Clyde Shanks

Chapter 7

Water Environment

7. The Water Environment

Introduction

7.1 This addendum is presented after a review of both the original (March 2014) Environmental Statement (ES) and the ES addendum submissions made in March 2019, August 2019 and September 2023. It is focused on changes made following a consultation response to the Department from NIEA Water Management Unit to the previous FEI submission in September 2023.

7.2 The principal aim of this Chapter is to identify the changes to the local water environment (since the March 2014 ES and subsequent March 2019, August 2019 and September 2023 addenda) which require consideration in relation to the proposed development. This addendum Chapter should be considered along with the original 2014 assessment Chapter and subsequent addendum submissions. Any updated information identified in relation to the local water environment within or near the site are described alongside the potential impacts that may occur during the construction and operational phases .

7.3 The original EIA submission (March 2014) assessed the water environment associated with the site and its wider context. As part of the original assessment, desk and site studies were undertaken. The application site does not contain any watercourses which are designated under the terms of the Drainage (NI) Order 1973.

7.4 The specific change, which this chapter examines, is a proposal to construct a separate foul sewage system including a package treatment plant and separate outfall and headwall structure to accommodate discharge of treated effluent to an unnamed watercourse. That directly responds to the consultation response from WMU and the requests they have made in relation to separating the foul and storm networks. The consultation response was the subject of two separate online Teams meetings with NIEA WMU on 11 June 2024 and 19 June 2024. A further e-mail consultation from NIEA on 15 January 2025 outlined that the department's hierarchy of discharge solutions is as follows:

a) discharging to NI Water's infrastructure, where possible;

b) discharge to sub surface irrigation where possible; and

c) discharge to waterway being the last option (least preferable).

7.5 Due to the lack of NI Water Infrastructure in the vicinity of the site, Arup carried out a desktop site suitability assessment of the potential for treated wastewater to be discharged to ground. This concluded that discharge to ground is not feasible based on the proposed discharge rates for treated effluent and currently available information on groundwater vulnerability and infiltration capability. As a result, it is proposed that the treated effluent emerging from the site will be discharged to a waterway and will meet specified water quality parameters as outlined by NIEA.

7.6 NIEA have carried out preliminary hydrology assessments on the nearby watercourses, outlined in the correspondence dated 15 January 2025. As a result of this the proposed treated foul effluent is to be discharged to the Flush River via a proposed dedicated c.1.1km pumping main and with pollution risk mitigation measures incorporated into the foul sewerage system.

7.7 Boghill Road upgrade works will pass over the Flush River and a tributary of the same watercourse. Flush River flows into Hydepark Dam and eventually enters the designated Ballymartin Water, which is one of the main tributaries of the Six Mile Water. The Six Mile Water flows into Lough Neagh at Antrim. The catchment is primarily rural, with no known significant flooding issues. However, downstream of this point there are some fluvial flood issues associated with the Ballymartin Water (due to extensive urbanisation in this area and the Blackwater Drain catchment).

Drainage Design Philosophy including Pollution Risk Mitigation Measures

7.8 The proposed storm drainage system (preliminary design) for the project, shown in green on Drawing No BCN-ARP-ZZ-XX-DR-CD-0013 P04 included in Appendix D5 to the updated Drainage Assessment Issue 7 attached at Appendix 7.1, is separate from the proposed foul sewerage system and incorporates a storm water collection piped system with intermediate catchpit chambers, including sumps to collect and remove silt. The drainage system will receive flows from building drainage and paved surface areas, including down pipes, gullies, linear drainage channels etc, which will be discharged to a proposed SuDS detention (attenuation) basin (greater than 5,000m3 in size) located in the central area of the site as shown in blue on Appendix D5. This detention basin has been sized to accommodate the 1 in 100-year design storm event + a 20% allowance for climate change (more intense rainfall). Silt within the storm water runoff will be collected in catchpit chambers and SuDS detention basin, and both will need to be maintained as part of the drainage system during the scheme operation phase. The storm water within the detention basin will be discharged through a flow control device i.e. a hydro-brake, that will attenuate flows to greenfield runoff rate (10 l/s/ha). A new outfall drainage pipe will be constructed within the laneway to transfer flows towards the proposed outfall location. This new outfall and headwall structure will form a connection and discharge point to an unnamed watercourse which is located along the northern edge of the site as marked on Drawing No BCN-ARP-ZZ-XX-DR-CD-0013 P04, Appendix D5.

7.9 A pollution control valve i.e. a penstock valve that can be controlled at ground level via a spindle mechanism will be located in a chamber located immediately downstream of the SuDS detention basin. This penstock valve will enable closure of the outfall in the potential event of an accidental spillage of contaminant occurring on the site. This element of the drainage system will form part of the pollution risk mitigation measures to be delivered as part of the project.

7.10 All storm water collected on the site shall be discharged through a new Petrol/Oil interceptor tank which will be located downstream of the SuDS detention basin and upstream of the proposed outfall and headwall structure at the receiving watercourse.

Foul Sewage Treatment and Disposal

7.11 NI Water has confirmed in a pre-development enquiry response in 2010 that there is no foul sewer available to serve this proposed development in the vicinity of the site. Arup have carried out a review of the NI Water record information and established that there is still no public foul sewer in the site vicinity. The design includes provision of a package treatment plant that will meet the water quality requirements of discharge of NIEA and be designed in accordance with best practice and all statutory requirements. The NIEA water quality sampling point will be located immediately downstream of the new package treatment plant. A further pollution risk mitigation measure has been included in the design that includes the provision of monitoring equipment to assess the quality of discharge from the package treatment plant. In the unlikely event of discharge failing to meet the required limits, the flow will be diverted to a separate storage tank which will include four days storage, and will require emptying after it has intercepted any non-compliant treated effluent. This storage tank and system will provide time for maintenance of the package treatment plant to resolve a potential issue causing water quality issues that may not satisfy the specified limits as set by NIEA.

7.12 Treated effluent that meets the required water quality standards will be discharged via a proposed foul pumping main to be located in the access lane and realigned Boghill Road, to be discharged via a new outfall on the Flush River, in order to meet NIEA requirements.

7.13 These drainage design proposals are illustrated on Drawing No. BCN-ARP-ZZ-XX-DR-CD-0013 P04 at Appendix D5

Previous Assessments

7.14 The key findings from the original 2014 assessment are as follows:

- Construction impacts will be controlled via measures and procedures included within the Outline Construction and Environmental Management Plan (OCEMP) which incorporates an Environmental Management Plan (EMP);
- Operational impacts from the proposed development will be controlled by a comprehensive drainage network with associated attenuation ponds/basins (SuDS), which will limit the flows from the site to greenfield run-off rate (as is explained in detail in the proposed mitigation section of this chapter). Therefore, the proposed development work will not increase the flood risk elsewhere due to the surface water management system that will be implemented as part of the proposed development; and
- The operation of the site in terms of water quality and drainage will be governed by Discharge Consents and Pollution Prevention Control (PPC) Licence conditions and will, therefore, be subject to overview by NIEA. An Environmental Management System (EMS) will be implemented for the operation of the entire plant and will cover all operational procedures that may impact on the environment.

7.15 The March 2019 addendum provided updates to the Water Framework Directive (WFD) Classifications and the WFD Assessment. Overall, the predicted impacts of the original 2014 assessment remained valid.

7.16 Following the March 2019 Addendum submission, DfI Rivers responded requesting a Drainage Assessment to be provided in accordance with PPS15. The Drainage Assessment was prepared by Arup and submitted in a further ES addendum made in August 2019 with a subsequent schedule 6 consent renewal received 26 May 2023.

7.17 Following consultation with NIEA to provide separate storm and foul effluent discharge points the August 2019 Drainage Assessment was revised in November 2024 and an updated Schedule 6 approval was received from DfI Rivers on 15 November 2024. Following the further consultation from NIEA via email on 15 January 2025 the Drainage Assessment report has been further updated, and a fresh Schedule 6 Application was submitted to DfI Rivers. This subsequent Schedule 6 Discharge Consent was received on the 20th March 2025, valid until 20th March 2027.

Methodology

7.18 A site visit, carried out on 28 June 2024 and a review of published information have been undertaken to inform this ES addendum. The following databases have been consulted to identify any changes in terms of the baseline information utilised in both the 2014 assessment and the 2019 addendum:

- Geoindex – which contains information on the hydrogeology of the area; and
- Department of Environment Agriculture and Rural Affairs (DAERA) Interactive Water Framework Directive (WFD) Mapping.

7.19 This updated information has been used to inform an updated WFD Assessment which is contained at Appendix 7.2. DAERA guidance on carrying out WFD assessment has not changed since the original assessment in 2014.

7.20 A review has taken place of committed planning permission the (14/03/2023) (Ref LA03/2022/0649/F) at the site for the “Erection of a replacement Coated Roadstone Plant and associated ancillary development to include bitumen storage tanks; aggregate and recycled asphalt pavement storage bays; hoppers; storage silos and conveyors” to determine awareness of the potential future baseline at the site.

7.21 A summary is also provided of the 2019 Drainage Assessment (as revised 2024) and status of the Schedule 6 (Drainage NI Order) consent to discharge storm water from the site.

Baseline

7.22 Information originally obtained from the “Geoindex” databases relating to hydrogeology remains valid. Updated WFD classifications have been obtained for the waterbodies downstream of the application site. WFD classifications are based on a six-year cycle. The current cycle is 2021- 2027.

7.23 If a water body is classified as ‘high’ or ‘good’ status then it has a healthy ecology, which deviates only slightly from natural conditions, is an important natural asset and can support a wide range of matters such as recreation, fishing and drinking supply. If a water body is classified as ‘moderate’, ‘poor’ or ‘bad’ then the ecology is adversely affected and the range of uses that can be supported is reduced.

7.24 Some water bodies have been modified to such an extent that they can no longer be restored to their original condition without compromising their current use. These are known as Heavily Modified Water Bodies (HMWB). There are four classes for the status of HMWB’s as follows:

- Good ecological potential or better (GEP);
- Moderate ecological potential (MEP);
- Poor ecological potential (PEP); and
- Bad ecological potential (BEP).

7.25 Table 3.1 below displays the most recently available (June 2021) WFD classifications for waterbodies downstream of the application site.

Table 3.1 Latest WFD River Basin Management Plan (RBMP) Classifications

Water Body Name	2009	2010	2011	2015	2021
Ballymartin Water (Flush River) (Not Heavily Modified)	Moderate	Moderate	Moderate	Moderate	Moderate
Six Mile Water (Reach between Ballymartin Water and Lough Neagh) (Heavily Modified)	PEP	PEP	MEP	MEP	MEP
Lough Neagh (Not Heavily Modified)	BEP	BEP	BEP	BEP	Bad[1]
Antrim Groundwater (Not Heavily Modified)	Good	Good	Good	Poor	Good

7.26 Utilising the latest WFD information, the WFD Assessment previously undertaken in March 2019 has been updated and forms Appendix 7.2 The majority of the mitigation measures detailed in Schedule B of the WFD Assessment remain the same as the 2014 assessment and the March 2019 addendum, with the "Storm Water and Treated Foul Discharge from Operational Area – Component 1" being the only update:

- **Storm Water and Treated Foul Discharge from Operational Area – Component 1** Foul discharges to be treated in a Package treatment plant before being discharged to an existing watercourse. All storm water discharge to flow through SuDS detention basin. No operational (trade effluent) discharges are to be made from the operational site.

7.27 *Following a Hydrological Assessment carried out by the NIEA, which found that the unnamed watercourse adjacent to the site does not provide significant dilution to receive the treated foul effluent, it is proposed that this flow will be discharged to the Flush River via a dedicated c1.1km pumping main, and to meet all water quality requirements outlined by NIEA.*

- **Boghill Road Drainage – Component 2** Gullies and Petrol interceptor to be installed to minimise siltation and hydrocarbon potential. No road gullies or interceptors with existing situation. Construction mitigation procedures in operation.

[1] No longer classified as heavily modified (was prior to 2021).

- **Boghill Road Drainage – Component 3** Gullies and Petrol interceptor to be installed to minimise siltation and hydrocarbon potential. No road gullies or interceptors with existing situation. Construction mitigation procedures in operation.

- **Boghill Road Drainage – Component 4** Gullies and Petrol interceptor to be installed to minimise siltation and hydrocarbon potential. No road gullies or interceptors with existing situation. Construction mitigation procedures in operation.

- **Boghill Road New Bridge Structure – Component 5** Watercourse realignment with flexi-arch bridge to replace existing bridge. The capacity of the new channel will be no less than the existing situation. Flexi arch clearance greater than existing situation. Construction mitigation procedures in operation including specific measures for Works In or Adjacent to Watercourses.

- **Boghill Road New Bridge (Blacks Bridge) – Component 6** Flexi arch bridge to replace existing bridge. Flexi arch clearance greater than existing situation. Construction mitigation procedures in operation including specific measures for Works In or Adjacent to Watercourses.

Drainage Assessment and Schedule 6 Consent

7.28 A Drainage Assessment was prepared and submitted as part of the August 2019 ES addendum in response to a request from DfI Rivers. This has been reviewed and revised to update the timeliness and robustness of the ES baseline evidence as of January 2025. The drainage assessment now reflects the requests from NIEA WMU to provide separate storm and foul effluent discharge points, with treated foul effluent proposed to be discharged to Flush River via a dedicated pumping main outfall pipeline. The revised drainage design proposals can be summarised as follows:

- The run-off from the application site will be limited to the equivalent greenfield run off rate (10 l/s per hectare);

- The proposed discharge rate from the main site will be restricted to 201 litres per second during the 1 in 100 year design event plus an additional flow of 20% for climate change through the provision of a proposed attenuation basin (as agreed with DfI Rivers) with an adequate storage volume of approximately 5,582m3. A hydro-brake flow control device will be placed in a chamber which is located immediately downstream of the basin;

- The proposed attenuation basin outlet pipe will convey flows from the proposed attenuation basin and discharge directly to an unnamed watercourse via a dedicated outfall at the same location as the existing site storm outfall

- A Schedule 6 consent to discharge storm water from the application site has been granted by DfI Rivers (DfI Rivers Reference: IN1-19-9442) with DfI letters issued 22/08/2019 and renewed 18/08/2020 and 26/05/2023 which do not expire until 26/05/2025. However, following a planning response from NIEA (dated 19/04/2024), the proposed site drainage

system was further reviewed and updated to provide a separate outfall for the treated foul final effluent. An updated Schedule 6 application has been made to reflect this updated status, with DfI letter issued 15/11/2024 which will not expire until 15/11/2026. Following the further consultation from NIEA via email on 15 January 2025, a revised Schedule 6 application was submitted to DfI Rivers 10/02/2025, with the proposed treated foul final effluent now to be discharged from the single package treatment plant to Flush River via a dedicated c1.1km pumping main. The peak discharge rate for treated foul effluent to the Flush River is proposed to be 5 l/s. This subsequent Schedule 6 Discharge Consent was received on the 20th March 2025, valid until 20th March 2027. This is provided at Appendix 7.3.

- As a result of the proposed Boghill Road realignment, the construction of a new road drainage system will be required which includes new road drainage outfall and headwall structures to the Flush River and a tributary of the Flush River. The discharge rates for new outfalls to be provided will be restricted to the existing brownfield runoff rate. This will be achieved through provision of attenuation storage within the new drainage system i.e. enlarged pipes and chambers and through the use of a hydro-brake flow control device to be located upstream of the outfall points to the receiving watercourses.

7.29 The proposed Boghill Road improvements will include the replacement of both existing Flush and Blacks Bridges. A preliminary hydraulic assessment undertaken as part of the Drainage Assessment demonstrates that the extent of fluvial flooding/flow is considered to be limited and contained within the existing watercourse channel.

7.30 Notwithstanding this, the applicant will be required to obtain Schedule 6 consent for the required works relating to the bridge replacements. A detailed river model of both watercourses will be provided as part of future Schedule 6 applications to demonstrate that the abutments or culvert walls will be positioned outside of any Q100 floodplain.

7.31 The proposed development complies with Policy FLD1 and FLD3 of Planning Policy Statement 15 'Planning and Flood Risk' insofar as the proposed development is located outside of the floodplain and adequate measures will be in place to mitigate flood risk to the proposed development and from the development elsewhere. These measures include SuDS Design proposals to limit the storm discharge rates to no greater than the existing peak flows.

Conclusion

7.32 Informed by the review provided in this Chapter, the WFD classifications have been updated in relation to waterbodies downstream from the application site. The WFD Assessment has been updated with this information and forms Appendix 7.2

7.33 The revised Drainage Assessment has also been reviewed and summarised. A renewed Schedule 6 Consent to Discharge Application (from the application site) is located in Appendix 7.3.

7.34 The committed development on the application site (T/2014/0114/F) does not impact the findings of these assessments.

7.35 The findings and conclusions of the original 2014 WFD assessment and previous March 2019, August 2019 and September 2023 ES addendums remain valid and reflect changes in development plans. The overall predicted impacts and suggested mitigation from the original 2014 ES remain valid. A summary of drainage design, including mitigation measures, is as follows:

Storm Drainage System Design

7.36 For the main site the permitted discharge for the main site will be restricted to 201 l/s (i.e. green field run-off based on a catchment area of 20.1 hectares) through the provision of a SuDS Detention Basin and Hydro-brake flow control device. Upstream drainage network to include catchpit chambers to collect/remove silt. Petrol/Oil interceptor tank to be provided between SuDS detention basin outlet and discharge point to receiving unnamed watercourse.

7.37 A penstock valve will be located in the SuDS detention basin outlet chamber which will enable closure of the outfall in the event of an accidental spillage of contaminant occurring within the site area.

7.38 The discharge rates for new outfalls to be provided for the realigned Boghill Road will be restricted to the existing brownfield runoff rate. This will be achieved through provision of online attenuation storage within the new drainage system i.e. enlarged pipes and chambers, and through the use of hydro-brake flow control devices to be located upstream of the outfall points to the receiving watercourses.

Foul Sewerage System Design

7.39 Foul sewage flows shall be treated by a single package treatment plant and the final effluent discharged to the Flush River via a dedicated c1.1km pumping main and reinforced concrete outfall headwall structure. This will be discharged at a peak flow rate of 5 l/s via the proposed pumping station arrangements.

7.40 To ensure that the required final effluent quality compliance is maintained, an automated effluent quality testing system, linked to an actuated penstock will be provided that will divert flows into an emergency storage tank in the event of a quality failure. This non-compliant effluent will then be tankered off site for treatment.

Clyde Shanks

Appendix 7.1

Drainage Assessment

arc21/Becon consortium

arc21 Residual Waste Treatment Project

Drainage Assessment

Issue 8 | 24 March 2025

Job number 264848-00

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Document Verification

ARUP

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Document title		Drainage Assessment			**File reference** 4-50 / Drainage
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Revision	**Date**	**Filename**	Becon Drainage Assessment		
Draft 1	2nd July 2019	**Description**	First draft		
			Prepared by	Checked by	Approved by
		Name	Eoghan Kilroy	Stephen Flynn	Pete Gray
		Signature			
Issue 2	11th July 2019	**Filename**	264848-00 Becon Drainage Assessment		
		Description	Issue for Planning Approval draft		
			Prepared by	Checked by	Approved by
		Name	Eoghan Kilroy	Stephen Flynn	Pete Gray
		Signature			
Issue 3	29th July 2019	**Filename**	264848-00 arc21 Residual Waste Treatment Project		
		Description	Issue for Planning Approval		
			Prepared by	Checked by	Approved by
		Name	Eoghan Kilroy	Stephen Flynn	Pete Gray
		Signature			
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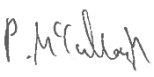
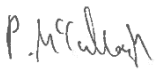
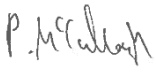
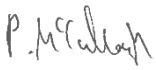
		Description	Issue for Planning Approval (updated after receipt of Schedule 6 approval).		
			Prepared by	Checked by	Approved by
		Name	Phil McCullough	Stephen Flynn	Pete Gray
		Signature			

Issue 5	23rd September 2024	**Filename**	264848-00 arc21 Residual Waste Treatment Project		
		Description	Issue for Planning Approval (updated after receipt of NIEA response).		
			Prepared by	Checked by	Approved by
		Name	Phil McCullough	Pete Gray	Pete Gray
		Signature			
Issue 6	25th November 2024	**Filename**	264848-00 arc21 Residual Waste Treatment Project		
		Description	Issue for Planning Approval (updated after receipt of NIEA response and Schedule 6 approval received 15th November 2024).		
			Prepared by	Checked by	Approved by
		Name	Phil McCullough	Pete Gray	Pete Gray
		Signature			
Issue 7	14th February 2025	**Filename**	264848-00 arc21 Residual Waste Treatment Project		
		Description	Issue for Planning Approval (updated after receipt of NIEA hydrological assessment results received 15th January 2025).		
			Prepared by	Checked by	Approved by
		Name	Phil McCullough	Pete Gray	Pete Gray
		Signature			
Issue 8	24th March 2025	**Filename**	264848-00 arc21 Residual Waste Treatment Project		
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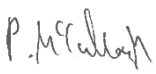
			Prepared by	Checked by	Approved by
		Name	Phil McCullough	Pete Gray	Pete Gray
		Signature			
			Issue Document Verification with Document		✓

Contents

1 Introduction

1.1 Terms of Reference

This Drainage Assessment report has been commissioned to support a planning application (ref: T/2014/0114/F) for the proposed development of;

- A Residual Waste Treatment Facility incorporating a Mechanical and Biological Treatment (MBT) facility.
- An Energy from Waste (EfW) Thermal Treatment facility.
- An Incinerator Bottom Ash (IBA) Treatment facility.
- A Refuse Derived Fuel (RDF) Bale Storage building.
- An Administration / Visitor Centre.

It reviews and updates an earlier drainage assessment prepared as part of the ES addendum submitted to the Department in August 2019.

The development includes related infrastructure along with the widening of the Boghill Road from its junction with Hydepark Road to the existing access road into Hightown Quarry site and other ancillary works. Supporting documentation references, which forms parts of this assessment, includes:

- Planning Application Documentation to include Environmental Statement, Addendums I-II and accompanying planning application drawings as outlined below:

  1. Original ES – March 2014
  2. Appeal – August 2016
  3. March 2019
  4. August 2019
  5. October 2020
  6. December 2020
  7. May 2021
  8. September 2023

1.2 Approach to the Assessment

DfI Rivers was consulted by DfI Strategic Planning Division following the submission of an ES Addendum for the proposed development on 19th March 2019. DfI Rivers raised a number of queries regarding this scheme in their response dated 11th June 2019 (DfI Rivers Ref: IN1-19-5942 included in Appendix C). Subsequently, the applicant consulted with DfI Rivers and the outworking's of this is the following Drainage Assessment which meets the requirements set out in PPS15 and which addresses the requirements outlined by DfI Rivers on the 11th June 2019.

Arups Drainage Assessment, which formed part of the ES Addendum issued to DfI in August 2019 (Appendix 2.1), was reviewed by DfI Rivers who confirmed no objection on 24th September 2019.

This update to the Drainage Assessment follows a planning response from the NIEA (dated 19/04/2024), and subsequent receipt of the results of a hydrological assessment carried out and issued by NIEA in December 2024. The drainage design has been updated to provide a separate foul system, with flows in the revised design to be treated by one larger package treatment plant and the final effluent discharged to the Flush River via a dedicated c1.1km pumping main to be constructed to the proposed outfall location as shown on Drawings BCN-ARP-ZZ-00-DR-CH-0101 - BCN-ARP-ZZ-00-DR-CH-0105 and BCN-ARP-ZZ-00-DR-CH-0013 included in Appendix D1.

To ensure that the required final effluent quality compliance is maintained, an automated effluent quality testing system, linked to an actuated penstock will be provided. This pollution risk mitigation system will operate to divert flows into an emergency storage tank in the event of a quality failure. This non-compliant effluent will then be tankered off site for disposal at a treatment facility.

A Drainage Assessment is required for the proposed development to identify the extent of flooding which may occur from a variety of sources. Additionally, it will demonstrate that overland flows and surface runoff will be considered within the design.

The requirements for Drainage Assessments are generally as set out in Planning Policies Statement 15 (PPS15). For the purposes of this study, the following has been considered;

- Available information on historical flooding in the area.
- Site level information.
- Allowances for increased flows resulting from the effects of climate change.
- Assessment of the existing runoff characteristics at the site and the potential impact that the proposed development will have on surface water runoff.

1.3 Glossary of Terms

CIRIA	Construction Industry Research and Information Association
DfI	Department for Infrastructure
DMRB	Design Manual for Roads and Bridges
EfW	Energy from Waste
GIS	Geographic Information Systems
GSNI	Geological Survey Northern Ireland
IBA	Incinerator Bottom Ash
MBT	Mechanical and Biological Treatment

NI	Northern Ireland
NI Water	Northern Ireland Water
NIEA	Northern Ireland Environmental Agency
OSNI	Ordnance Survey of Northern Ireland
PDE	Pre-Development Enquiry
PPS15	Planning Policy Statement 15
RDF	Refuse Derived Fuel
SR	Service Reservoir
SuDS	Sustainable Drainage Systems
WPS	Water Pumping Station

1.4 Existing Site Description

The application site is located within the Hightown Quarry in the townland of Ballyutoag, which is accessed from the Boghill Road. Refer to Figure 1.1 for the extent of the site boundary including the widening of the Boghill Road from its junction with Hydepark Road, and Appendix A for the site location plan.

Figure 1.1: Proposed Site Boundary including Boghill Road

The site retains an extant planning consent for the extraction and production of basalt aggregate, asphalt concrete, block production and an inert recycling facility.

The southern, eastern and western boundaries comprise of vertical quarry rock faces, while the northern boundary comprises of security fencing. The site is approximately 20.1 hectares. Access to the lands is provided off the Boghill Road which includes existing storm water drainage channels / ditches and reedbed ponds.

Existing storm water runoff from the 'operational area' drains via a network of small ditches and streams to the Flush River which flows to Hydepark Dam before entering the Ballymartin Water. The Ballymartin Water is one of the main tributaries of the Six Mile Water which enters and flow into Lough Neagh adjacent to Lough Shore Park in Antrim. The proposed Boghill Road upgrade works will pass over the Flush River and a tributary of the same watercourse via provision of two new structures.

DfI Rivers has confirmed that there are areas of historical flooding downstream of the site.

1.5 Proposals for the Site

The proposed development of the site is for a Residual Waste Treatment Facility incorporating a MBT facility, an EfW Thermal Treatment facility, an IBA Treatment facility, a RDF Bale Storage building and an Administration/Visitor Centre. The proposal also includes related site infrastructure along with the widening of the Boghill Road from its junction with Hydepark Road to the existing access road into Hightown Quarry site.

2 Background Information Review

As part of the Drainage Assessment, a number of available sources of information were investigated in order to build an understanding of the potential risk of flooding to the site. An overview of these sources is provided in Table 2.0. This was undertaken as a means of indicating whether the proposals would contribute to any flooding issues.

Table 2.0: Sources of Information for Flood Risk Assessment

Data	Comments
Geographic Information Systems (GIS) Data	Ordnance Survey of Northern Ireland (OSNI) data was supplied by client. The NI Water GIS data has been reviewed by Arup.
Site Walkover	Arup carried out site walkovers (drainage) on the 7/12/2018, 10/12/2018, 24/06/2019 and again on 28/06/2024.
Customer Interviews	No formal interviews have been undertaken by Arup.
Topographical survey	A topographical survey has been supplied by the client.
Historic Mapping & ground conditions	Arup carried out a desktop review of all available historic records for the site. Due to the presence of rock it is assumed infiltration to the ground/subgrade will not be possible.
Service Requests	No infrastructure requests have been submitted.
Internet / Media	A brief media search found no evidence of flooding occurring at or in the immediate vicinity of the site.
DfI Rivers	A Schedule 6 application has been submitted to DfI Rivers on the 18th July 2019 in relation to storm water discharge design proposals from the site area. Schedule 6 approval was received from DFI Rivers on the 22nd August 2019, and renewed on the 18th August 2020, 26th May 2023, 15th November 2024 and 20th March 2025 for consent to discharge storm water. Refer to Appendix C1 for scanned copies of approval letters from DFI Rivers.

2.1 GIS Data

OSNI data vector mapping was supplied by the client and a review of the NI Water GIS data has been carried out by Arup. An image which shows the NI Water GIS data for the area is provided in Figure 2.1. As can be seen in Figure 2.1 there are watermains (shown in blue lines) in the vicinity of the site. However, there is no foul sewer within 20m of site. Additional details relating the NI Water Infrastructure are provided in Section 2.8.

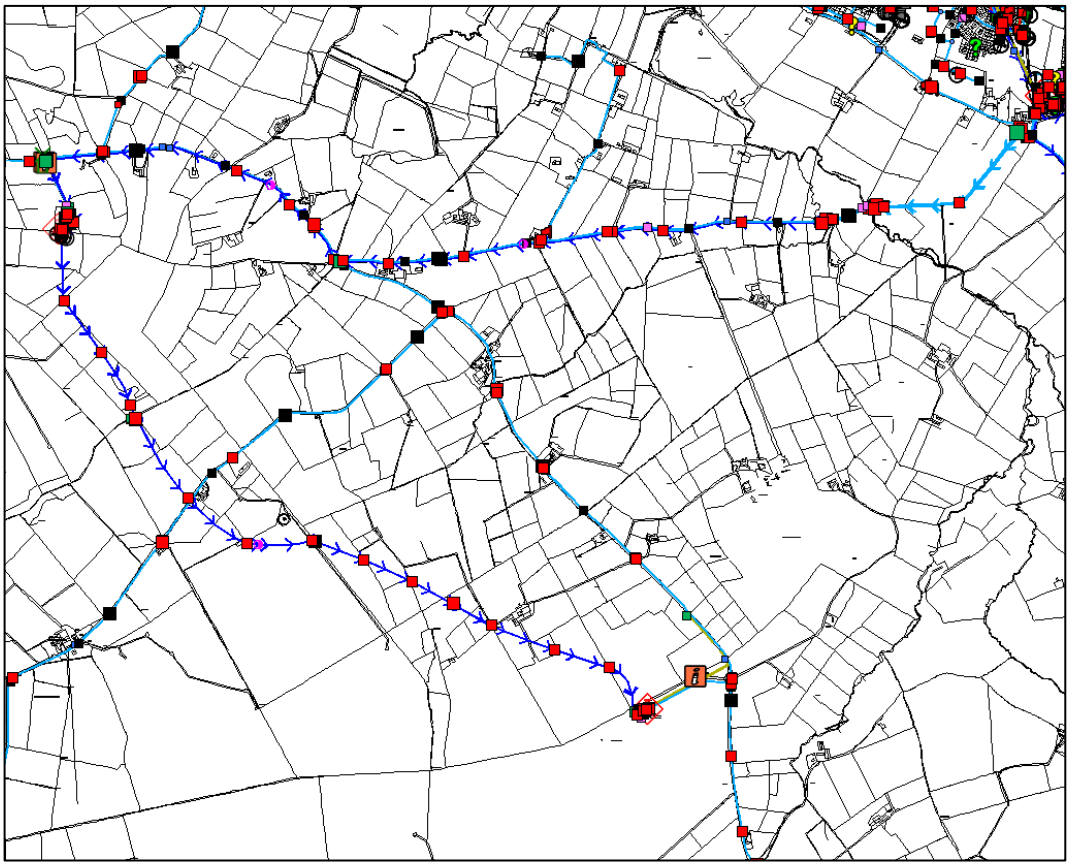


Figure 2.1.: NI Water GIS Data screenshot image

2.2 Site Walkover

Arup carried out site walkovers to examine the current drainage regime on 7/12/2018, 10/12/2018, 24/06/2019 and 28/06/2024 to assess site constraints, existing storm water drainage arrangements and consideration of the potential methods and measures for proposed storm water management. The site walkover findings were cross-referenced with the topographical survey and with the DfI River's flood maps.

The site contains an existing network of surface channels that utilises the topography of the site to direct flow to surface water drains. An example of the existing surface water channels on site is provided in Figure 2.2. These surface water channels discharge to six treatment lagoons. An example of these treatment lagoons is provided in Figure 2.3. At present only surface water runoff is managed and disposed of for the development as no water is used in the current site processes. A plan sketch of the site detailing the location of the existing settlement ponds and lagoons is provided in Figure 2.4.

Figure 2.2: Example of Existing Surface Channels

Figure 2.3: Settling Treatment Lagoons 1. Refer to Figure 2.4.

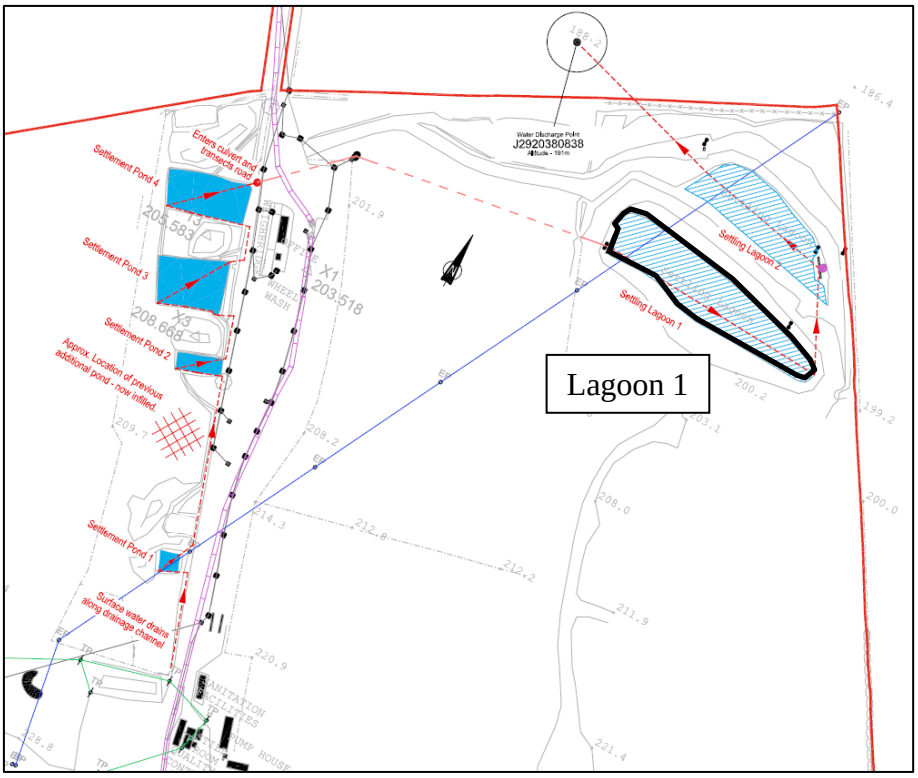


Figure 2.4: Existing Settlement Ponds and Lagoons layout sketch

2.3 Customer Interviews

No formal interviews have been undertaken by Arup.

2.4 Topographical survey

A topographical survey of the site has been supplied by the client. The survey was used to gain an appreciation of the topography and surface gradients within the site and to confirm existing site levels. This data was also used to determine the channel levels of the watercourses which are located in the vicinity of the two proposed watercourse bridges to be constructed on the realigned section of the Boghill Road.

2.5 Historic Mapping Review

Arup carried out a desktop review of all available historic records for the site. This review included maps from OSNI and data from Geological Survey Northern Ireland (GSNI). An image of the historical OSNI map for the site is provided in Figure 2.5.

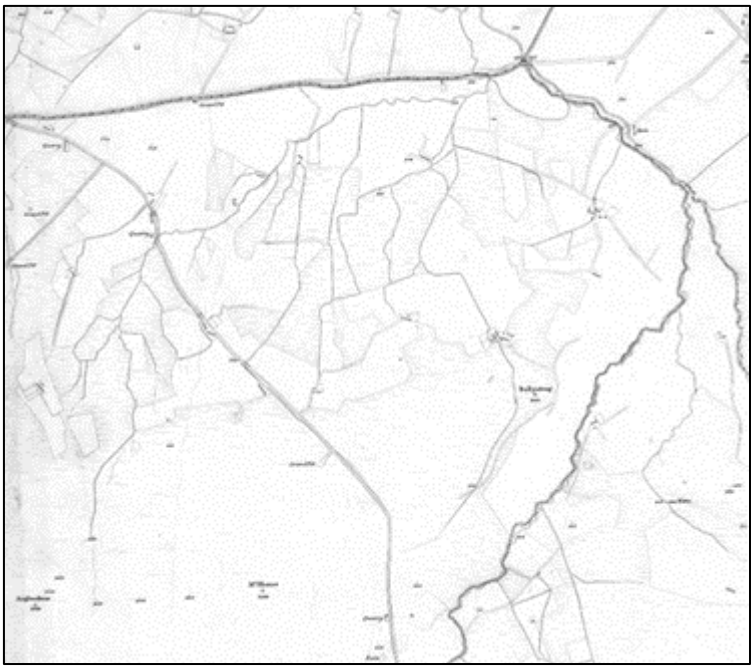


Figure 2.5: OSNI Historical First Edition (1832-1846) Map

2.6 Service Requests

No infrastructure enquiries to the utility providers have been requested as part of this assessment.

2.7 Internet / Media

A brief media search found no evidence of flooding occurring at or in the immediate vicinity of the site.

2.8 Northern Ireland Water

Based on a review of NI Water record information it was established that a public foul sewer is not present in the vicinity of the site and a water supply main is located within the Boghill Road.

There are no proposals to discharge foul or storm water which is generated from the site area to NI Water sewerage infrastructure.

2.8.1 Storm Drainage

It is proposed that all surface water runoff will be collected and conveyed by a dedicated storm drainage system and suitable storm water outfalls will be provided which meet the requirements of DfI Rivers.

2.9 DfI Rivers - Flood Maps (NI)

The proposed development is not located within the Northern Ireland Flood Risk Assessment (NIFRA) 2018 area. Figure 2.6 indicates the areas that are at risk of flooding from fluvial and pluvial sources which could adversely impact on people and property in the local area.

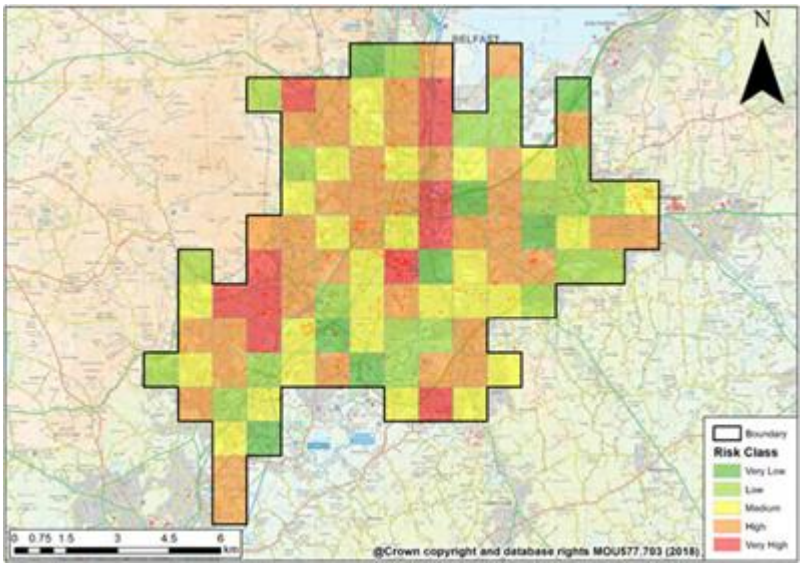


Figure 2.6: Northern Ireland Flood Risk Assessment (NIFRA) 2018

As shown in Figure 2.7 the DfI Rivers Historical Flooding Record indicates that there is no record of flooding in or within the vicinity of the site. Therefore, the risk of fluvial flooding within the site is considered to be low.

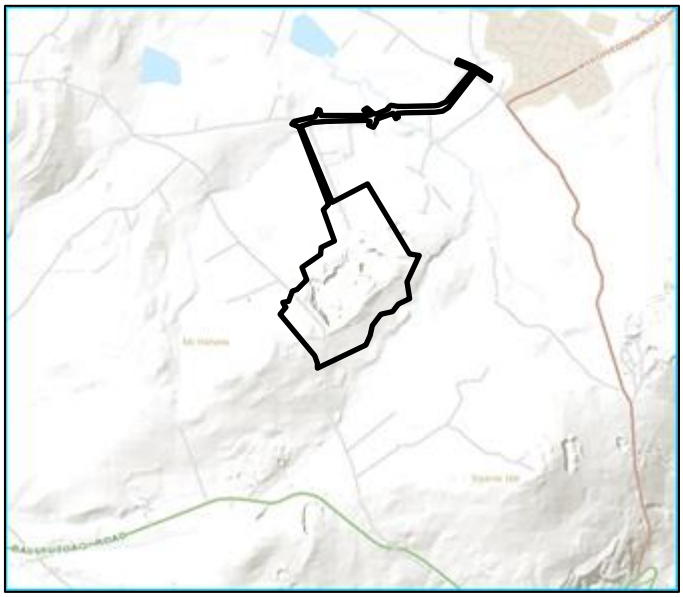


Figure 2.7: DfI Rivers Historical Flooding Record

2.10 Planning

Details of the existing planning application for the site and statutory responses have been used to inform the Drainage Assessment.

3 Flood Risk Assessment

3.1 Requirements under PPS15

In accordance with the DfI Rivers correspondence, dated 11th June 2019 (ref: IN1-19-5942), an overview of the requirements in compliance with PPS15 is provided in Table 3.0.

Table 3.0: Overview of information Requirement within Planning Policies Statement 15

Planning Policy	Assessment required?	Comment
FLD1 – Development in Fluvial (River) and Coastal Flood Plains	Yes	The application site does not contain any watercourses which are designated under the terms of the Drainage (NI) Order 1973. Details of flood plain within the vicinity of the Boghill Road upgrade is discussed in Section 4. Replacement of both the existing Flush and Blacks bridges will require Schedule 6 Consent under the Drainage (NI) Order 1973. As part of the required consent for the works from DfI Rivers Local Area Office related to the bridge replacements, the applicant shall conduct a detail river model of both watercourses so as to provide DfI Rivers with assurance/evidence that the abutments are to be positioned outside of the Q100 floodplain to be completed at detailed design stage as agreed with DfI Rivers post their consultation response.
FLD2 – Protection of Flood Defence and Drainage Infrastructure	No	There are no DfI Rivers flood defences located in the immediate vicinity of the site.
FLD3 - Development and Surface Water (Pluvial) Flood Risk Outside Flood Plains	Yes	A Drainage Assessment is required because: • It is a development in excess of 1 hectare. • It is a change of use involving new buildings and hard standing exceeding 1000 square metres. • The surface water run-off may adversely affect other development downstream. Schedule 6 consent for the proposed discharge to the watercourses has been sought via submission made on the 18th July 2019 to DfI Rivers , and renewed on the 18th August 2020, 1st December 2022, 25th October 2024 and the 3rd March 2025,. The design information and assessment included within the Schedule 6 application document aligns with the principals set out in this drainage assessment. Schedule 6 approval was received from DFI Rivers on the 22nd August 2019 and renewed on the 18th August 2020, 26th May 2023, 15th November 2024 and the 20th March 2025, valid until 20th March 2027, for consent to discharge

		storm water. Refer to Appendix C1 for scanned copy of approval letter from DfI Rivers.
FLD4 - Artificial Modification of Watercourses	Yes	It is proposed to modify the Blacks Bridge and Flush Bridge as part of the Boghill Road upgrade. Refer to comment related to FLD1 above.
FLD5 - Development in Proximity to Reservoirs	No	The site is not located within the potential flood inundation area of any known reservoirs. Therefore, this Sub-Policy is not applicable for the proposals submitted.

A Drainage Assessment is required because:

- It is a development in excess of 1 hectare.
- It is a change of use involving new buildings and hard standing exceeding 1000 square metres.
- The surface water run-off may adversely affect other development downstream

An assessment of the possible flood mechanisms affecting the application site is provided in Table 3.1.

Table 3.1: Assessment of Possible Flooding Mechanisms

Source	Significant	Comment
Coastal	No	The site is not affected by coastal flooding.
Fluvial	No	The flood hazard and flood risk maps for Northern Ireland indicate a limited fluvial flooding area to the north-east part of the development. Risk of fluvial flooding within the site is considered low.
Pluvial	No	Flood Maps (NI) indicates that part of the site lies within pluvial floodplains. This should be collected and resolved by the proposed site drainage.
Urban	No	There is no NI Water sewerage infrastructure in the vicinity of the site and a water supply main is located along the Boghill Road. There appears to be no existing road drainage infrastructure on Boghill Road within the site area. It is unlikely that out of sewer flooding would affect the proposed development.
Reservoir Inundation	No	The site is not affected by any reservoir flow paths.

3.2 Tidal Flooding

The site is not affected by coastal flooding or coastal erosion.

3.3 Fluvial Flooding

The flood hazard and flood risk maps for Northern Ireland indicate limited fluvial flooding adjacent to the local watercourses. Therefore, risk of fluvial flooding

within the site is considered low. The Fluvial map for the area surrounding the site is provided in Figure 3.1.

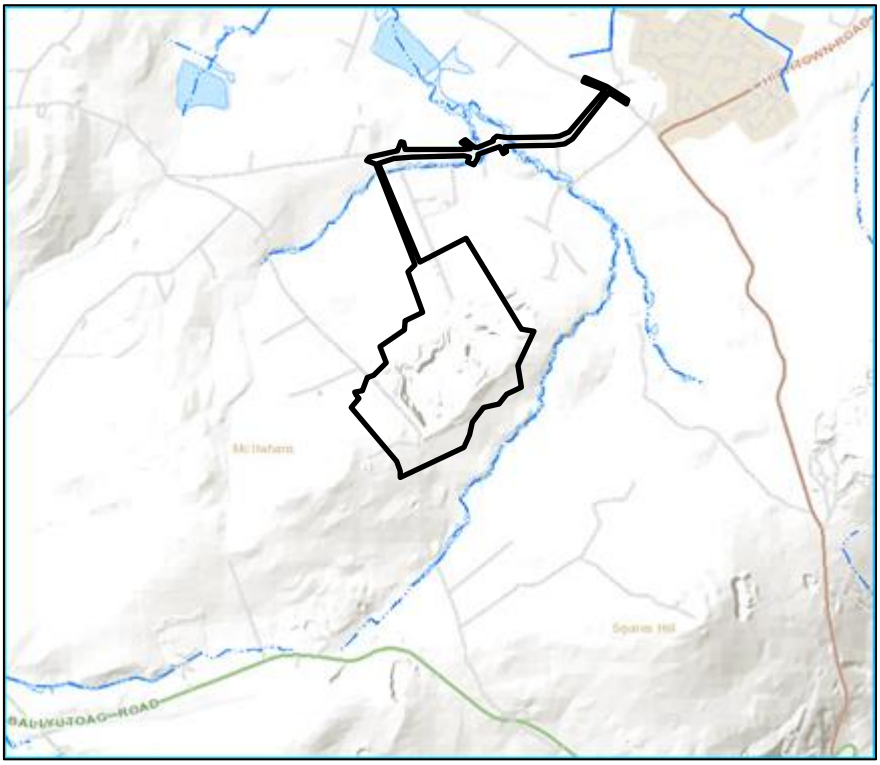


Figure 3.1: Fluvial Present Day Fluvial Floodplain including Climate Change

Refer to Table 3.1; comment for FLD1 regarding river modelling requirements. A review of the proposed replacement of the Flush and Blacks has been carried out. The flow estimations for the watercourse catchment included in Appendix D was completed using Poots Cochrane and IH124 methods.

The Poots Cochrane method in both cases produced a more conservative (higher) flow estimate. Hydraulic calculations included in Appendix D were prepared to assess whether the Q100 and Q100 + 20% CC flows would produce water levels that exceed top of watercourse bank level. In both cases the Flush River and Blacks Bridge watercourses, at the locations immediately upstream of the bridges, based on the preliminary assessment it was concluded that the Q100 + 20% CC flows would be contained within the existing channels with water levels below the top of the lowest bank.

3.4 Pluvial Flooding

Flood Maps (NI) indicate that there is a limited volume and extent of pluvial flooding across the site. The extent of this flooding appears to be limited to specific low point areas within the existing quarry. It is proposed that the combination of the new site levels and the proposed surface water drainage network will alleviate these issues. For reference the predicted Pluvial flood map for the area surrounding the site is provided in Figure 3.2.

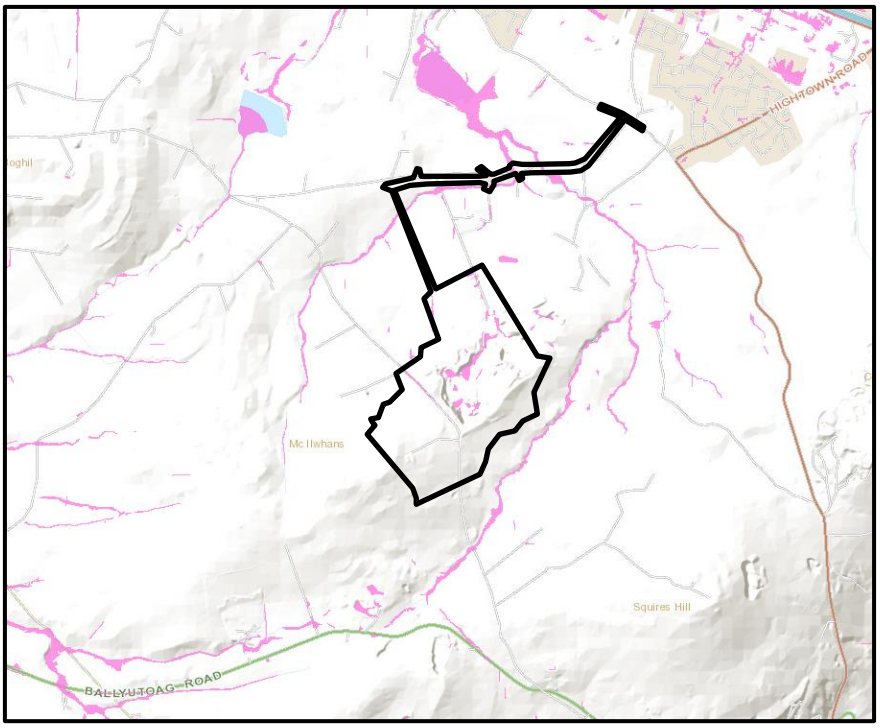


Figure 3.2: Pluvial Present Day Pluvial Floodplain including Climate Change

3.5 Urban Flooding

Refer to Table 3.1 for relevant information on urban flooding.

3.6 Reservoir Flooding

DfI Rivers Reservoir Flood Mapping for Emergency Planning indicates that the site is not within, or on the outskirts of a flood inundation zone from a Waterworks Reservoir. The reservoir flood map for area surrounding the site is provided in Figure 3.3.

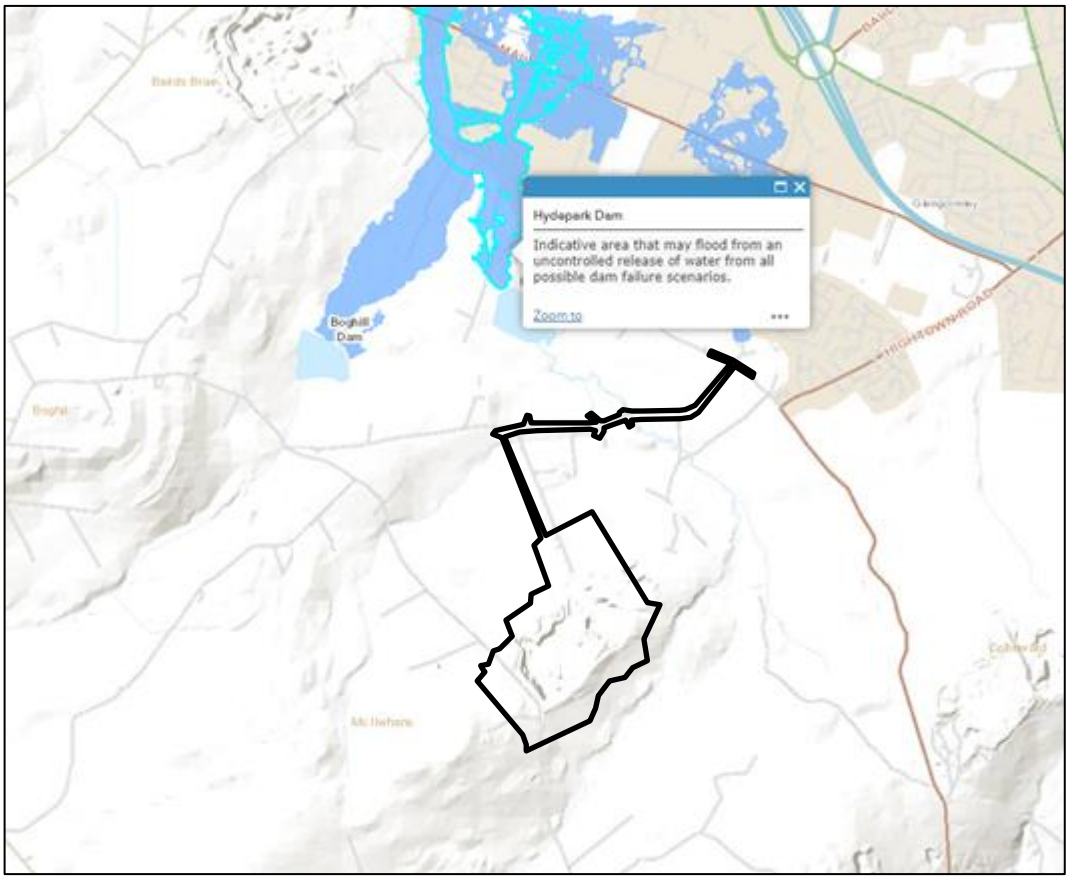


Figure 3.3: Present Day Reservoir Inundation Extents including Climate Change

Any upstream surface water runoff that is generated from the development or associated works will either preserve the natural surface water flows or will be hydraulically controlled. The proposed attenuation basin for the development has a storage volume during the design event of approximately 5,582 m^3.

The possible impact of inundation of the proposed attenuation basin has been considered as part of the design. The Reservoirs Act (Northern Ireland) 2015 defines in part a *"Structure or area which is to be treated as a controlled reservoir" "…above the natural level of any part of the surrounding land"*. The proposed attenuation basin is not elevated above the natural level and therefore it would not fall under the Reservoirs Act (Northern Ireland) 2015. In addition the proposed storm water attenuation basin has a storage volume which is less than 10,000 m^3.

In accordance with CIRIA guidance the proposed basin will be provided with an emergency overflow facility with due consideration for design exceedance.

4 Drainage Design Philosophy

All sewers within the site will be designed in accordance with NI Waters Sewers for Adoption (NI) Edition 1 and sustainable drainage systems will be designed in accordance best practice guidance from Construction Industry Research and Information Association (CIRIA), including:

- CIRIA C521 (2000) Sustainable Urban Drainage Systems; Design Manual for Scotland and Northern Ireland.
- CIRIA C697 (2007) The SuDS Manual.
- CIRIA C609 (2004) Sustainable drainage systems, hydraulic, structural and water quality advice.
- CIRIA C698 (2007) Site Handbook for the construction of SuDS.
- CIRIA C753 (2015) The SuDS Manual.

Previous discussions with DfI Rivers required that; all the surface water discharging from the site shall be limited to the ‘green field run-off’, at a rate of 10 litres per second per hectare. The design basis is that DfI Rivers will permit a discharge rate of 201 l/s (i.e. green field run-off based on a catchment area of 20.1 hectares), including the following assumptions:

- 20% allowance for climate change (10% was requested by DfI Rivers).
- 1:4 internal slopes to the proposed attenuation basin.
- The proposed drainage allows for future expansion plans for the development. Therefore, urban expansion is considered at 0%. Allowance for additional expansion could be compensated for by using 10% climate change allowance.
- All drainage systems have been designed for critical design storm storage volumes.
- The system has been designed not to flood the site during a 1 in 30-year return period rainfall event 30-minute duration, including 300mm freeboard depth.
- Checks have been carried out to ensure that an adequate level of protection against flooding will be provided for all duration, 1 in 100-year return period rainfall events.
- Design for exceedance, for extreme events; during the 1 in 100-year design event finished site levels will be designed to ensure that water is channelled and directed away from buildings towards the proposed attenuation basin or adjacent land drainage systems with safety in mind. The design drainage model would contain all flows below finished ground level during a Q100 plus 20% Climate Change event. Refer to Appendix D for relevant software output results.

4.1 Surface Water Runoff Calculations

At present surface water runoff from the application site is drained via a network of small ditches and streams to the Flush River which flows and discharges to Hydepark Dam before entering the Ballymartin Water / River. The works proposed will not alter the extent of the catchment areas to the receiving watercourse(s).

Site surface water collection (within the main site area) will be directed towards road drainage gullies which will be designed in accordance with the Design Manual for Roads and Bridges (DMRB). The gully spacing calculations assumed grating type R, subject to review during detailed design preparation.

Any works that will alter a tributary drainage catchment area will be restricted to its original greenfield runoff rate. The greenfield runoff rate is used for assessing the requirements for limiting discharge flow rates and establishing the quantity of attenuation storage for the main site.

For the realigned Boghill Road, drainage discharge rates will be limited to the existing brownfield runoff rate.

4.2 Catchments

A breakdown of the extent and location of all surface water catchments across the site is provided in Figure 4.1. The catchments in Figure 4.1 are displayed as follows:

- All contributing runoff areas in the ‘operational area’ is considered 100% impermeable and will be attenuated (see Figure 4.1 – Grey);
- All greenfield runoff areas outside the ‘operational area’ is considered 25% impermeable and the design will allow for the additional attenuation (see Figure 4.1 – Green);
- Hightown quarry access lane in the ‘operational area’ is considered 100% impermeable and will be attenuated (see Figure 4.1 – Cyan);
- All hardstanding runoff along the Hightown quarry access lane outside the ‘operational area’ is considered as 100% brownfield runoff and will not be attenuated (see Figure 4.1 – orange);
- Existing Boghill Road and proposed carriageway widening including earthworks areas (see Section 4.5 and Figure 4.1 – Magenta); Due to the additional hardstanding areas associated with the Boghill Road upgrade, storage for flow attenuation will need to be provided within the proposed drainage systems. The proposed discharge rates at new road drainage outfalls will be limited to no greater than the existing brownfield runoff rate using Hydro-Brake or orifice plate flow control devices and online attenuation storage.
- Lands outside the ‘operational area’ drainage flow paths and discharges will be maintained. Stormwater runoff from these lands will not be attenuated or subject to change as a result of the scheme (see Figure 4.1 – Blue and Red);

- The possible construction compound area will be subject to temporary consents which will form part of the design and final Construction Management Plan. Details to be submitted during the construction phase (see Figure 4.1 – Red);

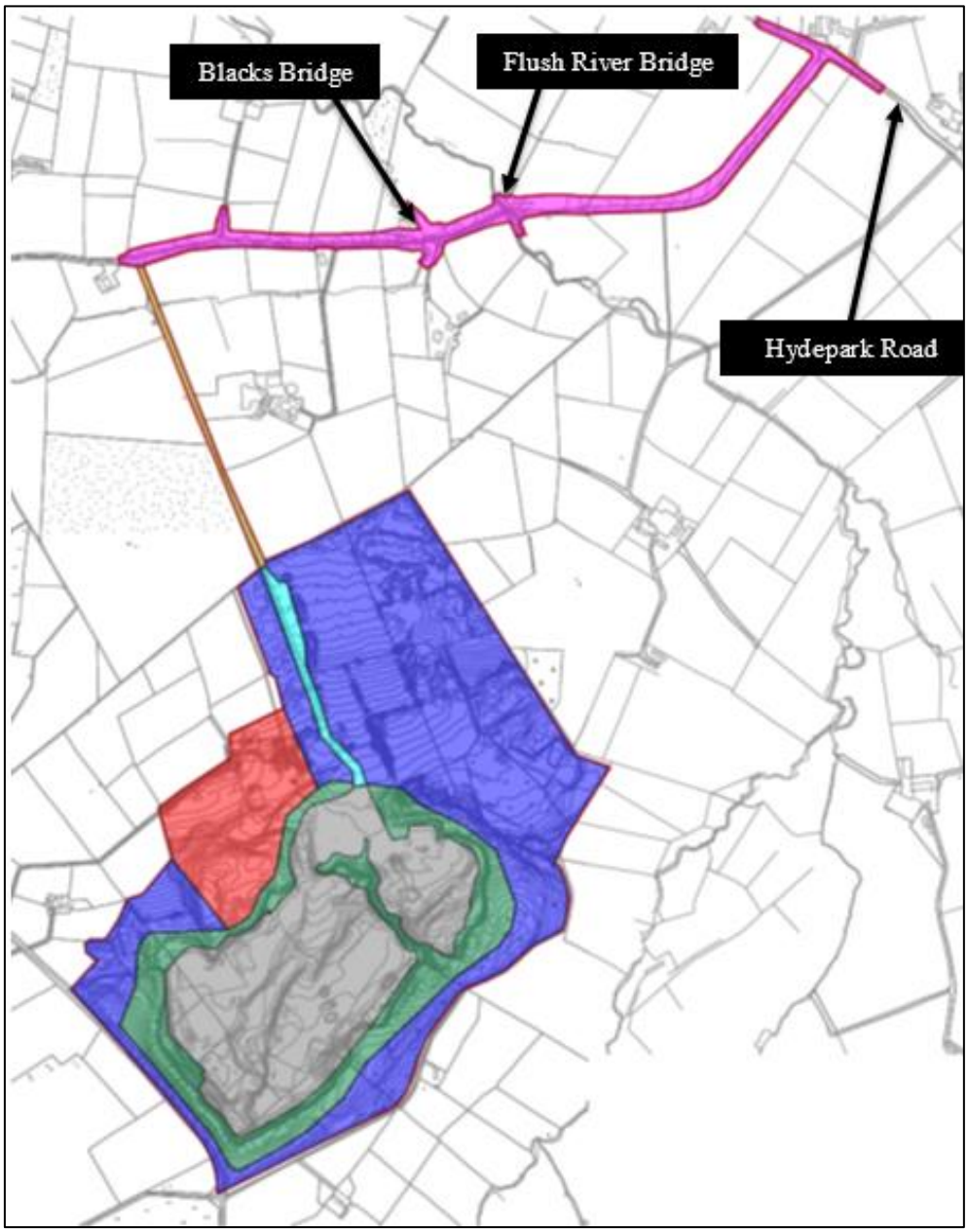


Figure 4.1: Proposed Catchment Areas

Table 4.0 summarises the extent of each catchment and the receiving watercourse.

Table 4.0: Proposed watercourse Catchment Areas

Watercourse	Catchment	Proposed Catchment Area (ha)
Flush River	Operational Area	13.16
Flush River	Landscape	6.9
Flush River	Hightown quarry access lane inside the operational area	0.7
Flush / Black River	Hightown quarry access lane inside the operational area	0.41
Flush / Black River	Boghill Road upgrade	See Section 4.5
Flush / Black River	Land outside operational area’	23.5

4.3 Operational Lands

Site surface water runoff collection from operational lands will be channelled via road gullies and rain water pipes to a surface water drainage network, which will convey flows to a proposed attenuation basin, including:

- A flow control device (located at the attenuation basin outlet) to limit discharges to the receiving watercourse to the greenfield runoff rate.
- Headwalls.
- Anti-erosion provisions.
- A high-level overflow.
- 300mm freeboard during the Q100 plus Climate Change (CC) design event.

The proposed attenuation basin for the development has a storage volume of approximately 5,582m^3. Refer to Appendix D for the preliminary attenuation basin details which were input to MicroDrainage design software.

The attenuation basin outlet pipe will convey flows from the proposed attenuation basin and discharge directly to an unnamed watercourse via a dedicated outfall at the same location as the existing site storm outfall as shown on Drawing BCN-ARP-ZZ-00-DR-CH-0104 in Appendix D1.

For very extreme events which are greater than the Q100 plus 20% CC event, it is proposed to provide an emergency overflow facility at the SuDS pond via a pipeline that would discharge water safely away from buildings and the main site to the unnamed watercourse.

4.4 Hightown Quarry Access Road

The drainage catchment area for the existing access lane to the main site, which connects the Boghill Road to the site, will be unaltered. Therefore, no additional drainage infrastructure will be required.

4.5 Boghill Road

There are no formal storm water collection system(s) (i.e. gullies) along the existing Boghill Road, within the area located between the junction with Hydepark Road and the existing access road into the Hightown Quarry site. Currently, the storm water runs off the carriageway to an adjacent field ditch which conveys the flows to a nearby watercourse, which provides no formal storm water attenuation. It is therefore considered that the surface runoff coefficient is the same for the existing and proposed carriageway.

Conversely it is proposed that the storm water in the proposed layout (see drawing GE-C-BOG-XX-040) for the Boghill Road will be collected (and attenuated) in a proposed drainage system which includes filter drains. Tables 4.1 and 4.2 below show the attenuation requirements for the existing and proposed pavement layouts respectfully (see Drawing GE-C-BOG-XX-055 Appendix B for extent of proposed/existing catchment areas). For each catchment it is proposed to reduce storm water discharge flows, via a flow control device or devices located within the downstream end of the system, upstream of the discharge point to the receiving watercourse. The discharge rate will be restricted to the existing brownfield runoff rate for the 1 in 100 year return period storm plus10% allowance for CC.

Minimum and maximum attenuation volumes have been calculated using Micro-drainage source control software. Refer to software output information included in Appendix D.

The storm water in the proposed layout will be collected and attenuated in a proposed filter drain with additional online storage to be provided to meet the requirements. To enable an assessment of the attenuation requirements for the areas of carriage way to be widened, Table 4.1 shows the attenuation requirements that would be needed based on the existing road alignment and layout.

Table 4.1: Boghill Road Existing Attenuation

Area	**Length**	**Area**	**Attenuation Required**	
	m	**m^2**	**Min (m^3)**	**Max (m^3)**
Catchment 1	604.17	4129.895	146	232
Catchment 2	651.32	4729.967	168	266
Sum	1255.49	8859.862	314	498

For each catchment it is proposed to reduce storm water discharge flows, via provision of flow control devices, to 10 l/sec/ha for the 100-year return period storm plus 10% CC event. Table 4.2 below includes the attenuation requirements for the proposed layout.

Table 4.2: Boghill Road Proposed Attenuation

Area	Length	Area	Attenuation Required	
	m	m^2	Min (m^3)	Max (m^3)
Catchment 1	594.64	5975.89	211	335
Catchment 2	127.76	1493.112	53	83
Catchment 3	668.45	6731.793	238	378
Sum	1390.85	14200.8	502	796

A proposed attenuation volume of 298m^3 ($796^{\text{max proposed}} - 498^{\text{max existing}}$) is therefore required for the proposed additional pavement area as a result of the carriageway upgrades. Attenuation will be achieved by providing filter drains including pipe and chamber storage on both sides of the carriageway. The filter drains will be compliant with the Design Manual for Roads and Bridges (DMRB) and the Manual of Contract Documents for Highway Works (MCHW).

The proposed and existing catchment areas are provided in drawing GE-C-BOG-XX-040 and drawing GE-C-BOG-XX-055 in Appendix B. Flow control devices will be provided in chambers located upstream of the discharge points to the receiving watercourse.

It is proposed that filter drainage pipes (perforated or half perforated pipes) will be provided with access chambers provided at regular intervals to facilitate rodding access and maintenance of the drainage system.

4.6 Flush River Bridge (Flush bridge)

The proposed watercourse realignment will require an arch bridge to replace the existing bridge. The capacity of the new channel will be no less than the existing situation. The proposed arch bridge clearances will have a span width greater than the existing bridge to avoid encroaching into the watercourse channel. Construction mitigation procedures will be provided including specific measures for works in or adjacent to the watercourse. Refer to Figure 4.2 for the location of the proposed Flush River bridge (Flush bridge).

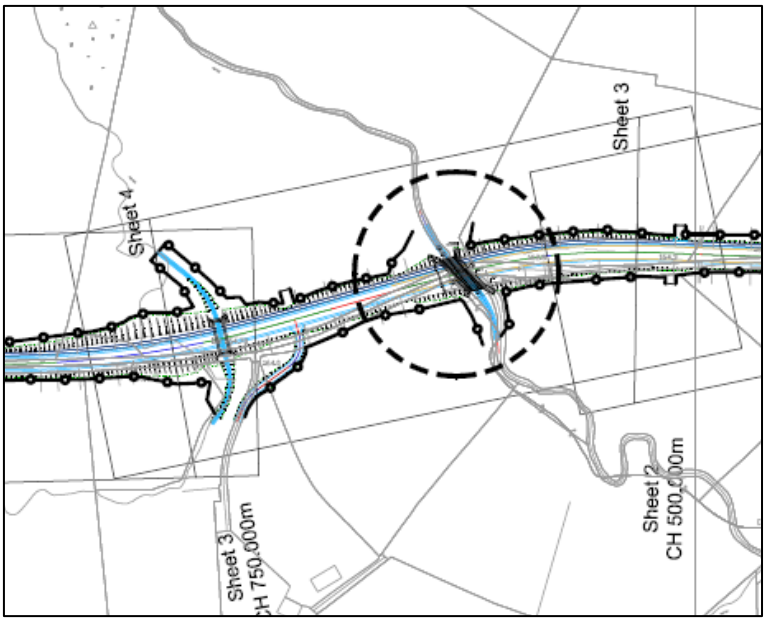


Figure 4.2: Location of the Flush Bridge

Refer to Figure 4.3 for details of proposed Flush bridge.

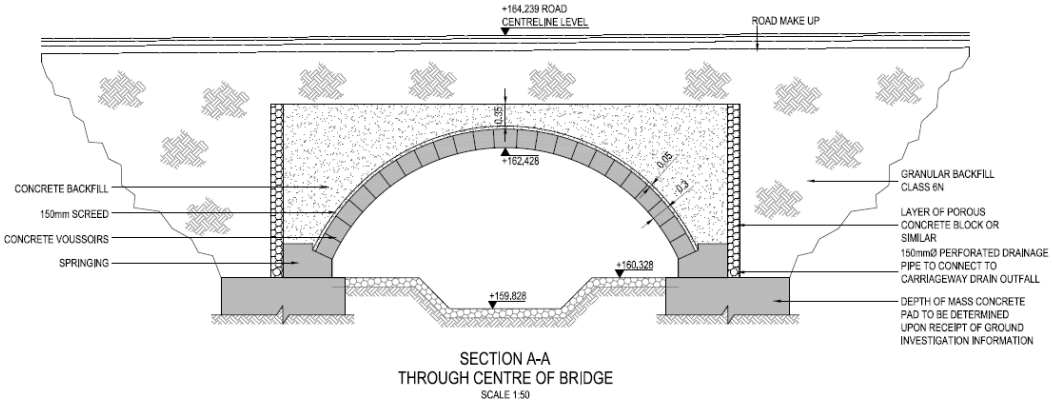


Figure 4.3: Details of Flush bridge design proposals

The hydraulic design of the Flush bridge will be assessed during detailed design. The proposed channel will ensure that there are no hydraulic impacts to the upstream or downstream flow rates or pass forward volumes or flows.

Following discussions with DfI Rivers, Arup carried out a survey of the existing Flush bridge upstream culvert opening and the surrounding embankments. Figure 4.4 includes details of the extent of the existing Flush bridge opening and banks (in blue) and an overlay of the proposed Flush bridge. Images of the existing structure and watercourse at the location are provided in Figure 4.5, Figure 4.6 and Figure 4.7.

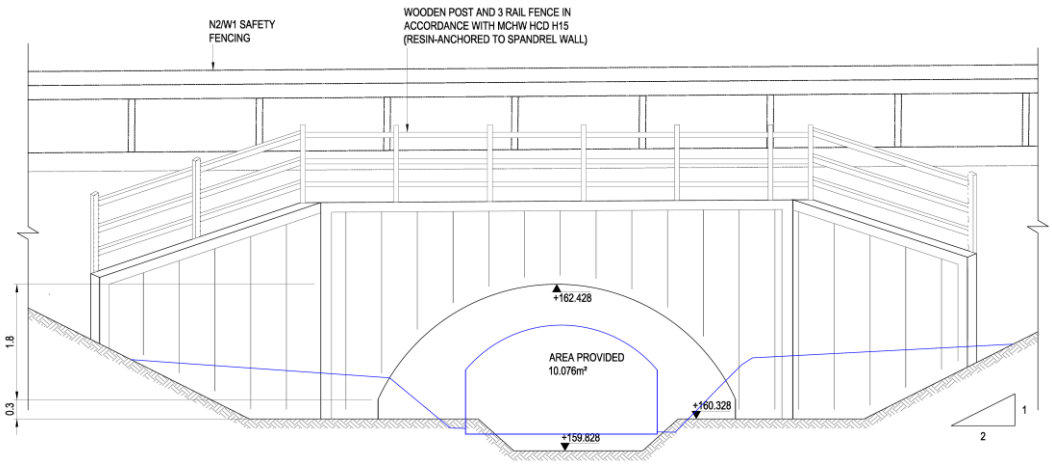


Figure 4.4: Details of the Existing Flush Bridge (blue) and the Proposed Flush Bridge

Figure 4.5: Southern Face of the Existing Flush Bridge

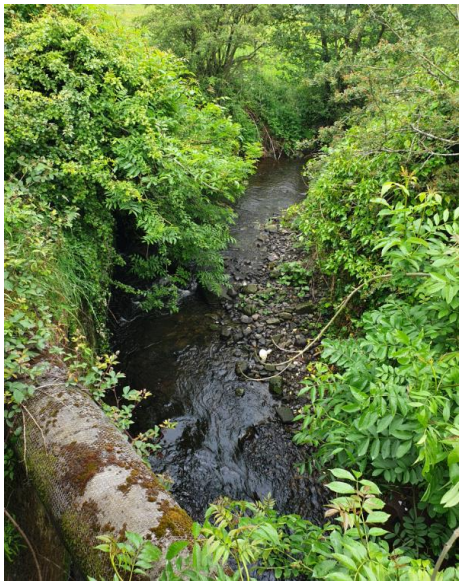


Figure 4.6: Existing Flush River South

Figure 4.7: Existing Flush River North

At its intersection with the Flush River the realignment of the Boghill Road and associated works to the bridges extends north and south of the existing carriageway. Figure 4.8 is an extract from Flood Maps NI.

A preliminary assessment of watercourse channel capacity has been carried out and it has been shown that the Q100 + 20% CC flow can be contained within the river channel upstream of the existing bridge. This is based on a simple Manning's open channel formula calculation. The extent of the fluvial flow is considered to be limited and contained within the existing watercourse channel. The proposed bridge will span the full extent of the existing watercourse channel. The risk of adversely affecting the existing fluvial flood risk is considered to be low.

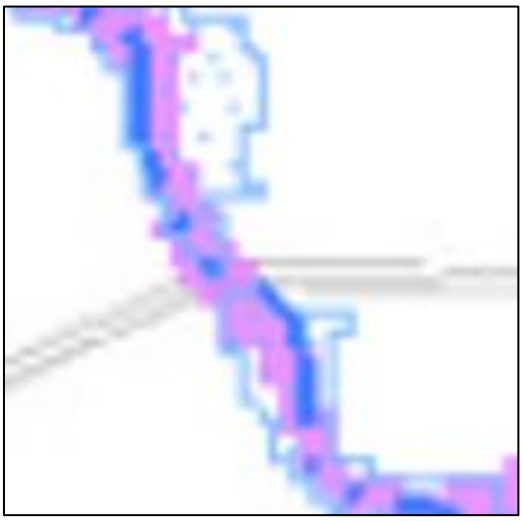


Figure 4.8: Flush bridge Flood Map from Flood Maps NI

A river flood model will be prepared during detailed design stage to assess and inform the hydraulic design of the proposed replacement of the Flush bridge. The modelling report outputs will form part of the final Construction Management

Plan, and details were also issued to DfI Rivers as part of a Schedule 6 consent application, which was approved on the 22nd August 2019 and renewed on the 18th August 2020, 26th May 2023, 15th November 2024 and the 20th March 2025. Refer to Appendix C1 for scanned copy of approval letter from DfI Rivers.

4.7 Undesignated Watercourse (Blacks bridge)

The proposed watercourse realignment will be provided with an arch bridge to replace the existing bridge based on the design proposals. The capacity of the new channel will be no less than the existing situation. The proposed arch bridge clearance that will span the watercourse is greater than the existing bridge span. Construction mitigation procedures will be provided including specific measures for works in or adjacent to the watercourse. Refer to Figure 4.9 for the location of the proposed undesignated watercourse bridge (Blacks bridge).

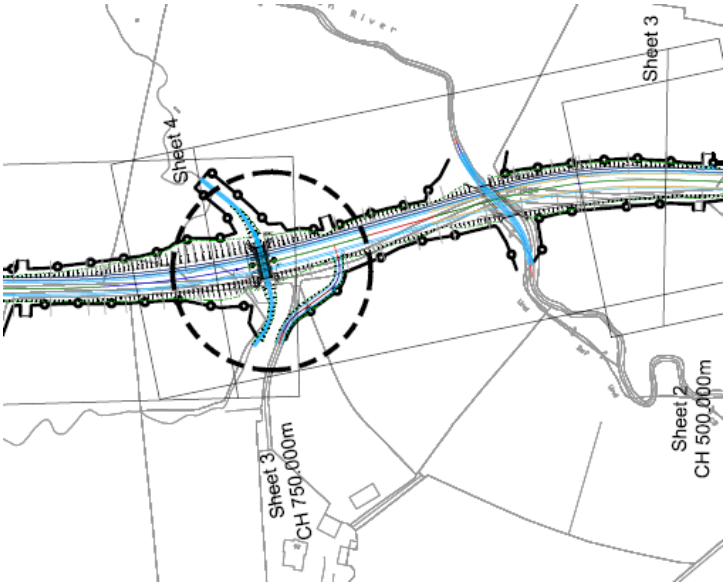


Figure 4.9: Location of the Blacks Bridge

Details of the proposed structure at Black Bridge are provided in Figure 4.10.

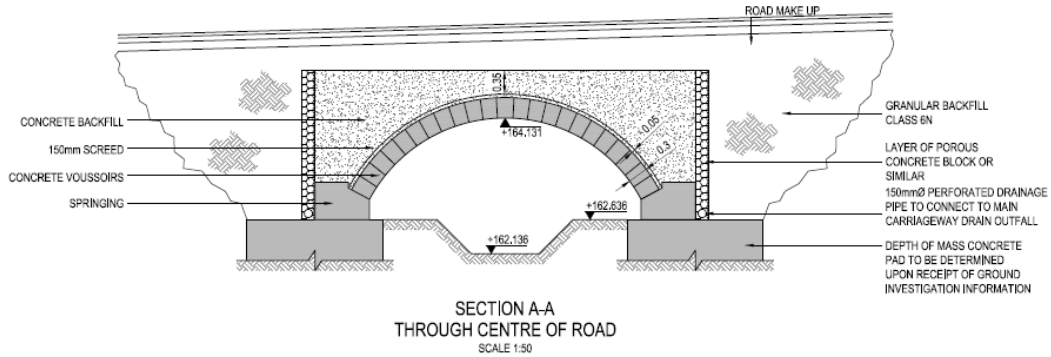


Figure 4.10: Details of the Blacks bridge proposals

The hydraulic design of the Blacks bridge will be assessed during detailed design. The proposed channel will ensure that there are no hydraulic impacts to the upstream or downstream flow rates or pass forward volumes or flows.

Following discussions with DfI Rivers, Arup carried out a survey of the existing Blacks bridge upstream cross section opening dimensions. Figure 4.11 shows the extents of the existing Blacks bridge opening and watercourse banks (in blue line) and an overlay of the proposed Blacks bridge. Images of the existing structure and watercourse at the location are provided in Figure 4.12, Figure 4.13 and Figure 4.14.

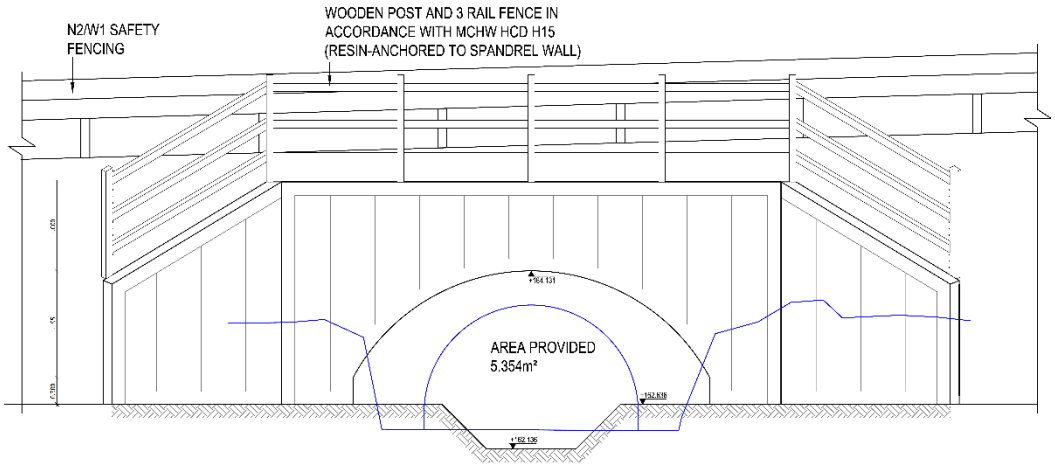


Figure 4.11: Details of the Existing Blacks Bridge (blue) and the Proposed Blacks Bridge

Figure 4.12: Existing Undesignated Watercourse South

Figure 4.13: Existing Undesignated Watercourse South

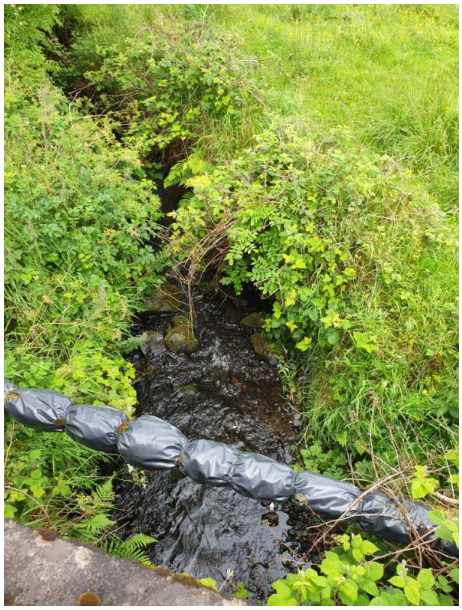


Figure 4.14: Existing Undesignated Watercourse North

A preliminary assessment of watercourse channel capacity has been carried out and it has been established that the Q100 plus 20% CC flow can be contained within the river channel upstream of the existing bridge. This is based on a simple Manning's open channel formula calculation. The flood hazard and flood risk maps extract for the area shown in Figure 4.15 and the Manning's formula calculation indicate that the Blacks bridge abutments do not lie within the 1 in 100-year fluvial floodplain. The proposed bridge will span the full extent of the existing watercourse channel. The risk of adversely affecting the existing fluvial flooding is considered low.

Figure 4.15: Blacks bridge area flood map extract from Flood Maps NI

A river flood model will be prepared during detailed design stage to assess and inform the hydraulic design of the proposed replacement of Blacks bridge. The modelling report will form part of the final Construction Management Plan and details will also be issued to DfI Rivers as part of a Schedule 6 consent application.

4.8 DFI Rivers Design Criteria

During a design meeting held on 20/06/2019 the following design criteria were agreed with DfI Rivers. At this meeting the current DfI Rivers policies were defined to facilitate the uptake of SuDS by private developers and include;

- New (Greenfield) developments; Restrict storm discharges to that equivalent to 'greenfield' runoff rate (a limit of 10 litres / second / hectare is typically accepted by DfI Rivers), where the receiving watercourses have known flooding and / or capacity issues.
- Brownfield developments; Restrict storm discharges so that there is no increase in the current rate of storm discharge subject to review by DfI Rivers.

Following these discussions with DfI Rivers the Drainage Assessment and design was developed on the basis that the permitted discharge for the main site will be restricted to 201 l/s (i.e. green field run-off based on a catchment area of 20.1 hectares). The current outline design for the peak discharge flow rate is outlined in Table 4.3.

In order to maintain the discharge rate to the unnamed watercourse, the storm flow will therefore be limited to 201 l/s through the provision of an attenuation basin and Hydro-Brake flow control facility which shall be located in an outlet chamber located immediately downstream of the basin.

A penstock valve will be located in the SuDS detention basin outlet chamber which will enable closure of the outfall in the event of an accidental spillage of contaminant occurring within the site area. This will be incorporated into the drainage system as a pollution risk mitigation measure.

Following a planning response from the NIEA (dated 19/04/2024), and subsequent receipt of the results of a NIEA hydrological assessment in January 2025, the foul flow is to be treated by one larger package treatment plant and the final effluent discharged to the Flush River via a dedicated c1.1km pumping main to be constructed to the proposed outfall location as shown on Drawing BCN-ARP-ZZ-00-DR-CH-0104 in Appendix D1.

To ensure that the required final effluent quality compliance is maintained, an automated effluent quality testing system, which shall incorporate an actuated penstock, will be provided that will divert flows into an emergency storage tank in the event of a water quality failure. This non-compliant effluent will then be tankered off site for treatment.

The proposed peak discharge rate for treated effluent, as shown in the design calculations in Appendix D7, is 5 l/s peak flow. This flow rate will be provided by the proposed treated foul effluent pumping station, with pumps to be selected and

the pumping system programmed to ensure that this peak flow rate shall not be exceeded.

Table 4.3: Summary of arc21 Project Catchment Runoff Figures

Total Catchment Area	Total Hardstanding Area	Total Greenfield Area	Peak Discharge Flow Rate
20.08 ha	13.16 ha	6.92 ha	201 l/s

The calculations undertaken include the total runoff area. The remaining 6.92ha will be managed via existing channels at the top of the cliff edges around the extents of the site boundary.

This site has a current Schedule 6 Consent, as seen in Appendix C, received 20th March 2025 and valid until 20th March 2027, for a storm discharge to the unnamed watercourse of 201 l/s, 5 l/s of treated foul final effluent to the Flush River.

4.9 Roof Drainage and Collection Systems

For roof areas, an impermeability of 100% has been assumed for the design of the storm water drainage system.

4.10 Attenuation Basin

The performance of the storm water management system and the consequences of consecutive rainfall events occurring to all additional storage, has been assessed, subject to detailed design. Emptying time checks from full to half-full have also been considered so that the drainage system is able to manage multiple rainfall events, i.e. half emptying occurs within 24 hours.

In addition, the upstream proposed rock trap(s) can be utilised as a swales/channels. This method could reduce drainage excavation, drainage diameters and storage requirements, subject to detailed design and geological considerations.

The shape and total size of the attenuation basin includes;

- Dead water storage (for settlement).
- Storage.
- Freeboard (300 mm depth requirement during Q100 + CC design event).

A permanent pool will be provided which will serve as a reserve water supply for fire-fighting in the event of an emergency.

4.11 Soil Classification

The basis of design is that existing ground conditions will not facilitate infiltration from the Attenuation Basin.

4.12 Erosion Protection

Erosion protection is required due to the velocity of the discharges to the attenuation basin and will be designed in accordance with best practice.

4.13 Silt Control

To ease maintenance, settlement of solids will be considered within the storm water drainage network upstream of the proposed attenuation basin. The development will consider a series of silt trap manholes. Alternatively, consideration will be given to provision of Vortex Separators with a separator upstream bypass. Refer to Figure 4.16 for a typical arrangement of a vortex separator.

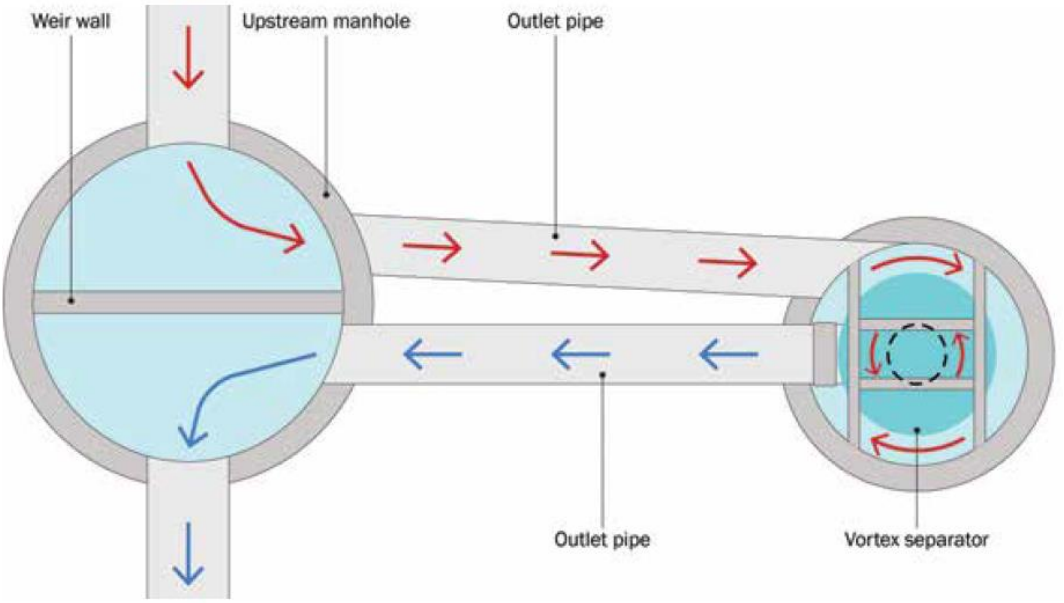


Figure 4.16: Vortex Separator Typical Arrangement

4.14 EMS / Pollution Prevention Guidelines

The operation of the site, in terms of water quality and drainage, will be governed by discharge consents and Pollution Prevention Control (PPC) Licence conditions and will, therefore, be subject to NIEA requirements. However, the site specific Environmental Management Systems (EMS) and the pollution prevention conditions including procedures and systems to be used in the event of a fire will take into account the guidance documents set out below:

- PPG 1: Understanding your environmental responsibilities - good environmental practices. A basic introduction to pollution prevention, with signposts to other PPGs and publications. (July 2013).

- PPG 18: Managing fire water and major spillages. For identifying equipment and techniques available to prevent damage to the water environment caused by fires and major spillages. (June 2000).
- GPP 21: Pollution incident response planning. For producing emergency pollution incident response plans to deal with accidents, spillages and fires. (July 2017).
- GPP 22: Dealing with spills. For anyone who is responsible for storing and transporting materials that could cause pollution if they spill. (October 2018).

4.15 Effective Catchment Area of Buildings:

Due to the large vertical surfaces associated with the proposed buildings and quarry face, consideration will be taken for the effective catchment area of all vertical surfaces (in accordance with BS EN 12056-3:2000) for calculating peak run-off flows for inclusion in the drainage system design.

4.16 Residual Risk

Any development within or adjacent to a floodplain will be subject to a residual risk, due to the occurrence of a flood event greater than that adopted as a design basis. The provision for an emergency overflow and consent to discharge emergency flows will be required. This arrangement is described as part of the Schedule 6 application for discharge consent for the main site, submitted to DfI Rivers on the 18th July 2019, and renewed on the 18th August 2020, 26th May 2023, and the 15th November 2024.

Following a planning response from the NIEA (dated 19/04/2024), and subsequent receipt of the results of a NIEA hydrological assessment in January 2025, the foul flow is now to be treated by one larger package treatment plant and the final effluent discharged to the Flush River via a dedicated c1.1km pumping main and reinforced concrete outfall headwall structure.

Due to the updates discussed above to provide a dedicated final effluent discharge to the Flush River, to meet the requirements of NIEA, a subsequent Schedule 6 Application was submitted to DfI Rivers on the 3rd March 2025 to update the existing consent to 201 l/s of storm discharge to the unnamed watercourse, and 5 l/s of treated foul final effluent to the Flush River. This subsequent Schedule 6 Discharge Consent was received on the 20th March 2025, valid until 20th March 2027 as seen in Appendix C1.

5 Conclusion

This Drainage Assessment report was commissioned by arc21/Becon consortium to support a planning application (ref: T/2014/0114/F) for a proposed development of;

- A Residual Waste Treatment Facility incorporating a Mechanical and Biological Treatment facility.
- An Energy from Waste Thermal Treatment facility.
- An Incinerator Bottom Ash Treatment facility.
- A Refuse Derived Fuel Bale Storage building.
- an Administration / Visitor Centre.

The Drainage Assessment, which formed part of the ES Addendum issued to DfI in August 2019 (Appendix 2.1), was reviewed by DfI Rivers who confirmed no objection.

This update to the Drainage Assessment follows a planning response from the NIEA (dated 19/04/2024), and subsequent receipt of the results of a NIEA hydrological assessment in December 2024. The drainage design has been updated to provide a separate foul system, with flows in the revised design to be treated by one larger package treatment plant and the final effluent discharged to the Flush River via a dedicated c1.1km pumping main to be constructed to the proposed outfall location as shown on Drawing BCN-ARP-ZZ-00-DR-CH-0105 which is included in Appendix D1.

The application site is located within the Hightown Quarry site in the townland of Ballyutoag, off the Boghill Road. The site retains an extant planning consent for the extraction and production of basalt aggregate, asphalt concrete, block production and an inert recycling facility. Access to the lands is provided off the Boghill Road which includes existing storm water drainage channels / ditches and a reedbed pond.

As part of the Drainage Assessment, a number of available sources of information were investigated and assessment works carried out in order to build an understanding of the potential risk of flooding to the site, and to areas which are located downstream and upstream of the site. The drainage design proposals were developed to consider and provide mitigation measures where this was necessary to address the potential effects of the project, in accordance with the requirements of DfI Rivers.

The drainage design proposals are summarised in the following text:

- For the main site area (including the existing quarry), following discussions with DfI Rivers the design was developed on the basis that the permitted discharge for the main site will be restricted to 201 l/s (i.e. green field run-off based on a catchment area of 20.1 hectares). This informed the Drainage Assessment Issue 4, which was reviewed and acknowledged DfI Rivers in August 2019.

Following a planning response from the NIEA (dated 19/04/2024), and subsequent receipt of the results of a NIEA hydrological assessment in January 2025, the foul flow is now to be treated by one larger package treatment plant and the final effluent discharged to the Flush River via a dedicated c1.1km pumping main and reinforced concrete outfall headwall structure.

This site had a Schedule 6 Consent, received 15th November 2025, for a combined storm and final effluent discharge to the unnamed watercourse of 201 l/s. Due to the NIEA responses above, which have resulted in the proposed dedicated final effluent discharge to the Flush River, a subsequent Schedule 6 Application was submitted to DfI Rivers on the 3rd March 2025 to update the existing consent to 201 l/s of storm discharge to the unnamed watercourse, and 5 l/s of treated foul final effluent to the Flush River. This subsequent Schedule 6 Discharge Consent was received on the 20th March 2025, valid until 20th March 2027 as seen in Appendix C1.

- The proposed peak discharge rate for treated effluent, as shown in the design calculations in Appendix D7, is 5 l/s peak flow. This flow rate will be provided by the proposed treated foul effluent pumping station, with pumps to be selected and the pumping system programmed to ensure that this peak flow rate shall not be exceeded. A schedule 6 Application has therefore been submitted to DfI Rivers to obtain consent for this proposed discharge.

  To ensure that the required final effluent quality compliance is maintained, an automated effluent quality testing system, linked to an actuated penstock will be provided that will divert flows into an emergency storage tank in the event of a quality failure. This non-compliant effluent will then be tankered off site for treatment.

- It is proposed to utilise an existing site drainage outfall for the main site area which currently discharges to a tributary watercourse of the Flush River. The proposed attenuation basin will discharge to an existing settlement pond (Lagoon 1 shown in Figure 2.4 and as shown on Drawing No BCN-ARP-ZZ-00-DR-CH-0104 in Appendix D1).
- It is proposed that a section of the Boghill Road will be realigned as part of the project. This will require the construction of a new road drainage system which includes new road drainage outfall headwall structures to the Flush River and a tributary of the Flush River.
- The discharge rates for new outfalls to be provided for the realigned Boghill Road will be restricted to the existing brownfield runoff rate. This will be achieved through provision of online attenuation storage within the new drainage system i.e. enlarged pipes and chambers, and through the use of orifice plate or hydrobrake flow control devices to be located upstream of the outfall points to the receiving watercourses.

It is noted that as part of the Boghill Road improvements the scheme includes replacement of both the existing Flush and Blacks bridges. DfI River's Flood

Maps (NI) indicate that only strategic river modelling was carried out by them for both of these watercourses.

This matter has been reviewed through the flow and hydraulic assessment carried out as part of and included within this Drainage Assessment in the areas of the proposed bridges. A preliminary assessment of watercourse channel capacity was carried out and it was demonstrated that the Q100 + 20% CC flow can be contained within the river channel at the 2 separate locations upstream of the existing bridges. Refer to Section 4.6 and Section 4.7 of this report. This is based on a Manning's formula calculation. On the basis of this assessment the extent of the fluvial flooding / flow is considered to be limited and contained within the existing watercourse channel. The proposed bridge will span the full extent of the existing watercourse channel. The risk of adversely affecting the existing fluvial flood risk is considered to be low.

The consents necessary prior to undertaking these works, will require the applicant to contact the DfI Rivers local area office with a view to obtaining Schedule 6 consent under the Drainage (NI) Order 1973. As part of the required consent for the works from DfI Rivers Local Area Office relating to the bridge replacements, the applicant should prepare a detailed river model of both watercourses so as to provide DfI Rivers with assurance/evidence that the abutments or culvert walls are to be positioned outside of the Q100 floodplain.

5.1 DfI Rivers Consultation

DfI Rivers raised a number of queries regarding this scheme within a letter dated 11th June 2019 (DfI Rivers Ref: IN1-19-5942 included in Appendix C) and a subsequent meeting regarding the same matters on 21 June 2019.

Under FLD1 of PPS 15 (Revised) DfI Rivers Agency requested a detailed river model of both watercourses at the Flush and Black bridges so as to provide DfI Rivers with assurance/evidence that the abutments are to be positioned outside of the Q100 floodplain. This has been addressed through the hydraulic assessment carried out within the Drainage Assessment in the areas of the proposed bridges and as described in Section 4.6 and Section 4.7 of this report. It is confirmed in the Drainage Assessment that a detailed river model will be prepared during detailed design stage to support this assessment.

Under FLD 3, DfI Rivers require a Drainage Assessment and this has been completed and is presented within this document. It is understood that all of the relevant queries have been addressed within this Drainage Assessment report.

Appendix A

Site Location Plan & Existing Site Layout

A1 Site Location Plan

A1

Plan
Scale: NTS

Plan
Scale: 1:50000

Rev	Date	Description	By	Chkd	Appd	Auth
P01	13-03-19	For Information	PB	MD	MM	

ARUP

Bedford House 3rd Floor 16-22 Bedford Street
Belfast BT2 7FD
Tel +44 28 9089 0900 Fax +44 28 9089 0901
www.arup.com

Client
INDAVER

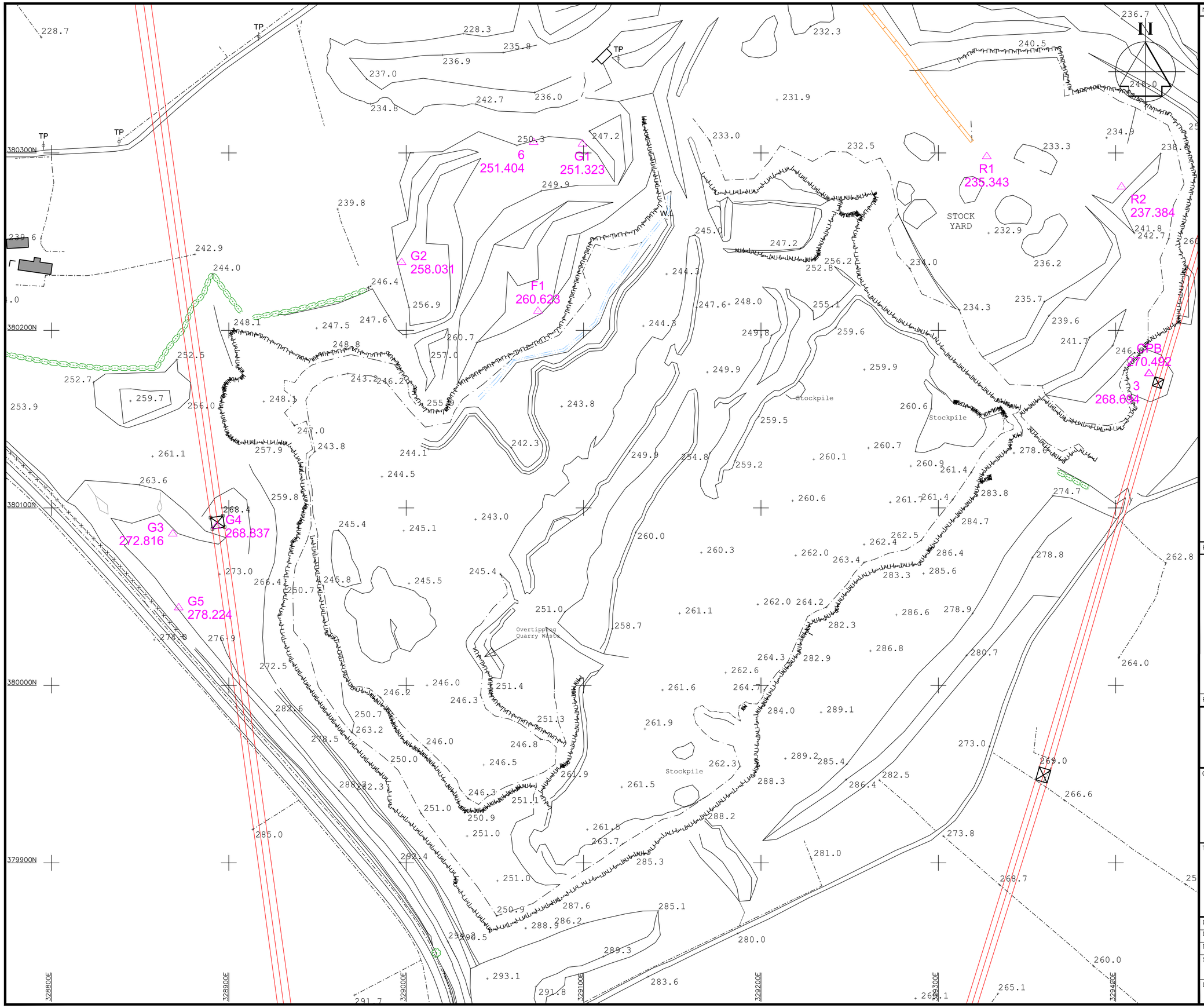
Project Title
Becon Project

Drawing Title
Site Location Plan

Scale at A1	As Shown		Arup Job No	264848-00	
Role	Multiple Disipline				
Suitability	S2 - Issued For Information				
Rev	By	Chkd	Appd	Auth	
P01	PB	DM	MM		
	Date	Date	Date	Date	
	13-03-19	13-03-19	13-03-19		

Name
BCN - ARP - ZZ - 00 - DR - ZZ - 0001
Project | Originator | Volume | Location | Type | Role | Number

A2 Existing Site Layout



Notes

Key to symbols

Rev	Date	Drawn	Description	Ch'k'd	App'd

becon
generating value
from waste

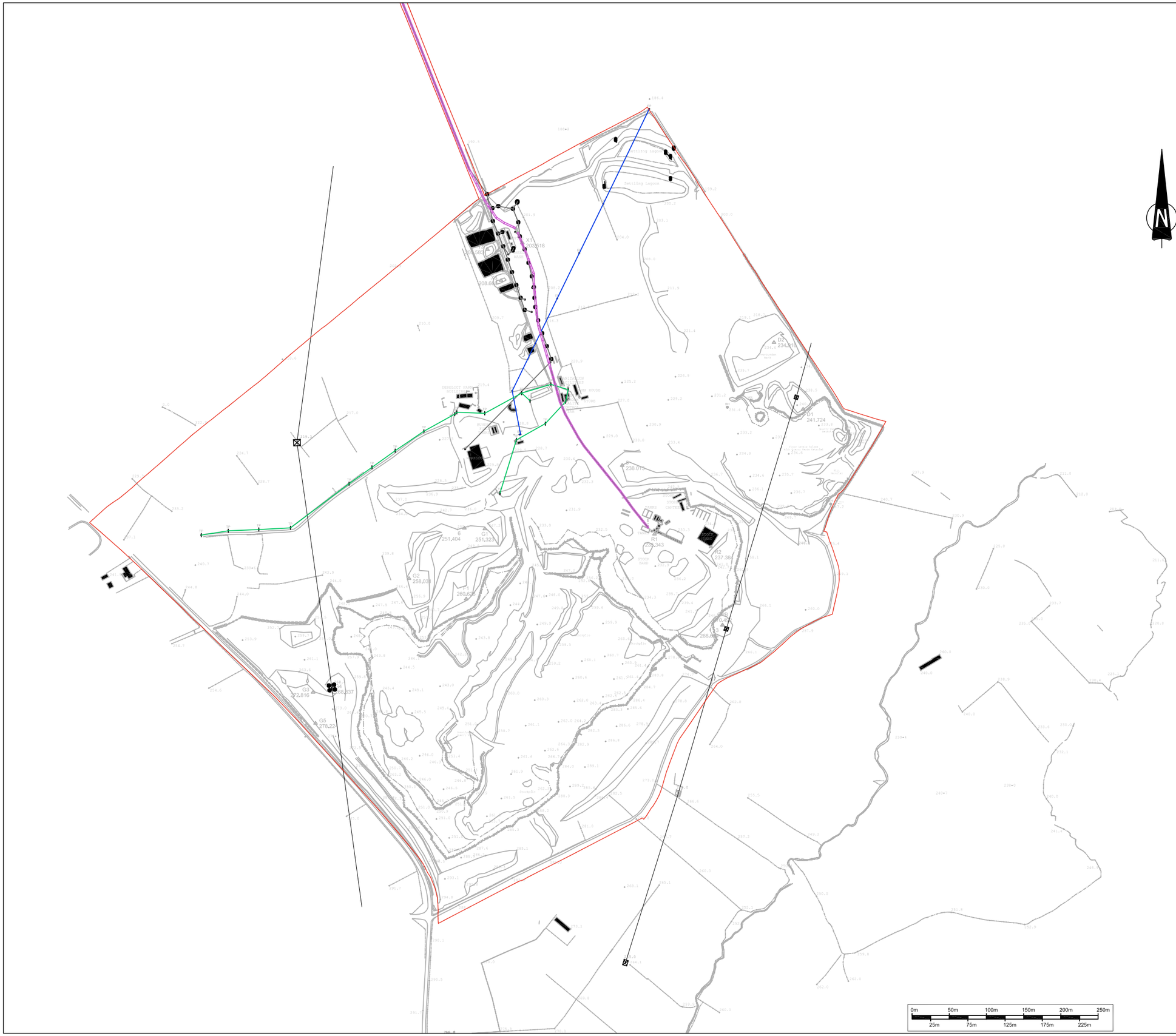
Client

arc 21
Walsh House
Fortwilliam Business Park
35 Dargan Road
Belfast BT3 9LZ

Title

ARC 21 RESIDUAL WASTE TREATMENT PROJECT
EXISTING SURVEY OF QUARRY VOID

Designed	JH	05/11/13	Eng.Chk.	RA	05/11/13
Drawn	JH	05/11/13	Coordination	RA	05/11/13
Dwg.Chk.	RA	05/11/13	Approved	RA	05/11/13
Scale @ A1		Project 5090959			Status
1:1000		CAD file			T
Drawing No					Rev
GE–C–GEN–XX–001					



NOTES

1. Verifying Dimensions.
   The contractor shall verify dimensions against such other drawings or site conditions as pertain to this part of the work.

2. Existing Services.
   Any information concerning the location of existing services indicated on this drawing is intended for general guidance only. It shall be the responsibility of the contractor to determine and verify the exact horizontal and vertical alignment of all cables, pipes, etc. (both underground and overhead) before work commences.

3. Issue of Drawings.
   Hard copies, dwf and pdf will form a controlled issue of the drawing. All other formats (dwg, dxf etc.) are deemed to be an uncontrolled issue and any work carried out based on these files is at the recipients own risk. RPS will not accept any responsibility for any errors arising from the use of these files, either by human error by the recipient, listing of un-dimensioned measurements, compatibility issues with the recipient's software, and any errors arising when these files are used to aid the recipients drawing production, or setting out on site.

4. Datum:

5. Key:
   - Electric
   - Telephone
   - Overhead Power Line
   - Underground Gas Line

6. Ground and pylon elevations have been established from OSNI base mapping and from information provided by NIE, if pylon elevations are to be relied upon these levels should be confirmed by on site measurements.

rev	amendments	drawn	date

RPS
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W www.rpsgroup.com/ireland
E ireland@rpsgroup.com

Client: arc21

Project: Lands at Hightown Quarry - A Report for arc21 as Prospective Purchaser of a Site within the Lands

Title: Site Services & Existing Structures

Drawing Status	Sheet Size	Drawing Scale
Preliminary	A3	1:5,000

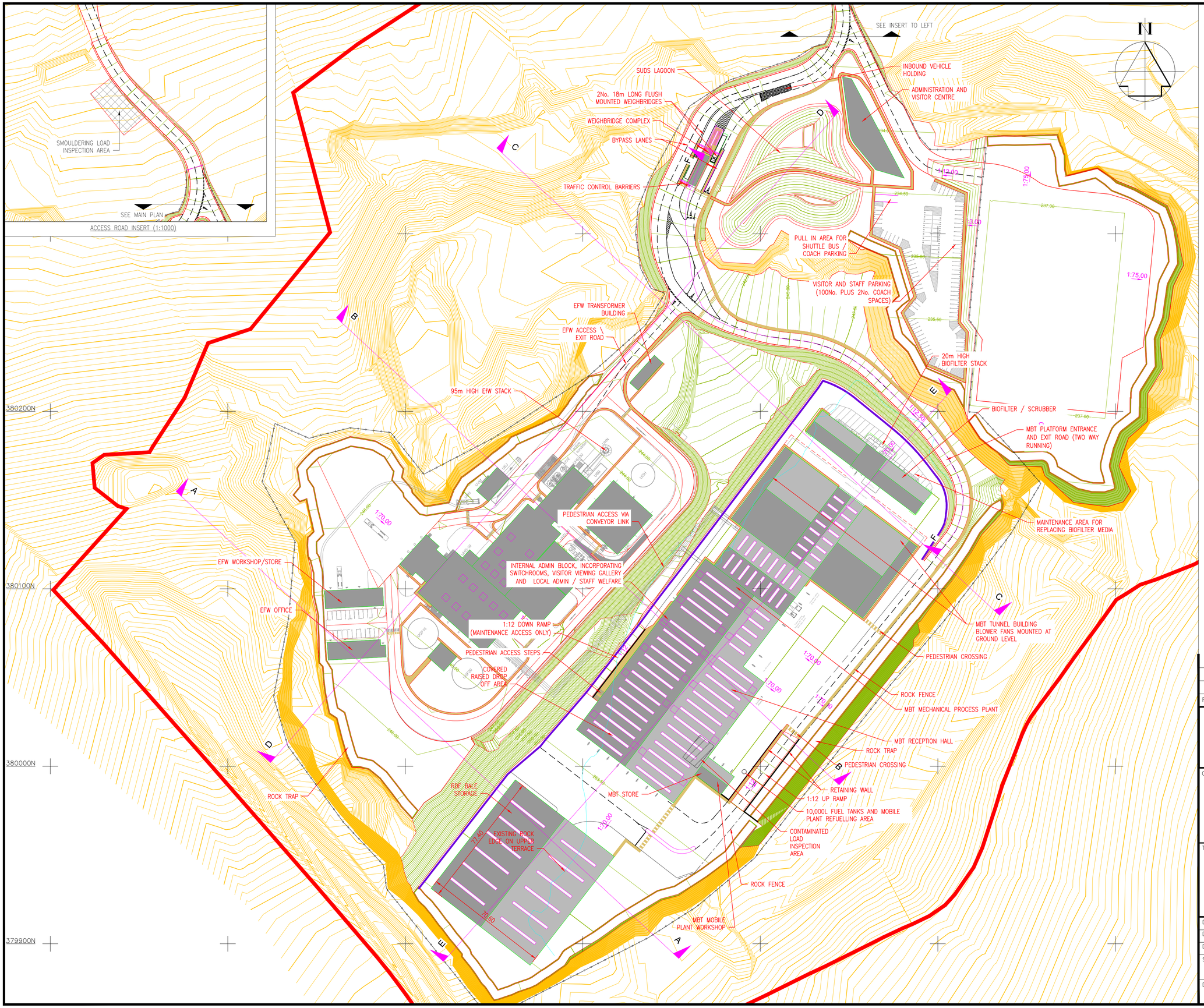
Drawing Number	Rev
IBR0016 /10.1	-

Project Leader	Drawn By	Date	Initial Review
A. Baskin	P. McMath	03/09/10	K.McNamara

Appendix B

Proposed Site Layout

B1 Proposed Site Layout



- SITE BOUNDARY INCLUDING LIMIT OF LANDSCAPE WORKS AND EXCLUDING COMMON ACCESS ROAD
- BRITPAVE SURFACE MOUNTED CONCRETE BARRIER (TYPE T2) OR SIMILAR APPROVED
- KEEKLAMP HANDRAILING OR SIMILAR APPROVED
- ONE ARM BARRIERS LOCAL TO WEIGHBRIDGE
- 2.1m HIGH PALADIN FENCE POWDER COATED GREEN
- FOOTPATH

Rev	Date	Drawn	Description	Ch'k'd	App'd
B	22/12/14	AQ	LAYOUT UPDATED	DMcF	SW
A	29/07/14	AQ	BUILDING LAYOUT REVISED	DMcF	SW

becon
generating value from waste

Client

arc 21
sustainable waste management

arc 21
Walsh House
Fortwilliam Business Park
35 Dargan Road
Belfast BT3 9LZ

Title

ARC 21 RESIDUAL WASTE TREATMENT PROJECT
PROPOSED EARTHWORKS AND GENERAL ARRANGEMENT

Designed	JH	05/11/13	Eng.Chk.	RA	05/11/13
Drawn	JH	05/11/13	Coordination	RA	05/11/13
Dwg.Chk.	RA	05/11/13	Approved	RA	05/11/13

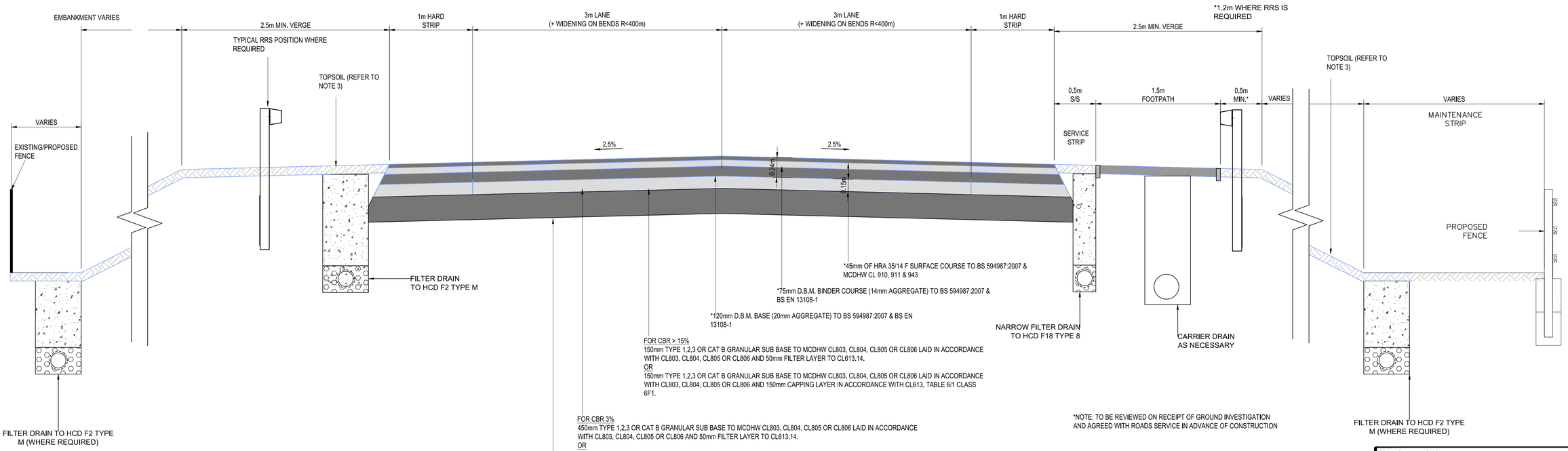
Scale @ A1: 1:1000
Project: 5090959
CAD file
Status: T
Drawing No: GE-C-GEN-XX-002
Rev: B

V:\CAD_PROJECTS\IE\IE_ARC21\2014_MODIFIED DRAWINGS\To Modify_delete wheelwash\C-GEN-XX-002 EARTHWORKS REV B.dwg Tijl De Ridder

B2 Boghill Road Proposed GA Layout & Construction Cross Section

Notes

1. ALL DIMENSIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. REFER TO DRAWING NO. GE-C-BOG-□□-003 FOR GENERAL NOTES
3. MINIMUM 150mm THICK LAYER OF TOPSOIL AS SPEC CL61□. TOPSOILED□ FERTILISED AND SEEDED AS TREATMENT I□SPEC CL61□. DETAILS OF HYDRAULIC MULCH SEEDING TO BE AGREED WITH THE ENGINEER PRIOR TO APPLICATION. GRASS TO BE MOWN TWICE DURING MAINTENANCE PERIOD AS SPEC CL61□.□10□ HERBICIDE APPLICATION□ AS RE□UIRED□AS SPEC CL61□.□11□



*NOTE: TO BE REVIEWED ON RECEIPT OF GROUND INVESTIGATION AND AGREED WITH ROADS SERVICE IN ADVANCE OF CONSTRUCTION

TYPICAL CROSS SECTION
SCALE 1:25

Key to symbols

Rev	Date	Drawn	Description	Ch'k'd	App'd
A	25/07/14	ML	ALIGNMENT REVISED	MK	SW

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Client

arc 21
Walsh House
Fortwilliam Business Park
35 Dargan Road
Belfast BT3 9LZ

Title

ARC 21 RESIDUAL WASTE TREATMENT PROJECT
PROPOSED ROAD CONSTRUCTION DETAILS

Designed	MK	02/08/12	Eng.Chk.	SW	02/08/12
Drawn	ML	02/08/12	Coordination	DMcF	02/08/12
Dwg.Chk.	DJM	02/08/12	Approved	SW	02/08/12

Scale @ A1: AS SHOWN
Project: 5090959
CAD file: GE-C-BOG-XX-040-A.dwg
Status: T
Drawing No: GE-C-BOG-XX-040
Rev: A

PROPOSED CATCHMENTS	AREA
CATCHMENT 1	5975.890m²
CATCHMENT 2	1493.112m²
CATCHMENT 3	6731.793m²
EXISTING CATCHMENTS	AREA
CATCHMENT 1	4129.895m²
CATCHMENT 2	4729.967m²

1 PROPOSED DRAINAGE CATCHMENT PLAN
SCALE 1: 2000

Notes

1. ALL DIMENSIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. VERIFYING DIMENSIONS
   THE CONTRACTOR SHALL VERIFY DIMENSIONS AGAINST SUCH OTHER DRAWINGS OR SITE CONDITIONS AS PERTAINING TO THIS PART OF THE WORK.
3. DATUM: IRISH GRID
4. ALL WORKS SHALL COMPY WITH THE MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS.

Key to symbols

- PROPOSED CATCHMENT -1
- PROPOSED CATCHMENT -2
- PROPOSED CATCHMENT -3
- EXISTING CATCHMENT -1
- EXISTING CATCHMENT -2

Rev	Date	Drawn	Description	Ch'k'd	App'd
A	12/08/14	ML	REVISED ALIGNMENT	MK	SW

becon
generating value from waste

Client

arc21
sustainable waste management

arc 21
Walsh House
Fortwilliam Business Park
35 Dargan Road
Belfast BT3 9LZ

Title

ARC 21 RESIDUAL WASTE TREATMENT PROJECT
BOGHILL ROAD, PROPOSED DRAINAGE CATCHMENT PLAN

Designed	MK	02/08/12	Eng.Chk.	SW	02/08/12
Drawn	SV	02/08/12	Coordination	DMcF	02/08/12
Dwg.Chk.	DJM	02/08/12	Approved	SW	02/08/12

Scale @ A1: 1:2000
Project: 5090959
CAD file: GE-C-BOG-XX-055-A.dwg
Status: T
Drawing No: GE-C-BOG-XX-055
Rev: A

Appendix C

Department for Infrastructure
Rivers Correspondence

C1 Correspondence

Department for Infrastructure
An Roinn Bonneagair
www.infrastructure-ni.gov.uk

DfI Strategic Planning Division
Clarence Court
10-18 Adelaide Street
Belfast
BT2 8GB

44 Seagoe Industrial Estate
CRAIGAVON
Co. Armagh
BT63 5QE
Tel: 028 3839 9118

Our ref: IN1-19-5942
Your ref: T/2014/0114/F
11th June 2019

Dear Sir/Madam,

Re: Hightown Quarry 40a Boghill Road, Ballyutoag & lands adjacent to the existing Boghill Road from its junction with Hydepark Road to the west of the existing access road into Hightown Quarry.

Proposed development of Residual Waste Treatment Facility including widening of Boghill Road and other ancillary works.

Thank you for your consultation dated 8th April 2019 regarding the above proposal.

Our previous response (dated 11/7/2014) to your consultation of 17/6/2014 was based on PPS 15 issued June 2006. Since then the Revised Planning Policy Statement 15 "Planning and Flood risk" dated September 2014 came into effect. This response reflects this latest Planning Policy.

As a result revised information is now required (See FLD 1 & FLD 3 below):

FLD 1 - Development in Fluvial (River) and Coastal Flood Plains. DfI River's Flood Map (NI) indicates that the development does not lie within the 1 in 100 year fluvial Plain.

The Planning Authority should be aware that the Department for Infrastructure updated its Technical Flood Risk Guidance in relation to "Allowances for Climate Change in Northern Ireland" on 25th February 2019.

The Guidance and associated documentation can be accessed or downloaded via the Department for Infrastructure's web page as follows:- https://www.infrastructure-ni.gov.uk/publications/technical-flood-risk-guidance-relation-allowances-climate-change-northern-ireland

For your information, based on the climate change maps, the site remains outside the Q100 Flood Plain + Climate Change.

It is noted that as part of the Boghill Road improvements (refer to the Proposed Drainage Sheet 3 of 5 number GE-C-BOG -XX-052) of the intension to replace both the existing Flush and Blacks bridges. DfI River's Flood Maps (NI) indicate strategic river modelling only for both these watercourses. The consents necessary prior to undertaking these works, will require the applicant to contact the DfI local area office with a view to obtaining Schedule 6 Consent under the Drainage (NI) Order 1973. As part of the required consent for the works from DfI Rivers Local Area Office related to the bridge replacements, the applicant should conduct a detail river model of both watercourses so as to provide DfI Rivers with assurance/evidence that the abutments are to be positioned outside of the Q100 floodplain.

FLD 2 – Protection of Flood Defence and Drainage Infrastructure.

It is noted that there are 2 undesignated watercourses along the boundaries of the main site area. PPS 15, policy FLD2 states Planning Authority will not permit development that would impede the operational effectiveness of flood defence and drainage infrastructure or hinder access to enable their maintenance. Also paragraph 6.32 states, where a new development proposal is located beside a watercourse it is essential that an adjacent working strip is retained to facilitate future maintenance by the riparian owners. The working strip should have a minimum width of 5 metres, but up to 10 metres where considered necessary, and be provided with clear access and egress at all times.

The proposed arrangement indicated on Site Plan drawing number GE-C-GEN-XX-060 are **deemed to comply with this sub-policy FLD2.**

FLD 3 - Development and Surface Water (Pluvial) Flood Risk Outside Flood Plains.

For this current application DfI Rivers advise that in accordance with the Revised PPS 15, Planning and Flood Risk, FLD 3, "Development and Surface Water (Pluvial) Flood Risk outside Flood Plains", a **Drainage Assessment is required** because:

- It is a development in excess of 1 hectare.
- It is a change of use involving new buildings and hard standing exceeding 1000 square metres.
- The surface water run-off may adversely affect other development downstream.

The Revised Policy PPS 15 FLD 3 states that the drainage assessment demonstrates that adequate measures will effectively mitigate flood risk. In carrying out the drainage assessment (refer to Annex D of the Revised PPS 15: Assessing Flood Risk and Drainage Impact) the applicant should obtain from the relevant authority evidence that the proposed storm water run-off from the site can be safely discharged**.**

If the proposal is to discharge into a watercourse then an application should be made to the local DfI Rivers office for consideration under Schedule 6 of the Drainage (NI) Order 1973. **Schedule 6 correspondence should be included within the Drainage Assessment to confirm DfI Rivers local area office is in agreement to this proposed arrangement.**

You should also note that, similar to previous advice that was given (11/7/2014), that three surface water Schedule 6 discharge consents are now required under the revised policy. Further detail on these locations is as follows:

- The drawing entitled "Proposed Drainage Layout 2 of 3 number GE-C-GEN -XX-011" contains a note that surface water from the main treatment facility attenuation pond is to discharge to a tributary of the Flush River.

- The drawing entitled "Proposed Drainage Sheet 3 of 5 number GE-C-BOG -XX-052" indicate 2 separate discharge points from the upgraded Boghill Road to the Flush River either side of Blacks Bridge and the replacement of both bridges.

If it is proposed to discharge storm water into an NI Water system then a Pre-Development Enquiry should be made and if a simple solution cannot be identified then a Network Capacity Check should be carried out. **Correspondence with relevant statutory authorities should be included in the drainage assessment regardless of outcome.**

It is also worth noting following the previous consultation of 10/4/2014, DfI Rivers at that time reached agreement (in their letter dated 11/7/2014) that all the surface water from the entire site within the red line boundary was to be attenuated and the discharge was to be limited to the green field run-off rate. You should reassess/revise these proposals, considering SuDs as appropriate in developing the detailed hydraulic calculations required.

In order to comply with NI Water Sewer for adaption standards, please supply within the Drainage Assessment:
a) evidence of the revised attenuation calculations to show that the system will not flood any part of the site in a 1 in 30 year designed event whilst retaining a 300mm free-board within the manholes network and
b) carry-out checks and show that during exceedence of the 1 in 30 year pipe design for up to a 1 in 100 year return period, that the buildings will not flood & indicate the flow path and location of surplus storage on site.

FLD 4 – Artificial Modification of Watercourses. The drawings do not show any proposal or reference to culverting any watercourses, therefore this Sub-Policy is not applicable for the proposals submitted.

Department for Infrastructure
An Roinn Bonneagair
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FLD 5 – Development in Proximity to Reservoirs.
The site is not within the inundation flood zone of any reservoir, therefore this Sub-Policy is not applicable for the proposals submitted.

Under the terms of Schedule 6 of the Drainage (NI) Order 1973 any proposal either temporary or permanent, in connection with the development which involves interference with any watercourse such as culverting, bridging, diversion, building adjacent to or discharge of storm water etc requires the written consent of DfI Rivers. This should be obtained from our Eastern Regional Office, Ravarnet House, Altona Road, Largymore, Lisburn. BT27 5QB

Please quote our reference number above on any future correspondence.

Michael Sands
Planning Advisory Unit

RIVERS Agency

Eastern Regional Office
Ravarnet House
Altona Road
LISBURN
Co. Antrim
BT27 5QB

Telephone: 028 9260 6100
Fax: 028 9260 6111
Web: www.riversagencyni.gov.uk

Our Ref: DA2-10-3023
Your Ref: IBH02152010-02-17

Mr K Harley
RPS Consulting Engineers
Elmwood House
74 Boucher Road
Belfast
BT12 6RZ

IBH0215 JB/KH

22 March 2010

Dear Sir

Upgrade of culverts, Boghill Road, Mallusk

Thank you for your email dated 19 February 2010. This Agency is prepared to agree in principle to your proposals for replacing the road culverts in question, which are not designated watercourses within the meaning of the Drainage (Northern Ireland) Order 1973; subject to the following conditions being fulfilled.

1. A box culvert 3.6m wide by 2.3m high is required to replace the road culvert at A (Blacks Bridge). (You should note that this is a minimum culvert size and may be revised on receipt of comments from DCAL). 8.28 m^2

2. A box culvert 2.4m wide by 1.7m high is required to replace the road culvert at B (to the west of Blacks Bridge). (You should note that this is a minimum culvert size and may be revised on receipt of comments from DCAL). 4.08 m^2

3. The culverts should be laid to the best attainable uniform gradient with invert level a minimum 150mm below existing firm bed level. Suitable head walls and aprons should be constructed at the culvert inlet/outlet in order to reduce the effect of bank and bed erosion.

4. The construction should be in accordance with the Civil Engineering Specification for the Water Industry – 6th Edition.

As these watercourses may have a fishery interest you should consult with the following prior to commencing any works at this location –

DCAL Inland Fisheries
Movanagher Fish Farm
152 Vow Road
Ballymoney
BT53 7NT

RIVERS Agency

Please note that you are required to forward comments from DCAL Inland Fisheries regarding any fishery measures that may be required to Rivers Agency for consideration prior to full consent being given.

In accordance with Para 1(e) of schedule 6 of the Drainage Order, you are required to submit for appraisal, plans, sections and specifications in relation to your proposals for culverting the watercourses, indicating bedding/surround details and any other relevant information.

You should note that the Agency will not confirm its consent to your proposals until it has received and appraised the details requested above and is satisfied with them.

Commencement of the works in advance of the above mentioned plans, sections and specifications being approved by the Agency is a contravention of the Drainage (Northern Ireland) Order 1973 and is likely to lead to legal proceedings.

Applicants should note that, in accordance with Para 11 of Schedule 6 of the Drainage (Northern Ireland) Order 1973, any consents/approvals given by Rivers Agency under Schedule 6 shall not affect the liability of any applicant to comply with other legislation relevant to works undertaken in pursuit of such consents/approvals.

Please quote our reference number above in any further correspondence.

Yours faithfully

Thomas Magee
Engineering Section

DfI Rivers Lisburn

Department for Infrastructure
An Roinn Bonneagair
www.infrastructure-ni.gov.uk

Pete Gray
Bedford House
16-22 Bedford Street
Belfast
BT2 7FD

Ravarnet House
36 Altona Road
Lisburn, BT27 5QB
Tel: 028 92 606 100

Your ref:
Our ref: IN1-19 - 9442

Date: 22st August 2019

Dear Pete,

RE: Becon Project - Schedule 6 application for consent to discharge

Thank you for your application dated 18th July 2019 and continued correspondence regarding Schedule 6 approval. From a drainage aspect my comments are as follows.

DfI Rivers consents to storm discharge at your total stated maximum attenuated run-off rate of 201l/s from the main site to the undesignated watercourse under the terms of the Drainage (Northern Ireland) Order 1973. This is shown on BCN-ARP-ZZ-XX-DR-CD-0013.

DfI Rivers also consents to storm discharge at your total stated maximum attenuated run-off rate of 135.4 l/s from the road to the undesignated watercourses under the terms of the Drainage (Northern Ireland) Order 1973. This consists of three individual discharge locations as shown on drawing no. GE-C-BOG-XX-055 (63.1l/s, 13l/s and 59.3l/s).

The Department accepts the outfall submitted with the same application as above and advises that it should be constructed in appropriate scale to the size of the outlet pipe. The discharge pipes and outlet structures should be turned in the direction of flow and anti-scour measures taken to prevent bank and bed erosion.

The developer should also satisfy himself that the watercourse downstream from the proposed discharge should be free from obstructions such as silt, weed growth or debris to provide adequate outfall for storm discharge. This should be brought to the attention of the developer or landowner prior to discharge.

Please note that DfI Rivers consent relates to quantity of discharge, it is your responsibility to ensure permission from NIEA where required in relation to the quality of discharge.

You should note that, in accordance with Paragraph 11 of Schedule 6 of the Drainage (Northern Ireland) Order 1973, any consents/ approvals given by DfI Rivers under Schedule 6 shall not affect the liability of any riparian/developer to comply with other legislation. It is your responsibility to contact any other parties which may have an interest in your proposals e.g. NIEA, Landowners, Fisheries etc.

In giving its consent the Department would stress that it is your responsibility to ensure that the proposed works do not result in any obstruction to flow arising from blockage, structural failure, poor workmanship or any other reasons.

This consent is valid for a period of 12 months from the date of this letter. If proposals are not completed within this period of time they should be resubmitted for further appraisal.

Please note that the responsibility for the continued maintenance of undesignated watercourses rest with riparian landowners.

Please quote the above reference number in any future correspondence.

Yours sincerely

Jonathan Steenson
Engineering Section

DfI Rivers Lisburn

Department for Infrastructure
An Roinn Bonneagair
www.infrastructure-ni.gov.uk

Pete Gray
Bedford House
16-22 Bedford Street
Belfast
BT2 7FD

Ravarnet House
36 Altona Road
Lisburn, BT27 5QB
Tel: 028 92 606 100

Your ref:
Our ref: IN1-19-9442

Date: 26 May 2023

Dear Pete,

RE: Schedule 6 Application Ref: IN1-19-9442 - Becon Project application for consent to discharge storm water

Thank you for your Schedule 6 renewal application received 1 December 2022 and further correspondence regarding Schedule 6 approval. From a drainage aspect my comments are as follows.

DfI Rivers is satisfied with your proposals to discharge at the total stated maximum Greenfield rate of 201l/s to the undesignated watercourse as shown on Drawing no. BCN-ARP-ZZ-XX-DR-CD-0013 under the terms of the Drainage (Northern Ireland) Order 1973.

DfI Rivers is also satisfied with your proposals to discharge at your total stated maximum rates of 63.1l/s, 13l/s and 59.3l/s to the undesignated watercourses as shown on Drawing no. GE-C-BOG-XX-055 under the terms of the Drainage (Northern Ireland) Order 1973. This consists of three individual discharge locations as shown on your original application.

The Department accepts the outfalls submitted with the same application as above and advises that they should be constructed in appropriate scale to the size of the outlet pipe. The discharge pipes and outlet structures should be turned in the direction of flow and anti-scour measures taken to prevent bank and bed erosion.

Attenuation method is to be by using a hydrobrake fitted manhole and appropriate storage systems within the site.

The developer should also satisfy himself that the watercourse downstream from the proposed discharge locations should be free from obstructions such as silt, weed

growth or debris to provide adequate outfall for storm discharge. This should be brought to the attention of the developer or landowner prior to discharge.

You should note that, in accordance with Paragraph 11 of Schedule 6 of the Drainage (Northern Ireland) Order 1973, any consents/ approvals given by DfI Rivers under Schedule 6 shall not affect the liability of any riparian/developer to comply with other legislation. It is your responsibility to contact any other parties which may have an interest in your proposals e.g. NIEA, Landowners, Fisheries etc.

You are requested to notify DfI Rivers of the commencement date of your works so that an inspection may take place during construction.

The Department would stress that it is your responsibility to ensure that the proposed works do not result in any obstruction to flow arising from blockage, structural failure, poor workmanship or any other reasons.

This is valid for a period of 24 months from the date of this letter. If proposals are not completed within this period of time they should be resubmitted for further appraisal.

Please quote the reference number at the top of this letter in any future correspondence.

Yours sincerely

Jonathan Steenson
Engineering Section

DfI Rivers Lisburn

Department for Infrastructure
An Roinn Bonneagair
www.infrastructure-ni.gov.uk

Pete Gray
Arup
Bedford House
16-22 Bedford Street
Belfast
BT2 7FD

Ravarnet House
36 Altona Road
Lisburn, BT27 5QB
Tel: 028 92 606 100

Your ref:
Our ref: IN1-19-9442

Date: 15 November 2024

Dear Pete,

RE: IN1-19-9442 - Becon Schedule 6

Thank you for your Schedule 6 renewal application received 25 October 2024 and further correspondence regarding Schedule 6 approval. From a drainage aspect my comments are as follows.

DfI Rivers is satisfied with your proposals to discharge at the total stated maximum rate of 200.7l/s to the undesignated watercourse as shown on Drawing no. BCN-ARP-ZZ-XX-DR-CD-0013 under the terms of the Drainage (Northern Ireland) Order 1973.

DfI Rivers is also satisfied with your proposals to discharge effluent at the total stated maximum rate of 0.258l/s to the undesignated watercourse as shown on Drawing no. BCN-ARP-ZZ-XX-DR-CD-0013 under the terms of the Drainage (Northern Ireland) Order 1973.

DfI Rivers is also satisfied with your proposals to discharge at your total stated maximum rates (63.1l/s to outfall SR-OF01, 13l/s to outfall SR-OF02 and 59.3l/s to outfall SR-OF03) to the undesignated watercourses as shown on Drawing no. GE-C-BOG-XX-055 under the terms of the Drainage (Northern Ireland) Order 1973. This consists of three separate discharge locations on two watercourses as shown on the above detail submitted with your application.

The Department accepts the outfall submitted with the same application as above and advises that it should be constructed in an appropriate scale to the size of the outlet pipe. The discharge pipes and outlet structures should be turned in the direction of flow and anti-scour measures taken to prevent bank and bed erosion.

Attenuation method is to be by using a hydrobrake fitted manhole and appropriate storage systems within the site.

The developer should also satisfy himself that the watercourse downstream from the proposed discharge locations should be free from obstructions such as silt, weed growth or debris to provide adequate outfall for storm discharge. This should be brought to the attention of the developer or landowner prior to discharge.

You should note that, in accordance with Paragraph 11 of Schedule 6 of the Drainage (Northern Ireland) Order 1973, any consents/ approvals given by DfI Rivers under Schedule 6 shall not affect the liability of any riparian/developer to comply with other legislation. It is your responsibility to contact any other parties which may have an interest in your proposals e.g. NIEA, Landowners, Fisheries etc.

You are requested to notify DfI Rivers of the commencement date of your works so that an inspection may take place during construction.

The Department would stress that it is your responsibility to ensure that the proposed works do not result in any obstruction to flow arising from blockage, structural failure, poor workmanship or any other reasons.

This is valid for a period of 24 months from the date of this letter. If proposals are not completed within this period of time they should be resubmitted for further appraisal.

Please quote the reference number at the top of this letter in any future correspondence.

Yours sincerely

Jonathan Steenson
Engineering Section

Dfl Rivers Lisburn

Department for Infrastructure
An Roinn Bonneagair
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Pete Gray
Arup
Bedford House
16-22 Bedford Street
Belfast
BT2 7FD

Ravarnet House
36 Altona Road
Lisburn, BT27 5QB
Tel: 028 92 606 100

Your ref:
Our ref: IN1-19-9442

Date: 20 March 2025

Dear Pete,

RE: IN1-19-9442 - Becon Schedule 6

Thank you for your Schedule 6 application to received 3 March 2025 regarding amending the previous letter dated 15 November 2024. From a drainage aspect my comments are as follows.

The Department for Infrastructure - Rivers Directorate is satisfied with your proposals to discharge at the total stated maximum rate of 201l/s to the watercourse as shown on your application. This watercourse is undesignated under the terms of the Drainage (Northern Ireland) Order 1973.

The Department is also satisfied with your proposals to discharge treated effluent at the total stated maximum rate of 5l/s to the watercourse as shown on your application Drawing No. BCN-ARP-ZZ-XX-DR-CD-0013 Rev P04. This watercourse is undesignated under the terms of the Drainage (Northern Ireland) Order 1973.

The Department is also satisfied with your proposals to discharge at your total stated maximum rates (63.1l/s to outfall SR-OF01, 13l/s to outfall SR-OF02 and 59.3l/s to outfall SR-OF03) to the undesignated watercourses as shown on Drawing no. GE-C-BOG-XX-055 under the terms of the Drainage (Northern Ireland) Order 1973. This consists of three separate discharge locations on two watercourses as shown on the above detail submitted with your prior application.

The Department accepts the outfall submitted with the same application as above and advises that it should be constructed in an appropriate scale to the size of the outlet pipe. The discharge pipes and outlet structures should be turned in the direction of flow and anti-scour measures taken to prevent bank and bed erosion.

Attenuation method is to be by using a hydrobrake fitted manhole and appropriate storage systems within the site.

The developer should also satisfy himself that the watercourse downstream from the proposed discharge locations should be free from obstructions such as silt, weed growth or debris to provide adequate outfall for storm discharge. This should be brought to the attention of the developer or landowner prior to discharge.

You should note that, in accordance with Paragraph 11 of Schedule 6 of the Drainage (Northern Ireland) Order 1973, any consents/ approvals given by DfI Rivers under Schedule 6 shall not affect the liability of any riparian/developer to comply with other legislation. It is your responsibility to contact any other parties which may have an interest in your proposals e.g. NIEA, Landowners, Fisheries etc.

You are requested to notify the Department of the commencement date of your works so that an inspection may take place during construction.

The Department would stress that it is your responsibility to ensure that the proposed works do not result in any obstruction to flow arising from blockage, structural failure, poor workmanship or any other reasons.

This is valid for a period of 24 months from the date of this letter. If proposals are not completed within this period of time they should be resubmitted for further appraisal.

Please quote the reference number at the top of this letter in any future correspondence.

Yours sincerely

Jonathan Steenson
Engineering Section

Appendix D

Calculations

D1 Drainage General Arrangements

A1

GENERAL NOTES:

1. ALL DIMENSIONS ARE IN METRES UNLESS STATED OTHERWISE.
2. VERIFYING DIMENSIONS. THE CONTRACTOR SHALL VERIFY DIMENSIONS AGAINST SUCH OTHER DRAWING OR SITE CONDITIONS AS PERTAIN TO THIS PART OF THE WORK
3. ALL LEVELS ARE IN ACCORDANCE WITH THE DATUM OF THE SITE SURVEY UNLESS STATED OTHERWISE.
4. EXISTING SERVICES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO DETERMINE AND VERIFY THE EXACT HORIZONTAL AND VERTICAL ALIGNMENT OF ALL SERVICES (BOTH UNDERGROUND AND OVERHEAD) BEFORE WORK COMMENCES.
5. THE CONTRACTOR SHALL CHECK THE LAYOUT, TYPE AND LEVEL OF ALL SERVICES PRIOR TO COMMENCING EXCAVATION WORKS. ANY ERRORS, OR DIFFERENCES TO THOSE LEVELS ASSUMED IN THE DESIGN, AND SHALL BE REPORTED TO THE PROJECT MANAGER IN ACCORDANCE WITH THE CONTRACT.
6. ALL NEW DRAINAGE TRENCHES SHALL BE EXCAVATED DOWN TO A FIRM BEARING STRATA.
7. ALL NEW DRAINAGE LAID TO FALLS OF LESS THAN 1:100 TO BE INSTALLED BY LASER ALIGNMENT METHOD.
8. WHERE REQUIRED; IT IS THE CONTRACTOR'S RESPONSIBILITY TO ENSURE THAT BEFORE ANY SEWER IS ABANDONED IT IS SUBJECT TO CCTV SURVEY AND ANY BRANCHES OF THAT SEWER ALSO TRACED TO THEIR ORIGIN.
9. ALL MANHOLE COVERS WITHIN LANDSCAPED AREAS SHALL HAVE A MIN. 300mm CONCRETE SURFACE SLAB.
10. IF IT IS DISCOVERED THAT THERE IS ANY DISCREPANCY BETWEEN GENERAL TECHNICAL SPECIFICATIONS (CESWI, THE NBS CIVIL ENGINEERING SPECIFICATION, SEWERS FOR ADOPTION) AND THE WORKS INFORMATION, THE ORDER OF PRECEDENCE FOR THE WORKS REQUIREMENTS IS AS FOLLOWS:
    - 10.1. BUILDING REGULATIONS;
    - 10.2. WORKS INFORMATION / CONTRACT DRAWINGS;
    - 10.3. GENERAL TECHNICAL SPECIFICATIONS.
11. PACKAGE TREATMENT PLANT: PACKAGE TREATMENT PLANT TO BE INSTALLED IN ACCORDANCE WITH NIEA REQUIREMENTS AND MANUFACTURER'S RECOMMENDATIONS.
12. EMERGENCY STORAGE: TO ENSURE THAT THE REQUIRED FINAL EFFLUENT QUALITY COMPLIANCE IS MAINTAINED, AN AUTOMATED EFFLUENT QUALITY TESTING SYSTEM, LINKED TO AN ACTUATED PENSTOCK WILL BE PROVIDED THAT WILL DIVERT FLOWS INTO AN EMERGENCY STORAGE TANK IN THE EVENT OF A QUALITY FAILURE. THIS NON-COMPLIANT EFFLUENT WILL THEN BE TANKERED OFF SITE FOR FURTHER TREATMENT.
13. ALL RWP'S & SVP BRANCHES TO BE 100mm DIA.
14. ALL GULLY OUTLET BRANCHES TO BE 150mm DIA.

KEY

- PROPOSED STORM DRAINAGE
- PROPOSED FOUL/TREATED FOUL DRAINAGE
- PROPOSED EMERGENCY OVERFLOW
- PROPOSED ANTI-EROSION STRIP
- PROPOSED OUTFALL ARRANGEMENT
- PROPOSED DRAINAGE CHANNEL
- PROPOSED FE PUMPING MAIN
- PROPOSED DEVELOPMENT
- PROPOSED MANHOLE
- PROPOSED GULLY

Do not scale

Rev	Date	Description	By	Chkd	Appd	Auth
P03	14/02/25	For Preliminary Information	PM	PG	PG	
P02	19/09/24	For Preliminary Information	PM	PG	PG	
P01	27/07/19	For Preliminary Information	PM	SF	PG	

ARUP

Bedford House 3rd Floor 16-22 Bedford Street
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www.arup.com

Client

INDAVER

Project Title

Becon Project

Drawing Title

GENERAL ARRANGEMENT
DRAINAGE LAYOUT
1 of 5

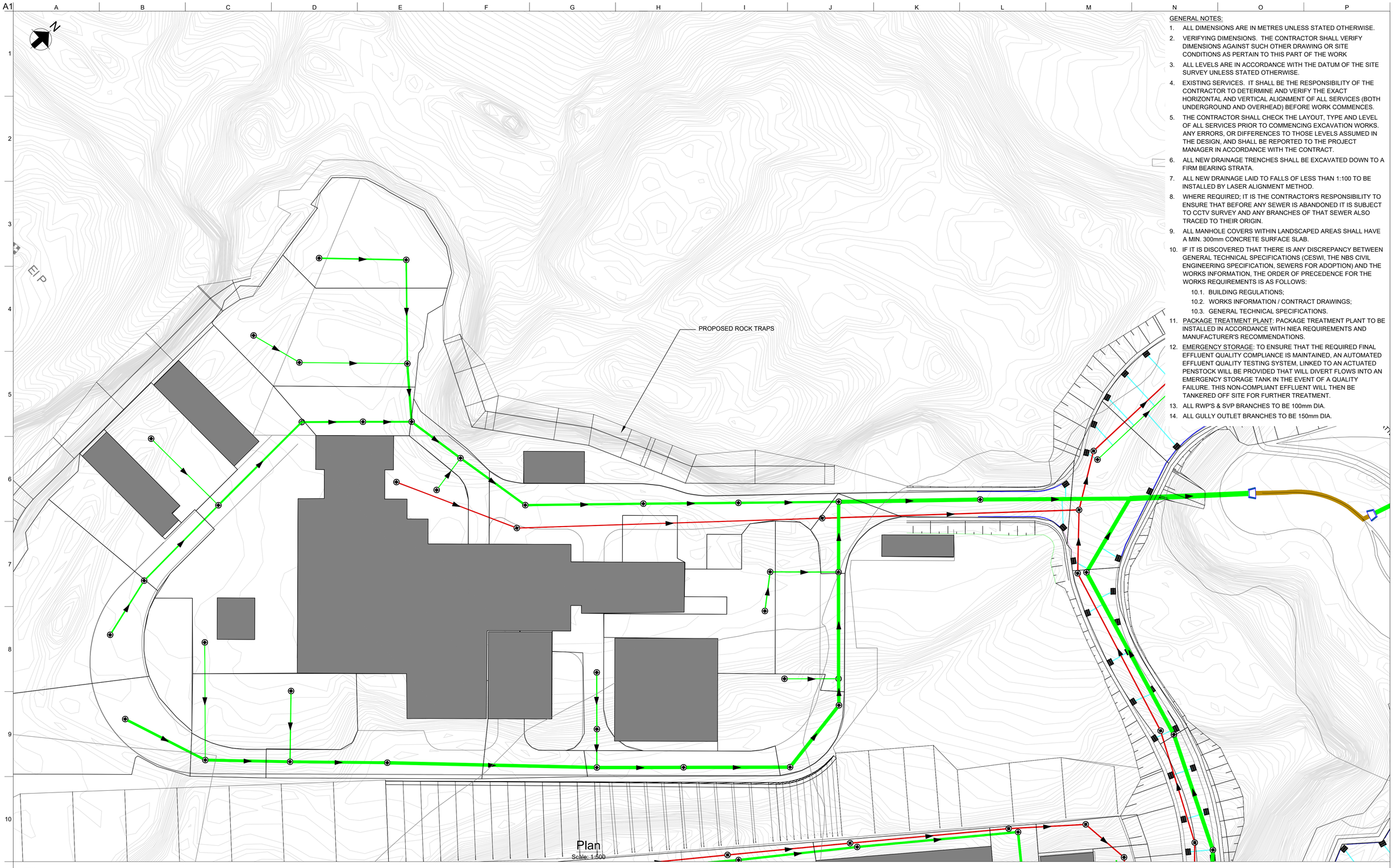
Scale at A1	1:500		Arup Job No	264848-00
Role	Civil Drainage			
Suitability	S2 - Issued For Preliminary Information			
Rev	By	Chkd	Appd	Auth
P03	PM	PG	PG	
	Date	Date	Date	Date
	14/02/2025	14/02/2025	14/02/2025	

Name

BCN - ARP - ZZ - 00 - DR - CH - 0101

Project | Originator | Volume | Location | Type | Role | Number

A1



Plan
Scale: 1:500

GENERAL NOTES:

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13. ALL RWP'S & SVP BRANCHES TO BE 100mm DIA.
14. ALL GULLY OUTLET BRANCHES TO BE 150mm DIA.

KEY

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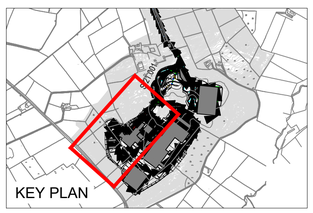
- PROPOSED FOUL/TREATED FOUL DRAINAGE
- PROPOSED EMERGENCY OVERFLOW
- PROPOSED ANTI-EROSION STRIP
- PROPOSED OUTFALL ARRANGEMENT
- PROPOSED DRAINAGE CHANNEL
- PROPOSED FE PUMPING MAIN
- PROPOSED DEVELOPMENT
- PROPOSED MANHOLE
- PROPOSED GULLY

Do not scale



Rev	Date	Description	By	Chkd	Appd	Auth
P03	14/02/25	For Preliminary Information	PM	PG	PG	
P02	19/09/24	For Preliminary Information	PM	PG	PG	
P01	27/07/19	For Preliminary Information	PM	SF	PG	

ARUP

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www.arup.com

Client

INDAVER

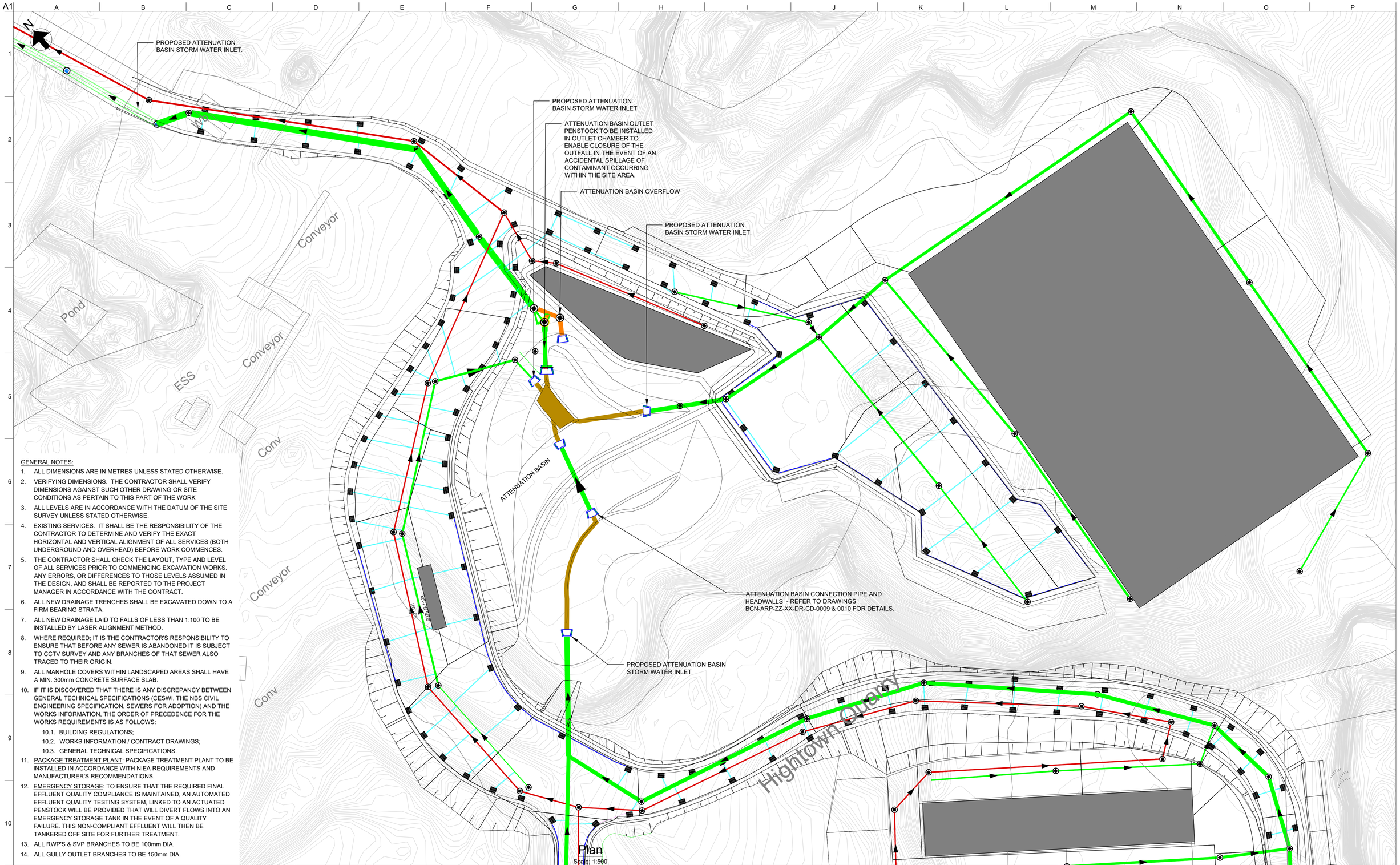
Project Title
Becon Project

Drawing Title
GENERAL ARRANGEMENT
DRAINAGE LAYOUT
2 of 5

Scale at A1	1:500		Arup Job No	264848-00	
Role	Civil Drainage				
Suitability	S2 - Issued For Preliminary Information				
Rev	By	Chkd	Appd	Auth	
P03	PM	PG	PG		
	Date 14/02/2025	Date 14/02/2025	Date 14/02/2025	Date	

Name
BCN - ARP - ZZ - 00 - DR - CH - 0102
Project | Originator | Volume | Location | Type | Role | Number

A1



Plan
Scale 1:500

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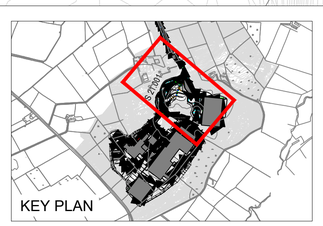
Do not scale



Rev	Date	Description	By	Chkd	Appd	Auth
P03	14/02/25	For Preliminary Information	PM	PG	PG	
P02	19/09/24	For Preliminary Information	PM	PG	PG	
P01	27/07/19	For Preliminary Information	PM	SF	PG	

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www.arup.com

Client

INDAVER

Project Title
Becon Project

Drawing Title
GENERAL ARRANGEMENT
DRAINAGE LAYOUT
3 of 5

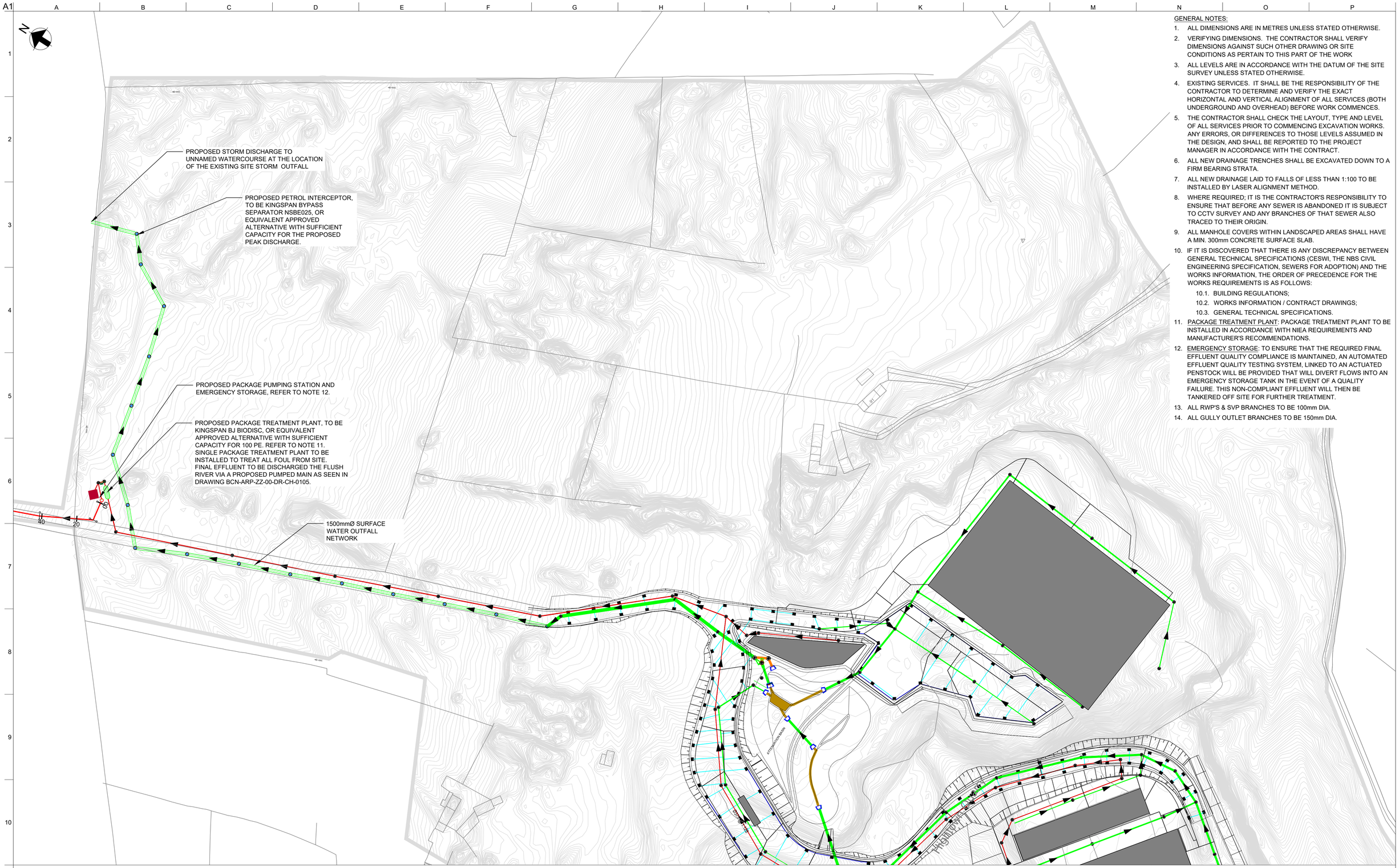
Scale at A1	1:500	Arup Job No	264848-00
Role	Civil Drainage		
Suitability	S2 - Issued For Preliminary Information		

Rev	By	Chkd	Appd	Auth
P03	PM	PG	PG	
	Date 14/02/2025	Date 14/02/2025	Date 14/02/2025	Date

Name

Project	Originator	Volume	Location	Type	Role	Number
BCN	ARP	ZZ	00	DR	CH	0103

A1



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Client: INDAVER

Project Title: Becon Project

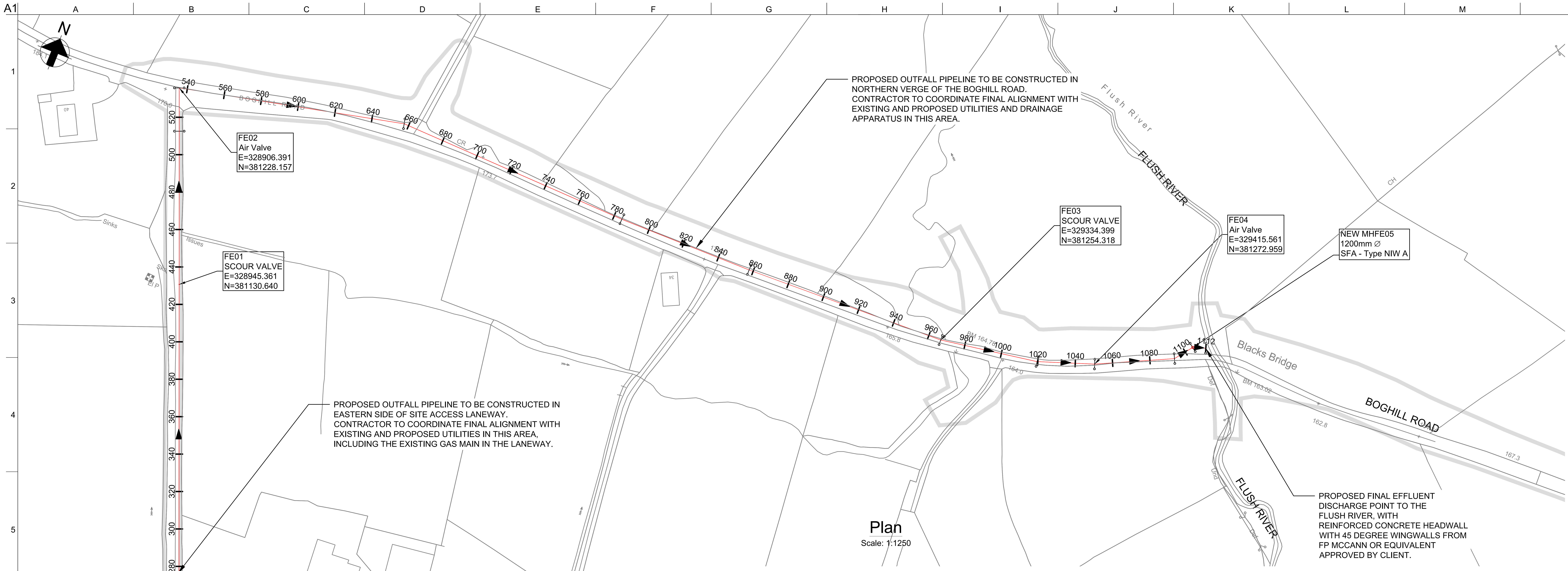
Drawing Title: GENERAL ARRANGEMENT DRAINAGE LAYOUT 4 of 5

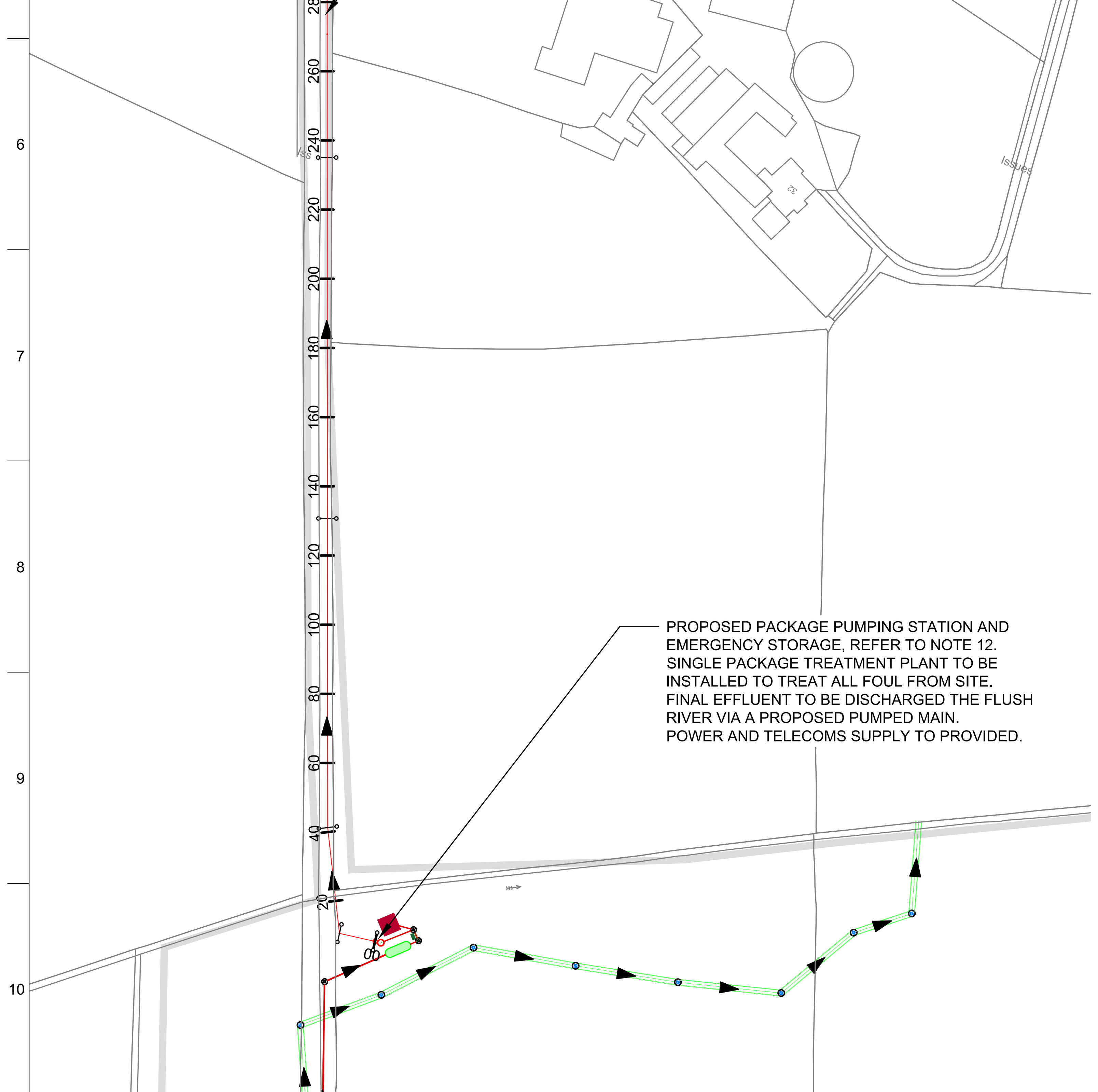
Scale at A1	1:500	Arup Job No	264848-00			
Role	Civil Drainage					
Suitability	S2 - Issued For Preliminary Information					
Rev	By	Chkd	Appd	Auth		
P03	PM	CM	PG			
	Date	Date	Date	Date		
	14/02/2025	14/02/2025	14/02/2025			

Name: BCN - ARP - ZZ - 00 - DR - CH - 0104

Project | Originator | Volume | Location | Type | Role | Number

A1 — A B C D E F G H I J K L M N O P





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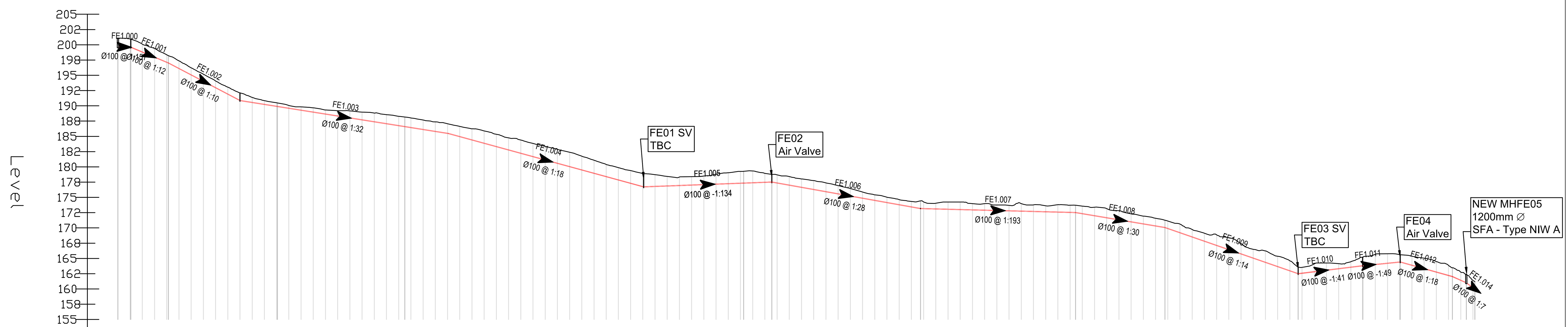

Chainage (m)	0.000 10.000 20.000 30.000 40.000 41.940 50.000 60.000 70.000 80.000 90.000 100.000 110.000 120.000 130.000 130.692 140.000 150.000 160.000 170.000 180.000 190.000 200.000 210.000 220.000 230.000 235.024 240.000 250.000 260.000 270.000 280.000 290.000 300.000 310.000 320.000 330.000 340.000 350.000 360.000 370.000 380.000 390.000 400.000 410.000 420.000 430.000 440.000 450.000 460.000 470.000 480.000 490.000 500.000 510.000 512.555 520.000 530.000 535.678 540.000 550.000 560.000 570.000 580.000 590.000 600.000 610.000 620.000 630.000 640.000 650.000 657.442 660.000 670.000 680.000 690.000 700.000 710.000 720.000 730.000 740.000 750.000 760.000 770.000 780.000 784.516 790.000 800.000 810.000 820.000 830.000 840.000 850.000 857.739 860.000 870.000 880.000 890.000 900.000 910.000 920.000 930.000 940.000 950.000 960.000 966.808 970.000 980.000 990.000 1000.000 1010.000 1020.000 1029.600 1030.000 1040.000 1050.000 1050.390 1060.000 1070.000 1080.000 1090.000 1093.143 1100.000 1104.579 1110.000 1112.625
Existing Levels	201.101 200.950 200.106 199.389 198.356 197.373 196.224 195.186 194.074 193.068 192.123 191.377 190.856 190.511 190.061 189.838 189.666 189.326 189.206 189.164 188.968 188.824 188.563 188.281 188.014 187.679 187.378 187.066 186.634 186.245 185.887 185.336 184.752 184.391 183.850 183.355 182.872 182.405 181.751 181.089 180.400 179.876 179.397 178.918 178.723 178.435 178.332 178.403 178.508 178.803 179.033 179.253 179.326 178.942 178.695 178.418 178.023 177.755 177.374 176.935 176.452 175.882 175.426 175.025 174.637 174.337 174.272 174.042 174.250 174.250 173.970 173.982 173.757 173.688 173.972 173.775 173.622 173.801 173.720 173.570 173.393 173.166 172.818 172.307 171.927 171.587 171.129 170.620 169.738 169.132 168.870 168.386 167.434 166.500 166.232 165.361 164.605 163.537 164.104 164.250 164.149 164.462 165.250 165.664 165.768 165.629 165.373 165.047 164.469 163.874 162.758 161.409
Proposed Main Invert Level (m)	199.617 199.549 196.968 190.823 185.416 176.680 177.465 173.124 172.467 170.005 162.445 163.742 164.365 161.981 160.959 159.933
Pipe Material	125mm OD PE100 SDR17 (×9 segments)
Pipe Bedding	Graded 20-5 Aggregate in Accordance with BS EN 1610 (×9 segments)

TREATED FOUL EFFLUENT DISCHARGE MAIN
SCALE: H 1:1000,V 1:200. DATUM: 155.000

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Rev	Date	Description	By	Chkd	Appd	Auth
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Project Title: Becon Project

Drawing Title: GENERAL ARRANGEMENT DRAINAGE LAYOUT 5 of 5

Scale at A1	As Shown
Arup Job No	264848-00
Role	Civil Drainage
Suitability	S2 - Issued For Preliminary Information
Rev	P01
By	PM, Date 14/02/2025
Chkd	CM, Date 14/02/2025
Appd	PG, Date 14/02/2025
Auth	
Name	BCN - ARP - ZZ - 00 - DR - CH - 0105 (Project - Originator - Volume - Location - Type - Role - Number)

D2 MicroDrainage Software Design Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	17.100	Add Flow / Climate Change (%)	20
Ratio R	0.300	Minimum Backdrop Height (m)	0.100
Maximum Rainfall (mm/hr)	550	Maximum Backdrop Height (m)	10.000
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)	125

Designed with Level Soffits

Network Design Table for Surface

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	21.203	0.170	124.7	0.180	4.00	0.0	0.600	o	375	Pipe/Conduit	
1.001	49.711	0.398	124.9	0.279	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.002	49.711	0.407	122.1	0.401	0.00	0.0	0.600	o	600	Pipe/Conduit	
2.000	67.337	0.539	124.9	0.321	4.00	0.0	0.600	o	375	Pipe/Conduit	
2.001	46.037	0.368	125.1	0.170	0.00	0.0	0.600	o	525	Pipe/Conduit	
2.002	31.903	0.255	125.1	0.200	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.003	57.389	0.459	125.0	0.330	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.004	42.718	0.342	124.9	0.101	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.005	42.716	0.342	124.9	0.090	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.006	42.717	0.342	124.9	0.116	0.00	0.0	0.600	o	750	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	57.22	4.22	258.425	0.180	0.0	0.0	7.4	1.62	179.0	44.6
1.001	55.14	4.67	258.180	0.459	0.0	0.0	18.3	1.82	289.1	109.6
1.002	53.56	5.05	257.707	0.860	0.0	0.0	33.3	2.20	622.7	199.6
2.000	55.06	4.69	258.425	0.321	0.0	0.0	12.8	1.62	178.9	76.6
2.001	53.45	5.08	257.886	0.491	0.0	0.0	19.0	2.00	433.3	113.8
2.002	52.41	5.34	257.518	0.691	0.0	0.0	26.2	2.00	433.2	157.0
1.003	50.99	5.72	257.038	1.882	0.0	0.0	69.3	2.50	1105.2	415.7
1.004	49.99	6.01	256.579	1.983	0.0	0.0	71.6	2.50	1105.7	429.5
1.005	49.04	6.29	256.237	2.073	0.0	0.0	73.4	2.50	1105.7	440.5
1.006	48.13	6.58	255.895	2.190	0.0	0.0	76.1	2.50	1105.7	456.7

Network Design Table for Surface

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
3.000	35.107	0.281	124.9	0.338	4.00	0.0	0.600	o	450	Pipe/Conduit	
3.001	50.322	0.403	124.9	0.351	0.00	0.0	0.600	o	450	Pipe/Conduit	
3.002	25.910	0.207	125.2	0.345	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.007	31.735	0.254	124.9	0.107	0.00	0.0	0.600	o	900	Pipe/Conduit	
1.008	31.735	0.254	124.9	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	
4.000	33.260	0.268	124.1	0.260	4.00	0.0	0.600	o	375	Pipe/Conduit	
4.001	32.608	0.265	123.0	0.121	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.002	37.138	0.280	132.6	0.149	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.003	34.281	0.280	122.4	0.140	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.004	46.404	0.383	121.2	0.126	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.005	47.804	0.383	124.8	0.121	0.00	0.0	0.600	o	525	Pipe/Conduit	
4.006	43.828	0.351	124.9	0.125	0.00	0.0	0.600	o	525	Pipe/Conduit	
4.007	20.106	0.161	124.9	0.211	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.009	21.397	0.171	125.1	0.090	0.00	0.0	0.600	o	900	Pipe/Conduit	
1.010	21.323	0.171	124.7	0.060	0.00	0.0	0.600	o	900	Pipe/Conduit	
5.000	35.663	0.285	125.1	0.181	4.00	0.0	0.600	o	300	Pipe/Conduit	
5.001	41.337	0.337	122.7	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
5.002	11.729	0.094	124.8	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)
3.000	56.73	4.32	258.425	0.338	0.0	0.0	13.8	1.82	289.1	83.1
3.001	54.67	4.78	258.144	0.689	0.0	0.0	27.2	1.82	289.2	163.3
3.002	53.68	5.02	257.666	1.034	0.0	0.0	40.1	1.82	288.8	240.5
1.007	47.55	6.77	255.479	3.331	0.0	0.0	114.4	2.80	1782.6	686.3
1.008	46.99	6.96	255.225	3.331	0.0	0.0	114.4	2.80	1782.6	686.3
4.000	56.64	4.34	258.500	0.260	0.0	0.0	10.6	1.63	179.5	63.8
4.001	55.30	4.64	258.232	0.381	0.0	0.0	15.2	1.83	291.3	91.4
4.002	53.81	4.99	257.892	0.530	0.0	0.0	20.6	1.76	280.5	123.6
4.003	52.57	5.30	257.612	0.670	0.0	0.0	25.4	1.84	292.0	152.6
4.004	51.01	5.72	257.332	0.796	0.0	0.0	29.3	1.85	293.6	176.0
4.005	49.62	6.12	256.874	0.917	0.0	0.0	32.9	2.00	433.8	197.2
4.006	48.43	6.48	256.491	1.043	0.0	0.0	36.5	2.00	433.7	218.8
4.007	47.95	6.64	256.140	1.254	0.0	0.0	43.4	2.18	615.8	260.6
1.009	46.62	7.08	254.971	4.675	0.0	0.0	157.4	2.80	1781.3	944.3
1.010	46.26	7.21	254.800	4.735	0.0	0.0	158.2	2.80	1784.4	949.0
5.000	56.26	4.42	257.989	0.181	0.0	0.0	7.4	1.40	99.3	44.1
5.001	54.14	4.91	257.704	0.181	0.0	0.0	7.4	1.42	100.3	44.1
5.002	53.57	5.05	256.402	0.181	0.0	0.0	7.4	1.41	99.4	44.1

Network Design Table for Surface

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.011	34.660	0.277	125.1	0.054	0.00	0.0	0.600	o	900	Pipe/Conduit	
1.012	49.740	0.398	125.0	0.094	0.00	0.0	0.600	o	900	Pipe/Conduit	
1.013	34.994	0.280	125.0	0.756	0.00	0.0	0.600	o	900	Pipe/Conduit	
1.014	52.939	0.424	124.9	0.210	0.00	0.0	0.600	o	900	Pipe/Conduit	
1.015	24.590	0.197	124.8	0.041	0.00	0.0	0.600	o	900	Pipe/Conduit	
6.000	25.842	0.219	118.0	0.756	4.00	0.0	0.600	o	525	Pipe/Conduit	
7.000	33.787	0.335	100.9	0.000	4.00	0.0	0.600	o	150	Pipe/Conduit	
6.001	24.332	0.226	107.7	0.147	0.00	0.0	0.600	o	600	Pipe/Conduit	
8.000	20.320	0.201	101.1	0.092	4.00	0.0	0.600	o	225	Pipe/Conduit	
6.002	27.938	0.345	81.0	0.241	0.00	0.0	0.600	o	600	Pipe/Conduit	
6.003	60.216	0.345	174.5	0.077	0.00	0.0	0.600	o	750	Pipe/Conduit	
9.000	16.278	0.262	62.1	0.060	4.00	0.0	0.600	o	225	Pipe/Conduit	
9.001	11.025	0.075	147.7	0.085	0.00	0.0	0.600	o	225	Pipe/Conduit	
6.004	24.908	0.220	113.2	0.126	0.00	0.0	0.600	o	750	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)
1.011	45.68	7.42	253.171	4.969	0.0	0.0	163.9	2.80	1781.3	983.6
1.012	44.89	7.71	249.397	5.063	0.0	0.0	164.1	2.80	1782.4	984.8
1.013	44.35	7.92	246.310	5.819	0.0	0.0	186.4	2.80	1782.3	1118.3
1.014	43.56	8.23	242.321	6.029	0.0	0.0	189.7	2.80	1783.2	1138.2
1.015	43.21	8.38	239.138	6.070	0.0	0.0	189.7	2.80	1783.5	1138.2
6.000	57.26	4.21	242.539	0.756	0.0	0.0	31.3	2.06	446.2	187.6
7.000	55.63	4.56	243.650	0.000	0.0	0.0	0.0	1.00	17.7	0.0
6.001	54.87	4.74	242.245	0.903	0.0	0.0	35.8	2.35	663.5	214.8
8.000	57.02	4.26	243.575	0.092	0.0	0.0	3.8	1.30	51.7	22.8
6.002	54.14	4.91	242.019	1.237	0.0	0.0	48.4	2.71	765.6	290.1
6.003	52.25	5.38	241.674	1.313	0.0	0.0	49.6	2.12	934.5	297.3
9.000	57.48	4.16	243.650	0.060	0.0	0.0	2.5	1.66	66.1	14.9
9.001	56.67	4.33	243.313	0.145	0.0	0.0	5.9	1.07	42.7	35.6
6.004	51.66	5.54	241.329	1.583	0.0	0.0	59.1	2.63	1161.7	354.5

Network Design Table for Surface

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
6.005	30.598	0.257	119.1	0.181	0.00	0.0	0.600	o	750	Pipe/Conduit	
6.006	22.642	0.197	114.9	0.094	0.00	0.0	0.600	o	750	Pipe/Conduit	
6.007	7.620	0.106	71.9	0.536	0.00	0.0	0.600	o	750	Pipe/Conduit	
10.000	15.533	0.156	99.6	0.000	4.00	0.0	0.600	o	150	Pipe/Conduit	
6.008	30.641	0.106	289.1	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
11.000	11.359	0.103	110.3	0.087	4.00	0.0	0.600	o	225	Pipe/Conduit	
11.001	19.646	0.196	100.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
6.009	20.204	0.212	95.3	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
12.000	25.032	0.279	89.7	0.251	4.00	0.0	0.600	o	300	Pipe/Conduit	
12.001	29.805	0.279	106.8	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
13.000	15.283	0.151	101.2	0.000	4.00	0.0	0.600	o	150	Pipe/Conduit	
13.001	31.004	0.307	101.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
12.002	16.736	0.302	55.4	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
14.000	18.378	0.182	101.0	0.311	4.00	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)
6.005	50.93	5.74	241.109	1.765	0.0	0.0	64.9	2.56	1132.7	389.5
6.006	50.42	5.88	240.777	1.858	0.0	0.0	67.7	2.61	1152.9	406.0
6.007	50.29	5.92	240.580	2.395	0.0	0.0	87.0	3.30	1459.3	521.8
10.000	57.03	4.26	243.650	0.000	0.0	0.0	0.0	1.01	17.8	0.0
6.008	49.24	6.23	240.474	2.395	0.0	0.0	87.0	1.64	724.9	521.8
11.000	57.53	4.15	243.650	0.087	0.0	0.0	3.6	1.24	49.5	21.8
11.001	56.35	4.40	243.547	0.087	0.0	0.0	3.6	1.31	51.9	21.8
6.009	48.85	6.35	240.368	2.482	0.0	0.0	87.6	2.87	1266.7	525.4
12.000	57.06	4.25	243.575	0.251	0.0	0.0	10.4	1.66	117.4	62.2
12.001	55.56	4.58	243.296	0.251	0.0	0.0	10.4	1.52	107.5	62.2
13.000	57.04	4.26	243.650	0.000	0.0	0.0	0.0	1.00	17.6	0.0
13.001	54.72	4.77	243.499	0.000	0.0	0.0	0.0	1.00	17.7	0.0
12.002	54.29	4.87	243.017	0.251	0.0	0.0	10.4	2.74	435.1	62.2
14.000	57.32	4.20	243.500	0.311	0.0	0.0	12.9	1.56	110.6	77.4

Network Design Table for Surface

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
14.001	30.397	0.301	101.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
15.000	27.188	0.269	101.1	0.000	4.00	0.0	0.600	o	150	Pipe/Conduit	
14.002	33.831	0.100	338.3	0.139	0.00	0.0	0.600	o	375	Pipe/Conduit	
14.003	17.577	0.064	275.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
14.004	13.984	0.066	211.9	0.079	0.00	0.0	0.600	o	375	Pipe/Conduit	
12.003	17.502	0.148	118.7	0.208	0.00	0.0	0.600	o	450	Pipe/Conduit	
16.000	11.438	0.113	101.2	0.000	4.00	0.0	0.600	o	150	Pipe/Conduit	
12.004	22.991	0.148	155.9	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
12.005	33.915	0.437	77.6	0.028	0.00	0.0	0.600	o	450	Pipe/Conduit	
12.006	27.312	0.183	149.2	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
12.007	28.800	0.121	238.0	0.056	0.00	0.0	0.600	o	475	Pipe/Conduit	
6.010	40.680	0.344	118.3	0.796	0.00	0.0	0.600	o	900	Pipe/Conduit	
6.011	42.984	0.344	125.0	0.113	0.00	0.0	0.600	o	900	Pipe/Conduit	
1.016	28.312	0.226	125.3	0.255	0.00	0.0	0.600	o	1200	Pipe/Conduit	
1.017	48.834	0.698	70.0	0.278	0.00	0.0	0.600	o	1200	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)
14.001	55.82	4.52	243.318	0.311	0.0	0.0	12.9	1.56	110.6	77.4
15.000	56.12	4.45	243.650	0.000	0.0	0.0	0.0	1.00	17.7	0.0
14.002	53.38	5.10	242.942	0.450	0.0	0.0	17.3	0.98	108.2	104.1
14.003	52.32	5.36	242.842	0.450	0.0	0.0	17.3	1.09	120.1	104.1
14.004	51.61	5.55	242.778	0.529	0.0	0.0	19.7	1.24	137.0	118.4
12.003	51.04	5.71	242.637	0.988	0.0	0.0	36.4	1.87	296.7	218.6
16.000	57.35	4.19	243.650	0.000	0.0	0.0	0.0	1.00	17.6	0.0
12.004	50.21	5.94	242.490	0.988	0.0	0.0	36.4	1.63	258.6	218.6
12.005	49.38	6.19	242.342	1.016	0.0	0.0	36.4	2.31	367.3	218.6
12.006	48.49	6.46	241.905	1.016	0.0	0.0	36.4	1.66	264.3	218.6
12.007	47.40	6.82	241.697	1.073	0.0	0.0	36.7	1.36	240.8	220.3
6.010	46.71	7.05	240.081	4.351	0.0	0.0	146.8	2.88	1832.5	880.5
6.011	45.98	7.31	239.736	4.464	0.0	0.0	148.2	2.80	1782.5	889.5
1.016	42.88	8.52	232.380	10.789	0.0	0.0	334.1	3.34	3779.2	2004.5
1.017	42.46	8.70	231.929	11.067	0.0	0.0	339.3	4.48	5062.1	2035.9

Network Design Table for Surface

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
17.000	41.743	0.334	125.0	0.170	4.00	0.0	0.600	o	300	Pipe/Conduit	
17.001	54.562	0.436	125.1	0.159	0.00	0.0	0.600	o	375	Pipe/Conduit	
18.000	57.571	0.461	124.9	0.491	4.00	0.0	0.600	o	450	Pipe/Conduit	
18.001	57.439	0.460	124.9	0.158	0.00	0.0	0.600	o	450	Pipe/Conduit	
19.000	38.997	0.195	200.0	0.173	4.00	0.0	0.600	o	300	Pipe/Conduit	
19.001	59.426	0.297	200.1	0.532	0.00	0.0	0.600	o	525	Pipe/Conduit	
19.002	59.426	0.297	200.1	0.207	0.00	0.0	0.600	o	600	Pipe/Conduit	
19.003	85.275	0.426	200.2	0.201	0.00	0.0	0.600	o	600	Pipe/Conduit	
18.002	24.935	0.125	200.0	0.054	0.00	0.0	0.600	o	750	Pipe/Conduit	
20.000	39.303	0.314	125.2	0.059	4.00	0.0	0.600	o	300	Pipe/Conduit	
20.001	5.198	0.042	123.8	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
17.002	31.952	0.160	199.7	0.586	0.00	0.0	0.600	o	750	Pipe/Conduit	
17.003	13.266	0.095	139.6	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
17.004	39.421	0.079	500.0	0.240	0.00	0.0	0.600	o	1200	Pipe/Conduit	
21.000	38.929	0.311	125.2	0.025	4.00	0.0	0.600	o	150	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)
17.000	55.93	4.50	233.479	0.170	0.0	0.0	6.8	1.41	99.3	41.1
17.001	53.53	5.06	233.070	0.328	0.0	0.0	12.7	1.62	178.7	76.1
18.000	55.79	4.53	232.775	0.491	0.0	0.0	19.8	1.82	289.1	118.6
18.001	53.54	5.05	232.314	0.649	0.0	0.0	25.1	1.82	289.2	150.5
19.000	55.52	4.59	232.781	0.173	0.0	0.0	6.9	1.11	78.3	41.6
19.001	52.91	5.21	232.411	0.705	0.0	0.0	26.9	1.58	342.0	161.6
19.002	50.75	5.79	232.064	0.912	0.0	0.0	33.4	1.72	485.7	200.5
19.003	48.01	6.62	231.767	1.113	0.0	0.0	38.6	1.72	485.6	231.5
18.002	47.37	6.83	231.340	1.816	0.0	0.0	62.1	1.98	872.6	372.7
20.000	56.06	4.47	232.232	0.059	0.0	0.0	2.4	1.40	99.2	14.4
20.001	55.79	4.53	231.918	0.059	0.0	0.0	2.4	1.41	99.8	14.4
17.002	46.58	7.10	231.215	2.789	0.0	0.0	93.8	1.98	873.3	562.8
17.003	46.31	7.19	231.055	2.789	0.0	0.0	93.8	2.37	1045.4	562.8
17.004	45.22	7.58	230.960	3.029	0.0	0.0	98.9	1.67	1884.5	593.5
21.000	54.93	4.72	238.078	0.025	0.0	0.0	1.0	0.90	15.8	5.8

Network Design Table for Surface

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
21.001	43.460	0.348	124.9	0.206	0.00	0.0	0.600	o	375	Pipe/Conduit	
21.002	43.460	0.348	124.9	0.127	0.00	0.0	0.600	o	375	Pipe/Conduit	
21.003	23.609	0.787	30.0	0.240	0.00	0.0	0.600	o	450	Pipe/Conduit	
21.004	39.384	0.300	131.3	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.018	39.915	1.331	30.0	0.203	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.019	36.516	1.217	30.0	0.000	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.020	30.515	2.543	12.0	0.000	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.021	66.240	5.520	12.0	0.000	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.022	9.585	0.799	12.0	0.000	0.00	0.0	0.600	o	1500	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)
21.001	53.08	5.17	236.932	0.231	0.0	0.0	8.8	1.62	178.9	53.1
21.002	51.37	5.62	233.327	0.358	0.0	0.0	13.3	1.62	178.9	79.6
21.003	50.99	5.72	232.979	0.598	0.0	0.0	22.0	3.72	592.1	132.1
21.004	49.70	6.09	231.861	0.598	0.0	0.0	22.0	1.77	282.0	132.1
1.018	42.26	8.79	230.789	14.897	0.0	0.0	454.7	7.84	13862.7	2728.0
1.019	42.09	8.87	229.458	14.897	0.0	0.0	454.7	7.84	13859.0	2728.0
1.020	42.00	8.91	228.241	14.897	0.0	0.0	454.7	12.41	21928.8	2728.0
1.021	41.80	9.00	225.698	14.897	0.0	0.0	454.7	12.41	21928.3	2728.0
1.022	41.77	9.01	220.178	14.897	0.0	0.0	454.7	12.41	21931.7	2728.0

Manhole Schedules for Surface

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
1	259.879	1.454	Open Manhole	1350	1.000	258.425	375				
2	259.881	1.701	Open Manhole	1350	1.001	258.180	450	1.000	258.255	375	
3	260.000	2.293	Open Manhole	1500	1.002	257.707	600	1.001	257.782	450	
4	260.000	1.575	Open Manhole	1350	2.000	258.425	375				
5	259.322	1.436	Open Manhole	1500	2.001	257.886	525	2.000	257.886	375	
6	260.000	2.482	Open Manhole	1500	2.002	257.518	525	2.001	257.518	525	
7	260.000	2.962	Open Manhole	1800	1.003	257.038	750	1.002	257.300	600	112
								2.002	257.263	525	
8	260.000	3.421	Open Manhole	1800	1.004	256.579	750	1.003	256.579	750	
9	260.000	3.763	Open Manhole	1800	1.005	256.237	750	1.004	256.237	750	
10	260.000	4.105	Open Manhole	1800	1.006	255.895	750	1.005	255.895	750	
11	260.000	1.575	Open Manhole	1350	3.000	258.425	450				
12	260.000	1.856	Open Manhole	1350	3.001	258.144	450	3.000	258.144	450	
13	260.000	2.334	Open Manhole	1350	3.002	257.666	450	3.001	257.741	450	75
14	260.000	4.521	Open Manhole	1800	1.007	255.479	900	1.006	255.553	750	
								3.002	257.459	450	1530
15	260.000	4.775	Open Manhole	1800	1.008	255.225	900	1.007	255.225	900	
16	260.000	1.500	Open Manhole	1350	4.000	258.500	375				
17	259.836	1.604	Open Manhole	1350	4.001	258.232	450	4.000	258.232	375	
18	259.738	1.846	Open Manhole	1350	4.002	257.892	450	4.001	257.967	450	75
19	259.224	1.612	Open Manhole	1350	4.003	257.612	450	4.002	257.612	450	
20	258.731	1.399	Open Manhole	1350	4.004	257.332	450	4.003	257.332	450	
21	258.630	1.756	Open Manhole	1500	4.005	256.874	525	4.004	256.949	450	
22	259.720	3.229	Open Manhole	1500	4.006	256.491	525	4.005	256.491	525	
23	259.675	3.535	Open Manhole	1500	4.007	256.140	600	4.006	256.140	525	
24	259.954	4.983	Open Manhole	1800	1.009	254.971	900	1.008	254.971	900	
								4.007	255.979	600	708
25	259.558	4.758	Open Manhole	1800	1.010	254.800	900	1.009	254.800	900	
26	259.414	1.425	Open Manhole	1200	5.000	257.989	300				
27	259.645	1.941	Open Manhole	1200	5.001	257.704	300	5.000	257.704	300	
28	258.755	2.353	Open Manhole	1200	5.002	256.402	300	5.001	257.367	300	965
29	257.708	4.537	Open Manhole	1800	1.011	253.171	900	1.010	254.629	900	1458
								5.002	256.308	300	2537
30	254.944	5.547	Open Manhole	1800	1.012	249.397	900	1.011	252.894	900	3497
31	250.920	4.610	Open Manhole	1800	1.013	246.310	900	1.012	248.999	900	2689
32	248.076	5.755	Open Manhole	1800	1.014	242.321	900	1.013	246.030	900	3709
33	243.777	4.639	Open Manhole	1800	1.015	239.138	900	1.014	241.897	900	2759
38	245.000	2.461	Open Manhole	1500	6.000	242.539	525				

Manhole Schedules for Surface

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
35	245.000	1.350	Open Manhole	1200	7.000	243.650	150				
39	245.000	2.755	Open Manhole	1500	6.001	242.245	600	6.000	242.320	525	
								7.000	243.315	150	620
40	245.000	1.425	Open Manhole	1200	8.000	243.575	225				
41	245.068	3.049	Open Manhole	1500	6.002	242.019	600	6.001	242.019	600	
								8.000	243.374	225	980
42	245.000	3.326	Open Manhole	1800	6.003	241.674	750	6.002	241.674	600	
43	245.000	1.350	Open Manhole	1200	9.000	243.650	225				
44	245.000	1.687	Open Manhole	1200	9.001	243.313	225	9.000	243.388	225	75
45	245.000	3.671	Open Manhole	1800	6.004	241.329	750	6.003	241.329	750	
								9.001	243.239	225	1385
46	245.000	3.891	Open Manhole	1800	6.005	241.109	750	6.004	241.109	750	
47	245.000	4.223	Open Manhole	1800	6.006	240.777	750	6.005	240.852	750	75
48	245.000	4.420	Open Manhole	1800	6.007	240.580	750	6.006	240.580	750	
46	245.000	1.350	Open Manhole	1200	10.000	243.650	150				
49	245.000	4.526	Open Manhole	1800	6.008	240.474	750	6.007	240.474	750	
								10.000	243.494	150	2420
57	245.000	1.350	Open Manhole	1200	11.000	243.650	225				
58	245.000	1.453	Open Manhole	1200	11.001	243.547	225	11.000	243.547	225	
49	245.000	4.632	Open Manhole	1800	6.009	240.368	750	6.008	240.368	750	
								11.001	243.351	225	2458
49	245.000	1.425	Open Manhole	1200	12.000	243.575	300				
50	244.901	1.605	Open Manhole	1200	12.001	243.296	300	12.000	243.296	300	
53	245.000	1.350	Open Manhole	1200	13.000	243.650	150				
54	245.000	1.501	Open Manhole	1200	13.001	243.499	150	13.000	243.499	150	
50	244.802	1.785	Open Manhole	1350	12.002	243.017	450	12.001	243.017	300	
								13.001	243.192	150	
52	245.000	1.500	Open Manhole	1200	14.000	243.500	300				
53	245.000	1.682	Open Manhole	1200	14.001	243.318	300	14.000	243.318	300	
54	245.000	1.350	Open Manhole	1200	15.000	243.650	150				
51	244.795	1.853	Open Manhole	1350	14.002	242.942	375	14.001	243.017	300	
								15.000	243.381	150	214
52	245.000	2.158	Open Manhole	1350	14.003	242.842	375	14.002	242.842	375	
53	245.000	2.222	Open Manhole	1350	14.004	242.778	375	14.003	242.778	375	
54	244.627	1.990	Open Manhole	1350	12.003	242.637	450	12.002	242.715	450	78
								14.004	242.712	375	
63	245.000	1.350	Open Manhole	1200	16.000	243.650	150				
60	244.813	2.324	Open Manhole	1350	12.004	242.490	450	12.003	242.490	450	

Manhole Schedules for Surface

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
								16.000	243.537	150	747
55	245.000	2.658	Open Manhole	1350	12.005	242.342	450	12.004	242.342	450	
56	244.640	2.735	Open Manhole	1350	12.006	241.905	450	12.005	241.905	450	
59	244.868	3.171	Open Manhole	1350	12.007	241.697	475	12.006	241.722	450	
60	245.000	4.919	Open Manhole	1800	6.010	240.081	900	6.009	240.156	750	
								12.007	241.576	475	1070
61	243.215	3.479	Open Manhole	1800	6.011	239.736	900	6.010	239.737	900	1
62	242.377	9.997	Open Manhole	2100	1.016	232.380	1200	1.015	238.941	900	6261
								6.011	239.392	900	6712
63	234.254	2.325	Open Manhole	2100	1.017	231.929	1200	1.016	232.154	1200	225
64	234.904	1.425	Open Manhole	1200	17.000	233.479	300				
65	234.645	1.575	Open Manhole	1350	17.001	233.070	375	17.000	233.145	300	
66	234.175	1.400	Open Manhole	1350	18.000	232.775	450				
67	234.175	1.861	Open Manhole	1350	18.001	232.314	450	18.000	232.314	450	
68	233.981	1.200	Open Manhole	1200	19.000	232.781	300				
69	234.092	1.681	Open Manhole	1500	19.001	232.411	525	19.000	232.586	300	
70	234.002	1.938	Open Manhole	1500	19.002	232.064	600	19.001	232.114	525	
71	234.095	2.328	Open Manhole	1500	19.003	231.767	600	19.002	231.767	600	
72	234.084	2.744	Open Manhole	1800	18.002	231.340	750	18.001	231.854	450	214
								19.003	231.341	600	
73	234.357	2.125	Open Manhole	1200	20.000	232.232	300				
74	234.135	2.217	Open Manhole	1200	20.001	231.918	300	20.000	231.918	300	
75	234.219	3.003	Open Manhole	1800	17.002	231.215	750	17.001	232.634	375	1044
								18.002	231.215	750	
								20.001	231.876	300	211
76	234.450	3.395	Open Manhole	1800	17.003	231.055	750	17.002	231.055	750	
77	234.450	3.490	Open Manhole	2100	17.004	230.960	1200	17.003	230.960	750	
78	242.254	4.176	Open Manhole	1200	21.000	238.078	150				
79	239.193	2.261	Open Manhole	1350	21.001	236.932	375	21.000	237.767	150	610
80	238.010	4.683	Open Manhole	1350	21.002	233.327	375	21.001	236.584	375	3257
81	234.479	1.500	Open Manhole	1350	21.003	232.979	450	21.002	232.979	375	
82	234.450	2.589	Open Manhole	1350	21.004	231.861	450	21.003	232.192	450	
83	234.541	3.752	Open Manhole	2400	1.018	230.789	1500	1.017	231.231	1200	142
								17.004	230.881	1200	
								21.004	231.561	450	547
84	233.416	3.958	Open Manhole	2400	1.019	229.458	1500	1.018	229.458	1500	
85	230.946	2.705	Open Manhole	2400	1.020	228.241	1500	1.019	228.241	1500	
86	229.095	3.397	Open Manhole	2400	1.021	225.698	1500	1.020	225.698	1500	

Manhole Schedules for Surface

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
87	223.777	3.599	Open Manhole	2400	1.022	220.178	1500	1.021	220.178	1500	
Outfall	223.200	3.821	Open Manhole	0		OUTFALL		1.022	219.379	1500	

PIPELINE SCHEDULES for Surface

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	375	1	259.879	258.425	1.079	Open Manhole	1350
1.001	o	450	2	259.881	258.180	1.251	Open Manhole	1350
1.002	o	600	3	260.000	257.707	1.693	Open Manhole	1500
2.000	o	375	4	260.000	258.425	1.200	Open Manhole	1350
2.001	o	525	5	259.322	257.886	0.911	Open Manhole	1500
2.002	o	525	6	260.000	257.518	1.957	Open Manhole	1500
1.003	o	750	7	260.000	257.038	2.212	Open Manhole	1800
1.004	o	750	8	260.000	256.579	2.671	Open Manhole	1800
1.005	o	750	9	260.000	256.237	3.013	Open Manhole	1800
1.006	o	750	10	260.000	255.895	3.355	Open Manhole	1800
3.000	o	450	11	260.000	258.425	1.125	Open Manhole	1350
3.001	o	450	12	260.000	258.144	1.406	Open Manhole	1350
3.002	o	450	13	260.000	257.666	1.884	Open Manhole	1350
1.007	o	900	14	260.000	255.479	3.621	Open Manhole	1800
1.008	o	900	15	260.000	255.225	3.875	Open Manhole	1800
4.000	o	375	16	260.000	258.500	1.125	Open Manhole	1350

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	21.203	124.7	2	259.881	258.255	1.251	Open Manhole	1350
1.001	49.711	124.9	3	260.000	257.782	1.768	Open Manhole	1500
1.002	49.711	122.1	7	260.000	257.300	2.100	Open Manhole	1800
2.000	67.337	124.9	5	259.322	257.886	1.061	Open Manhole	1500
2.001	46.037	125.1	6	260.000	257.518	1.957	Open Manhole	1500
2.002	31.903	125.1	7	260.000	257.263	2.212	Open Manhole	1800
1.003	57.389	125.0	8	260.000	256.579	2.671	Open Manhole	1800
1.004	42.718	124.9	9	260.000	256.237	3.013	Open Manhole	1800
1.005	42.716	124.9	10	260.000	255.895	3.355	Open Manhole	1800
1.006	42.717	124.9	14	260.000	255.553	3.697	Open Manhole	1800
3.000	35.107	124.9	12	260.000	258.144	1.406	Open Manhole	1350
3.001	50.322	124.9	13	260.000	257.741	1.809	Open Manhole	1350
3.002	25.910	125.2	14	260.000	257.459	2.091	Open Manhole	1800
1.007	31.735	124.9	15	260.000	255.225	3.875	Open Manhole	1800
1.008	31.735	124.9	24	259.954	254.971	4.083	Open Manhole	1800
4.000	33.260	124.1	17	259.836	258.232	1.229	Open Manhole	1350

PIPELINE SCHEDULES for Surface

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)
4.001	o	450	17	259.836	258.232	1.154	Open Manhole	1350
4.002	o	450	18	259.738	257.892	1.396	Open Manhole	1350
4.003	o	450	19	259.224	257.612	1.162	Open Manhole	1350
4.004	o	450	20	258.731	257.332	0.949	Open Manhole	1350
4.005	o	525	21	258.630	256.874	1.231	Open Manhole	1500
4.006	o	525	22	259.720	256.491	2.704	Open Manhole	1500
4.007	o	600	23	259.675	256.140	2.935	Open Manhole	1500
1.009	o	900	24	259.954	254.971	4.083	Open Manhole	1800
1.010	o	900	25	259.558	254.800	3.858	Open Manhole	1800
5.000	o	300	26	259.414	257.989	1.125	Open Manhole	1200
5.001	o	300	27	259.645	257.704	1.641	Open Manhole	1200
5.002	o	300	28	258.755	256.402	2.053	Open Manhole	1200
1.011	o	900	29	257.708	253.171	3.637	Open Manhole	1800
1.012	o	900	30	254.944	249.397	4.647	Open Manhole	1800
1.013	o	900	31	250.920	246.310	3.710	Open Manhole	1800
1.014	o	900	32	248.076	242.321	4.855	Open Manhole	1800
1.015	o	900	33	243.777	239.138	3.739	Open Manhole	1800

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)
4.001	32.608	123.0	18	259.738	257.967	1.321	Open Manhole	1350
4.002	37.138	132.6	19	259.224	257.612	1.162	Open Manhole	1350
4.003	34.281	122.4	20	258.731	257.332	0.949	Open Manhole	1350
4.004	46.404	121.2	21	258.630	256.949	1.231	Open Manhole	1500
4.005	47.804	124.8	22	259.720	256.491	2.704	Open Manhole	1500
4.006	43.828	124.9	23	259.675	256.140	3.010	Open Manhole	1500
4.007	20.106	124.9	24	259.954	255.979	3.375	Open Manhole	1800
1.009	21.397	125.1	25	259.558	254.800	3.858	Open Manhole	1800
1.010	21.323	124.7	29	257.708	254.629	2.179	Open Manhole	1800
5.000	35.663	125.1	27	259.645	257.704	1.641	Open Manhole	1200
5.001	41.337	122.7	28	258.755	257.367	1.088	Open Manhole	1200
5.002	11.729	124.8	29	257.708	256.308	1.100	Open Manhole	1800
1.011	34.660	125.1	30	254.944	252.894	1.150	Open Manhole	1800
1.012	49.740	125.0	31	250.920	248.999	1.021	Open Manhole	1800
1.013	34.994	125.0	32	248.076	246.030	1.146	Open Manhole	1800
1.014	52.939	124.9	33	243.777	241.897	0.980	Open Manhole	1800
1.015	24.590	124.8	62	242.377	238.941	2.536	Open Manhole	2100

PIPELINE SCHEDULES for Surface

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)
6.000	o	525	38	245.000	242.539	1.936	Open Manhole	1500
7.000	o	150	35	245.000	243.650	1.200	Open Manhole	1200
6.001	o	600	39	245.000	242.245	2.155	Open Manhole	1500
8.000	o	225	40	245.000	243.575	1.200	Open Manhole	1200
6.002	o	600	41	245.068	242.019	2.449	Open Manhole	1500
6.003	o	750	42	245.000	241.674	2.576	Open Manhole	1800
9.000	o	225	43	245.000	243.650	1.125	Open Manhole	1200
9.001	o	225	44	245.000	243.313	1.462	Open Manhole	1200
6.004	o	750	45	245.000	241.329	2.921	Open Manhole	1800
6.005	o	750	46	245.000	241.109	3.141	Open Manhole	1800
6.006	o	750	47	245.000	240.777	3.473	Open Manhole	1800
6.007	o	750	48	245.000	240.580	3.670	Open Manhole	1800
10.000	o	150	46	245.000	243.650	1.200	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)
6.000	25.842	118.0	39	245.000	242.320	2.155	Open Manhole	1500
7.000	33.787	100.9	39	245.000	243.315	1.535	Open Manhole	1500
6.001	24.332	107.7	41	245.068	242.019	2.449	Open Manhole	1500
8.000	20.320	101.1	41	245.068	243.374	1.469	Open Manhole	1500
6.002	27.938	81.0	42	245.000	241.674	2.726	Open Manhole	1800
6.003	60.216	174.5	45	245.000	241.329	2.921	Open Manhole	1800
9.000	16.278	62.1	44	245.000	243.388	1.387	Open Manhole	1200
9.001	11.025	147.7	45	245.000	243.239	1.536	Open Manhole	1800
6.004	24.908	113.2	46	245.000	241.109	3.141	Open Manhole	1800
6.005	30.598	119.1	47	245.000	240.852	3.398	Open Manhole	1800
6.006	22.642	114.9	48	245.000	240.580	3.670	Open Manhole	1800
6.007	7.620	71.9	49	245.000	240.474	3.776	Open Manhole	1800
10.000	15.533	99.6	49	245.000	243.494	1.356	Open Manhole	1800

PIPELINE SCHEDULES for Surface

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)
6.008	o	750	49	245.000	240.474	3.776	Open Manhole	1800
11.000	o	225	57	245.000	243.650	1.125	Open Manhole	1200
11.001	o	225	58	245.000	243.547	1.228	Open Manhole	1200
6.009	o	750	49	245.000	240.368	3.882	Open Manhole	1800
12.000	o	300	49	245.000	243.575	1.125	Open Manhole	1200
12.001	o	300	50	244.901	243.296	1.305	Open Manhole	1200
13.000	o	150	53	245.000	243.650	1.200	Open Manhole	1200
13.001	o	150	54	245.000	243.499	1.351	Open Manhole	1200
12.002	o	450	50	244.802	243.017	1.335	Open Manhole	1350
14.000	o	300	52	245.000	243.500	1.200	Open Manhole	1200
14.001	o	300	53	245.000	243.318	1.382	Open Manhole	1200
15.000	o	150	54	245.000	243.650	1.200	Open Manhole	1200
14.002	o	375	51	244.795	242.942	1.478	Open Manhole	1350

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)
6.008	30.641	289.1	49	245.000	240.368	3.882	Open Manhole	1800
11.000	11.359	110.3	58	245.000	243.547	1.228	Open Manhole	1200
11.001	19.646	100.2	49	245.000	243.351	1.424	Open Manhole	1800
6.009	20.204	95.3	60	245.000	240.156	4.094	Open Manhole	1800
12.000	25.032	89.7	50	244.901	243.296	1.305	Open Manhole	1200
12.001	29.805	106.8	50	244.802	243.017	1.485	Open Manhole	1350
13.000	15.283	101.2	54	245.000	243.499	1.351	Open Manhole	1200
13.001	31.004	101.0	50	244.802	243.192	1.460	Open Manhole	1350
12.002	16.736	55.4	54	244.627	242.715	1.462	Open Manhole	1350
14.000	18.378	101.0	53	245.000	243.318	1.382	Open Manhole	1200
14.001	30.397	101.0	51	244.795	243.017	1.478	Open Manhole	1350
15.000	27.188	101.1	51	244.795	243.381	1.264	Open Manhole	1350
14.002	33.831	338.3	52	245.000	242.842	1.783	Open Manhole	1350

PIPELINE SCHEDULES for Surface

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)
14.003	o	375	52	245.000	242.842	1.783	Open Manhole	1350
14.004	o	375	53	245.000	242.778	1.847	Open Manhole	1350
12.003	o	450	54	244.627	242.637	1.540	Open Manhole	1350
16.000	o	150	63	245.000	243.650	1.200	Open Manhole	1200
12.004	o	450	60	244.813	242.490	1.874	Open Manhole	1350
12.005	o	450	55	245.000	242.342	2.208	Open Manhole	1350
12.006	o	450	56	244.640	241.905	2.285	Open Manhole	1350
12.007	o	475	59	244.868	241.697	2.696	Open Manhole	1350
6.010	o	900	60	245.000	240.081	4.019	Open Manhole	1800
6.011	o	900	61	243.215	239.736	2.579	Open Manhole	1800
1.016	o	1200	62	242.377	232.380	8.797	Open Manhole	2100
1.017	o	1200	63	234.254	231.929	1.125	Open Manhole	2100
17.000	o	300	64	234.904	233.479	1.125	Open Manhole	1200
17.001	o	375	65	234.645	233.070	1.200	Open Manhole	1350

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)
14.003	17.577	275.0	53	245.000	242.778	1.847	Open Manhole	1350
14.004	13.984	211.9	54	244.627	242.712	1.540	Open Manhole	1350
12.003	17.502	118.7	60	244.813	242.490	1.874	Open Manhole	1350
16.000	11.438	101.2	60	244.813	243.537	1.126	Open Manhole	1350
12.004	22.991	155.9	55	245.000	242.342	2.208	Open Manhole	1350
12.005	33.915	77.6	56	244.640	241.905	2.285	Open Manhole	1350
12.006	27.312	149.2	59	244.868	241.722	2.696	Open Manhole	1350
12.007	28.800	238.0	60	245.000	241.576	2.949	Open Manhole	1800
6.010	40.680	118.3	61	243.215	239.737	2.578	Open Manhole	1800
6.011	42.984	125.0	62	242.377	239.392	2.085	Open Manhole	2100
1.016	28.312	125.3	63	234.254	232.154	0.900	Open Manhole	2100
1.017	48.834	70.0	83	234.541	231.231	2.110	Open Manhole	2400
17.000	41.743	125.0	65	234.645	233.145	1.200	Open Manhole	1350
17.001	54.562	125.1	75	234.219	232.634	1.210	Open Manhole	1800

PIPELINE SCHEDULES for Surface

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)
18.000	o	450	66	234.175	232.775	0.950	Open Manhole	1350
18.001	o	450	67	234.175	232.314	1.411	Open Manhole	1350
19.000	o	300	68	233.981	232.781	0.900	Open Manhole	1200
19.001	o	525	69	234.092	232.411	1.156	Open Manhole	1500
19.002	o	600	70	234.002	232.064	1.338	Open Manhole	1500
19.003	o	600	71	234.095	231.767	1.728	Open Manhole	1500
18.002	o	750	72	234.084	231.340	1.994	Open Manhole	1800
20.000	o	300	73	234.357	232.232	1.825	Open Manhole	1200
20.001	o	300	74	234.135	231.918	1.917	Open Manhole	1200
17.002	o	750	75	234.219	231.215	2.253	Open Manhole	1800
17.003	o	750	76	234.450	231.055	2.645	Open Manhole	1800
17.004	o	1200	77	234.450	230.960	2.290	Open Manhole	2100
21.000	o	150	78	242.254	238.078	4.026	Open Manhole	1200
21.001	o	375	79	239.193	236.932	1.886	Open Manhole	1350
21.002	o	375	80	238.010	233.327	4.308	Open Manhole	1350
21.003	o	450	81	234.479	232.979	1.050	Open Manhole	1350

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)
18.000	57.571	124.9	67	234.175	232.314	1.411	Open Manhole	1350
18.001	57.439	124.9	72	234.084	231.854	1.780	Open Manhole	1800
19.000	38.997	200.0	69	234.092	232.586	1.206	Open Manhole	1500
19.001	59.426	200.1	70	234.002	232.114	1.363	Open Manhole	1500
19.002	59.426	200.1	71	234.095	231.767	1.728	Open Manhole	1500
19.003	85.275	200.2	72	234.084	231.341	2.143	Open Manhole	1800
18.002	24.935	200.0	75	234.219	231.215	2.253	Open Manhole	1800
20.000	39.303	125.2	74	234.135	231.918	1.917	Open Manhole	1200
20.001	5.198	123.8	75	234.219	231.876	2.043	Open Manhole	1800
17.002	31.952	199.7	76	234.450	231.055	2.645	Open Manhole	1800
17.003	13.266	139.6	77	234.450	230.960	2.740	Open Manhole	2100
17.004	39.421	500.0	83	234.541	230.881	2.460	Open Manhole	2400
21.000	38.929	125.2	79	239.193	237.767	1.276	Open Manhole	1350
21.001	43.460	124.9	80	238.010	236.584	1.051	Open Manhole	1350
21.002	43.460	124.9	81	234.479	232.979	1.125	Open Manhole	1350
21.003	23.609	30.0	82	234.450	232.192	1.808	Open Manhole	1350

PIPELINE SCHEDULES for Surface

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)
21.004	o	450	82	234.450	231.861	1.314	Open Manhole	1350
1.018	o	1500	83	234.541	230.789	2.252	Open Manhole	2400
1.019	o	1500	84	233.416	229.458	2.458	Open Manhole	2400
1.020	o	1500	85	230.946	228.241	1.205	Open Manhole	2400
1.021	o	1500	86	229.095	225.698	1.897	Open Manhole	2400
1.022	o	1500	87	223.777	220.178	2.099	Open Manhole	2400

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)
21.004	39.384	131.3	83	234.541	231.561	1.705	Open Manhole	2400
1.018	39.915	30.0	84	233.416	229.458	2.458	Open Manhole	2400
1.019	36.516	30.0	85	230.946	228.241	1.205	Open Manhole	2400
1.020	30.515	12.0	86	229.095	225.698	1.897	Open Manhole	2400
1.021	66.240	12.0	87	223.777	220.178	2.099	Open Manhole	2400
1.022	9.585	12.0	Outfall	223.200	219.379	2.321	Open Manhole	0

Free Flowing Outfall Details for Surface

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.022	Outfall	223.200	219.379	0.000	0	0

Simulation Criteria for Surface

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet 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	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Region	Scotland and Ireland
Return Period (years)	1	M5-60 (mm)	17.100

Synthetic Rainfall Details

Ratio R	0.300	Cv (Winter)	0.750
Profile Type	Winter	Storm Duration (mins)	30
Cv (Summer)	1.000		

Online Controls for Surface

Hydro-Brake® Optimum Manhole: 83, DS/PN: 1.018, Volume (m³): 117.7

Unit Reference	MD-SHE-0492-1930-3150-1930
Design Head (m)	3.150
Design Flow (l/s)	193.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	492
Invert Level (m)	230.789
Minimum Outlet Pipe Diameter (mm)	Site Specific Design (Contact Hydro International)
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	3.150	193.0
Flush-Flo™	0.978	193.0
Kick-Flo®	2.129	159.4
Mean Flow over Head Range	-	165.4

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	12.5	1.200	191.7	3.000	188.4	7.000	285.3
0.200	45.8	1.400	189.1	3.500	203.2	7.500	295.1
0.300	92.7	1.600	185.5	4.000	216.9	8.000	304.6
0.400	143.2	1.800	179.8	4.500	229.8	8.500	313.8
0.500	179.2	2.000	169.8	5.000	241.9	9.000	322.8
0.600	185.3	2.200	162.0	5.500	253.5	9.500	331.4
0.800	191.6	2.400	169.0	6.000	264.5		
1.000	193.0	2.600	175.7	6.500	275.1		

Storage Structures for Surface

Tank or Pond Manhole: 83, DS/PN: 1.018

Invert Level (m) 230.789

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	800.0	1.000	1316.5	2.000	1961.1	3.000	2733.6
0.500	1042.3	1.500	1622.8	2.500	2331.4		

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	17.600	Add Flow / Climate Change (%)	20
Ratio R	0.300	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	100	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	60	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.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	20.004	1.334	15.0	0.030	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	20.004	1.334	15.0	0.028	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.002	20.000	1.333	15.0	0.026	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.003	20.027	1.335	15.0	0.024	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.004	20.020	1.335	15.0	0.022	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.005	20.020	1.335	15.0	0.023	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.006	20.020	1.335	15.0	0.033	0.00	0.0	0.600	o	250	Pipe/Conduit	
S1.007	20.020	0.667	30.0	0.044	0.00	0.0	0.600	o	250	Pipe/Conduit	
S1.008	20.020	0.160	125.1	0.048	0.00	0.0	0.600	oo	-1	Pipe/Conduit	
S1.009	20.020	0.160	125.0	0.051	0.00	0.0	0.600	oo	-2	Pipe/Conduit	
S1.010	20.020	0.160	125.0	0.055	0.00	0.0	0.600	oo	-2	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)
S1.000	54.80	5.13	221.584	0.030	0.0	0.0	0.9	2.61	46.2	5.3
S1.001	54.29	5.26	219.634	0.058	0.0	0.0	1.7	2.61	46.2	10.2
S1.002	53.78	5.38	217.433	0.084	0.0	0.0	2.4	2.61	46.2	14.6
S1.003	53.28	5.51	215.100	0.108	0.0	0.0	3.1	2.61	46.2	18.6
S1.004	52.80	5.64	213.035	0.130	0.0	0.0	3.7	2.61	46.2	22.3
S1.005	52.33	5.77	210.385	0.153	0.0	0.0	4.3	2.61	46.2	26.0
S1.006	51.99	5.86	208.185	0.187	0.0	0.0	5.3	3.63	178.3	31.5
S1.007	51.53	5.99	205.642	0.231	0.0	0.0	6.4	2.56	125.9	38.7
S1.008	51.11	6.11	203.160	0.278	0.0	0.0	7.7	2.80	3562.5	46.3
S1.009	50.74	6.21	202.701	0.329	0.0	0.0	9.0	3.08	5336.3	54.3
S1.010	50.37	6.32	201.560	0.384	0.0	0.0	10.5	3.08	5336.3	62.9

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.011	20.019	0.160	125.0	0.058	0.00	0.0	0.600	oo	-2	Pipe/Conduit	
S1.012	20.006	0.160	125.0	0.039	0.00	0.0	0.600	oo	-2	Pipe/Conduit	
S1.013	16.114	0.129	125.0	0.017	0.00	0.0	0.600	o	150	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)
S1.011	50.01	6.43	200.795	0.442	0.0	0.0	12.0	3.08	5336.3	71.9
S1.012	49.66	6.54	199.560	0.482	0.0	0.0	13.0	3.08	5335.5	77.8
S1.013	48.72	6.84	199.400	0.498	0.0	0.0	13.2	0.90	15.9«	78.9

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backd (mm
S1	223.250	1.666	Open Manhole	1200	S1.000	221.584	150				
S2	221.600	1.966	Open Manhole	1200	S1.001	219.634	150	S1.000	220.250	150	
S3	219.650	2.217	Open Manhole	1200	S1.002	217.433	150	S1.001	218.300	150	
S4	217.450	2.350	Open Manhole	1200	S1.003	215.100	150	S1.002	216.100	150	
S5	216.250	3.215	Open Manhole	1200	S1.004	213.035	150	S1.003	213.765	150	
S6	213.050	2.665	Open Manhole	1200	S1.005	210.385	150	S1.004	211.700	150	
S7	210.400	2.215	Open Manhole	1200	S1.006	208.185	250	S1.005	209.050	150	
S8	208.200	2.558	Open Manhole	1200	S1.007	205.642	250	S1.006	206.850	250	
S9	206.400	3.240	Open Manhole	3000	S1.008	203.160	-1	S1.007	204.975	250	
S10	204.800	2.099	Open Manhole	3000	S1.009	202.701	-2	S1.008	203.000	-1	
S11	204.000	2.440	Open Manhole	3000	S1.010	201.560	-2	S1.009	202.541	-2	
S12	203.500	2.705	Open Manhole	3000	S1.011	200.795	-2	S1.010	201.400	-2	
S13	202.735	3.175	Open Manhole	3000	S1.012	199.560	-2	S1.011	200.635	-2	
S14	201.500	2.100	Open Manhole	3000	S1.013	199.400	150	S1.012	199.400	-2	
SOutfall	202.000	2.729	Open Manhole	0		OUTFALL		S1.013	199.271	150	

PIPELINE SCHEDULES for Storm

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)
S1.000	o	150	S1	223.250	221.584	1.516	Open Manhole	1200
S1.001	o	150	S2	221.600	219.634	1.816	Open Manhole	1200
S1.002	o	150	S3	219.650	217.433	2.067	Open Manhole	1200
S1.003	o	150	S4	217.450	215.100	2.200	Open Manhole	1200
S1.004	o	150	S5	216.250	213.035	3.065	Open Manhole	1200
S1.005	o	150	S6	213.050	210.385	2.515	Open Manhole	1200
S1.006	o	250	S7	210.400	208.185	1.965	Open Manhole	1200
S1.007	o	250	S8	208.200	205.642	2.308	Open Manhole	1200
S1.008	oo	-1	S9	206.400	203.160	2.340	Open Manhole	3000
S1.009	oo	-2	S10	204.800	202.701	1.049	Open Manhole	3000
S1.010	oo	-2	S11	204.000	201.560	1.390	Open Manhole	3000
S1.011	oo	-2	S12	203.500	200.795	1.655	Open Manhole	3000
S1.012	oo	-2	S13	202.735	199.560	2.125	Open Manhole	3000
S1.013	o	150	S14	201.500	199.400	1.950	Open Manhole	3000

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)
S1.000	20.004	15.0	S2	221.600	220.250	1.200	Open Manhole	1200
S1.001	20.004	15.0	S3	219.650	218.300	1.200	Open Manhole	1200
S1.002	20.000	15.0	S4	217.450	216.100	1.200	Open Manhole	1200
S1.003	20.027	15.0	S5	216.250	213.765	2.335	Open Manhole	1200
S1.004	20.020	15.0	S6	213.050	211.700	1.200	Open Manhole	1200
S1.005	20.020	15.0	S7	210.400	209.050	1.200	Open Manhole	1200
S1.006	20.020	15.0	S8	208.200	206.850	1.100	Open Manhole	1200
S1.007	20.020	30.0	S9	206.400	204.975	1.175	Open Manhole	3000
S1.008	20.020	125.1	S10	204.800	203.000	0.900	Open Manhole	3000
S1.009	20.020	125.0	S11	204.000	202.541	0.409	Open Manhole	3000
S1.010	20.020	125.0	S12	203.500	201.400	1.050	Open Manhole	3000
S1.011	20.019	125.0	S13	202.735	200.635	1.050	Open Manhole	3000
S1.012	20.006	125.0	S14	201.500	199.400	1.050	Open Manhole	3000
S1.013	16.114	125.0	SOutfall	202.000	199.271	2.579	Open Manhole	0

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.030	0.030	0.030
1.001	User	-	100	0.028	0.028	0.028
1.002	User	-	100	0.026	0.026	0.026
1.003	User	-	100	0.024	0.024	0.024
1.004	User	-	100	0.022	0.022	0.022
1.005	User	-	100	0.023	0.023	0.023
1.006	User	-	100	0.033	0.033	0.033
1.007	User	-	100	0.044	0.044	0.044
1.008	User	-	100	0.048	0.048	0.048
1.009	User	-	100	0.051	0.051	0.051
1.010	User	-	100	0.055	0.055	0.055
1.011	User	-	100	0.058	0.058	0.058
1.012	User	-	100	0.039	0.039	0.039
1.013	User	-	100	0.017	0.017	0.017
				Total	Total	Total
				0.498	0.498	0.498

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.013	SOutfall	202.000	199.271	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet 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	0
Number of Online Controls	5	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)	2	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	17.600	Storm Duration (mins)	30
Ratio R	0.300		

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet 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	0
Number of Online Controls	5	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 0.300
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200
Return Period(s) (years)	100
Climate Change (%)	20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	480 Summer	100	+20%				
S1.001	S2	480 Summer	100	+20%				
S1.002	S3	480 Summer	100	+20%				
S1.003	S4	480 Summer	100	+20%				
S1.004	S5	480 Summer	100	+20%				
S1.005	S6	480 Summer	100	+20%				
S1.006	S7	480 Summer	100	+20%				
S1.007	S8	480 Summer	100	+20%				
S1.008	S9	480 Summer	100	+20%	100/480 Summer			
S1.009	S10	480 Summer	100	+20%	100/480 Summer			
S1.010	S11	480 Winter	100	+20%	100/480 Summer	100/480 Winter		
S1.011	S12	480 Winter	100	+20%	100/480 Summer	100/480 Winter		
S1.012	S13	600 Winter	100	+20%	100/480 Summer	100/480 Winter		
S1.013	S14	960 Winter	100	+20%	100/480 Summer	100/480 Winter		

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	221.606	-0.128	0.000	0.05		2.3	OK	
S1.001	S2	219.666	-0.118	0.000	0.10		4.4	OK	
S1.002	S3	217.471	-0.112	0.000	0.15		6.4	OK	
S1.003	S4	215.144	-0.106	0.000	0.19		8.3	OK	
S1.004	S5	213.084	-0.101	0.000	0.23		10.0	OK	
S1.005	S6	210.438	-0.097	0.000	0.27		11.8	OK	
S1.006	S7	208.235	-0.200	0.000	0.09		14.3	OK	
S1.007	S8	205.708	-0.184	0.000	0.16		17.7	OK	
S1.008	S9	204.301	0.241	0.000	0.01		19.0	SURCHARGED	
S1.009	S10	204.301	0.550	0.000	0.00		13.5	SURCHARGED	
S1.010	S11	204.000	1.390	0.322	0.00		9.5	FLOOD	1
S1.011	S12	203.504	1.659	3.548	0.00		8.7	FLOOD	2
S1.012	S13	202.741	2.131	5.610	0.00		7.2	FLOOD	4
S1.013	S14	201.506	1.956	5.705	0.34		5.0	FLOOD	6

D3 MicroDrainage Simulation Calculations for Q100 + 20% Climate Change

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet 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	1
Number of Online Controls	1	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 0.300
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	17.800	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS 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)	100
Climate Change (%)	20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	100	+20%					258.624
1.001	2	15 Winter	100	+20%					258.489
1.002	3	15 Winter	100	+20%					258.089
2.000	4	15 Winter	100	+20%					258.699
2.001	5	15 Winter	100	+20%					258.176
2.002	6	15 Winter	100	+20%					257.890
1.003	7	15 Winter	100	+20%					257.641
1.004	8	15 Winter	100	+20%	100/15 Winter				257.447
1.005	9	15 Winter	100	+20%	100/15 Summer				257.274
1.006	10	15 Winter	100	+20%	100/15 Summer				257.081
3.000	11	15 Winter	100	+20%	100/15 Summer				259.037
3.001	12	15 Winter	100	+20%	100/15 Summer				258.952
3.002	13	15 Winter	100	+20%	100/15 Summer				258.489
1.007	14	15 Winter	100	+20%	100/15 Summer				256.877
1.008	15	15 Winter	100	+20%	100/15 Summer				256.637
4.000	16	15 Winter	100	+20%					258.744
4.001	17	15 Winter	100	+20%					258.510
4.002	18	15 Winter	100	+20%	100/15 Summer				258.388
4.003	19	15 Winter	100	+20%	100/15 Summer				258.181
4.004	20	15 Winter	100	+20%	100/15 Summer				257.885

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.176	0.000	0.55		83.7	OK	
1.001	2	-0.141	0.000	0.80		209.6	OK	
1.002	3	-0.218	0.000	0.70		383.0	OK	
2.000	4	-0.101	0.000	0.85		144.0	OK	
2.001	5	-0.235	0.000	0.57		217.7	OK	
2.002	6	-0.153	0.000	0.83		304.0	OK	
1.003	7	-0.147	0.000	0.86		822.4	OK	
1.004	8	0.118	0.000	0.87		793.5	SURCHARGED	
1.005	9	0.287	0.000	0.79		718.1	SURCHARGED	
1.006	10	0.436	0.000	0.78		715.4	SURCHARGED	
3.000	11	0.162	0.000	0.54		137.1	SURCHARGED	
3.001	12	0.358	0.000	1.05		276.5	SURCHARGED	
3.002	13	0.373	0.000	1.70		412.5	SURCHARGED	
1.007	14	0.498	0.000	0.96		1093.3	SURCHARGED	
1.008	15	0.512	0.000	0.97		1096.7	SURCHARGED	
4.000	16	-0.131	0.000	0.75		120.5	OK	
4.001	17	-0.172	0.000	0.69		173.5	OK	
4.002	18	0.046	0.000	0.88		216.7	SURCHARGED	
4.003	19	0.119	0.000	1.02		260.6	SURCHARGED	
4.004	20	0.103	0.000	1.14		301.1	SURCHARGED	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
4.005	21	15 Winter	100	+20%					257.320
4.006	22	15 Winter	100	+20%	100/15 Winter				257.044
4.007	23	15 Winter	100	+20%					256.740
1.009	24	15 Winter	100	+20%	100/15 Summer				256.398
1.010	25	15 Winter	100	+20%	100/15 Summer				255.944
5.000	26	15 Winter	100	+20%					258.215
5.001	27	15 Winter	100	+20%					257.925
5.002	28	15 Summer	100	+20%	100/15 Summer				256.704
1.011	29	15 Winter	100	+20%	100/15 Summer				254.250
1.012	30	15 Winter	100	+20%	100/15 Summer				250.370
1.013	31	15 Winter	100	+20%	100/15 Summer				247.546
1.014	32	15 Winter	100	+20%	100/15 Summer				243.434
1.015	33	15 Winter	100	+20%	100/15 Summer				240.458
6.000	38	15 Summer	100	+20%					242.953
7.000	35	360 Winter	100	+20%					243.650
6.001	39	15 Summer	100	+20%					242.687
8.000	40	15 Winter	100	+20%					243.744
6.002	41	15 Winter	100	+20%					242.497
6.003	42	15 Winter	100	+20%					242.299
9.000	43	15 Winter	100	+20%					243.768
9.001	44	15 Winter	100	+20%	100/15 Summer				243.710
6.004	45	15 Winter	100	+20%	100/15 Summer				242.200
6.005	46	15 Winter	100	+20%	100/15 Summer				242.110
6.006	47	15 Winter	100	+20%	100/15 Summer				241.978
6.007	48	15 Winter	100	+20%	100/15 Summer				241.812
10.000	46	360 Winter	100	+20%					243.650
6.008	49	15 Winter	100	+20%	100/15 Summer				241.538
11.000	57	15 Summer	100	+20%					243.826
11.001	58	15 Summer	100	+20%					243.711
6.009	49	15 Winter	100	+20%	100/15 Summer				241.268
12.000	49	15 Winter	100	+20%	100/15 Summer				244.101
12.001	50	15 Winter	100	+20%	100/15 Summer				243.911
13.000	53	15 Winter	100	+20%					243.658
13.001	54	15 Winter	100	+20%	100/15 Winter				243.689
12.002	50	15 Winter	100	+20%	100/15 Summer				243.713
14.000	52	15 Winter	100	+20%	100/15 Summer				244.740
14.001	53	15 Winter	100	+20%	100/15 Summer				244.517
15.000	54	15 Winter	100	+20%	100/15 Summer				244.202
14.002	51	15 Winter	100	+20%	100/15 Summer				244.202
14.003	52	15 Winter	100	+20%	100/15 Summer				243.995
14.004	53	15 Winter	100	+20%	100/15 Summer				243.864
12.003	54	15 Winter	100	+20%	100/15 Summer				243.685
16.000	63	360 Winter	100	+20%					243.650
12.004	60	15 Winter	100	+20%	100/15 Summer				243.397
12.005	55	15 Winter	100	+20%	100/15 Summer				243.101
12.006	56	15 Winter	100	+20%	100/15 Summer				242.689
12.007	59	15 Winter	100	+20%	100/15 Summer				242.336
6.010	60	15 Winter	100	+20%	100/15 Winter				241.004
6.011	61	15 Winter	100	+20%					240.636

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
4.005	21	-0.079	0.000	0.85		326.5	OK	
4.006	22	0.028	0.000	0.94		357.1	SURCHARGED	
4.007	23	0.000	0.000	1.01		404.3	OK	
1.009	24	0.527	0.000	1.59		1518.5	SURCHARGED	
1.010	25	0.244	0.000	1.60		1526.7	SURCHARGED	
5.000	26	-0.074	0.000	0.91		83.5	OK	
5.001	27	-0.079	0.000	0.89		83.3	OK	
5.002	28	0.002	0.000	1.08		83.1	SURCHARGED	
1.011	29	0.179	0.000	1.34		1593.0	SURCHARGED	
1.012	30	0.073	0.000	1.13		1610.2	SURCHARGED	
1.013	31	0.336	0.000	1.52		1812.5	SURCHARGED	
1.014	32	0.213	0.000	1.26		1848.2	SURCHARGED	
1.015	33	0.420	0.000	1.85		1850.6	SURCHARGED	
6.000	38	-0.111	0.000	0.98		351.9	OK	
7.000	35	-0.150	0.000	0.00		0.0	OK	
6.001	39	-0.158	0.000	0.88		421.5	OK	
8.000	40	-0.056	0.000	0.92		42.9	OK	
6.002	41	-0.122	0.000	0.97		571.8	OK	
6.003	42	-0.125	0.000	0.71		573.0	OK	
9.000	43	-0.107	0.000	0.47		27.4	OK	
9.001	44	0.172	0.000	1.83		66.2	SURCHARGED	
6.004	45	0.121	0.000	0.82		599.5	SURCHARGED	
6.005	46	0.251	0.000	0.79		624.2	SURCHARGED	
6.006	47	0.451	0.000	0.93		647.9	SURCHARGED	
6.007	48	0.482	0.000	1.35		816.3	SURCHARGED	
10.000	46	-0.150	0.000	0.00		0.0	OK	
6.008	49	0.314	0.000	1.44		810.1	SURCHARGED	
11.000	57	-0.049	0.000	0.97		40.7	OK	
11.001	58	-0.061	0.000	0.87		40.8	OK	
6.009	49	0.150	0.000	1.15		829.0	SURCHARGED	
12.000	49	0.226	0.000	1.03		108.4	SURCHARGED	
12.001	50	0.315	0.000	0.98		96.0	SURCHARGED	
13.000	53	-0.142	0.000	0.01		0.1	OK	
13.001	54	0.040	0.000	0.20		3.4	SURCHARGED	
12.002	50	0.246	0.000	0.27		85.1	SURCHARGED	
14.000	52	0.940	0.000	1.15		109.8	FLOOD RISK	
14.001	53	0.899	0.000	1.06		106.4	SURCHARGED	
15.000	54	0.402	0.000	0.23		3.8	SURCHARGED	
14.002	51	0.885	0.000	1.51		145.9	SURCHARGED	
14.003	52	0.778	0.000	1.44		142.5	SURCHARGED	
14.004	53	0.710	0.000	1.54		164.7	SURCHARGED	
12.003	54	0.598	0.000	1.44		311.3	SURCHARGED	
16.000	63	-0.150	0.000	0.00		0.0	OK	
12.004	60	0.457	0.000	1.44		307.0	SURCHARGED	
12.005	55	0.309	0.000	0.98		313.4	SURCHARGED	
12.006	56	0.333	0.000	1.39		310.7	SURCHARGED	
12.007	59	0.164	0.000	1.58		323.1	SURCHARGED	
6.010	60	0.023	0.000	1.05		1382.2	SURCHARGED	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
6.011	61	0.000	0.000	1.04		1374.4	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.016	62	15 Winter	100	+20%	100/15 Summer			
1.017	63	240 Winter	100	+20%	100/30 Winter			
17.000	64	240 Winter	100	+20%	100/120 Winter			
17.001	65	240 Winter	100	+20%	100/60 Winter			
18.000	66	240 Winter	100	+20%	100/60 Summer			
18.001	67	240 Winter	100	+20%	100/15 Summer			
19.000	68	240 Winter	100	+20%	100/15 Summer			
19.001	69	240 Winter	100	+20%	100/30 Summer			
19.002	70	240 Winter	100	+20%	100/15 Winter			
19.003	71	240 Winter	100	+20%	100/15 Summer			
18.002	72	240 Winter	100	+20%	100/15 Summer			
20.000	73	240 Winter	100	+20%	100/15 Summer			
20.001	74	240 Winter	100	+20%	100/15 Summer			
17.002	75	240 Winter	100	+20%	100/15 Summer			
17.003	76	240 Winter	100	+20%	100/15 Summer			
17.004	77	240 Winter	100	+20%	100/15 Summer			
21.000	78	15 Winter	100	+20%				
21.001	79	15 Winter	100	+20%				
21.002	80	240 Winter	100	+20%	100/120 Winter			
21.003	81	240 Winter	100	+20%	100/60 Winter			
21.004	82	240 Winter	100	+20%	100/15 Summer			
1.018	83	240 Winter	100	+20%	100/15 Summer			
1.019	84	240 Winter	100	+20%				
1.020	85	240 Winter	100	+20%				
1.021	86	240 Winter	100	+20%				
1.022	87	240 Winter	100	+20%				

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.016	62	233.940	0.360	0.000	1.66		3251.5	SURCHARGED	
1.017	63	233.904	0.775	0.000	0.30		1005.1	SURCHARGED	
17.000	64	233.913	0.134	0.000	0.17		15.8	SURCHARGED	
17.001	65	233.910	0.465	0.000	0.18		30.6	SURCHARGED	
18.000	66	233.918	0.693	0.000	0.17		45.5	FLOOD RISK	
18.001	67	233.914	1.150	0.000	0.20		54.0	FLOOD RISK	
19.000	68	233.925	0.844	0.000	0.22		16.0	FLOOD RISK	
19.001	69	233.922	0.986	0.000	0.19		59.0	FLOOD RISK	
19.002	70	233.918	1.254	0.000	0.16		70.8	FLOOD RISK	
19.003	71	233.914	1.547	0.000	0.19		86.6	FLOOD RISK	
18.002	72	233.909	1.819	0.000	0.23		136.8	FLOOD RISK	
20.000	73	233.907	1.375	0.000	0.05		4.6	SURCHARGED	
20.001	74	233.906	1.688	0.000	0.06		3.8	FLOOD RISK	
17.002	75	233.906	1.941	0.000	0.34		213.1	SURCHARGED	
17.003	76	233.901	2.096	0.000	0.35		211.6	SURCHARGED	
17.004	77	233.898	1.738	0.000	0.17		230.5	SURCHARGED	
21.000	78	238.175	-0.053	0.000	0.74		11.4	OK	

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

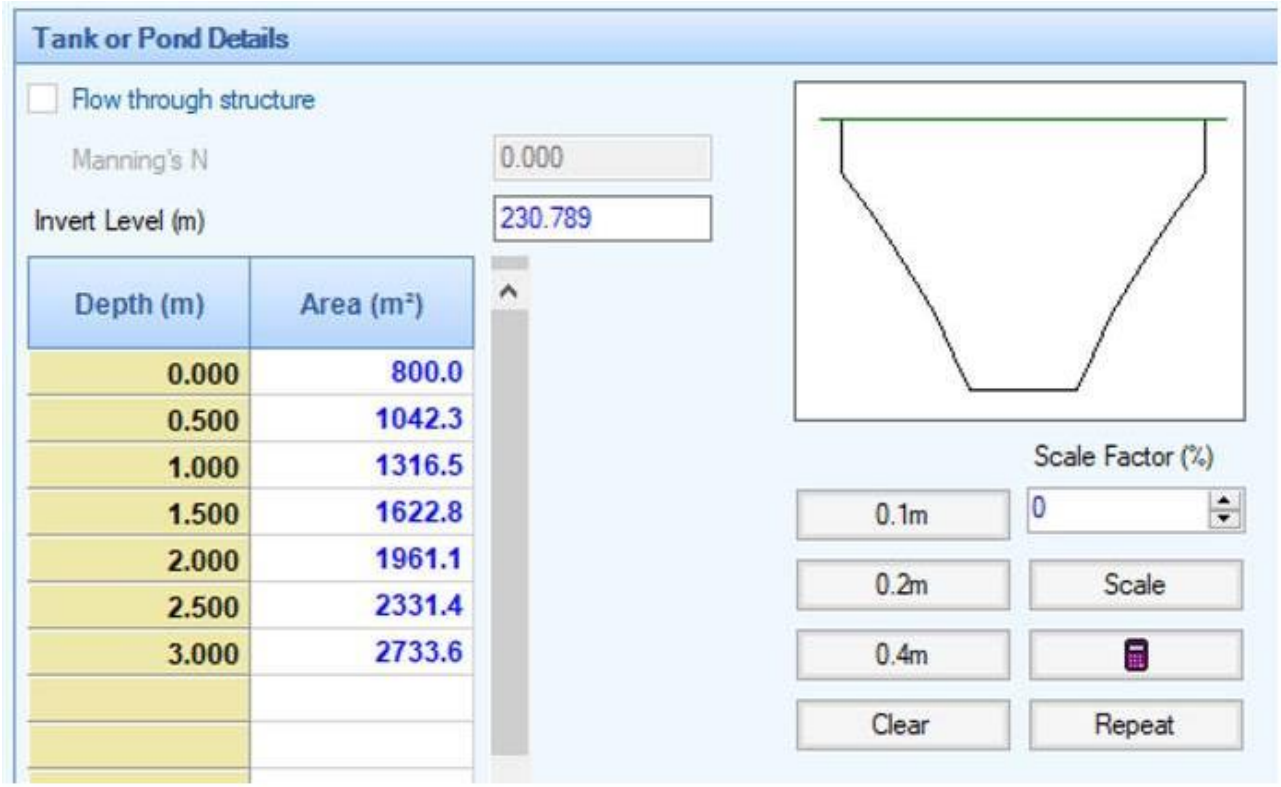
PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
21.001	79	237.154	-0.153	0.000	0.65		106.6	OK	
21.002	80	233.907	0.205	0.000	0.20		33.4	SURCHARGED	
21.003	81	233.903	0.474	0.000	0.11		55.7	SURCHARGED	
21.004	82	233.900	1.589	0.000	0.21		52.3	SURCHARGED	
1.018	83	233.897	1.608	0.000	0.03		191.7	SURCHARGED	
1.019	84	229.623	-1.335	0.000	0.03		191.7	OK	
1.020	85	228.377	-1.364	0.000	0.02		191.7	OK	
1.021	86	225.790	-1.408	0.000	0.01		191.7	OK	
1.022	87	220.357	-1.321	0.000	0.03		191.7	OK	

D4 Attenuation Basin Layout & Profile included in Software Drainage Model

ARUP

Subject	Becon Project Drainage Assessment		
Date	11 July 2019	**Job No/Ref**	264848-00 Appendix D

Microdrainage Attenuation Basin Layout &Profile



D5 Extracts from Schedule 6 Application for consent to discharge

(Estimation of runoff from main site area calculations)

(Boghill Road outfalls drawing & calculations)

(Main Site drainage proposals drawing)

Calculation Sheet

ARUP

Job title	Becon	Job number	Sheet number	Revision
		264848-00	1 of 1	P01
Calc title	Schedule 6 Approval Report Appendix A - Existing Runoff Calculations	Member/Location	Site Wide	
		Drg. Ref.	Refer to Schedule 6 Approval Report	
		Made by RM	Date 17/07/19	Chd. PG

Estimation of runoff from existing main site area

Existing Operational Area = 13.16 ha
Existing Landscape Area = 6.9 ha

Total Existing Site Area = 20.1 ha
(Refer to Figure 1 below)

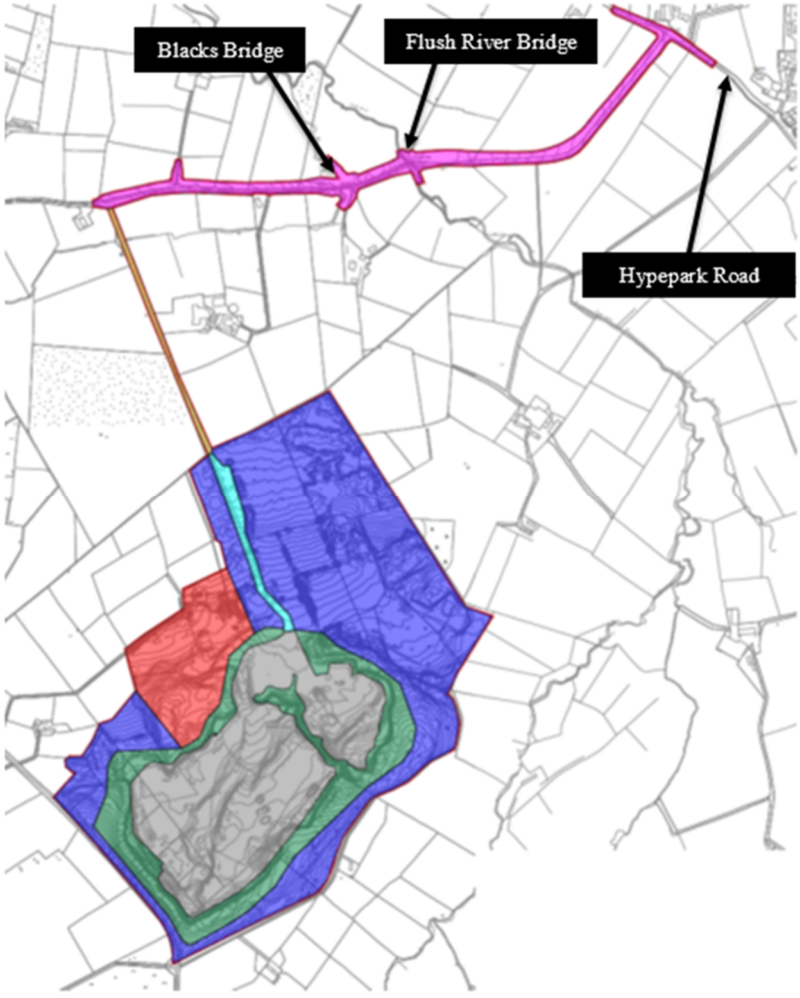


Figure 1: Proposed Catchment Areas

Existing greenfield runoff rate (Q100 based on 10 l/s/ha) $= 20.1 \times 10$
$= 201\ l/s$

Refer to Boghill Road Existing Runoff Calculation.

Calculation Sheet

ARUP

Job title	Becon	Job number	Sheet number	Revision
		264848-00	1 of 1	P01
Calc title	Schedule 6 Approval Report Appendix A – Boghill Road Runoff Calculations	Member/Location	Boghill Road	
		Drg. Ref.	Refer to Schedule 6 Approval Report	
		Made by	PM Date 17/07/19	Chd. PG

Existing and proposed runoff rates for a 1 in 100-year storm +10% Climate Change are calculated using the below equation:

$$Q_p = 2.78 C_v C_R i A \times CC$$

Catchment Areas:
Existing Catchment 1 – 0.413ha
Existing Catchment 2 – 0.473ha
Proposed Catchment 1 – 0.598ha
Proposed Catchment 2 – 0.150ha
Proposed Catchment 3 – 0.673ha

Runoff Calculations

Existing Catchment 1

$$Q_P = 2.78 \times 50 \times 1.1 \times 0.413$$
$$= 63.1\ l/s$$

Existing Catchment 2

$$Q_P = 2.78 \times 50 \times 1.1 \times 0.473$$
$$= 72.3\ l/s$$

Proposed Catchment 1

$$Q_P = 2.78 \times 50 \times 1.1 \times 0.598$$
$$= 91.4\ l/s$$

Proposed Catchment 2

$$Q_P = 2.78 \times 50 \times 1.1 \times 0.150$$
$$= 22.9\ l/s$$

Proposed Catchment 3

$$Q_P = 2.78 \times 50 \times 1.1 \times 0.598$$
$$= 102.9\ l/s$$

Outfall Ref	Irish Grid Coordinates	Catchment Area	Unattenuated Runoff Rate Q100 + 10% CC	Proposed Discharge Rate Q100 + 10% CC	Reinforeced concrete headwall pipe Diameter
		m^2	l/s	l/s	mm
SR-OF01	329458E 381290N	6731.79	102.9	63.1	300
SR-OF02	329451E 381286N	1493.11	22.9	13	225
SR-OF03	329316E 381240N	5975.89	91.4	59.3	375

*Note Road Drainage Pipe Networks designed to accommodate the 1 in 5 year event plus climate change in accordance with DMRB.

SR-OF01

SR-OF02

SR-OF03

PROPOSED CATCHMENTS	AREA
CATCHMENT 1	5975.890m²
CATCHMENT 2	1493.112m²
CATCHMENT 3	6731.793m²
EXISTING CATCHMENTS	AREA
CATCHMENT 1	4129.895m²
CATCHMENT 2	4729.967m²

1 PROPOSED DRAINAGE CATCHMENT PLAN
SCALE 1: 2000

ARUP DRAWING MARK-UP INCLUDING DETAILS FOR SCHEDULE 6 APPLICATION
AUTHORED BY: PM DATE: 17/07/19
CHECKED BY: PG DATE: 17/07/19
APPROVED BY: MM DATE: 17/07/19

Notes

1. ALL DIMENSIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. VERIFYING DIMENSIONS
   THE CONTRACTOR SHALL VERIFY DIMENSIONS AGAINST SUCH OTHER DRAWINGS OR SITE CONDITIONS AS PERTAINING TO THIS PART OF THE WORK.
3. DATUM: IRISH GRID
4. ALL WORKS SHALL COMPY WITH THE MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS.

Key to symbols

- PROPOSED CATCHMENT -1
- PROPOSED CATCHMENT -2
- PROPOSED CATCHMENT -3
- EXISTING CATCHMENT -1
- EXISTING CATCHMENT -2

Rev	Date	Drawn	Description	Ch'k'd	App'd
A	12/08/14	ML	REVISED ALIGNMENT	MK	SW

Client

arc 21
Walsh House
Fortwilliam Business Park
35 Dargan Road
Belfast BT3 9LZ

Title

ARC 21 RESIDUAL WASTE TREATMENT PROJECT
BOGHILL ROAD, PROPOSED DRAINAGE CATCHMENT PLAN

Designed	MK	02/08/12	Eng.Chk.	SW	02/08/12
Drawn	SV	02/08/12	Coordination	DMcF	02/08/12
Dwg.Chk.	DJM	02/08/12	Approved	SW	02/08/12
Scale @ A1	1: 2000	Project	5090959	Status	T
		CAD file	GE-C-BOG-XX-055-A.dwg		
Drawing No	GE-C-BOG-XX-055			Rev	A

A1

Outfall Ref	Irish Grid Coordinates	Catchment Area	Unattenuated Runoff Rate Q100 + 20% CC	Proposed Discharge Rate Q100 +20% CC	Reinforced concrete headwall pipe diameter
		m^2	l/s	l/s	mm
OF-S01	329280, 380843	201000	4304	201	300
OF-F01	329468, 381304	N/A	N/A (Foul Final Effluent)	5 (Foul Final Effluent)	300

Do not scale

Notes:
This Drawing is preliminary and is not for construction.

Rev	Date	Description	By	Chkd	Appd	Auth
P04	08/02/25	For Preliminary Information	PM	PG	PG	
P03	09/01/25	For Preliminary Information	PM	PG	PG	
P02	23/09/24	For Preliminary Information	PM	PG	PG	
P01	20/08/19	For Preliminary Information	PM	PG	PG	

ARUP

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Client
INDAVER

Project Title
Becon Project

Drawing Title
Main Site drainage proposals
For Schedule 6 approval

Scale at A1	Arup Job No
As Shown	264848-00

Role: Civil Drainage

Suitability: S2 - Issued For Information

Rev	By	Chkd	Appd	Auth
P04	PM	PG	PG	
	Date 08/02/2025	Date 08/02/2025	Date 08/02/2025	Date

Name: BCN - ARP - ZZ - XX - DR - CD - 0013
Project | Originator | Volume | Location | Type | Role | Number

D6 Boghill Road Flush River Bridge and Boghill Road Blacks Bridge Hydraulic Assessment

Calculation Sheet

ARUP

Job title	Becon	Job number	Sheet number	Revision
		264848		
Calc title	Flow assessment	Member/Location		
		Drg. Ref.		
		Made by PM	Date 02/07/19	Chd. PG

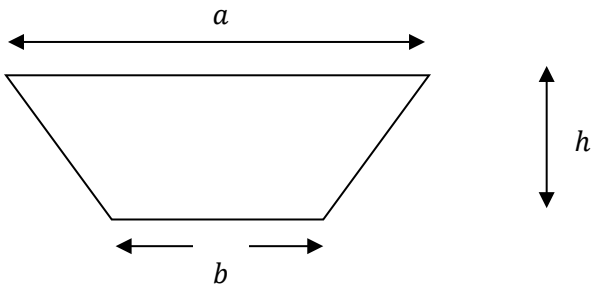
Flow calculated using the Poots & Cochrane Method:

$$Q_{bar} = 0.015AREA^{0.882}RSMD^{1.462}SOIL^{1.904}(1+URB)^{1.5}\left(1+0.3URB\left(\left(\frac{70}{102.4SOIL-0.56}\right)-1\right)\right)$$

Hydraulic Capacity of channel calculated using Manning's resistance equation:

$$Q = \frac{A^{1.667} * S^{0.5}}{n * P^{0.667}}$$

Where $A = h * \frac{a+c}{2}$



Boghill Road Flush River Culvert

Flow estimation
Catchment area = 416ha
Proportion paved = 0.05
SOIL from WRAP Map = 0.45
SAAR = 1025mm

∴ Q100 = 5853 l/sec (based on Poots & Cochrane formula)
Q100 + 20% CC = 7023.6 l/sec

Watercourse Hydraulic Capacity
a = 5.3m
b = 3.5m
h = 0.8
Longitudinal gradient = 1 in 35
Manning's n = 0.05 - refer to Table 2.1 within DMRB HA 107/04.
∴ Q = 8565.3 l/sec

Cross-section extracted from topographical survey, approximately 0.5m upstream of existing bridge.

Hydraulic assessment above shows that Q100 + 20% CC flow would be contained within the existing channel.

Calculation Sheet

ARUP

Job title	Becon	Job number	Sheet number	Revision
		264848		
Calc title	Flow assessment	Member/Location		
		Drg. Ref.		
		Made by PM	Date 02/07/19	Chd. PG

Boghill Road Blacks Bridge (Undesignated River) Culvert

Flow estimation
Catchment area = 140ha
Proportion paved = 0.05
SOIL from WRAP Map = 0.45
SAAR = 1025mm

∴ Q100 = 2065 l/sec (based on Poots & Cochrane formula)
Q100 + 20% CC = 2478 l/sec

Watercourse Capacity
a = 3.2m
b = 1.85m
h = 0.0.5
Longitudinal gradient = 1 in 7
Manning's n = 0.05 - refer to Table 2.1 within DMRB HA 107/04.

∴ Q = 5064.6 l/sec

Cross-section extracted from topographical survey, approximately 0.5m upstream of existing bridge.

Hydraulic assessment above shows that Q100 + 20% CC flow would be contained within the existing channel.

Clyde Shanks

Appendix 7.2

WFD Assessment

ARUP

Technical Note

Project title	Hightown/Becon
Job number	304122
File reference	File Reference
cc	
Prepared by	Francesca Abbotts
Date	21/02/2025
Subject	Water Framework Directive (WFD) Assessment

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DOCUMENT CHECKING

	Prepared by	Checked by	Approved by
Name	Francesca Abbotts	Matt Ross	David Hetherington
Signature			

1. Introduction

1.1 Project background

Arc21 has developed proposals to build integrated waste management infrastructure, referred to hereafter as 'the proposed development', at the Hightown Quarry site, Boghill Road within the Ballyutoag townland, Northern Ireland (NI); hereafter referred to as 'the proposed development site' or 'the site'. The project is part of an integrated solution proposed in the arc21 Waste Management Plan[1] and will contribute to the delivery of the Northern Ireland Waste Management Strategy[2] ,Circular Economy and Climated Change targets. The project will allow councils to treat residual waste in a sustainable manner, substantially reducing the need for landfill or export of this waste overseas, where it is used to fuel similar Energy from Waste plants abroad[3].

The proposed development site is located at Hightown Quarry, approximately 7.5km north-west of Belfast City Centre with an area equating to 20.1 hectares. The Ballymartin Water waterbody catchment size is approximately 37km^2.

[1] Arc21 Waste Management Plan. Available at: https://www.arc21.org.uk/what-we-do/waste-management-plan. Accessed: 15/10/2024.

[2]The Northern Ireland Waste Management Strategy/Waste Management Plan. Available at: https://www.daera-ni.gov.uk/articles/northern-ireland-waste-management-strategy-waste-management-plan. Accessed: 15/10/2024.

[3] The Becon Project, 2023. Available at: https://becon.co.uk/. Accessed: 15/10/2024.

An Environmental Impact Assessment (EIA) submission was made for the proposed development in March 2014, with addenda in September 2014, August 2016, March 2019, August 2019, October 2020, December 2020, May 2021 and September 2023. This technical note provides an updated Water Framework Directive (WFD)/Water Environment Regulations (WER)[4] assessment, to reflect changes to the proposed development, following submission of a previous WFD compliance assessment by Atkins (March 2019)[5].

Changes to the proposed development include separation of the storm and on-site treated foul (water) discharge from the operational site, with storm (i.e. surface water) discharge being made to an existing outfall and treated foul effluent being discharged (proposed 5l/s) to the Flush River via a dedicated c1.1km underground pumping main, with new outfall and headwall structure. These changes directly respond to consultation responses and requests from NIEA Water Management Unit to the Department for Infrastructure in April 2024 and to Arup in January 2025.

1.2 Purpose of this report

This WFD/WER screening assessment has been prepared to identify WFD water bodies that could potentially be affected by the proposed development, to establish what the potential effects could be on these waterbodies and to identify if any further assessment is required.

This document provides a revised WFD/WER assessment and acknowledges WFD work to date after the previous Atkins WFD (2019) assessment in order to understand proposed design changes. This includes updates to the WFD water bodies and/or their associated statuses and targets, based on review of the most publicly available data (likely to have changed since the 2019 Atkins report).

The key objectives of the assessment are to:

- Identify the relevant water bodies that may be affected by the proposed development and collate the available baseline information (where relevant);
- Identify relevant development components with the potential to affect the water bodies at the site, together with any embedded mitigation measures integrated into the current design; and
- Provide screening assessment of potential effects on the identified WFD water bodies and confirm the need for further assessment (if applicable).

This technical note summarises the proposed development (Section 1.3), the legislative context and assessment methodology (Sections 2 and 3, respectively) and provides the screening assessment (Section 4).

[4] The Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017 superseded the previous WFD legislation, following EU Exit.

[5] Appendix 3.1 to the Water Environment Chapter 2 (Drainage Assessment) (2019).

It should be noted that this report has been prepared on the best available information on the proposed development at the time of writing. Should the development components or any other underlying assumptions fundamentally change prior to obtainment of final construction consents, this WFD/WER screening assessment must be updated.

1.3 Proposed development

1.3.1 Location

The proposed development is located within the Hightown Quarry (Grid Reference NW 421363), approximately 2km south of Mallusk, in Ballyutoag townland, County Antrim.

The proposed development site is surrounded by:

- To the north by a boundary of security fencing, beyond which lies pastures[6] and Boghill Road, which provides access to the site;
- To the east by vertical quarry rock faces, followed by pastures;
- To the south by vertical quarry rock faces and natural grasslands;
- To the west by vertical quarry rock faces and Flush Road.

Currently (2025), the site holds a planning consent for extraction and production of basalt aggregate, asphalt concrete, block production, and an inert recycling facility. The facility is also surrounded by pastures and natural grasslands. Access is provided off Boghill Road, which is associated with existing storm water drainage channels/ditches and reedbed ponds.

The total area of the site equates to 20.1 hectares and sits entirely within the wider operational and ownership boundary.

Existing runoff from the site drains via a network of small ditches and streams to the Flush River that flows to Hydepark Dam before entering the Ballymartin Water. The Ballymartin Water is one of the main tributaries of the Six Mile Water that enters and flows into Lough Neagh adjacent to Lough Shore Park in Antrim. The proposed Boghill Road upgrade works will cross the Flush River and a tributary of the same watercourse via provision of two new structures.

Approximately 0.5km north east of the main site boundary, Flush River also splits off into Milewater that flows south to Belfast Harbour.

1.3.2 Development proposals

The proposed development, relating to the operation of the Residual Waste Treatment Facility will include:

- Mechanical and Biological Treatment (MBT) facility;
- Energy from Waste (EfW) Thermal Treatment facility;

[6] CORINE Land Cover data viewer. Available at: https://land.copernicus.eu/en/products/corine-land-cover. Accessed: 16/10/2024.

- Incinerator Bottom Ash (IBA) Treatment facility;
- Refuse Derived Fuel (RDF) Bale Storage building;
- Administration/Visitor Centre.

The proposed development also includes site infrastructure including the widening of the Boghill Road from its junction with Hydepark Road to the existing road into Hightown Quarry site and other ancillary works.

The original drainage proposals (as assessed in the Atkins WFD 2019) were for foul water to be treated by package treatment plants at each building, where required. The final effluent from these package treatment plants would then enter to the proposed site storm network, to be discharged to an unnamed watercourse through an existing outfall.

In response to consultation responses from NIEA Water Management Unit (WMU) dated 19 April 2024 and 15 January 2025, the foul flow is now to be treated by one larger package treatment plant, with the final effluent being discharged (proposed 5 l/s) to the Flush River via a dedicated c1.1km pumping main (see Appendix A for updated drainage proposals).

1.3.3 Construction

Following planning and permitting consent approval, the proposed development is anticipated to be constructed over a 41-month period. Construction will comprise[7]:

- Treatment to the existing quarry face
- Site set-up
- Existing structures and buildings
- Enabling works
- Boghill Road Upgrade Works
- MBT Construction
- EfW Construction
- Visitors Centre and Administration Building Construction
- Roads and drainage
- IBA treatment

During construction, activities will be controlled through the implementation of a Construction Management Plan (CMP). The CMP will identify 'best practice' mitigation measures to be used during construction and includes a Site Environmental Management Plan (SEMP) which is based on the Farrans[8] Environmental Management Systems, in accordance with the requirements of ISO 14001 and 50001.

Mitigation measures in the CMP are expected to include:

[7] Arc21 Residual Waste Treatment Facility Construction Management Plan March 2019, Draft Report. Accessed: 18/10/2024.

[8]Farrans Construction. Available at: https://www.farrans.com/about-us/. Accessed 15/10/2024.

- Best practice on working near watercourses, to prevent polluted surface water runoff (including sediment-laden water);
- All potential polluting substances e.g., fuel will be stored and managed appropriately by the contractor to reduce the risk of accidental spillages and/or discharges;
- There will be no direct discharge to surface water, groundwater, and appropriate measures to ensure effective incident control will be adhered to; and
- If needed, adherence will be made to best practice relating to groundwater control (e.g. CIRIA C750 (2016) or similar) and sheet piling (e.g. Westcott et al., 2003). Noise levels will also be monitored during any potentially loud works (excavation and piling).

1.3.4 Operation

Assuming all discharges will be made in accordance with the existing discharge consent (drainage consent applied for as part of this development[9]), the proposed development is not expected to result in potential detrimental emissions to water, once in operation. Foul flow is to be treated by a proposed Package Treatment Plant with the final effluent discharged to the Flush River via a dedicated c1.1km pumping main in accordance with NIEA WMU's April 2024 and January 2025 consultation (see Appendix A).

2. Legislative Context and Assessment Methodology

This section describes the legislative context, assessment methodology applied, study area and data sources used to inform the assessment.

2.1 Legislative context

The Water Environment (Water Framework Directive) (Northern Ireland) Regulations 2017 (WER), (Department of Agriculture, Environment and Rural Affairs, 2017) is currently the largest and most influential piece of legislation for the water environment and transposes the WFD into Northern Ireland law. The Department of Agriculture, Environment and Rural Affairs (DAERA) is responsible for implementation and regulation of the WFD in Northern Ireland.

The legislation takes an integrated approach to the sustainable management of water by considering the interactions between surface water, groundwater and water-dependent ecosystems.

Under the WFD/WER, water bodies are the basic management units and are defined as all or part of a river system or aquifer. These water bodies form part of a larger River Basin District (RBD), for which River Basin Management Plans (RBMPs) are developed and environmental objectives are set. These RBMPs are produced every six years, in accordance with River Basin Management Plan (RBMP) cycles. The WFD/WER requires classification of the current condition of water bodies. This is referred to as their 'status' or, for artificial or heavily modified water bodies, their 'potential'. The WFD/WER also requires the setting of a series of

[9] Following consultation with NIEA to provide separate storm and foul effluent discharge points this Drainage Assessment was revised in November 2024 and updated Schedule 6 approval was received from DfI Rivers on 15 November 2024. Following the further consultation from NIEA via email on 15 January 2025 the Drainage Assessment report has been revised and an updated Schedule 6 Application has been submitted to DfI Rivers. This subsequent Schedule 6 Discharge Consent was received on the 20th March 2025, valid until 20th March 2027.

objectives for maintaining or improving conditions so that water bodies reach and/or maintain at least 'Good' overall status or potential. These overall Environmental Objectives are:

- Prevent the deterioration in the status of aquatic ecosystems, protect them and improve the ecological condition of waters;
- Aim to achieve at least 'Good' status for all water bodies by 2015. Where this has not been possible and is subject to the criteria set out in the Directive, aim to achieve 'Good' status by 2021 or 2027;
- Meet the requirements of WFD Protected Areas[10]. This includes Drinking Water Protected Areas (DrWPRA), Shellfish Waters, Areas of Special Scientific Interest (ASSI), Special Protection Areas (SPAs), Special Areas of Conservation (SACs) and RAMSAR[11] sites;
- Promote sustainable use of water as a natural resource;
- Conserve habitats and species that depend directly on water;
- Progressively reduce or phase out the release of individual pollutants or groups of pollutants that present a significant threat to the aquatic environment;
- Progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants; and
- Contribute to mitigating the effects of floods and droughts.

All new (and on-going) activities in the water environment need to be guided by the requirements of the WFD/WER. This includes ensuring that no changes occur that could cause a deterioration of baseline status of a water body or would prevent achievement of the future status objectives of a water body.

2.2 WFD assessment

This screening assessment has been made in accordance with WFD/WER legislation, to identify activities related to the proposed development that may cause deterioration or prevent a water body from meeting its objectives. A source-pathway-receptor approach has been applied to determine potential effects. For example, construction activity (e.g. sediment stockpiling) could be a source for sediment-laden run-off, overland flow would be the pathway, and the receptor would be the receiving watercourse (e.g. a WFD water body). To this end, there must be a pathway between the source and receptor, for the activity to be screened in.

If identified, any such activities will be subject to further assessment as part of a detailed WFD/WER assessment, which would identify the need for additional mitigation (if necessary). Conversely, if this report concludes that activities related to the proposed development are not anticipated to significantly affect any water bodies, potential impacts can be screened out; no further assessment is required.

[10] As defined in Part 3 Protected Areas of the WER, including: drinking water protected areas or an area or body of water for the time being designated or otherwise identified to be providing for the protection of surface water and groundwater or for the conservation of habitats or species directly depending on water.

[11] Wetland site designated to be of international importance under the RAMSAR Convention.

2.3 Study area

To define the study area, a 2km (radius) buffer has been applied to screen proposed development activities and WFD water bodies or Protected Areas that could potentially be affected, based on professional judgement. This buffer is commensurate with the nature of the construction and operation phase activities associated with the proposed development.

2.4 Data sources

Various datasets and information sources have been used to inform this assessment, including:

- Previous Atkins WFD assessment 2019; (March 2019 ES addendum Chapter 3 and Appendix 3.1 refer);
- Environmental Statement Water Chapter; (March 2014 Chapter 7; Appendix 7.1 refer);
- Existing and proposed site plans for the proposed development (Appendix A); and
- Publicly available data, including but not limited to: the NIEA Water Information Request Viewer (website), NIEA Catchment Data Map Viewer, Natural Environment Map Viewer (website), Geological Survey of Northern Ireland (GSNI) GeoIndex, DAERA NI Groundwater Bodies, Catchment Based Approach Data Hub.

3. Water Body Scoping Assessment

3.1 Identification of WFD water bodies

Hightown Quarry boundary falls within, and involves works within, Ballymartin Water (UKGBNI1NB030305206) WFD/WER sub-catchment. Within this catchment and close to the site are the following tributaries/smaller waterbodies (Figure 3-1):

- Flush River
  - 0.1km east and 0.3km south of site boundary.
  - Flows northeast towards Hightown and Hydepark Dam.
- Milewater
  - Milewater meets Flush River 0.5km northeast of site boundary (see Figure 3-1).
  - According to the Flood Estimation Handbook[12] this river flows south from Upper Hightown Road to Belfast Harbour (via Lagan coastal interbasin waterbody (UKGBNI8NE023)).
- Hydepark Dam
  - Flush River discharges into the dam, approximately 1km north of the site boundary.

[12] https://fehweb.ceh.ac.uk/Map

- Ballymartin Water
    - Flush River flows into Hydepark Dam and eventually enters the designated Ballymartin Water which is one of the main tributaries of the Six Mile Water.

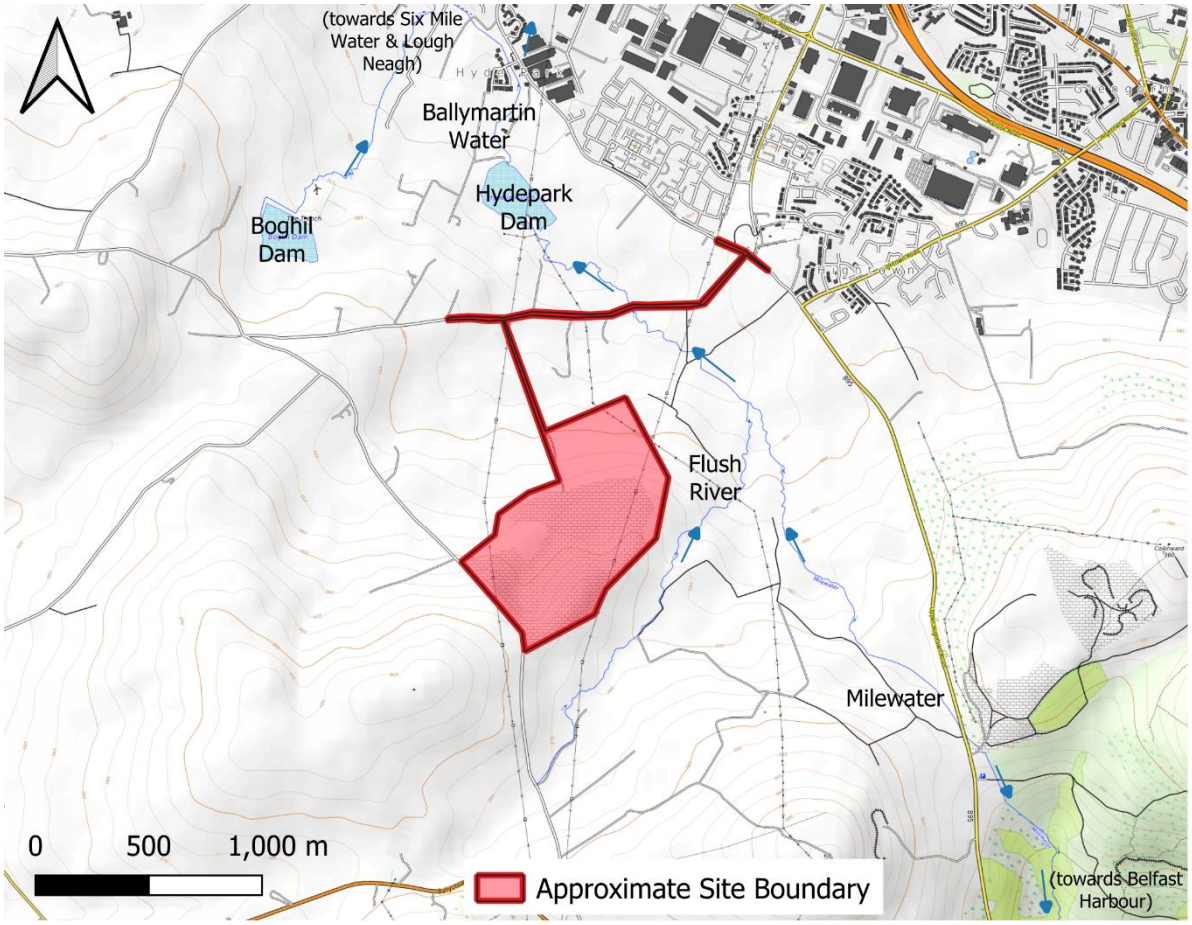

Figure 3-1. Location of site and associated watercourses.

Table 3.1 identifies WFD waterbodies within the study area.

Table 3.1: WFD water bodies identified within the study area

Water body	Water body ID	Water body type	Designation	Status (as of RBMP Cycle 3 2021-2027)	Area (km^2)	River Basin District	Approximate distance and direction from the proposed development	In hydrological connectivity with the proposed development?
Ballymartin Water	UKGBNI1NB030305206	River	Not Heavily Modified	Moderate	37	Neagh Bann	0km (overlaps proposed development)	Yes – existing site and proposed development discharge into this water body (Flush River).
Antrim	UKGBNI4NB005	Groundwater	Not Heavily Modified	Good	663	Neagh Bann	0km (overlaps proposed development)	Yes – GSNI data[13] shows that geology mostly comprises Lower Basalt Formation bedrock, suggesting potential to harbour relatively large volumes of groundwater. However, there is a dyke of microgabbro across the site which could either act as a barrier or a conduit for groundwater flow (depending on fractures).
Belfast Harbour	UKGBNI6NE180	Coastal	Heavily Modified	Moderate Ecological Potential (MEP)	3	North Eastern	6km southeast	Yes – located downstream, along Milewater.
Belfast Lough Inner	UKGBNI6NE090	Coastal	Not Heavily Modified	Moderate	50	North Eastern	5.6km east	Yes – located downstream, along Milewater.
Belfast Hills-Islandmagee	UKGBNI4NE004	Groundwater	Not Heavily Modified	Poor[14]	285	North Eastern	1.8km east and 1km south	Yes – located GSNI data shows that geology mostly comprises Lower Basalt Formation bedrock, suggesting potential to harbour relatively large volumes of groundwater.
Six Mile Water	UKGBNI1NB030305122	River	Heavily Modified[15]	Moderate Ecological Potential (MEP)	46	Neagh Bann	5km north west	Yes – located downstream, along Ballymartin Water.
Lough Neagh	UKGBNI3NB0032	Lake	Not Heavily Modified	Bad	392	Neagh Bann	19km east	Yes – located downstream, along Ballymartin Water and Six Mile Water which discharges into the lake.

[13]GSNI GeoIndex data viewer. Available at: https://mapapps2.bgs.ac.uk/GSNI_Geoindex/home.html. Accessed: 15/10/2024.

[14]NI WFD Groundwater chemical statuses. Available at: https://data.catchmentbasedapproach.org/datasets/theriverstrust::ni-wfd-groundwater-chemical-statuses/explore?location=54.649176%2C-6.780194%2C8.94&showTable=true. Accessed: 15/10/2024.

[15]NIEA, 2015. Available at: https://niopa.qub.ac.uk/bitstream/NIOPA/1111/1/six-mile-water-historical-status.pdf. Accessed: 15/10/2024.

Screening of WFD water bodies that could be affected by the proposed development is made in sub-section 4.4.

3.2 Identification of WFD Protected Areas

Table 3.2 identifies WFD Protected Areas that could potentially be affected by the proposed development.

Table 3.2: WFD Protected Areas identified within the study area

WFD Protected Area	Description	Approximate distance and direction from the proposed development[16]	In hydrological connectivity with the proposed development?
Antrim DrWPA (UKGBNIPA1_30005)	Designated as a Groundwater Drinking Water Protected Area.	0km (overlaps proposed development)	Yes – via Flush River (Ballymartin Water) / groundwater
Lough Neagh Catchment UWWTD (UKNI_CM00001)	Designated as an Urban Waste Water Treatment Directive Sensitive Area (June 2018)	0km (overlaps proposed development)	Yes – via Flush River (Ballymartin Water)
Ballymartin Water Upper FFD (UKGBNIIENB)	Designated as Freshwater Fish Directive Protected Area - River	0.1km east and 0.3km south	Yes – existing site and proposed development discharge into this water body (Flush River).
Belfast Hills Island Magee DrWPA (UKGBNIPA1_30017)	Designated as a Groundwater Drinking Water Protected Area	1.8km east and 1km south	Yes – via Flush River / Milewater / groundwater
Inner Belfast Lough Catchment UWWTD (UKNI_CM00023)	Designated as an Urban Waster Water Treatment Directive Sensitive Area (June 2018)	1.8km east and 1km south	Yes – via Flush River / Milewater
Ballymartin Water Lower FFD (UKGBNIIENB)	Designated as Freshwater Fish Directive Protected Area - River	4km north	Yes – Flush River flows through Hydepark Dam into Ballymartin Water
Belfast Lough (RAMSAR site 958[17])	SPA EC Directive; SSSI; ASSI; EU Natura 2000 The inner part of the lough comprises areas of intertidal foreshore composed of mudflats and lagoons, and land, both reclaimed and being reclaimed, which form important feeding/roosting site for significant numbers of wintering waders and wildfowl.	5.4km east	Yes – via Flush River / Milewater

[16] Measured from the quarry site boundary (not Boghill Road).

[17] RSIS. Available at: https://rsis.ramsar.org/ris/958. Accessed: 15/10/2024.

WFD Protected Area	Description	Approximate distance and direction from the proposed development[16]	In hydrological connectivity with the proposed development?
Six Mile Water Lower FFD (UKGBNIIENB)	Designated as Freshwater Fish Directive Protected Area - River	9km north west	Yes – Ballymartin Water is a tributary of Six Mile Water
Lough Neagh DrWPA (UKGBNIPA1_10034)	Designated as a Surface Water Drinking Water Protected Area.	19km west	Yes – via Ballymartin Water/Six Mile Water
Lough Neagh FFD (UKGBNI3NB0032)	Designated as a Freshwater Fish Directive – Lakes	19km west	Yes – via Ballymartin Water/Six Mile Water
Lough Neagh & Lough Beg (RAMSAR site 74[18])	RAMSAR site; NNR; SSSI; Wildfowl Refuge; EU Natura 2000 The largest freshwater lake in the British Isles, with a catchment of nearly 40% of the surface of NI and fed by major rivers. The site includes floodplains and marshes. Numerous species of waterbirds occur in nationally and internationally important numbers and include swans and ducks.	19km west	Yes – via Ballymartin Water/Six Mile Water

Screening of WFD Protected Areas that could be affected by the proposed development is made in sub-section 4.5.

4. Water Body Screening Assessment

4.1 Screened in potential effects (from the proposed development)

This section provides screening of potential effects from the proposed development, which could impact on the identified WFD water bodies or Protected Areas (sub-sections 3.4 and 3.5, respectively).

4.1.1 Construction Phase

During the construction phase there is potential for pollution of watercourses from suspended solids while pumping out trenches, foundations by direct run-off from quarry slopes, and site roads during extreme wet weather. There are several surface water drains leading to Flush River tributaries on the site, which potentially creates interception points for pollution and contamination.

[18]RSIS. Available at: https://rsis.ramsar.org/ris/74. Accessed: 15/10/2024.

Attention should also be given to the areas where the watercourses transect the roads to ensure that roadside drainage runs are treated before entering the watercourse. Impacts can therefore be avoided by adopting good construction practices, for example:

- Use of preconstruction drainage to divert run-off away from the stripped working area e.g. cut-off ditches.
- Land drains on the low side of excavations in high-risk areas where surface water is a problem will be plugged to stop water containing suspended solids from being transported to a watercourse.
- Use of filters such as natural vegetation, geotextiles, stone check dams etc.
- Use of settlement ponds/lagoons to treat run-off from hardstanding areas and when dewatering excavations, including management and maintenance of ponds.
- Use of above-ground settlement tanks.
- Use of check dams in steeper drains to slow down flows and aid settlement of silt.
- Filtration by pumping to grassland before discharge to watercourses.
- Good soil handling and storage methods including protection of stockpiles with geotextiles or re-establishing vegetation. Silt fencing can also be used at the toe of stockpiles when appropriate.

There is also a potential for pollution of watercourses from fuel, oil, and chemical spillage but these will be greatly reduced by following the CMP, and the requirements of the Control of Pollution (Oil Storage) Regulations (NI) 2010, which should be adhered to at all times.

As stated in the CMP, all works in or adjacent to watercourses will comply with NIEA requirements, and they will be consulted and discharge consents obtained for any proposals to discharge water from water mains and discharge of site runoff.

There are two waterbody crossings on Boghill Road to consider as part of the works. These existing culverts will need to be replaced, extended and strengthened to accommodate the new road alignment. One of the crossings requires no disturbance to the banks or bed of the river (due to in-line flexi-arch structure) whereas the other will be installed off-line with the watercourse diverting through this new culvert.

In discussions with NIEA following receipt of its consultation response to DfI dated 19 April 2024 it was agreed that the submission and agreement of a single, final Construction Management Plan will be the subject of a standard planning condition prior to commencement of construction and following appointment of a contractor who will inform and contribute to the final CMP. It was agreed that separate CMPs relating to bridge construction is not necessary and all related detail can be included in one document.

4.1.2 Operational Phase

Assuming that all surface water discharge is made in accordance with the existing Schedule 6 discharge consent (with no change to rate or volume of discharge, or water quality), there would be no significant risk to WFD water bodies from the operational phase.

Following a planning response from NIEA to DfI in January 2025, foul flow is now to be treated by a Package Treatment Plan (PTP), with the final effluent discharging to the Flush River via a new dedicated c1.1km pumping main (see Appendix A for drainage proposal).

4.2 Screening of WFD water bodies

For completeness, this section provides screening of identified WFD water bodies and Protected Areas.

Table 3.3 provides screening of the identified WFD water bodies (from Table 3.1).

Table 3.3: WFD water bodies screening

Water body	Water body ID	Water body type	Screened in or out	Justification
Ballymartin Water	UKGBNI1NB030305206	River	In	The proposed development directly interacts with the waterbody (Flush River), both in construction (e.g. bridges on Boghill Road) and in operation (e.g. foul flow discharged into watercourse). **Water body screened in**
Antrim	UKGBNI4NB005	Groundwater	In	The proposed development directly interacts with this waterbody. GSNI data[19] shows that geology mostly comprises Lower Basalt Formation bedrock, suggesting potential to harbour relatively large volumes of groundwater. However, there is a dyke of microgabbro across the site which could either act as a barrier or a conduit for groundwater flow (depending on fractures). **Water body screened in**
Lagan	UKGBNI8NE023	Transitional	Out	The proposed development does not directly interact with this water body. Potential for effects to be propagated downstream are also greatly reduced, due to use of mitigation and further still by virtue of distance and/or by way of dilution (relative to water body scale). **Water body screened out**
Belfast Harbour	UKGBNI6NE180	Coastal	Out	The proposed development does not directly interact with this water body. Potential for effects to be propagated downstream are also greatly reduced, due to use of mitigation and further still by virtue of distance and/or by way of dilution (relative to water body scale). **Water body screened out**
Belfast Lough Inner	UKGBNI6NE090	Coastal	Out	The proposed development does not directly interact with this water body. Potential for effects to be propagated downstream are also greatly reduced, due to use of mitigation and further still by virtue of distance and/or by way of dilution (relative to water body scale). **Water body screened out**
Belfast Hills-Islandmagee	UKGBNI4NE004	Groundwater	Out	The proposed development does not directly interact with this water body. Potential for effects to be propagated downstream are also greatly reduced, due to use of mitigation and further still by virtue of distance and/or by way of dilution (relative to water body scale). **Water body screened out**
Six Mile Water	UKGBNI1NB030305122	River	Out	The proposed development does not directly interact with this water body. Potential for effects to be propagated downstream are also greatly reduced, due to use of mitigation and further still by virtue of distance and/or by way of dilution (relative to water body scale). **Water body screened out**

[19] GSNI GeoIndex data viewer. Available at: https://mapapps2.bgs.ac.uk/GSNI_Geoindex/home.html. Accessed: 15/10/2024.

Water body	Water body ID	Water body type	Screened in or out	Justification
Lough Neagh	UKGBNI3NB0032	Lake	Out	The proposed development does not directly interact with this water body. Potential for effects to be propagated downstream are also greatly reduced, due to use of mitigation and further still by virtue of distance and/or by way of dilution (relative to water body scale). **Water body screened out**

4.3 Screening of WFD Protected Areas

Table 3.4 provides screening of the identified WFD Protected Areas (from Table 3.2).

Table 3.4: Screening of WFD Protected Areas

WFD Protected Area	Screened in or out	Justification
Antrim DrWPA (UKGBNIPA1_30005)	In	The proposed development directly interacts with this waterbody. GSNI data[20] shows that geology mostly comprises Lower Basalt Formation bedrock, suggesting potential to harbour relatively large volumes of groundwater. However, there is a dyke of microgabbro across the site which could either act as a barrier or a conduit for groundwater flow (depending on fractures). **Water body screened in**
Lough Neagh Catchment UWWTD (UKNI_CM00001)	In	The proposed development directly interacts with this protected area (Flush River), both in construction (e.g. bridges on Boghill Road) and in operation (e.g. foul flow discharged into watercourse). **Water body screened in**
Ballymartin Water Upper FFD (UKGBNIIENB)	In	The proposed development directly interacts with the waterbody (Flush River), both in construction (e.g. bridges on Boghill Road) and in operation (e.g. foul flow discharged into watercourse). **Water body screened in**
Belfast Hills Island Magee DrWPA (UKGBNIPA1_30017)	Out	The proposed development does not directly interact with this Protected Area. Potential for effects to be propagated downstream are also greatly reduced, due to use of mitigation and further still by virtue of distance and/or by way of dilution (relative to water body scale). **Water body screened out**

[20] GSNI GeoIndex data viewer. Available at: https://mapapps2.bgs.ac.uk/GSNI_Geoindex/home.html. Accessed: 15/10/2024.

WFD Protected Area	Screened in or out	Justification
Inner Belfast Lough Catchment UWWTD (UKNI_CM00023)	Out	The proposed development does not directly interact with this Protected Area. Potential for effects to be propagated downstream are also greatly reduced, due to use of mitigation and further still by virtue of distance and/or by way of dilution (relative to water body scale). **Water body screened out**
Ballymartin Water Lower FFD (UKGBNIIENB)	Out	The proposed development does not directly interact with this Protected Area. Potential for effects to be propagated downstream are also greatly reduced, due to use of mitigation and further still by virtue of distance and/or by way of dilution (relative to water body scale). **Water body screened out**
Belfast Lough (RAMSAR site 958[21])	Out	The proposed development does not directly interact with this Protected Area. Potential for effects to be propagated downstream are also greatly reduced, due to use of mitigation and further still by virtue of distance and/or by way of dilution (relative to water body scale). **Water body screened out**
Six Mile Water Lower FFD (UKGBNIIENB)	Out	The proposed development does not directly interact with this Protected Area. Potential for effects to be propagated downstream are also greatly reduced, due to use of mitigation and further still by virtue of distance and/or by way of dilution (relative to water body scale). **Water body screened out**
Lough Neagh DrWPA (UKGBNIPA1_10034)	Out	The proposed development does not directly interact with this Protected Area. Potential for effects to be propagated downstream are also greatly reduced, due to use of mitigation and further still by virtue of distance and/or by way of dilution (relative to water body scale). **Water body screened out**

5. Scoping

Following the screening exercise (Section 3), the following works have been identified to potentially impact on waterbodies:

- Construction/operation activities on groundwater;
- Storm water discharge from operational area;
- Treated foul discharge from operational area;
- Boghill Road drainage;
- Boghill Road new bridge structures.

[21] RSIS. Available at: https://rsis.ramsar.org/ris/958. Accessed: 15/10/2024.

Table 3.5 provides a scope of impacts on WFD quality elements.

Table 3.5: Scoping of impacts

Waterbody / Protected Area	Design components and activities	Potential Impacts	Mitigation
Groundwater Antrim (UKGBNI4NB005) Antrim DrWPA (UKGBNIPA1_30005)	Construction phase • Excavation, drilling, heavy machinery. • Dewatering activities.	• Construction activities can lead to the release of pollutants (e.g. oils, chemicals) into the groundwater. • The presence of the microgabbro dyke could either impede or facilitate groundwater flow, depending on its fracture characteristics. This could lead to changes in the natural flow patterns and potentially affect the availability of groundwater. • Dewatering activities required for construction could lower the groundwater table, impacting nearby wells and ecosystems.	• Implement pollution prevention measures, such as spill containment systems and proper storage of hazardous materials. • Regular monitoring of groundwater levels and quality to detect any changes early and take corrective actions. • Use controlled dewatering techniques to minimise the impact on groundwater levels. • Adherence to best working practice relating to groundwater e.g. see CIRIA (C741)[22], EA Pollution Prevention Guidance (PPGs)[23], along with CIRIA C750 (2016)[24] and EA groundwater protection guidance[25]. • Adherence to best practice relating groundwater control and sheet piling (e.g. Westcott et al., 2002).

[22] CIRIA, 2016. Environmental good practice on site guide (further edition) (C741), January 2015.

[23] The EA PPGs were formally withdrawn on 17 December 2015. However, they represent relevant best practice advice for construction works. Archived PPGs are available at: https://webarchive.nationalarchives.gov.uk/ukgwa/20140328090931/http:/www.environment-agency.gov.uk/business/topics/pollution/39083.aspx. Accessed 18/10/2024.

[24] CIRIA, 2015. Groundwater control: design and practice (second edition) (C750), April 2016.

[25] EA Groundwater Protection. Available at: https://www.gov.uk/government/collections/groundwater-protection. Accessed 18/10/2024.

Waterbody / Protected Area	Design components and activities	Potential Impacts	Mitigation
Groundwater Antrim (UKGBNI4NB005) Antrim DrWPA (UKGBNIPA1_30005)	Operation phase • MBT and EfW facilities	• Facilities like MBT and EfW could generate leachate, which if not properly managed, could infiltrate and contaminate groundwater. • The underground pumping main creates an increased risk of foul effluent leakage which, if not properly maintained or there are any structural failures, could infiltrate and contaminate groundwater. • The EfW facility might release heated water, potentially affecting the temperature of the groundwater and impacting local ecosystems. • Continuous operation increases the risk of accidental spills or leaks, which could have long-term impacts on groundwater quality.	• Install leachate collection and treatment systems to prevent contamination (e.g. see Bouauda et al., 2023). • Implementing systems to manage and mitigate thermal discharges from the EfW facility. • Conducting regular inspections and maintenance of all facilities to prevent leaks and spills. • Adherence to best working practice relating to groundwater e.g. see CIRIA (C741)[26], EA Pollution Prevention Guidance (PPGs)[27], along with CIRIA C750 (2016)[28] and EA groundwater protection guidance[29].

[26] CIRIA, 2016. Environmental good practice on site guide (further edition) (C741), January 2015.

[27] The EA PPGs were formally withdrawn on 17 December 2015. However, they represent relevant best practice advice for construction works. Archived PPGs are available at: https://webarchive.nationalarchives.gov.uk/ukgwa/20140328090931/http:/www.environment-agency.gov.uk/business/topics/pollution/39083.aspx. Accessed 18/10/2024.

[28] CIRIA, 2015. Groundwater control: design and practice (second edition) (C750), April 2016.

[29] EA Groundwater Protection. Available at: https://www.gov.uk/government/collections/groundwater-protection. Accessed 18/10/2024.

Waterbody / Protected Area	Design components and activities	Potential Impacts	Mitigation
River Ballymartin Water (UKGBNI1NB030 305206) Lough Neagh Catchment UWWTD (UKNI_CM00001) Ballymartin Water Upper FFD (UKGBNIIENB)	Operational Phase Storm water discharge from operational area • Storm water is to flow from SuDS attenuation basin through an outfall pipeline before discharging via an existing settling lagoon to an existing outfall. • New precast concrete headwall to be constructed (utilising existing outfall location) with 300mm diameter opening (see preliminary drainage proposal in Appendix A).	• Construction of new precast concrete headwall and outfall pipeline can alter physical characteristics of waterbody. • Discharge of storm water, even after passing through a SuDS attenuation basin and settling lagoon still has the potential to impact the habitats of riparian species through temperature changes, oxygen levels, or introducing harmful substances.	• Construction of headwall and any other associated structures should adhere to the SEPA Good Practice Guide[30] for intakes and outfalls or equivalent. • Use permeable paving materials in the operational area to reduce runoff and promote groundwater recharge. • Due to the large vertical surface associated with the quarry face, the contractor should take account of the catchment area of these vertical surfaces for calculating peak run-off flows for each rock trap. • Regular maintenance of SuDS ponds and proposed detention basin.
River Ballymartin Water (UKGBNI1NB030 305206) Lough Neagh Catchment UWWTD (UKNI_CM00001) Ballymartin Water Upper FFD (UKGBNIIENB)	Operational Phase Treated foul discharge from operational area • Single package treatment plant to be installed to treat all foul sewage from site (separate from storm water). • Final treated effluent to be discharged (proposed 5 l/s) to Flush River via a dedicated c1.1km pumping main. • New reinforced concrete headwall to be constructed (see preliminary drainage proposal in Appendix A).	• The construction of a reinforced concrete headwall and the discharge pipeline can alter the physical characteristics of the waterbody. • Treated effluent can alter chemical composition of the water, potentially impacting aquatic life. Sensitive species may be particularly vulnerable to change in nutrient levels and other water quality parameters.	• Construction of the headwall and any other associated structures should adhere to the SEPA Good Practice Guide for intakes and outfalls or equivalent. • Ensure treatment plant operates efficiently to meet discharge standards is crucial to minimise effluent impacts. • Careful monitoring and management of the effluent quality and discharge practices in line with the NIEA discharge consent.

[30] SEPA 2019. Available at: https://www.sepa.org.uk/media/150984/wat_sg_28.pdf. Accessed: 15/10/2024.

Waterbody / Protected Area	Design components and activities	Potential Impacts	Mitigation
River Ballymartin Water (UKGBNI1NB030 305206) Lough Neagh Catchment UWWTD (UKNI_CM00001) Ballymartin Water Upper FFD (UKGBNIIENB)	Construction phase Boghill Road widening and drainage	• Construction activities can introduce pollutants (i.e. sediments, oils and chemicals) into nearby water bodies. • Habitat disruption.	• Effective sediment control measures, such as silt fences and sediment basins. • Minimise habitat disruption by timing construction to avoid sensitive periods for aquatic species. • Gullies and petrol interceptor to be installed to minimise siltation and hydrocarbon potential. • Potential installation of check dams in steep sections of roadside ditches to slow down flows and aid settlement. • Discharge from widened road should be limited to/no greater than the existing discharge. Drainage system must be capable of handling runoff from the widened road.
River Ballymartin Water (UKGBNI1NB030 305206) Lough Neagh Catchment UWWTD (UKNI_CM00001) Ballymartin Water Upper FFD (UKGBNIIENB)	Construction Phase Boghill New Bridge (Blacks Bridge) • To accommodate increased road width and alignment modifications, the two existing bridge structures will have to be replaced. • The existing bridge will be deconstructed and replaced with a precast flexi-arch structure.	• Potential debris entering the waterway. • Potential cement wash from wet concrete entering the waterway. • Removal and replacement of the bridge can disrupt existing habitats for aquatic and riparian species.	• Consultation with NIEA WMU and the Pollution Prevention Team is required in advance of construction. • Working platform below the arch during removal to ensure debris does enter waterway. The platform should be equipped with toe-boards and a liner to prevent small debris falling between boards. Debris should be removed regularly and taken directly to main site for re-processing. • A cut off trench will be dug between the foundation and the waterway to contain any run-off of potential cement wash. • The capacity of new channel will be no less than the existing situation. • Flexi-arch clearance should be greater than existing situation. • Construction mitigation procedures in operation including specific measures for Works in or Adjacent to Watercourses. • Gullies and Petrol interceptor to be installed to minimise siltation and hydrocarbon potential.

Waterbody / Protected Area	Design components and activities	Potential Impacts	Mitigation
	Construction Phase Boghill Road New Bridge Structure (overarching tributary to Flush River) • To accommodate increased road width and alignment modifications, the two existing bridge structures will have to be replaced. • The existing tributary to the Flush River follows a very meandering path where it crosses beneath the existing road. The intention is to 'improve' the waterway alignment in this localised area by facilitating a more perpendicular path below the road. • A flexi-arch similar to that proposed for Blacks Bridge will also be used. However, a new channel will have to be excavated along the proposed realignment.	• Alignment modifications have the potential to change the physical characteristics of the waterbody – impacting flow patterns, sediment transport, and habitat structures, potentially leading to a deterioration in the ecological status of the waterbody. • Potential of introducing pollutants such as sediments, oils, and chemicals into the waterbody – therefore degrading water quality and harming aquatic life. • Realignment/construction work could disrupt existing habitats for fish, invertebrates, and other aquatic species – leading to loss of biodiversity and negatively impacting species that rely on the current meandering path for shelter and breeding.	• The capacity of the new channel should be no less than the existing situation. • Flexi-arch clearance should be greater than existing situation. • Construction mitigation procedures in operation including specific measures for Works in or Adjacent to Watercourses. • Gullies and Petrol interceptor to be installed to minimise siltation and hydrocarbon potential. • Consultation with NIEA WMU and the Pollution Prevention Team is required in advance of construction. • Select dry periods for groundworks and the new channel opening. • Water monitoring during the works. • Scour protection to the newly excavated channel. • Silt mats and oil booms downstream of the works. • Silt fencing along the banks of the live waterway. • Removal of any excavated material from the area to prevent washing into the waterway.

6. Conclusion and Recommendations

6.1 Conclusion

This technical note has provided an updated WFD assessment for the proposed arc21 Residual Waste Treatment project. Several WFD water bodies and Protected Areas have been identified that are within a 2km buffer (Tables 3.1 and 3.2) and could potentially be impacted by the proposed development.

A previous Environmental Impact Assessment (EIA) submission has been made for the proposed development in March 2014, with addenda in September 2014, August 2016, March 2019, August 2019, October 2020, December 2020, May 2021 and September 2023. This document provides an updated Water

Framework Directive (WFD)/Water Environment Regulations (WER)[31] assessment, to reflect changes to the proposed development, following submission of the previous WFD by Atkins (2019). Changes to the proposed development involve alteration of the storm and treated foul (water) discharge from the operational site, with storm discharge being made to an existing outfall and new pipeline with outfall and headwall structures for discharge of on-site treated foul effluent.

Provided the mitigation identified within this report is incorporated into the construction methodology and final scheme design, it can be concluded that the project is WFD compliant.

6.2 Recommendations

This assessment has been based on currently available WFD baseline data and design information for the proposed development (as of January 2025). It is considered a 'live' document and should be reviewed and updated during design and construction, particularly if:

- NIEA update or provide additional WFD baseline data for the relevant water bodies; and/or
- Significant changes to the nature, spatial or temporal extent, scale or construction methods of the scheme are made.

[31] The Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017 superseded the previous WFD legislation, following EU Exit.

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Appendix A Proposed Development Plans

A.1 Preliminary Drainage Proposals

A1

Outfall Ref	Irish Grid Coordinates	Catchment Area	Unattenuated Runoff Rate Q100 + 20% CC	Proposed Discharge Rate Q100 +20% CC	Reinforced concrete headwall pipe diameter
		m^2	l/s	l/s	mm
OF-S01	329280, 380843	201000	4304	201	300
OF-F01	329468, 381304	N/A	N/A (Foul Final Effluent)	5 (Foul Final Effluent)	300

Do not scale

Notes:
This Drawing is preliminary and is not for construction.

Rev	Date	Description	By	Chkd	Appd	Auth
P04	08/02/25	For Preliminary Information	PM	PG	PG	
P03	09/01/25	For Preliminary Information	PM	PG	PG	
P02	23/09/24	For Preliminary Information	PM	PG	PG	
P01	20/08/19	For Preliminary Information	PM	PG	PG	

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Client
INDAVER

Project Title
Becon Project

Drawing Title
Main Site drainage proposals
For Schedule 6 approval

Scale at A1	Arup Job No
As Shown	264848-00

Role: Civil Drainage

Suitability: S2 - Issued For Information

Rev	By	Chkd	Appd	Auth
P04	PM	PG	PG	
	Date 08/02/2025	Date 08/02/2025	Date 08/02/2025	Date

Name: BCN - ARP - ZZ - XX - DR - CD - 0013
Project | Originator | Volume | Location | Type | Role | Number

Clyde Shanks

Appendix 7.3

Schedule 6 Consent to Discharge Application

Dfl Rivers Lisburn

Department for Infrastructure
An Roinn Bonneagair
www.infrastructure-ni.gov.uk

Pete Gray
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Bedford House
16-22 Bedford Street
Belfast
BT2 7FD

Ravarnet House
36 Altona Road
Lisburn, BT27 5QB
Tel: 028 92 606 100

Your ref:
Our ref: IN1-19-9442

Date: 18 March 2025

Dear Pete,

RE: IN1-19-9442 - Becon Schedule 6

Thank you for your Schedule 6 application to received 3 March 2025 regarding amending the previous letter dated 15 November 2024. From a drainage aspect my comments are as follows.

The Department for Infrastructure - Rivers Directorate is satisfied with your proposals to discharge at the total stated maximum rate of 201l/s to the watercourse as shown on your application. This watercourse is undesignated under the terms of the Drainage (Northern Ireland) Order 1973.

The Department is also satisfied with your proposals to discharge treated effluent at the total stated maximum rate of 5l/s to the watercourse as shown on your application. This watercourse is undesignated under the terms of the Drainage (Northern Ireland) Order 1973.

The Department is also satisfied with your proposals to discharge at your total stated maximum rates (63.1l/s to outfall SR-OF01, 13l/s to outfall SR-OF02 and 59.3l/s to outfall SR-OF03) to the undesignated watercourses as shown on Drawing no. GE-C-BOG-XX-055 under the terms of the Drainage (Northern Ireland) Order 1973. This consists of three separate discharge locations on two watercourses as shown on the above detail submitted with your prior application.

The Department accepts the outfall submitted with the same application as above and advises that it should be constructed in an appropriate scale to the size of the outlet pipe. The discharge pipes and outlet structures should be turned in the direction of flow and anti-scour measures taken to prevent bank and bed erosion.

Attenuation method is to be by using a hydrobrake fitted manhole and appropriate storage systems within the site.

The developer should also satisfy himself that the watercourse downstream from the proposed discharge locations should be free from obstructions such as silt, weed growth or debris to provide adequate outfall for storm discharge. This should be brought to the attention of the developer or landowner prior to discharge.

You should note that, in accordance with Paragraph 11 of Schedule 6 of the Drainage (Northern Ireland) Order 1973, any consents/ approvals given by DfI Rivers under Schedule 6 shall not affect the liability of any riparian/developer to comply with other legislation. It is your responsibility to contact any other parties which may have an interest in your proposals e.g. NIEA, Landowners, Fisheries etc.

You are requested to notify the Department of the commencement date of your works so that an inspection may take place during construction.

The Department would stress that it is your responsibility to ensure that the proposed works do not result in any obstruction to flow arising from blockage, structural failure, poor workmanship or any other reasons.

This is valid for a period of 24 months from the date of this letter. If proposals are not completed within this period of time they should be resubmitted for further appraisal.

Please quote the reference number at the top of this letter in any future correspondence.

Yours sincerely

Jonathan Steenson
Engineering Section