & SMH3.01 been represented properly in the model for the actual head? •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? 6 The model is based on a free-flowing outfall. DOBA should confirm that he outfall will not be surcharged.	DOBA to comment	1. The Met Eirann data has been updated. 2. 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. 3. A catchment area and hydrobrake have been added to the model to account for the 5.3 l/s from the exisitng adjacent site. 4. 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. 5. The model has been revised to reflect 0.9 metres of head above the hydrobrake. 6. 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)	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:	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	Soakaway Calculations 1 30% climate change has been allowed for but there is no allowance for urban creep. 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	DOBA to comment 1 is UC to be included in the infiltration calculations? 2 are 100% impermeable areas allowed for in the infiltration calculations	1. 40% climate change was included in the Microdrainage design criteria to include the 10% urban creep factor. 2. 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.	**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

DONNACHADH O'BRIEN
& ASSOCIATES CONSULTING ENGINEERS

Document Control

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Issue	Date	Status	Issued to	Copies	Checked for Issue
1	23.09.2022	Issue 1	Auditor	1	
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3	25.10.2022	Issue 3	Auditor	1	

DONNACHADH O'BRIEN
& ASSOCIATES CONSULTING ENGINEERS

Contents

Appendices

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.

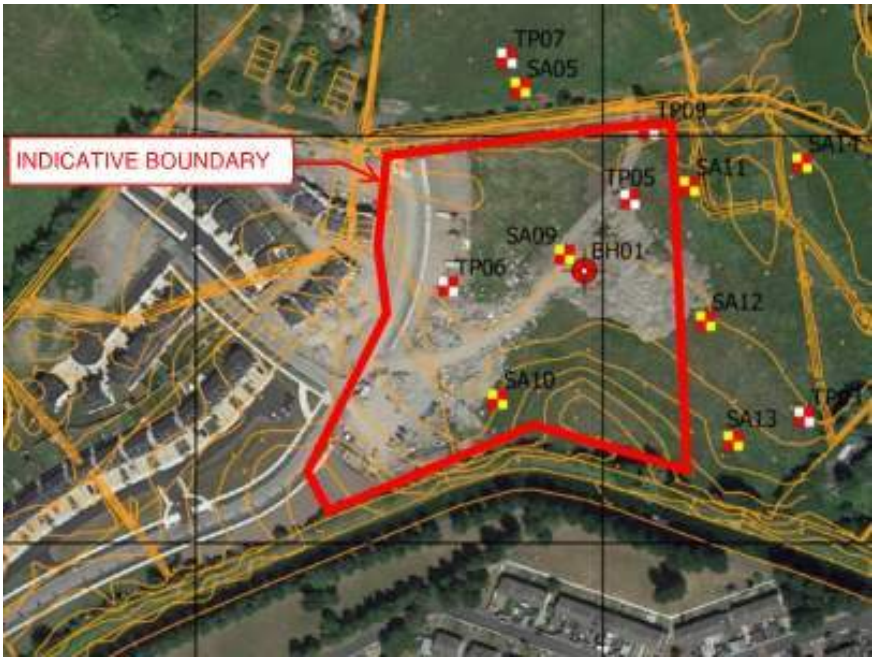

Figure 2 Extract of survey locations from GII site investigation report

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 x 10^{-6} m/s and 7 x 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:
    - 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
    - Bioswales
    - Green Roof
    - Blue Roof
    - Green Wall
    - Tree Pits
- Infiltration System SuDS:
    - Unlined Tree Pits
    - Unlined Permeable Paving
    - Infiltration Trenches
- Filtration System SuDS:
    - 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:

- Permeable paving 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 @ $15m^2$ = $1.2m^3$ interception storage per permeable pavement parking space;
- Tree Pits 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 = $0.18m^3$ per tree pit
- Green Roofs 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:
    - Total Green Roof area provided: 2022 m^2

- Blue Roof 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:
    - Total Blue Roof area provided: 4244 m^2
- Infiltration Trenches (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^3 / m of infiltration trench
    - Infiltration Trench B, C: 1m (L) x 1m (W) x 1.5m (depth) x 40% voids = 0.6m^3 / m of infiltration trench
    - Infiltration Trench D: 1m (L) x 1.5m (W) x 1.5m (depth) x 40% voids = 0.9m^3 / m of infiltration trench
- Bio Retention Ponds 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^2
    - West bio retention area: 126 m^2

The total hard standing area within the site is 14,710 m^2; for a 5mm interception storage depth, 74 m^3 of interception storage is required. Based on the interception treatment measures discussed above, a total interception storage of 350 m^3 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:

$$QBAR_{rural} = 0.00108AREA^{0.89}SAAR^{1.17}SOIL^{2.17}$$

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 l/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.

Table 1 Attenuation Tank Maintenance Programme

SuDS Feature	**Maintenance**		
Attenuation Tank	**Potential Issues**	Failure of components, blockage from debris	
	Period	**Task**	**Frequency**
	Regular	Inspect and identify non-operating features. Remove sediment/ debris.	Monthly or as required.
	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 2 Permeable Paving Maintenance Programme

SuDS Feature	**Maintenance**		
Permeable Paving	**Potential Issues**	Failure of components, blockage from debris	
	Period	**Task**	**Frequency**
	Regular	Brushing/ sweeping of surfaces and cleaning of joints	Monthly or as required.
	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		
Tree Pit / Swale	**Potential Issues**	Failure of components, blockage from debris	
	Period	**Task**	**Frequency**
	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		
Tree Pit / Swale	**Potential Issues**	Failure of components, blockage from debris	
	Period	**Task**	**Frequency**
	Regular	Remove debris, manage vegetation, inspect inlets, outlets, overflows, inspect infiltration material, inspect silt accumulation, maintain plants	Monthly or as required.
	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		
Tree Pit / Swale	**Potential Issues**	Failure of components, blockage from debris	
	Period	**Task**	**Frequency**
	Regular	Remove debris, manage vegetation, inspect inlets, outlets, overflows	Monthly or as required.
	Remedial Work	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
	Monitoring	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.

DONNACHADH O'BRIEN
& ASSOCIATES CONSULTING ENGINEERS

Appendix A

Site Investigation Reports

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

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Hazelhatch Road,
Newcastle,
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Ground Investigations Ireland

Finlay Park

Westar Group

Ground Investigation Report

GROUND INVESTIGATIONS IRELAND
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DOCUMENT CONTROL SHEET

Project Title	Finlay Park
Engineer	CORA
Client	Westar Group
Project No	9990-09-20
Document Title	Ground Investigation Report

Rev.	Status	Author(s)	Reviewed By	Approved By	Office of Origin	Issue Date
A	Final	S Kealy	D Maglochlainn	C Finnerty	Dublin	21 October 2020

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.

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

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CONTENTS

APPENDICES

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 in-situ 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 G*rey 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

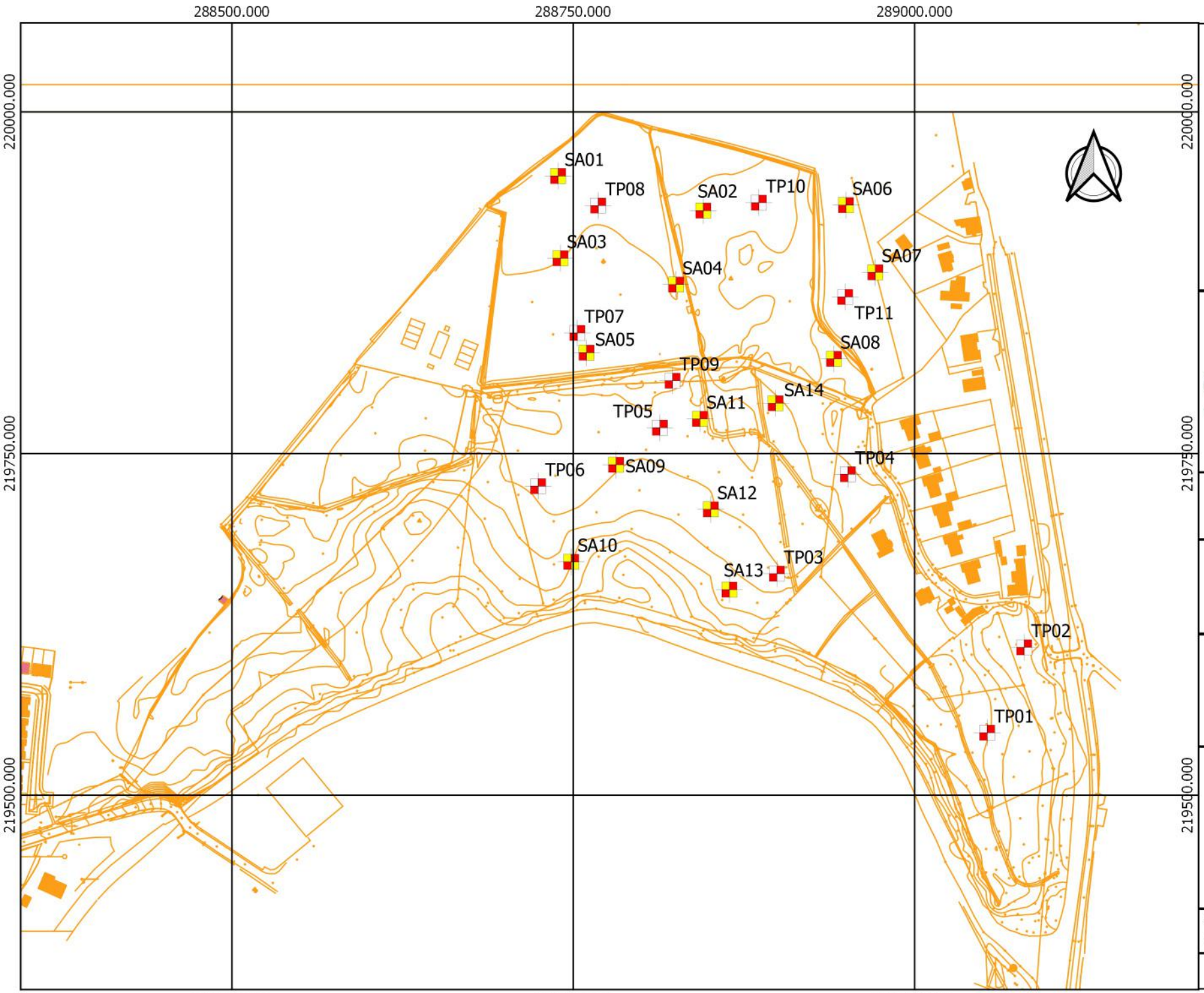
To determine the strength of the cohesive deposits and density of the granular we would recommend carrying out a sequence of cable percussion to determine a suitable depth for foundations and a sequence of rotary boreholes to determine the presence of bedrock.

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



LEGEND

- Soakaways
- Trial Pits

Client:

CORA CONSULTING ENGINEERS

Project Code:
9990-09-20

Project Title:
Finaly Park

Drawing Title:
Figure 1 Site Location

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental
Ground Investigations Ireland Ltd.
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Hazelhatch Road,
Newcastle, Co. Dublin
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0 50 100 150 m

Drawn By:	Date:
SK	21/10/2020

APPENDIX 2 – Trial Pit Records

Ground Investigations Ireland Ltd
www.gii.ie

Site Finlay Park			**Trial Pit Number** SA09
Machine : Tracked Excavator **Method :** Trial Pit	**Dimensions** 1.90m x 0.60m x 1.50m (L x W x D)	**Ground Level (mOD)**	**Client** Westar Group	**Job Number** 9990-09-20
	Location 288781 E 219740.9 N	**Dates** 23/09/2020	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	TOPSOIL: Brown slightly sandy slightly gravelly Clay with grass and rootlets. Gravel is fine to coarse subangular to subrounded.		
					0.30			
					(0.60)	Grey/brown clayey sandy fine to coarse subangular to subrounded GRAVEL with subrounded cobbles and boulders.		
					0.90			
					(0.60)	Grey/brown clayey sandy fine to coarse subrounded to rounded GRAVEL with subrounded cobbles.		
					1.50	Complete at 1.50m		

Plan

Remarks

No groundwater encountered.
Spalling at 0.50m BGL.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	JMD	9990-09-20.SA09

Ground Investigations Ireland Ltd
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Site Finlay Park			**Trial Pit Number** SA10
Machine : Tracked Excavator **Method :** Trial Pit	**Dimensions** 1.60m x 0.60m x 1.50m (L x W x D)	**Ground Level (mOD)**	**Client** Westar Group	**Job Number** 9990-09-20
	Location 288748.1 E 219669.8 N	**Dates** 23/09/2020	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	MADE GROUND: Light brown sandy gravelly Clay with occasional subrounded cobbles, red brick and rootlets. Gravel is fine to coarse subangular to subrounded.		
0.40	B				0.40			
					(0.50)	Grey/brown slightly sandy slightly gravelly silty CLAY. Gravel is fine to coarse subangular to subrounded with rootlets.		
					0.90			
					(0.60)	Dark grey/brown clayey gravelly fine to coarse SAND. Gravel is fine to coarse subrounded to rounded.		
1.50	B		Slow(1) at 1.50m.		1.50	Complete at 1.50m		▽1

Plan

Remarks

Groundwater encountered at 1.50m BGL.
Trial pit stable.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	JMD	9990-09-20.SA10

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Site Finlay Park			**Trial Pit Number** SA11
Machine : Tracked Excavator **Method :** Trial Pit	**Dimensions** 1.50m x 0.60m x 1.40m (L x W x D)	**Ground Level (mOD)**	**Client** Westar Group	**Job Number** 9990-09-20
	Location 288842.4 E 219774.5 N	**Dates** 23/09/2020	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.50)	TOPSOIL: Brown slightly sandy slightly gravelly Clay with grass and rootlets. Gravel is fine to medium subrounded to rounded.		
0.50	B				0.50			
					(0.60)	Grey slightly silty fine to medium SAND.		
1.00	B				1.10			
					(0.30)	Light grey slightly silty fine to medium SAND.		
1.40	B		Slow(1) at 1.40m.		1.40	Complete at 1.40m		▽1

Plan

Remarks

Groundwater encountered at 1.40m BGL.
Trial pit stable.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	JMD	9990-09-20.SA11

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Site Finlay Park			**Trial Pit Number** SA12
Machine : Tracked Excavator **Method :** Trial Pit	**Dimensions** 2.00m x 0.60m x 1.50m (L x W x D)	**Ground Level (mOD)**	**Client** Westar Group	**Job Number** 9990-09-20
	Location 288850.3 E 219708.2 N	**Dates** 23/09/2020	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(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			
					(1.00)	Grey/brown slightly clayey sandy fine to coarse subrounded to rounded GRAVEL with subangular to rounded cobbles and boulders.		
					1.50	Complete at 1.50m		

Plan

Remarks

No groundwater encountered.
Collapsing at 0.45m BGL.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	JMD	9990-09-20.SA12

Ground Investigations Ireland Ltd

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Site Finlay Park			**Trial Pit Number** TP05
Machine : Tracked Excavator **Method :** Trial Pit	**Dimensions** 2.60m x 1.10m x 2.60m (L x W x D)	**Ground Level (mOD)**	**Client** Westar Group	**Job Number** 9990-09-20
	Location 288813.4 E 219768 N	**Dates** 23/09/2020	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.50)	MADE GROUND: Brown clayey gravelly fine to coarse SAND with pieces of concrete and tar.		
0.50	B				0.50			
					(0.70)	Grey clayey sandy fine to coarse subangular to rounded GRAVEL with occasional subrounded cobbles.		
1.20	B				1.20			
1.90	B		Slow(1) at 1.90m. Fast(2) at 2.05m.		(1.40)	Grey/brown slightly clayey sandy fine to coarse subangular to rounded GRAVEL with subrounded to rounded cobbles and boulders.		▽1 ▽2
2.50	B				2.60			
						Complete at 2.60m		

Plan

Remarks

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 collapse.

Scale (approx)	Logged By	Figure No.
1:25	JMD	9990-09-20.TP05

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Site Finlay Park			**Trial Pit Number** TP06
Machine : Tracked Excavator **Method :** Trial Pit	**Dimensions** 2.30m x 0.60m x 2.00m BGL	**Ground Level (mOD)**	**Client** Westar Group	**Job Number** 9990-09-20
	Location 288724.2 E 219725.2 N	**Dates** 23/09/2020	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	MADE GROUND: Brown slightly sandy gravelly Clay with red brick fragments. Gravel is fine to coarse subrounded to rounded.		
					0.30			
					(0.20)	Firm to stiff light brown sandy gravelly CLAY. Gravel is fine to medium subangular to subrounded.		
0.50	B				0.50			
					(0.90)	Grey slightly clayey gravelly fine to medium SAND with occasional subrounded cobbles.		
1.00	B							
			Slow(1) at 1.40m.		1.40			▽1
1.50	B				(0.40)	Firm to stiff grey mottled brown sandy gravelly CLAY with subrounded to rounded cobbles. Gravel is fine to coarse subangular to rounded.		
					1.80			
					(0.20)	Grey sandy clayey fine to coarse subangular to rounded GRAVEL with subangular to rounded cobbles and boulders.		
2.00	B		Medium(2) at 2.00m.		2.00			▽2
						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.
Trial pit backfilled on completion.
Trial pit terminated at 2.00m BGL due to collapse.

Scale (approx)	Logged By	Figure No.
1:25	JMD	9990-09-20.TP06

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Site	Trial Pit Number
Finlay Park	TP09

Machine : Tracked Excavator Method : Trial Pit	Dimensions 2.20m x 0.60m x 2.60m (L x W x D)	Ground Level (mOD)	Client Westar Group	Job Number 9990-09-20
	Location 288822.7 E 219802.3 N	Dates 23/09/2020	Engineer	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40) 0.40	TOPSOIL: Brown slightly sandy gravelly Clay with grass and rootlets. Gravel is fine to coarse subangular to rounded.		
0.50	B				(0.60) 1.00	Soft brown slightly sandy gravelly CLAY. Gravel is fine to coarse subrounded to rounded.		
1.20	B				(0.50) 1.50	Soft grey/brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse subangular to rounded.		
1.90	B				(0.90) 2.40	Grey slightly gravelly silty fine to medium SAND. Gravel is fine to coarse subrounded to rounded.		▽1
2.50	B		Slow to Medium(1) at 2.40m.		(0.20) 2.60	Grey silty gravelly fine to coarse SAND with subangular to rounded cobbles and boulders. Gravel is fine to coarse subangular to rounded.		
						Complete at 2.60m		

Plan

Remarks

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.

Scale (approx)	Logged By	Figure No.
1:25	JMD	9990-09-20.TP09

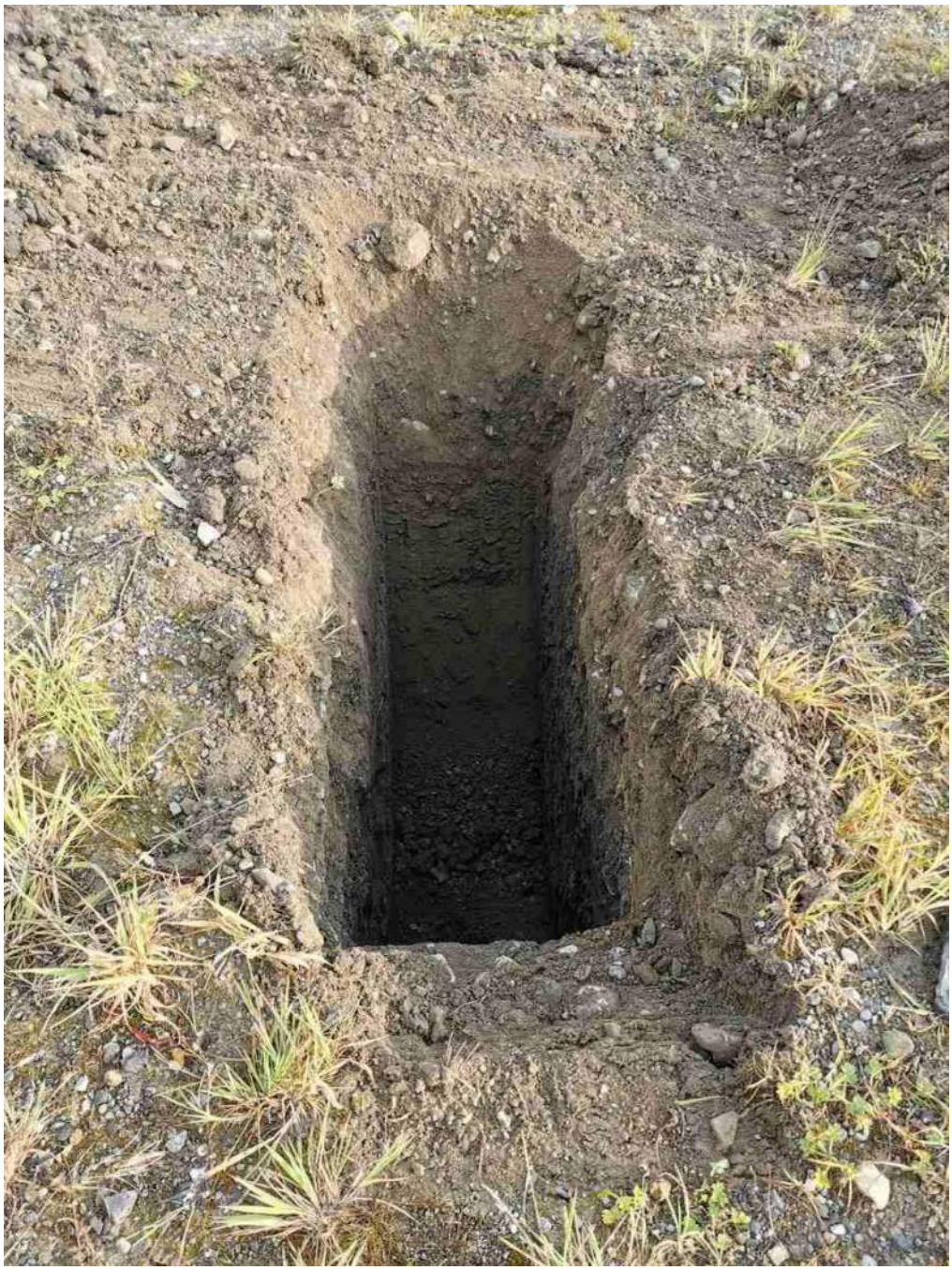
TP05

TP06

TP09

SA09

SA10



SA11

SA12

APPENDIX 3 – Soakaway Records

Ground Investigations Ireland Ltd
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Site Finlay Park			**Trial Pit Number** SA09
Machine : Tracked Excavator **Method :** Trial Pit	**Dimensions** 1.90m x 0.60m x 1.50m (L x W x D)	**Ground Level (mOD)**	**Client** Westar Group	**Job Number** 9990-09-20
	Location 288781 E 219740.9 N	**Dates** 23/09/2020	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	TOPSOIL: Brown slightly sandy slightly gravelly Clay with grass and rootlets. Gravel is fine to coarse subangular to subrounded.		
					0.30			
					(0.60)	Grey/brown clayey sandy fine to coarse subangular to subrounded GRAVEL with subrounded cobbles and boulders.		
					0.90			
					(0.60)	Grey/brown clayey sandy fine to coarse subrounded to rounded GRAVEL with subrounded cobbles.		
					1.50	Complete at 1.50m		

Plan

Remarks

No groundwater encountered.
Spalling at 0.50m BGL.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	JMD	9990-09-20.SA09

Ground Investigations Ireland Ltd
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Site Finlay Park			**Trial Pit Number** SA10
Machine : Tracked Excavator **Method :** Trial Pit	**Dimensions** 1.60m x 0.60m x 1.50m (L x W x D)	**Ground Level (mOD)**	**Client** Westar Group	**Job Number** 9990-09-20
	Location 288748.1 E 219669.8 N	**Dates** 23/09/2020	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	MADE GROUND: Light brown sandy gravelly Clay with occasional subrounded cobbles, red brick and rootlets. Gravel is fine to coarse subangular to subrounded.		
0.40	B				0.40			
					(0.50)	Grey/brown slightly sandy slightly gravelly silty CLAY. Gravel is fine to coarse subangular to subrounded with rootlets.		
					0.90			
					(0.60)	Dark grey/brown clayey gravelly fine to coarse SAND. Gravel is fine to coarse subrounded to rounded.		
1.50	B		Slow(1) at 1.50m.		1.50	Complete at 1.50m		▽1

Plan

Remarks

Groundwater encountered at 1.50m BGL.
Trial pit stable.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	JMD	9990-09-20.SA10

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Site Finlay Park			**Trial Pit Number** SA11
Machine : Tracked Excavator **Method :** Trial Pit	**Dimensions** 1.50m x 0.60m x 1.40m (L x W x D)	**Ground Level (mOD)**	**Client** Westar Group	**Job Number** 9990-09-20
	Location 288842.4 E 219774.5 N	**Dates** 23/09/2020	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.50)	TOPSOIL: Brown slightly sandy slightly gravelly Clay with grass and rootlets. Gravel is fine to medium subrounded to rounded.		
0.50	B				0.50			
					(0.60)	Grey slightly silty fine to medium SAND.		
1.00	B				1.10			
					(0.30)	Light grey slightly silty fine to medium SAND.		
1.40	B		Slow(1) at 1.40m.		1.40	Complete at 1.40m		▽1

Plan

Remarks

Groundwater encountered at 1.40m BGL.
Trial pit stable.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	JMD	9990-09-20.SA11

Ground Investigations Ireland Ltd
www.gii.ie

Site Finlay Park			**Trial Pit Number** SA12
Machine : Tracked Excavator **Method :** Trial Pit	**Dimensions** 2.00m x 0.60m x 1.50m (L x W x D)	**Ground Level (mOD)**	**Client** Westar Group	**Job Number** 9990-09-20
	Location 288850.3 E 219708.2 N	**Dates** 23/09/2020	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(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			
					(1.00)	Grey/brown slightly clayey sandy fine to coarse subrounded to rounded GRAVEL with subangular to rounded cobbles and boulders.		
					1.50	Complete at 1.50m		

Plan

Remarks

No groundwater encountered.
Collapsing at 0.45m BGL.
Trial pit backfilled on completion.

Scale (approx)	Logged By	Figure No.
1:25	JMD	9990-09-20.SA12

Ground Investigations Ireland Ltd

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Site Finlay Park			**Trial Pit Number** TP05
Machine : Tracked Excavator **Method :** Trial Pit	**Dimensions** 2.60m x 1.10m x 2.60m (L x W x D)	**Ground Level (mOD)**	**Client** Westar Group	**Job Number** 9990-09-20
	Location 288813.4 E 219768 N	**Dates** 23/09/2020	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.50)	MADE GROUND: Brown clayey gravelly fine to coarse SAND with pieces of concrete and tar.		
0.50	B				0.50			
					(0.70)	Grey clayey sandy fine to coarse subangular to rounded GRAVEL with occasional subrounded cobbles.		
1.20	B				1.20			
1.90	B		Slow(1) at 1.90m. Fast(2) at 2.05m.		(1.40)	Grey/brown slightly clayey sandy fine to coarse subangular to rounded GRAVEL with subrounded to rounded cobbles and boulders.		▽1 ▽2
2.50	B				2.60			
						Complete at 2.60m		

Plan

Remarks

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 collapse.

Scale (approx)	Logged By	Figure No.
1:25	JMD	9990-09-20.TP05

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Site Finlay Park			**Trial Pit Number** TP06
Machine : Tracked Excavator **Method :** Trial Pit	**Dimensions** 2.30m x 0.60m x 2.00m BGL	**Ground Level (mOD)**	**Client** Westar Group	**Job Number** 9990-09-20
	Location 288724.2 E 219725.2 N	**Dates** 23/09/2020	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	MADE GROUND: Brown slightly sandy gravelly Clay with red brick fragments. Gravel is fine to coarse subrounded to rounded.		
					0.30			
					(0.20)	Firm to stiff light brown sandy gravelly CLAY. Gravel is fine to medium subangular to subrounded.		
0.50	B				0.50			
					(0.90)	Grey slightly clayey gravelly fine to medium SAND with occasional subrounded cobbles.		
1.00	B							
			Slow(1) at 1.40m.		1.40			▽1
1.50	B				(0.40)	Firm to stiff grey mottled brown sandy gravelly CLAY with subrounded to rounded cobbles. Gravel is fine to coarse subangular to rounded.		
					1.80			
					(0.20)	Grey sandy clayey fine to coarse subangular to rounded GRAVEL with subangular to rounded cobbles and boulders.		
2.00	B		Medium(2) at 2.00m.		2.00			▽2
						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.
Trial pit backfilled on completion.
Trial pit terminated at 2.00m BGL due to collapse.

Scale (approx)	Logged By	Figure No.
1:25	JMD	9990-09-20.TP06

Ground Investigations Ireland Ltd
www.gii.ie

Site	Trial Pit Number
Finlay Park	TP09

Machine : Tracked Excavator Method : Trial Pit	Dimensions 2.20m x 0.60m x 2.60m (L x W x D)	Ground Level (mOD)	Client Westar Group	Job Number 9990-09-20
	Location 288822.7 E 219802.3 N	Dates 23/09/2020	Engineer	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40) 0.40	TOPSOIL: Brown slightly sandy gravelly Clay with grass and rootlets. Gravel is fine to coarse subangular to rounded.		
0.50	B				(0.60) 1.00	Soft brown slightly sandy gravelly CLAY. Gravel is fine to coarse subrounded to rounded.		
1.20	B				(0.50) 1.50	Soft grey/brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse subangular to rounded.		
1.90	B				(0.90) 2.40	Grey slightly gravelly silty fine to medium SAND. Gravel is fine to coarse subrounded to rounded.		▽1
2.50	B		Slow to Medium(1) at 2.40m.		(0.20) 2.60	Grey silty gravelly fine to coarse SAND with subangular to rounded cobbles and boulders. Gravel is fine to coarse subangular to rounded.		
						Complete at 2.60m		

Plan

Remarks

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.

Scale (approx)	Logged By	Figure No.
1:25	JMD	9990-09-20.TP09

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		
Location	BH01		
Level	Metres below 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	16:30:00	2.0566	9.818
20/02/2022	17:00:00	2.0643	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	00:00:00	2.12	9.861
21/02/2022	00:30:00	2.1183	9.872
21/02/2022	01:00:00	2.1172	9.877
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	2.1104	9.875
21/02/2022	07:30:00	2.1203	9.872
21/02/2022	08:00:00	2.1115	9.879
21/02/2022	08:30:00	2.1147	9.872
21/02/2022	09:00:00	2.1191	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	14:30:00	2.1476	9.872
21/02/2022	15:00:00	2.1372	9.873
21/02/2022	15:30:00	2.1443	9.866
21/02/2022	16:00:00	2.1475	9.866
21/02/2022	16:30:00	2.1484	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

Unit W9 E&F Ladytown BP
Newhall Naas
Co Kildare

Date 25/10/2022 10:35 | Designed by stevep
File DOBA2110 2022 10 20 Sur | Checked by
XP Solutions

30% Climate Change + 10% Urban Creep

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 2

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	16.900	Add Flow / Climate Change (%)	40
Ratio R	0.288	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	1.000	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Surface Network 2

- Indicates pipe length does not match coordinates
« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (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		o	225	Pipe/Conduit	
1.001	22.377	0.118	189.6	0.024	0.00	0.0	0.600		o	225	Pipe/Conduit	
2.000	55.000#	0.275	200.0	0.083	5.00	0.0		0.010	→|_|→		Infiltration Trench	
2.001	8.176#	0.409	20.0	0.000	0.00	0.0	0.600		o	150	Pipe/Conduit	
1.002	9.909	0.050	198.2	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.003	53.645	0.255	210.4	0.038	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.004	11.430	0.056	204.1	0.023	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.005	53.500#	0.268	200.0	0.027	0.00	0.0	0.600		o	300	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 (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

Network Design Table for Surface Network 2

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.006	45.139#	0.226	199.7	0.058	0.00	0.0	0.600		o	300	Pipe/Conduit	
3.000	2.528	0.013	194.5	0.021	5.00	0.0	0.600		o	225	Pipe/Conduit	
3.001	15.540	0.081	191.9	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
3.002	18.832	0.249	75.6	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
4.000	4.001	0.050	80.0	0.337	5.00	0.0	0.600		o	225	Pipe/Conduit	
4.001	13.938	0.160	87.1	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
4.002	9.313	0.264	35.2	0.000	0.00	0.0	0.600		o	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	0.600		o	150	Pipe/Conduit	
6.000	60.811	0.635	95.8	0.145	5.00	0.0		0.010			Infiltration Trench	
5.003	15.930#	0.080	199.1	0.000	0.00	0.0	0.600		o	150	Pipe/Conduit	
5.004	23.108#	0.116	199.2	0.000	0.00	0.0	0.600		o	150	Pipe/Conduit	
5.005	19.886	0.225	88.4	0.040	0.00	0.0	0.600		o	225	Pipe/Conduit	
4.003	8.685	0.050	173.3	0.015	0.00	0.0	0.600		o	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 (l/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	50.00	5.05	85.093	0.021	0.0	0.0	1.5	0.93	37.1	5.3
3.001	50.00	5.32	85.080	0.021	0.0	0.0	1.5	0.94	37.4	5.3
3.002	50.00	5.53	84.999	0.021	0.0	0.0	1.5	1.51	59.9	5.3
4.000	50.00	5.05	85.450	0.337	0.0	0.0	24.3	1.46	58.2«	85.2
4.001	50.00	5.21	85.400	0.337	0.0	0.0	24.3	1.40	55.7«	85.2
4.002	50.00	5.28	85.240	0.337	0.0	0.0	24.3	2.21	87.9	85.2
5.000	50.00	5.14	86.040	0.011	0.0	0.0	0.8	1.71	997.4	2.8
5.001	50.00	6.23	85.970	0.179	0.0	0.0	12.9	1.90	1482.0	45.2
5.002	50.00	6.46	86.843	0.179	0.0	0.0	12.9	0.71	12.5«	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	50.00	6.83	86.796	0.324	0.0	0.0	23.4	0.71	12.5«	81.9
5.004	50.00	7.37	85.216	0.324	0.0	0.0	23.4	0.71	12.5«	81.9
5.005	50.00	7.61	85.100	0.364	0.0	0.0	26.3	1.39	55.3«	92.0
4.003	50.00	7.76	84.800	0.716	0.0	0.0	51.7	0.99	39.4«	181.1

Network Design Table for Surface Network 2

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
3.003	12.019	0.025	480.8	0.126	0.00	0.0	0.600		o	300	Pipe/Conduit	
3.004	48.592	0.090	539.9	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	
3.005	9.715	0.015	647.7	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.007	8.107	0.120	67.6	0.000	0.00	0.0	0.600		o	300	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 (l/s)	Flow (l/s)
3.003	50.00	8.04	84.750	0.863	0.0	0.0	62.3	0.71	50.2«	218.2
3.004	50.00	9.25	84.725	0.863	0.0	0.0	62.3	0.67	47.3«	218.2
3.005	49.36	9.51	84.635	0.863	0.0	0.0	62.3	0.61	43.2«	218.2
1.007	49.19	9.58	84.620	1.525	0.0	0.0	108.4	1.92	135.4«	379.3

TOTAL SITE I. AREA IS 1.525 - .021 (Existing Area from Phase 1 Pipe 3.00)=1.50 ha

PIPELINE SCHEDULES for Surface Network 2

Upstream Manhole

- Indicates pipe length does not match coordinates

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	o		SMH1.0	87.000	85.620	1.155	Open Manhole	1200
1.001	o	225	SMH1.01	87.000	85.600	1.175	Open Manhole	1200
2.000	→|_|→		SMH2.00	87.300	85.800	0.000	Open Manhole	3000
2.001	o	150	SMH2.01	87.200	87.000	0.050	Open Manhole	3000
1.002	o	225	SMH1.02	86.899	85.482	1.192	Open Manhole	1200
1.003	o	225	SMH1.03	86.771	85.432	1.114	Open Manhole	1200
1.004	o	225	SMH1.04	86.621	85.177	1.219	Open Manhole	1200
1.005	o	300	SMH1.05	86.987	85.114	1.573	Open Manhole	1200
1.006	o	300	SMH1.06	86.600	84.846	1.454	Open Manhole	1200
3.000	o	225	SMH3.0	87.840	85.093	2.522	Open Manhole	1200
3.001	o	225	SMH3.01	87.840	85.080	2.535	Open Manhole	1200
3.002	o	225	SMH3.02	87.350	84.999	2.126	Open Manhole	1200
4.000	o	225	SMH4.00	87.000	85.450	1.325	Open Manhole	1200
4.001	o	225	SMH4.01	87.000	85.400	1.375	Open Manhole	1200
4.002	o	225	SMH4.02	87.000	85.240	1.535	Open Manhole	1200

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	0.158	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	1.219	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	2.126	Open Manhole	1200
3.002	18.832	75.6	SMH3.03	87.100	84.750	2.125	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	1.535	Open Manhole	1200
4.002	9.313	35.2	SMH4.03	87.300	84.976	2.099	Open Manhole	1200

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)
5.000	→|_|→		SMH5.00	87.500	86.040	0.000	Open Manhole	3000
5.001	→|_|→		SMH5.01	87.500	85.970	0.030	Open Manhole	3000
5.002	o	150	SMH5.02	88.000	86.843	1.007	Open Manhole	3000
6.000	→|_|→		SMH6.00	87.500	85.930	0.070	Open Manhole	3000
5.003	o	150	SMH5.03	88.000	86.796	1.054	Open Manhole	3000
5.004	o	150	SMH5.04	87.000	85.216	1.634	Open Manhole	1050
5.005	o	225	SMH5.05	87.000	85.100	1.675	Open Manhole	1200
4.003	o	225	SMH4.03	87.300	84.800	2.275	Open Manhole	1200
3.003	o	300	SMH3.03	87.100	84.750	2.050	Open Manhole	1200
3.004	o	300	SMH3.04	86.848	84.725	1.823	Open Manhole	1200
3.005	o	300	SMH3.05	86.254	84.635	1.319	Open Manhole	1200
1.007	o	300	SMH1.07	86.300	84.620	1.380	Open Manhole	1200

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)
5.000	14.000#	200.0	SMH5.01	87.500	85.970	0.070	Open Manhole	3000
5.001	125.000#	200.0	SMH5.02	88.000	85.345	1.155	Open Manhole	3000
5.002	9.420#	200.0	SMH5.03	88.000	86.796	1.054	Open Manhole	3000
6.000	60.811	95.8	SMH5.03	88.000	85.295	1.205	Open Manhole	3000
5.003	15.930#	199.1	SMH5.04	87.000	86.716	0.134	Open Manhole	1050
5.004	23.108#	199.2	SMH5.05	87.000	85.100	1.750	Open Manhole	1200
5.005	19.886	88.4	SMH4.03	87.300	84.875	2.200	Open Manhole	1200
4.003	8.685	173.3	SMH3.03	87.100	84.750	2.125	Open Manhole	1200
3.003	12.019	480.8	SMH3.04	86.848	84.725	1.823	Open Manhole	1200
3.004	48.592	539.9	SMH3.05	86.254	84.635	1.319	Open Manhole	1200
3.005	9.715	647.7	SMH1.07	86.300	84.620	1.380	Open Manhole	1200
1.007	8.107	67.6	SMH1.08	85.925	84.500	1.125	Open Manhole	1200

Free Flowing Outfall Details for Surface Network 2

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.007	SMH1.08	85.925	84.500	0.000	1200	0

Simulation Criteria for Surface Network 2

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	40.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	9
Number of Online Controls	6	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	5	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	16.900	Storm Duration (mins)	30
Ratio R	0.288		

Online Controls for Surface Network 2

Hydro-Brake® Optimum Manhole: SMH1.01, DS/PN: 1.001, Volume (m³): 1.7

Unit Reference	MD-SHE-0224-2650-1000-2650
Design Head (m)	1.000
Design Flow (l/s)	26.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	224
Invert Level (m)	85.600
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	26.5
Flush-Flo™	0.367	26.5
Kick-Flo®	0.739	22.9
Mean Flow over Head Range	-	22.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.5	1.200	28.9	3.000	44.9	7.000	67.7
0.200	22.3	1.400	31.1	3.500	48.4	7.500	70.1
0.300	26.3	1.600	33.2	4.000	51.6	8.000	72.3
0.400	26.5	1.800	35.1	4.500	54.7	8.500	74.5
0.500	26.1	2.000	36.9	5.000	57.5	9.000	76.6
0.600	25.4	2.200	38.7	5.500	60.3	9.500	78.6
0.800	23.8	2.400	40.3	6.000	62.9		
1.000	26.5	2.600	41.9	6.500	65.4		

Hydro-Brake® Optimum Manhole: SMH1.05, DS/PN: 1.005, Volume (m³): 2.5

Unit Reference	MD-SHE-0181-1600-0900-1600
Design Head (m)	0.900
Design Flow (l/s)	16.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	181
Invert Level (m)	85.121
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Hydro-Brake® Optimum Manhole: SMH1.05, DS/PN: 1.005, Volume (m³): 2.5

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	16.0
Flush-Flo™	0.307	16.0
Kick-Flo®	0.651	13.7
Mean Flow over Head Range	-	13.4

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
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	48.3
0.600	14.6	2.200	24.5	5.500	38.1	9.500	49.4
0.800	15.1	2.400	25.5	6.000	39.7		
1.000	16.8	2.600	26.5	6.500	41.3		

Hydro-Brake® Optimum Manhole: SMH3.01, DS/PN: 3.001, Volume (m³): 3.2

Unit Reference	MD-SHE-0108-5300-1000-5300
Design Head (m)	1.000
Design Flow (l/s)	5.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	108
Invert Level (m)	85.080
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	5.3
Flush-Flo™	0.295	5.3
Kick-Flo®	0.641	4.3
Mean Flow over Head Range	-	4.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.7	0.300	5.3	0.500	5.0	0.800	4.8
0.200	5.2	0.400	5.2	0.600	4.6	1.000	5.3

Hydro-Brake® Optimum Manhole: SMH3.01, DS/PN: 3.001, Volume (m³): 3.2

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (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® Optimum Manhole: SMH4.01, DS/PN: 4.001, Volume (m³): 1.9

Unit Reference	MD-SHE-0180-1600-1000-1600
Design Head (m)	1.000
Design Flow (l/s)	16.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	180
Invert Level (m)	85.400
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	16.0
Flush-Flo™	0.324	16.0
Kick-Flo®	0.706	13.6
Mean Flow over Head Range	-	13.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.3	1.200	17.4	3.000	27.0	7.000	40.7
0.200	15.4	1.400	18.8	3.500	29.1	7.500	42.1
0.300	16.0	1.600	20.0	4.000	31.0	8.000	43.4
0.400	15.9	1.800	21.2	4.500	32.9	8.500	44.7
0.500	15.6	2.000	22.3	5.000	34.6	9.000	45.9
0.600	15.0	2.200	23.3	5.500	36.2	9.500	47.2
0.800	14.4	2.400	24.3	6.000	37.7		
1.000	16.0	2.600	25.2	6.500	39.2		

Hydro-Brake® Optimum Manhole: SMH4.03, DS/PN: 4.003, Volume (m³): 3.9

Unit Reference	MD-SHE-0152-1000-0500-1000
Design Head (m)	0.500
Design Flow (l/s)	10.0
Flush-Flo™	Calculated

Hydro-Brake® Optimum Manhole: SMH4.03, DS/PN: 4.003, Volume (m³): 3.9

Objective	Minimise upstream storage
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 (l/s)
Design Point (Calculated)	0.500	10.0
Flush-Flo™	0.225	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 the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
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	25.2	7.500	36.5
0.300	9.8	1.600	17.3	4.000	26.9	8.000	37.7
0.400	9.0	1.800	18.3	4.500	28.5	8.500	38.9
0.500	10.0	2.000	19.3	5.000	30.0	9.000	40.1
0.600	10.9	2.200	20.2	5.500	31.2	9.500	41.2
0.800	12.5	2.400	21.1	6.000	32.6		
1.000	13.9	2.600	21.9	6.500	34.0		

Hydro-Brake® Optimum Manhole: SMH1.07, DS/PN: 1.007, Volume (m³): 5.6

Unit Reference	MD-SHE-0126-8800-1800-8800
Design Head (m)	1.800
Design Flow (l/s)	8.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	126
Invert Level (m)	84.620
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.800	8.8
Flush-Flo™	0.541	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 the Hydro-Brake® Optimum as specified. Should another type of control device other than a

Hydro-Brake® Optimum Manhole: SMH1.07, DS/PN: 1.007, Volume (m³): 5.6

Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
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		

Storage Structures for Surface Network 2

Tank or Pond Manhole: SMH1.0, DS/PN: 1.000

Invert Level (m) 85.620

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2007.0	0.150	2007.0	0.151	0.0

Infiltration Trench Pipe: 2.000

Manning's N	0.010	Trench Width (m)	1.5
Infiltration Coefficient Base (m/hr)	0.02592	Trench Length (m)	55.0
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)	85.800		

Tank or Pond Manhole: SMH1.04, DS/PN: 1.004

Invert Level (m) 85.177

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
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 (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
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		

Infiltration Trench Pipe: 5.001

Manning's N	0.010	Invert Level (m)	85.970
Infiltration Coefficient Base (m/hr)	0.02592	Trench Width (m)	1.3
Infiltration Coefficient Side (m/hr)	0.02592	Trench Length (m)	125.0
Safety Factor	2.0	Slope (1:X)	200.0
Porosity	0.40	Cap Volume Depth (m)	1.500

Infiltration Trench Pipe: 5.001

Cap Infiltration Depth (m) 1.500

Infiltration Trench Pipe: 6.000

Manning's N	0.010	Trench Width (m)	1.0
Infiltration Coefficient Base (m/hr)	0.02592	Trench Length (m)	60.8
Infiltration Coefficient Side (m/hr)	0.02592	Slope (1:X)	95.8
Safety Factor	2.0	Cap Volume Depth (m)	1.500
Porosity	0.40	Cap Infiltration Depth (m)	1.500
Invert Level (m)	85.930		

Tank or Pond Manhole: SMH5.05, DS/PN: 5.005

Invert Level (m) 85.100

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	104.0	0.500	104.0	0.501	0.0

Tank or Pond Manhole: SMH1.07, DS/PN: 1.007

Invert Level (m) 84.620

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	130.0	1.000	130.0	1.010	0.0

Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

30% Climate Change + 10% Urban Creep

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	40.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	9
Number of Online Controls	6	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.288
Region	Scotland and Ireland	Cv (Summer)	1.000
M5-60 (mm)	16.900	Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	50.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 0

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	SMH1.0	1440 Summer	100	+0%				
1.001	SMH1.01	15 Summer	100	+0%				
2.000	SMH2.00	1440 Summer	100	+0%				
2.001	SMH2.01	1440 Summer	100	+0%				
1.002	SMH1.02	1440 Summer	100	+0%	100/960 Summer			
1.003	SMH1.03	1440 Summer	100	+0%	100/480 Summer			
1.004	SMH1.04	1440 Summer	100	+0%	30/240 Summer			
1.005	SMH1.05	1440 Summer	100	+0%	30/240 Summer			
1.006	SMH1.06	2160 Summer	100	+0%	30/60 Summer			
3.000	SMH3.0	30 Summer	100	+0%	30/15 Summer			
3.001	SMH3.01	30 Summer	100	+0%	30/15 Summer			
3.002	SMH3.02	2160 Summer	100	+0%	30/15 Summer			
4.000	SMH4.00	2160 Summer	100	+0%	100/720 Summer			
4.001	SMH4.01	2160 Summer	100	+0%	100/600 Summer			
4.002	SMH4.02	2160 Summer	100	+0%	30/240 Summer			

Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/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	SMH1.0	
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	

Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
5.000	SMH5.00	600 Summer	100	+0%				
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)	Flooded Volume (m^3)	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	85.866	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

PN	US/MH Name	Level 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	

HIGH LEVEL OVERFLOW MODEL

30% Climate Change + 10% Urban Creep

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 2

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	16.900	Add Flow / Climate Change (%)	40
Ratio R	0.288	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	1.000	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Surface Network 2

- Indicates pipe length does not match coordinates
« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (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		o	225	Pipe/Conduit	
1.001	22.377	0.118	189.6	0.024	0.00	0.0	0.600		o	225	Pipe/Conduit	
2.000	55.000#	0.275	200.0	0.083	5.00	0.0		0.010	→|_|→		Infiltration Trench	
2.001	8.176#	0.409	20.0	0.000	0.00	0.0	0.600		o	150	Pipe/Conduit	
1.002	9.909	0.050	198.2	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.003	53.645	0.255	210.4	0.038	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.004	11.430	0.056	204.1	0.023	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.005	53.500#	0.268	200.0	0.027	0.00	0.0	0.600		o	300	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 (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

Network Design Table for Surface Network 2

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.006	45.139#	0.226	199.7	0.058	0.00	0.0	0.600		o	300	Pipe/Conduit	
3.000	2.528	0.013	194.5	0.021	5.00	0.0	0.600		o	225	Pipe/Conduit	
3.001	15.540	0.081	191.9	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
3.002	18.832	0.249	75.6	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
4.000	4.001	0.050	80.0	0.337	5.00	0.0	0.600		o	225	Pipe/Conduit	
4.001	13.938	0.160	87.1	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
4.002	9.313	0.264	35.2	0.000	0.00	0.0	0.600		o	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	0.600		o	150	Pipe/Conduit	
6.000	60.811	0.635	95.8	0.145	5.00	0.0		0.010			Infiltration Trench	
5.003	15.930#	0.080	199.1	0.000	0.00	0.0	0.600		o	150	Pipe/Conduit	
5.004	23.108#	0.116	199.2	0.000	0.00	0.0	0.600		o	150	Pipe/Conduit	
5.005	19.886	0.225	88.4	0.040	0.00	0.0	0.600		o	225	Pipe/Conduit	
4.003	8.685	0.050	173.3	0.015	0.00	0.0	0.600		o	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 (l/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	50.00	5.05	85.093	0.021	0.0	0.0	1.5	0.93	37.1	5.3
3.001	50.00	5.32	85.080	0.021	0.0	0.0	1.5	0.94	37.4	5.3
3.002	50.00	5.53	84.999	0.021	0.0	0.0	1.5	1.51	59.9	5.3
4.000	50.00	5.05	85.450	0.337	0.0	0.0	24.3	1.46	58.2«	85.2
4.001	50.00	5.21	85.400	0.337	0.0	0.0	24.3	1.40	55.7«	85.2
4.002	50.00	5.28	85.240	0.337	0.0	0.0	24.3	2.21	87.9	85.2
5.000	50.00	5.14	86.040	0.011	0.0	0.0	0.8	1.71	997.4	2.8
5.001	50.00	6.23	85.970	0.179	0.0	0.0	12.9	1.90	1482.0	45.2
5.002	50.00	6.46	86.843	0.179	0.0	0.0	12.9	0.71	12.5«	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	50.00	6.83	86.796	0.324	0.0	0.0	23.4	0.71	12.5«	81.9
5.004	50.00	7.37	85.216	0.324	0.0	0.0	23.4	0.71	12.5«	81.9
5.005	50.00	7.61	85.100	0.364	0.0	0.0	26.3	1.39	55.3«	92.0
4.003	50.00	7.76	84.800	0.716	0.0	0.0	51.7	0.99	39.4«	181.1

Network Design Table for Surface Network 2

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
3.003	12.019	0.025	480.8	0.126	0.00	0.0	0.600		o	300	Pipe/Conduit	
3.004	48.592	0.090	539.9	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	
3.005	9.715	0.015	647.7	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.007	8.107	0.020	405.3	0.000	0.00	0.0	0.600		o	300	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 (l/s)	Flow (l/s)
3.003	50.00	8.04	84.750	0.863	0.0	0.0	62.3	0.71	50.2«	218.2
3.004	50.00	9.25	84.725	0.863	0.0	0.0	62.3	0.67	47.3«	218.2
3.005	49.36	9.51	84.635	0.863	0.0	0.0	62.3	0.61	43.2«	218.2
1.007	48.94	9.69	85.020	1.525	0.0	0.0	107.8	0.77	54.8«	377.4

TOTAL SITE I. AREA IS 1.525 - .021 (Existing Area from Phase 1 Pipe 3.00)=1.50 ha

PIPELINE SCHEDULES for Surface Network 2

Upstream Manhole

- Indicates pipe length does not match coordinates

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	o		SMH1.0	87.000	85.620	1.155	Open Manhole	1200
1.001	o	225	SMH1.01	87.000	85.600	1.175	Open Manhole	1200
2.000	→|_|→		SMH2.00	87.300	85.800	0.000	Open Manhole	3000
2.001	o	150	SMH2.01	87.200	87.000	0.050	Open Manhole	3000
1.002	o	225	SMH1.02	86.899	85.482	1.192	Open Manhole	1200
1.003	o	225	SMH1.03	86.771	85.432	1.114	Open Manhole	1200
1.004	o	225	SMH1.04	86.621	85.177	1.219	Open Manhole	1200
1.005	o	300	SMH1.05	86.987	85.114	1.573	Open Manhole	1200
1.006	o	300	SMH1.06	86.600	84.846	1.454	Open Manhole	1200
3.000	o	225	SMH3.0	87.840	85.093	2.522	Open Manhole	1200
3.001	o	225	SMH3.01	87.840	85.080	2.535	Open Manhole	1200
3.002	o	225	SMH3.02	87.350	84.999	2.126	Open Manhole	1200
4.000	o	225	SMH4.00	87.000	85.450	1.325	Open Manhole	1200
4.001	o	225	SMH4.01	87.000	85.400	1.375	Open Manhole	1200
4.002	o	225	SMH4.02	87.000	85.240	1.535	Open Manhole	1200

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	0.158	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	1.219	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	2.126	Open Manhole	1200
3.002	18.832	75.6	SMH3.03	87.100	84.750	2.125	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	1.535	Open Manhole	1200
4.002	9.313	35.2	SMH4.03	87.300	84.976	2.099	Open Manhole	1200

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)
5.000	→|_|→		SMH5.00	87.500	86.040	0.000	Open Manhole	3000
5.001	→|_|→		SMH5.01	87.500	85.970	0.030	Open Manhole	3000
5.002	o	150	SMH5.02	88.000	86.843	1.007	Open Manhole	3000
6.000	→|_|→		SMH6.00	87.500	85.930	0.070	Open Manhole	3000
5.003	o	150	SMH5.03	88.000	86.796	1.054	Open Manhole	3000
5.004	o	150	SMH5.04	87.000	85.216	1.634	Open Manhole	1050
5.005	o	225	SMH5.05	87.000	85.100	1.675	Open Manhole	1200
4.003	o	225	SMH4.03	87.300	84.800	2.275	Open Manhole	1200
3.003	o	300	SMH3.03	87.100	84.750	2.050	Open Manhole	1200
3.004	o	300	SMH3.04	86.848	84.725	1.823	Open Manhole	1200
3.005	o	300	SMH3.05	86.254	84.635	1.319	Open Manhole	1200
1.007	o	300	SMH1.07	86.300	85.020	0.980	Open Manhole	1200

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)
5.000	14.000#	200.0	SMH5.01	87.500	85.970	0.070	Open Manhole	3000
5.001	125.000#	200.0	SMH5.02	88.000	85.345	1.155	Open Manhole	3000
5.002	9.420#	200.0	SMH5.03	88.000	86.796	1.054	Open Manhole	3000
6.000	60.811	95.8	SMH5.03	88.000	85.295	1.205	Open Manhole	3000
5.003	15.930#	199.1	SMH5.04	87.000	86.716	0.134	Open Manhole	1050
5.004	23.108#	199.2	SMH5.05	87.000	85.100	1.750	Open Manhole	1200
5.005	19.886	88.4	SMH4.03	87.300	84.875	2.200	Open Manhole	1200
4.003	8.685	173.3	SMH3.03	87.100	84.750	2.125	Open Manhole	1200
3.003	12.019	480.8	SMH3.04	86.848	84.725	1.823	Open Manhole	1200
3.004	48.592	539.9	SMH3.05	86.254	84.635	1.319	Open Manhole	1200
3.005	9.715	647.7	SMH1.07	86.300	84.620	1.380	Open Manhole	1200
1.007	8.107	405.3	SMH1.08	85.925	85.000	0.625	Open Manhole	1200

Free Flowing Outfall Details for Surface Network 2

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.007	SMH1.08	85.925	85.000	0.000	1200	0

Simulation Criteria for Surface Network 2

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	40.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	9
Number of Online Controls	6	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	5	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	16.900	Storm Duration (mins)	30
Ratio R	0.288		

Online Controls for Surface Network 2

Hydro-Brake® Optimum Manhole: SMH1.01, DS/PN: 1.001, Volume (m³): 1.7

Unit Reference	MD-SHE-0224-2650-1000-2650
Design Head (m)	1.000
Design Flow (l/s)	26.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	224
Invert Level (m)	85.600
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	26.5
Flush-Flo™	0.367	26.5
Kick-Flo®	0.739	22.9
Mean Flow over Head Range	-	22.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.5	1.200	28.9	3.000	44.9	7.000	67.7
0.200	22.3	1.400	31.1	3.500	48.4	7.500	70.1
0.300	26.3	1.600	33.2	4.000	51.6	8.000	72.3
0.400	26.5	1.800	35.1	4.500	54.7	8.500	74.5
0.500	26.1	2.000	36.9	5.000	57.5	9.000	76.6
0.600	25.4	2.200	38.7	5.500	60.3	9.500	78.6
0.800	23.8	2.400	40.3	6.000	62.9		
1.000	26.5	2.600	41.9	6.500	65.4		

Hydro-Brake® Optimum Manhole: SMH1.05, DS/PN: 1.005, Volume (m³): 2.5

Unit Reference	MD-SHE-0181-1600-0900-1600
Design Head (m)	0.900
Design Flow (l/s)	16.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	181
Invert Level (m)	85.121
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Hydro-Brake® Optimum Manhole: SMH1.05, DS/PN: 1.005, Volume (m³): 2.5

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	16.0
Flush-Flo™	0.307	16.0
Kick-Flo®	0.651	13.7
Mean Flow over Head Range	-	13.4

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
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	48.3
0.600	14.6	2.200	24.5	5.500	38.1	9.500	49.4
0.800	15.1	2.400	25.5	6.000	39.7		
1.000	16.8	2.600	26.5	6.500	41.3		

Hydro-Brake® Optimum Manhole: SMH3.01, DS/PN: 3.001, Volume (m³): 3.2

Unit Reference	MD-SHE-0108-5300-1000-5300
Design Head (m)	1.000
Design Flow (l/s)	5.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	108
Invert Level (m)	85.080
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	5.3
Flush-Flo™	0.295	5.3
Kick-Flo®	0.641	4.3
Mean Flow over Head Range	-	4.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.7	0.300	5.3	0.500	5.0	0.800	4.8
0.200	5.2	0.400	5.2	0.600	4.6	1.000	5.3

Hydro-Brake® Optimum Manhole: SMH3.01, DS/PN: 3.001, Volume (m³): 3.2

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (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® Optimum Manhole: SMH4.01, DS/PN: 4.001, Volume (m³): 1.9

Unit Reference	MD-SHE-0180-1600-1000-1600
Design Head (m)	1.000
Design Flow (l/s)	16.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	180
Invert Level (m)	85.400
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	16.0
Flush-Flo™	0.324	16.0
Kick-Flo®	0.706	13.6
Mean Flow over Head Range	-	13.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.3	1.200	17.4	3.000	27.0	7.000	40.7
0.200	15.4	1.400	18.8	3.500	29.1	7.500	42.1
0.300	16.0	1.600	20.0	4.000	31.0	8.000	43.4
0.400	15.9	1.800	21.2	4.500	32.9	8.500	44.7
0.500	15.6	2.000	22.3	5.000	34.6	9.000	45.9
0.600	15.0	2.200	23.3	5.500	36.2	9.500	47.2
0.800	14.4	2.400	24.3	6.000	37.7		
1.000	16.0	2.600	25.2	6.500	39.2		

Hydro-Brake® Optimum Manhole: SMH4.03, DS/PN: 4.003, Volume (m³): 3.9

Unit Reference	MD-SHE-0152-1000-0500-1000
Design Head (m)	0.500
Design Flow (l/s)	10.0
Flush-Flo™	Calculated

Hydro-Brake® Optimum Manhole: SMH4.03, DS/PN: 4.003, Volume (m³): 3.9

Objective	Minimise upstream storage
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 (l/s)
Design Point (Calculated)	0.500	10.0
Flush-Flo™	0.225	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 the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
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	25.2	7.500	36.5
0.300	9.8	1.600	17.3	4.000	26.9	8.000	37.7
0.400	9.0	1.800	18.3	4.500	28.5	8.500	38.9
0.500	10.0	2.000	19.3	5.000	30.0	9.000	40.1
0.600	10.9	2.200	20.2	5.500	31.2	9.500	41.2
0.800	12.5	2.400	21.1	6.000	32.6		
1.000	13.9	2.600	21.9	6.500	34.0		

Hydro-Brake® Optimum Manhole: SMH1.07, DS/PN: 1.007, Volume (m³): 5.2

Unit Reference	MD-SHE-0126-8800-1800-8800
Design Head (m)	1.800
Design Flow (l/s)	8.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	126
Invert Level (m)	85.020
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.800	8.8
Flush-Flo™	0.541	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 the Hydro-Brake® Optimum as specified. Should another type of control device other than a

Hydro-Brake® Optimum Manhole: SMH1.07, DS/PN: 1.007, Volume (m³): 5.2

Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
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		

Storage Structures for Surface Network 2

Tank or Pond Manhole: SMH1.0, DS/PN: 1.000

Invert Level (m) 85.620

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2007.0	0.150	2007.0	0.151	0.0

Infiltration Trench Pipe: 2.000

Manning's N	0.010	Trench Width (m)	1.5
Infiltration Coefficient Base (m/hr)	0.02592	Trench Length (m)	55.0
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)	85.800		

Tank or Pond Manhole: SMH1.04, DS/PN: 1.004

Invert Level (m) 85.177

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
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 (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
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		

Infiltration Trench Pipe: 5.001

Manning's N	0.010	Invert Level (m)	85.970
Infiltration Coefficient Base (m/hr)	0.02592	Trench Width (m)	1.3
Infiltration Coefficient Side (m/hr)	0.02592	Trench Length (m)	125.0
Safety Factor	2.0	Slope (1:X)	200.0
Porosity	0.40	Cap Volume Depth (m)	1.500

Infiltration Trench Pipe: 5.001

Cap Infiltration Depth (m) 1.500

Infiltration Trench Pipe: 6.000

Manning's N	0.010	Trench Width (m)	1.0
Infiltration Coefficient Base (m/hr)	0.02592	Trench Length (m)	60.8
Infiltration Coefficient Side (m/hr)	0.02592	Slope (1:X)	95.8
Safety Factor	2.0	Cap Volume Depth (m)	1.500
Porosity	0.40	Cap Infiltration Depth (m)	1.500
Invert Level (m)	85.930		

Tank or Pond Manhole: SMH5.05, DS/PN: 5.005

Invert Level (m) 85.100

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	104.0	0.500	104.0	0.501	0.0

Tank or Pond Manhole: SMH1.07, DS/PN: 1.007

Invert Level (m) 85.020

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	130.0	1.000	130.0	1.010	0.0

Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

30% Climate Change + 10% Urban Creep

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	40.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	9
Number of Online Controls	6	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.288
Region	Scotland and Ireland	Cv (Summer)	1.000
M5-60 (mm)	16.900	Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	50.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 0

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	SMH1.0	1440 Summer	100	+0%	100/960 Summer			
1.001	SMH1.01	1440 Summer	100	+0%	100/960 Summer			
2.000	SMH2.00	1440 Summer	100	+0%				
2.001	SMH2.01	1440 Summer	100	+0%				
1.002	SMH1.02	1440 Summer	100	+0%	100/600 Summer			
1.003	SMH1.03	1440 Summer	100	+0%	100/360 Summer			
1.004	SMH1.04	1440 Summer	100	+0%	30/120 Summer			
1.005	SMH1.05	1440 Summer	100	+0%	30/180 Summer			
1.006	SMH1.06	1440 Summer	100	+0%	1/60 Summer			
3.000	SMH3.0	30 Summer	100	+0%	30/15 Summer			
3.001	SMH3.01	30 Summer	100	+0%	30/15 Summer			
3.002	SMH3.02	1440 Summer	100	+0%	1/360 Summer			
4.000	SMH4.00	1440 Summer	100	+0%	100/480 Summer			
4.001	SMH4.01	1440 Summer	100	+0%	100/180 Summer			
4.002	SMH4.02	1440 Summer	100	+0%	30/120 Summer			

Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	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	SMH1.0	
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	

Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
5.000	SMH5.00	600 Summer	100	+0%				
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)	Flooded Volume (m^3)	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

PN	US/MH Name	Level 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	

SOAKAWAY DESIGN

In accordance with BRE Digest 365 - Soakaway design

Tedds calculation version 2.0.04

Design rainfall intensity

Location of catchment area	Other
Impermeable area drained to the system	A = **1675.0** m^2
Return period	Period = **100** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.288**
5-year return period rainfall of 60 minutes duration	M5_60min = **16.9** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **30** %

Soakaway / infiltration trench details

Soakaway type	Rectangular
Minimum depth of pit (below incoming invert)	d = **1500** mm
Width of pit	w = **1250** mm
Length of pit	l = **125000** mm
Percentage free volume	V_{free} = **40** %
Soil infiltration rate	f = **7.20×10^{-6}** m/s
Wetted area of pit 50% full	$a_{s50} = l \times d + w \times d$ = **189375000** mm^2

Table equations

Inflow (cl.3.3.1)	$I = M100 \times A$
Outflow (cl.3.3.2)	$O = a_{s50} \times f \times D$
Storage (cl.3.3.3)	$S = I - O$

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m^3)	Outflow (m^3)	Storage required (m^3)
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

Required storage volume S_{req} = **89.10** m^3

Soakaway storage volume $S_{act} = l \times d \times w \times V_{free}$ = **93.75** m^3

PASS - Soakaway storage volume

Time for emptying soakaway to half volume $t_{s50} = S_{req} \times 0.5 / (a_{s50} \times f)$ = 9hr 4min 34s

PASS - Soakaway discharge time less than or equal to 24 hours

SOAKAWAY DESIGN

In accordance with BRE Digest 365 - Soakaway design

Tedds calculation version 2.0.04

Design rainfall intensity

Location of catchment area	Other
Impermeable area drained to the system	A = **1448.0** m^2
Return period	Period = **100** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.288**
5-year return period rainfall of 60 minutes duration	M5_60min = **16.9** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **30** %

Soakaway / infiltration trench details

Soakaway type	Rectangular
Minimum depth of pit (below incoming invert)	d = **1500** mm
Width of pit	w = **1000** mm
Length of pit	l = **127000** mm
Percentage free volume	V_{free} = **40** %
Soil infiltration rate	f = **7.20×10^{-6}** m/s
Wetted area of pit 50% full	$a_{s50} = l \times d + w \times d$ = **192000000** mm^2

Table equations

Inflow (cl.3.3.1)	$I = M100 \times A$
Outflow (cl.3.3.2)	$O = a_{s50} \times f \times D$
Storage (cl.3.3.3)	$S = I - O$

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m^3)	Outflow (m^3)	Storage required (m^3)
5	0.34;	7.4;	1.91;	14.1;	20.44;	0.41;	20.03
10	0.49;	10.7;	1.97;	21.0;	30.48;	0.83;	29.65
15	0.59;	12.9;	1.98;	25.4;	36.83;	1.24;	35.59
30	0.77;	16.8;	1.96;	33.0;	47.80;	2.49;	45.32
60	1.00;	22.0;	1.91;	42.1;	60.90;	4.98;	55.92
120	1.26;	27.6;	1.87;	51.7;	74.79;	9.95;	64.84
240	1.60;	35.1;	1.81;	63.5;	91.97;	19.91;	72.06
360	1.82;	40.0;	1.77;	70.8;	102.49;	29.86;	72.63
600	2.17;	47.6;	1.73;	82.5;	119.44;	49.77;	69.68
1440	2.94;	64.7;	1.66;	107.5;	155.59;	119.44;	36.15

Required storage volume	S_{req} = **72.63** m^3
Soakaway storage volume	$S_{act} = l \times d \times w \times V_{free}$ = **76.20** m^3

PASS - Soakaway storage volume

Time for emptying soakaway to half volume	$t_{s50} = S_{req} \times 0.5 / (a_{s50} \times f)$ = 7hr 17min 50s

PASS - Soakaway discharge time less than or equal to 24 hours

SOAKAWAY DESIGN

In accordance with BRE Digest 365 - Soakaway design

Tedds calculation version 2.0.04

Design rainfall intensity

Location of catchment area	Other
Impermeable area drained to the system	A = **106.0** m^2
Return period	Period = **100** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.288**
5-year return period rainfall of 60 minutes duration	M5_60min = **16.9** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **30** %

Soakaway / infiltration trench details

Soakaway type	Rectangular
Minimum depth of pit (below incoming invert)	d = **1500** mm
Width of pit	w = **1000** mm
Length of pit	l = **14000** mm
Percentage free volume	V_{free} = **40** %
Soil infiltration rate	f = **7.20×10^{-6}** m/s
Wetted area of pit 50% full	a_{s50} = l × d + w × d = **22500000** mm^2

Table equations

Inflow (cl.3.3.1)	I = M100 × A
Outflow (cl.3.3.2)	O = a_{s50} × f × D
Storage (cl.3.3.3)	S = I - O

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m^3)	Outflow (m^3)	Storage required (m^3)
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

Required storage volume S_{req} = **4.40** m^3

Soakaway storage volume S_{act} = l × d × w × V_{free} = **8.40** m^3

PASS - Soakaway storage volume

Time for emptying soakaway to half volume t_{s50} = S_{req} × 0.5 / (a_{s50} × f) = 3hr 46min 21s

PASS - Soakaway discharge time less than or equal to 24 hours

SOAKAWAY DESIGN

In accordance with BRE Digest 365 - Soakaway design

Tedds calculation version 2.0.04

Design rainfall intensity

Location of catchment area	Other
Impermeable area drained to the system	A = **832.0** m^2
Return period	Period = **100** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.288**
5-year return period rainfall of 60 minutes duration	M5_60min = **16.9** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **30** %

Soakaway / infiltration trench details

Soakaway type	Rectangular
Minimum depth of pit (below incoming invert)	d = **1500** mm
Width of pit	w = **1500** mm
Length of pit	l = **55000** mm
Percentage free volume	V_{free} = **40** %
Soil infiltration rate	f = **7.20×10^{-6}** m/s
Wetted area of pit 50% full	a_{s50} = l × d + w × d = **84750000** mm^2

Table equations

Inflow (cl.3.3.1)	I = M100 × A
Outflow (cl.3.3.2)	O = a_{s50} × f × D
Storage (cl.3.3.3)	S = I - O

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m^3)	Outflow (m^3)	Storage required (m^3)
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

Required storage volume	S_{req} = **46.66** m^3
Soakaway storage volume	S_{act} = l × d × w × V_{free} = **49.50** m^3

PASS - Soakaway storage volume

Time for emptying soakaway to half volume	t_{s50} = S_{req} × 0.5 / (a_{s50} × f) = 10hr 37min 14s

PASS - Soakaway discharge time less than or equal to 24 hours

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Project *Finlay Park, Naas*
Project No. *DOBA2110*
Title: *Phase 1*
Calcs By *SP* Date: 21/10/2022

PRELIMINARY QBAR TOTAL PERMISSIBLE OUTFLOW

Catchment Characteristics **Greenfield Runoff Flows (Sites < 50 Ha)** denotes Input Value

Standard Average Annual Rainfal (SAAR) =						831	mm
Soil Index =						0.3	
Total Site Area =						1.5500	Hectares (ha)
Storm Return Period =						100	Years
Permissible Outflow per hectare, QBAR =						2.2	l/s/ha
*** Total Permissible Outflow=**						3.45	l/s

Soil Classification for Runoff Potential

Based on FSR Maps

Soil 1	0	%
Soil 2	100	%
Soil 3	0	%
Soil 4	0	%
Soil 5	0	%

Infiltration

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Project Finlay Park
Project No. DOBA2110
Title: Total Site
Calcs By SP Date: 24/10/2022

Interception Storage - Surface Water Treatment Analysis

Total Treatment Volume Required

Total Site Hard Standing Area: 14,710 m^2

Treatment Volume Required (5mm over treated area):	**74**	**m^3**

Treatment Measures and Volumes Provided

Permeable Pavement: Treatment Volume = Permeable Pavement Area x 200mm Depth x 40% Void Space

Permeable Pavement Area:	288	m^2
Treatment Volume:	**23**	**m^3**

Tree Pits: Treatment Volume = Tree Pit Volume (1.5m x 1.5m x 0.2m) x 40% Void Space

Treatment Volume Per Tree Pit:	0.2	m^3
Total Number of Tree Pits:	1	ea
Treatment Volume:	**0.2**	**m^3**

Infiltration Trench/Swales: Treatment Volume = Infiltration Trench Volume x 40% Void Space

Infiltration Trench A (1m x 1.25m x 1.5m)

Treatment Volume Per Meter:	0.75	m^3/m
Total Length:	125	m
Treatment Volume:	94	m^3

Infiltration Trench B, C (1m x 1m x 1.5m)

Treatment Volume Per Meter:	0.6	m^3/m
Total Length:	141	m
Treatment Volume:	85	m^3

Infiltration Trench D (1m x 1.5m x 1.5m)

Treatment Volume Per Meter:	0.9	m^3/m
Total Length:	55	m
Treatment Volume:	50	m^3
Total Infiltration Trench Treatment Volume:	**228**	**m^3**

Green Roof/Blue Roof: Treatment Volume = Green Roof/Blue Roof Area x 5mm Depth

Green Roof Area	2,022	m^2
Blue Roof Area	4,244	m^2
Treatment Volume:	**31**	**m^3**

Filter Drain/Retention Pond: Treatment Volume = Trench Volume x 40% Void Space

Trench Area:	280	m^2
Trench Depth	0.5	m
Treatment Volume:	**56**	**m^3**

Attenuation System: Treatment Volume = Tank Area x 150mm Depth x 40% Void Space

Tank Area:	194	m^2
Treatment Volume:	**12**	**m^3**

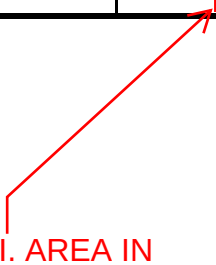
Total Treatment Volume Provided

	Volume	
Permeable Pavement	23	m^3
Tree Pits	0.2	m^3
Infiltration Trench/Swales	228	m^3
Green Roof/Blue Roof	31	m^3
Filter Drain/Retention Pond	56	m^3
Attenuation System	12	m^3
	350	m^3

Total Treatment Volume Provided:	**350**	**m^3**

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

Surface Type	Catchment Area (m^2)	Runoff Factor Applied	Equiv. Imp. Area (m^2)
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

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Appendix C

SuDS Treatment Train

Sustainable Urban Drainage System		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	●					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 green 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 SuDS						
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 SuDS						
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		●				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 SuDS						
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 Treatment Systems						
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

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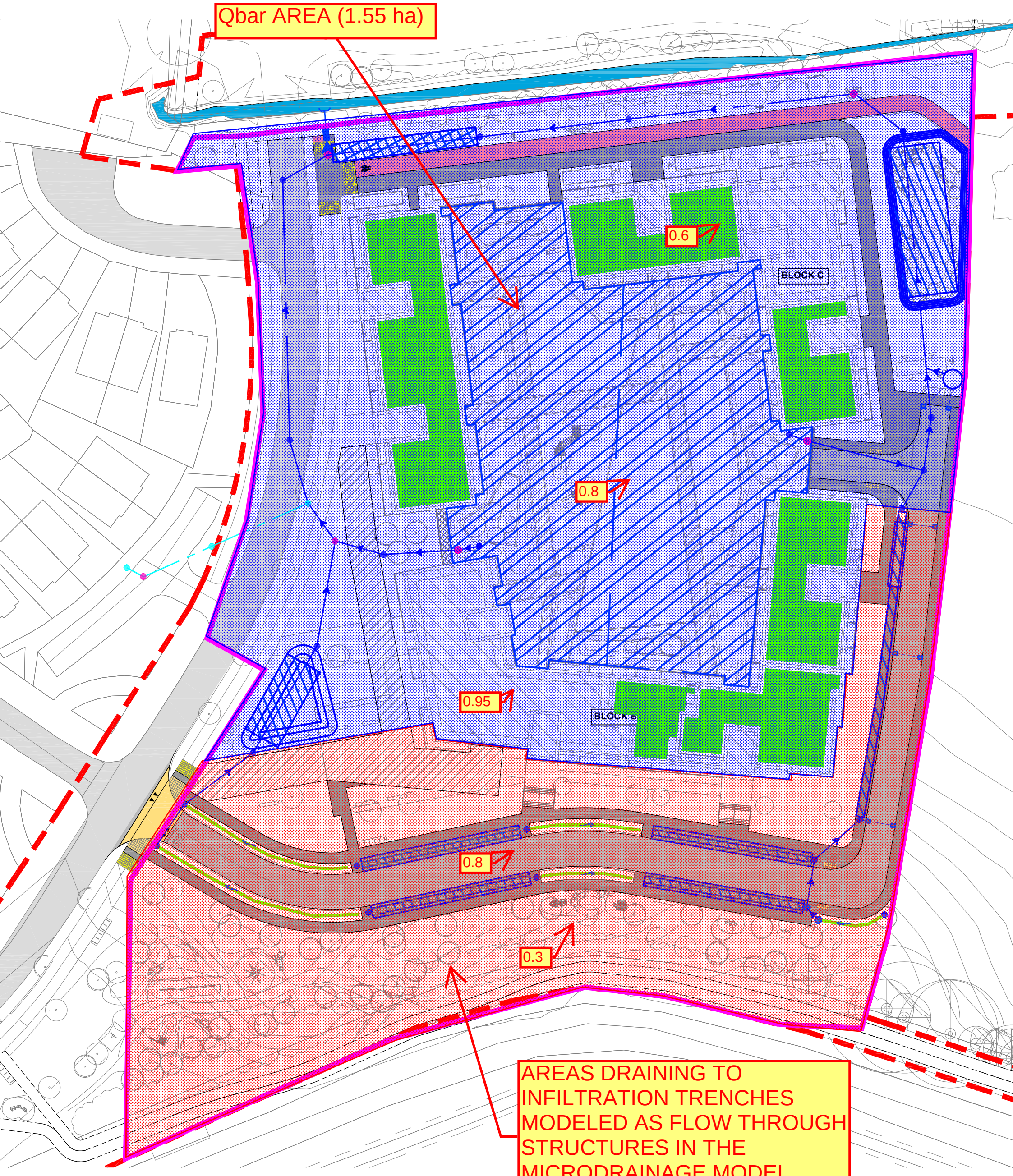
Appendix D

Runoff Factor Sketch



FINLAY PARK SURFACE WATER SKETCH WITH RUNOFF FACTORS

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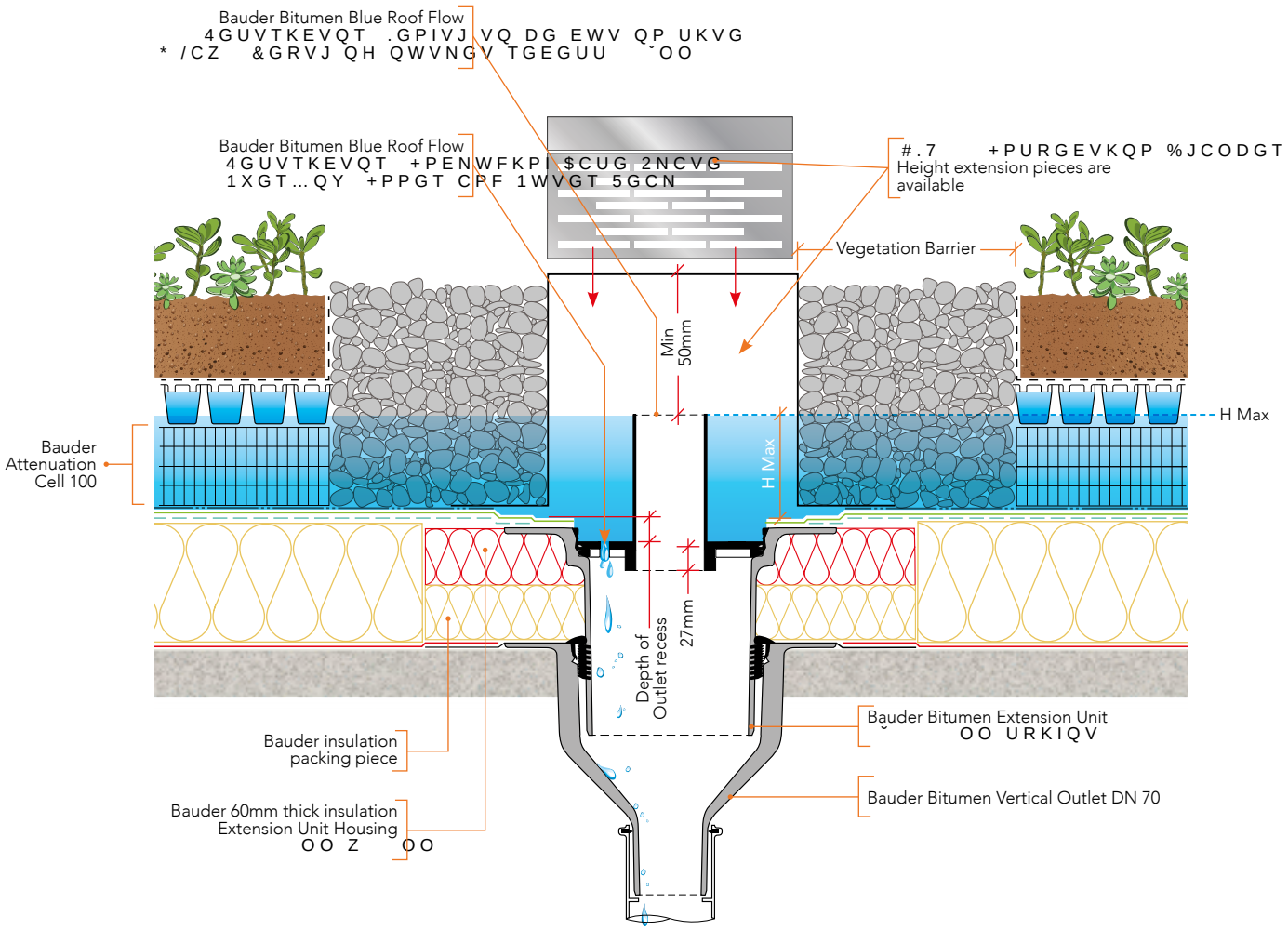
Appendix E

Blue Roof Reference Information

GENERAL DETAILING

Blue roofs for SuDS

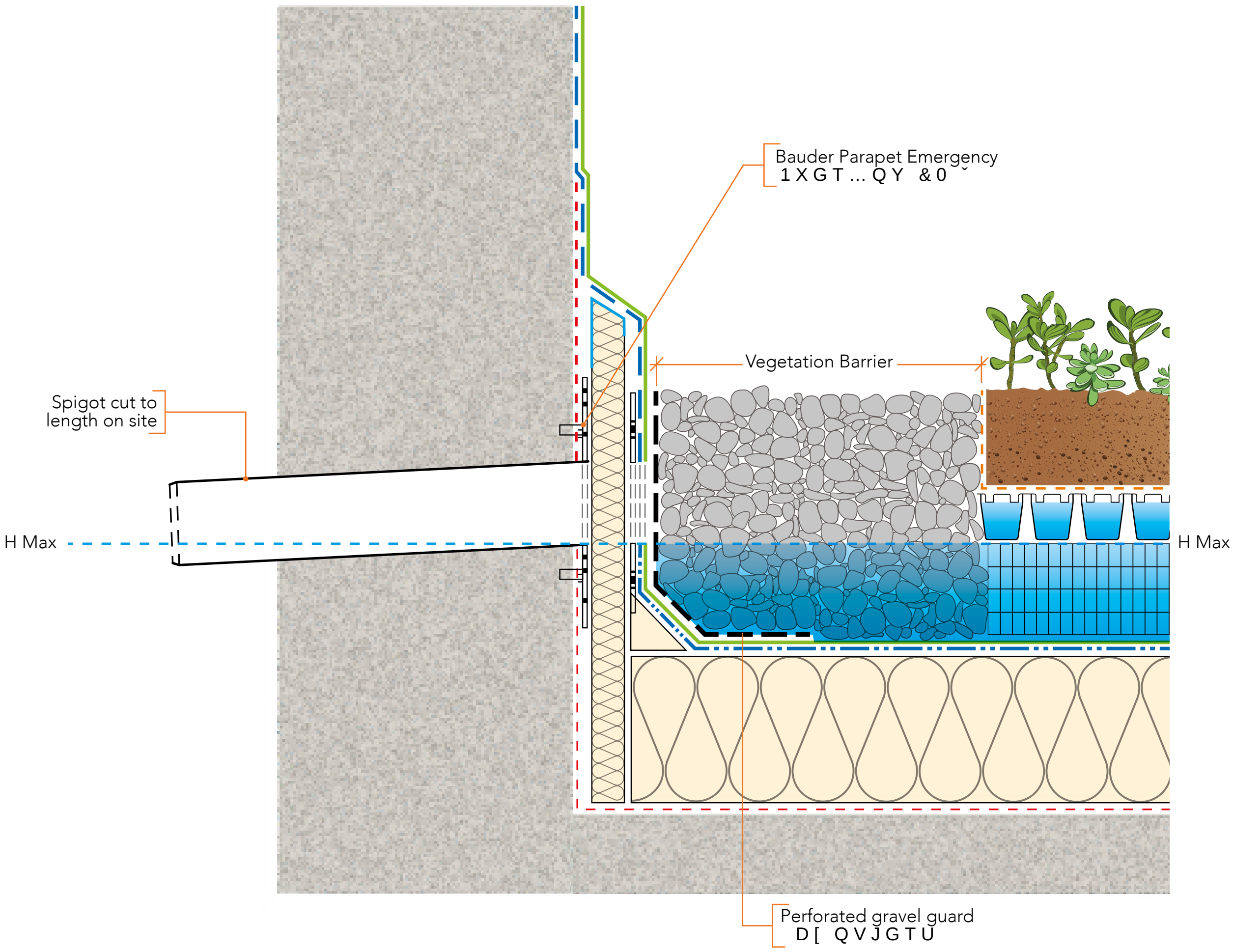


The cross section above shows the BauderBLUE Roof
5 [U V G O G N Q 4 Y G U V T U K E L W G E T W Y T K G V N [K E W V N G V
C P R T G E K E U Q G P V [T Q G L Q T Y C V Q G T C K P Y C H W E G
T Q Q H C E G U V T K D E G V U Q R T Q M G G Q T E S W K T G O G P V U

The Attenuation Cell 100 provides an open void for
J Q N F K P C E T M C K P Y C P V G T J Q V T G T O J K U K Q N R N [
U V C T Q M N E G C K [V Q E Q P F K Y K Q V P U G G U V T K E V G F
... Q K V G Z E G G & W F T K P G C K [V Q T O Y C V G W T K N F U
W P V C O C Z K O W Q T O C G X [˝ ; T U V Q G X G P V
H Q T N Q D Y C N T O K P V J G X G Q W J K U G K P I
exceeded the water is safely discharged through the
Q X G T ... Q Y K P V J G E G P V T G Q H V J G ... Q Y T G U V T K E V Q T

2 T K Q Q P C N K U J K P Q Q H E U K E W F E C T T Q W U
F G V C K N C N E W N V C Q K U Q P C U N K E U P ‡ I W T Q M K Q P
V J G G U V T K E P W Q T G U K T F K X K . F Q Y C N R G N W U G
maximum depth of water allowed to build up on the
T Q Q H * / C Z

6 J G N C [G T D Q X G J G # V G P W % V G K N Q N P & 5 '
F T C K P D Q Q G T F W D U Y C P K V G G V C V K Q P E T 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
RCTCRQZVGT.KQPYK[PUVVNQGFEDGNZGEGUU
YCVGT VQ FTCKP QHH VJG TQQH

6JG$CWFGTTIGP1EKGT..KQYGUKIPQFEVUC
JKIJXKUKVDGNGNQ YCNGXQHNCVGTVJGQ+H
provides a useful indicator should water build up to the
* /CZRQKPVCWFGNTQUGUVTKEVQFEUKVKQPCN
XGTVQEGNT...VQRUGXGPG /CZGXGTGKPI
GZEGGFGF

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
Sent: 12 May 2021 11:43
To: Alan Lambe
Subject: FW: Lands at Finlay Park Naas

Follow Up Flag: Follow up
Flag Status: Flagged

Kindest Regards

Donnachadh O' Brien
Director & Chartered Engineer

Mobile +353 87 2231452

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From: Roisin O'Callaghan <Roisin.OCallaghan@fisheriesireland.ie>
Sent: Tuesday 20 April 2021 08:30
To: Donnachadh O'Brien <donnachadh@dobrien-engineers.ie>
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

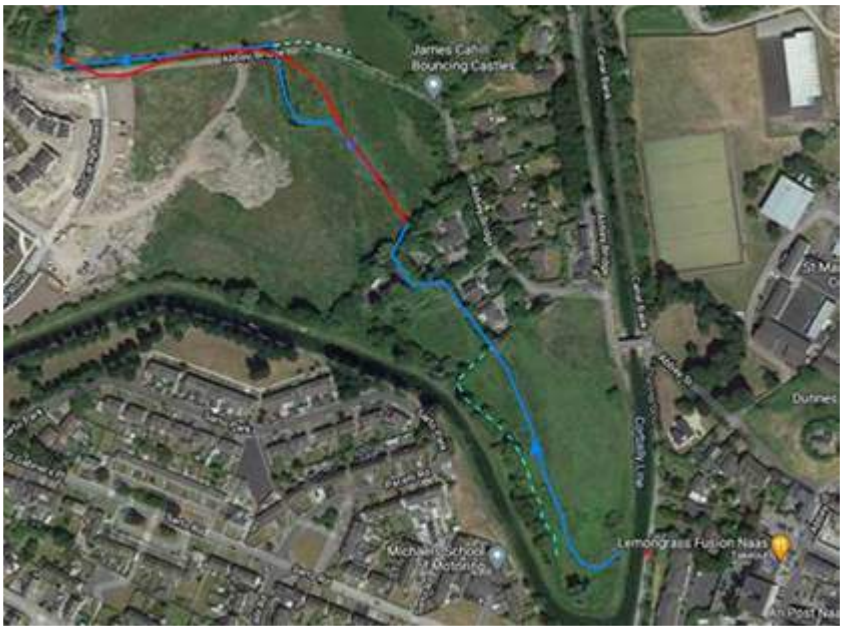
Tel +353 (0)1 8842651
Fax +353 (0)1 8360060
Email roisin.ocallaghan@fisheriesireland.ie
Web www.fisheriesireland.ie

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 re-diverted 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

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From: Roisin O'Callaghan <Roisin.OCallaghan@fisheriesireland.ie>
Sent: Thursday 15 April 2021 11:19
To: Donnachadh O'Brien <donnachadh@dobrien-engineers.ie>
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 www.fisheriesireland.ie :

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

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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".

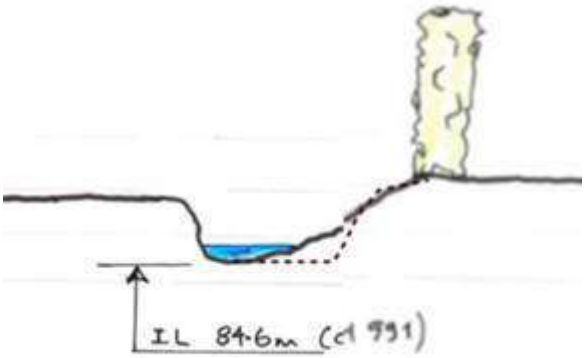
A small watercourse passes through our site and also other lands near the canal harbour, which are also in the same client ownership. So a large extent of the watercourse is located on our clients lands.

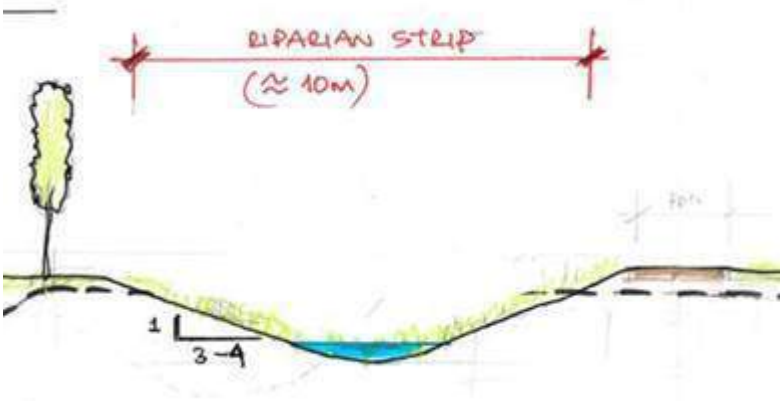
The watercourse is served by a 375mm surface water pipe extending from Naas town centre which is located under the canal. Within the site there is a small ditch at the bottom of the canal tow path which connects internally to the main watercourse. There is one other connection which is a dry ditch at 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

UNIT 5C
ELM HOUSE
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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

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

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 www.water.ie/connections. 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)(https://www.cru.ie/document_group/irish-waters-water-charges-plan-2018/).

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,

Yvonne Harris

Yvonne Harris
Head of Customer Operations

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

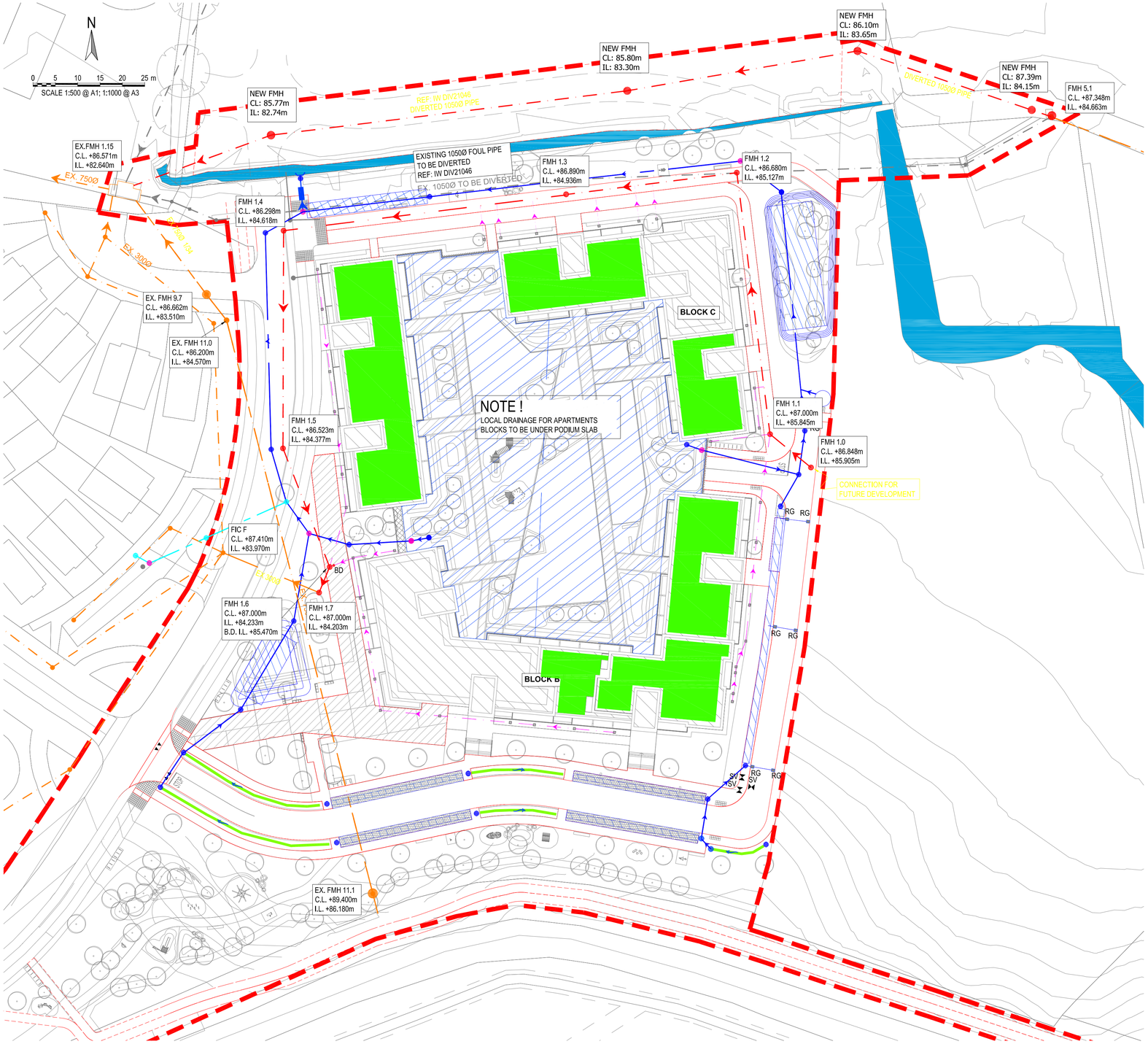
Additional Comments

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***

Notwithstanding any matters listed above, the Customer (including any appointed designers/contractors, etc.) is entirely responsible for the design and construction of the Self-Lay Works. 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.



GENERAL NOTES:

1. FOR STANDARD DOBA NOTES REFER TO DRAWING 2110-S00.1
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEER'S DRAWINGS AND SPECIFICATIONS.
3. USE FIGURED DIMENSIONS ONLY. DO NOT SCALE
4. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND LEVELS WITH ENGINEERING DRAWINGS PRIOR TO START OF CONSTRUCTION. ANY DISCREPANCIES TO BE NOTIFIED TO THE ENGINEER FOR RESOLUTION.
5. CONTRACTOR IS RESPONSIBLE FOR ANY NECESSARY CONDITION SURVEY OF THE WORKS AREA, PUBLIC ROADS AND RETURN TO ORIGINAL CONDITION FOLLOWING WORKS
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

FOUL WATER LEGEND:

- EXISTING FOUL SEWER
- PR. PHASE 1 FOUL DRAINAGE
- EXISTING FOUL DRAINAGE TO BE DIVERTED
- FMH — PROPOSED FOUL WATER MH
- FIC — PROPOSED FOUL WATER INSPECTION CHAMBER
- BD — PROPOSED BACKDROP IN MH
- PROPOSED UNDERSLUNG LOCAL DRAINAGE (TYPICAL)
- PROPOSED LOCAL DRAINAGE (TYPICAL)

SURFACE WATER LEGEND:

- EXISTING SURFACE WATER
- PROPOSED SURFACE WATER DRAINAGE
- PR. INFILTRATION TRENCH
- PR. SWALE
- SMH — PROPOSED SURFACE WATER MH
- TP — PR. TREE PIT
- PR. ATTENUATION TANK
- PR. PERMEABLE PAVING AREAS
- EXISTING WATERCOURSE
- PR. BLUE ROOF
- PR. GREEN ROOF
- PR. GREEN WALL

NOTE 1: MANHOLE COVER LEVELS ARE APPROXIMATE. ACTUAL COVER LEVELS SHOULD MATCH SURROUNDING FINISHED GROUND LEVELS U.N.O.

NOTE 2: PIPES WITH LESS COVER THAN
- 600mm FOR GRASSED AREAS
- 900mm FOR FOOTPATHS
- 1200mm FOR ROADS

TO BE SURROUNDED IN 150mm CONCRETE PROTECTION IN ACCORDANCE WITH IRISH WATER STANDARD DETAIL STD-WW-07

NOTE 3: ALL MANHOLE COVERS LOCATED IN GRASS AREAS TO BE SURROUNDED (Min. 200mm SURROUND) IN 100mm THK C20/25 CONCRETE APRON

NOTE 1: MANHOLE COVER LEVELS ARE APPROXIMATE. ACTUAL COVER LEVELS SHOULD MATCH SURROUNDING FINISHED GROUND LEVELS U.N.O.

NOTE 2: PIPES WITH LESS COVER THAN
- 600mm FOR GRASSED AREAS
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TO BE SURROUNDED IN 150mm CONCRETE PROTECTION IN ACCORDANCE WITH IRISH WATER STANDARD DETAIL STD-WW-07

NOTE 3: ALL MANHOLE COVERS LOCATED IN GRASS AREAS TO BE SURROUNDED (Min. 200mm SURROUND) IN 100mm THK C20/25 CONCRETE APRON

FOUL PIPE MATERIAL TO BE IN ACCORDANCE WITH IW-CDS-5030-03 SECTION 3.13.2

- 3.13.2 THERMOPLASTIC STRUCTURAL WALL PIPES; THERMOPLASTIC STRUCTURED WALL PIPES SHALL COMPLY WITH THE PROVISIONS OF IS EN 13476 (2007/2009), PIPES TO BE OF STIFFNESS CLASS 8kN/m² & TO BE CAPABLE OF DEMONSTRATING A JETTING RESISTANCE OF 2,600 PSI (180 BAR) WITHOUT DAMAGE WHEN TESTED IN ACCORDANCE WITH SECTION 3.3 OF WIS 4-35-01 (2008). (SEWER DIAMETERS 150mm UP TO 450mm, SERVICE CONNECTIONS OF 100mm DIAMETER).

SURFACE WATER MATERIAL TO BE IN ACCORDANCE WITH GREATER DUBLIN REGIONAL CODE OF PRACTICE FOR DRAINAGE WORKS

- UNPLASTICISED P.V.C. PIPES MUST COMPLY WITH THE "PROVISIONAL SPECIFICATION FOR SOIL PIPES, DRAINS, SEWERS & FITTINGS MADE OF UNPLASTICISED P.V.C." ISSUED BY THE DEPARTMENT OF THE ENVIRONMENT.
- B.S. 8005: PART 1 - SEWERAGE OR EQUIVALENT;
- B.S. 8010: PART 2 - PIPELINES ON LAND OR EQUIVALENT: DESIGN, CONSTRUCTION & INSTALLATION;
- B.S. 5955: PART 6 CODE OF PRACTICE FOR THE INSTALLATION OF UNPLASTICISED P.V.C. PIPEWORK FOR GRAVITY DRAINS & SEWERS OR EQUIVALENT
- EN1401 - UNPLASTICISED P.V.C. SEWER PIPE SPECIFICATION
- B.S.4514 - UNPLASTICISED P.V.C. SOIL PIPE SPECIFICATION
- DoEHLG 'SITE DEVELOPMENT WORKS' & SECTION H OF THE BUILDING REGULATIONS

DRAFT ISSUE

Rev.	Note	Date	Drawn	Check
S2.P03	DRAFT ISSUE	18.10.2022	SP	AL
S2.P02	DRAFT ISSUE	07.10.2022	NQ	AL
S2.P01	PRE-PLANNING ISSUE	02/09/2022	BB	AL

DONNACHADH O'BRIEN & ASSOCIATES CONSULTING ENGINEERS
UNIT 5C ELM HOUSE MILLENNIUM PARK NAAS CO. KILDARE
PHONE +353 45 984 042
INFO@DOBRIEN-ENGINEERS.IE
WWW.DOBRIEN-ENGINEERS.IE

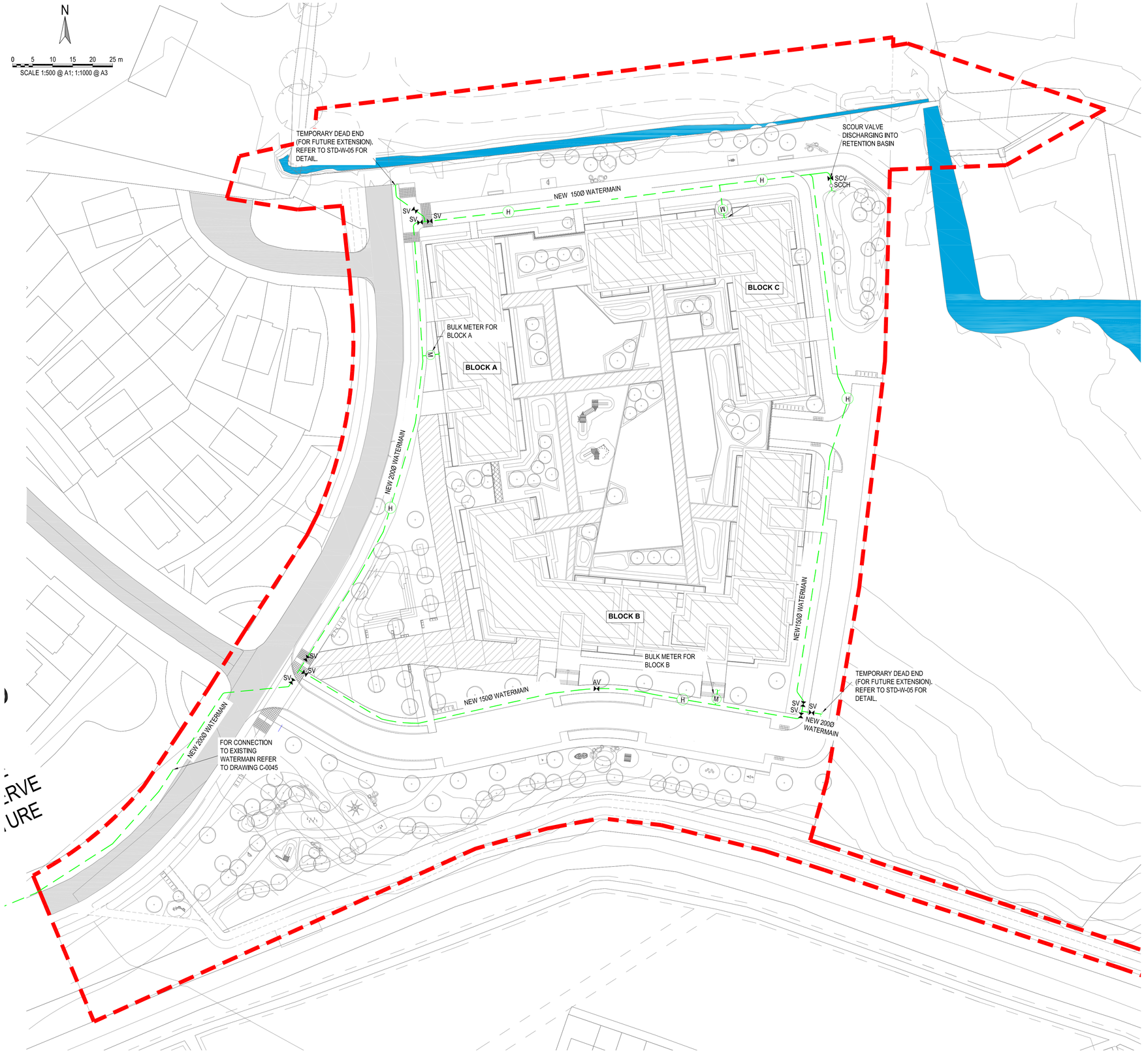
Client: WESTAR HOMES LTD.

Project: FINLAY PARK

Drawing Title: PROPOSED FOUL AND SURFACE WATER LAYOUT

Drawn By:	Checked By:	Approved By:	Date:	Scale:	Sheet Size:
MF	AL	DOB	MAR'2021	1:500	A1

Project Number:	Drawing Number:	Status Code:	Rev Number:
DOBA2110	FINLAY -DOB- XX-SI- DR -C-0031	S2	P03



GENERAL NOTES:

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WATERMAIN LEGEND:

	EXISTING WATERMAIN
	PROPOSED WATERMAIN
H	PROPOSED HYDRANT
M	PROPOSED BOUNDARY BOX
BM	PROPOSED BULK WATER METER
AV	PROPOSED AIR VALVE
SV	PROPOSED SLUICE VALVE
SCV	PROPOSED SCOUR VALVE
SCCH	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

Rev.	Note	Date	Drawn	Check
S2.P05	DRAFT ISSUE	18/10/2022	SP	AL
S2.P04	DRAFT ISSUE	11/10/2022	NQ	AL
S2.P03	DRAFT ISSUE	07/10/2022	NQ	AL
S2.P02	DRAFT ISSUE	06/10/2022	NQ	AL
S2.P01	PRE-PLANNING ISSUE	02/09/2022	BB	AL

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UNIT 5C ELM HOUSE MILLENNIUM PARK NAAS CO. KILDARE
PHONE +353 45 984 042
INFO@DOBRIEN-ENGINEERS.IE
WWW.DOBRIEN-ENGINEERS.IE

Client: WESTAR HOMES LTD.

Project: FINLAY PARK

Drawing Title: PROPOSED WATERMAIN LAYOUT

Drawn By:	Checked By:	Approved By:	Date:	Scale:	Sheet Size:
MF	AL	DOB	MAR'2021	1:500	A1

Project Number:	Drawing Number:	Status Code:	Rev Number:
DOBA2110	FINLAY -DOB- XX-SI- DR -C-0040	S2	P05

DO NOT SCALE: CONTRACTOR TO CHECK ALL DIMENSIONS AND REPORT ANY ERRORS OR OMISSIONS

GENERAL NOTES:

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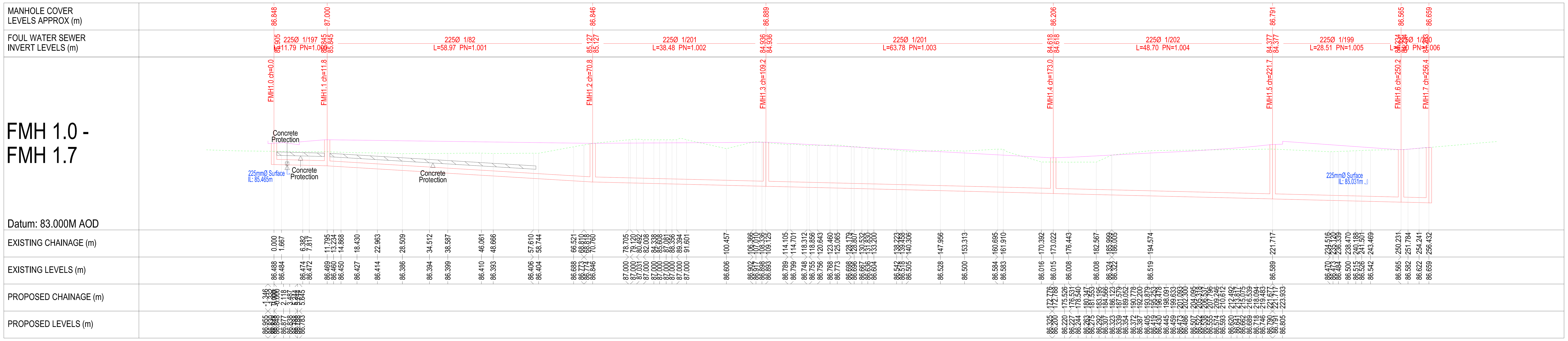


LEGEND:

- PROPOSED SURFACE WATER
- PROPOSED FOUL WATER
- PROPOSED GROUND/ ROAD LEVEL
- EXISTING GROUND PROFILE

DRAFT ISSUE

Rev.	Note	Date	Drawn	Check
S2.P03	DRAFT ISSUE	18.10.2022	SP	AL
S2.P02	DRAFT ISSUE	07.10.2022	NQ	AL
S2.P01	DRAFT ISSUE	02.09.2022	SP	AL

DONNACHADH O'BRIEN & ASSOCIATES CONSULTING ENGINEERS
UNIT 5C ELM HOUSE MILLENNIUM PARK NAAS CO. KILDARE
PHONE +353 45 984 042
INFO@DOBRIEN-ENGINEERS.IE
WWW.DOBRIEN-ENGINEERS.IE

Client: WESTAR HOMES LTD.

Project: FINLAY PARK

Drawing Title: PROPOSED FOUL LONG SECTIONS

Drawn By:	Checked By:	Approved By:	Date:	Scale:	Sheet Size:
SP	AL	DOB	SEP'2022	(H)1:500, (V)1:100	A1

Project Number:	Drawing Number:	Status Code:	Rev Number:
DOBA2110	FINLAY -DOB- XX-SI- DR -C-0141	S2	P03

CONFIRMATION OF FEASIBILITY

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

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 Connection** - 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

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 diversions@water.ie

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 diversions@water.ie 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 and be granted and sign 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 www.water.ie/connections/get-connected/

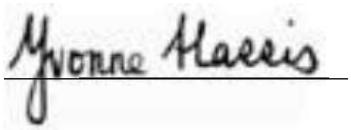
Where can you find more information?

- **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 **www.water.ie/connections, email newconnections@water.ie** or contact 1800 278 278**.**

Yours sincerely,



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). • Before the Development can connect to Irish Water's network(s), you must submit a connection application and be granted and sign a connection agreement with Irish Water.
When should I submit a Connection Application?	• A connection application should only be submitted after planning permission has been granted.
Where can I find information on connection charges?	• Irish Water connection charges can be found at: https://www.water.ie/connections/information/charges/
Who will carry out the connection work?	• All works to Irish Water's network(s), including works in the public space, must be carried out by Irish Water*. *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. • **What to do?** - Contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges.
Where do I find details of Irish Water's network(s)?	• Requests for maps showing Irish Water's network(s) can be submitted to: datarequests@water.ie

What are the design requirements for the connection(s)?	• 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,*** available at www.water.ie/connections
Trade Effluent Licensing	• 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). • More information and an application form for a Trade Effluent License can be found at the following link: https://www.water.ie/business/trade-effluent/about/ **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

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

8 October 2020

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

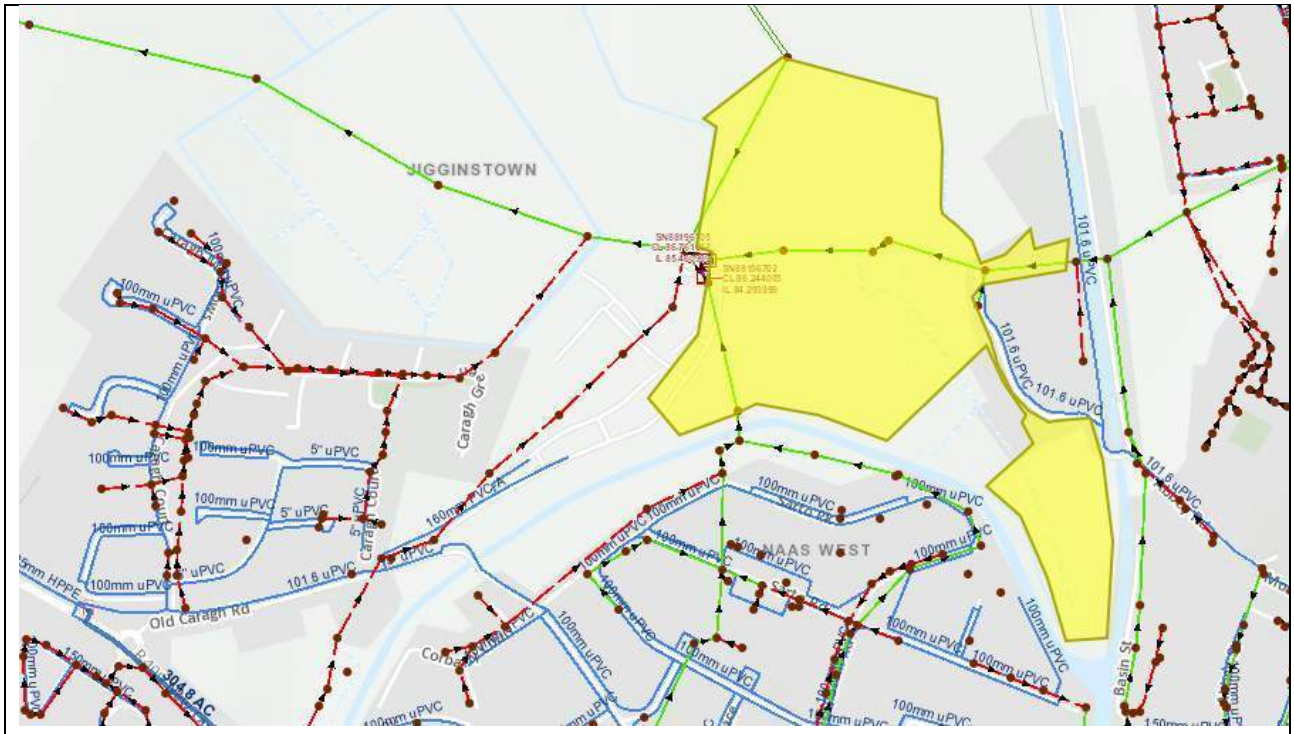
Dear Sir/Madam,

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** **THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.**
Water Connection	Feasible Subject to upgrades
Wastewater Connection	Feasible without infrastructure upgrade by Irish Water
SITE SPECIFIC COMMENTS	
Water Connection	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. 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.

Wastewater Connection	The proposed development indicates that important Irish Water assets are present on the site. The Developer has to demonstrate that proposed structures and works will not inhibit access for maintenance or endanger structural or functional integrity of the infrastructure during and after the works. Diversion of the infrastructure may be required subject to layout proposal of the development and separation distances. For further information related to diversion please visit www.water.ie/connections/developer-services/diversions. Separate storm and foul water connection services should be provided for the Development.
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 https://www.water.ie/connections/get-connected/
5) A Connection Agreement cannot be issued until all statutory approvals are successfully in place.
6) 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 datarequests@water.ie
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,

Maria O'Dwyer

Connections and Developer Services

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

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

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

Yours sincerely,

Yvonne Harris

Yvonne Harris
Head of Customer Operations

DONNACHADH O'BRIEN
& ASSOCIATES CONSULTING ENGINEERS

Appendix E

Foul Calculations

FOUL SEWERAGE DESIGN

Design Criteria for Foul Network 3

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.200
Flow Per Person (l/per/day)	150.00	Maximum Backdrop Height (m)	1.500
Persons per House	3.00	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	0.75
Domestic Peak Flow Factor	6.00	Min 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	Base Flow (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	o	225	Pipe/Conduit	
1.001	58.965	0.718	82.1	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
1.002	38.482	0.191	201.5	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
1.003	63.780	0.318	200.6	0.000	30	0.0	1.500	o	225	Pipe/Conduit	
1.004	48.696	0.241	202.1	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
1.005	28.514	0.143	199.4	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
1.006	6.200	0.031	200.0	0.000	80	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/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 <sdeegan@kildarecoco.ie>
Sent: Thursday 27 October 2022 11:24
To: Donnachadh O'Brien <d.obrien@doba.ie>
Cc: Frank O'Rourke <frankoroufrank@gmail.com>; George Willoughby <gwilloughby@kildarecoco.ie>
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