Project

Residential Development at Newcastle South, Co. Dublin

Report Title

Infrastructure Design Report

Client

Cairn Homes Properties Ltd

INFRASTRUCTURE

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DBFL CONSULTING ENGINEERS

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APPENDICES

1.0 INTRODUCTION

1.1 Background

DBFL were commissioned to undertake an Infrastructure Design Report to accompany a planning submission to An Bord Pleanála for a residential development at Newcastle, South County Dublin.

The Graydon SHD development is currently under construction to the east of the subject site under planning reference ABP 305343-19.

Previously the Newcastle South lands obtained planning permission from South Dublin City Council for 743 dwellings including a neighbourhood centre and a Creche in March 2006 under application Ref. SD05A/0344. This planning permission also granted permission to construct the western section of the main spine road through the subject site. A planning permission extension was requested under application Ref. SD05A/0344/EP in July 2014, which was granted by SDCC in September 2014 and expired in November 2017.

The proposed development will consist of the construction of 280 no. dwellings and associated ancillary infrastructure on a site of c. 8.47 hectares.

1.2 Objectives

This report aims to consider the proposed development main infrastructure elements, including the following;

- Road Layout/Site access including cyclist infrastructure.
- Surface water strategy and servicing.
- Foul sewer strategy and servicing.
- Water supply and servicing.

1.3 Location

The subject site, of approximately 8.47 hectares, is located to the south of the R120/Main Street at Newcastle Village. The site is bounded by the Graydon residential development to the east, the Athgoe Road to the west, by single dwellings to the north and existing agricultural lands to the south. The St Finian's National School and Church is located to the north of the site. St Finian's Way residential development is also located to the north of the site.

The development lands form part of the South Dublin County Development Plan (2016-2022) and the Draft South Dublin County Council Development Plan 2022-2028. The proposed development is zoned 'to provide for new residential communities in accordance with approved planning schemes' (RES-N).

The proposed development Site is predominantly greenfield and a construction compound has been constructed on the eastern area adjacent to Graydon development as well as a construction access across the site from the Athgoe Road to the Graydon development lands. Existing boundaries within the site are predominantly hedgerows and fencing with some drainage ditches. The proposed creche is located in the previously permitted Graydon development.

Figure 1.1 Site Location

1.3.1 Topography

The overall topography of the site falls from south to north toward Newcastle Village as shown in Figure 1.2. A topographical survey of the site is provided as a background to the road layout drawing 210026-DBFL-RD-SP-DR-C-1101.

Figure 1.2 Site Topography.

1.4 Proposed Development

The development will consist of the construction of 280 no. dwellings and associated ancillary infrastructure on lands of c. 8.47 hectares (2 no. sites comprising main development site (8.4 ha.) and site relating to permitted creche c. 0.07 ha. in 'Graydon') as follows:

The development will consist of the construction of 280 no. dwellings, a creche, and open space as follows:

A) 128 no. 2 storey houses (8 no. 2 bedroom houses, 94 no. 3 bedroom houses, 25 no. 4 bedroom houses and 1 no. 5 bedroom house;

B) 116 no. apartments in 2 no. 5 storey buildings comprising (54 no. 1 bedroom apartments & 62 no. 2 bedroom apartments, all with terrace or balcony along with solar panels and green roofs at roof level as well as telecommunications infrastructure comprising 9 no. support poles on ballast mounts (to accommodate 1No. 2m 2G/3G/4G antenna & 1No. 5G antenna each) & 3 no. poles on lift overrun (to accommodate 2No. Ø0.3m Microwave links each at roof level of Apartment building B, together with associated equipment and cabinets/shrouds);

C) 36 no. apartments/duplex apartments in 3 no. 3 storey buildings – (18 no. 2 bedroom apartments and 18 no. 3 bedroom duplex apartments) all with terrace;

D) Amendment to permitted Creche (c. 518sqm) in 'Graydon' (ABP References: TA06S.305343 & ABP-305343-19) to now provide a Creche of c. 778 sq. m of 2 no. storeys;

E) Open space, hard and soft landscaping (including public lighting & boundary treatment), communal open space for duplex apartments and apartments; along with single storey bicycle/bin stores and ESB substations;

F) Vehicular access from the Athgoe Road from a new signalised junction along with upgrades to footpath and pedestrian crossing as well as provision of vehicular/pedestrian/cycle link to permitted 'Graydon' (TA06S.305343) 'Newcastle Boulevard' to the east, as well as 423 no. car parking spaces and 370 no. bicycle spaces and all internal roads, cycleways, green routes and paths;

G) Provision of Surface water attenuation measures and underground attenuation systems, connection to water supply, and provision of foul drainage infrastructure as well as underground local pumping station to Irish Water specifications and all ancillary site development/construction/landscaping works.

1.5 Flood Risk

A separate Site Specific Flood Risk Assessment has been prepared as part of the application.

1.6 Existing Ground Conditions

A detailed site investigation was undertaken by Ground Investigations Ireland in April 2018 to ascertain the existing ground conditions on the overall lands. The ground conditions generally consist of topsoil to a maximum depth of 400mm over sandy gravelly clays with occasional cobbles and boulders over gravel deposits. No bedrock was discovered in the boreholes undertaken on the subject site. (Ground investigation report by Ground Investigations Ireland is included with the planning information.).

2.0 ACCESS AND ROADS

2.1 Overall Road and Access Layout

The proposed development will be accessed from the L6001 Athgoe Road to the west of the site. The access point from the L6001 Athgoe Road to the west of the site is proposed to be a signal controlled junction with crossing facilities for pedestrians. The proposed signalised junction aims to improve pedestrian accessibility to the existing footpath on Athgoe Road and improve connectivity to Newcastle Main Street. There will be a link from the Graydon Development provided under planning reference ABP 305343-19 to the south west of the site. A local street to the north of the site allows access to the village main street through an adjoining development under reference SD18A/0363. The east / west link street alignment allows for the future continuation of the link street through the adjacent school site to generally align with the objectives of the LAP.

In relation to item 3 of on ABP opinion (Ref ABP- 311861-21), the subject proposals include for the provision of the continuation of the east-west Principal Access Road, as per the Newcastle LAP, between the Graydon Residential Development site boundary westwards to Athgoe Road. The design of the road infrastructure has sought to fully respect the LAP objectives in addition to the DMURS design objectives. As per the LAP, the proposed infrastructure allows for additional vehicular and cycle / pedestrian connections to the north via St. Finian's Way and permeable connections to adjacent future potential development lands surrounding the subject site.

Rather than a continuous link through the subject site that could encourage speeds, the alignment of the Principal Access Road includes for 2 no. priority controlled junctions along the route and tighter corner radii which differs from the LAP Principal Access Road alignment but adheres more closely to the principles of DMURS which seek to reduce vehicular speeds and create a more pedestrian / cycle friendly environment.

The road infrastructure within the subject site has been designed taking cognisance of further LAP objectives which can be easily achieved as part of future development schemes within the LAP boundary by tie-ing into the subject proposed road infrastructure.

The road network through the site respects the open space zoned lands to the east of the subject site. The main link through the development has been designed with a number of junctions and a meandering alignment through the development to promote traffic calming and discourage "rat running" through the development. The alignment has been tracked using vehicle tracking software at junctions and horizontal curves.

The proposed link street carriageway is 6.5m wide with a raised adjacent cycle track on each side in the western and eastern area of the site. The cycle facilities deviate from

the link street onto a 4m wide green link in the centre section of the site. Intermittent parallel parking bays are provided as per the Newcastle LAP, 2012.

The development's internal layout has been designed with speed reduction bends to provide traffic calming together with a combination of road vertical and horizontal deflections and forward sight visibility to reduce speeds. Flat top table ramps have been provided at strategic locations to calm traffic at junctions in particular at green-link/vehicular interfaces. Design speed limits of 30km/hr are applied throughout the development as per Design Manual for Urban Roads and Streets (DMURS).

DBFL consulted with SDCC roads department in relation to the Athgoe Road and connectivity from the subject site to Newcastle Main Street. It was agreed to provide a footpath on the eastern side of the carriageway to link the development to the exiting footpath to the north on the Athgoe Road and provide pedestrian connectivity to Newcastle Main Street. In order to provide a 2m footpath the road carriageway will be reduced to 6.5m wide. This layout is displayed on drawing 210026-DBFL-RD-SP-DR-C-1101.

2.2 Green-link Cycle Infrastructure

Green-link cycle infrastructure has been provided throughout the development to link parks, existing roads and local amenities in accordance with the Newcastle LAP 2012. Cycle infrastructure on the east/west link street has been provided as raised adjacent cycle tracks to align with the Newcastle LAP, 2012 and ties into existing cycle infrastructure in the Graydon Development to the east. The cycle facilities deviate from the link street onto a 4m wide green link in the centre section of the site. The proposed north/south green link is provided as a 4m wide shared surface for pedestrians and cyclists migrating between the various amenities and runs through predominantly green open space. This green link is designed as an amenity route for less confident cyclists and children. The green link has been designed with no proposed vehicular crossings. The green link ties into the east/west link street at the south of the proposed site and ties into the east/west link street to the north. The green link has been designed in accordance with TII TD300 (Rural Cycleway Design Guide) and the National Cycle Manual.

Given the low vehicular traffic volumes within the internal local streets (<2,000 AADT), cyclists will share the road surface with vehicular traffic as per Section 1.7 of the National Cycle Manual.

2.3 Road Layout Design

The proposed development's road layout is shown on drawing 210026-DBFL-RD-SP-DR-C-1101. Drawing number 210026-DBFL-RD-SP-DR-C-1104 outlines the road hierarchy and possible future connections. The standard road cross-sections on

drawing 210026-DBFL-RD-SP-DR-C-5101 Typical Road Construction Details Sheet 1 will comprise the following;

• Link Streets – providing typically 6.5m carriageway, 2m raised adjacent cycle tracks and 2.0m wide footways on each side with intermittent parallel parking bays as per Newcastle LAP, 2012. A 750mm buffer zone is provided between parking bays and cycle tracks as per the requirements of the National Cycle Manual.

• Residential Local Streets – typically 5m to 5.5m wide carriageway with 2m footways and intermittent 2.4m wide public parking bays.

• Shared Home-Zone Streets – 4.8m to 6.0m shared surface with 1.5m wide vulnerable user strips and different colour contrast and texture to Local Streets (no footpaths).

Maximum road corner radii of 4.5m are provided within the local streets and 6m on the main access road as per DMURS and the requirements of South Dublin County Council.

2.4 Pavement Design Standards

The main internal access roads are designed in accordance with the Design Manual for Urban Roads and Streets (DMURS) and Local Authority taking in charge requirements. Refer to drawing 210026-DBFL-RD-SP-DR-C-5101 for the proposed road construction thicknesses based on an assumed existing ground minimum design CBR of 3%. Actual CBRs and ground conditions will be confirmed by detailed site investigations prior to construction.

2.5 Traffic & Transportation

A separate Traffic and Transportation Assessment has been prepared as part of this application and is included in the overall planning pack.

2.6 Vehicle Tracking

The proposed development has been tracked to show that the development's proposed turning heads will accommodate a large refuse vehicle. Internal radii have been tracked to ensure a car and refuse vehicle can pass at the same time. Internal radii at the proposed signalised junction at L6001 Athgoe Road have also been tracked to ensure a car and refuse vehicle can pass at the same time

2.7 Driveway Access

Access driveways are set to accommodate a targeted maximum 1:20 driveway gradient. All driveways are permeable paving within private curtilage. Entrances to driveways in public footpaths comprise drop kerbs with 150mm deep concrete pavement.

2.8 Quality Audit

An independent DMURS Quality Audit (including Road Safety Audit, Access Audit, Cycle Audit and Walking Audit) has been undertaken by Bruton Consulting Engineers and no adverse road safety or quality concerns have been raised for the subject site. All recommendations from the Quality Audit have been incorporated into the design for the subject site. A copy of the Quality Audit is provided in Appendix H. The proposed creche will use the permitted Graydon road network.

3.0 SURFACE WATER DRAINAGE

3.1 Existing Surface Water

The existing site is predominantly greenfield, and the topography of the site generally falls to the north towards Main Street. A network of existing drainage ditches currently drains the site. Drainage infrastructure has been constructed as part of the Graydon development (under planning reference ABP 305343-19) to the east of the subject site in accordance with the Greater Dublin Strategic Drainage Study (GDSDS). The subject sites surface water network will not connect to any surface water infrastructure constructed under the Graydon development. There are existing 225mm surface water sewers located in Athgoe road to the west of the subject site.

An existing “pond” is identified on the Newcastle LAP, 2012 in the south western area of the subject site. DBFL have reviewed this area on site and no pond was present but it appears there is a depression in this area of the site based on the topography. Some evidence of an overland flow route is present on historic aerial mapping.

In response to the SDCC Report (Ref. SHD2ABP-311861-21) and ABP Opinion Item 10 (ABP- 311861-21) a meeting and consultation with SDCC drainage department took place. The existing surface water outfalls were CCTVd in order to establish where they outfall to. The majority of the site outfalls to an existing drainage ditch within the site which flows to a pond to the rear of the Old Glebe on Main Street and ultimately follows an undefined network of drainage ditches through agricultural lands within the River Liffey catchment. Similarly the surface water network on the Athgoe Road was surveyed to establish in so far as possible its outfall. It outfalls to a drainage ditch on the Hazelhatch road and follows an undefined network of drainage ditches through agricultural lands within the River Liffey catchment. Some damage to the surface water network was identified in the survey on Athgoe Road and this was discussed with SDCC for their review. It is noted that the run-off from the site is restricted to greenfield run-off rates to mimic the current scenario.

CCTV report is included in Appendix I.

3.2 Surface Water Drainage Strategy

3.2.1 General

An overall surface water drainage strategy was developed by DBFL Consulting Engineers for the overall development site including the Graydon development under planning reference ABP 305343-19 and future zoned lands. This strategy is shown on drawing number 210026-DBFL-CS-SP-DR-C-1202 which outlines each catchment and its corresponding attenuation facility. Surface water runoff from the development will be

attenuated to greenfield runoff rates (Qbar) in accordance with the Greater Dublin Strategic Drainage Study (GDSDS).

Where possible, attenuation facilities have been designed as above ground storage in order to maximize the use of SuDs and limit the requirement of underground tanks to promote biodiversity. This approach was adopted in line with SDCCs Sustainable Drainage Explanatory Design Guide 2022. The open ponds have been designed to cater for the 1:5 year storm in a low flow channel which will be predominantly wet and the 1:100 year storm will be stored at the next level which will be predominantly dry and lend itself to a usable amenity space except in adverse weather conditions. Where design constraints did not allow for open ponds, attenuation facilities will store up to the 30-year critical storm in underground stormtech attenuation systems and shallow detention basins will be used to store surface water for storms between the 30 year and the 100 year critical storms. The detention basins will be incorporated into the landscape plan with gently sloping side slopes. The maximum open water depth in the detention basins will be 1.14m in the 100 year critical storm. This arrangement ensures that the detention basins remain mainly dry and usable as an amenity space, with the detention basins only utilised during extreme events. An example of a useable detention basin is shown below in Figure 3.1. Typical construction details are shown on drawings 210026-DBFL-CS-SP-DR-C-1203,1204,1205,1206 & 1208. Calculations are included in Appendix B and C.

Figure 3.1 Example underground storage and detention basin from the Graydon Development

The surface water drainage system will collect storm-water run-off generated from the proposed residential development using traditional pipe-work and manholes laid along the main access roads collecting run-off from impermeable road surfaces via gullies

and adjoining areas. Swales will be utilised as a SuDs measure where possible to drain adjacent roads and green links. Swales and other SuDs measures such as tree pits, permeable paving and green roofs have been incorporated into the drainage design to reduce the run-off volume and improve run-off water quality as described in Section 3.3 below.

3.2.2 Compliance with Surface Water Policy

Surface water management for the proposed development is designed to comply with the Greater Dublin Strategic Drainage Study (GDSDS) policies and guidelines and the requirements of South Dublin County Council. The guidelines require the following four main criteria to be provided by the development's surface water design;

- Criterion 1: River Water Quality Protection – satisfied by providing interception storage using permeable paving in driveways, greenroofs, treatment of run-off within the SUDS features e.g. permeable paving for driveways/parking bays, swales and within the attenuation storage system and oil separators on the main surface water outfalls from the development.
- Criterion 2: River Regime Protection – satisfied by attenuating run-off with flow control devices prior to discharge to the outfall.
- Criterion 3: Level of Service (flooding) for the site – satisfied by the Site being outside the 1000 year coastal and fluvial flood zones, (See Flood Risk Assessment). Pluvial flood risk addressed by development designed to accommodate a 100 year storm as per GDSDS. Planned flood routing for storms greater than 100 year level, considered in design, the development has been designed to provide an overland flood route from the development towards the surface water outfall.
- Criterion 4: River flood protection – attenuation and long term storage provided within the SUDS features e.g. permeable paving construction, swales and attenuation facility.

3.2.3 Underground Storage Justification

Attenuation facility 1 located in Sean Feirm Park has been design as an underground stormtech SC740 tank with an above ground detention basin. An underground tank has been utilised to store the 1:30 year storm to allow the above ground detention basin store the 1:100 year critical storm event. This approach means the above ground detention basin will remain dry outside off critical storm events and increase the usable space in Sean Feirm park for the future residents of the development. If an underground tank was not utilised a significant area of Sean Feirm park would be taken up by a permanent wet pond which would not be usable as an amenity area. Maintaining as

much usable space as possible is important in providing a high quality living environment for all is well established.

Attenuation facility 3 has also has been designed as a underground stormtech SC740 tank with an above ground detention basin. The space constraints and site levels at attenuation facility 3 do not allow for the installation of a pond due to the requirement for gently sloping side slopes.

At all other attenuation areas, open attenuation has been utilised where it could be successfully integrated into the landscape.

3.2.4 Ground Investigation

Site investigation was undertaken on the Subject Site which included trial pits, boreholes and infiltration tests. Topsoil over clays over gravel was encountered with no bedrock discovered in the boreholes taken on the subject site. Infiltration tests in accordance with BRE Digest 365 were carried out at 2 locations on site. The results indicated negligible soakage rates therefore no benefit was taken from infiltration in the design of the attenuation facilities although some infiltration will naturally occur.

3.3 SUDS

In accordance with the GDSDS it is proposed to use Sustainable Urban Drainage systems (SUDS) for managing storm-water for the proposed development. The aim of the SUDS strategy for the site will be to;

- Attenuate storm-water runoff.
- Reduce storm-water runoff.
- Reduce pollution impact.
- Replicate the natural characteristics of rainfall runoff for the site.
- Recharge the groundwater profile

The proposed layout of the drainage and SUDS is detailed on drawing 210026-DBFL-CS-SP-DR-C-1201.

An assessment of the potential SuDS that could be incorporated within the site was conducted using the SuDS Manual, CIRIA 753. The SuDS elements which were found applicable to the proposed scheme design and layout include the following:

1. Permeable paving driveways for all on-curtilage driveways
2. Green link to drain to swales for reduction and treatment of run-off
3. The attenuation storage systems will be an on-line system for treatment of run-off. The storage systems will be designed to maximise water quality.

4. Above ground attenuation provided where possible
5. Down pipes from roof surfaces diverted into driveway permeable paving to allow infiltration of run-off from roofs.
6. Green roofs at apartment blocks
7. Gully connections to tree pits
8. A petrol interceptor to be provided before the outfalls from the subject site.

The incorporation of the above SuDS elements will provide a sustainable manner in which to disperse surface water from the site, encourage groundwater recharge and provide treatment of run-off and subsequent improvement of discharge quality.

Following submission of the stage 2 application and subsequent feedback and consultation with SDCC a number of underground attenuation systems have been removed. In some instances these have been maintained and justification is provided in section 3.2.3. Overground attenuation is provided in lieu of the below ground attenuation and will enhance provide additional nature based SuDs solutions along with promoting biodiversity.

The proposed headwalls in the attenuation zones will be appropriately landscaped and incorporated into the landscape at each location.

3.4 Surface Attenuation Storage

Surface water run-off from the subject site, future phases and zoned lands as outlined on drawing number 210026-DBFL-CS-SP-DR-C-1202) will be attenuated to greenfield runoff rates (Qbar). This is calculated as 24.51l/s using the Institute of Hydrology equation as recommended in the Greater Dublin Strategic drainage Study (GDSDS) based on an area of 11.63Ha which is associated with the greater site area. The overall catchment and a catchment plan strategy is shown on drawing number 210026-DBFL-CS-SP-DR-C-1202.

There are 5 catchments within the subject site. Catchment 2A, catchment 2D, catchment 2E and catchment 2F are within the subject site and will share the same outfall to an existing drainage ditch as catchments 2B, and catchment 2C which are included as future residential developments and will be attenuated. Catchment 3 is also within the subject site and will outfall to the existing surface water network in the Athgoe road. Refer to figure 3.4 below for indicative overall catchments areas within the subject site. Refer to drawing number 210026-DBFL-CS-SP-DR-C-1202 for the Surface Water Drainage Strategy for permissible outflow.

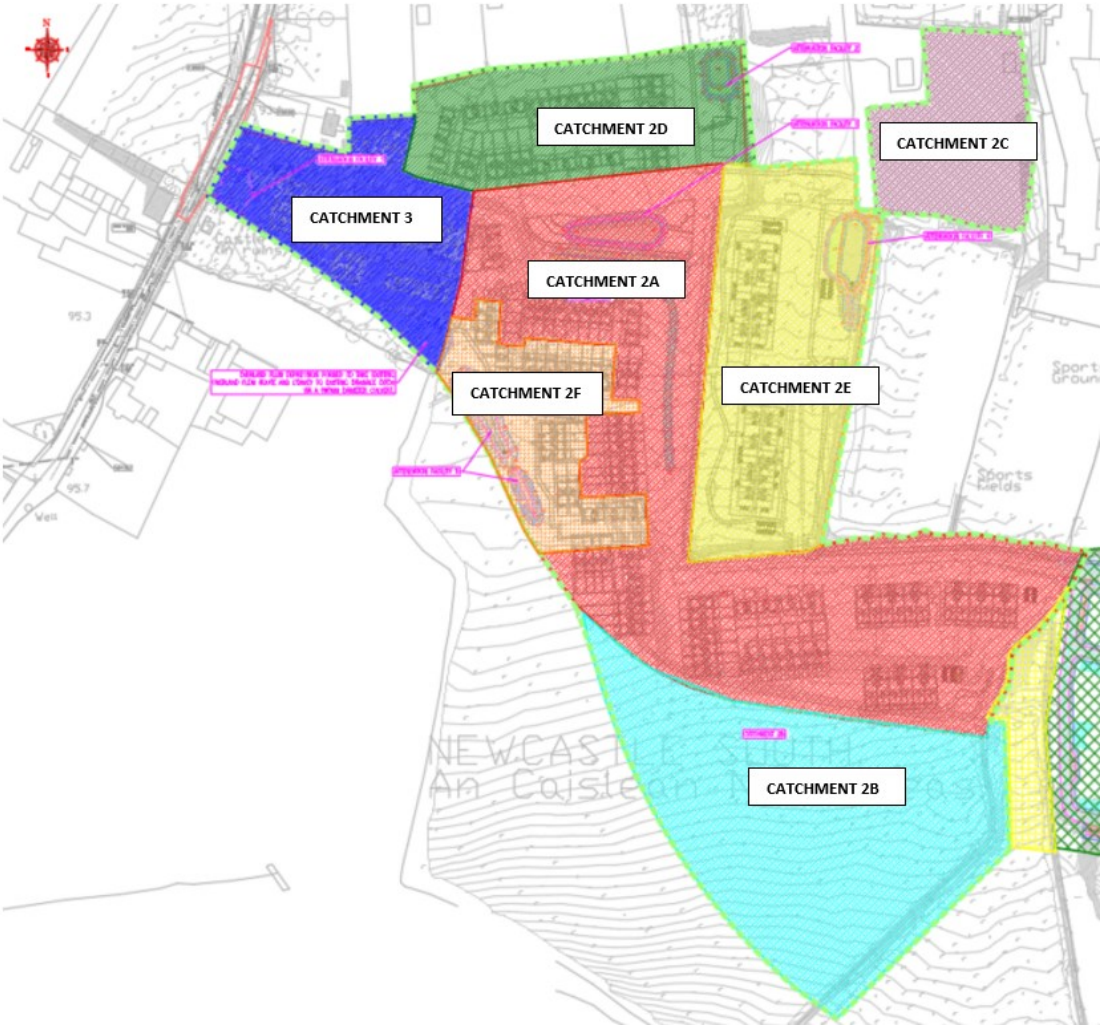


Figure 3.4 – Overall catchment areas (Note: the creche will be within the permitted Graydon development network and catchment)

Soil Type 2 has been used to calculate Qbar and the attenuation storage. The SOIL value was selected using Table 4.5 of the Flood Studies report – The Classification of Soils from Winter Rainfall Acceptance with the following criteria:

Drainage Group	2 - Commonly waterlogged within 60cm
Depth to impermeable layer	2 - 80-40cm
Permeability group (above 'impermeable' layers or to 80cm)	2 - Medium
Slope	1 – 0 -2°

Table 3.1 Summary of Site Characteristics

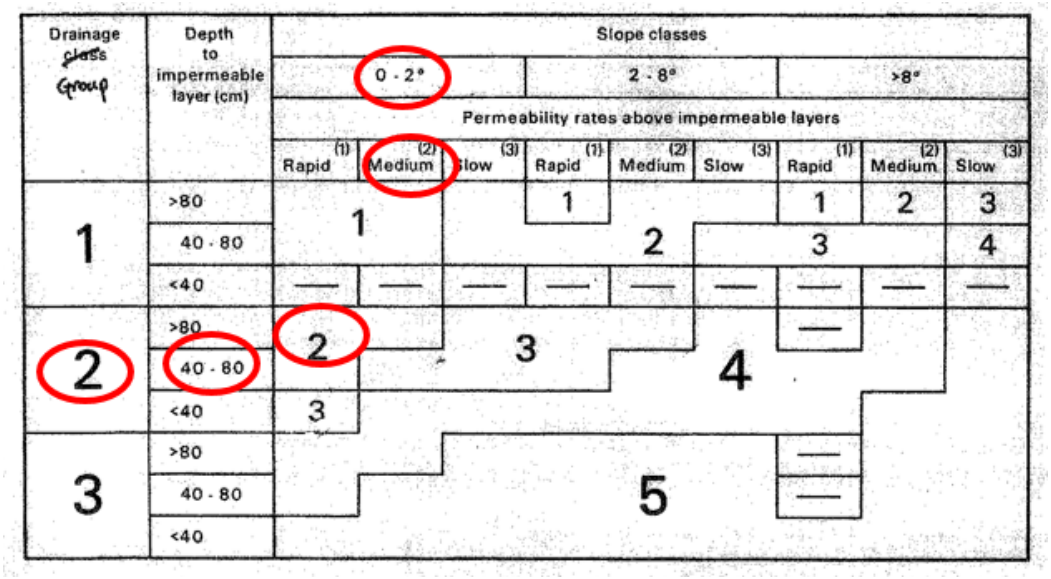


Table 3.2 The classification of soils by winter rain acceptance rate from soil survey data

Run-off from the proposed development will be limited/attenuated using vortex flow control devices (Hydrobrake or equivalent) at each outfall limiting discharge to greenfield runoff rates (Q_{bar}) in accordance with the GDSDS for the total area of the site within the catchment of the new drainage networks.

The resultant design attenuation volumes, discharge limits, types of storage and storage volumes for each catchment are summarised in Table 3.1 (See Appendix D for detailed calculations).

Catchment	Catchment Area (m^2)	Storage System Type	Calculated Allowable Outflow (l/s)	Storage Volume Required (m^3) (100 years) calculated using Microdrainage	Storage Volume Provided (m^3) (100 years)
2A	37,910	Detention Basin & stormtech	8.02	1,059	1,072
2D	11,392	Pond	18.87 *(8.02 catchment 2A +2.41*	208	283

			catchment 2D+5.15catchment 2B+1.55 catchment 2C+1.74 catchment 2F)		
3	10,220	Detention Basin & stormtech	2.16	215	233
2E	16,718	Pond	3.54	404	531
2F	8,242	Upper and Lower pond with weir control	1.74	157	170
2B (Future Residential Site)	24,343	TBC	5.15	TBC	TBC
2C (Future Residential Site)	7,323	TBC	1.55	TBC	TBC
Total	**115,438**		**24.60**	**2,043**	**2,289**

Table 3.3 – Surface Water Attenuation Storage and Discharge Limits

DBFL have calculated the attenuation volumes using Microdrainage as shown in Table 3.3 above, the following should be noted in relation to Microdrainage:

- Micro Drainage is the industry standard drainage design suite in the UK and Ireland for the last 30 years. Microdrainage is used by the majority of engineering consultancies and is the most recognised drainage calculation method by local authorities.
- Microdrainage models the variable head/ discharge relationship of the hydrobrake and models the actual tank shape

- Microdrainage models the time of concentration - the time needed for water to flow from the most remote point in the drainage network to the tank. This becomes significant in large sites such as the subject site.
- The M5-60 and r value (M5-60:M5-2Day) are sourced from Met Eireann and inputted to Microdrainage. The inflow hydrograph for each storm is then calculated by Microdrainage using the Flood Studies Report method as recommended by Section 6.4 of the GDSDS.
- Microdrainage uses the unit hydrograph method at 2min intervals to model the storm, i.e. it models the flow into the system and flow out of the system every 2 minutes for all storm events (38 storm events). Therefore it can accurately calculate the maximum storage volume required in the system for the critical storm.

Typical details and cross-sections of the proposed surface water attenuation facilities are provided on drawings 210026-DBFL-CS-SP-DR-C-1203,1204,1205,1206 & 1208.

3.5 Interception Volume

To prevent pollutants or sediments discharging into water courses, the GDSDS requires “interception storage” to be incorporated into the development. This interception storage is designed to receive the run-off for rainfall depths of 5mm up to 10mm if possible. The SUDS features including permeable driveways, tree pits, green roofs, swales and “open bottom” attenuation facilities will provide the necessary interception volume required by the GDSDS.

3.6 Design Standards

Drainage is designed in accordance with the Greater Dublin Regional Code of Practice for Drainage Works. Surface water pipe-work was sized using the Microdrainage Windes drainage modelling software. The following parameters apply to the design:

• Return period for pipe work 2 years,

check 30 year, no flooding.

check 100 year, flooding in designated areas only.

• Time of entry 4 minutes

• Discharge Limit 24.6 l/s @ 100 years for subject site

• Pipe Friction (Ks) 0.6 mm

• Minimum Velocity 1.0 m/s

• Standard Average Annual Rainfall 795mm (Met Eireann 1km2 grid)

• M5-60 17.7mm (Met Eireann)

• Ratio r (M5-60/M5-2D) 0.271 (Met Eireann)

• Attenuation Tank Storm Return Event GDSDS Volume 2, p61, Criterion 3

30 year no flooding on site.

100 year check no internal property flooding. Flood routing plan. FFL freeboard above 100 year flood level. No flooding to adjacent areas.

• Climate Change Allowance 20%

• Factor of Safety for infiltration 2.0

• Runoff from Roads and Footpaths 100%

• Runoff from houses draining direct to SW network: 100%

• Runoff from houses draining to permeable paving: 80%

• Runoff from green roofs: 75%

• Runoff from Roads, footpaths & Green-links draining to swales 80%

• Runoff from Permeable Paving Driveways 75%

• Runoff from Open Grassed Areas 15%

Surface water sewers have been designed in accordance with IS EN 752 and the recommendations of the 'Greater Dublin Strategic Drainage Study', (GDSDS).

The minimum pipe diameter for public surface water sewers is 225mm. Private drains within the proposed development will be 150mm as outlined on DBFL drawing 210026-DBFL-CS-SP-DR-C-1201.

Surface water sewer modelling results for the main drainage networks is included in Appendix C. The surface water drainage network simulation results are included in Appendix C which demonstrate that stormwater is contained below ground for the 1:30 year critical storm and within the open detention basins for the 1:100 year critical storm.

3.7 Drainage Ditches and Overland Flow

A network of drainage ditches exist within the existing hedgerows on the subject site. In general it is proposed to maintain these drainage ditches and incorporate them into the proposed development. Culverts and headwalls are required where roads cross the existing ditches. As noted in Section 3.1 above, an existing "pond" is identified on the Newcastle LAP, 2012 in the south western area of the subject site. DBFL have reviewed this area on site and no pond was present but it appears there is a depression in this area of the site based on the topography. Some evidence of an overland flow route is

present on historic aerial mapping and appears to be emanating from an existing drainage ditch.

DBFL undertook a catchment analysis on the ditch upstream of the existing depression using the Institute of Hydrology (IOH) formula for small catchments less than 25km^2. The flow for the 1% AEP event was calculated as 0.21m^3/s. This flow was also multiplied by the Standard Factorial Error (1.65) for the IOH formula factored up by 20% for climate change. The resulting design flow for the culverts sizing was calculated as 0.25m^3/s.

A 600m diameter culvert and swale have been designed to convey any over land flow from the depression to the existing ditch network as shown on drawing 210026-DBFL-CS-SP-DR-C-1201. Refer to Appendix D for detailed design calculations.

3.8 Climate Change

Rainfall values for the proposed development are sourced from Met Eireann to calculate the FSR input hydrograph for the drainage design as required by the GDSDS. The design rainfall intensities were increased by a factor of 20% to take account of climate change, as required by the GDSDS for attenuation storage design.

3.9 Pluvial Flooding Provision

The surface water network, attenuation storage and site levels are designed to accommodate a 100 year storm event and includes climate change provision. Floor levels of houses are set above the 100 year flood levels by a minimum of 0.5m for protection. For storms in excess of 100 years, the development has been designed to provide overland flood routes along the various development roads towards the surface water drainage outfall and adjoining roads. Refer to DBFL's Site Specific Flood Risk Assessment for further details.

3.10 Surface Water Quality Impact

Run-off rates from the site are controlled by vortex flow control devices. Surface water management proposals for the development also incorporate the following to reduce its impact;

- Designed in accordance with GDSDS requirements;
- Incorporates SUDS features e.g. permeable paving in high risk parking areas at the front of houses;
- On-line attenuation/infiltration facilities with an oil separator prior to discharge to a public surface water sewer.

4.0 FOUL DRAINAGE

4.1 Existing Foul Drainage

The existing site is predominantly greenfield and therefore has no foul loading at present. Foul infrastructure has been constructed as part of the Graydon development to the east of the subject site in accordance with the Irish water code of practice. A 225mm foul sewer is located in the Athgoe Road to the west of the site. Irish Water have indicated that the foul sewer outfalls to Peamount Pump Station where there are some network constraints.

The existing foul sewers are shown on drawing 210026-DBFL-CS-SP-DR-C-1201.

4.2 Consultation with Irish Water

An Irish Water Pre-Connection Enquiry form was submitted to Irish Water and an Irish Water Feedback form has been received outlining that a Wastewater connection can be facilitated for the proposed development. Refer to Appendix A for a copy of the confirmation of feasibility. DBFL and Cairn Homes have liaised with Irish Water regarding the Newcastle Local Network Reinforcement Project and Newcastle Pumping Station. It was agreed that a pumping station within the subject site to pump back to the Graydon development was the optimum solution as the foul outflow would then avoid the network constraints in Newcastle Village and Peamount Pump Station. Cairn Homes have also entered into a Project Works Services Agreement (PWSA) on Newcastle Pumping Station to establish if any constraints exist at the pumping station. Cairn Homes entered into this PWSA in April 2021 and agreed to fund the study of the pumping station for Irish Water. The study is ongoing and preliminary results are expected imminently. Cairn Homes, DBFL and Irish Water hold regular meetings on the progress of the study.

4.3 Design Strategy

The proposed foul drainage system for the subject site will connect to the existing 225mm diameter foul sewer in the Graydon development provided under planning reference ABP 305343-19. A Wastewater Pumping Station is proposed to serve the majority of the subject site and forms part of this planning application. Foul drainage from the proposed development will drain to a proposed pumping station at the north of the site by gravity before being pumped back to a stand-off manhole at the south of the site and discharging to Graydon development infrastructure. The capacity of the foul infrastructure in the Graydon development was reviewed and found to have to have sufficient capacity to accommodate the subject site. The Creche will use the permitted Graydon infrastructure.

A section to the southeast of the subject site will not make use of the pumping station due to favourable levels and will flow by gravity and discharge to the Graydon development where it will be connected by gravity.

Individual houses will connect to the 225mm diameter foul drains via individual 100mm diameter house connections, as per Irish Water Code of Practice for Wastewater Infrastructure.

A Statement of Design Acceptance has also been received from Irish Water and included in Appendix A.

The proposed foul sewer network is shown on DBFL drawing 210026-DBFL-CS-SP-DR-C-1201.

4.4 Design Calculations

Foul sewers have been designed in accordance with the Building Regulations and specifically in accordance with the principles and methods set out in the Irish Water Code of Practice, IS EN752 (2008), IS EN12056: Part 2 (2000) and the recommendations of the 'Greater Dublin Strategic Drainage Study', (GDSDS).

The following criteria have been applied:

Demand	446l/dwelling/day (based on 2.7 persons per house, a per capita wastewater flow of 150 litres per head per day and a 10% allowance for infiltration)
	60l per person per day for Creche
Discharge units	14 units per house (as BS8301)
Pipe Friction (Ks)	1.5 mm
Minimum Velocity	0.75 m/s (self-cleansing velocity)
Maximum Velocity	2.5 m/s
Frequency Factor	0.5 for domestic use
Manhole Depths	< 5.0m

Foul sewer design calculations from Windes are provided in Appendix F.

All foul sewers and manholes will be constructed in accordance with the Irish Water Standard Details and the Irish Water Code of Practice for Wastewater.

Longitudinal sections will be provided on drawings 210026-DBFL-CS-SP-DR-C-3205, 210026-DBFL-CS-SP-DR-C-3206, 210026-DBFL-CS-SP-DR-C-3207 & 210026-DBFL-FW-SP-DR-C-3208.

4.5 Compliance with Irish Water Standards

The proposed foul sewer design and layout is in accordance with the Irish Water Code of Practice for Wastewater Infrastructure and The Irish Water Wastewater Infrastructure Standard Details.

4.6 Foul Environmental Impacts

This application comprises 280 residential units and a creche in the existing Graydon development. The majority of the development will discharge by gravity to a proposed pumping station at the subject site before being pumped back to the Graydon development where by gravity sewers it will discharge to the existing Newcastle Pumping Station which pumps foul water to a gravity sewer at the Rathcoole Interchange which ultimately discharges to Ringsend waste water treatment works. The estimated average daily load from the development is 190m^3 with a total average BOD loading of 32 Kg per day. See below for calculations.

PREDICTED DEVELOPMENT FOUL FLOWS						
Use Type	**No. of Units / Area**	**Occupancy Rate**	**Population (P)**	**Loading (G) (l/day/person) ***	**Daily Loading (PG) (l/day)**	**Daily Loading (l/s)**
Residential	280	2.7 people/ dwelling	756	150	113,400	1.32
Creche	700m^2	20	35	60	2100	0.02
					Total Loading (l/s)	**1.34**
					Growth Factor	1
					Infiltration @ 10% (as Cop App C 1.2.4)	0.13
					Dry Weather Flow l/s	**1.47**
					Residential Peaking factor (as CoP App C 1.2.5)	6
					Residential Design Foul Flow (l/s)	**8.844**
***Flow rates calculated using IW CoP for Wastewater Infrastructure Appendix F**						

Table 4.1 – Development Foul Flow Calculations

4.7 Pumping station

As discussed in Section 4.3 a Wastewater Pumping Station is proposed for the site. The pumping station layout has been developed with the project Landscape Architect to integrate the pumping station into the open space. The majority of the pumping station infrastructure will be located below ground in the form of tanks. These tanks can be landscaped over, and the only indication of their presence is the locked access covers.

As per Irish Water's latest Code of Practice for Wastewater, welfare buildings are not required at pumping stations of this size and the only above ground infrastructure required is the control kiosk and wet kiosk. Example of where similar kiosks have been incorporated into landscaped open space within residential developments is shown in Figure 4.1 and 4.2 below.

Figure 4.1 – Example foul pumping station

Figure 4.2 – Example of foul pumping station

The pumping station will be constructed in compliance with Irish Water Code of Practice for Wastewater Infrastructure (IW-CDS-5030-03) and Irish Water Technical Standard – Wastewater Pumping Stations & Rising Mains (IW-TEC-800-02). The proposed pumping station layout is shown on drawing numbers 210026-DBFL-CS-SP-DR-C-5111 & 210026-DBFL-CS-SP-DR-C-1207.

The design parameters for the proposed pumping station are shown below. Detailed calculations are provided in Appendix F.

	Pump Station
Residential Units Subject Site	238
Future Residential Units – zoned lands to the north and east	32
Future Residential Units – Zoned lands to the south	82
Total Residential Units	352
DWF	157m^3/day

PE	1200
Pass Forward Flow	440m^3/day
Pump Design Flow	6l/s
Pump Design Head	9.04m
Rising Main Dia	160mm OD (PE 100)
Emergency Storage Volume	144m^3

5.0 WATER SUPPLY AND DISTRIBUTION

5.1 Existing Water supply

The existing site is predominantly greenfield and therefore has no water supply at present. Water supply infrastructure has been constructed as part of Graydon development to the east of the subject site (under planning reference ABP 305343-19) in accordance with the Irish water code of practice. There is a 100mm and 150mm watermain along the L6001 to the west of the subject site.

The existing watermains are shown on drawing 210026-DBFL-WM-SP-DR-C-1301.

5.2 Development Water Main Layout

The development's proposed water-main distribution system is shown on drawing 210026-DBFL-WM-SP-DR-C-1301.

It is proposed to connect to the existing 250mm watermain provided in the Graydon development at Newcastle boulevard to the south east of the site through the link street of the proposed site. A closed valve connection is also proposed to the existing watermain in Athgoe road. The proposed 250mm trunk watermain will serve a number of 150mm diameter watermain loops throughout the development. A number of 100mm watermain loops will be fed from the 150mm watermains along the Local Streets.

The creche will use the permitted Graydon development water supply.

The selected pipe material options for the development will be PE-100.

Individual houses will have their own connections to the distribution main via service connections and boundary boxes. Individual service boundary boxes will be of the type to suit Irish Water and to facilitate domestic meter installation.

Hydrants are provided for fire-fighting at locations to ensure that each dwelling is within the required Building Regulations distance of a hydrant.

5.3 Compliance with Irish Water Standards

The proposed watermain design and layout is in accordance with the Irish Water Code of Practice for Water Infrastructure and The Irish Water, Water Infrastructure Standard Details.

5.4 Water Demand & Conservation

The average daily domestic demand (ADDD) for the proposed development is approximately 116m³ and an average day / peak week demand of 144.3m³ has been calculated as outlined in the Irish Water Code of Practice for Water Infrastructure.

The average water daily domestic demand is estimated to be 1.34l/s. The peak demand for sizing of the pipe network (5 times the average day, peak week demand) is calculated as 8.35 l/s. See calculations below in Table 5.1.

An Irish Water Pre-Connection Enquiry form has been submitted to Irish Water and an Irish Water Feedback form has been received outlining that a Watermain connection is possible for the proposed development. A network extension from the east of the subject site through the Graydon development has been provided as part of the previously permitted Graydon development. Refer to Appendix A for confirmation of feasibility.

A Statement of Design Acceptance has also been received from Irish Water and included in Appendix A.

WATER DEMAND							
Use Type	**No. of units / Area**	**Occupancy Rate**	**Population (P)**	**Average daily domestic demand (l/day)**	**Average daily domestic demand (l/s)**	**Average day/peak week demand (l/s)**	**Peak hour water demand (l/s)**
Residential	280	2.7 per dwelling	756	113,400	1.32	1.65	8.25
Creche	700m^2	20	35	60	0.02	0.025	0.12
						Peak hour water demand (l/s)	**8.37**
***Flow rates calculated using IW CoP for Watermains**							

Table 5.1 – Development Water Demand

Appendix A
IW CONFIRMATION OF FEASIBILITY & STATEMENT OF DESIGN ACCEPTANCE

Conor O' Loughlin
Ormond House
Upper Ormond Quay
Dublin 7
D07N5YH

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

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

www.water.ie

9 June 2022

Re: Design Submission for Newcastle, South Dublin, Dublin (the "Development") (the "Design Submission") / Connection Reference No: CDS22003002

Dear Conor O' Loughlin,

Many thanks for your recent Design Submission.

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

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

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

If you have any further questions, please contact your Irish Water representative:
Name: Dario Alvarez
Email: dalvarez@water.ie

Yours sincerely,

Yvonne Harris

Yvonne Harris
Head of Customer Operations

Appendix A

Document Title & Revision

- 210026-DBFL-WM-SP-DR-C-1301 Proposed Watermain Layout
- 210026-DBFL-CS-SP-DR-C-1201 Proposed Drainage Layout
- 210026-DBFL-CS-SP-DR-C-3205 Foul Sewer Longitudinal Sections Sheet 1
- 210026-DBFL-CS-SP-DR-C-3206 Foul Sewer Longitudinal Sections Sheet 2
- 210026-DBFL-CS-SP-DR-C-3207 Foul Sewer Longitudinal Sections Sheet 3

Standard Details/Code of Practice Exemption: N/A

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

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

Conor O' Loughlin
DBFL Consulting Engineers
Ormond House
Upper Ormond Quay
Dublin 7

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

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

www.water.ie

31 May 2022

Re: CDS22003002 pre-connection enquiry - Subject to contract | Contract denied

Connection for Housing Development of 309 unit(s) at Newcastle, South Dublin, Dublin

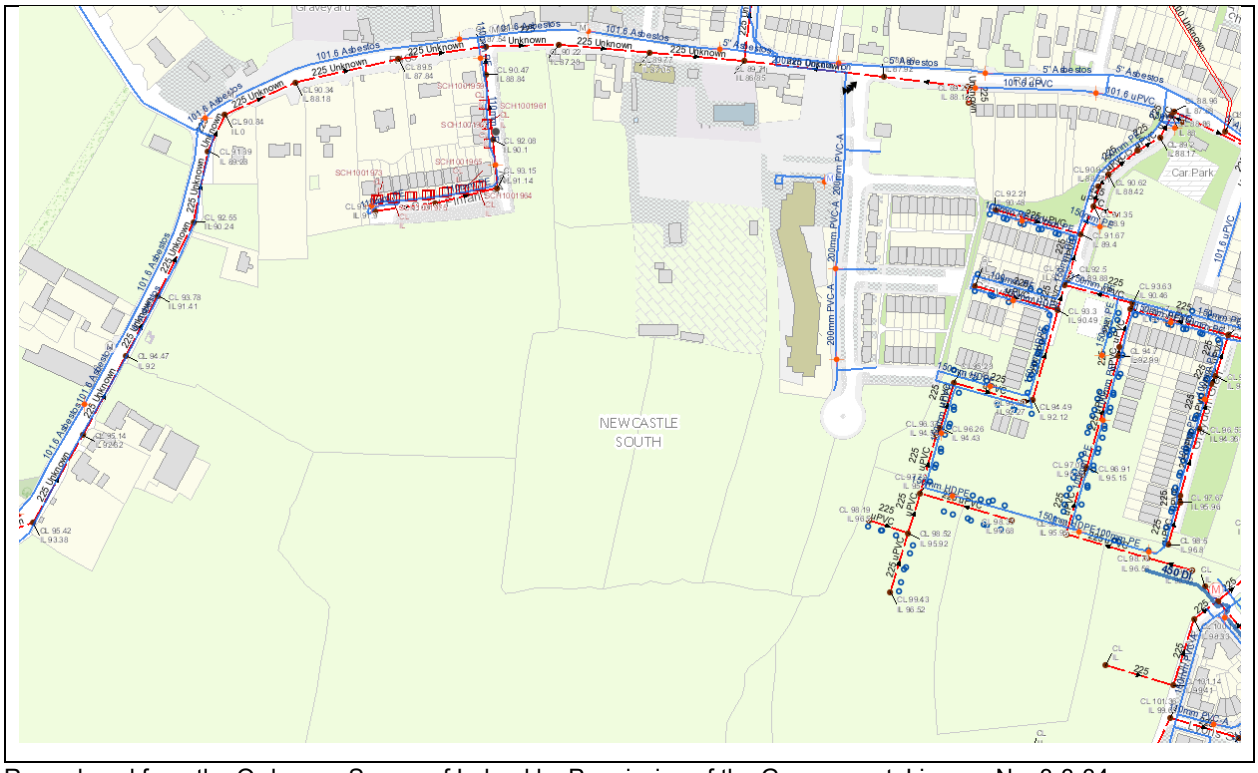
Dear Sir/Madam,

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

SERVICE	**OUTCOME OF PRE-CONNECTION ENQUIRY** **THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.**
Water Connection	Feasible Subject to upgrades
Wastewater Connection	Feasible Subject to upgrades
SITE SPECIFIC COMMENTS	
Water Connection	A network extension of approximately 300m of new 300mm ID watermain will be required to connect to the existing 450mm DI main to the East of the site (Red line in below mapping). These extension works are not currently on the Irish Water investment plan therefore, the applicant will be required to fund these local network upgrades. The fee will be calculated at a connection application stage. A new 200mm ID connection (Green line below) will be made to the new Section of 300mm watermain. A bulk meter will be required on this connection main. A secondary 150mm ID connection is to be made to the existing 6” AC main to the West of the site (Orange line in mapping below). This connection main is to be fitted with a control valve which is to be set to closed during normal operations.

	
Wastewater Connection	There is an ongoing Project Works Services Agreement to establish the upgrades required at Newcastle Wastewater Pumping Station and the immediate downstream network. The customer will be required to fund the upgrades. The connection for the development can be facilitated in the interim with the installation of an on-site pumping station with 24-hour storage to cater for the full development. The customer will also be responsible for any additional maintenance requirements such as dosing. The new pumping station is to discharge to the existing development to the East which bypasses the constrained network to the North of the development. Forward flows from the development are to be managed via telemetry link between the new on-site pumping station and the Newcastle pumping station.
The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement.	

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



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

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

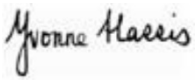
General Notes:

1) The initial assessment referred to above is carried out taking into account water demand and wastewater discharge volumes and infrastructure details on the date of the assessment. **The availability of capacity may change at any date after this assessment.**
2) This feedback does not constitute a contract in whole or in part to provide a connection to any Irish Water infrastructure. All feasibility assessments are subject to the constraints of the Irish Water Capital Investment Plan.
3) The feedback provided is subject to a Connection Agreement/contract being signed at a later date.
4) A Connection Agreement will be required to commencing the connection works associated with the enquiry this can be applied for at https://www.water.ie/connections/get-connected/
5) A Connection Agreement cannot be issued until all statutory approvals are successfully in place.
6) Irish Water Connection Policy/ Charges can be found at https://www.water.ie/connections/information/connection-charges/
7) Please note the Confirmation of Feasibility does not extend to your fire flow requirements.

8) Irish Water is not responsible for the management or disposal of storm water or ground waters. You are advised to contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges
9) To access Irish Water Maps email datarequests@water.ie
10) All works to the Irish Water infrastructure, including works in the Public Space, shall have to be carried out by Irish Water.

If you have any further questions, please contact Kevin McManmon from the design team at kmcmanmon@water.ie For further information, visit **www.water.ie/connections.**

Yours sincerely,



Yvonne Harris

Head of Customer Operations

Appendix B
SURFACE WATER NETWORK CALCULATIONS

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW_1

Pipe Sizes standard Manhole Sizes standard

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	17.700	Add Flow / Climate Change (%)	20
Ratio R	0.271	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	100	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for SW_1

« - 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
1.000	33.252	0.166	200.3	0.084	4.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	10.400	0.052	200.0	0.067	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	62.621	0.313	200.1	0.045	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	69.106	0.346	200.0	0.045	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.004	9.223	0.046	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	24.880	0.711	35.0	0.054	4.00	0.0	0.600	o	225	Pipe/Conduit	
2.001	71.262	0.356	200.2	0.128	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.002	12.727	0.069	185.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.003	8.756	0.052	167.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	54.41	4.60	93.369	0.084	0.0	0.0	2.5	0.92	36.6	14.9
1.001	53.64	4.79	93.203	0.151	0.0	0.0	4.4	0.92	36.6	26.3
1.002	49.52	5.92	93.151	0.196	0.0	0.0	5.3	0.92	36.6	31.5
1.003	45.80	7.17	92.838	0.241	0.0	0.0	6.0	0.92	36.6	35.9
1.004	45.35	7.34	92.492	0.241	0.0	0.0	6.0	0.92	36.6	35.9
2.000	56.21	4.19	94.575	0.054	0.0	0.0	1.6	2.22	88.2	9.9
2.001	51.04	5.48	93.864	0.182	0.0	0.0	5.0	0.92	36.6	30.2
2.002	50.27	5.70	93.508	0.182	0.0	0.0	5.0	0.96	38.1	30.2
2.003	49.79	5.84	93.439	0.182	0.0	0.0	5.0	1.01	40.1	30.2

Network Design Table for SW_1

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	51.375	0.588	87.4	0.132	4.00	0.0	0.600	o	225	Pipe/Conduit	
3.001	70.339	1.353	52.0	0.129	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.000	17.521	0.088	200.0	0.137	4.00	0.0	0.600	o	225	Pipe/Conduit	
4.001	53.542	0.268	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.002	15.093	0.067	225.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
5.000	53.155	0.401	132.6	0.080	4.00	0.0	0.600	o	225	Pipe/Conduit	
5.001	19.808	0.073	271.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
5.002	26.197	0.110	238.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
5.003	28.718	0.220	130.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.003	12.697	0.063	201.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.004	24.449	0.144	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.005	10.047	0.067	149.9	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.006	13.580	0.102	133.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.007	15.223	0.106	143.6	0.092	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.008	15.978	0.094	170.0	0.013	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.009	13.911	0.082	169.6	0.013	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.010	9.170	0.055	166.7	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.011	9.262	0.054	171.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.012	62.815	0.819	76.7	0.161	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	54.37	4.61	95.870	0.132	0.0	0.0	3.9	1.40	55.6	23.3
3.001	51.84	5.26	95.282	0.261	0.0	0.0	7.3	1.82	72.3	44.0
4.000	55.63	4.32	95.885	0.137	0.0	0.0	4.1	0.92	36.6	24.8
4.001	51.73	5.29	95.797	0.137	0.0	0.0	4.1	0.92	36.6	24.8
4.002	50.70	5.58	95.530	0.137	0.0	0.0	4.1	0.87	34.5	24.8
5.000	53.67	4.78	96.975	0.080	0.0	0.0	2.3	1.13	45.1	14.0
5.001	52.05	5.20	96.574	0.080	0.0	0.0	2.3	0.79	31.4	14.0
5.002	50.21	5.72	96.501	0.080	0.0	0.0	2.3	0.84	33.5	14.0
5.003	48.83	6.14	96.391	0.080	0.0	0.0	2.3	1.14	45.4	14.0
4.003	48.11	6.37	95.463	0.217	0.0	0.0	5.7	0.92	36.5	33.9
4.004	46.91	6.77	95.390	0.217	0.0	0.0	5.7	1.00	39.8	33.9
4.005	46.46	6.93	95.246	0.217	0.0	0.0	5.7	1.07	42.4	33.9
4.006	45.91	7.13	95.179	0.217	0.0	0.0	5.7	1.13	45.0	33.9
4.007	45.29	7.36	95.139	0.309	0.0	0.0	7.6	1.09	43.3«	45.5
4.008	44.72	7.59	94.958	0.322	0.0	0.0	7.8	1.20	85.0	46.8
4.009	44.24	7.78	94.864	0.335	0.0	0.0	8.0	1.20	85.1	48.2
4.010	43.93	7.90	94.782	0.335	0.0	0.0	8.0	1.21	85.9	48.2
4.011	43.62	8.03	94.727	0.335	0.0	0.0	8.0	1.20	84.6	48.2
4.012	42.28	8.62	94.673	0.496	0.0	0.0	11.4	1.80	127.0	68.2

Network Design Table for SW_1

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
6.000	63.218	0.506	124.9	0.178	4.00	0.0	0.600	o	225	Pipe/Conduit	
6.001	62.882	0.758	83.0	0.172	0.00	0.0	0.600	o	300	Pipe/Conduit	
7.000	9.926	0.095	104.5	0.032	4.00	0.0	0.600	o	225	Pipe/Conduit	
7.001	51.857	0.576	90.0	0.162	0.00	0.0	0.600	o	225	Pipe/Conduit	
8.000	14.848	0.190	78.1	0.048	4.00	0.0	0.600	o	255	Pipe/Conduit	
9.000	20.094	0.229	87.7	0.010	4.00	0.0	0.600	o	225	Pipe/Conduit	
8.001	14.848	0.095	156.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
7.002	47.048	0.803	58.6	0.058	0.00	0.0	0.600	o	225	Pipe/Conduit	
6.002	42.231	0.194	217.7	0.085	0.00	0.0	0.600	o	375	Pipe/Conduit	
6.003	44.022	0.209	210.6	0.108	0.00	0.0	0.600	o	375	Pipe/Conduit	
10.000	46.964	0.671	70.0	0.103	4.00	0.0	0.600	o	225	Pipe/Conduit	
6.004	26.248	0.164	160.0	0.063	0.00	0.0	0.600	o	375	Pipe/Conduit	
6.005	18.464	0.115	160.6	0.000	0.00	0.0	0.600	o	375	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)
6.000	53.19	4.90	98.825	0.178	0.0	0.0	5.1	1.17	46.5	30.8
6.001	50.93	5.51	98.244	0.350	0.0	0.0	9.7	1.73	122.1	57.9
7.000	56.47	4.13	99.035	0.032	0.0	0.0	1.0	1.28	50.8	5.9
7.001	53.77	4.76	98.940	0.194	0.0	0.0	5.7	1.38	54.8	33.9
8.000	56.36	4.15	98.755	0.048	0.0	0.0	1.5	1.60	81.9	8.8
9.000	55.97	4.24	98.795	0.010	0.0	0.0	0.3	1.40	55.5	1.8
8.001	54.93	4.48	98.565	0.058	0.0	0.0	1.7	1.04	41.5	10.4
7.002	52.00	5.21	98.364	0.310	0.0	0.0	8.7	1.71	68.1	52.4
6.002	49.00	6.08	97.411	0.745	0.0	0.0	19.8	1.22	135.2	118.6
6.003	47.20	6.67	97.217	0.853	0.0	0.0	21.8	1.24	137.5	130.9
10.000	54.84	4.50	98.175	0.103	0.0	0.0	3.1	1.57	62.2	18.4
6.004	46.33	6.98	97.008	1.019	0.0	0.0	25.6	1.43	157.9	153.4
6.005	45.74	7.19	96.844	1.019	0.0	0.0	25.6	1.43	157.6	153.4

Network Design Table for SW_1

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
6.006	115.373	2.747	42.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
6.007	9.821	0.196	50.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
3.002	16.804	0.454	37.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
3.003	18.612	0.058	321.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
2.004	12.489	0.062	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.005	15.306	0.077	198.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
11.000	67.336	0.458	147.0	0.060	4.00	0.0	0.600	o	225	Pipe/Conduit	
11.001	15.706	0.107	146.8	0.010	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.006	58.428	0.329	177.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.005	8.051	0.036	223.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.006	19.051	0.048	400.9	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.007	3.784	0.027	140.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
6.006	43.99	7.88	96.729	1.019	0.0	0.0	25.6	2.80	309.6	153.4
6.007	43.83	7.94	93.982	1.019	0.0	0.0	25.6	2.57	283.6	153.4
3.002	42.07	8.71	93.779	1.776	0.0	0.0	40.5	2.99	329.9	242.8
3.003	41.54	8.96	93.175	1.776	0.0	0.0	40.5	1.24	269.5	242.8
2.004	41.07	9.19	92.980	1.958	0.0	0.0	43.6	0.92	36.6«	261.3
2.005	40.51	9.46	92.918	1.958	0.0	0.0	43.6	0.92	36.7«	261.3
11.000	52.65	5.04	93.525	0.060	0.0	0.0	1.7	1.08	42.8	10.3
11.001	51.73	5.29	93.067	0.070	0.0	0.0	2.0	1.08	42.8	11.8
2.006	38.65	10.46	92.841	2.028	0.0	0.0	43.6	0.98	38.9«	261.3
1.005	38.43	10.59	92.437	2.269	0.0	0.0	47.2	1.05	74.0«	283.4
1.006	37.98	10.85	92.101	2.269	0.0	0.0	47.2	1.21	342.1	283.4
1.007	37.89	10.90	92.386	2.269	0.0	0.0	47.2	1.10	43.8«	283.4

Free Flowing Outfall Details for SW_1

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.007	S0	94.000	92.359	0.000	0	0

Online Controls for SW_1

Hydro-Brake® Optimum Manhole: S4, DS/PN: 2.005, Volume (m³): 2.8

Unit Reference	MD-SHE-0130-9500-1830-9500
Design Head (m)	1.830
Design Flow (l/s)	9.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	130
Invert Level (m)	92.918
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.830	9.5
Flush-Flo™	0.542	9.5
Kick-Flo®	1.114	7.5
Mean Flow over Head Range	-	8.3

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	4.7	1.200	7.8	3.000	12.0	7.000	18.0
0.200	8.1	1.400	8.4	3.500	12.9	7.500	18.6
0.300	8.9	1.600	8.9	4.000	13.8	8.000	19.2
0.400	9.3	1.800	9.4	4.500	14.5	8.500	19.7
0.500	9.5	2.000	9.9	5.000	15.3	9.000	20.3
0.600	9.5	2.200	10.4	5.500	16.0	9.500	20.8
0.800	9.2	2.400	10.8	6.000	16.7		
1.000	8.4	2.600	11.2	6.500	17.3		

Hydro-Brake® Optimum Manhole: S01, DS/PN: 1.007, Volume (m³): 7.5

Unit Reference	MD-SHE-0193-1900-1070-1900
Design Head (m)	1.070
Design Flow (l/s)	19.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	193
Invert Level (m)	92.386
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Hydro-Brake® Optimum Manhole: S01, DS/PN: 1.007, Volume (m³): 7.5

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.070	19.0
Flush-Flo™	0.349	19.0
Kick-Flo®	0.756	16.1
Mean Flow over Head Range	-	16.1

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.7	1.200	20.1	3.000	31.1	7.000	46.8
0.200	18.0	1.400	21.6	3.500	33.5	7.500	48.4
0.300	18.9	1.600	23.0	4.000	35.7	8.000	50.0
0.400	18.9	1.800	24.3	4.500	37.8	8.500	51.5
0.500	18.6	2.000	25.6	5.000	39.8	9.000	52.9
0.600	18.2	2.200	26.8	5.500	41.7	9.500	54.3
0.800	16.6	2.400	27.9	6.000	43.5		
1.000	18.4	2.600	29.0	6.500	45.2		

Summary of Critical Results by Maximum Level (Rank 1) for SW_1

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	20.000
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	4
Number of Online Controls	2	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 0.271
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	17.700	Cv (Winter)	0.840

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

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

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	S2-5	15 Winter	30	+0%	30/15 Summer				93.993
1.001	S2-4	15 Winter	30	+0%	30/15 Summer				93.950
1.002	S2-3	15 Winter	30	+0%	30/15 Summer				93.885
1.003	S2-2	15 Winter	30	+0%	30/15 Summer				93.501
1.004	S2-1	15 Winter	30	+0%	30/15 Summer				92.875
2.000	S5-3	15 Winter	30	+0%					94.647
2.001	S5-2	15 Winter	30	+0%	30/15 Summer				94.588
2.002	S5-1	960 Winter	30	+0%	30/15 Summer				94.375
2.003	S5-1-1	960 Winter	30	+0%	30/15 Summer				94.374
3.000	S7-1	15 Winter	30	+0%					96.078
3.001	S7	15 Winter	30	+0%	30/15 Summer				95.782
4.000	S6-8-5	15 Winter	30	+0%	30/15 Summer				96.295
4.001	S6-8-4	15 Winter	30	+0%	30/15 Summer				96.175
4.002	S6-8-3	15 Winter	30	+0%	30/15 Summer				95.902
5.000	S6-11	15 Winter	30	+0%					97.105
5.001	S6-10	15 Winter	30	+0%					96.744
5.002	SX	15 Winter	30	+0%					96.659
5.003	SX	15 Winter	30	+0%					96.506

Summary of Critical Results by Maximum Level (Rank 1) for SW_1

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S2-5	0.399	0.000	0.64			21.9	SURCHARGED	
1.001	S2-4	0.522	0.000	1.18			36.3	SURCHARGED	
1.002	S2-3	0.509	0.000	1.22			43.3	SURCHARGED	
1.003	S2-2	0.438	0.000	1.31			46.6	SURCHARGED	
1.004	S2-1	0.158	0.000	1.54			46.5	SURCHARGED	
2.000	S5-3	-0.153	0.000	0.23			18.6	OK	
2.001	S5-2	0.499	0.000	1.42			50.3	SURCHARGED	
2.002	S5-1	0.642	0.000	0.16			5.2	SURCHARGED	
2.003	S5-1-1	0.710	0.000	0.16			5.1	SURCHARGED	
3.000	S7-1	-0.017	0.000	0.82			43.6	OK	
3.001	S7	0.275	0.000	1.05			73.5	SURCHARGED	
4.000	S6-8-5	0.185	0.000	1.28			41.9	SURCHARGED	
4.001	S6-8-4	0.153	0.000	1.07			37.6	SURCHARGED	
4.002	S6-8-3	0.147	0.000	1.14			34.6	SURCHARGED	
5.000	S6-11	-0.095	0.000	0.61			26.3	OK	
5.001	S6-10	-0.055	0.000	0.92			26.1	OK	
5.002	SX	-0.067	0.000	0.82			25.5	OK	
5.003	SX	-0.110	0.000	0.52			21.9	OK	

Summary of Critical Results by Maximum Level (Rank 1) for SW_1

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
4.003	S6-8-2	15 Winter	30	+0%	30/15 Summer			
4.004	S6-12	120 Winter	30	+0%				
4.005	S6-13	120 Winter	30	+0%				
4.006	S6-14	15 Winter	30	+0%				
4.007	S6-6	15 Winter	30	+0%				
4.008	S6-5	15 Winter	30	+0%				
4.009	S6-4	15 Winter	30	+0%				
4.010	S6-3	15 Winter	30	+0%				
4.011	S6-2	15 Winter	30	+0%				
4.012	S6-1	15 Winter	30	+0%				
6.000	S13	15 Winter	30	+0%	30/15 Summer			
6.001	S12	15 Winter	30	+0%	30/15 Summer			
7.000	S11-3	15 Winter	30	+0%	30/15 Summer			
7.001	S11-2	15 Winter	30	+0%	30/15 Summer			
8.000	S11-1-2	15 Winter	30	+0%	30/15 Summer			
9.000	S11-1-1-2	15 Winter	30	+0%	30/15 Summer			
8.001	S11-1-1	15 Winter	30	+0%	30/15 Summer			
7.002	S11-1	15 Winter	30	+0%	30/15 Summer			
6.002	S11	15 Winter	30	+0%	30/15 Summer			
6.003	S10	15 Winter	30	+0%	30/15 Summer			
10.000	S9-1	15 Winter	30	+0%				
6.004	S9	15 Winter	30	+0%	30/15 Summer			
6.005	S8	15 Winter	30	+0%	30/15 Summer			
6.006	S8-1	15 Winter	30	+0%				
6.007	S6X	15 Winter	30	+0%	30/15 Summer			
3.002	S6	15 Winter	30	+0%	30/15 Summer			
3.003	S5	960 Winter	30	+0%	30/15 Summer			
2.004	S4-A	960 Winter	30	+0%	30/15 Summer			
2.005	S4	960 Winter	30	+0%	30/15 Summer			
11.000	S3-2	15 Winter	30	+0%				
11.001	S3-1	15 Winter	30	+0%				
2.006	S3	15 Winter	30	+0%				
1.005	S2	15 Winter	30	+0%	30/15 Summer			
1.006	S1	240 Winter	30	+0%				
1.007	S01	240 Winter	30	+0%	30/180 Winter			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
4.003	S6-8-2	95.817	0.129	0.000	1.78			56.0	SURCHARGED
4.004	S6-12	95.488	-0.127	0.000	0.39			14.4	OK
4.005	S6-13	95.346	-0.125	0.000	0.41			14.4	OK
4.006	S6-14	95.293	-0.111	0.000	0.21			8.1	OK
4.007	S6-6	95.294	-0.070	0.000	0.81			30.8	OK
4.008	S6-5	95.107	-0.151	0.000	0.49			35.1	OK
4.009	S6-4	95.026	-0.138	0.000	0.55			39.0	OK
4.010	S6-3	94.958	-0.124	0.000	0.64			39.5	OK

Summary of Critical Results by Maximum Level (Rank 1) for SW_1

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
4.011	S6-2	94.902	-0.125	0.000	0.64			39.4	OK
4.012	S6-1	94.871	-0.102	0.000	0.73			88.6	OK
6.000	S13	99.380	0.330	0.000	1.14			51.3	SURCHARGED
6.001	S12	98.844	0.300	0.000	0.77			90.2	SURCHARGED
7.000	S11-3	99.544	0.284	0.000	0.18			7.8	SURCHARGED
7.001	S11-2	99.536	0.371	0.000	0.97			50.8	SURCHARGED
8.000	S11-1-2	99.194	0.184	0.000	0.23			15.9	SURCHARGED
9.000	S11-1-1-2	99.185	0.165	0.000	0.07			3.3	SURCHARGED
8.001	S11-1-1	99.180	0.390	0.000	0.64			23.3	SURCHARGED
7.002	S11-1	99.161	0.572	0.000	0.97			63.2	SURCHARGED
6.002	S11	98.478	0.692	0.000	1.27			156.9	SURCHARGED
6.003	S10	98.168	0.576	0.000	1.37			172.9	SURCHARGED
10.000	S9-1	98.300	-0.100	0.000	0.59			35.4	OK
6.004	S9	97.772	0.389	0.000	1.53			209.6	SURCHARGED
6.005	S8	97.385	0.166	0.000	1.60			209.3	SURCHARGED
6.006	S8-1	96.961	-0.143	0.000	0.69			206.7	OK
6.007	S6X	94.797	0.440	0.000	1.24			214.7	SURCHARGED
3.002	S6	94.513	0.359	0.000	1.25			328.5	SURCHARGED
3.003	S5	94.375	0.675	0.000	0.25			51.7	SURCHARGED
2.004	S4-A	94.373	1.168	0.000	0.30			9.5	SURCHARGED
2.005	S4	94.359	1.216	0.000	0.29			9.5	SURCHARGED
11.000	S3-2	93.637	-0.113	0.000	0.46			19.2	OK
11.001	S3-1	93.193	-0.099	0.000	0.60			22.6	OK
2.006	S3	92.991	-0.075	0.000	0.75			27.9	OK
1.005	S2	92.764	0.027	0.000	1.26			69.5	SURCHARGED
1.006	S1	92.653	-0.048	0.000	0.07			18.4	OK
1.007	S01	92.616	0.005	0.000	0.61			18.3	SURCHARGED

PN	US/MH Name	Level Exceeded
4.003	S6-8-2	
4.004	S6-12	
4.005	S6-13	
4.006	S6-14	
4.007	S6-6	
4.008	S6-5	
4.009	S6-4	
4.010	S6-3	
4.011	S6-2	
4.012	S6-1	
6.000	S13	
6.001	S12	
7.000	S11-3	
7.001	S11-2	
8.000	S11-1-2	
9.000	S11-1-1-2	

Summary of Critical Results by Maximum Level (Rank 1) for SW_1

PN	US/MH Name	Level Exceeded
8.001	S11-1-1	
7.002	S11-1	
6.002	S11	
6.003	S10	
10.000	S9-1	
6.004	S9	
6.005	S8	
6.006	S8-1	
6.007	S6X	
3.002	S6	
3.003	S5	
2.004	S4-A	
2.005	S4	
11.000	S3-2	
11.001	S3-1	
2.006	S3	
1.005	S2	
1.006	S1	
1.007	S01	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW_2

Pipe Sizes standard Manhole Sizes standard

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	17.700	Add Flow / Climate Change (%)	20
Ratio R	0.271	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	100	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for SW_2

« - 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
3.000	60.802	0.380	160.0	0.168	4.00	0.0	0.600	o	225	Pipe/Conduit	
3.001	57.101	0.571	100.0	0.149	0.00	0.0	0.600	o	225	Pipe/Conduit	
3.002	10.511	0.105	100.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.000	25.021	0.626	40.0	0.055	4.00	0.0	0.600	o	225	Pipe/Conduit	
3.003	5.592	0.042	133.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
3.004	4.837	0.020	237.4	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
3.005	3.600	0.021	171.4	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
3.006	7.567	0.045	168.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
3.007	6.218	0.037	168.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
3.000	52.88	4.98	93.715	0.168	0.0	0.0	4.8	1.03	41.0	28.9
3.001	50.23	5.71	93.335	0.317	0.0	0.0	8.6	1.31	52.0	51.8
3.002	49.78	5.84	92.764	0.317	0.0	0.0	8.6	1.31	52.0	51.8
4.000	56.14	4.20	93.375	0.055	0.0	0.0	1.7	2.08	82.5	10.0
3.003	49.55	5.91	92.584	0.372	0.0	0.0	10.0	1.36	96.2	59.9
3.004	49.29	5.99	92.542	0.372	0.0	0.0	10.0	1.02	71.8	59.9
3.005	49.13	6.04	92.390	0.372	0.0	0.0	10.0	1.20	84.7	59.9
3.006	48.73	6.17	92.369	0.372	0.0	0.0	10.0	1.01	40.0«	59.9
3.007	48.41	6.27	92.324	0.372	0.0	0.0	10.0	1.01	40.0«	59.9

Free Flowing Outfall Details for SW_2

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
3.007	SA0-4	94.000	92.287	0.000	0	0

Simulation Criteria for SW_2

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	20.000
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	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	17.700	Storm Duration (mins)	30
Ratio R	0.271		

Online Controls for SW_2

Hydro-Brake® Optimum Manhole: SA0-2, DS/PN: 3.006, Volume (m³): 2.0

Unit Reference	MD-SHE-0060-1900-1390-1900
Design Head (m)	1.390
Design Flow (l/s)	1.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	60
Invert Level (m)	92.369
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.390	1.9
Flush-Flo™	0.268	1.5
Kick-Flo®	0.540	1.2
Mean Flow over Head Range	-	1.5

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	1.3	1.200	1.8	3.000	2.7	7.000	4.0
0.200	1.5	1.400	1.9	3.500	2.9	7.500	4.1
0.300	1.5	1.600	2.0	4.000	3.1	8.000	4.3
0.400	1.5	1.800	2.1	4.500	3.3	8.500	4.4
0.500	1.3	2.000	2.2	5.000	3.4	9.000	4.5
0.600	1.3	2.200	2.3	5.500	3.6	9.500	4.6
0.800	1.5	2.400	2.4	6.000	3.7		
1.000	1.6	2.600	2.5	6.500	3.9		

Summary of Critical Results by Maximum Level (Rank 1) for SW_2

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	20.000
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 0.271
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	17.700	Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
3.000	SA4	15 Winter	30	+0%	30/15 Summer				94.867
3.001	SA3	15 Winter	30	+0%	30/15 Summer				94.501
3.002	SA2	1440 Winter	30	+0%	30/15 Summer				93.335
4.000	SA1-1	15 Winter	30	+0%					93.451
3.003	SA1	1440 Winter	30	+0%	30/15 Summer				93.333
3.004	SA2	1440 Winter	30	+0%	30/15 Summer				93.332
3.005	SA0-1	1440 Winter	30	+0%	30/15 Winter				93.331
3.006	SA0-2	1440 Winter	30	+0%	30/15 Summer				93.335
3.007	SA0-3	1440 Winter	30	+0%					92.357

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
3.000	SA4	0.927	0.000	0.97			38.3	SURCHARGED	
3.001	SA3	0.941	0.000	1.44			71.9	SURCHARGED	
3.002	SA2	0.346	0.000	0.16			7.0	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for SW_2

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
4.000	SA1-1	-0.149	0.000	0.25			18.9	OK	
3.003	SA1	0.449	0.000	0.13			8.3	SURCHARGED	
3.004	SA2	0.490	0.000	0.17			8.2	SURCHARGED	
3.005	SA0-1	0.641	0.000	0.09			4.7	SURCHARGED	
3.006	SA0-2	0.741	0.000	0.05			1.6	SURCHARGED	
3.007	SA0-3	-0.192	0.000	0.05			1.6	OK	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW_3

Pipe Sizes standard Manhole Sizes standard

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	17.700	Add Flow / Climate Change (%)	20
Ratio R	0.271	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	100	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for SW_3

« - 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
1.000	49.885	0.900	55.4	0.373	4.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	23.979	0.225	106.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	14.536	0.087	167.1	0.000	4.00	0.0	0.600	o	225	Pipe/Conduit	
2.001	62.402	0.956	65.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.002	39.757	0.282	141.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	30.865	0.225	137.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.003	11.458	0.450	25.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.004	52.811	0.236	223.7	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)
1.000	54.95	4.47	96.875	0.373	0.0	0.0	11.1	1.76	70.0	66.6
1.001	53.86	4.73	95.900	0.373	0.0	0.0	11.1	1.52	107.6	66.6
2.000	55.97	4.24	97.075	0.000	0.0	0.0	0.0	1.01	40.1	0.0
2.001	53.27	4.88	96.988	0.000	0.0	0.0	0.0	1.62	64.5	0.0
2.002	51.02	5.48	96.032	0.000	0.0	0.0	0.0	1.10	43.7	0.0
1.002	49.70	5.87	95.675	0.373	0.0	0.0	11.1	1.34	94.8	66.6
1.003	49.50	5.93	95.450	0.373	0.0	0.0	11.1	3.13	221.1	66.6
1.004	46.92	6.77	95.000	0.373	0.0	0.0	11.1	1.05	74.0	66.6

Network Design Table for SW_3

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	64.673	0.583	110.9	0.290	4.00	0.0	0.600	o	300	Pipe/Conduit	
4.000	15.471	0.091	170.0	0.018	4.00	0.0	0.600	o	225	Pipe/Conduit	
4.001	63.186	0.372	169.9	0.015	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.002	40.204	0.554	72.6	0.015	0.00	0.0	0.600	o	225	Pipe/Conduit	
3.001	9.295	0.039	238.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
3.002	11.089	0.037	299.7	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
3.003	4.280	0.016	267.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.005	5.653	0.052	108.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.006	48.474	0.280	173.1	0.000	0.00	0.0	0.600	o	375	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	53.91	4.72	94.962	0.290	0.0	0.0	8.5	1.49	105.5	50.8
4.000	55.89	4.26	95.175	0.018	0.0	0.0	0.5	1.00	39.8	3.3
4.001	51.64	5.31	95.084	0.033	0.0	0.0	0.9	1.00	39.8	5.5
4.002	50.11	5.75	94.712	0.048	0.0	0.0	1.3	1.54	61.1	7.8
3.001	49.60	5.90	94.083	0.338	0.0	0.0	9.1	1.01	71.7	54.5
3.002	48.94	6.10	94.044	0.338	0.0	0.0	9.1	0.90	63.8	54.5
3.003	48.70	6.18	94.007	0.338	0.0	0.0	9.1	0.96	67.6	54.5
1.005	46.71	6.85	93.990	0.711	0.0	0.0	18.0	1.25	49.8«	107.9
1.006	45.11	7.43	93.788	0.711	0.0	0.0	18.0	1.37	151.8	107.9

Free Flowing Outfall Details for SW_3

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.006	SB01	96.000	93.508	0.000	0	0

Simulation Criteria for SW_3

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	20.000
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	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	17.700	Storm Duration (mins)	30
Ratio R	0.271		

Online Controls for SW_3

Hydro-Brake® Optimum Manhole: SB1, DS/PN: 1.006, Volume (m³): 2.1

Unit Reference	MD-SHE-0082-3800-1723-3800
Design Head (m)	1.723
Design Flow (l/s)	3.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	82
Invert Level (m)	93.788
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.723	3.8
Flush-Flo™	0.361	3.2
Kick-Flo®	0.735	2.6
Mean Flow over Head Range	-	3.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.4	1.200	3.2	3.000	4.9	7.000	7.3
0.200	3.0	1.400	3.5	3.500	5.3	7.500	7.6
0.300	3.2	1.600	3.7	4.000	5.6	8.000	7.8
0.400	3.2	1.800	3.9	4.500	5.9	8.500	8.0
0.500	3.1	2.000	4.1	5.000	6.2	9.000	8.3
0.600	3.0	2.200	4.3	5.500	6.5	9.500	8.5
0.800	2.7	2.400	4.4	6.000	6.8		
1.000	3.0	2.600	4.6	6.500	7.1		

Summary of Critical Results by Maximum Level (Rank 1) for SW_3

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	20.000
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 0.271
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	17.700	Cv (Winter)	0.840

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

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

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	SB9	15 Winter	30	+0%	30/15 Summer				98.254
1.001	SB8	15 Winter	30	+0%	30/15 Summer				96.236
2.000	SB7-3	15 Summer	30	+0%					97.075
2.001	SB7-2	15 Summer	30	+0%					96.988
2.002	SB7-1	15 Summer	30	+0%					96.032
1.002	SB7	15 Winter	30	+0%	30/15 Summer				96.012
1.003	SB6	15 Winter	30	+0%					95.620
1.004	SB03	15 Winter	30	+0%	30/15 Summer				95.478
3.000	SB5	15 Winter	30	+0%					95.231
4.000	SB4-3	15 Winter	30	+0%					95.238
4.001	SB4-2	15 Winter	30	+0%					95.167
4.002	SB4-1	15 Winter	30	+0%					94.808
3.001	SB4	15 Winter	30	+0%	30/15 Summer				94.768
3.002	SB3	960 Winter	30	+0%	30/15 Summer				94.641
3.003	SB02	960 Winter	30	+0%	30/15 Summer				94.640
1.005	SB0	960 Winter	30	+0%	30/60 Summer				94.639
1.006	SB1	960 Winter	30	+0%	30/30 Summer				94.641

Summary of Critical Results by Maximum Level (Rank 1) for SW_3

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SB9	1.154	0.000	1.49			99.8	SURCHARGED	
1.001	SB8	0.036	0.000	1.02			97.5	SURCHARGED	
2.000	SB7-3	-0.225	0.000	0.00			0.0	OK	
2.001	SB7-2	-0.225	0.000	0.00			0.0	OK	
2.002	SB7-1	-0.225	0.000	0.00			0.0	OK	
1.002	SB7	0.037	0.000	1.10			95.1	SURCHARGED	
1.003	SB6	-0.130	0.000	0.56			94.4	OK	
1.004	SB03	0.178	0.000	1.35			94.1	SURCHARGED	
3.000	SB5	-0.031	0.000	0.94			94.9	OK	
4.000	SB4-3	-0.162	0.000	0.18			6.2	OK	
4.001	SB4-2	-0.142	0.000	0.28			10.6	OK	
4.002	SB4-1	-0.129	0.000	0.25			14.8	OK	
3.001	SB4	0.385	0.000	1.83			100.9	SURCHARGED	
3.002	SB3	0.297	0.000	0.19			9.8	SURCHARGED	
3.003	SB02	0.333	0.000	0.20			9.7	SURCHARGED	
1.005	SB0	0.424	0.000	0.10			3.3	SURCHARGED	
1.006	SB1	0.478	0.000	0.02			3.2	SURCHARGED	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW_1

Pipe Sizes standard Manhole Sizes standard

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	17.700	Add Flow / Climate Change (%)	20
Ratio R	0.271	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	100	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for SW_1

« - 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
1.000	33.252	0.166	200.3	0.084	4.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	10.400	0.052	200.0	0.067	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	62.621	0.313	200.1	0.045	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	69.106	0.346	200.0	0.045	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.004	9.223	0.046	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	24.880	0.711	35.0	0.054	4.00	0.0	0.600	o	225	Pipe/Conduit	
2.001	71.262	0.356	200.2	0.128	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.002	12.727	0.069	185.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.003	8.756	0.052	167.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	54.41	4.60	93.369	0.084	0.0	0.0	2.5	0.92	36.6	14.9
1.001	53.64	4.79	93.203	0.151	0.0	0.0	4.4	0.92	36.6	26.3
1.002	49.52	5.92	93.151	0.196	0.0	0.0	5.3	0.92	36.6	31.5
1.003	45.80	7.17	92.838	0.241	0.0	0.0	6.0	0.92	36.6	35.9
1.004	45.35	7.34	92.492	0.241	0.0	0.0	6.0	0.92	36.6	35.9
2.000	56.21	4.19	94.575	0.054	0.0	0.0	1.6	2.22	88.2	9.9
2.001	51.04	5.48	93.864	0.182	0.0	0.0	5.0	0.92	36.6	30.2
2.002	50.27	5.70	93.508	0.182	0.0	0.0	5.0	0.96	38.1	30.2
2.003	49.79	5.84	93.439	0.182	0.0	0.0	5.0	1.01	40.1	30.2

Network Design Table for SW_1

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	51.375	0.588	87.4	0.132	4.00	0.0	0.600	o	225	Pipe/Conduit	
3.001	70.339	1.353	52.0	0.129	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.000	17.521	0.088	200.0	0.137	4.00	0.0	0.600	o	225	Pipe/Conduit	
4.001	53.542	0.268	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.002	15.093	0.067	225.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
5.000	53.155	0.401	132.6	0.080	4.00	0.0	0.600	o	225	Pipe/Conduit	
5.001	19.808	0.073	271.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
5.002	26.197	0.110	238.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
5.003	28.718	0.220	130.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.003	12.697	0.063	201.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.004	24.449	0.144	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.005	10.047	0.067	149.9	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.006	13.580	0.102	133.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.007	15.223	0.106	143.6	0.092	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.008	15.978	0.094	170.0	0.013	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.009	13.911	0.082	169.6	0.013	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.010	9.170	0.055	166.7	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.011	9.262	0.054	171.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.012	62.815	0.819	76.7	0.161	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	54.37	4.61	95.870	0.132	0.0	0.0	3.9	1.40	55.6	23.3
3.001	51.84	5.26	95.282	0.261	0.0	0.0	7.3	1.82	72.3	44.0
4.000	55.63	4.32	95.885	0.137	0.0	0.0	4.1	0.92	36.6	24.8
4.001	51.73	5.29	95.797	0.137	0.0	0.0	4.1	0.92	36.6	24.8
4.002	50.70	5.58	95.530	0.137	0.0	0.0	4.1	0.87	34.5	24.8
5.000	53.67	4.78	96.975	0.080	0.0	0.0	2.3	1.13	45.1	14.0
5.001	52.05	5.20	96.574	0.080	0.0	0.0	2.3	0.79	31.4	14.0
5.002	50.21	5.72	96.501	0.080	0.0	0.0	2.3	0.84	33.5	14.0
5.003	48.83	6.14	96.391	0.080	0.0	0.0	2.3	1.14	45.4	14.0
4.003	48.11	6.37	95.463	0.217	0.0	0.0	5.7	0.92	36.5	33.9
4.004	46.91	6.77	95.390	0.217	0.0	0.0	5.7	1.00	39.8	33.9
4.005	46.46	6.93	95.246	0.217	0.0	0.0	5.7	1.07	42.4	33.9
4.006	45.91	7.13	95.179	0.217	0.0	0.0	5.7	1.13	45.0	33.9
4.007	45.29	7.36	95.139	0.309	0.0	0.0	7.6	1.09	43.3«	45.5
4.008	44.72	7.59	94.958	0.322	0.0	0.0	7.8	1.20	85.0	46.8
4.009	44.24	7.78	94.864	0.335	0.0	0.0	8.0	1.20	85.1	48.2
4.010	43.93	7.90	94.782	0.335	0.0	0.0	8.0	1.21	85.9	48.2
4.011	43.62	8.03	94.727	0.335	0.0	0.0	8.0	1.20	84.6	48.2
4.012	42.28	8.62	94.673	0.496	0.0	0.0	11.4	1.80	127.0	68.2

Network Design Table for SW_1

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
6.000	63.218	0.506	124.9	0.178	4.00	0.0	0.600	o	225	Pipe/Conduit	
6.001	62.882	0.758	83.0	0.172	0.00	0.0	0.600	o	300	Pipe/Conduit	
7.000	9.926	0.095	104.5	0.032	4.00	0.0	0.600	o	225	Pipe/Conduit	
7.001	51.857	0.576	90.0	0.162	0.00	0.0	0.600	o	225	Pipe/Conduit	
8.000	14.848	0.190	78.1	0.048	4.00	0.0	0.600	o	255	Pipe/Conduit	
9.000	20.094	0.229	87.7	0.010	4.00	0.0	0.600	o	225	Pipe/Conduit	
8.001	14.848	0.095	156.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
7.002	47.048	0.803	58.6	0.058	0.00	0.0	0.600	o	225	Pipe/Conduit	
6.002	42.231	0.194	217.7	0.085	0.00	0.0	0.600	o	375	Pipe/Conduit	
6.003	44.022	0.209	210.6	0.108	0.00	0.0	0.600	o	375	Pipe/Conduit	
10.000	46.964	0.671	70.0	0.103	4.00	0.0	0.600	o	225	Pipe/Conduit	
6.004	26.248	0.164	160.0	0.063	0.00	0.0	0.600	o	375	Pipe/Conduit	
6.005	18.464	0.115	160.6	0.000	0.00	0.0	0.600	o	375	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)
6.000	53.19	4.90	98.825	0.178	0.0	0.0	5.1	1.17	46.5	30.8
6.001	50.93	5.51	98.244	0.350	0.0	0.0	9.7	1.73	122.1	57.9
7.000	56.47	4.13	99.035	0.032	0.0	0.0	1.0	1.28	50.8	5.9
7.001	53.77	4.76	98.940	0.194	0.0	0.0	5.7	1.38	54.8	33.9
8.000	56.36	4.15	98.755	0.048	0.0	0.0	1.5	1.60	81.9	8.8
9.000	55.97	4.24	98.795	0.010	0.0	0.0	0.3	1.40	55.5	1.8
8.001	54.93	4.48	98.565	0.058	0.0	0.0	1.7	1.04	41.5	10.4
7.002	52.00	5.21	98.364	0.310	0.0	0.0	8.7	1.71	68.1	52.4
6.002	49.00	6.08	97.411	0.745	0.0	0.0	19.8	1.22	135.2	118.6
6.003	47.20	6.67	97.217	0.853	0.0	0.0	21.8	1.24	137.5	130.9
10.000	54.84	4.50	98.175	0.103	0.0	0.0	3.1	1.57	62.2	18.4
6.004	46.33	6.98	97.008	1.019	0.0	0.0	25.6	1.43	157.9	153.4
6.005	45.74	7.19	96.844	1.019	0.0	0.0	25.6	1.43	157.6	153.4

Network Design Table for SW_1

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
6.006	115.373	2.747	42.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
6.007	9.821	0.196	50.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
3.002	16.804	0.454	37.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
3.003	18.612	0.058	321.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
2.004	12.489	0.062	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.005	15.306	0.077	198.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
11.000	67.336	0.458	147.0	0.060	4.00	0.0	0.600	o	225	Pipe/Conduit	
11.001	15.706	0.107	146.8	0.010	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.006	58.428	0.329	177.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.005	8.051	0.036	223.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.006	19.051	0.048	400.9	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.007	3.784	0.027	140.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
6.006	43.99	7.88	96.729	1.019	0.0	0.0	25.6	2.80	309.6	153.4
6.007	43.83	7.94	93.982	1.019	0.0	0.0	25.6	2.57	283.6	153.4
3.002	42.07	8.71	93.779	1.776	0.0	0.0	40.5	2.99	329.9	242.8
3.003	41.54	8.96	93.175	1.776	0.0	0.0	40.5	1.24	269.5	242.8
2.004	41.07	9.19	92.980	1.958	0.0	0.0	43.6	0.92	36.6«	261.3
2.005	40.51	9.46	92.918	1.958	0.0	0.0	43.6	0.92	36.7«	261.3
11.000	52.65	5.04	93.525	0.060	0.0	0.0	1.7	1.08	42.8	10.3
11.001	51.73	5.29	93.067	0.070	0.0	0.0	2.0	1.08	42.8	11.8
2.006	38.65	10.46	92.841	2.028	0.0	0.0	43.6	0.98	38.9«	261.3
1.005	38.43	10.59	92.437	2.269	0.0	0.0	47.2	1.05	74.0«	283.4
1.006	37.98	10.85	92.101	2.269	0.0	0.0	47.2	1.21	342.1	283.4
1.007	37.89	10.90	92.386	2.269	0.0	0.0	47.2	1.10	43.8«	283.4

Free Flowing Outfall Details for SW_1

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.007	S0	94.000	92.359	0.000	0	0

Online Controls for SW_1

Hydro-Brake® Optimum Manhole: S4, DS/PN: 2.005, Volume (m³): 2.8

Unit Reference	MD-SHE-0130-9500-1830-9500
Design Head (m)	1.830
Design Flow (l/s)	9.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	130
Invert Level (m)	92.918
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.830	9.5
Flush-Flo™	0.542	9.5
Kick-Flo®	1.114	7.5
Mean Flow over Head Range	-	8.3

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	4.7	1.200	7.8	3.000	12.0	7.000	18.0
0.200	8.1	1.400	8.4	3.500	12.9	7.500	18.6
0.300	8.9	1.600	8.9	4.000	13.8	8.000	19.2
0.400	9.3	1.800	9.4	4.500	14.5	8.500	19.7
0.500	9.5	2.000	9.9	5.000	15.3	9.000	20.3
0.600	9.5	2.200	10.4	5.500	16.0	9.500	20.8
0.800	9.2	2.400	10.8	6.000	16.7		
1.000	8.4	2.600	11.2	6.500	17.3		

Hydro-Brake® Optimum Manhole: S01, DS/PN: 1.007, Volume (m³): 7.5

Unit Reference	MD-SHE-0193-1900-1070-1900
Design Head (m)	1.070
Design Flow (l/s)	19.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	193
Invert Level (m)	92.386
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Hydro-Brake® Optimum Manhole: S01, DS/PN: 1.007, Volume (m³): 7.5

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.070	19.0
Flush-Flo™	0.349	19.0
Kick-Flo®	0.756	16.1
Mean Flow over Head Range	-	16.1

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.7	1.200	20.1	3.000	31.1	7.000	46.8
0.200	18.0	1.400	21.6	3.500	33.5	7.500	48.4
0.300	18.9	1.600	23.0	4.000	35.7	8.000	50.0
0.400	18.9	1.800	24.3	4.500	37.8	8.500	51.5
0.500	18.6	2.000	25.6	5.000	39.8	9.000	52.9
0.600	18.2	2.200	26.8	5.500	41.7	9.500	54.3
0.800	16.6	2.400	27.9	6.000	43.5		
1.000	18.4	2.600	29.0	6.500	45.2		

Summary of Critical Results by Maximum Level (Rank 1) for SW_1

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	20.000
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	4
Number of Online Controls	2	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 0.271
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	17.700	Cv (Winter)	0.840

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

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
1.000	S2-5	15 minute 100 year Winter I+0%	94.818	94.441	0.847	0.000	0.80
1.001	S2-4	15 minute 100 year Winter I+0%	94.301	94.302	0.874	1.065	1.33
1.002	S2-3	15 minute 100 year Winter I+0%	94.221	94.222	0.846	1.242	1.31
1.003	S2-2	15 minute 100 year Winter I+0%	94.430	93.803	0.740	0.000	1.53
1.004	S2-1	15 minute 100 year Winter I+0%	93.700	92.951	0.234	0.000	1.79
2.000	S5-3	15 minute 100 year Winter I+0%	96.000	95.075	0.275	0.000	0.25
2.001	S5-2	15 minute 100 year Winter I+0%	95.270	95.035	0.946	0.000	1.70
2.002	S5-1	960 minute 100 year Winter I+0%	94.924	94.945	1.212	21.387	0.34
2.003	S5-1-1	960 minute 100 year Winter I+0%	95.450	94.969	1.304	0.000	0.31
3.000	S7-1	15 minute 100 year Winter I+0%	97.922	96.821	0.726	0.000	0.87
3.001	S7	15 minute 100 year Winter I+0%	97.000	96.466	0.959	0.000	1.16
4.000	S6-8-5	15 minute 100 year Winter I+0%	96.960	96.631	0.521	0.000	1.50
4.001	S6-8-4	15 minute 100 year Winter I+0%	96.900	96.446	0.424	0.000	1.30
4.002	S6-8-3	15 minute 100 year Winter I+0%	97.000	96.050	0.295	0.000	1.45
5.000	S6-11	15 minute 100 year Winter I+0%	98.400	97.131	-0.069	0.000	0.79
5.001	S6-10	15 minute 100 year Winter I+0%	98.000	96.815	0.016	0.000	1.15
5.002	SX	15 minute 100 year Winter I+0%	97.701	96.719	-0.007	0.000	1.00
5.003	SX	15 minute 100 year Winter I+0%	97.362	96.517	-0.099	0.000	0.60

Summary of Critical Results by Maximum Level (Rank 1) for SW_1

PN	US/MH Name	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	S2-5		27.6	SURCHARGED
1.001	S2-4		40.9	FLOOD
1.002	S2-3		46.5	FLOOD
1.003	S2-2		54.5	SURCHARGED
1.004	S2-1		53.8	SURCHARGED
2.000	S5-3		20.0	SURCHARGED
2.001	S5-2		60.5	FLOOD RISK
2.002	S5-1		11.2	FLOOD
2.003	S5-1-1		10.1	SURCHARGED
3.000	S7-1		46.3	SURCHARGED
3.001	S7		81.2	SURCHARGED
4.000	S6-8-5		49.0	SURCHARGED
4.001	S6-8-4		45.9	SURCHARGED
4.002	S6-8-3		44.1	SURCHARGED
5.000	S6-11		34.1	OK
5.001	S6-10		32.6	SURCHARGED
5.002	SX		31.0	OK
5.003	SX		25.4	OK

Summary of Critical Results by Maximum Level (Rank 1) for SW_1

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)
4.003	S6-8-2	15 minute 100 year Winter I+0%	97.000	95.906	0.218	0.000
4.004	S6-12	60 minute 100 year Winter I+0%	96.961	95.511	-0.104	0.000
4.005	S6-13	60 minute 100 year Winter I+0%	96.775	95.370	-0.101	0.000
4.006	S6-14	30 minute 100 year Winter I+0%	96.550	95.351	-0.054	0.000
4.007	S6-6	15 minute 100 year Winter I+0%	96.590	95.372	0.008	0.000
4.008	S6-5	15 minute 100 year Winter I+0%	96.480	95.308	0.050	0.000
4.009	S6-4	15 minute 100 year Winter I+0%	96.360	95.232	0.068	0.000
4.010	S6-3	15 minute 100 year Winter I+0%	95.976	95.138	0.056	0.000
4.011	S6-2	15 minute 100 year Winter I+0%	95.932	95.056	0.029	0.000
4.012	S6-1	960 minute 100 year Winter I+0%	96.270	94.988	0.015	0.000
6.000	S13	15 minute 100 year Winter I+0%	100.250	100.180	1.130	0.000
6.001	S12	15 minute 100 year Winter I+0%	99.750	99.560	1.016	0.000
7.000	S11-3	15 minute 100 year Winter I+0%	100.460	100.301	1.041	0.000
7.001	S11-2	15 minute 100 year Winter I+0%	100.365	100.290	1.125	0.000
8.000	S11-1-2	15 minute 100 year Winter I+0%	100.180	99.861	0.851	0.000
9.000	S11-1-1-2	15 minute 100 year Winter I+0%	100.220	99.850	0.830	0.000
8.001	S11-1-1	15 minute 100 year Winter I+0%	101.299	99.840	1.050	0.000
7.002	S11-1	15 minute 100 year Winter I+0%	99.800	99.801	1.212	0.567
6.002	S11	15 minute 100 year Winter I+0%	99.000	99.000	1.214	0.339
6.003	S10	15 minute 100 year Winter I+0%	98.800	98.610	1.018	0.000
10.000	S9-1	15 minute 100 year Winter I+0%	99.620	98.324	-0.076	0.000
6.004	S9	15 minute 100 year Winter I+0%	99.020	98.048	0.665	0.000
6.005	S8	15 minute 100 year Winter I+0%	98.470	97.506	0.287	0.000
6.006	S8-1	15 minute 100 year Winter I+0%	97.803	97.007	-0.097	0.000
6.007	S6X	15 minute 100 year Winter I+0%	95.793	95.166	0.809	0.000
3.002	S6	960 minute 100 year Winter I+0%	95.800	94.986	0.832	0.000
3.003	S5	960 minute 100 year Winter I+0%	95.562	94.989	1.289	0.000
2.004	S4-A	960 minute 100 year Winter I+0%	95.347	94.988	1.783	0.000
2.005	S4	960 minute 100 year Winter I+0%	95.000	94.987	1.844	0.000
11.000	S3-2	15 minute 100 year Winter I+0%	94.950	93.657	-0.093	0.000
11.001	S3-1	15 minute 100 year Winter I+0%	95.220	93.218	-0.074	0.000
2.006	S3	15 minute 100 year Winter I+0%	95.156	93.034	-0.032	0.000
1.005	S2	15 minute 100 year Winter I+0%	93.900	92.803	0.066	0.000
1.006	S1	240 minute 100 year Winter I+0%	93.837	92.706	0.005	0.000
1.007	S01	240 minute 100 year Winter I+0%	93.800	92.714	0.103	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
4.003	S6-8-2	2.15		67.4	SURCHARGED
4.004	S6-12	0.56		20.7	OK
4.005	S6-13	0.59		20.7	OK
4.006	S6-14	0.47		18.3	OK
4.007	S6-6	1.00		38.1	SURCHARGED
4.008	S6-5	0.61		43.9	SURCHARGED
4.009	S6-4	0.69		49.0	SURCHARGED
4.010	S6-3	0.75		45.8	SURCHARGED

Summary of Critical Results by Maximum Level (Rank 1) for SW_1

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
4.011	S6-2	0.69		42.4	SURCHARGED
4.012	S6-1	0.14		17.4	SURCHARGED
6.000	S13	1.24		55.5	FLOOD RISK
6.001	S12	0.85		98.7	FLOOD RISK
7.000	S11-3	0.22		9.2	FLOOD RISK
7.001	S11-2	1.06		56.0	FLOOD RISK
8.000	S11-1-2	0.25		17.6	SURCHARGED
9.000	S11-1-1-2	0.11		5.7	SURCHARGED
8.001	S11-1-1	0.62		22.6	SURCHARGED
7.002	S11-1	1.08		70.1	FLOOD
6.002	S11	1.46		180.4	FLOOD
6.003	S10	1.61		203.0	FLOOD RISK
10.000	S9-1	0.77		45.6	OK
6.004	S9	1.80		247.5	SURCHARGED
6.005	S8	1.90		248.5	SURCHARGED
6.006	S8-1	0.82		244.6	OK
6.007	S6X	1.42		246.6	SURCHARGED
3.002	S6	0.24		63.9	SURCHARGED
3.003	S5	0.31		63.5	SURCHARGED
2.004	S4-A	0.36		11.4	SURCHARGED
2.005	S4	0.31		9.9	FLOOD RISK
11.000	S3-2	0.60		25.0	OK
11.001	S3-1	0.78		29.3	OK
2.006	S3	0.88		32.9	OK
1.005	S2	1.54		85.1	SURCHARGED
1.006	S1	0.09		22.2	SURCHARGED
1.007	S01	0.63		18.9	SURCHARGED

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW_2

Pipe Sizes standard Manhole Sizes standard

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	17.700	Add Flow / Climate Change (%)	20
Ratio R	0.271	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	100	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for SW_2

« - 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
3.000	60.802	0.380	160.0	0.168	4.00	0.0	0.600	o	225	Pipe/Conduit	
3.001	57.101	0.571	100.0	0.149	0.00	0.0	0.600	o	225	Pipe/Conduit	
3.002	10.511	0.105	100.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.000	25.021	0.626	40.0	0.055	4.00	0.0	0.600	o	225	Pipe/Conduit	
3.003	5.592	0.042	133.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
3.004	4.837	0.020	237.4	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
3.005	3.600	0.021	171.4	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
3.006	7.567	0.045	168.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
3.007	6.218	0.037	168.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
3.000	52.88	4.98	93.715	0.168	0.0	0.0	4.8	1.03	41.0	28.9
3.001	50.23	5.71	93.335	0.317	0.0	0.0	8.6	1.31	52.0	51.8
3.002	49.78	5.84	92.764	0.317	0.0	0.0	8.6	1.31	52.0	51.8
4.000	56.14	4.20	93.375	0.055	0.0	0.0	1.7	2.08	82.5	10.0
3.003	49.55	5.91	92.584	0.372	0.0	0.0	10.0	1.36	96.2	59.9
3.004	49.29	5.99	92.542	0.372	0.0	0.0	10.0	1.02	71.8	59.9
3.005	49.13	6.04	92.390	0.372	0.0	0.0	10.0	1.20	84.7	59.9
3.006	48.73	6.17	92.369	0.372	0.0	0.0	10.0	1.01	40.0«	59.9
3.007	48.41	6.27	92.324	0.372	0.0	0.0	10.0	1.01	40.0«	59.9

Free Flowing Outfall Details for SW_2

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
3.007	SA0-4	94.000	92.287	0.000	0	0

Simulation Criteria for SW_2

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	20.000
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	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	17.700	Storm Duration (mins)	30
Ratio R	0.271		

Online Controls for SW_2

Hydro-Brake® Optimum Manhole: SA0-2, DS/PN: 3.006, Volume (m³): 2.0

Unit Reference	MD-SHE-0060-1900-1390-1900
Design Head (m)	1.390
Design Flow (l/s)	1.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	60
Invert Level (m)	92.369
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.390	1.9
Flush-Flo™	0.268	1.5
Kick-Flo®	0.540	1.2
Mean Flow over Head Range	-	1.5

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	1.3	1.200	1.8	3.000	2.7	7.000	4.0
0.200	1.5	1.400	1.9	3.500	2.9	7.500	4.1
0.300	1.5	1.600	2.0	4.000	3.1	8.000	4.3
0.400	1.5	1.800	2.1	4.500	3.3	8.500	4.4
0.500	1.3	2.000	2.2	5.000	3.4	9.000	4.5
0.600	1.3	2.200	2.3	5.500	3.6	9.500	4.6
0.800	1.5	2.400	2.4	6.000	3.7		
1.000	1.6	2.600	2.5	6.500	3.9		

Summary of Critical Results by Maximum Level (Rank 1) for SW_2

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	20.000
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 0.271
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	17.700	Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
3.000	SA4	15 Winter	100	+0%	100/15 Summer	100/15 Summer		
3.001	SA3	15 Winter	100	+0%	100/15 Summer	100/15 Summer		
3.002	SA2	1440 Winter	100	+0%	100/15 Summer			
4.000	SA1-1	1440 Winter	100	+0%	100/600 Winter			
3.003	SA1	1440 Winter	100	+0%	100/15 Summer			
3.004	SA2	1440 Winter	100	+0%	100/15 Summer			
3.005	SA0-1	1440 Winter	100	+0%	100/15 Summer			
3.006	SA0-2	2160 Winter	100	+0%	100/15 Summer			
3.007	SA0-3	1440 Winter	100	+0%				

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
3.000	SA4	95.303	1.363	3.149	1.25			49.5	FLOOD
3.001	SA3	95.001	1.441	0.635	1.65			82.4	FLOOD
3.002	SA2	93.796	0.807	0.000	0.19			8.5	SURCHARGED

Summary of Critical Results by Maximum Level (Rank 1) for SW_2

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
4.000	SA1-1	93.795	0.195	0.000	0.02			1.5	SURCHARGED
3.003	SA1	93.794	0.910	0.000	0.16			9.8	SURCHARGED
3.004	SA2	93.793	0.951	0.000	0.21			9.8	SURCHARGED
3.005	SA0-1	93.792	1.102	0.000	0.09			4.4	FLOOD RISK
3.006	SA0-2	93.785	1.191	0.000	0.06			1.9	FLOOD RISK
3.007	SA0-3	92.361	-0.188	0.000	0.06			1.9	OK

PN	US/MH Name	Level Exceeded
3.000	SA4	4
3.001	SA3	2
3.002	SA2	
4.000	SA1-1	
3.003	SA1	
3.004	SA2	
3.005	SA0-1	
3.006	SA0-2	
3.007	SA0-3	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW_3

Pipe Sizes standard Manhole Sizes standard

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	17.700	Add Flow / Climate Change (%)	20
Ratio R	0.271	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	100	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for SW_3

« - 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
1.000	49.885	0.900	55.4	0.373	4.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	23.979	0.225	106.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	14.536	0.087	167.1	0.000	4.00	0.0	0.600	o	225	Pipe/Conduit	
2.001	62.402	0.956	65.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.002	39.757	0.282	141.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	30.865	0.225	137.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.003	11.458	0.450	25.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.004	52.811	0.236	223.7	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)
1.000	54.95	4.47	96.875	0.373	0.0	0.0	11.1	1.76	70.0	66.6
1.001	53.86	4.73	95.900	0.373	0.0	0.0	11.1	1.52	107.6	66.6
2.000	55.97	4.24	97.075	0.000	0.0	0.0	0.0	1.01	40.1	0.0
2.001	53.27	4.88	96.988	0.000	0.0	0.0	0.0	1.62	64.5	0.0
2.002	51.02	5.48	96.032	0.000	0.0	0.0	0.0	1.10	43.7	0.0
1.002	49.70	5.87	95.675	0.373	0.0	0.0	11.1	1.34	94.8	66.6
1.003	49.50	5.93	95.450	0.373	0.0	0.0	11.1	3.13	221.1	66.6
1.004	46.92	6.77	95.000	0.373	0.0	0.0	11.1	1.05	74.0	66.6

Network Design Table for SW_3

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	64.673	0.583	110.9	0.290	4.00	0.0	0.600	o	300	Pipe/Conduit	
4.000	15.471	0.091	170.0	0.018	4.00	0.0	0.600	o	225	Pipe/Conduit	
4.001	63.186	0.372	169.9	0.015	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.002	40.204	0.554	72.6	0.015	0.00	0.0	0.600	o	225	Pipe/Conduit	
3.001	9.295	0.039	238.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
3.002	11.089	0.037	299.7	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
3.003	4.280	0.016	267.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.005	5.653	0.052	108.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.006	48.474	0.280	173.1	0.000	0.00	0.0	0.600	o	375	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	53.91	4.72	94.962	0.290	0.0	0.0	8.5	1.49	105.5	50.8
4.000	55.89	4.26	95.175	0.018	0.0	0.0	0.5	1.00	39.8	3.3
4.001	51.64	5.31	95.084	0.033	0.0	0.0	0.9	1.00	39.8	5.5
4.002	50.11	5.75	94.712	0.048	0.0	0.0	1.3	1.54	61.1	7.8
3.001	49.60	5.90	94.083	0.338	0.0	0.0	9.1	1.01	71.7	54.5
3.002	48.94	6.10	94.044	0.338	0.0	0.0	9.1	0.90	63.8	54.5
3.003	48.70	6.18	94.007	0.338	0.0	0.0	9.1	0.96	67.6	54.5
1.005	46.71	6.85	93.990	0.711	0.0	0.0	18.0	1.25	49.8«	107.9
1.006	45.11	7.43	93.788	0.711	0.0	0.0	18.0	1.37	151.8	107.9

Free Flowing Outfall Details for SW_3

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.006	SB01	96.000	93.508	0.000	0	0

Simulation Criteria for SW_3

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	20.000
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	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	17.700	Storm Duration (mins)	30
Ratio R	0.271		

Online Controls for SW_3

Hydro-Brake® Optimum Manhole: SB1, DS/PN: 1.006, Volume (m³): 2.1

Unit Reference	MD-SHE-0082-3800-1723-3800
Design Head (m)	1.723
Design Flow (l/s)	3.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	82
Invert Level (m)	93.788
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.723	3.8
Flush-Flo™	0.361	3.2
Kick-Flo®	0.735	2.6
Mean Flow over Head Range	-	3.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.4	1.200	3.2	3.000	4.9	7.000	7.3
0.200	3.0	1.400	3.5	3.500	5.3	7.500	7.6
0.300	3.2	1.600	3.7	4.000	5.6	8.000	7.8
0.400	3.2	1.800	3.9	4.500	5.9	8.500	8.0
0.500	3.1	2.000	4.1	5.000	6.2	9.000	8.3
0.600	3.0	2.200	4.3	5.500	6.5	9.500	8.5
0.800	2.7	2.400	4.4	6.000	6.8		
1.000	3.0	2.600	4.6	6.500	7.1		

Summary of Critical Results by Maximum Level (Rank 1) for SW_3

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	20.000
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 0.271
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	17.700	Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	SB9	15 Winter	100	+0%	100/15 Summer	100/15 Summer		
1.001	SB8	15 Winter	100	+0%	100/15 Summer			
2.000	SB7-3	15 Summer	100	+0%				
2.001	SB7-2	15 Summer	100	+0%				
2.002	SB7-1	15 Winter	100	+0%				
1.002	SB7	15 Winter	100	+0%	100/15 Summer			
1.003	SB6	15 Winter	100	+0%	100/15 Winter			
1.004	SB03	15 Winter	100	+0%	100/15 Summer			
3.000	SB5	15 Winter	100	+0%	100/15 Summer			
4.000	SB4-3	15 Winter	100	+0%				
4.001	SB4-2	15 Winter	100	+0%				
4.002	SB4-1	960 Winter	100	+0%	100/15 Summer			
3.001	SB4	960 Winter	100	+0%	100/15 Summer			
3.002	SB3	960 Winter	100	+0%	100/15 Summer			
3.003	SB02	960 Winter	100	+0%	100/15 Summer			
1.005	SB0	960 Winter	100	+0%	100/30 Summer			
1.006	SB1	1440 Winter	100	+0%	100/15 Winter	100/720 Winter		

Summary of Critical Results by Maximum Level (Rank 1) for SW_3

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	SB9	98.641	1.541	4.684	1.62			108.7	FLOOD
1.001	SB8	96.353	0.153	0.000	1.12			106.8	SURCHARGED
2.000	SB7-3	97.075	-0.225	0.000	0.00			0.0	OK
2.001	SB7-2	96.988	-0.225	0.000	0.00			0.0	OK
2.002	SB7-1	96.072	-0.185	0.000	0.01			0.4	OK
1.002	SB7	96.075	0.100	0.000	1.23			105.7	SURCHARGED
1.003	SB6	95.758	0.008	0.000	0.60			101.2	SURCHARGED
1.004	SB03	95.543	0.243	0.000	1.45			101.2	SURCHARGED
3.000	SB5	95.607	0.345	0.000	1.11			112.0	SURCHARGED
4.000	SB4-3	95.248	-0.152	0.000	0.23			8.0	OK
4.001	SB4-2	95.180	-0.129	0.000	0.36			13.8	OK
4.002	SB4-1	95.131	0.194	0.000	0.03			1.7	SURCHARGED
3.001	SB4	95.131	0.748	0.000	0.22			12.3	SURCHARGED
3.002	SB3	95.129	0.785	0.000	0.24			12.3	FLOOD RISK
3.003	SB02	95.128	0.821	0.000	0.26			12.3	FLOOD RISK
1.005	SB0	95.127	0.912	0.000	0.17			5.6	FLOOD RISK
1.006	SB1	95.124	0.961	13.360	0.02			3.4	FLOOD

PN	US/MH Name	Level Exceeded
1.000	SB9	4
1.001	SB8	
2.000	SB7-3	
2.001	SB7-2	
2.002	SB7-1	
1.002	SB7	
1.003	SB6	
1.004	SB03	
3.000	SB5	
4.000	SB4-3	
4.001	SB4-2	
4.002	SB4-1	
3.001	SB4	
3.002	SB3	
3.003	SB02	
1.005	SB0	
1.006	SB1	4

Appendix C

ATTENUATION CALCULATIONS

Summary of Results for 30 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	93.364	0.264	7.9	225.2	O K
30 min Summer	93.459	0.359	8.1	306.7	O K
60 min Summer	93.559	0.459	8.2	392.3	O K
120 min Summer	93.666	0.566	8.2	483.0	O K
180 min Summer	93.727	0.627	8.2	535.8	O K
240 min Summer	93.770	0.670	8.2	571.8	O K
360 min Summer	93.823	0.723	8.2	617.1	O K
480 min Summer	93.853	0.753	8.2	642.8	O K
600 min Summer	93.869	0.769	8.2	657.1	O K
720 min Summer	93.878	0.778	8.2	664.4	O K
960 min Summer	93.887	0.787	8.2	672.2	O K
1440 min Summer	93.887	0.787	8.2	672.2	O K
2160 min Summer	93.867	0.767	8.2	654.9	O K
2880 min Summer	93.836	0.736	8.2	628.7	O K
4320 min Summer	93.764	0.664	8.2	567.0	O K
5760 min Summer	93.689	0.589	8.2	502.7	O K
7200 min Summer	93.617	0.517	8.2	441.1	O K
8640 min Summer	93.550	0.450	8.2	384.4	O K
10080 min Summer	93.492	0.392	8.2	334.4	O K
15 min Winter	93.396	0.296	8.0	253.1	O K
30 min Winter	93.504	0.404	8.2	345.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	71.420	0.0	232.8	22
30 min Summer	49.076	0.0	319.9	37
60 min Summer	32.017	0.0	417.7	66
120 min Summer	20.414	0.0	532.7	126
180 min Summer	15.583	0.0	609.8	184
240 min Summer	12.841	0.0	670.1	244
360 min Summer	9.756	0.0	763.9	362
480 min Summer	8.019	0.0	837.2	482
600 min Summer	6.885	0.0	898.5	600
720 min Summer	6.077	0.0	951.7	684
960 min Summer	4.990	0.0	1042.1	802
1440 min Summer	3.778	0.0	1182.1	1064
2160 min Summer	2.858	0.0	1343.1	1472
2880 min Summer	2.343	0.0	1467.9	1880
4320 min Summer	1.769	0.0	1662.4	2688
5760 min Summer	1.449	0.0	1815.3	3464
7200 min Summer	1.241	0.0	1943.2	4248
8640 min Summer	1.093	0.0	2054.5	5008
10080 min Summer	0.982	0.0	2153.5	5656
15 min Winter	71.420	0.0	260.7	22
30 min Winter	49.076	0.0	358.4	37

Summary of Results for 30 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	93.618	0.518	8.2	442.4	O K
120 min Winter	93.741	0.641	8.2	547.3	O K
180 min Winter	93.814	0.714	8.2	609.8	O K
240 min Winter	93.865	0.765	8.2	653.4	O K
360 min Winter	93.933	0.833	8.2	711.2	O K
480 min Winter	93.975	0.875	8.2	747.3	O K
600 min Winter	94.003	0.903	8.2	770.8	O K
720 min Winter	94.020	0.920	8.2	786.0	O K
960 min Winter	94.037	0.937	8.2	800.0	O K
1440 min Winter	94.027	0.927	8.2	791.7	O K
2160 min Winter	93.990	0.890	8.2	760.1	O K
2880 min Winter	93.934	0.834	8.2	711.8	O K
4320 min Winter	93.804	0.704	8.2	601.2	O K
5760 min Winter	93.677	0.577	8.2	492.5	O K
7200 min Winter	93.563	0.463	8.2	395.4	O K
8640 min Winter	93.467	0.367	8.1	313.7	O K
10080 min Winter	93.390	0.290	8.0	248.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	32.017	0.0	467.6	66
120 min Winter	20.414	0.0	596.8	124
180 min Winter	15.583	0.0	683.1	182
240 min Winter	12.841	0.0	750.6	240
360 min Winter	9.756	0.0	855.5	356
480 min Winter	8.019	0.0	937.8	472
600 min Winter	6.885	0.0	1006.3	584
720 min Winter	6.077	0.0	1066.2	698
960 min Winter	4.990	0.0	1167.1	916
1440 min Winter	3.778	0.0	1231.7	1186
2160 min Winter	2.858	0.0	1504.1	1624
2880 min Winter	2.343	0.0	1644.1	2076
4320 min Winter	1.769	0.0	1862.3	2940
5760 min Winter	1.449	0.0	2032.7	3744
7200 min Winter	1.241	0.0	2176.6	4472
8640 min Winter	1.093	0.0	2301.6	5184
10080 min Winter	0.982	0.0	2412.1	5856

Model Details

Storage is Online Cover Level (m) 95.200

Tank or Pond Structure

Invert Level (m) 93.100

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	854.0	0.700	854.0	1.400	0.0	2.100	0.0
0.100	854.0	0.800	854.0	1.500	0.0	2.200	0.0
0.200	854.0	0.900	854.0	1.600	0.0	2.300	0.0
0.300	854.0	1.000	854.0	1.700	0.0	2.400	0.0
0.400	854.0	1.100	854.0	1.800	0.0	2.500	0.0
0.500	854.0	1.200	854.0	1.900	0.0		
0.600	854.0	1.300	0.0	2.000	0.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0122-8200-1750-8200
Design Head (m)	1.750
Design Flow (l/s)	8.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	122
Invert Level (m)	93.034
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.750	8.2
Flush-Flo™	0.514	8.2
Kick-Flo®	1.058	6.5
Mean Flow over Head Range	-	7.2

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	4.3	1.200	6.9	3.000	10.6	7.000	15.8
0.200	7.1	1.400	7.4	3.500	11.4	7.500	16.4
0.300	7.8	1.600	7.9	4.000	12.1	8.000	16.9
0.400	8.1	1.800	8.3	4.500	12.8	8.500	17.4
0.500	8.2	2.000	8.7	5.000	13.5	9.000	17.8
0.600	8.1	2.200	9.1	5.500	14.1	9.500	18.3
0.800	7.8	2.400	9.5	6.000	14.7		
1.000	6.9	2.600	9.9	6.500	15.3		

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	93.495	0.415	8.2	294.9	O K
30 min Summer	93.650	0.570	8.2	404.6	O K
60 min Summer	93.808	0.728	8.2	516.6	O K
120 min Summer	93.976	0.896	8.2	636.5	O K
180 min Summer	94.079	0.999	8.2	709.0	O K
240 min Summer	94.150	1.070	8.2	759.8	O K
360 min Summer	94.375	1.295	8.2	824.7	O K
480 min Summer	94.430	1.350	8.2	862.7	O K
600 min Summer	94.464	1.384	8.2	886.3	O K
720 min Summer	94.485	1.405	8.2	900.5	O K
960 min Summer	94.500	1.420	8.2	911.1	O K
1440 min Summer	94.502	1.422	8.2	912.4	O K
2160 min Summer	94.479	1.399	8.2	896.8	O K
2880 min Summer	94.445	1.365	8.2	873.0	O K
4320 min Summer	94.359	1.279	8.2	816.0	O K
5760 min Summer	94.136	1.056	8.2	749.8	O K
7200 min Summer	94.012	0.932	8.2	662.0	O K
8640 min Summer	93.896	0.816	8.2	579.2	O K
10080 min Summer	93.793	0.713	8.2	506.3	O K
15 min Winter	93.546	0.466	8.2	331.0	O K
30 min Winter	93.721	0.641	8.2	454.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	92.775	0.0	302.5	23
30 min Summer	64.070	0.0	417.9	37
60 min Summer	41.518	0.0	541.8	66
120 min Summer	26.230	0.0	684.6	126
180 min Summer	19.894	0.0	778.9	186
240 min Summer	16.313	0.0	851.6	246
360 min Summer	12.304	0.0	964.0	364
480 min Summer	10.060	0.0	1050.8	484
600 min Summer	8.601	0.0	1123.0	602
720 min Summer	7.565	0.0	1181.3	722
960 min Summer	6.178	0.0	1239.5	932
1440 min Summer	4.642	0.0	1213.1	1158
2160 min Summer	3.483	0.0	1637.2	1560
2880 min Summer	2.838	0.0	1778.3	1968
4320 min Summer	2.123	0.0	1996.2	2812
5760 min Summer	1.727	0.0	2165.1	3688
7200 min Summer	1.472	0.0	2305.0	4464
8640 min Summer	1.291	0.0	2426.9	5184
10080 min Summer	1.156	0.0	2535.1	5856
15 min Winter	92.775	0.0	338.8	22
30 min Winter	64.070	0.0	468.1	37

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	93.900	0.820	8.2	581.9	O K
120 min Winter	94.094	1.014	8.2	720.1	O K
180 min Winter	94.242	1.162	8.2	803.3	O K
240 min Winter	94.427	1.347	8.2	860.5	O K
360 min Winter	94.537	1.457	8.2	936.8	O K
480 min Winter	94.606	1.526	8.2	985.0	O K
600 min Winter	94.652	1.572	8.2	1016.7	O K
720 min Winter	94.682	1.602	8.2	1037.7	O K
960 min Winter	94.752	1.672	8.2	1059.0	O K
1440 min Winter	94.741	1.661	8.2	1058.1	O K
2160 min Winter	94.679	1.599	8.2	1035.4	O K
2880 min Winter	94.623	1.543	8.2	996.6	O K
4320 min Winter	94.484	1.404	8.2	899.9	O K
5760 min Winter	94.213	1.133	8.2	797.6	O K
7200 min Winter	94.000	0.920	8.2	653.4	O K
8640 min Winter	93.813	0.733	8.2	520.4	O K
10080 min Winter	93.664	0.584	8.2	414.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	41.518	0.0	606.7	66
120 min Winter	26.230	0.0	766.8	124
180 min Winter	19.894	0.0	872.7	184
240 min Winter	16.313	0.0	954.3	242
360 min Winter	12.304	0.0	1079.6	358
480 min Winter	10.060	0.0	1176.9	474
600 min Winter	8.601	0.0	1239.4	588
720 min Winter	7.565	0.0	1270.1	700
960 min Winter	6.178	0.0	1271.1	920
1440 min Winter	4.642	0.0	1234.6	1316
2160 min Winter	3.483	0.0	1833.7	1652
2880 min Winter	2.838	0.0	1991.9	2132
4320 min Winter	2.123	0.0	2212.4	3068
5760 min Winter	1.727	0.0	2425.0	3984
7200 min Winter	1.472	0.0	2582.2	4824
8640 min Winter	1.291	0.0	2718.8	5456
10080 min Winter	1.156	0.0	2839.7	6152

Model Details

Storage is Online Cover Level (m) 95.400

Tank or Pond Structure

Invert Level (m) 93.080

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	710.0	0.700	710.0	1.400	695.0	2.100	0.0
0.100	710.0	0.800	710.0	1.500	695.0	2.200	0.0
0.200	710.0	0.900	710.0	1.600	695.0	2.300	0.0
0.300	710.0	1.000	710.0	1.700	0.0	2.400	0.0
0.400	710.0	1.100	710.0	1.800	0.0	2.500	0.0
0.500	710.0	1.200	0.0	1.900	0.0		
0.600	710.0	1.300	695.0	2.000	0.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0122-8200-1720-8200
Design Head (m)	1.720
Design Flow (l/s)	8.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	122
Invert Level (m)	93.034
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.720	8.2
Flush-Flo™	0.508	8.2
Kick-Flo®	1.045	6.5
Mean Flow over Head Range	-	7.2

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	4.4	1.200	6.9	3.000	10.7	7.000	16.0
0.200	7.1	1.400	7.4	3.500	11.5	7.500	16.5
0.300	7.8	1.600	7.9	4.000	12.2	8.000	17.0
0.400	8.1	1.800	8.4	4.500	12.9	8.500	17.5
0.500	8.2	2.000	8.8	5.000	13.6	9.000	18.0
0.600	8.1	2.200	9.2	5.500	14.2	9.500	18.5
0.800	7.8	2.400	9.6	6.000	14.8		
1.000	6.9	2.600	10.0	6.500	15.4		

Summary of Results for 5 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	92.495	0.095	2.1	31.7	O K
30 min Summer	92.526	0.126	2.2	42.6	O K
60 min Summer	92.558	0.158	2.2	54.4	O K
120 min Summer	92.591	0.191	2.2	66.5	O K
180 min Summer	92.608	0.208	2.2	73.0	O K
240 min Summer	92.618	0.218	2.2	76.9	O K
360 min Summer	92.630	0.230	2.2	81.4	O K
480 min Summer	92.636	0.236	2.2	84.0	O K
600 min Summer	92.640	0.240	2.2	85.5	O K
720 min Summer	92.642	0.242	2.2	86.4	O K
960 min Summer	92.643	0.243	2.2	86.6	O K
1440 min Summer	92.637	0.237	2.2	84.2	O K
2160 min Summer	92.621	0.221	2.2	78.0	O K
2880 min Summer	92.602	0.202	2.2	70.9	O K
4320 min Summer	92.566	0.166	2.2	57.2	O K
5760 min Summer	92.535	0.135	2.2	46.1	O K
7200 min Summer	92.512	0.112	2.2	37.6	O K
8640 min Summer	92.494	0.094	2.1	31.4	O K
10080 min Summer	92.482	0.082	2.1	27.3	O K
15 min Winter	92.506	0.106	2.1	35.7	O K
30 min Winter	92.541	0.141	2.2	48.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	48.389	0.0	33.1	22
30 min Summer	33.003	0.0	45.3	36
60 min Summer	21.748	0.0	59.7	64
120 min Summer	14.058	0.0	77.2	124
180 min Summer	10.835	0.0	89.3	182
240 min Summer	8.993	0.0	98.9	240
360 min Summer	6.907	0.0	113.9	308
480 min Summer	5.722	0.0	125.9	376
600 min Summer	4.944	0.0	135.9	442
720 min Summer	4.386	0.0	144.7	512
960 min Summer	3.631	0.0	159.8	652
1440 min Summer	2.781	0.0	183.5	928
2160 min Summer	2.129	0.0	210.8	1340
2880 min Summer	1.761	0.0	232.5	1732
4320 min Summer	1.348	0.0	267.0	2468
5760 min Summer	1.115	0.0	294.4	3176
7200 min Summer	0.962	0.0	317.6	3888
8640 min Summer	0.853	0.0	337.9	4576
10080 min Summer	0.770	0.0	356.1	5240
15 min Winter	48.389	0.0	37.1	22
30 min Winter	33.003	0.0	50.7	36

Summary of Results for 5 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	92.577	0.177	2.2	61.5	O K
120 min Winter	92.615	0.215	2.2	75.5	O K
180 min Winter	92.635	0.235	2.2	83.4	O K
240 min Winter	92.648	0.248	2.2	88.4	O K
360 min Winter	92.662	0.262	2.2	94.0	O K
480 min Winter	92.668	0.268	2.2	96.3	O K
600 min Winter	92.671	0.271	2.2	97.8	O K
720 min Winter	92.673	0.273	2.2	98.4	O K
960 min Winter	92.671	0.271	2.2	97.7	O K
1440 min Winter	92.658	0.258	2.2	92.3	O K
2160 min Winter	92.628	0.228	2.2	80.6	O K
2880 min Winter	92.595	0.195	2.2	68.2	O K
4320 min Winter	92.538	0.138	2.2	46.9	O K
5760 min Winter	92.498	0.098	2.1	32.7	O K
7200 min Winter	92.478	0.078	2.0	25.7	O K
8640 min Winter	92.468	0.068	1.8	22.3	O K
10080 min Winter	92.461	0.061	1.6	19.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	21.748	0.0	66.9	64
120 min Winter	14.058	0.0	86.5	122
180 min Winter	10.835	0.0	100.0	178
240 min Winter	8.993	0.0	110.7	234
360 min Winter	6.907	0.0	127.8	344
480 min Winter	5.722	0.0	141.1	440
600 min Winter	4.944	0.0	152.2	476
720 min Winter	4.386	0.0	162.1	554
960 min Winter	3.631	0.0	178.9	712
1440 min Winter	2.781	0.0	205.6	1014
2160 min Winter	2.129	0.0	236.1	1448
2880 min Winter	1.761	0.0	260.5	1844
4320 min Winter	1.348	0.0	299.0	2556
5760 min Winter	1.115	0.0	329.7	3224
7200 min Winter	0.962	0.0	355.7	3824
8640 min Winter	0.853	0.0	378.5	4504
10080 min Winter	0.770	0.0	398.9	5240

Model Details

Storage is Online Cover Level (m) 94.000

Tank or Pond Structure

Invert Level (m) 92.400

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	320.0	0.700	0.0	1.400	0.0	2.100	0.0
0.100	350.0	0.800	0.0	1.500	0.0	2.200	0.0
0.200	380.0	0.900	0.0	1.600	0.0	2.300	0.0
0.300	410.0	1.000	0.0	1.700	0.0	2.400	0.0
0.400	440.0	1.100	0.0	1.800	0.0	2.500	0.0
0.500	470.0	1.200	0.0	1.900	0.0		
0.600	0.0	1.300	0.0	2.000	0.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0076-2200-0600-2200
Design Head (m)	0.600
Design Flow (l/s)	2.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	76
Invert Level (m)	92.386
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.600	2.2
Flush-Flo™	0.179	2.2
Kick-Flo®	0.401	1.8
Mean Flow over Head Range	-	1.9

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.1	1.200	3.0	3.000	4.6	7.000	6.9
0.200	2.2	1.400	3.2	3.500	5.0	7.500	7.1
0.300	2.1	1.600	3.4	4.000	5.3	8.000	7.4
0.400	1.8	1.800	3.6	4.500	5.6	8.500	7.6
0.500	2.0	2.000	3.8	5.000	5.9	9.000	7.8
0.600	2.2	2.200	4.0	5.500	6.1	9.500	8.0
0.800	2.5	2.400	4.2	6.000	6.4		
1.000	2.8	2.600	4.3	6.500	6.6		

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	92.579	0.179	2.2	61.9	O K
30 min Summer	92.639	0.239	2.2	84.9	O K
60 min Summer	92.697	0.297	2.2	108.1	O K
120 min Summer	92.755	0.355	2.2	132.4	O K
180 min Summer	92.788	0.388	2.2	146.6	O K
240 min Summer	92.810	0.410	2.2	156.2	O K
360 min Summer	92.836	0.436	2.2	167.9	O K
480 min Summer	92.849	0.449	2.2	174.1	O K
600 min Summer	92.856	0.456	2.2	177.2	O K
720 min Summer	92.859	0.459	2.2	178.4	O K
960 min Summer	92.861	0.461	2.2	179.3	O K
1440 min Summer	92.858	0.458	2.2	177.8	O K
2160 min Summer	92.844	0.444	2.2	171.7	O K
2880 min Summer	92.826	0.426	2.2	163.6	O K
4320 min Summer	92.781	0.381	2.2	143.7	O K
5760 min Summer	92.729	0.329	2.2	121.6	O K
7200 min Summer	92.682	0.282	2.2	102.2	O K
8640 min Summer	92.640	0.240	2.2	85.3	O K
10080 min Summer	92.602	0.202	2.2	70.8	O K
15 min Winter	92.599	0.199	2.2	69.5	O K
30 min Winter	92.665	0.265	2.2	95.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	92.775	0.0	63.7	22
30 min Summer	64.070	0.0	88.0	37
60 min Summer	41.518	0.0	114.1	66
120 min Summer	26.230	0.0	144.2	126
180 min Summer	19.894	0.0	164.1	184
240 min Summer	16.313	0.0	179.4	244
360 min Summer	12.304	0.0	203.0	362
480 min Summer	10.060	0.0	221.4	482
600 min Summer	8.601	0.0	236.6	600
720 min Summer	7.565	0.0	249.7	690
960 min Summer	6.178	0.0	271.6	806
1440 min Summer	4.642	0.0	300.8	1068
2160 min Summer	3.483	0.0	345.0	1476
2880 min Summer	2.838	0.0	374.7	1904
4320 min Summer	2.123	0.0	420.6	2728
5760 min Summer	1.727	0.0	456.3	3464
7200 min Summer	1.472	0.0	485.9	4184
8640 min Summer	1.291	0.0	511.5	4928
10080 min Summer	1.156	0.0	534.3	5640
15 min Winter	92.775	0.0	71.3	22
30 min Winter	64.070	0.0	98.6	36

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	92.730	0.330	2.2	121.7	O K
120 min Winter	92.795	0.395	2.2	149.9	O K
180 min Winter	92.832	0.432	2.2	166.3	O K
240 min Winter	92.857	0.457	2.2	177.4	O K
360 min Winter	92.887	0.487	2.2	191.5	O K
480 min Winter	92.905	0.505	2.2	199.6	O K
600 min Winter	92.917	0.517	2.2	204.3	O K
720 min Winter	92.926	0.526	2.2	206.7	O K
960 min Winter	92.930	0.530	2.2	207.7	O K
1440 min Winter	92.919	0.519	2.2	204.7	O K
2160 min Winter	92.895	0.495	2.2	195.0	O K
2880 min Winter	92.866	0.466	2.2	181.8	O K
4320 min Winter	92.797	0.397	2.2	150.5	O K
5760 min Winter	92.710	0.310	2.2	113.4	O K
7200 min Winter	92.635	0.235	2.2	83.6	O K
8640 min Winter	92.574	0.174	2.2	60.0	O K
10080 min Winter	92.528	0.128	2.2	43.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	41.518	0.0	127.8	66
120 min Winter	26.230	0.0	161.6	124
180 min Winter	19.894	0.0	183.8	182
240 min Winter	16.313	0.0	201.0	240
360 min Winter	12.304	0.0	227.4	356
480 min Winter	10.060	0.0	247.9	470
600 min Winter	8.601	0.0	265.0	582
720 min Winter	7.565	0.0	279.4	692
960 min Winter	6.178	0.0	302.0	898
1440 min Winter	4.642	0.0	324.9	1126
2160 min Winter	3.483	0.0	386.4	1600
2880 min Winter	2.838	0.0	419.7	2052
4320 min Winter	2.123	0.0	471.1	2980
5760 min Winter	1.727	0.0	511.1	3696
7200 min Winter	1.472	0.0	544.2	4400
8640 min Winter	1.291	0.0	572.9	5024
10080 min Winter	1.156	0.0	598.4	5648

Model Details

Storage is Online Cover Level (m) 94.000

Tank or Pond Structure

Invert Level (m) 92.400

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	320.0	0.700	0.0	1.400	0.0	2.100	0.0
0.100	350.0	0.800	0.0	1.500	0.0	2.200	0.0
0.200	380.0	0.900	0.0	1.600	0.0	2.300	0.0
0.300	410.0	1.000	0.0	1.700	0.0	2.400	0.0
0.400	440.0	1.100	0.0	1.800	0.0	2.500	0.0
0.500	470.0	1.200	0.0	1.900	0.0		
0.600	0.0	1.300	0.0	2.000	0.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0076-2200-0600-2200
Design Head (m)	0.600
Design Flow (l/s)	2.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	76
Invert Level (m)	92.386
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.600	2.2
Flush-Flo™	0.179	2.2
Kick-Flo®	0.401	1.8
Mean Flow over Head Range	-	1.9

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.1	1.200	3.0	3.000	4.6	7.000	6.9
0.200	2.2	1.400	3.2	3.500	5.0	7.500	7.1
0.300	2.1	1.600	3.4	4.000	5.3	8.000	7.4
0.400	1.8	1.800	3.6	4.500	5.6	8.500	7.6
0.500	2.0	2.000	3.8	5.000	5.9	9.000	7.8
0.600	2.2	2.200	4.0	5.500	6.1	9.500	8.0
0.800	2.5	2.400	4.2	6.000	6.4		
1.000	2.8	2.600	4.3	6.500	6.6		

Summary of Results for 5 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	93.787	0.087	3.6	60.7	O K
30 min Summer	93.816	0.116	3.7	81.3	O K
60 min Summer	93.848	0.148	3.7	103.4	O K
120 min Summer	93.879	0.179	3.8	125.3	O K
180 min Summer	93.895	0.195	3.8	136.4	O K
240 min Summer	93.904	0.204	3.8	142.7	O K
360 min Summer	93.911	0.211	3.8	147.8	O K
480 min Summer	93.914	0.214	3.8	149.5	O K
600 min Summer	93.915	0.215	3.8	150.5	O K
720 min Summer	93.916	0.216	3.8	151.0	O K
960 min Summer	93.916	0.216	3.8	150.9	O K
1440 min Summer	93.910	0.210	3.8	147.3	O K
2160 min Summer	93.897	0.197	3.8	137.6	O K
2880 min Summer	93.880	0.180	3.8	126.0	O K
4320 min Summer	93.845	0.145	3.7	101.8	O K
5760 min Summer	93.814	0.114	3.7	80.0	O K
7200 min Summer	93.788	0.088	3.6	61.4	O K
8640 min Summer	93.766	0.066	3.5	46.2	O K
10080 min Summer	93.748	0.048	3.4	33.7	O K
15 min Winter	93.798	0.098	3.6	68.5	O K
30 min Winter	93.832	0.132	3.7	92.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	48.389	0.0	64.8	22
30 min Summer	33.003	0.0	88.3	37
60 min Summer	21.748	0.0	116.4	66
120 min Summer	14.058	0.0	151.0	124
180 min Summer	10.835	0.0	174.4	184
240 min Summer	8.993	0.0	193.0	242
360 min Summer	6.907	0.0	222.4	330
480 min Summer	5.722	0.0	245.9	394
600 min Summer	4.944	0.0	265.7	462
720 min Summer	4.386	0.0	282.7	526
960 min Summer	3.631	0.0	312.2	668
1440 min Summer	2.781	0.0	358.7	944
2160 min Summer	2.129	0.0	412.1	1364
2880 min Summer	1.761	0.0	454.1	1760
4320 min Summer	1.348	0.0	521.3	2552
5760 min Summer	1.115	0.0	575.2	3288
7200 min Summer	0.962	0.0	620.4	4032
8640 min Summer	0.853	0.0	660.2	4680
10080 min Summer	0.770	0.0	695.7	5440
15 min Winter	48.389	0.0	72.5	22
30 min Winter	33.003	0.0	99.1	36

Summary of Results for 5 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	93.868	0.168	3.8	117.6	O K
120 min Winter	93.906	0.206	3.8	144.0	O K
180 min Winter	93.926	0.226	3.8	158.3	O K
240 min Winter	93.939	0.239	3.8	167.0	O K
360 min Winter	93.951	0.251	3.8	176.0	O K
480 min Winter	93.955	0.255	3.8	178.8	O K
600 min Winter	93.955	0.255	3.8	178.8	O K
720 min Winter	93.955	0.255	3.8	178.4	O K
960 min Winter	93.952	0.252	3.8	176.3	O K
1440 min Winter	93.940	0.240	3.8	167.9	O K
2160 min Winter	93.913	0.213	3.8	149.1	O K
2880 min Winter	93.883	0.183	3.8	128.2	O K
4320 min Winter	93.828	0.128	3.7	89.3	O K
5760 min Winter	93.782	0.082	3.6	57.5	O K
7200 min Winter	93.748	0.048	3.4	33.3	O K
8640 min Winter	93.722	0.022	3.3	15.7	O K
10080 min Winter	93.706	0.006	3.1	3.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	21.748	0.0	130.7	64
120 min Winter	14.058	0.0	169.0	122
180 min Winter	10.835	0.0	195.3	180
240 min Winter	8.993	0.0	216.4	236
360 min Winter	6.907	0.0	249.4	348
480 min Winter	5.722	0.0	275.7	452
600 min Winter	4.944	0.0	297.3	494
720 min Winter	4.386	0.0	316.6	568
960 min Winter	3.631	0.0	349.5	726
1440 min Winter	2.781	0.0	401.5	1030
2160 min Winter	2.129	0.0	461.1	1476
2880 min Winter	1.761	0.0	508.6	1900
4320 min Winter	1.348	0.0	584.2	2684
5760 min Winter	1.115	0.0	644.3	3408
7200 min Winter	0.962	0.0	695.2	4104
8640 min Winter	0.853	0.0	739.5	4752
10080 min Winter	0.770	0.0	779.2	5344

Model Details

Storage is Online Cover Level (m) 95.450

Tank or Pond Structure

Invert Level (m) 93.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	700.0	0.700	0.0	1.400	0.0	2.100	0.0
0.100	700.0	0.800	0.0	1.500	0.0	2.200	0.0
0.200	700.0	0.900	0.0	1.600	0.0	2.300	0.0
0.300	700.0	1.000	0.0	1.700	0.0	2.400	0.0
0.400	0.0	1.100	0.0	1.800	0.0	2.500	0.0
0.500	0.0	1.200	0.0	1.900	0.0		
0.600	0.0	1.300	0.0	2.000	0.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0090-3800-1179-3800
Design Head (m)	1.179
Design Flow (l/s)	3.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	90
Invert Level (m)	93.590
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.179	3.8
Flush-Flo™	0.355	3.8
Kick-Flo®	0.733	3.1
Mean Flow over Head Range	-	3.3

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	2.8	1.200	3.8	3.000	5.9	7.000	8.8
0.200	3.6	1.400	4.1	3.500	6.3	7.500	9.0
0.300	3.8	1.600	4.4	4.000	6.7	8.000	9.3
0.400	3.8	1.800	4.6	4.500	7.1	8.500	9.6
0.500	3.7	2.000	4.9	5.000	7.5	9.000	9.9
0.600	3.6	2.200	5.1	5.500	7.8	9.500	10.1
0.800	3.2	2.400	5.3	6.000	8.1		
1.000	3.5	2.600	5.5	6.500	8.5		

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	93.871	0.171	3.8	120.0	O K
30 min Summer	93.935	0.235	3.8	164.4	O K
60 min Summer	93.999	0.299	3.8	209.0	O K
120 min Summer	94.090	0.390	3.8	255.3	O K
180 min Summer	94.177	0.477	3.8	281.8	O K
240 min Summer	94.237	0.537	3.8	299.7	O K
360 min Summer	94.315	0.615	3.8	323.1	O K
480 min Summer	94.361	0.661	3.8	335.9	O K
600 min Summer	94.385	0.685	3.8	342.3	O K
720 min Summer	94.394	0.694	3.8	344.6	O K
960 min Summer	94.386	0.686	3.8	342.4	O K
1440 min Summer	94.360	0.660	3.8	335.7	O K
2160 min Summer	94.317	0.617	3.8	323.6	O K
2880 min Summer	94.259	0.559	3.8	306.3	O K
4320 min Summer	94.138	0.438	3.8	270.1	O K
5760 min Summer	94.041	0.341	3.8	235.0	O K
7200 min Summer	93.989	0.289	3.8	202.0	O K
8640 min Summer	93.946	0.246	3.8	171.9	O K
10080 min Summer	93.907	0.207	3.8	144.8	O K
15 min Winter	93.893	0.193	3.8	135.0	O K
30 min Winter	93.965	0.265	3.8	185.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	92.775	0.0	124.4	22
30 min Summer	64.070	0.0	171.9	37
60 min Summer	41.518	0.0	222.8	66
120 min Summer	26.230	0.0	281.8	126
180 min Summer	19.894	0.0	320.4	186
240 min Summer	16.313	0.0	350.4	246
360 min Summer	12.304	0.0	396.7	364
480 min Summer	10.060	0.0	432.4	484
600 min Summer	8.601	0.0	462.0	602
720 min Summer	7.565	0.0	487.8	722
960 min Summer	6.178	0.0	531.2	914
1440 min Summer	4.642	0.0	584.9	1156
2160 min Summer	3.483	0.0	674.0	1560
2880 min Summer	2.838	0.0	731.8	1956
4320 min Summer	2.123	0.0	821.5	2728
5760 min Summer	1.727	0.0	891.2	3520
7200 min Summer	1.472	0.0	949.3	4256
8640 min Summer	1.291	0.0	998.9	5016
10080 min Summer	1.156	0.0	1043.4	5752
15 min Winter	92.775	0.0	139.4	22
30 min Winter	64.070	0.0	192.6	37

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	94.044	0.344	3.8	236.2	O K
120 min Winter	94.205	0.505	3.8	290.0	O K
180 min Winter	94.312	0.612	3.8	322.2	O K
240 min Winter	94.394	0.694	3.8	344.4	O K
360 min Winter	94.505	0.805	3.8	372.1	O K
480 min Winter	94.568	0.868	3.8	387.9	O K
600 min Winter	94.606	0.906	3.8	397.1	O K
720 min Winter	94.637	0.937	3.8	402.0	O K
960 min Winter	94.672	0.972	3.8	403.9	O K
1440 min Winter	94.591	0.891	3.8	393.7	O K
2160 min Winter	94.525	0.825	3.8	377.2	O K
2880 min Winter	94.442	0.742	3.8	356.4	O K
4320 min Winter	94.220	0.520	3.8	294.6	O K
5760 min Winter	94.040	0.340	3.8	234.2	O K
7200 min Winter	93.961	0.261	3.8	182.6	O K
8640 min Winter	93.898	0.198	3.8	138.4	O K
10080 min Winter	93.846	0.146	3.7	102.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	41.518	0.0	249.7	66
120 min Winter	26.230	0.0	315.5	124
180 min Winter	19.894	0.0	359.2	184
240 min Winter	16.313	0.0	392.6	242
360 min Winter	12.304	0.0	444.1	358
480 min Winter	10.060	0.0	484.3	472
600 min Winter	8.601	0.0	517.6	586
720 min Winter	7.565	0.0	546.3	698
960 min Winter	6.178	0.0	594.9	914
1440 min Winter	4.642	0.0	597.4	1182
2160 min Winter	3.483	0.0	754.9	1644
2880 min Winter	2.838	0.0	820.3	2128
4320 min Winter	2.123	0.0	920.6	2988
5760 min Winter	1.727	0.0	998.8	3752
7200 min Winter	1.472	0.0	1063.0	4536
8640 min Winter	1.291	0.0	1119.1	5272
10080 min Winter	1.156	0.0	1169.4	5952

Model Details

Storage is Online Cover Level (m) 95.450

Tank or Pond Structure

Invert Level (m) 93.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	700.0	0.700	249.0	1.400	0.0	2.100	0.0
0.100	700.0	0.800	249.0	1.500	0.0	2.200	0.0
0.200	700.0	0.900	249.0	1.600	0.0	2.300	0.0
0.300	700.0	1.000	0.0	1.700	0.0	2.400	0.0
0.400	300.0	1.100	0.0	1.800	0.0	2.500	0.0
0.500	300.0	1.200	0.0	1.900	0.0		
0.600	300.0	1.300	0.0	2.000	0.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0090-3800-1150-3800
Design Head (m)	1.150
Design Flow (l/s)	3.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	90
Invert Level (m)	93.590
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.150	3.8
Flush-Flo™	0.346	3.8
Kick-Flo®	0.716	3.1
Mean Flow over Head Range	-	3.3

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	2.8	1.200	3.9	3.000	5.9	7.000	8.9
0.200	3.6	1.400	4.2	3.500	6.4	7.500	9.1
0.300	3.8	1.600	4.4	4.000	6.8	8.000	9.4
0.400	3.8	1.800	4.7	4.500	7.2	8.500	9.7
0.500	3.7	2.000	4.9	5.000	7.5	9.000	10.0
0.600	3.5	2.200	5.1	5.500	7.9	9.500	10.2
0.800	3.2	2.400	5.3	6.000	8.2		
1.000	3.6	2.600	5.5	6.500	8.5		

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	96.563	0.063	11.8	6.3	O K
30 min Summer	96.569	0.069	12.4	6.9	O K
60 min Summer	96.562	0.062	11.6	6.2	O K
120 min Summer	96.546	0.046	9.9	4.6	O K
180 min Summer	96.534	0.034	8.6	3.4	O K
240 min Summer	96.524	0.024	7.5	2.4	O K
360 min Summer	96.511	0.011	6.3	1.1	O K
480 min Summer	96.503	0.003	5.7	0.3	O K
600 min Summer	96.500	0.000	5.2	0.0	O K
720 min Summer	96.500	0.000	4.6	0.0	O K
960 min Summer	96.500	0.000	3.7	0.0	O K
1440 min Summer	96.500	0.000	2.8	0.0	O K
2160 min Summer	96.500	0.000	2.1	0.0	O K
2880 min Summer	96.500	0.000	1.7	0.0	O K
4320 min Summer	96.500	0.000	1.3	0.0	O K
5760 min Summer	96.500	0.000	1.0	0.0	O K
7200 min Summer	96.500	0.000	0.9	0.0	O K
8640 min Summer	96.500	0.000	0.8	0.0	O K
10080 min Summer	96.500	0.000	0.7	0.0	O K
15 min Winter	96.572	0.072	12.8	7.2	O K
30 min Winter	96.575	0.075	13.1	7.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	92.775	0.0	12.9	13
30 min Summer	64.070	0.0	17.9	21
60 min Summer	41.518	0.0	23.0	38
120 min Summer	26.230	0.0	29.3	70
180 min Summer	19.894	0.0	33.1	100
240 min Summer	16.313	0.0	36.1	130
360 min Summer	12.304	0.0	41.0	190
480 min Summer	10.060	0.0	44.6	248
600 min Summer	8.601	0.0	47.7	0
720 min Summer	7.565	0.0	50.4	0
960 min Summer	6.178	0.0	54.9	0
1440 min Summer	4.642	0.0	61.8	0
2160 min Summer	3.483	0.0	69.6	0
2880 min Summer	2.838	0.0	75.6	0
4320 min Summer	2.123	0.0	84.8	0
5760 min Summer	1.727	0.0	92.0	0
7200 min Summer	1.472	0.0	98.0	0
8640 min Summer	1.291	0.0	103.2	0
10080 min Summer	1.156	0.0	107.8	0
15 min Winter	92.775	0.0	14.3	13
30 min Winter	64.070	0.0	19.8	22

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	96.562	0.062	11.6	6.2	O K
120 min Winter	96.539	0.039	9.2	3.9	O K
180 min Winter	96.524	0.024	7.5	2.4	O K
240 min Winter	96.512	0.012	6.5	1.2	O K
360 min Winter	96.500	0.000	5.4	0.0	O K
480 min Winter	96.500	0.000	4.4	0.0	O K
600 min Winter	96.500	0.000	3.8	0.0	O K
720 min Winter	96.500	0.000	3.3	0.0	O K
960 min Winter	96.500	0.000	2.7	0.0	O K
1440 min Winter	96.500	0.000	2.0	0.0	O K
2160 min Winter	96.500	0.000	1.5	0.0	O K
2880 min Winter	96.500	0.000	1.2	0.0	O K
4320 min Winter	96.500	0.000	0.9	0.0	O K
5760 min Winter	96.500	0.000	0.8	0.0	O K
7200 min Winter	96.500	0.000	0.6	0.0	O K
8640 min Winter	96.500	0.000	0.6	0.0	O K
10080 min Winter	96.500	0.000	0.5	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	41.518	0.0	25.7	40
120 min Winter	26.230	0.0	32.6	72
180 min Winter	19.894	0.0	37.1	104
240 min Winter	16.313	0.0	40.6	134
360 min Winter	12.304	0.0	45.9	0
480 min Winter	10.060	0.0	50.0	0
600 min Winter	8.601	0.0	53.5	0
720 min Winter	7.565	0.0	56.4	0
960 min Winter	6.178	0.0	61.4	0
1440 min Winter	4.642	0.0	69.3	0
2160 min Winter	3.483	0.0	77.9	0
2880 min Winter	2.838	0.0	84.7	0
4320 min Winter	2.123	0.0	95.0	0
5760 min Winter	1.727	0.0	103.1	0
7200 min Winter	1.472	0.0	109.8	0
8640 min Winter	1.291	0.0	115.6	0
10080 min Winter	1.156	0.0	120.7	0

Model Details

Storage is Online Cover Level (m) 97.000

Tank or Pond Structure

Invert Level (m) 96.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	100.0	0.700	0.0	1.400	0.0	2.100	0.0
0.100	100.0	0.800	0.0	1.500	0.0	2.200	0.0
0.200	100.0	0.900	0.0	1.600	0.0	2.300	0.0
0.300	100.0	1.000	0.0	1.700	0.0	2.400	0.0
0.400	100.0	1.100	0.0	1.800	0.0	2.500	0.0
0.500	100.0	1.200	0.0	1.900	0.0		
0.600	100.0	1.300	0.0	2.000	0.0		

Orifice Outflow Control

Diameter (m) 0.150 Discharge Coefficient 0.600 Invert Level (m) 96.400

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	95.413	0.113	1.3	45.4	O K
30 min Summer	95.455	0.155	1.3	62.1	O K
60 min Summer	95.497	0.197	1.3	79.0	O K
120 min Summer	95.541	0.241	1.3	96.6	O K
180 min Summer	95.567	0.267	1.3	106.9	O K
240 min Summer	95.585	0.285	1.3	113.9	O K
360 min Summer	95.607	0.307	1.3	122.9	O K
480 min Summer	95.620	0.320	1.3	127.9	O K
600 min Summer	95.626	0.326	1.3	130.6	O K
720 min Summer	95.629	0.329	1.3	131.7	O K
960 min Summer	95.628	0.328	1.3	131.3	O K
1440 min Summer	95.623	0.323	1.3	129.2	O K
2160 min Summer	95.614	0.314	1.3	125.6	O K
2880 min Summer	95.602	0.302	1.3	121.0	O K
4320 min Summer	95.572	0.272	1.3	108.7	O K
5760 min Summer	95.539	0.239	1.3	95.5	O K
7200 min Summer	95.507	0.207	1.3	82.8	O K
8640 min Summer	95.477	0.177	1.3	70.9	O K
10080 min Summer	95.450	0.150	1.3	59.8	O K
15 min Winter	95.427	0.127	1.3	51.0	O K
30 min Winter	95.475	0.175	1.3	69.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	92.775	0.0	46.6	19
30 min Summer	64.070	0.0	64.4	34
60 min Summer	41.518	0.0	83.5	64
120 min Summer	26.230	0.0	105.5	122
180 min Summer	19.894	0.0	120.2	182
240 min Summer	16.313	0.0	131.4	242
360 min Summer	12.304	0.0	148.8	362
480 min Summer	10.060	0.0	162.2	482
600 min Summer	8.601	0.0	173.3	602
720 min Summer	7.565	0.0	182.9	720
960 min Summer	6.178	0.0	199.2	954
1440 min Summer	4.642	0.0	203.9	1198
2160 min Summer	3.483	0.0	252.7	1584
2880 min Summer	2.838	0.0	274.7	2016
4320 min Summer	2.123	0.0	308.2	2808
5760 min Summer	1.727	0.0	334.3	3584
7200 min Summer	1.472	0.0	356.3	4392
8640 min Summer	1.291	0.0	374.9	5104
10080 min Summer	1.156	0.0	391.7	5848
15 min Winter	92.775	0.0	52.2	19
30 min Winter	64.070	0.0	72.2	33

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	95.523	0.223	1.3	89.1	O K
120 min Winter	95.574	0.274	1.3	109.6	O K
180 min Winter	95.605	0.305	1.3	121.9	O K
240 min Winter	95.626	0.326	1.3	130.3	O K
360 min Winter	95.653	0.353	1.3	141.3	O K
480 min Winter	95.670	0.370	1.3	147.9	O K
600 min Winter	95.680	0.380	1.3	152.0	O K
720 min Winter	95.686	0.386	1.3	154.5	O K
960 min Winter	95.691	0.391	1.3	156.3	O K
1440 min Winter	95.684	0.384	1.3	153.4	O K
2160 min Winter	95.669	0.369	1.3	147.5	O K
2880 min Winter	95.652	0.352	1.3	140.7	O K
4320 min Winter	95.606	0.306	1.3	122.4	O K
5760 min Winter	95.548	0.248	1.3	99.1	O K
7200 min Winter	95.495	0.195	1.3	78.1	O K
8640 min Winter	95.448	0.148	1.3	59.4	O K
10080 min Winter	95.408	0.108	1.3	43.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	41.518	0.0	93.6	62
120 min Winter	26.230	0.0	118.3	122
180 min Winter	19.894	0.0	134.6	180
240 min Winter	16.313	0.0	147.2	238
360 min Winter	12.304	0.0	166.5	356
480 min Winter	10.060	0.0	181.6	472
600 min Winter	8.601	0.0	194.2	586
720 min Winter	7.565	0.0	205.0	700
960 min Winter	6.178	0.0	207.7	924
1440 min Winter	4.642	0.0	203.7	1342
2160 min Winter	3.483	0.0	283.0	1684
2880 min Winter	2.838	0.0	307.4	2160
4320 min Winter	2.123	0.0	345.3	3108
5760 min Winter	1.727	0.0	374.4	3912
7200 min Winter	1.472	0.0	398.9	4680
8640 min Winter	1.291	0.0	419.8	5368
10080 min Winter	1.156	0.0	438.6	6056

Model Details

Storage is Online Cover Level (m) 96.300

Tank or Pond Structure

Invert Level (m) 95.300

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	400.0	0.700	0.0	1.400	0.0	2.100	0.0
0.100	400.0	0.800	0.0	1.500	0.0	2.200	0.0
0.200	400.0	0.900	0.0	1.600	0.0	2.300	0.0
0.300	400.0	1.000	0.0	1.700	0.0	2.400	0.0
0.400	400.0	1.100	0.0	1.800	0.0	2.500	0.0
0.500	400.0	1.200	0.0	1.900	0.0		
0.600	400.0	1.300	0.0	2.000	0.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0059-1300-0610-1300
Design Head (m)	0.610
Design Flow (l/s)	1.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	59
Invert Level (m)	95.200
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.610	1.3
Flush-Flo™	0.185	1.3
Kick-Flo®	0.397	1.1
Mean Flow over Head Range	-	1.1

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	1.2	1.200	1.8	3.000	2.7	7.000	4.0
0.200	1.3	1.400	1.9	3.500	2.9	7.500	4.1
0.300	1.3	1.600	2.0	4.000	3.1	8.000	4.3
0.400	1.1	1.800	2.1	4.500	3.2	8.500	4.4
0.500	1.2	2.000	2.2	5.000	3.4	9.000	4.5
0.600	1.3	2.200	2.3	5.500	3.6	9.500	4.6
0.800	1.5	2.400	2.4	6.000	3.7		
1.000	1.6	2.600	2.5	6.500	3.8		

Summary of Results for 30 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	92.816	0.216	1.7	47.6	O K
30 min Summer	92.895	0.295	1.7	64.9	O K
60 min Summer	92.977	0.377	1.7	83.0	O K
120 min Summer	93.065	0.465	1.7	102.3	O K
180 min Summer	93.115	0.515	1.7	113.2	O K
240 min Summer	93.147	0.547	1.7	120.4	O K
360 min Summer	93.186	0.586	1.7	129.0	O K
480 min Summer	93.205	0.605	1.7	133.2	O K
600 min Summer	93.213	0.613	1.7	134.8	O K
720 min Summer	93.214	0.614	1.7	135.0	O K
960 min Summer	93.213	0.613	1.7	134.9	O K
1440 min Summer	93.210	0.610	1.7	134.1	O K
2160 min Summer	93.197	0.597	1.7	131.4	O K
2880 min Summer	93.177	0.577	1.7	126.9	O K
4320 min Summer	93.125	0.525	1.7	115.5	O K
5760 min Summer	93.066	0.466	1.7	102.6	O K
7200 min Summer	92.999	0.399	1.7	87.8	O K
8640 min Summer	92.920	0.320	1.7	70.4	O K
10080 min Summer	92.857	0.257	1.7	56.5	O K
15 min Winter	92.844	0.244	1.7	53.6	O K
30 min Winter	92.933	0.333	1.7	73.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	71.420	0.0	49.6	22
30 min Summer	49.076	0.0	68.4	36
60 min Summer	32.017	0.0	89.2	66
120 min Summer	20.414	0.0	113.7	124
180 min Summer	15.583	0.0	130.3	184
240 min Summer	12.841	0.0	143.2	244
360 min Summer	9.756	0.0	163.2	362
480 min Summer	8.019	0.0	178.9	482
600 min Summer	6.885	0.0	192.1	600
720 min Summer	6.077	0.0	203.4	700
960 min Summer	4.990	0.0	222.7	816
1440 min Summer	3.778	0.0	252.9	1080
2160 min Summer	2.858	0.0	286.8	1492
2880 min Summer	2.343	0.0	313.8	1908
4320 min Summer	1.769	0.0	355.3	2764
5760 min Summer	1.449	0.0	387.7	3576
7200 min Summer	1.241	0.0	415.3	4400
8640 min Summer	1.093	0.0	438.9	5096
10080 min Summer	0.982	0.0	460.4	5752
15 min Winter	71.420	0.0	55.6	22
30 min Winter	49.076	0.0	76.6	36

Summary of Results for 30 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	93.027	0.427	1.7	94.0	O K
120 min Winter	93.128	0.528	1.7	116.1	O K
180 min Winter	93.187	0.587	1.7	129.1	O K
240 min Winter	93.227	0.627	1.7	137.9	O K
360 min Winter	93.277	0.677	1.7	149.0	O K
480 min Winter	93.306	0.706	1.7	155.3	O K
600 min Winter	93.322	0.722	1.7	158.8	O K
720 min Winter	93.329	0.729	1.7	160.5	O K
960 min Winter	93.330	0.730	1.7	160.6	O K
1440 min Winter	93.316	0.716	1.7	157.5	O K
2160 min Winter	93.292	0.692	1.7	152.3	O K
2880 min Winter	93.255	0.655	1.7	144.1	O K
4320 min Winter	93.165	0.565	1.7	124.3	O K
5760 min Winter	93.065	0.465	1.7	102.4	O K
7200 min Winter	92.936	0.336	1.7	73.9	O K
8640 min Winter	92.827	0.227	1.7	50.0	O K
10080 min Winter	92.744	0.144	1.7	31.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	32.017	0.0	100.0	64
120 min Winter	20.414	0.0	127.5	122
180 min Winter	15.583	0.0	146.0	180
240 min Winter	12.841	0.0	160.4	240
360 min Winter	9.756	0.0	182.8	354
480 min Winter	8.019	0.0	200.3	468
600 min Winter	6.885	0.0	215.1	582
720 min Winter	6.077	0.0	227.7	692
960 min Winter	4.990	0.0	249.3	902
1440 min Winter	3.778	0.0	267.3	1132
2160 min Winter	2.858	0.0	321.5	1604
2880 min Winter	2.343	0.0	351.3	2076
4320 min Winter	1.769	0.0	398.0	2984
5760 min Winter	1.449	0.0	434.8	3864
7200 min Winter	1.241	0.0	464.9	4616
8640 min Winter	1.093	0.0	491.7	5272
10080 min Winter	0.982	0.0	515.2	5944

Model Details

Storage is Online Cover Level (m) 94.400

Tank or Pond Structure

Invert Level (m) 92.600

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	220.0	0.700	220.0	1.400	0.0	2.100	0.0
0.100	220.0	0.800	220.0	1.500	0.0	2.200	0.0
0.200	220.0	0.900	220.0	1.600	0.0	2.300	0.0
0.300	220.0	1.000	220.0	1.700	0.0	2.400	0.0
0.400	220.0	1.100	220.0	1.800	0.0	2.500	0.0
0.500	220.0	1.200	0.0	1.900	0.0		
0.600	220.0	1.300	0.0	2.000	0.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0063-1900-1170-1900
Design Head (m)	1.170
Design Flow (l/s)	1.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	63
Invert Level (m)	92.434
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.170	1.9
Flush-Flo™	0.274	1.7
Kick-Flo®	0.560	1.4
Mean Flow over Head Range	-	1.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.4	1.200	1.9	3.000	2.9	7.000	4.3
0.200	1.7	1.400	2.1	3.500	3.1	7.500	4.5
0.300	1.7	1.600	2.2	4.000	3.3	8.000	4.6
0.400	1.6	1.800	2.3	4.500	3.5	8.500	4.8
0.500	1.5	2.000	2.4	5.000	3.7	9.000	4.9
0.600	1.4	2.200	2.5	5.500	3.9	9.500	5.0
0.800	1.6	2.400	2.6	6.000	4.0		
1.000	1.8	2.600	2.7	6.500	4.2		

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	92.750	0.350	1.5	63.1	O K
30 min Summer	92.882	0.482	1.5	86.7	O K
60 min Summer	93.017	0.617	1.5	111.0	O K
120 min Summer	93.159	0.759	1.5	136.6	O K
180 min Summer	93.243	0.843	1.5	151.7	O K
240 min Summer	93.301	0.901	1.6	162.1	O K
360 min Summer	93.376	0.976	1.6	175.6	O K
480 min Summer	93.420	1.020	1.7	183.6	O K
600 min Summer	93.447	1.047	1.7	188.5	O K
720 min Summer	93.463	1.063	1.7	191.3	O K
960 min Summer	93.475	1.075	1.7	193.4	O K
1440 min Summer	93.479	1.079	1.7	194.2	O K
2160 min Summer	93.463	1.063	1.7	191.4	O K
2880 min Summer	93.439	1.039	1.7	187.0	O K
4320 min Summer	93.380	0.980	1.7	176.3	O K
5760 min Summer	93.315	0.915	1.6	164.7	O K
7200 min Summer	93.250	0.850	1.6	152.9	O K
8640 min Summer	93.186	0.786	1.5	141.5	O K
10080 min Summer	93.125	0.725	1.5	130.4	O K
15 min Winter	92.794	0.394	1.5	70.8	O K
30 min Winter	92.942	0.542	1.5	97.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	92.775	0.0	64.6	22
30 min Summer	64.070	0.0	89.3	37
60 min Summer	41.518	0.0	115.8	66
120 min Summer	26.230	0.0	146.3	126
180 min Summer	19.894	0.0	166.4	184
240 min Summer	16.313	0.0	181.9	244
360 min Summer	12.304	0.0	205.9	362
480 min Summer	10.060	0.0	224.4	482
600 min Summer	8.601	0.0	239.9	602
720 min Summer	7.565	0.0	249.2	720
960 min Summer	6.178	0.0	252.5	892
1440 min Summer	4.642	0.0	248.6	1138
2160 min Summer	3.483	0.0	349.8	1536
2880 min Summer	2.838	0.0	380.0	1960
4320 min Summer	2.123	0.0	426.4	2772
5760 min Summer	1.727	0.0	462.5	3632
7200 min Summer	1.472	0.0	492.5	4400
8640 min Summer	1.291	0.0	518.6	5272
10080 min Summer	1.156	0.0	541.7	6048
15 min Winter	92.775	0.0	72.4	22
30 min Winter	64.070	0.0	100.0	37

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	93.093	0.693	1.5	124.8	O K
120 min Winter	93.256	0.856	1.6	154.1	O K
180 min Winter	93.353	0.953	1.6	171.6	O K
240 min Winter	93.421	1.021	1.7	183.9	O K
360 min Winter	93.513	1.113	1.7	200.1	O K
480 min Winter	93.785	1.385	1.9	209.7	O K
600 min Winter	93.809	1.409	1.9	215.8	O K
720 min Winter	93.823	1.423	1.9	219.8	O K
960 min Winter	93.837	1.437	2.0	223.6	O K
1440 min Winter	93.838	1.438	2.0	223.9	O K
2160 min Winter	93.824	1.424	1.9	219.9	O K
2880 min Winter	93.797	1.397	1.9	212.6	O K
4320 min Winter	93.491	1.091	1.7	196.4	O K
5760 min Winter	93.386	0.986	1.7	177.4	O K
7200 min Winter	93.282	0.882	1.6	158.8	O K
8640 min Winter	93.183	0.783	1.5	140.9	O K
10080 min Winter	93.085	0.685	1.5	123.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	41.518	0.0	129.6	66
120 min Winter	26.230	0.0	163.8	124
180 min Winter	19.894	0.0	186.4	182
240 min Winter	16.313	0.0	203.8	240
360 min Winter	12.304	0.0	230.6	356
480 min Winter	10.060	0.0	250.3	470
600 min Winter	8.601	0.0	258.8	584
720 min Winter	7.565	0.0	261.3	694
960 min Winter	6.178	0.0	262.7	910
1440 min Winter	4.642	0.0	263.3	1154
2160 min Winter	3.483	0.0	391.8	1620
2880 min Winter	2.838	0.0	425.6	2076
4320 min Winter	2.123	0.0	463.6	3024
5760 min Winter	1.727	0.0	518.0	3912
7200 min Winter	1.472	0.0	551.8	4760
8640 min Winter	1.291	0.0	580.8	5624
10080 min Winter	1.156	0.0	606.7	6456

Model Details

Storage is Online Cover Level (m) 94.200

Tank or Pond Structure

Invert Level (m) 92.400

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	180.0	0.700	180.0	1.400	280.0	2.100	0.0
0.100	180.0	0.800	180.0	1.500	280.0	2.200	0.0
0.200	180.0	0.900	180.0	1.600	280.0	2.300	0.0
0.300	180.0	1.000	180.0	1.700	0.0	2.400	0.0
0.400	180.0	1.100	180.0	1.800	0.0	2.500	0.0
0.500	180.0	1.200	0.0	1.900	0.0		
0.600	180.0	1.300	0.0	2.000	0.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0061-1910-1390-1910
Design Head (m)	1.390
Design Flow (l/s)	1.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	61
Invert Level (m)	92.369
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.390	1.9
Flush-Flo™	0.269	1.5
Kick-Flo®	0.542	1.2
Mean Flow over Head Range	-	1.5

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	1.3	1.200	1.8	3.000	2.7	7.000	4.0
0.200	1.5	1.400	1.9	3.500	2.9	7.500	4.2
0.300	1.5	1.600	2.0	4.000	3.1	8.000	4.3
0.400	1.5	1.800	2.1	4.500	3.3	8.500	4.4
0.500	1.3	2.000	2.3	5.000	3.4	9.000	4.5
0.600	1.3	2.200	2.4	5.500	3.6	9.500	4.7
0.800	1.5	2.400	2.4	6.000	3.7		
1.000	1.6	2.600	2.5	6.500	3.9		

Appendix D
SWALE AND CULVERT CALCULATIONS

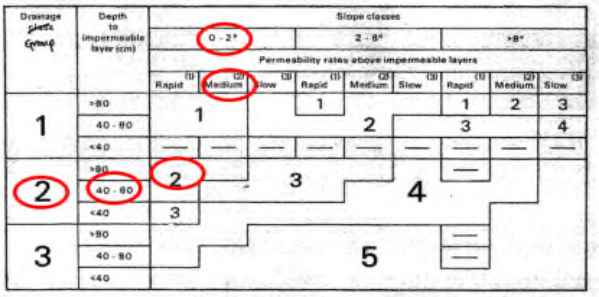
TITLE		**Job Reference**	
Newcastle South		210026	
SUBJECT		**Calc. Sheet No.**	
Hydrological Flow Estimation - Newcastle Phase 2		1	
DRAWING NUMBER	**Calculations by**	**Checked by**	**Date**
-	JJM	NG	01/05/2022

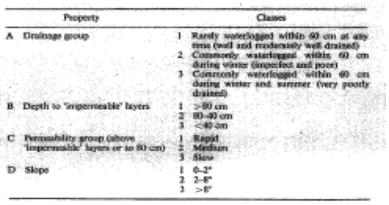
Catchment Map

Catchment Characteristics

Area	0.3	km²
BFISOIL	0.5878	
SAAR	731.16	mm
FARL	1	
DRAIND	0.055	km/km²
S1085	0.1	m/km
ARTDRAIN2	0.089	
URBEXT	0	
LAKE	0	

Soil Characteristics





Soil Type	2
SOIL Index	0.30

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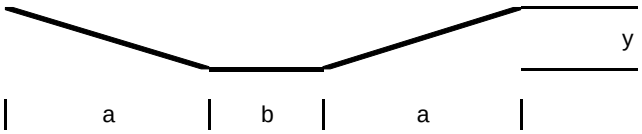
$$QBAR_{Rural} = 0.00108\,AREA^{0.89}\,SAAR^{1.17}\,SOIL^{2.17}$$

QBAR$_{rural}$	0.064	m^3/s
Factorial Standard Error	1.65	
Growth Factor to Q100	1.96	<- From FSR
Growth Factor to Q1000	2.6	<- From FSR

Q100	0.21
Q1000	0.27

TITLE		**Job Reference**	
Newcastle South		210026	
SUBJECT		**Calc. Sheet No.**	
Swale Capacity		2	
Overland flow route - Newcastle South			
DRAWING NUMBER	**Calculations by**	**Checked by**	**Date**
	JJM	NCG	May 2022

Using Mannings Equation



Dimensions

Height (y)	0.525	m (allow 300mm freeboard)
Width of Base (b)	0.600	m
Width of Slope (a)	2.250	m
Length (L)	70.000	m
Start Invert (u/s)	94.280	m
Final Invert (d/s)	94.148	m

(For S)

Velocity (V) 0.755 m/s

$$V = \frac{R^{\frac{2}{3}}\sqrt{S}}{n}$$

Flow (Q) 1.130 m^3/s

$$Q = V \times A$$

Design Flow

Stream Design Flow - Q100 = 0.25 m3/s
(Includes 20% Climate Change)

OK - Stream Capacity greater than Design Flow

Properties

Channel Slope (S)	0.00189	
Channel Cross Sectional Area (A)	1.496	m^2
Wetted Perimeter (P)	5.221	m
Mannings Roughness coefficient (n)	0.025	
Hydraulic Mean Depth (R)	0.2866	m

$$A = (b \times y) + (a \times y)$$

$$P = b + 2y\sqrt{1 + \left(\frac{a}{y}\right)^2}$$

$$R = \frac{A}{P}$$

Appendix E

FOUL SEWER NETWORK CALCULATIONS

FOUL SEWERAGE DESIGN

Design Criteria for FS_1

Pipe Sizes standard Manhole Sizes standard

Industrial Flow (l/s/ha)	0.00
Industrial Peak Flow Factor	0.00
Calculation Method	BS 8301
Frequency Factor	0.00
Domestic (l/s/ha)	0.00
Domestic Peak Flow Factor	6.00
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	0.75
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for FS_1

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	20.072	0.333	60.3	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
1.001	48.808	0.858	56.9	0.000	168.0	0.0	1.500	o	150	Pipe/Conduit	
2.000	45.945	0.765	60.1	0.000	84.0	0.0	1.500	o	150	Pipe/Conduit	
3.000	12.896	0.217	59.4	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
2.001	19.074	0.517	36.9	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
1.002	40.768	0.713	57.2	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
1.003	69.991	0.466	150.2	0.000	168.0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	99.742	0.000	0.0	0.0	0.0	0	0.00	1.13	20.0	0.0
1.001	99.409	0.000	0.0	168.0	0.0	47	0.93	1.16	20.6	4.4
2.000	99.908	0.000	0.0	84.0	0.0	44	0.87	1.13	20.0	3.8
3.000	99.285	0.000	0.0	0.0	0.0	0	0.00	1.49	59.3	0.0
2.001	99.068	0.000	0.0	84.0	0.0	39	1.03	1.45	25.5	3.8
1.002	98.476	0.000	0.0	252.0	0.0	44	0.92	1.52	60.4	5.0
1.003	97.763	0.000	0.0	420.0	0.0	60	0.68	0.94	37.2	5.8

Network Design Table for FS_1

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.004	52.037	0.347	150.0	0.000	168.0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.004	97.297	0.000	0.0	588.0	0.0	64	0.70	0.94	37.2	6.5

Free Flowing Outfall Details for FS_1

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.004	F28-1	100.400	96.950	0.000	0	0

FOUL SEWERAGE DESIGN

Design Criteria for FS_2

Pipe Sizes standard Manhole Sizes standard

Industrial Flow (l/s/ha)	0.00
Industrial Peak Flow Factor	0.00
Calculation Method	BS 8301
Frequency Factor	0.00
Domestic (l/s/ha)	0.00
Domestic Peak Flow Factor	6.00
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	0.75
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for FS_2

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
6.000	29.209	0.487	60.0	0.000	56.0	0.0	1.500	o	225	Pipe/Conduit	
6.001	56.156	0.936	60.0	0.000	252.0	0.0	1.500	o	225	Pipe/Conduit	
6.002	56.156	0.375	149.7	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
6.003	10.654	0.071	150.1	0.000	56.0	0.0	1.500	o	225	Pipe/Conduit	
6.004	3.730	0.024	155.4	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
6.005	53.024	0.354	149.8	0.000	56.0	0.0	1.500	o	225	Pipe/Conduit	
6.006	53.024	0.499	106.3	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
7.000	32.089	0.533	60.2	0.000	42.0	0.0	1.500	o	150	Pipe/Conduit	
7.001	6.994	0.117	59.8	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
7.002	65.721	1.075	61.1	0.000	98.0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
6.000	93.570	0.000	0.0	56.0	0.0	37	0.81	1.48	59.0	3.5
6.001	93.083	0.000	0.0	308.0	0.0	45	0.92	1.48	59.0	5.3
6.002	92.147	0.000	0.0	308.0	0.0	57	0.66	0.94	37.3	5.3
6.003	91.772	0.000	0.0	364.0	0.0	59	0.67	0.94	37.2	5.5
6.004	91.701	0.000	0.0	364.0	0.0	59	0.66	0.92	36.6	5.5
6.005	91.677	0.000	0.0	420.0	0.0	60	0.68	0.94	37.3	5.8
6.006	91.323	0.000	0.0	420.0	0.0	55	0.77	1.11	44.3	5.8
7.000	93.467	0.000	0.0	42.0	0.0	41	0.83	1.13	20.0	3.3
7.001	92.859	0.000	0.0	42.0	0.0	41	0.83	1.13	20.0	3.3
7.002	92.742	0.000	0.0	140.0	0.0	41	0.85	1.47	58.4	4.3

Network Design Table for FS_2

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
7.003	63.293	0.340	186.2	0.000	56.0	0.0	1.500	o	225	Pipe/Conduit	
7.004	61.989	0.503	123.2	0.000	112.0	0.0	1.500	o	225	Pipe/Conduit	
8.000	78.888	1.389	56.8	0.000	112.0	0.0	1.500	o	150	Pipe/Conduit	
9.000	43.948	0.733	60.0	0.000	1148.0	0.0	1.500	o	150	Pipe/Conduit	
8.001	32.581	0.543	60.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
10.000	50.068	0.908	55.1	0.000	56.0	0.0	1.500	o	150	Pipe/Conduit	
8.002	64.754	1.079	60.0	0.000	112.0	0.0	1.500	o	150	Pipe/Conduit	
11.000	20.024	0.333	60.1	0.000	56.0	0.0	1.500	o	150	Pipe/Conduit	
11.001	11.937	0.260	45.9	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
11.002	46.095	0.706	65.3	0.000	140.0	0.0	1.500	o	150	Pipe/Conduit	
11.003	20.560	0.343	59.9	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
8.003	63.246	1.027	61.6	0.000	28.0	0.0	1.500	o	225	Pipe/Conduit	
12.000	10.369	0.173	59.9	0.000	14.0	0.0	1.500	o	150	Pipe/Conduit	
12.001	15.776	0.145	108.8	0.000	14.0	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
7.003	91.667	0.000	0.0	196.0	0.0	57	0.59	0.84	33.4	4.6
7.004	91.327	0.000	0.0	308.0	0.0	54	0.71	1.03	41.1	5.3
8.000	97.709	0.000	0.0	112.0	0.0	45	0.90	1.16	20.6	4.0
9.000	98.275	0.000	0.0	1148.0	0.0	69	1.09	1.13	20.0	8.6
8.001	96.320	0.000	0.0	1260.0	0.0	70	1.10	1.13	20.0	8.9
10.000	96.685	0.000	0.0	56.0	0.0	41	0.87	1.18	20.9	3.5
8.002	95.777	0.000	0.0	1428.0	0.0	73	1.12	1.13	20.0	9.5
11.000	96.415	0.000	0.0	56.0	0.0	42	0.84	1.13	20.0	3.5
11.001	96.082	0.000	0.0	56.0	0.0	40	0.93	1.30	22.9	3.5
11.002	95.822	0.000	0.0	196.0	0.0	50	0.89	1.09	19.2	4.6
11.003	95.041	0.000	0.0	196.0	0.0	43	0.88	1.48	59.0	4.6
8.003	94.623	0.000	0.0	1652.0	0.0	64	1.10	1.46	58.2	10.2
12.000	96.067	0.000	0.0	14.0	0.0	36	0.77	1.13	20.0	2.6
12.001	95.894	0.000	0.0	28.0	0.0	46	0.65	0.84	14.8	3.0

Network Design Table for FS_2

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
12.002	14.403	0.240	60.0	0.000	28.0	0.0	1.500	o	150	Pipe/Conduit	
13.000	12.900	0.219	58.9	0.000	28.0	0.0	1.500	o	150	Pipe/Conduit	
13.001	48.561	0.809	60.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
12.003	13.018	0.085	153.2	0.000	42.0	0.0	1.500	o	225	Pipe/Conduit	
12.004	5.163	0.036	143.4	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
12.005	21.561	0.143	150.8	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
12.006	12.516	0.084	149.0	0.000	14.0	0.0	1.500	o	225	Pipe/Conduit	
12.007	10.026	0.050	200.5	0.000	28.0	0.0	1.500	o	225	Pipe/Conduit	
12.008	59.862	0.299	200.2	0.000	98.0	0.0	1.500	o	225	Pipe/Conduit	
8.004	16.630	0.083	200.4	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
8.005	17.992	0.091	197.7	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
8.006	40.034	0.200	200.2	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
6.007	18.580	0.093	199.8	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
14.000	68.004	2.267	30.0	0.000	966.0	0.0	1.500	o	225	Pipe/Conduit	
14.001	20.506	0.683	30.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
14.002	41.479	0.693	59.9	0.000	483.0	0.0	1.500	o	225	Pipe/Conduit	
14.003	21.239	0.354	60.0	0.000	483.0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
12.002	95.749	0.000	0.0	56.0	0.0	42	0.85	1.13	20.0	3.5
13.000	95.396	0.000	0.0	28.0	0.0	39	0.81	1.14	20.2	3.0
13.001	95.177	0.000	0.0	28.0	0.0	39	0.81	1.13	20.0	3.0
12.003	94.293	0.000	0.0	126.0	0.0	51	0.61	0.93	36.8	4.1
12.004	94.208	0.000	0.0	126.0	0.0	50	0.63	0.96	38.1	4.1
12.005	94.172	0.000	0.0	126.0	0.0	51	0.62	0.93	37.1	4.1
12.006	94.029	0.000	0.0	140.0	0.0	51	0.62	0.94	37.4	4.3
12.007	93.945	0.000	0.0	168.0	0.0	57	0.57	0.81	32.2	4.4
12.008	94.361	0.000	0.0	266.0	0.0	60	0.59	0.81	32.2	5.0
8.004	93.596	0.000	0.0	1918.0	0.0	91	0.73	0.81	32.2	11.1
8.005	93.513	0.000	0.0	1918.0	0.0	91	0.74	0.81	32.4	11.1
8.006	93.422	0.000	0.0	1918.0	0.0	91	0.73	0.81	32.2	11.1
6.007	90.824	0.000	0.0	2646.0	0.0	101	0.77	0.81	32.2	13.3
14.000	96.990	0.000	0.0	966.0	0.0	47	1.32	2.10	83.5	7.9
14.001	94.723	0.000	0.0	966.0	0.0	47	1.32	2.10	83.5	7.9
14.002	94.040	0.000	0.0	1449.0	0.0	61	1.09	1.49	59.1	9.6
14.003	93.347	0.000	0.0	1932.0	0.0	66	1.14	1.48	59.0	11.1

Network Design Table for FS_2

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
14.004	30.174	0.503	60.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
15.000	25.089	0.167	150.2	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
14.005	44.549	0.743	60.0	0.000	350.0	0.0	1.500	o	225	Pipe/Conduit	
6.008	13.921	0.078	178.5	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
14.004	92.993	0.000	0.0	1932.0	0.0	66	1.14	1.48	59.0	11.1
15.000	92.657	0.000	0.0	0.0	0.0	0	0.00	0.94	37.2	0.0
14.005	92.490	0.000	0.0	2282.0	0.0	69	1.17	1.48	59.0	12.2
6.008	90.731	0.000	0.0	4928.0	0.0	125	0.90	0.86	34.1	20.4

Free Flowing Outfall Details for FS_2

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
6.008	F0	94.800	90.653	0.000	0	0

Appendix F

PUMPING STATION CALCULATIONS

TITLE		**Job Reference**	
Newcastle Phase 2		210026	
SUBJECT		**Calc. Sheet No.**	
Foul Pumping Station and Rising Main Calculations PS02 (SDCC)		1	
DRAWING NUMBER	**Calculations by**	**Checked by**	
210026	COL	DJR	

PUMP REQUIREMENTS

Development Type	No	Occupancy	Population	Consumption (l/head/day)	DWF (m^3/day)
Residential Units	352	2.7	950	150	143

Development Type	Area (sqm)	Occupancy (m^2 per person)	Population	Consumption (l/head/day)	DWF (m^3/day)
Retail	0	18	0	50	0
Employment	0	25	0	100	0
Community	0	5	0	40	0
School	0	20	0	90	0

DWF (Excluding Infiltration) =	142.56	m^3/d	
Infiltration I =	14.26	m^3/d	10% of DWF IW COP
DWF =	156.82	m^3/d	
PE =	1045	say	1200
Pass forward flow (2.5 x DWF) =	392.04	m^3/d	IW-TEC-800-01
Pump Design Flow =	16.34	m^3/hr	Based on 24 hour Day
Pump Design Flow =	**4.54**	l/s	Based on 24 hour Day

RISING MAIN

Pipe Ks =	0.15	mm	
Rising main diameter =	100	mm	(160mm OD dia. HDPE, SDR 17)
Minimum velocity =	0.75	m/s	(For self cleansing)
Chosen pumping rate =	6	l/s	OK > minimum flow rate

Minimum flow rate for self cleaning velocity =	5.89	l/s
Velocity for pumping rate of 6 l/s =	0.764	m/s

TITLE	Job Reference
Newcastle Phase 2	210026
SUBJECT	**Calc. Sheet No.**
Foul Pumping Station and Rising Main Calculations PS02 (SDCC)	1

DRAWING NUMBER	Calculations by	Checked by
210026	COL	DJR

Rising Main Head

Cover Level at PS =	94.50	m		
Pump Invert Level =	89.41	m	Incoming Sewer = 51.4	91.3
Outfall Invert Level =	97.45	m		
Static Lift =	9.04	m		
Length of rising main =	450	m		
Friction Losses (1m in 138m) =	3.26	m		
Valve Losses =	1.00	m		
Pump Station Losses =	1.00	m		
Total Losses =	14.30	m …….	say 15m	

Wet Well Size

Assume 1m depth in wet well to minimise depth
IW - no more than 10 starts per hour = pump on every 6 minutes
Conservative = 10 minutes

Assume depth	1.00	m
Volume in 10 minutes (DWF) =	0.91	m^3
Diameter required:	1.07	m

Septicity of Rising Main & Wet Well

Length of rising main =	450	m
Volume of rising main =	3.53	m^3
Volume of wet well between cut in/cut out =	0.91	m^3
Total daily flow =	156.82	m^3 day
Time interval between clearing of main & wet well =	0.7	hours

0.7hrs < 6.0hrs max retention time …….. septicity OK ***(IW < 6 hours)***

Emergency Storage		***Storage***	***(based on PE)***	
0 to 250	24 hour	*102*		
250 to 333	18 hour	*25*		
334 to 1667	12 hour	*13*		
1668-3333	10 hour			
Total:		***140***	***m^3***	note based on 352 units (tank has been sized to store a 140 m3 for future units)

Appendix G

QBAR CALCULATIONS

PROJECT			JOB REF.
Newcastle phase 2			p210026
SUBJECT			**Calc. Sheet No.**
Surface Water Calculations Allowable Outflow			1
Drawing ref.	**Calculations by**	**Checked by**	**Date**
210026-	COL	NCG	23-Apr-22

PERMISSIBLE SURFACE WATER DISCHARGE CALCULATIONS

Site Area

What is the overall site area? **11.63** Hectares (ha) Site is Less than 50 Hectares

(Area of site within catchment of new drainage networks excludes open space areas not within new drainage networks)
Shown on drawing 210026-DBFL-CS-SP-DR-C-1202

Pre-Development Catchment Soil Characteristics

Are there different soil types present on the pre-developed site? No

Catchment This refers to the entire site area	1	
Area	11.63	Hectares (ha)
Drainage Group	1	Class
Depth to Impermeable Layers	1	Class
Permeability Group above Impermeable Layers	2	Class
Slope [6]	1	Class
SOIL Type	**2**	From FSR Table
[1]**SOIL Index**	0.30	

SOIL	SOIL Value	SPR
1	0.15	0.10
2	0.30	0.30
3	0.40	0.37
4	0.45	0.47
5	0.50	0.53

Site SOIL Index Value **0.30**

Site SPR Value **0.30**

Post-Development Catchment Characteristics

Is the development divided into sub-catchments? Yes

How many sub-catchments? 4

Catchment 2A

What is the overall site area for Catchment 2A? 3.79 Hectares (ha)

Catchment 2A	Area (m^2)	Runoff Coeff.	Effective Area (m^2)
Roofs - Type 1 (Draining to gullies)	0.0	1.00	0.0
Roofs - Type 2 (Draining to SUDS features)	5745.0	0.80	4596.0
Green Roofs		0.80	0.0
Roads and Footpaths - Type 1 (Draining to gullies)	8097.0	1.00	8097.0
Roads and Footpaths - Type 2 (Draining to Suds features)	2296.0	0.80	1836.8
Paved Areas		1.00	0.0
Permeable Paving	3008.0	0.75	2256.0
Bioretention Areas		1.00	0.0
Grassed Areas (Open)	3824.0	0.15	573.6
Grassed Areas (Enclosed)	14940.0	0.00	0.0

Include Public Open Space in Effective Catchment Area 1A? No

Catchment 2A - Effective Catchment Area **17359.4** m^2

Catchment 2A - Effective Catchment Runoff Coefficient **0.46**

Catchment 2F

What is the overall site area for catchment? 0.82 Hectares (ha)

Catchment 2A	Area (m^2)	Runoff Coeff.	Effective Area (m^2)
Roofs - Type 1 (Draining to gullies)	0.0	1.00	0.0
Roofs - Type 2 (Draining to SUDS features)	1497.0	0.80	1197.6
Green Roofs		0.80	0.0
Roads and Footpaths - Type 1 (Draining to gullies)	965.0	1.00	965.0
Roads and Footpaths - Type 2 (Draining to Suds features)	194.0	0.80	155.2
Paved Areas		1.00	0.0
Permeable Paving	265.0	0.75	198.8
Bioretention Areas		1.00	0.0
Grassed Areas (Open)	2230.0	0.15	334.5
Grassed Areas (Enclosed)	3090.0	0.00	0.0

Include Public Open Space in Effective Catchment Area? No

Effective Catchment Area	2851.1	m^2
Effective Catchment Runoff Coefficient	0.35	

Catchment 2D

What is the overall site area for Catchment 2D? 1.14 Hectares (ha)

Catchment 2D	Area (m^2)	Runoff Coeff.	Effective Area (m^2)
Roofs - Type 1 (Draining to gullies)	0.0	1.00	0.0
Roofs - Type 2 (Draining to SUDS features)	1650.0	0.80	1320.0
Green Roofs	0.0	0.50	0.0
Roads and Footpaths - Type 1 (Draining to gullies)	1837.0	1.00	1837.0
Roads and Footpaths - Type 2 (Draining to Suds features)	220.0	0.80	176.0
Paved Areas		1.00	0.0
Permeable Paving	850.0	0.75	637.5
Bioretention Areas		1.00	0.0
Grassed Areas (Open)	1025.0	0.15	153.8
Grassed Areas (Enclosed)	5810.0	0.00	0.0
Public Open Space		0.30	0.0

Include Public Open Space in Effective Catchment Area 1B?	No	
Catchment 2D - Effective Catchment Area	4124.3	m^2
Catchment 2D - Effective Catchment Runoff Coefficient	0.36	

Catchment 3

What is the overall site area for Catchment 3? 1.02 Hectares (ha)

Catchment 3	Area (m^2)	Runoff Coeff.	Effective Area (m^2)
Roofs - Type 1 (Draining to gullies)	0.0	1.00	0.0
Roofs - Type 2 (Draining to SUDS features)	1645.0	0.80	1316.0
Green Roofs		0.50	0.0
Roads and Footpaths - Type 1 (Draining to gullies)	2120.0	1.00	2120.0
Roads and Footpaths - Type 2 (Draining to Suds features)	0.0	0.80	0.0
Paved Areas		1.00	0.0
Permeable Paving	709.0	0.75	531.8
Bioretention Areas		1.00	0.0
Grassed Areas (Open)	1027.0	0.15	154.1
Grassed Areas (Enclosed)	4719.0	0.00	0.0
Public Open Space		0.30	0.0

Include Public Open Space in Effective Catchment Area 1B?	No	
Catchment 3 - Effective Catchment Area	4121.8	m^2
Catchment 3 - Effective Catchment Runoff Coefficient	0.40	

Catchment 2E

What is the overall site area for Catchment 2E? 1.67 Hectares (ha)

Catchment 1C	Area (m^2)	Runoff Coeff.	Effective Area (m^2)
Roofs - Type 1 (Draining to gullies)	1260.0	1.00	1260.0
Roofs - Type 2 (Draining to SUDS features)	0.0	0.80	0.0
Green Roofs	1260.0	0.75	945.0
Roads and Footpaths - Type 1 (Draining to gullies)	2862.0	1.00	2862.0
Roads and Footpaths - Type 2 (Draining to Suds features)	0.0	0.80	0.0
Paved Areas		1.00	0.0
Permeable Paving	2139.0	0.75	1604.3
Bioretention Areas		1.00	0.0
Grassed Areas (Open)	3298.0	0.15	494.7
Grassed Areas (Enclosed)	5899.0	0.00	0.0
Public Open Space		0.30	0.0

Include Public Open Space in Effective Catchment Area 1B?	No	
Catchment 2E - Effective Catchment Area	7166.0	m^2
Catchment 2E - Effective Catchment Runoff Coefficient	0.43	

Catchment 2B (Future Residential Site)			
What is the overall site area for Catchment 2B?	2.43	Hectares (ha)	5.48
Catchment 2B will be attenuated within its own Catchment			
Catchment 2C (Future Residential Site)			
What is the overall site area for Catchment 2C?	0.73	Hectares (ha)	1.55
Catchment 2C will be attenuated within its own Catchment			
What is the Standard Average Annual Rainfall (SAAR)?	795.0	mm	From Met Eireann, Co-ordinates 299000, 235000
Is the overall site area less than 50 hectares?	Yes		
[5]$QBAR_{Rural}$ calculated for 50 ha and linearly interpolated for area of site	24.60	Litres/sec	
[7]Site Discharge =	**24.60**	Litres/sec	

Outflow for Each Sub-Catchment

Sub - Catchment	Area (m^2)	Calculated Allowable Outflow (l/s)	
2A	37910	8.02	
2F	8242	1.74	
2D	11392	2.41	
3	10220	2.16	
2E	16718	3.54	
2B	24343	5.15	
2C	7323	1.55	
	0	0.00	
	0	0.00	
		24.57	

Notes and Formulae

1. SOIL index value calculated from Flood Studies Report - The Classification of Soils from Winter Rainfall Acceptance Rate (Table 4.5).

2. SPR value calculated from GDSDS - Table 6.7.

3. Rainfall depth for 100 year return period, 6 hour duration with additional 10% for climate change.

4. Long-term storage Vol_{xs} (m^3) = Rainfall.Area.10.[(PIMP/100)(0.8.α)+(1-PIMP/100)(β.SPR)-SPR]. (GDSDS Section 6.7.3).

   Where long-term storage cannot be provided on-site due to ground conditions, Total Permissible Outflow is to be kept to $QBAR_{(Rural)}$.

5. Total Permissible Outflow - $QBAR_{(Rural)}$ calculated in accordance with GDSDS - Regional Drainage Policies

   (Volume 2 - Chapter 6), i.e. $QBAR(m3/s)=0.00108x(Area)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$ - For catchments greater than 50 hectares in area. Flow rates are linearly interpolated for areas samller than 50hectares.

6. Where Total Permissible Outflow is less than 2.0l/s and not achievable, use 2.0 l/s or closest value possible.

7. QBAR multiplied by growth factors of 0.85 for 1 year, 2.1 for 30 year and 2.6 for 100 year return period events, from GDSDS Figure C2.

Appendix H

DMURS QUALITY AUDIT

Title: **DMURS QUALITY AUDIT**

For;

Proposed Strategic Housing Development, Newcastle Phase 2, on Behalf of Cairn Homes.

Client: **DBFL Consulting Engineers.**

Date: **May 2022**

Report reference: **1491R01**

VERSION: **FINAL (May 31-5-2022)**

Prepared By:

Bruton Consulting Engineers Ltd

Glaspistol
Clogherhead
Drogheda
Co. Louth.

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CONTENTS SHEET

Contents

1.0 Introduction

This report was prepared in response to a request from Mr. Noel Gorman, DBFL Consulting Engineers, for a DMURS Quality Audit of the proposed Newcastle Phase 2 Strategic Housing Development.

The Quality Audit consists of the following elements.

- A Street Design Audit
- A Stage 1-2 Road Safety Audit
- A Pedestrian/Walking Audit
- A Cycling Audit
- An Accessibility Audit.

These audits consist of the portion of Quality Audits carried out independent of the Design Team.

The Quality Audit has been carried out in accordance with the guidance in the Design Manual for Urban Roads and Streets (DMURS), produced by Department of Transport Tourism and Sport in March 2013 and as updated in June 2019.

The Road Safety Audit has been carried out in accordance with TII Publication GE-DTY-01024, dated December 2017.

The Audit Team comprised of;

Team Leader: **Norman Bruton**, BE CEng FIEI, Cert Comp RSA.

TII Road safety Auditor approval number: NB 168446

Team Member: **Sayed Ahmad Saeed**, BEng Tech, BEng (Hons), MEng, MIEI

TII Road Safety Auditor approval number: SS 3419515

The Quality Audit comprised an examination of the drawings provided and a site visit by the Audit Team, together, on the 17th of May 2022.

The weather at the time of the daytime site visit was dry and the road surface was also dry.

The problems raised in this Quality Audit require responses from the Design Team. A feedback form sub-divided into the various sub-audits has been provided. Issues identified may belong to more than one sub audit however the primary safety concern has dictated which section each has been assigned to.

A location map showing where each problem occurs is provided in **Appendix A.**

A list of the documents provided to the Audit Team is provided in **Appendix B.**

The feedback form is provided in **Appendix C.**

2.0 Background

It is proposed to construct phase 2 of a large residential development in Newcastle South. This phase consists of a proposed signalised junction on the Athgoe Road and a connection to Phase 1 (Graydon ABP 305343-19) at Newcastle Boulevard, which was under construction at the time of the site visit. There is also a proposed tie in with St. Finian's Way which links to the R405, Main Street. There is a possible future connections to the East and South for subsequent phases.

The speed limit on the Athgoe Road changes from 50km/hr to 60km/hr just north of the proposed signalised junction.

The site location is shown below.

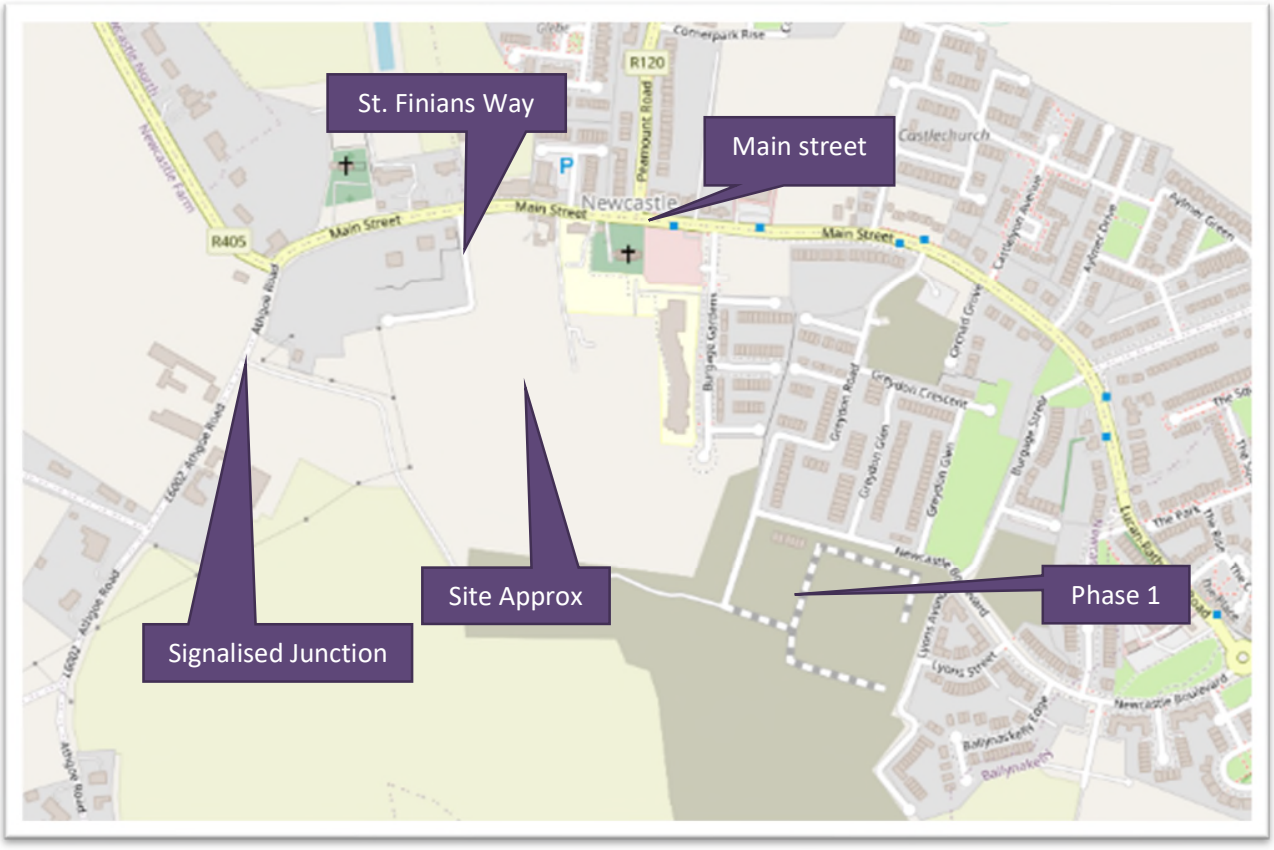


Image courtesy of openstreetmap.org

3.0 Design Street Audit.

The DMURS Street Design Audit is primarily concerned with four major aspects of street design:

- Connectivity
- Self-Regulating Street Environment
- Pedestrian and Cycling Environment
- Visual Quality

The Street Design Audit taken into consideration the issues and DMURS references as outlined in the template provided at DMURS.ie. The tables below summarises the issues considered along with evidence of these issues being addressed in the scheme design.

Any areas for improvement have been raised in the four subsequent sections of this report and in the feedback form in Appendix C.

Key Issues	**Key DMURS Reference.**	**Proposed Scheme**
Strategic routes/major desire lines been identified and are clearly incorporated into the design.	3.1 – Integrated Street Network 3.2.1 – Movement Function 3.3.1 – Street layouts 3.3.4 - Wayfinding	Desire lines to Phase 1, Athgoe Road and Main Street identified and catered for.
Multiple points of access are provided to the site/place, in particular for sustainable modes.	3.3.1 – Street Layouts 3.3.3 – Retrofitting[1]	Three access points provided with possible future additional access points.
Accessibility throughout the site is maximised for pedestrians and cyclists, ensuring route choice.	3.3.1 – Street Layouts 3.3.2 – Block Sizes 3.4.1 – Vehicle Permeability	Dedicated pedestrian facilities throughout. Dedicated cycle facilities on higher level streets.
Through movements by private vehicles on local streets are discouraged by an appropriate level of traffic calming measures.	3.2.1 – Movement Function 3.2.3 – Place Context 3.4.1 – Vehicle Permeability	Raised tables provided at junctions and sinusoidal alignment to traffic calm, short cuts or rat running discouraged.

Key Issues	Key DMURS Reference.	Proposed Scheme
A suitable range of design speeds have been applied with regard to context and function.	3.2.1 – Movement Function. 3.2.3 – Place Context. 4.1.1 – A Balanced Approach to Speed	Self-regulating speeds, Homezones in cul-de-sacs.
The street environment will facilitate the creation of a traffic clamed environment via the use of 'softer' or passive measures	4.2.1 – Building Height and Street Width 4.2.2 – Street Trees 4.2.3 – Active Street Edges 4.2.4 – Signage and Line Marking 4.2.7 – Planting 4.4.2 – Carriageway Surfaces 4.4.9 - On-Street Parking Advice Note 1 – Transitions and Gateways	On street parking
A suitable range of design standards/measures have been applied that are consistent with the applied design speeds.	4.4.1 - Carriageway Widths 4.4.4 – Forward Visibility 4.4.5 – Visibility Splays 4.4.6 – Alignment and curvature 4.4.7 – Horizontal and Vertical Deflections Advice Note 1 – Transitions and Gateways	Visibility splays provided, Carriageway widths vary, Both horizontal and vertical deflection provided.

Key Issues	Key DMURS Reference.	Proposed Scheme
The built environment contributes to the creation of a safe and comfortable pedestrian environment.	4.2.1 – Building Height and Street Width 4.2.3 – Active Street Edges 4.2.5 – Street Furniture 4.4.9 - On-Street parking	Footpath provision.

Junctions been designed to ensure the needs of pedestrians and cyclists are prioritised	4.3.2 - Pedestrian Crossings 4.3.3 – Corner Radii 4.4.3 - Junction Design 4.4.7 - Horizontal and Vertical Deflections	Tight radii, Vertical deflection, pedestrian crossings provided.
Footpaths are continuous and wide enough to cater for the anticipated number of pedestrian movements.	3.2.1 – Movement Function. 3.2.3 – Place Context. 4.2.5 – Street Furniture 4.3.1 - Footways, Verges and Strips 4.3.2 - Pedestrian Crossings	Continuous footpaths

Key Issues	Key DMURS Reference.	Proposed Scheme
The particular needs of visually and mobility impaired users been identified and incorporated in the design.	4.2.5 - Street Furniture 4.3.1 - Footways, Verges and Strips 4.2.5 - Street Furniture 4.3.2 - Pedestrian Crossings 4.3.4 - Pedestrianised and Shared Surfaces	Tactile paving and dropped kerbs provided.
Cycling facilities will cater for cyclists of all ages and abilities.	3.2.1 – Movement Function. 3.2.3 – Place Context. 4.3.5 - Cycle facilities.	Both dedicated and shared use provided.

4.0 Stage 1-2 Road Safety Audit

4.1 Issue

LOCATION

Drawing 210026-DBFL-RD-SP-DR-C-1101 P02

ISSUE

There is a risk that the speed limit change signs will not be obvious to drivers with the provision of the new signalised junction on Athgoe Road. This could lead to excessive speeds where pedestrians are crossing and onto the severe bend at the Celbridge Road junction.

RECOMMENDATION

It is recommended that that the speed limit signs be located where they can be seen by approaching drivers. At the next speed limit review the 50km/hr zone may be extended beyond the signalised junction.

5.0 Walking Audit

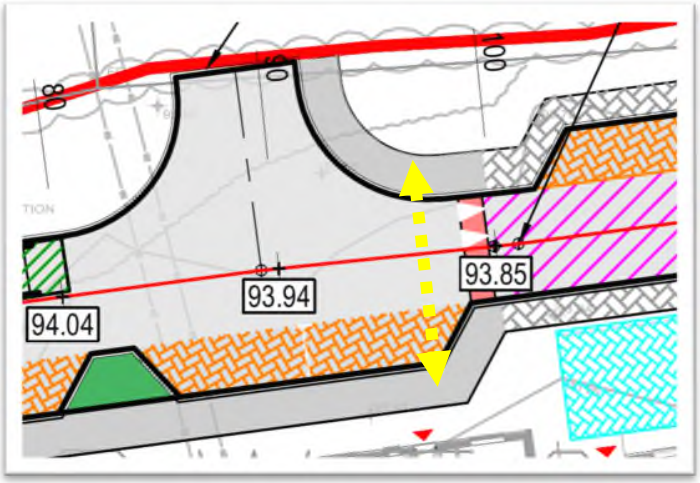
5.1 Issue

LOCATION

Drawing 210026-DBFL-RD-SP-DR-C-1101 P02

ISSUE

There will be a pedestrian desire line to cross the carriageway at the western tie-in to St. Finian's Way.



RECOMMENDATION

It is recommended that an uncontrolled pedestrian be provided to match the desire line with dropped kerbs and tactile paving.

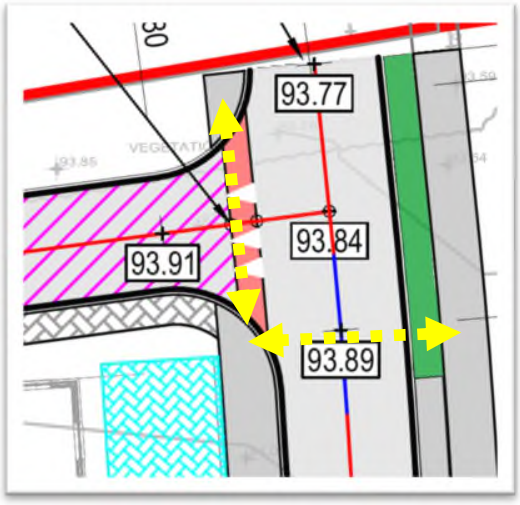
5.2 Issue

LOCATION

Drawing 210026-DBFL-RD-SP-DR-C-1101 P02

ISSUE

There will be pedestrian desire lines to cross the carriageway at the eastern tie-in to St. Finian's Way.



RECOMMENDATION

It is recommended that Dropped kerbs and tactile paving be provided. It is also recommended that the crossing area does not coincide with the taper of the raised table as it could lead to instability for some mobility impaired pedestrians.

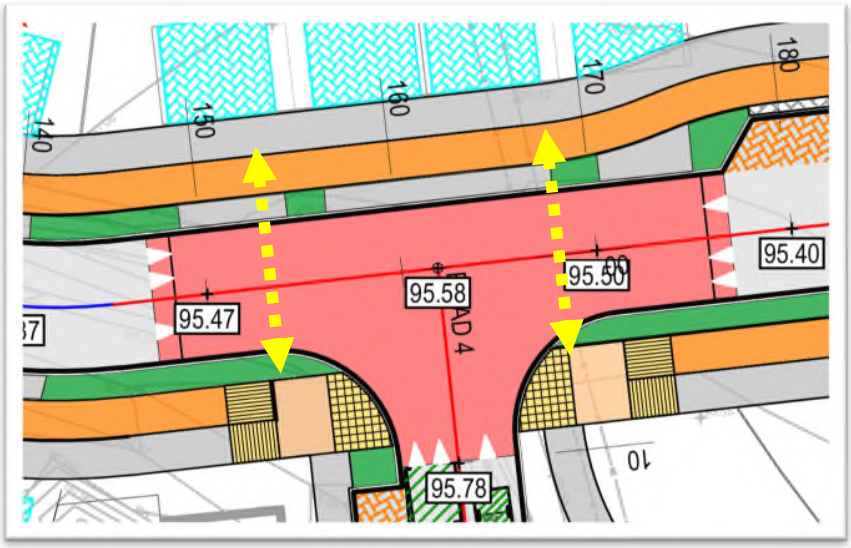
5.3 Issue

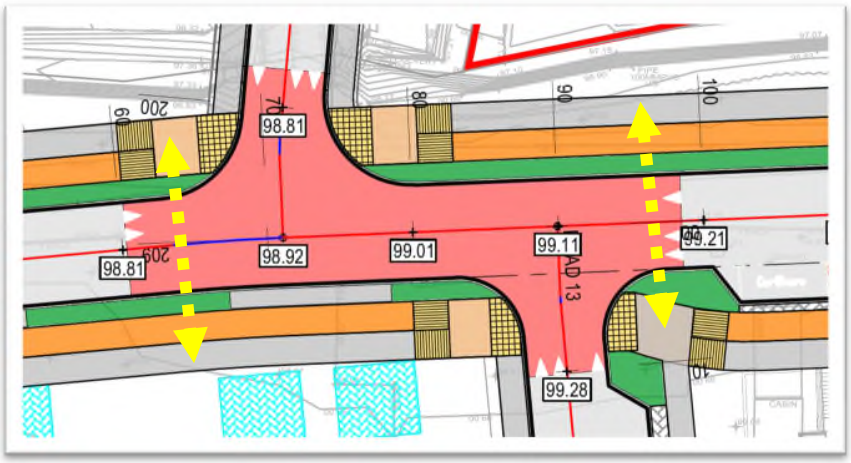
LOCATION

Drawing 210026-DBFL-RD-SP-DR-C-1101 P02, Pedestrian crossing facilities at junctions.

ISSUE

There will be pedestrian desire lines in all directions at the internal junctions. If the desire lines are not catered for this could lead to trips and falls at the kerb locations.





Examples only

RECOMMENDATION

It is recommended that uncontrolled pedestrian crossings be provided to match the desire lines with dropped kerbs and tactile paving. The presence of tactile paving and waiting areas for pedestrians to cross should be avoided at the rear of perpendicular parking spaces as drivers may not be able to see small children in their mirrors and vehicular forces can break tactile paving creating a trip hazard.

6.0 Cycling Audit

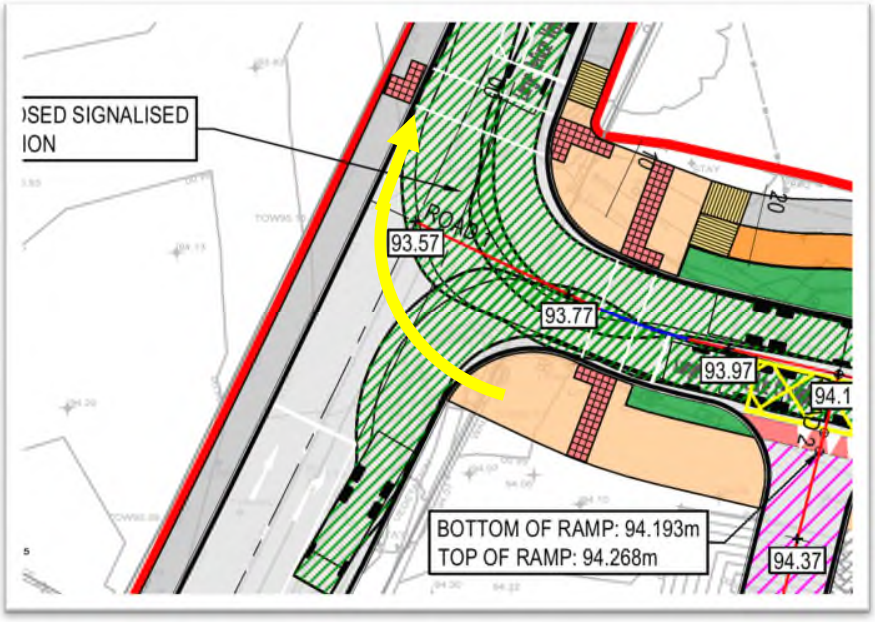
6.1 Issue

LOCATION

Drawing 210026-DBFL-RD-SP-DR-C-1101 P02

ISSUE

There are no facilities for cyclists to turn right when they exit the proposed development at the Athgoe signalised junction.



RECOMMENDATION

It is recommended that a signalised pedestrian/cyclist crossing be provided on the southern side of the junction.

6.2 Issue

LOCATION

Drawing 210026-DBFL-RD-SP-DR-C-1101 P02

ISSUE

The signalised pedestrian crossing on the development arm of the Athgoe junction will have to cater for cyclists as well as pedestrians. There may not be enough width to cater for both leading to collisions.

RECOMMENDATION

It is recommended that a toucan crossing of suitable width be provided.

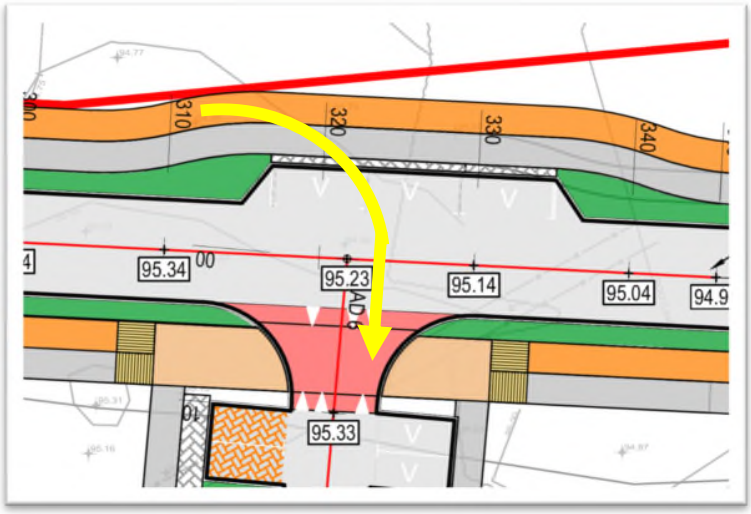
6.3 Issue

LOCATION

Drawing 210026-DBFL-RD-SP-DR-C-1101 P02, End of Road 1.

ISSUE

There is no provision for cyclists on the cycle track on the northern side of Road 1 to access Road 6.



RECOMMENDATION

It is recommended that a crossing facility for both cyclists and pedestrians be provided.

7.0 Accessibility Audit

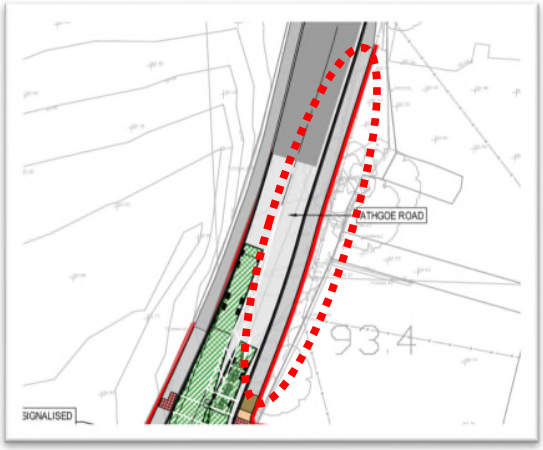
7.1 Issue

LOCATION

Drawing 210026-DBFL-RD-SP-DR-C-1101 P02

ISSUE

It is proposed to make the footpath continuous along Athgoe Road with the existing footpath. There are two access points along that section of infill path.



RECOMMENDATION

It is recommended that 25mm high kerbs be provided at the access points.

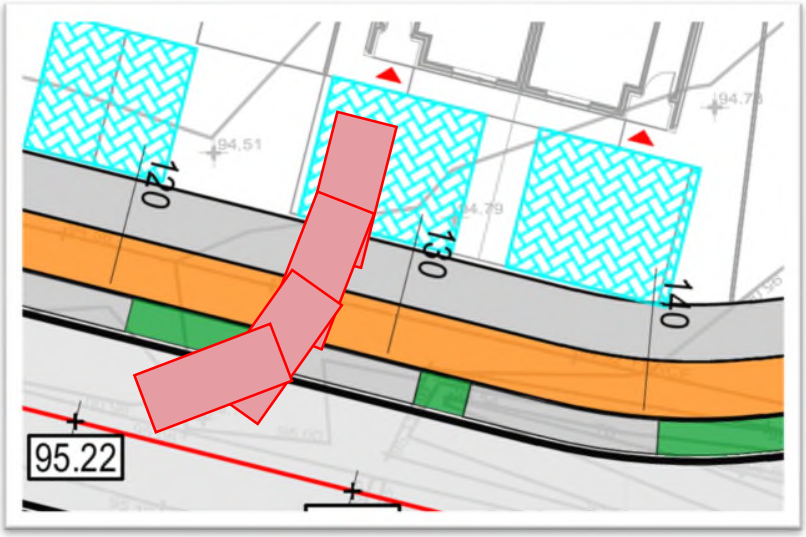
7.2 Issue

LOCATION

Drawing 210026-DBFL-RD-SP-DR-C-1101 P02, General issue with perpendicular car parking spaces behind the cycle tracks and footpaths.

ISSUE

It is proposed to provide landscaped areas between the on-curtilage perpendicular parking spaces behind the cycle tracks and footpaths. Drivers reversing out of these spaces will start their turning manoeuvre before they reach the carriageway and the tyres will cross the landscaped areas. This could lead to muck being brought onto the carriageway and footpath and possibly lead to rutting resulting in accessibility



Example only

RECOMMENDATION

It is recommended that wide enough paved areas ae provided for easy access and egress from the perpendicular parking spaces.

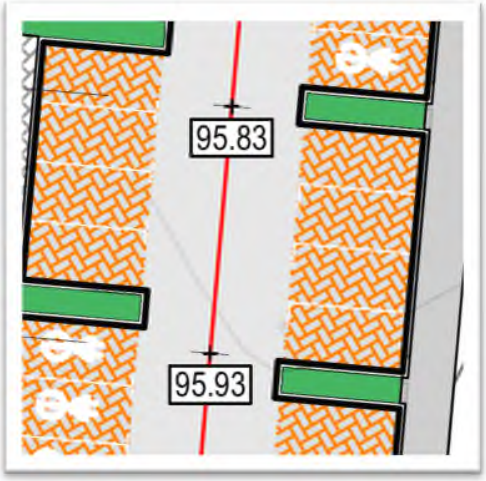
7.3 Issue

LOCATION

Drawing 210026-DBFL-RD-SP-DR-C-1101 P02, Road 6 & Road 14 Cross Section.

ISSUE

Road 6 and Road 14 have perpendicular parking on both sides. It is unclear what the carriageway width is. There is a risk that drivers will not be easily able to enter or egress from the parking spaces if the adjacent spaces are occupied. This could lead to material damage of other vehicles.



RECOMMENDATION

It is recommended that Road 6 have a suitable cross section and suitable parking space dimensions to allow easy access to the parking spaces.

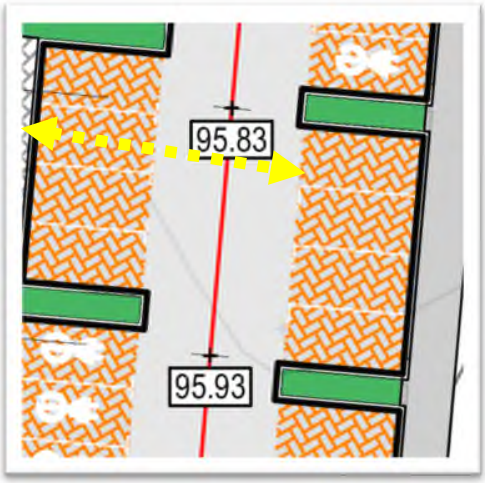
7.4 Issue

LOCATION

Drawing 210026-DBFL-RD-SP-DR-C-1101 P02, Road 6

ISSUE

There are no gaps/crossing points provided to allow pedestrians from parked vehicles on the eastern side of Road 6 to get to the residential side, especially if the car parking spaces are occupied.



RECOMMENDATION

It is recommended that crossing points be provided.

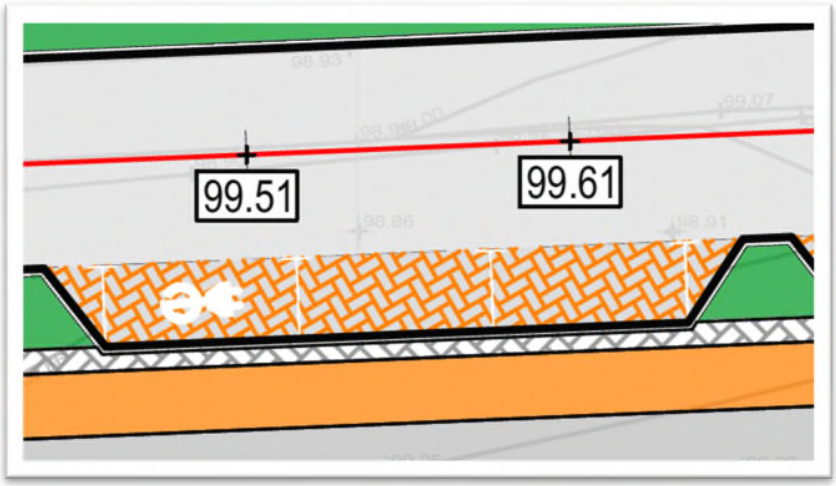
7.5 Issue

LOCATION

Drawing 210026-DBFL-RD-SP-DR-C-1101 P02, Electric Vehicle charging spaces.

ISSUE

It is unclear if there is sufficient space for drivers/other vehicle occupants to access the electric vehicle charging infrastructure and to charge their cars without being struck by cyclists on one side or passing vehicles on the other. This may be a particular issue for side charging vehicles.



Example only

RECOMMENDATION

It is recommended that adequate space be provided to facilitate charging with suitable buffer zones to passing vehicles and cyclists.

7.6 Issue

LOCATION

Drawing 210026-DBFL-RD-SP-DR-C-1101 P02, Disabled Parking spaces.

ISSUE

Dished kerbs have not be shown at the disabled parking spaces this could lead to inaccessibility to the footpath network for the mobility impaired.

Example only

RECOMMENDATION

Ensure that there are dropped kerbs and suitable tactile paving at on-road disabled parking spaces.

7.7 Issue

LOCATION

Drawing 210026-DBFL-RD-SP-DR-C-1101 P02, On-curtilage parking Space at Junction of Road 7 & Road 4.

ISSUE

It is unclear how a driver will be able to egress from the on-curtilage parking space at the junction of Road 4 and Road 7 given the orientation of the space, the proximity of the adjacent space and the proximity to the junction where vehicles could be approaching from a number of directions.

RECOMMENDATION

It is recommended that the parking space be realigned.

8.0 Audit Statement

We certify that we have examined the site on the 17th of May 2022. We have made recommendations that we feel would improve the Street Design. We have provided feedback forms for the Design Team to complete so that the design development can be tracked. We have not been involved in the Design.

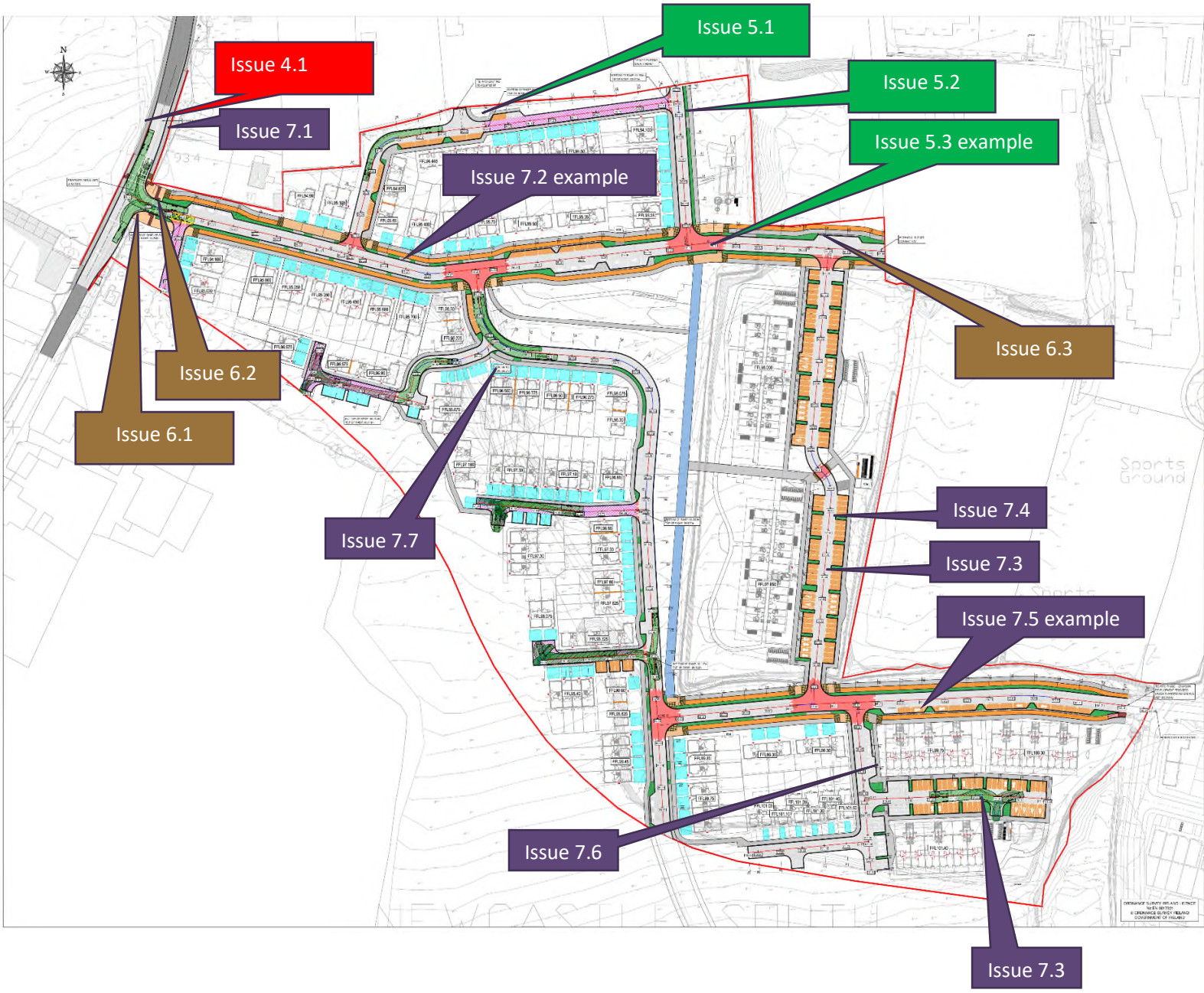
Norman Bruton **Signed:** 

(Audit Team Leader) **Dated: 31-5-2022**

Sayed Ahmad Saeed **Signed:** 

(Audit Team Member) **Dated: _31-5-2022**

Appendix A – Issue Location Map



Appendix B

Information Supplied to the Audit Team

Drawing -DBFL-CS-SP-DR-C-1201 Proposed Drainage Layout

Drawing -DBFL-CS-SP-DR-C-1202 Surface Water Drainage Strategy

Drawing -DBFL-CS-SP-DR-C-1203 Attenuation Facility 1

Drawing -DBFL-CS-SP-DR-C-1204 Attenuation Facility 2

Drawing -DBFL-CS-SP-DR-C-1205 Attenuation Facility 3

Drawing -DBFL-CS-SP-DR-C-1206 Attenuation Facility 4

Drawing -DBFL-CS-SP-DR-C-1207 Foul Pumping Station General Arrangement

Drawing -DBFL-CS-SP-DR-C-1208 Attenuation Facility 5

Drawing -DBFL-CS-SP-DR-C-5111 Foul Pumping Station Details

Drawing -DBFL-CS-SP-DR-C-5301 Typical Drainage Details Sheet 1

Drawing -DBFL-CS-SP-DR-C-5302 Typical Drainage Details Sheet 2

Drawing -DBFL-CS-SP-DR-C-5303 Typical Drainage Details Sheet 3

Drawing -DBFL-CS-SP-DR-C-5304 Typical Drainage Details Sheet 4

Drawing -DBFL-RD-SP-DR-C-1101 Proposed Roads Layout

Drawing -DBFL-RD-SP-DR-C-1104 Roads Hierarchy

Drawing -DBFL-RD-SP-DR-C-5101 Typical Road Construction Details Sheet 1

Drawing -DBFL-RD-SP-DR-C-5102 Typical Road Construction Details Sheet 2

Drawing -DBFL-RD-SP-DR-C-5103 Typical Road Construction Details Sheet 3

Drawing -DBFL-RD-SP-DR-C-5104 Typical Foundation Details Sheet 1

Drawing -DBFL-RD-SP-DR-C-5105 Typical Foundation Details Sheet 2

Drawing -DBFL-RD-SP-DR-C-5106 Typical Foundation Details Sheet 3

Drawing -DBFL-WM-SP-DR-C-1301 Proposed Watermain Layout

Drawing Public Lighting Layout - Cairn Homes Properties Ltd

Drawing 1855_PL_P_01

Appendix C

Feedback Form

DMURS STREET DESIGN AUDIT FORM – FEEDBACK ON AUDIT REPORT

Scheme: Newcastle Phase 2 QA
Stage: Street Design Audit (planning)
Date Audit (Site Visit) Completed:17-5-2022

Paragraph No. in Quality Audit Report	Problem accepted (yes/no)	Recommended measure accepted (yes/no)	Alternative measures (describe)	Alternative measures accepted by Auditors (Yes/No)
Road Safety Audit				
4.1	Yes	No	DBFL will make SDCC aware of this issue.	Yes
Walking Audit				
5.1	Yes	Yes		
5.2	Yes	Yes		
5.3	Yes	Yes	Crossing points and tactile pavements are provided. Dropped kerbs will be shown at detail design stage and will be provided at all crossing points.	Yes
Cycling Audit				
6.1	Yes	Yes		
6.2	Yes	Yes		
6.3	Yes		A concrete strip is now provided with a dropped kerb to allow cyclists get to road level	Yes
Accessibility Audit				

7.1	Yes	Yes		
7.2	Yes	Yes		
7.3	Yes	Yes		
7.4	No	No	A crossing point is provided at the central area for pedestrians. It is also possible to cross from the northern and southern end of the street. There is 45m between any one crossing point and the furthest away parking space. This provides suitable crossing points with safe visibility splays	Yes
7.5	Yes	Yes	A 750mm buffer is provided to the cycletrack to allow access and egress to parking spaces.	Yes
7.6	Yes	Yes		
7.7	Yes	Yes		

Design Team Leader **Date**…… 26/5/2022

Signed……John Moloney……

Signed……Norman Bruton…… **Date**…27/5/2022

Audit Team Leader

Signed…… …… **Date**…31/05/2022

Employer

APP I CCTV REPORTS

CES Environmental Services Ltd.
Tracklands Business Park, Clonroad More, Ennis
Tel. 065 - 6866850
kmurphy@cesenvironmental.ie

Project

Project Name:	Athgoe Newcastle Surface Water 25-04-22
Project Description:	CCTV Survey
Project Number:	CES 9404
Project Status:	Complete
Project Date:	25/04/2022
Inspection Standard:	MSCC5 Sewers & Drainage GB (SRM5 Scoring)

ENVIRONMENTAL SERVICES

CES Environmental Services Ltd.
Tracklands Business Park, Clonroad More, Ennis
Tel. 065 - 6866850
kmurphy@cesenvironmental.ie

Table of Contents

Project Name	Project Number	Project Date
Athgoe Newcastle Surface Water 25-04-22	CES 9404	25/04/2022

CES Environmental Services Ltd.
Tracklands Business Park, Clonroad More, Ennis
Tel. 065 - 6866850
kmurphy@cesenvironmental.ie

Project Information

Project Name	Project Number	Project Date
Athgoe Newcastle Surface Water 25-04-22	CES 9404	25/04/2022

Client

Company: DBFL
Description: Consulting Engineers
Contact: Conor O Loughlin
Department: Civil Engineer
Street: Ormond House
Town or City: Upper Ormond Quay
County: Dublin 7
Post Code: D07W704
Phone: 01 - 400 4000
Mobile: 085 - 169 8141
Email: conor.oloughlin@dbfl.ie

Manager

Company: Cairn Homes
Description: Planning Investigation Works
Contact: Conor O'Loughlin
Department: Civil Engineer
Street: Athgoe Road
Town or City: Newcastle
County: Dublin
Post Code: D22XV29
Phone: 01 - 400 4000
Email: conor.oloughlin@dbfl.ie

Contractor

Company: CES Environmental Services Ltd.
Description: CCTV Survey
Contact: Kieran Murphy
Department: CCTV & Rehabilitation
Street: Tracklands Business Park
Town or City: Clonroad More, Ennis
County: Clare
Post Code: V95A598
Phone: 065 - 6866850
Mobile: 085 - 2521556
Email: kmurphy@cesenvironmental.ie

CES Environmental Services Ltd.
Tracklands Business Park, Clonroad More, Ennis
Tel. 065 - 6866850
kmurphy@cesenvironmental.ie

Project Information

Project Name	Project Number	Project Date
Athgoe Newcastle Surface Water 25-04-22	CES 9404	25/04/2022

Project Drawing, Page 'Athgoe Newcastle Surface Water DBFL 250422'

ENVIRONMENTAL SERVICES

CES Environmental Services Ltd.
Tracklands Business Park, Clonroad More, Ennis
Tel. 065 - 6866850
kmurphy@cesenvironmental.ie

Scoring Summary

Project Name	Project Number	Project Date
Athgoe Newcastle Surface Water 25-04-22	CES 9404	25/04/2022

Structural Defects

Grade 3: Best practice suggests consideration should be given to repairs in the medium term.

Grade 4: Best practice suggests consideration should be given to repairs to avoid a potential collapse.

Grade 5: Best practice suggests that this pipe is at risk of collapse at any time. Urgent consideration should be given to repairs to avoid total failure.

Section	PLR	Grade	Description
7	S8X	4	Multiple defects
14	S14X	4	Multiple defects
17	S18X	4	Hole in drain or sewer from 11 o'clock to 1 o'clock
18	S20X	4	Hole in drain or sewer from 11 o'clock to 1 o'clock

Service / Operational Condition

Grade 3: Best practice suggests consideration should be given to maintenance activities in the medium term.

Grade 4: Best practice suggests consideration should be given to maintenance activity to avoid potential blockages.

Grade 5: Best practice suggests that this pipe is at a high risk of backing up or causing flooding.

Section	PLR	Grade	Description
5	S6X	5	Ingress of gravel from 4 o'clock to 8 o'clock, 20% cross-sectional area loss
6	S7X	3	Settled deposits, fine, 15% cross-sectional area loss
7	S8X	5	Roots, mass at joint, 20% cross-sectional area loss
8	S9X	4	Multiple defects
9	S8.1X	3	Ingress of gravel from 5 o'clock to 7 o'clock, 5% cross-sectional area loss
11	S13X	4	Multiple defects
12	S12X	3	Multiple defects
14	S14X	4	Multiple defects
15	S15X	3	Multiple defects
16	S17X	3	Joint displaced, medium, finish
17	S18X	4	Connection defective, connecting pipe is intruding at 2 o'clock, 150mm dia, intrusion: 20%
18	S20X	3	Roots, mass at joint, 15% cross-sectional area loss

Abandoned Surveys

Section	PLR	Description
5	S6X	Survey abandoned
5	S6X	Survey abandoned
6	S7X	Survey abandoned
7	S8X	Survey abandoned

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Scoring Summary

Project Name	Project Number	Project Date
Athgoe Newcastle Surface Water 25-04-22	CES 9404	25/04/2022

Section	PLR	Description
7	S8X	Survey abandoned
8	S9X	Survey abandoned
9	S8.1X	Survey abandoned
11	S13X	Survey abandoned
11	S13X	Survey abandoned
12	S12X	Survey abandoned
13	S13.1X	Survey abandoned
14	S14X	Survey abandoned

Information

These scoring summaries are based on the SRM grading from the WRc.

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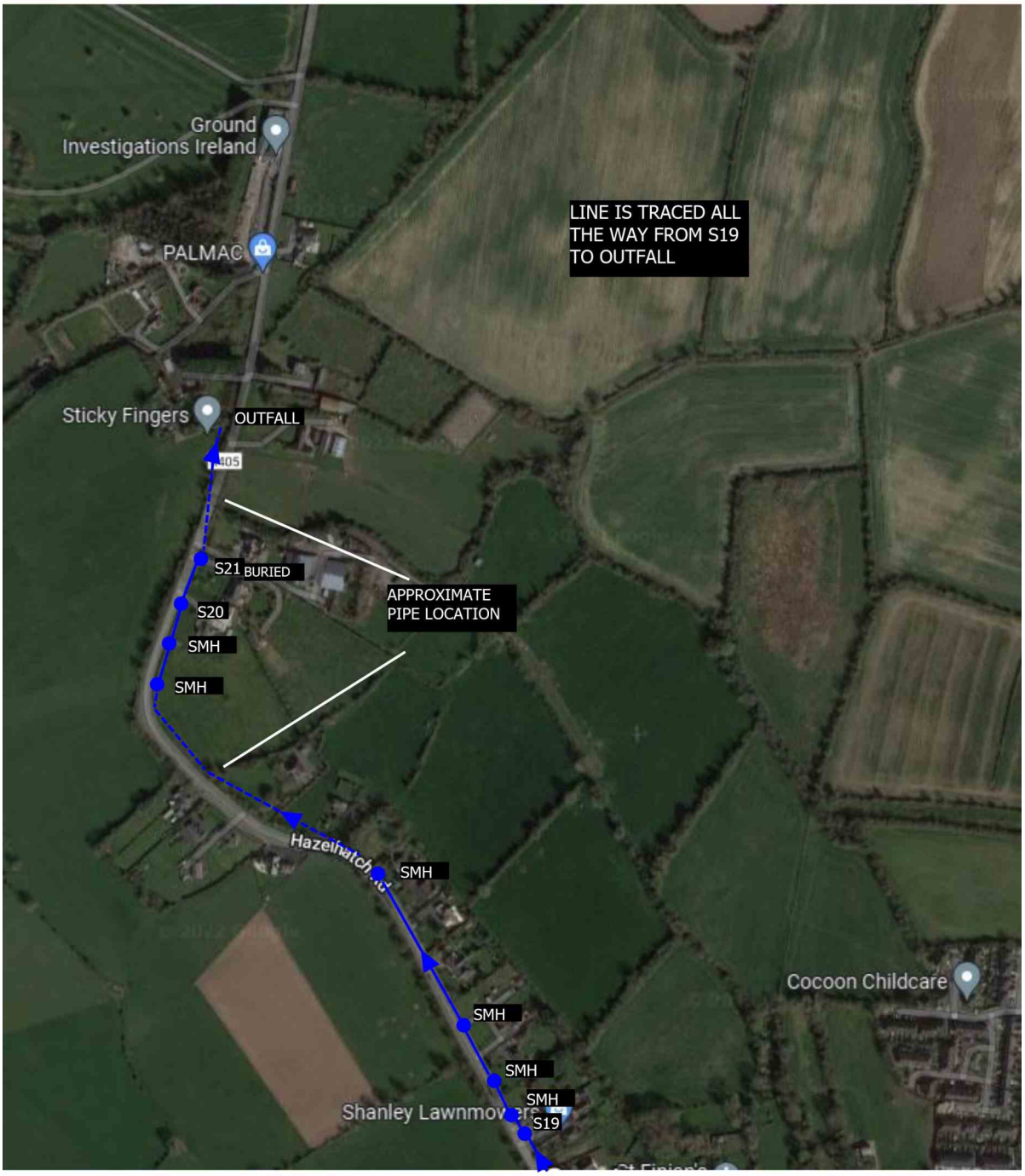
Project Pictures

Project Name	Project Number	Project Date
Athgoe Newcastle Surface Water 25-04-22	CES 9404	25/04/2022



hazelhatch_road

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Section Profile

Project Name	Project Number	Project Date
Athgoe Newcastle Surface Water 25-04-22	CES 9404	25/04/2022

Circular, 225 mm

Item No.	Upstream Node	Downstream Node	Date	Road	Material	Total Length	Inspected Length
12	S12	S13	26/04/2022	Athgoe	Polyvinyl chloride	27.01 m	27.01 m
14	S14	S15	26/04/2022	Athgoe	Polyvinyl chloride	118.39 m	118.39 m
15	S15	S16	27/04/2022	Athgoe	Concrete	13.45 m	13.45 m
16	S17	S18	27/04/2022	Athgoe	Concrete	7.62 m	**7.56 m**

Total: 4 Inspections x Circular 225 mm = 166.47 m Total Length and 166.41 m Inspected Length

Circular, 300 mm

Item No.	Upstream Node	Downstream Node	Date	Road	Material	Total Length	Inspected Length
17	S18	S19	27/04/2022	Hazelhatch road	Concrete	81.93 m	81.93 m
18	S20	S21	28/04/2022	Hazelhatch road	Concrete	71.19 m	71.19 m

Total: 2 Inspections x Circular 300 mm = 153.12 m Total Length and 153.12 m Inspected Length

Circular, 375 mm

Item No.	Upstream Node	Downstream Node	Date	Road	Material	Total Length	Inspected Length
8	S9	S8	25/04/2022	Athgoe	Concrete	37.00 m	37.00 m
10	S10	Outfall	26/04/2022	Athgoe	Concrete	37.34 m	37.34 m

Total: 2 Inspections x Circular 375 mm = 74.34 m Total Length and 74.34 m Inspected Length

Circular, 450 mm

Item No.	Upstream Node	Downstream Node	Date	Road	Material	Total Length	Inspected Length
1	S1	S2	25/04/2022	Athgoe	Polyvinyl chloride	31.55 m	31.55 m
2	S2	S3	25/04/2022	Athgoe	Polyvinyl chloride	3.29 m	3.29 m
3	S3	S4	25/04/2022	Athgoe	Polyvinyl chloride	2.80 m	2.80 m
4	S5	S1	25/04/2022	Athgoe	Polyvinyl chloride	6.63 m	6.63 m

Total: 4 Inspections x Circular 450 mm = 44.26 m Total Length and 44.26 m Inspected Length

Total: 12 Inspections = 438.18 m Total Length and 438.12 m Inspected Length

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Project Summary

Project Name	Project Number	Project Date
Athgoe Newcastle Surface Water 25-04-22	CES 9404	25/04/2022

Inspection Summary

Pipe No.	Insp. No.	Upstream Node	Downstream Node	Dir.	Operator	Insp. Date	Insp. Time	Str	Ser	Final Observation	Length
1	1	S1	S2	DS	Aaa	25/04/2022	10:35	1	1	MHF, UNABLE TO LOCATE	31.55 m
2	1	S2	S3	DS	Aaa	25/04/2022	10:50	1	1	MHF	3.29 m
3	1	S3	S4	DS	Aaa	25/04/2022	10:54	1	1	OCF, HOLDING TANK	2.80 m
4	1	S5	S1	US	Aaa	25/04/2022	11:03	1	1	MHF, CULVERT	6.63 m
5	**1**	**S6**	**S5**	**DS**	**Aaa**	**25/04/2022**	**11:42**	**1**	**5**	**SA, ECXTENSIVE JETTING REQUIRED.**	**0.48 m**
5	**2**	**S6**	**S5**	**US**	**Aaa**	**25/04/2022**	**11:21**	**1**	**4**	**SA, SILT IN LINE. ECXTENSIVE JETTING REQUIR**	**0.40 m**
6	**1**	**S7**	**S6**	**US**	**Aaa**	**25/04/2022**	**11:46**	**1**	**3**	**SA, ECXTENSIVE JETTING REQUIRED**	**1.22 m**
7	**1**	**S8**	**S6**	**DS**	**Aaa**	**25/04/2022**	**12:07**	**4**	**5**	**SA, UNABLE TO PASS THE ROOTS. CUTTING RE**	**49.17 m**
7	**2**	**S8**	**S6**	**US**	**Aaa**	**25/04/2022**	**11:53**	**4**	**3**	**SA, SILT IN LINE. ECXTENSIVE JETTING REQUIR**	**0.76 m**
8	1	S9	S8	US	Aaa	25/04/2022	15:39	1	4	BRF, START OF THE LINE. NO MANHOLE	37.00 m
8	**2**	**S9**	**S8**	**US**	**Aaa**	**25/04/2022**	**12:41**	**1**	**4**	**SA, UNABLE TO SURVEY. ECXTENSIVE JETTING**	**0.21 m**
9	**1**	**S8.1**	**S8**	**US**	**Aaa**	**25/04/2022**	**15:59**	**1**	**3**	**SA, UNABLE TO REACH THE PIPE FROM THE MA**	**0.00 m**
10	1	S10	OUTFALL	US	Aaa	26/04/2022	8:18	1	1	MHF, buried	37.34 m
11	**1**	**S13**	**S14**	**US**	**Aaa**	**26/04/2022**	**11:31**	**1**	**4**	**SA, UNABLE TO SURVEY. EXTENSIVE JETTING F**	**20.08 m**
11	**2**	**S13**	**S14**	**DS**	**Aaa**	**26/04/2022**	**10:22**	**1**	**4**	**SA, UNABLE TO SURVEY. ECXTENSIVE JETTING**	**34.49 m**
12	1	S12	S13	US	Aaa	26/04/2022	10:36	1	3	MHF	27.01 m
12	**2**	**S12**	**S13**	**US**	**Aaa**	**26/04/2022**	**10:29**	**1**	**3**	**SA, UNABLE TO SURVEY. JETTING REQUIRED.**	**16.50 m**
13	**1**	**S13.1**	**S13**	**US**	**Aaa**	**26/04/2022**	**11:13**	**1**	**1**	**SA, UNABLE TO SURVEY. CULVERT**	**0.13 m**
14	1	S14	S15	DS	Aaa	26/04/2022	12:59	4	4	GYF	118.39 m
14	**2**	**S14**	**S15**	**DS**	**Aaa**	**26/04/2022**	**11:50**	**1**	**4**	**SA, NEEDS JETTING**	**57.69 m**
15	1	S15	S16	DS	Aaa	27/04/2022	9:40	1	3	MHF, BURIED	13.45 m
16	1	S17	S18	US	Aaa	27/04/2022	14:59	2	3	MHF, BURIED	7.56 m
17	1	S18	S19	DS	Aaa	27/04/2022	15:04	4	4	MHF, SILT TRAP MANHOLE	81.93 m
18	1	S20	S21	DS	Aaa	28/04/2022	11:22	4	4	MHF, BURIED. NO COVER. GULLY CONNECTED	71.19 m
										Total:	**619.25 m**

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Project Summary

Project Name	Project Number	Project Date
Athgoe Newcastle Surface Water 25-04-22	CES 9404	25/04/2022

Defect Summary

				CCTV Drainage Survey Observation Count																			
				General				Structural Condition									Service Condition						Misc	
Sect. No.	Insp. No.	Upstream Node	Downstream Node	Insp. Length (m)	No. Grade 4/5 Obs.	Survey Abandoned	Camera Under Water	Cracks	Fractures	Broken	Deformed	Collapsed	Holes	Surface Damage	Displaced Joints	Open Joints	Roots	Infiltration	Encrustation	Silt	Grease	Obstruction	Water Level	Line Deviates
1	1	S1	S2	31.6												3							1	
2	1	S2	S3	3.3																			1	
3	1	S3	S4	2.8												1							1	
4	1	S5	S1	6.6																			1	
5	**1**	**S6**	**S5**	**0.5**		**1**												**1**					**1**	
5	**2**	**S6**	**S5**	**0.4**		**1**														**1**			**1**	
6	**1**	**S7**	**S6**	**1.2**		**1**														**1**			**1**	
7	**1**	**S8**	**S6**	**49.2**		**1**			**1**				**1**		**4**		**5**			**4**			**2**	
7	**2**	**S8**	**S6**	**0.8**		**1**			**3**											**2**			**1**	
8	1	S9	S8	37.0											11		5			1			2	
8	**2**	**S9**	**S8**	**0.2**		**1**														**2**			**1**	
9	**1**	**S8.1**	**S8**	**0.0**		**1**												**1**					**1**	
10	1	S10	OUTFALL	37.3																			3	
11	**1**	**S13**	**S14**	**20.1**		**1**										**1**				**5**			**2**	
11	**2**	**S13**	**S14**	**34.5**		**1**														**1**			**4**	
12	1	S12	S13	27.0																4			1	
12	**2**	**S12**	**S13**	**16.5**		**1**														**2**			**1**	
13	**1**	**S13.1**	**S13**	**0.1**		**1**																	**1**	
14	1	S14	S15	118.4					1		1		1		9	1				1			1	
14	**2**	**S14**	**S15**	**57.7**		**1**									**1**					**2**			**2**	
15	1	S15	S16	13.4											4								1	
16	1	S17	S18	7.6				2							2		1						1	
17	1	S18	S19	81.9				1	3				1		2		10						1	
18	1	S20	S21	71.2									1				4						2	
			Total:	**619.3**		**12**		**3**	**8**		**1**		**4**		**33**	**6**	**25**	**2**		**26**			**34**	

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Section Inspection - 25/04/2022 - S1X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
1	1	25/04/22	10:35	Athgoe Newcastl	No Rain Or Snow	Yes	S1X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	0.70 m	Public Sewer	Not Specified

Town or Village:	Newcastle	**Inspection Direction:**	Downstream	**Upstream Node:**	S1
Road:	Athgoe	**Inspected Length:**	31.55 m	**Upstream Pipe Depth:**	
Location:	Fields, farmland etc	**Total Length:**	31.55 m	**Downstream Node:**	S2
Surface Type:	Grass	**Joint Length:**	6.00 m	**Downstream Pipe Depth:**	

Use:	Surface water	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	450 mm
Flow Control:	No flow control	**Material:**	Polyvinyl chloride
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:273

Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node, manhole, reference: S1	00:00:00	1	
0.00	WL	Water level, 5% of the vertical dimension	00:00:06		
0.86	OJL	Open joint, large	00:00:16	2	1
7.14	OJL	Open joint, large	00:00:59	3	1
25.20	OJL	Open joint, large	00:03:05	4	1
31.55	MHF	Finish node, manhole, reference: S2: UNABLE TO LOCATE	00:03:56	5	

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	**STR Peak**	**STR Mean**	**STR Total**	**STR Grade**	**SER No. Def**	**SER Peak**	**SER Mean**	**SER Total**	**SER Grade**
3	2.0	0.0	6.0	1.0	0	0.0	0.0	0.0	1.0

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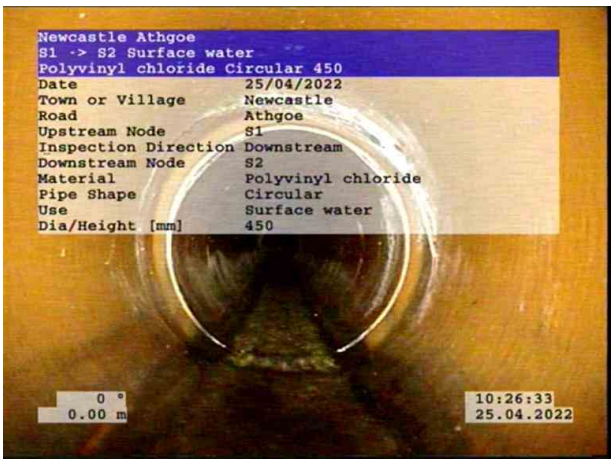
Section Pictures - 25/04/2022 - S1X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
1	Downstream	S1X	Athgoe Newcastl	DBFL



1, 00:00:00, 0.00 m
Start node, manhole, reference: S1

2, 00:00:16, 0.86 m
Open joint, large

3, 00:00:59, 7.14 m
Open joint, large

4, 00:03:05, 25.20 m
Open joint, large

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Section Pictures - 25/04/2022 - S1X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
1	Downstream	S1X	Athgoe Newcastl	DBFL

5, 00:03:56, 31.55 m
Finish node, manhole, reference: S2, UNABLE TO LOCATE

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Section Inspection - 25/04/2022 - S2X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
2	1	25/04/22	10:50	Athgoe Newcastl	No Rain Or Snow	Yes	S2X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	0.70 m	Public Sewer	Not Specified

Town or Village:	Newcastle	**Inspection Direction:**	Downstream	**Upstream Node:**	S2
Road:	Athgoe	**Inspected Length:**	3.29 m	**Upstream Pipe Depth:**	
Location:	Fields, farmland etc	**Total Length:**	3.29 m	**Downstream Node:**	S3
Surface Type:	Grass	**Joint Length:**	6.00 m	**Downstream Pipe Depth:**	

Use:	Surface water	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	450 mm
Flow Control:	No flow control	**Material:**	Polyvinyl chloride
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:50	Position [m]	Code	Observation	MPEG	Photo	Grade
Depth: m						
S2						
	0.00	MH	Start node, manhole, reference: S2	00:00:00	1	
	0.00	WL	Water level, 5% of the vertical dimension	00:00:05		
	3.29	MHF	Finish node, manhole, reference: S3	00:00:26	2	
S3						
Depth: m						

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	**STR Peak**	**STR Mean**	**STR Total**	**STR Grade**	**SER No. Def**	**SER Peak**	**SER Mean**	**SER Total**	**SER Grade**
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

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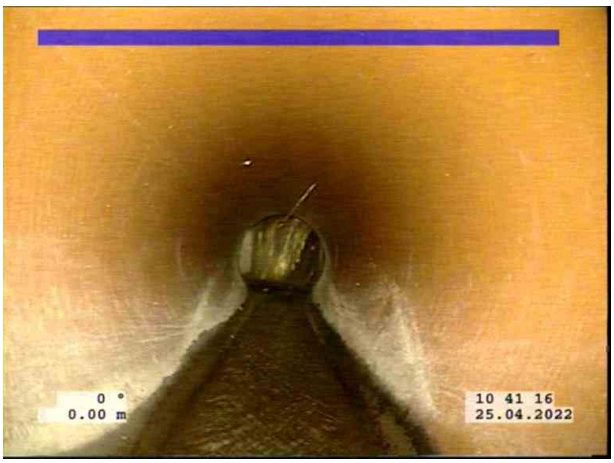
Section Pictures - 25/04/2022 - S2X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
2	Downstream	S2X	Athgoe Newcastl	DBFL



1, 00:00:00, 0.00 m
Start node, manhole, reference: S2

2, 00:00:26, 3.29 m
Finish node, manhole, reference: S3

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Section Inspection - 25/04/2022 - S3X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
3	1	25/04/22	10:54	Athgoe Newcastl	No Rain Or Snow	Yes	S3X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	0.70 m	Public Sewer	Not Specified

Town or Village:	Newcastle	**Inspection Direction:**	Downstream	**Upstream Node:**	S3
Road:	Athgoe	**Inspected Length:**	2.80 m	**Upstream Pipe Depth:**	
Location:	Gardens (private)	**Total Length:**	2.80 m	**Downstream Node:**	S4
Surface Type:	Grass	**Joint Length:**	6.00 m	**Downstream Pipe Depth:**	

Use:	Surface water	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	450 mm
Flow Control:	No flow control	**Material:**	Polyvinyl chloride
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:50	Position [m]	Code	Observation	MPEG	Photo	Grade
Depth: m S3						
	0.00	MH	Start node, manhole, reference: S3	00:00:00	1	
	1.50	WL	Water level, 5% of the vertical dimension	00:00:32		
	1.79	OJL	Open joint, large	00:00:20	2	1
	2.80	OCF	Finish node, other special chamber, reference: S4: HOLDING TANK	00:00:52	3	
S4 Depth: m						

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	**STR Peak**	**STR Mean**	**STR Total**	**STR Grade**	**SER No. Def**	**SER Peak**	**SER Mean**	**SER Total**	**SER Grade**
1	2.0	0.0	2.0	1.0	0	0.0	0.0	0.0	1.0

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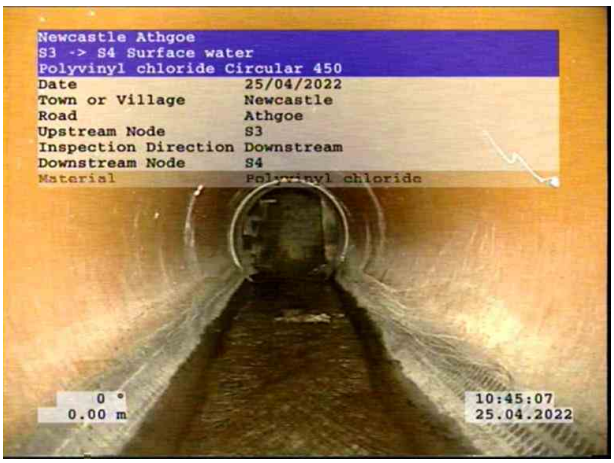
Section Pictures - 25/04/2022 - S3X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
3	Downstream	S3X	Athgoe Newcastl	DBFL



1, 00:00:00, 0.00 m
Start node, manhole, reference: S3

2, 00:00:20, 1.79 m
Open joint, large

3, 00:00:52, 2.80 m
Finish node, other special chamber, reference: S4, HOLDING TANK

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Section Inspection - 25/04/2022 - S5X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
4	1	25/04/22	11:03	Athgoe Newcastl	No Rain Or Snow	Yes	S5X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	0.70 m	Public Sewer	Not Specified

Town or Village:	Newcastle	**Inspection Direction:**	Upstream	**Upstream Node:**	S5
Road:	Athgoe	**Inspected Length:**	6.63 m	**Upstream Pipe Depth:**	
Location:	Fields, farmland etc	**Total Length:**	6.63 m	**Downstream Node:**	S1
Surface Type:	Grass	**Joint Length:**	6.00 m	**Downstream Pipe Depth:**	

Use:	Surface water	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	450 mm
Flow Control:	No flow control	**Material:**	Polyvinyl chloride
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:58

Position [m]	Code	Observation	MPEG	Photo	Grade
Depth: m					
S1					
0.00	MH	Start node, manhole, reference: S1	00:00:00	1	
0.00	WL	Water level, 5% of the vertical dimension	00:00:08		
6.63	MHF	Finish node, manhole, reference: S5: CULVERT	00:00:53	2, 3	
S5					
Depth: m					

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	**STR Peak**	**STR Mean**	**STR Total**	**STR Grade**	**SER No. Def**	**SER Peak**	**SER Mean**	**SER Total**	**SER Grade**
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

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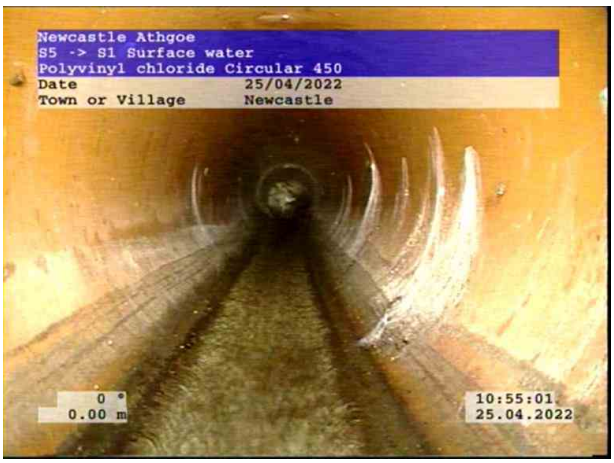
Section Pictures - 25/04/2022 - S5X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
4	Upstream	S5X	Athgoe Newcastl	DBFL



1, 00:00:00, 0.00 m
Start node, manhole, reference: S1

2, 00:00:53, 6.63 m
Finish node, manhole, reference: S5, CULVERT

3, 00:00:53, 6.63 m
Finish node, manhole, reference: S5, CULVERT

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Section Inspection - 25/04/2022 - S6X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
5	2	25/04/22	11:42	Athgoe Newcastl	No Rain Or Snow	No	S6X

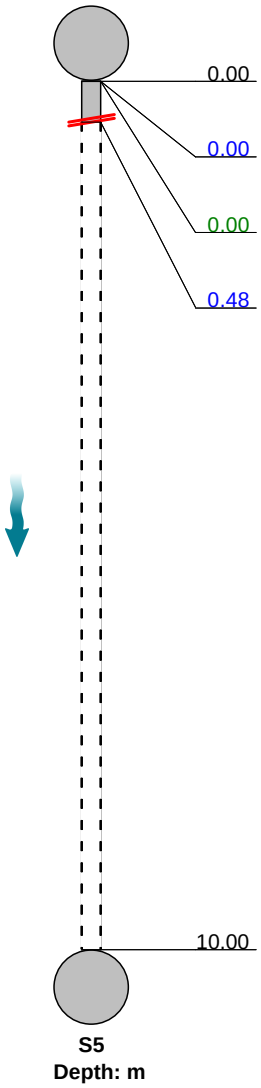
Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	Not Specified	Public Sewer	Not Specified

Town or Village:	Newcastle	**Inspection Direction:**	Downstream	**Upstream Node:**	S6
Road:	Athgoe	**Inspected Length:**	0.48 m	**Upstream Pipe Depth:**	
Location:	Other walkway	**Total Length:**	10.00 m	**Downstream Node:**	S5
Surface Type:	Grass	**Joint Length:**		**Downstream Pipe Depth:**	

Use:	Culverted watercourse	**Pipe Shape:**	Rectangular		
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	500 mm	**Width:**	500 mm
Flow Control:	No flow control	**Material:**	Masonry (random)		
Year Constructed:	Not Specified	**Lining Type:**	No Lining		
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining		

Comments:
Recommendations:

Scale: 1:87



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node, manhole, reference: S6	00:00:00	1	
0.00	WL	Water level, 20% of the vertical dimension	00:00:05		
0.00	INGG	Ingress of gravel from 4 o'clock to 8 o'clock, 20% cross-sectional area loss	00:00:06	2	5
0.48	SA	Survey abandoned: ECXTENSIVE JETTING REQUIRED.	00:00:08	3	
10.00		End of pipe			

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	**STR Peak**	**STR Mean**	**STR Total**	**STR Grade**	**SER No. Def**	**SER Peak**	**SER Mean**	**SER Total**	**SER Grade**
0	0.0	0.0	0.0	1.0	1	10.0	0.0	10.0	5.0

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Section Pictures - 25/04/2022 - S6X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
5	Downstream	S6X	Athgoe Newcastl	DBFL

1, 00:00:00, 0.00 m
Start node, manhole, reference: S6

2, 00:00:06, 0.00 m
Ingress of gravel from 4 o'clock to 8 o'clock, 20% cross-sectional area loss

3, 00:00:08, 0.48 m
Survey abandoned, ECXTENSIVE JETTING REQUIRED.

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Section Inspection - 25/04/2022 - S6X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
5	1	25/04/22	11:21	Athgoe Newcastl	No Rain Or Snow	Yes	S6X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	0.70 m	Public Sewer	Not Specified

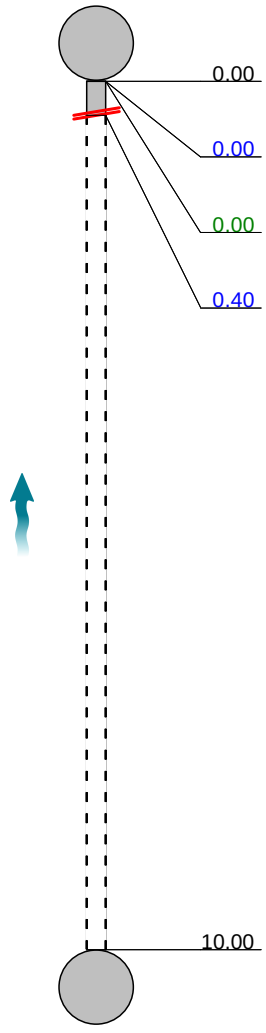
Town or Village:	Newcastle	**Inspection Direction:**	Upstream	**Upstream Node:**	S6
Road:	Athgoe	**Inspected Length:**	0.40 m	**Upstream Pipe Depth:**	
Location:	Other walkway	**Total Length:**	10.00 m	**Downstream Node:**	S5
Surface Type:	Grass	**Joint Length:**		**Downstream Pipe Depth:**	

Use:	Culverted watercourse	**Pipe Shape:**	Rectangular		
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	500 mm	**Width:**	500 mm
Flow Control:	No flow control	**Material:**	Masonry (random)		
Year Constructed:	Not Specified	**Lining Type:**	No Lining		
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining		

Comments:
Recommendations:

Scale: 1:87

Depth: m
S5



S6
Depth: m

Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node, manhole, reference: S5	00:00:00	1	
0.00	WL	Water level, 20% of the vertical dimension	00:00:08		
0.00	DES	Settled deposits, fine, 20% cross-sectional area loss	00:00:10	2	4
0.40	SA	Survey abandoned: SILT IN LINE. ECXTENSIVE JETTING REQUIRED.	00:00:46	3	
10.00		End of pipe			

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	**STR Peak**	**STR Mean**	**STR Total**	**STR Grade**	**SER No. Def**	**SER Peak**	**SER Mean**	**SER Total**	**SER Grade**
0	0.0	0.0	0.0	1.0	1	5.0	0.0	5.0	4.0

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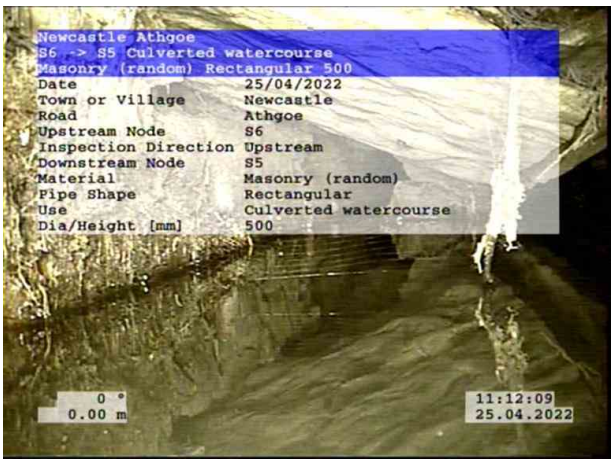
Section Pictures - 25/04/2022 - S6X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
5	Upstream	S6X	Athgoe Newcastl	DBFL



1, 00:00:00, 0.00 m
Start node, manhole, reference: S5

2, 00:00:10, 0.00 m
Settled deposits, fine, 20% cross-sectional area loss

3, 00:00:46, 0.40 m
Survey abandoned, SILT IN LINE. ECXTENSIVE JETTING REQUIRED.

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Section Inspection - 25/04/2022 - S7X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
6	1	25/04/22	11:46	Athgoe Newcastl	No Rain Or Snow	No	S7X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	0.70 m	Public Sewer	Not Specified

Town or Village:	Newcastle	**Inspection Direction:**	Upstream	**Upstream Node:**	S7
Road:	Athgoe	**Inspected Length:**	1.22 m	**Upstream Pipe Depth:**	
Location:	Road	**Total Length:**	30.00 m	**Downstream Node:**	S6
Surface Type:	Asphalt Highway	**Joint Length:**	2.50 m	**Downstream Pipe Depth:**	

Use:	Surface water	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	600 mm
Flow Control:	No flow control	**Material:**	Concrete
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:259	Position [m]	Code	Observation	MPEG	Photo	Grade
Depth: m S6						
	0.00	MH	Start node, manhole, reference: S6	00:00:00	1	
	0.00	WL	Water level, 15% of the vertical dimension	00:00:13		
	0.00	DES	Settled deposits, fine, 15% cross-sectional area loss	00:00:15	2	3
	1.22	SA	Survey abandoned: ECXTENSIVE JETTING REQUIRED	00:01:23	3	
	30.00		End of pipe			
S7 Depth: m						

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	**STR Peak**	**STR Mean**	**STR Total**	**STR Grade**	**SER No. Def**	**SER Peak**	**SER Mean**	**SER Total**	**SER Grade**
0	0.0	0.0	0.0	1.0	1	2.0	0.0	2.0	3.0

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Section Pictures - 25/04/2022 - S7X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
6	Upstream	S7X	Athgoe Newcastl	DBFL

1, 00:00:00, 0.00 m
Start node, manhole, reference: S6

2, 00:00:15, 0.00 m
Settled deposits, fine, 15% cross-sectional area loss

3, 00:01:23, 1.22 m
Survey abandoned, ECXTENSIVE JETTING REQUIRED

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Section Inspection - 25/04/2022 - S8X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
7	2	25/04/22	12:07	Athgoe Newcastl	No Rain Or Snow	Yes	S8X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	Not Specified	Public Sewer	Not Specified

Town or Village:	Newcastle	**Inspection Direction:**	Downstream	**Upstream Node:**	S8
Road:	Athgoe	**Inspected Length:**	49.17 m	**Upstream Pipe Depth:**	
Location:	Road	**Total Length:**	55.00 m	**Downstream Node:**	S6
Surface Type:	Asphalt Highway	**Joint Length:**	2.50 m	**Downstream Pipe Depth:**	

Use:	Surface water	**Pipe Shape:**	Rectangular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	600 mm
Flow Control:	No flow control	**Material:**	Concrete
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:387 **Depth: m**

Position [m]		Code	Observation	MPEG	Photo	Grade
0.00		MH	Start node, manhole, reference: S8	00:00:00	1	
0.00		WL	Water level, 5% of the vertical dimension	00:00:07		
8.71		H	Hole in drain or sewer at 7 o'clock	00:00:43	2	4
8.71		RF	Roots, fine	00:00:52	3	2
16.77		CXI	Connection defective, connecting pipe is intruding at 1 o'clock, 100mm dia, intrusion: 5%	00:02:03	4	3
19.57		CN	Connection other than junction at 3 o'clock, 150mm dia	00:02:24	5	
32.98		JDL	Joint displaced, large	00:03:49	6	1 / 4
35.20	S01	JDM	Joint displaced, medium, start	00:04:33	7	
35.63		RF	Roots, fine	00:04:43	8	2
38.53		JDL	Joint displaced, large	00:05:16	9	1 / 4
38.86		RFJ	Roots, fine at joint	00:05:24	10	2
39.92	F01	JDM	Joint displaced, medium, finish	00:05:35	11	1 / 3
40.89		WL	Water level, 10% of the vertical dimension	00:05:48		
42.89		FL	Fracture, longitudinal at 11 o'clock	00:06:10	12	3 / 2
43.92	S02	DES	Settled deposits, fine, 10% cross-sectional area loss, start	00:06:25	13	

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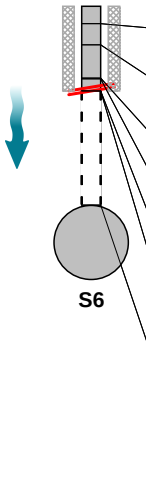
Section Inspection - 25/04/2022 - S8X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
7	2	25/04/22	12:07	Athgoe Newcastl	No Rain Or Snow	Yes	S8X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	Not Specified	Public Sewer	Not Specified



Scale: 1:387 Position [m]		Code	Observation	MPEG	Photo	Grade
45.72		RFJ	Roots, fine at joint	00:06:47	14	2
46.80		DES	Settled deposits, fine, 15% cross-sectional area loss	00:07:01	15	3
48.51		DES	Settled deposits, fine, 20% cross-sectional area loss	00:07:38	16	4
48.57		RMJ	Roots, mass at joint, 20% cross-sectional area loss	00:07:43	17	5
49.17	F02	DES	Settled deposits, fine, 10% cross-sectional area loss, finish	00:08:48		3
49.17		SA	Survey abandoned: UNABLE TO PASS THE ROOTS. CUTTING REQUIRED	00:08:51	18	
55.00			End of pipe			

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
5	80.0	0.0	129.0	4.0	13	12.0	0.0	56.0	5.0

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Section Pictures - 25/04/2022 - S8X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
7	Downstream	S8X	Athgoe Newcastl	DBFL

1, 00:00:00, 0.00 m
Start node, manhole, reference: S8

2, 00:00:43, 8.71 m
Hole in drain or sewer at 7 o'clock

3, 00:00:52, 8.71 m
Roots, fine

4, 00:02:03, 16.77 m
Connection defective, connecting pipe is intruding at 1 o'clock, 100mm dia, intrusion: 5%

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Section Pictures - 25/04/2022 - S8X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
7	Downstream	S8X	Athgoe Newcastl	DBFL

5, 00:02:24, 19.57 m
Connection other than junction at 3 o'clock, 150mm dia

6, 00:03:49, 32.98 m
Joint displaced, large

7, 00:04:33, 35.20 m
Joint displaced, medium, start

8, 00:04:43, 35.63 m
Roots, fine

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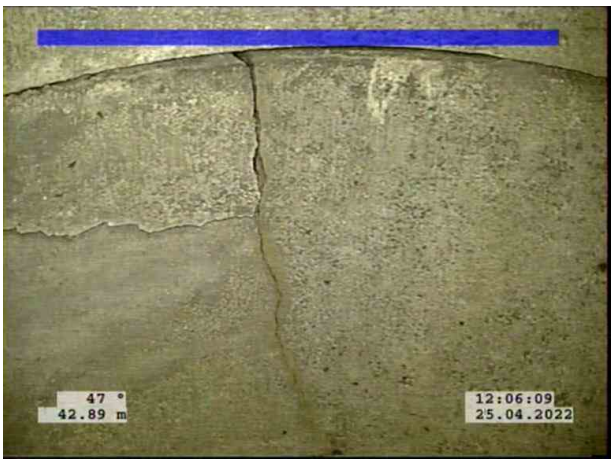
Section Pictures - 25/04/2022 - S8X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
7	Downstream	S8X	Athgoe Newcastl	DBFL

9, 00:05:16, 38.53 m
Joint displaced, large

10, 00:05:24, 38.86 m
Roots, fine at joint

11, 00:05:35, 39.92 m
Joint displaced, medium, finish



12, 00:06:10, 42.89 m
Fracture, longitudinal at 11 o'clock

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Section Pictures - 25/04/2022 - S8X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
7	Downstream	S8X	Athgoe Newcastl	DBFL

13, 00:06:25, 43.92 m
Settled deposits, fine, 10% cross-sectional area loss, start

14, 00:06:47, 45.72 m
Roots, fine at joint

15, 00:07:01, 46.80 m
Settled deposits, fine, 15% cross-sectional area loss

16, 00:07:38, 48.51 m
Settled deposits, fine, 20% cross-sectional area loss

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Section Pictures - 25/04/2022 - S8X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
7	Downstream	S8X	Athgoe Newcastl	DBFL

17, 00:07:43, 48.57 m
Roots, mass at joint, 20% cross-sectional area loss

18, 00:08:51, 49.17 m
Survey abandoned, UNABLE TO PASS THE ROOTS.
CUTTING REQUIRED

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Section Inspection - 25/04/2022 - S8X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
7	1	25/04/22	11:53	Athgoe Newcastl	No Rain Or Snow	Yes	S8X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	0.70 m	Public Sewer	Not Specified

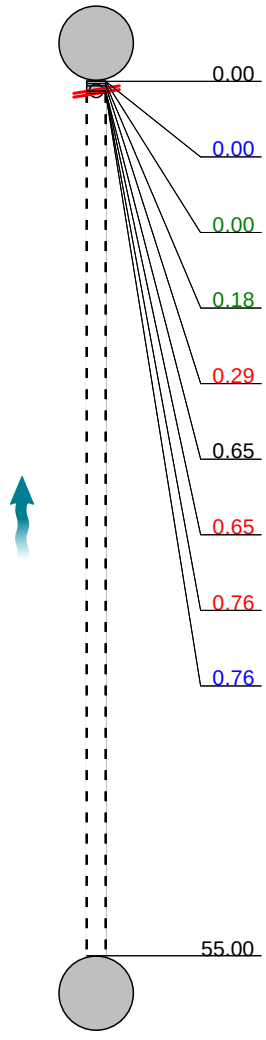
Town or Village:	Newcastle	**Inspection Direction:**	Upstream	**Upstream Node:**	S8
Road:	Athgoe	**Inspected Length:**	0.76 m	**Upstream Pipe Depth:**	
Location:	Road	**Total Length:**	55.00 m	**Downstream Node:**	S6
Surface Type:	Asphalt Highway	**Joint Length:**	2.50 m	**Downstream Pipe Depth:**	

Use:	Surface water	**Pipe Shape:**	Rectangular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	600 mm
Flow Control:	No flow control	**Material:**	Concrete
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:475

Depth: m
S6



S8
Depth: m

Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node, manhole, reference: S6	00:00:00	1	
0.00	WL	Water level, 15% of the vertical dimension	00:00:05		
0.00	DES	Settled deposits, fine, 10% cross-sectional area loss	00:00:09	2	3
0.18	DES	Settled deposits, fine, 15% cross-sectional area loss	00:01:00	3	3
0.29	FL	Fracture, longitudinal at 10 o'clock	00:01:07	4	3 / 2
0.65	CN	Connection other than junction at 12 o'clock, 150mm dia	00:01:18	5	
0.65	FM	Fractures, multiple from 10 o'clock to 2 o'clock	00:01:22	6	4 / 2
0.76	FL	Fracture, longitudinal at 2 o'clock	00:01:34	7	3 / 2
0.76	SA	Survey abandoned: SILT IN LINE. ECXTENSIVE JETTING REQUIRED	00:01:44	8	
55.00		End of pipe			

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	**STR Peak**	**STR Mean**	**STR Total**	**STR Grade**	**SER No. Def**	**SER Peak**	**SER Mean**	**SER Total**	**SER Grade**
3	160.0	0.0	160.0	4.0	5	4.0	0.0	7.0	3.0

ENVIRONMENTAL SERVICES

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Section Pictures - 25/04/2022 - S8X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
7	Upstream	S8X	Athgoe Newcastl	DBFL

1, 00:00:00, 0.00 m
Start node, manhole, reference: S6

2, 00:00:09, 0.00 m
Settled deposits, fine, 10% cross-sectional area loss

3, 00:01:00, 0.18 m
Settled deposits, fine, 15% cross-sectional area loss

4, 00:01:07, 0.29 m
Fracture, longitudinal at 10 o'clock

ENVIRONMENTAL SERVICES

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Section Pictures - 25/04/2022 - S8X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
7	Upstream	S8X	Athgoe Newcastl	DBFL

5, 00:01:18, 0.65 m
Connection other than junction at 12 o'clock, 150mm dia

6, 00:01:22, 0.65 m
Fractures, multiple from 10 o'clock to 2 o'clock

7, 00:01:34, 0.76 m
Fracture, longitudinal at 2 o'clock

8, 00:01:44, 0.76 m
Survey abandoned, SILT IN LINE. ECXTENSIVE JETTING REQUIRED

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Section Inspection - 25/04/2022 - S9X

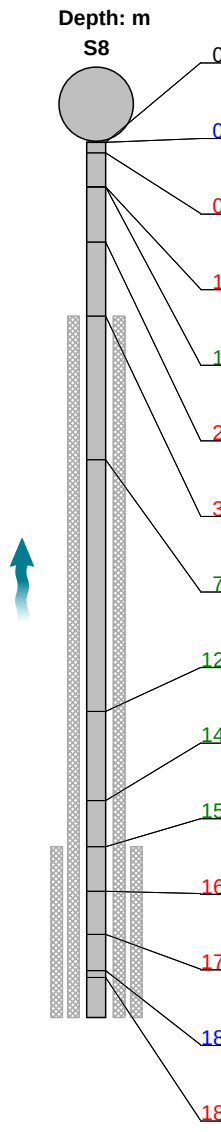
Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
8	2	25/04/22	15:39	Athgoe Newcastl	No Rain Or Snow	Yes	S9X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	Not Specified	Public Sewer	Not Specified

Town or Village:	Newcastle	**Inspection Direction:**	Upstream	**Upstream Node:**	S9
Road:	Athgoe	**Inspected Length:**	37.00 m	**Upstream Pipe Depth:**	
Location:	Other walkway	**Total Length:**	37.00 m	**Downstream Node:**	S8
Surface Type:	Grass	**Joint Length:**	0.90 m	**Downstream Pipe Depth:**	

Use:	Surface water	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	375 mm
Flow Control:	No flow control	**Material:**	Concrete
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:



Scale: 1:169 Position [m]		Code	Observation	MPEG	Photo	Grade
0.00		MH	Start node, manhole, reference: S8	00:00:00	1	
0.00		WL	Water level, 10% of the vertical dimension	00:00:06		
0.25		JDM	Joint displaced, medium	00:00:16	2	1 / 3
1.00		JDL	Joint displaced, large	00:00:28	3	1 / 4
1.00		RF	Roots, fine	00:00:39	4	2
2.23		JDM	Joint displaced, medium	00:00:52	5	1 / 3
3.90	S01	JDM	Joint displaced, medium, start	00:01:09	6	
7.10		DES	Settled deposits, fine, 15% cross-sectional area loss	00:01:29	7	3
12.74		RF	Roots, fine	00:01:56	8	2
14.73		RF	Roots, fine	00:02:09	9	2
15.76	S02	RF	Roots, fine, start	00:02:17	10	
16.76		JDL	Joint displaced, large	00:02:28	11	1 / 4
17.72		JDL	Joint displaced, large	00:02:36	12	1 / 4
18.53		WL	Water level, 5% of the vertical dimension	00:02:45		
18.68		JDL	Joint displaced, large	00:02:48	13	1 / 4

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Section Inspection - 25/04/2022 - S9X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
8	2	25/04/22	15:39	Athgoe Newcastl	No Rain Or Snow	Yes	S9X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	Not Specified	Public Sewer	Not Specified

Scale: 1:169	Position [m]		Code	Observation	MPEG	Photo	Grade
	20.49	F02	RF	Roots, fine, finish	00:03:00		2
	20.74		JDL	Joint displaced, large	00:03:04	14	1 / 4
	22.85		JDL	Joint displaced, large	00:03:20	15	1 / 4
	23.72		JDL	Joint displaced, large	00:03:27	16	1 / 4
	36.22	F01	JDM	Joint displaced, medium, finish	00:04:23		1 / 3
	36.84		CN	Connection other than junction at 4 o'clock, 150mm dia	00:04:30	17	
	37.00		BRF	Finish node, major connection without manhole, reference: S9: START OF THE LINE. NO MANHOLE	00:04:35	18	

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
10	3.0	0.0	49.0	1.0	15	8.0	0.0	115.0	4.0

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Section Pictures - 25/04/2022 - S9X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
8	Upstream	S9X	Athgoe Newcastl	DBFL

1, 00:00:00, 0.00 m
Start node, manhole, reference: S8

2, 00:00:16, 0.25 m
Joint displaced, medium

3, 00:00:28, 1.00 m
Joint displaced, large

4, 00:00:39, 1.00 m
Roots, fine

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Section Pictures - 25/04/2022 - S9X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
8	Upstream	S9X	Athgoe Newcastl	DBFL

5, 00:00:52, 2.23 m
Joint displaced, medium

6, 00:01:09, 3.90 m
Joint displaced, medium, start

7, 00:01:29, 7.10 m
Settled deposits, fine, 15% cross-sectional area loss

8, 00:01:56, 12.74 m
Roots, fine

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Section Pictures - 25/04/2022 - S9X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
8	Upstream	S9X	Athgoe Newcastl	DBFL

9, 00:02:09, 14.73 m
Roots, fine

10, 00:02:17, 15.76 m
Roots, fine, start

11, 00:02:28, 16.76 m
Joint displaced, large

12, 00:02:36, 17.72 m
Joint displaced, large

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Section Pictures - 25/04/2022 - S9X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
8	Upstream	S9X	Athgoe Newcastl	DBFL

13, 00:02:48, 18.68 m
Joint displaced, large

14, 00:03:04, 20.74 m
Joint displaced, large

15, 00:03:20, 22.85 m
Joint displaced, large

16, 00:03:27, 23.72 m
Joint displaced, large

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Section Pictures - 25/04/2022 - S9X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
8	Upstream	S9X	Athgoe Newcastl	DBFL

17, 00:04:30, 36.84 m
Connection other than junction at 4 o'clock, 150mm dia

18, 00:04:35, 37.00 m
Finish node, major connection without manhole, reference: S9, START OF THE LINE. NO MANHOLE

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Section Inspection - 25/04/2022 - S9X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
8	1	25/04/22	12:41	Athgoe Newcastl	No Rain Or Snow	No	S9X

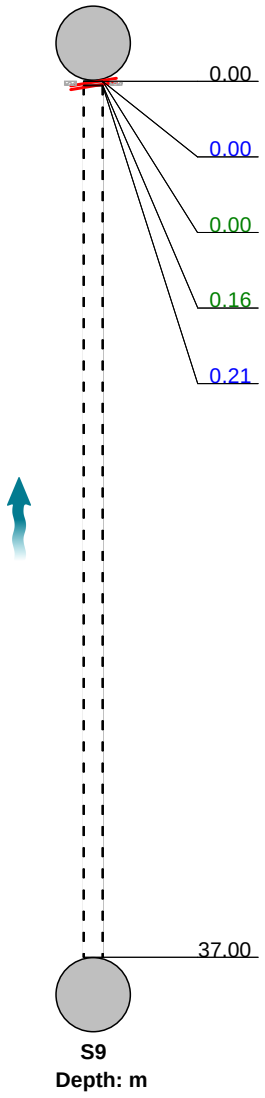
Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	0.70 m	Public Sewer	Not Specified

Town or Village:	Newcastle	**Inspection Direction:**	Upstream	**Upstream Node:**	S9
Road:	Athgoe	**Inspected Length:**	0.21 m	**Upstream Pipe Depth:**	
Location:	Other walkway	**Total Length:**	37.00 m	**Downstream Node:**	S8
Surface Type:	Grass	**Joint Length:**	0.90 m	**Downstream Pipe Depth:**	

Use:	Surface water	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	375 mm
Flow Control:	No flow control	**Material:**	Concrete
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:319



Position [m]		Code	Observation	MPEG	Photo	Grade
0.00		MH	Start node, manhole, reference: S8	00:00:00	1	
0.00		WL	Water level, 0% of the vertical dimension	00:00:05		
0.00	S01	DES	Settled deposits, fine, 25% cross-sectional area loss, start	00:00:08	2	
0.16	F01	DES	Settled deposits, fine, 25% cross-sectional area loss, finish	00:00:45		4
0.21		SA	Survey abandoned: UNABLE TO SURVEY. ECXTENSIVE JETTING REQUIRED	00:00:49	3	
37.00			End of pipe			

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	1	5.0	0.0	5.0	4.0

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Section Pictures - 25/04/2022 - S9X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
8	Upstream	S9X	Athgoe Newcastl	DBFL

1, 00:00:00, 0.00 m
Start node, manhole, reference: S8

2, 00:00:08, 0.00 m
Settled deposits, fine, 25% cross-sectional area loss, start

3, 00:00:49, 0.21 m
Survey abandoned, UNABLE TO SURVEY. ECXTENSIVE JETTING REQUIRED

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Section Inspection - 25/04/2022 - S8.1X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
9	1	25/04/22	15:59	Athgoe Newcastl	No Rain Or Snow	No	S8.1X

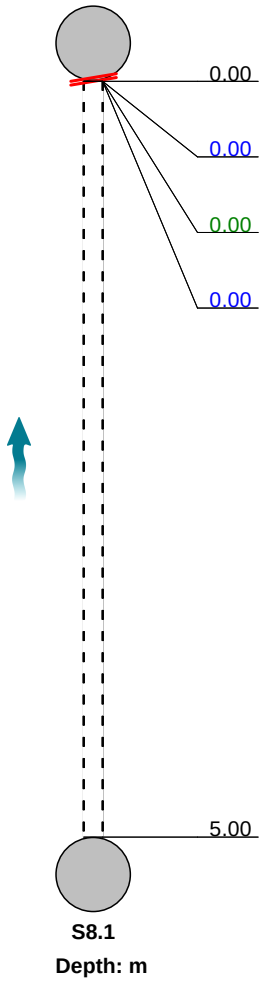
Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	0.70 m	Public Sewer	Not Specified

Town or Village:	Newcastle	**Inspection Direction:**	Upstream	**Upstream Node:**	S8.1
Road:	Athgoe	**Inspected Length:**	0.00 m	**Upstream Pipe Depth:**	
Location:	Other walkway	**Total Length:**	5.00 m	**Downstream Node:**	S8
Surface Type:	Grass	**Joint Length:**		**Downstream Pipe Depth:**	

Use:	Surface water	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	225 mm
Flow Control:	No flow control	**Material:**	Concrete
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:50



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node, manhole, reference: S8	00:00:00	1	
0.00	WL	Water level, 5% of the vertical dimension	00:00:06		
0.00	INGG	Ingress of gravel from 5 o'clock to 7 o'clock, 5% cross-sectional area loss	00:00:16		3
0.00	SA	Survey abandoned: UNABLE TO REACH THE PIPE FROM THE MANHOLE.	00:00:16	2	
5.00		End of pipe			

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	**STR Peak**	**STR Mean**	**STR Total**	**STR Grade**	**SER No. Def**	**SER Peak**	**SER Mean**	**SER Total**	**SER Grade**
0	0.0	0.0	0.0	1.0	1	4.0	0.0	4.0	3.0

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Section Pictures - 25/04/2022 - S8.1X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
9	Upstream	S8.1X	Athgoe Newcastl	DBFL

1, 00:00:00, 0.00 m
Start node, manhole, reference: S8

2, 00:00:16, 0.00 m
Survey abandoned, UNABLE TO REACH THE PIPE FROM THE MANHOLE.

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Section Inspection - 26/04/2022 - S10X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
10	2	26/04/22	8:18	Athgoe Newcastl	No Rain Or Snow	No	S10X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	Not Specified	Public Sewer	Not Specified

Town or Village:	Newcastle	**Inspection Direction:**	Upstream	**Upstream Node:**	S10
Road:	Athgoe	**Inspected Length:**	37.34 m	**Upstream Pipe Depth:**	
Location:	Road	**Total Length:**	37.34 m	**Downstream Node:**	OUTFALL
Surface Type:	Grass	**Joint Length:**	0.90 m	**Downstream Pipe Depth:**	

Use:	Surface water	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	375 mm
Flow Control:	No flow control	**Material:**	Concrete
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:322

Depth: m
Outfall

S10
Depth: m

Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	OF	Start node, outfall, reference: Outfall	00:00:00	1	
0.00	WL	Water level, 20% of the vertical dimension	00:00:05		
5.20	WL	Water level, 15% of the vertical dimension	00:00:35		
35.19	WL	Water level, 5% of the vertical dimension	00:03:29		
37.34	MHF	Finish node, manhole, reference: S10: buried	00:04:08	2	

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	**STR Peak**	**STR Mean**	**STR Total**	**STR Grade**	**SER No. Def**	**SER Peak**	**SER Mean**	**SER Total**	**SER Grade**
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

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Section Pictures - 26/04/2022 - S10X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
10	Upstream	S10X	Athgoe Newcastl	DBFL

1, 00:00:00, 0.00 m
Start node, outfall, reference: Outfall

2, 00:04:08, 37.34 m
Finish node, manhole, reference: S10, buried

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Section Inspection - 26/04/2022 - S13X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
11	3	26/04/22	11:31	Athgoe Newcastl	No Rain Or Snow	No	S13X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	Not Specified	Public Sewer	Not Specified

Town or Village:	Newcastle	**Inspection Direction:**	Upstream	**Upstream Node:**	S13
Road:	Athgoe	**Inspected Length:**	20.08 m	**Upstream Pipe Depth:**	
Location:	Road	**Total Length:**	60.00 m	**Downstream Node:**	S14
Surface Type:	Asphalt Highway	**Joint Length:**	6.00 m	**Downstream Pipe Depth:**	

Use:	Surface water	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	225 mm
Flow Control:	No flow control	**Material:**	Polyvinyl chloride
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:518

Position [m]		Code	Observation	MPEG	Photo	Grade
0.00		MH	Start node, manhole, reference: S14	00:00:00	1	
0.00		WL	Water level, 15% of the vertical dimension	00:00:06		
0.00	S01	DES	Settled deposits, fine, 15% cross-sectional area loss, start	00:00:06	2	
4.76		WL	Water level, 10% of the vertical dimension	00:04:01		
4.98		OJL	Open joint, large	00:04:06	3	1
5.21	F01	DES	Settled deposits, fine, 15% cross-sectional area loss, finish	00:04:11	4	3
10.77		DES	Settled deposits, fine, 20% cross-sectional area loss	00:04:51	5	4
11.56	S02	DES	Settled deposits, fine, 10% cross-sectional area loss, start	00:05:00	6	
18.48		DER	Settled deposits, coarse, 20% cross-sectional area loss	00:05:50	7	4
20.08	F02	DES	Settled deposits, fine, 10% cross-sectional area loss, finish	00:08:21	8	3
20.08		SA	Survey abandoned: UNABLE TO SURVEY. EXTENSIVE JETTING REQUIRED	00:08:22	9	
60.00			End of pipe			

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	**STR Peak**	**STR Mean**	**STR Total**	**STR Grade**	**SER No. Def**	**SER Peak**	**SER Mean**	**SER Total**	**SER Grade**
1	2.0	0.0	2.0	1.0	4	7.0	0.0	40.0	4.0

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Section Pictures - 26/04/2022 - S13X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
11	Upstream	S13X	Athgoe Newcastl	DBFL

1, 00:00:00, 0.00 m
Start node, manhole, reference: S14

2, 00:00:06, 0.00 m
Settled deposits, fine, 15% cross-sectional area loss, start

3, 00:04:06, 4.98 m
Open joint, large

4, 00:04:11, 5.21 m
Settled deposits, fine, 15% cross-sectional area loss, finish

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Section Pictures - 26/04/2022 - S13X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
11	Upstream	S13X	Athgoe Newcastl	DBFL

5, 00:04:51, 10.77 m
Settled deposits, fine, 20% cross-sectional area loss

6, 00:05:00, 11.56 m
Settled deposits, fine, 10% cross-sectional area loss, start

7, 00:05:50, 18.48 m
Settled deposits, coarse, 20% cross-sectional area loss

8, 00:08:21, 20.08 m
Settled deposits, fine, 10% cross-sectional area loss, finish

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Section Pictures - 26/04/2022 - S13X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
11	Upstream	S13X	Athgoe Newcastl	DBFL

9, 00:08:22, 20.08 m
Survey abandoned, UNABLE TO SURVEY. EXTENSIVE JETTING REQUIRED

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Section Inspection - 26/04/2022 - S13X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
11	2	26/04/22	10:22	Athgoe Newcastl	No Rain Or Snow	No	S13X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	Not Specified	Public Sewer	Not Specified

Town or Village:	Newcastle	**Inspection Direction:**	Downstream	**Upstream Node:**	S13
Road:	Athgoe	**Inspected Length:**	34.49 m	**Upstream Pipe Depth:**	
Location:	Road	**Total Length:**	60.00 m	**Downstream Node:**	S14
Surface Type:	Asphalt Highway	**Joint Length:**	6.00 m	**Downstream Pipe Depth:**	

Use:	Surface water	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	225 mm
Flow Control:	No flow control	**Material:**	Polyvinyl chloride
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:518 Position [m]	Code	Observation	MPEG	Photo	Grade
Depth: m S13					
0.00	MH	Start node, manhole, reference: S13	00:00:00	1	
0.00	WL	Water level, 5% of the vertical dimension	00:00:06		
6.49	WL	Water level, 15% of the vertical dimension	00:00:34		
12.85	WL	Water level, 5% of the vertical dimension	00:01:00		
28.47	CN	Connection other than junction at 10 o'clock, 150mm dia	00:01:55	2	
29.08	CN	Connection other than junction at 3 o'clock, 150mm dia	00:02:06	3	
33.20	WL	Water level, 15% of the vertical dimension	00:02:25		
34.49	DES	Settled deposits, fine, 30% cross-sectional area loss	00:02:36	4	4
34.49	SA	Survey abandoned: UNABLE TO SURVEY. ECXTENSIVE JETTING REQUIRED.	00:02:38	5	
60.00		End of pipe			
S14 Depth: m					

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	1	5.0	0.0	5.0	4.0

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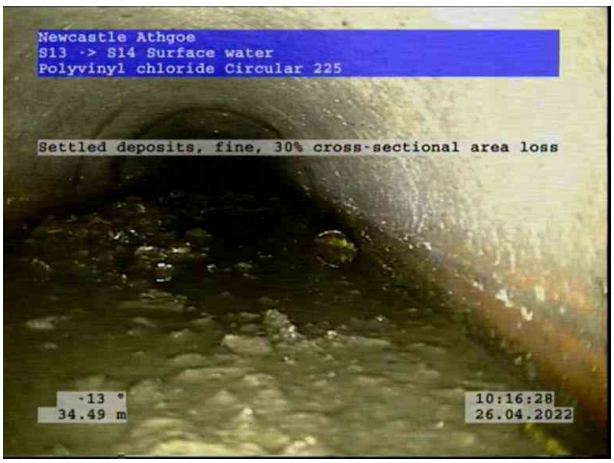
Section Pictures - 26/04/2022 - S13X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
11	Downstream	S13X	Athgoe Newcastl	DBFL

1, 00:00:00, 0.00 m
Start node, manhole, reference: S13

2, 00:01:55, 28.47 m
Connection other than junction at 10 o'clock, 150mm dia

3, 00:02:06, 29.08 m
Connection other than junction at 3 o'clock, 150mm dia



4, 00:02:36, 34.49 m
Settled deposits, fine, 30% cross-sectional area loss

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Section Pictures - 26/04/2022 - S13X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
11	Downstream	S13X	Athgoe Newcastl	DBFL

5, 00:02:38, 34.49 m
Survey abandoned, UNABLE TO SURVEY. ECXTENSIVE JETTING REQUIRED.

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Section Inspection - 26/04/2022 - S12X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
12	2	26/04/22	10:36	Athgoe Newcastl	No Rain Or Snow	No	S12X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	Not Specified	Public Sewer	Not Specified

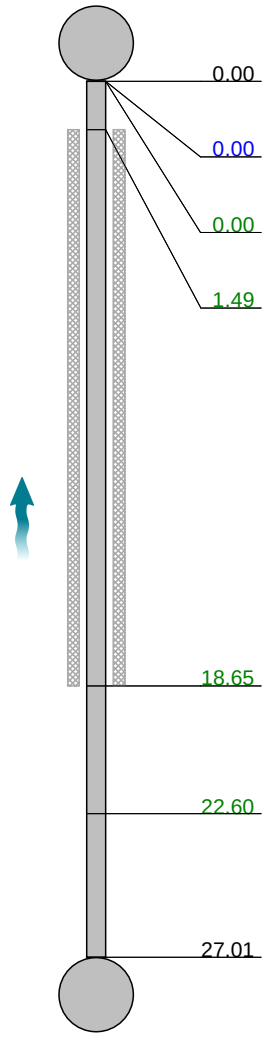
Town or Village:	Newcastle	**Inspection Direction:**	Upstream	**Upstream Node:**	S12
Road:	Athgoe	**Inspected Length:**	27.01 m	**Upstream Pipe Depth:**	
Location:	Road	**Total Length:**	27.01 m	**Downstream Node:**	S13
Surface Type:	Asphalt Highway	**Joint Length:**	6.00 m	**Downstream Pipe Depth:**	

Use:	Surface water	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	225 mm
Flow Control:	No flow control	**Material:**	Polyvinyl chloride
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:233

Depth: m
S13



Position [m]		Code	Observation	MPEG	Photo	Grade
0.00		MH	Start node, manhole, reference: S13	00:00:00	1	
0.00		WL	Water level, 0% of the vertical dimension	00:00:05		
0.00		DES	Settled deposits, fine, 5% cross-sectional area loss	00:00:08	2	3
1.49	S01	DES	Settled deposits, fine, 15% cross-sectional area loss, start	00:00:19	3	
18.65	F01	DES	Settled deposits, fine, 15% cross-sectional area loss, finish	00:01:58	4	3
22.60		DES	Settled deposits, fine, 5% cross-sectional area loss	00:02:17	5	3
27.01		MHF	Finish node, manhole, reference: S12	00:03:01	6	

S12
Depth: m

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	**STR Peak**	**STR Mean**	**STR Total**	**STR Grade**	**SER No. Def**	**SER Peak**	**SER Mean**	**SER Total**	**SER Grade**
0	0.0	0.0	0.0	1.0	3	2.0	0.0	40.0	3.0

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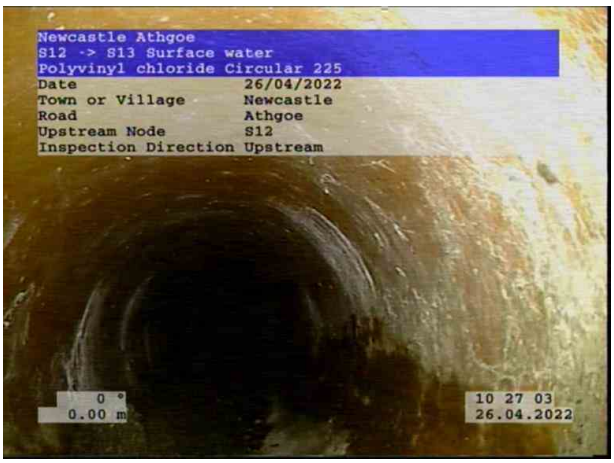
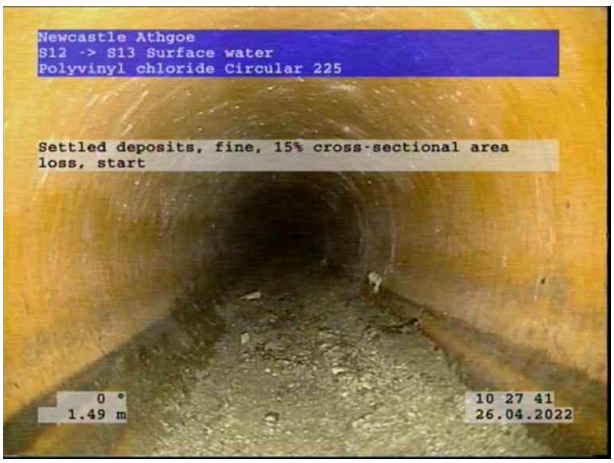
Section Pictures - 26/04/2022 - S12X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
12	Upstream	S12X	Athgoe Newcastl	DBFL



1, 00:00:00, 0.00 m
Start node, manhole, reference: S13

2, 00:00:08, 0.00 m
Settled deposits, fine, 5% cross-sectional area loss



3, 00:00:19, 1.49 m
Settled deposits, fine, 15% cross-sectional area loss, start

4, 00:01:58, 18.65 m
Settled deposits, fine, 15% cross-sectional area loss, finish

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Section Pictures - 26/04/2022 - S12X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
12	Upstream	S12X	Athgoe Newcastl	DBFL

5, 00:02:17, 22.60 m
Settled deposits, fine, 5% cross-sectional area loss

6, 00:03:01, 27.01 m
Finish node, manhole, reference: S12

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Section Inspection - 26/04/2022 - S12X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
12	1	26/04/22	10:29	Athgoe Newcastl	No Rain Or Snow	No	S12X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	0.70 m	Public Sewer	Not Specified

Town or Village:	Newcastle	**Inspection Direction:**	Upstream	**Upstream Node:**	S12
Road:	Athgoe	**Inspected Length:**	16.50 m	**Upstream Pipe Depth:**	
Location:	Road	**Total Length:**	27.01 m	**Downstream Node:**	S13
Surface Type:	Asphalt Highway	**Joint Length:**	6.00 m	**Downstream Pipe Depth:**	

Use:	Surface water	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	225 mm
Flow Control:	No flow control	**Material:**	Polyvinyl chloride
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:233 Position [m]		Code	Observation	MPEG	Photo	Grade
0.00		MH	Start node, manhole, reference: S13	00:00:00	1	
0.00		WL	Water level, 0% of the vertical dimension	00:00:06		
0.00		DER	Settled deposits, coarse, 5% cross-sectional area loss	00:00:09	2	3
1.29	S01	DES	Settled deposits, fine, 10% cross-sectional area loss, start	00:00:27	3	
16.50	F01	DES	Settled deposits, fine, 10% cross-sectional area loss, finish	00:02:09		3
16.50		SA	Survey abandoned: UNABLE TO SURVEY. JETTING REQUIRED.	00:02:10	4	
27.01			End of pipe			

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	2	2.0	0.0	34.0	3.0

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Section Pictures - 26/04/2022 - S12X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
12	Upstream	S12X	Athgoe Newcastl	DBFL

1, 00:00:00, 0.00 m
Start node, manhole, reference: S13

2, 00:00:09, 0.00 m
Settled deposits, coarse, 5% cross-sectional area loss

3, 00:00:27, 1.29 m
Settled deposits, fine, 10% cross-sectional area loss, start

4, 00:02:10, 16.50 m
Survey abandoned, UNABLE TO SURVEY. JETTING REQUIRED.

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Section Inspection - 26/04/2022 - S13.1X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
13	1	26/04/22	11:13	Athgoe Newcastl	No Rain Or Snow	No	S13.1X

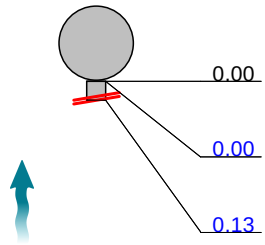
Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	0.70 m	Public Sewer	Not Specified

Town or Village:	Newcastle	**Inspection Direction:**	Upstream	**Upstream Node:**	S13.1
Road:	Athgoe	**Inspected Length:**	0.13 m	**Upstream Pipe Depth:**	
Location:	Road	**Total Length:**	0.13 m	**Downstream Node:**	S13
Surface Type:	Asphalt Highway	**Joint Length:**	6.00 m	**Downstream Pipe Depth:**	

Use:	Culverted watercourse	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	300 mm
Flow Control:	No flow control	**Material:**	Polyvinyl chloride
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:50



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node, manhole, reference: S13	00:00:00	1	
0.00	WL	Water level, 0% of the vertical dimension	00:00:15		
0.13	SA	Survey abandoned: UNABLE TO SURVEY. CULVERT	00:00:31	2	

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	**STR Peak**	**STR Mean**	**STR Total**	**STR Grade**	**SER No. Def**	**SER Peak**	**SER Mean**	**SER Total**	**SER Grade**
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

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Section Pictures - 26/04/2022 - S13.1X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
13	Upstream	S13.1X	Athgoe Newcastl	DBFL

1, 00:00:00, 0.00 m
Start node, manhole, reference: S13

2, 00:00:31, 0.13 m
Survey abandoned, UNABLE TO SURVEY. CULVERT

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Section Inspection - 26/04/2022 - S14X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
14	2	26/04/22	12:59	Athgoe Newcastl	No Rain Or Snow	Yes	S14X

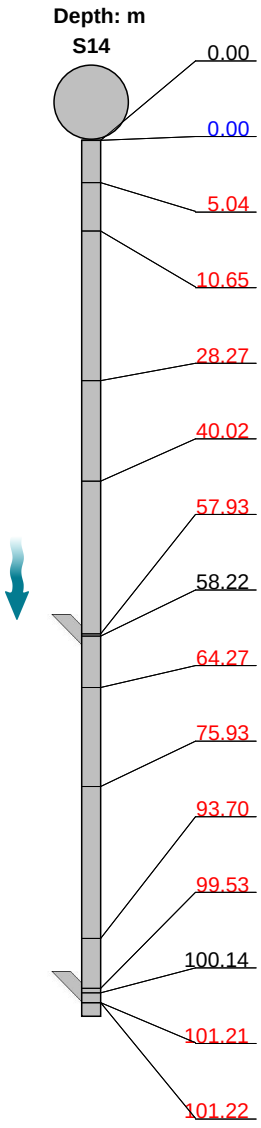
Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	0.70 m	Public Sewer	Not Specified

Town or Village:	Newcastle	**Inspection Direction:**	Downstream	**Upstream Node:**	S14
Road:	Athgoe	**Inspected Length:**	118.39 m	**Upstream Pipe Depth:**	
Location:	Road	**Total Length:**	118.39 m	**Downstream Node:**	S15
Surface Type:	Asphalt Highway	**Joint Length:**	6.00 m	**Downstream Pipe Depth:**	

Use:	Surface water	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	225 mm
Flow Control:	No flow control	**Material:**	Polyvinyl chloride
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:887



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node, manhole, reference: S14	00:00:00	1	
0.00	WL	Water level, 5% of the vertical dimension	00:00:05		
5.04	JDM	Joint displaced, medium	00:00:33	2	1 / 3
10.65	JDM	Joint displaced, medium	00:00:58	3	1 / 3
28.27	JDM	Joint displaced, medium	00:01:59	4	1 / 3
40.02	JDM	Joint displaced, medium	00:03:02	5	1 / 3
57.93	OJL	Open joint, large	00:04:31	6	1
58.22	CN	Connection other than junction at 2 o'clock, 225mm dia	00:05:22	7	
64.27	JDM	Joint displaced, medium	00:05:55	8, 9	1 / 3
75.93	JDM	Joint displaced, medium	00:08:17	10	1 / 3
93.70	JDM	Joint displaced, medium	00:09:27	11	1 / 3
99.53	JDL	Joint displaced, large	00:10:22	12	1 / 4
100.14	JNC	Junction, closed at 2 o'clock, 150mm dia	00:10:48	13	
101.21	FM	Fractures, multiple from 9 o'clock to 3 o'clock	00:12:40	14	4 / 2
101.22	H	Hole in drain or sewer from 11 o'clock to 1 o'clock	00:12:42	15	4

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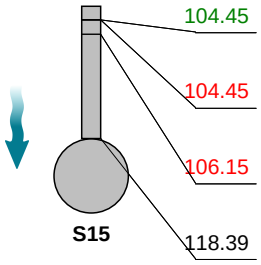
Section Inspection - 26/04/2022 - S14X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
14	2	26/04/22	12:59	Athgoe Newcastl	No Rain Or Snow	Yes	S14X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	0.70 m	Public Sewer	Not Specified

Scale: 1:887



Depth: m

Position [m]	Code	Observation	MPEG	Photo	Grade
104.45	DES	Settled deposits, fine, 5% cross-sectional area loss	00:13:46	16	3
104.45	D	Deformed sewer or drain, 5%	00:13:55	17	1 / 2
106.15	JDM	Joint displaced, medium	00:15:58	18	1 / 3
118.39	GYF	Finish node, gully, reference: S15	00:23:51	19	

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
13	160.0	0.0	172.0	4.0	12	5.0	0.0	25.0	4.0

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Section Pictures - 26/04/2022 - S14X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
14	Downstream	S14X	Athgoe Newcastl	DBFL

1, 00:00:00, 0.00 m
Start node, manhole, reference: S14

2, 00:00:33, 5.04 m
Joint displaced, medium

3, 00:00:58, 10.65 m
Joint displaced, medium

4, 00:01:59, 28.27 m
Joint displaced, medium

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Section Pictures - 26/04/2022 - S14X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
14	Downstream	S14X	Athgoe Newcastl	DBFL

5, 00:03:02, 40.02 m
Joint displaced, medium

6, 00:04:31, 57.93 m
Open joint, large

7, 00:05:22, 58.22 m
Connection other than junction at 2 o'clock, 225mm dia

8, 00:05:55, 64.27 m
Joint displaced, medium

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Section Pictures - 26/04/2022 - S14X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
14	Downstream	S14X	Athgoe Newcastl	DBFL

9, 00:05:55, 64.27 m
Joint displaced, medium

10, 00:08:17, 75.93 m
Joint displaced, medium

11, 00:09:27, 93.70 m
Joint displaced, medium

12, 00:10:22, 99.53 m
Joint displaced, large

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Section Pictures - 26/04/2022 - S14X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
14	Downstream	S14X	Athgoe Newcastl	DBFL

13, 00:10:48, 100.14 m
Junction, closed at 2 o'clock, 150mm dia

14, 00:12:40, 101.21 m
Fractures, multiple from 9 o'clock to 3 o'clock

15, 00:12:42, 101.22 m
Hole in drain or sewer from 11 o'clock to 1 o'clock

16, 00:13:46, 104.45 m
Settled deposits, fine, 5% cross-sectional area loss

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Section Pictures - 26/04/2022 - S14X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
14	Downstream	S14X	Athgoe Newcastl	DBFL

17, 00:13:55, 104.45 m
Deformed sewer or drain, 5%

18, 00:15:58, 106.15 m
Joint displaced, medium

19, 00:23:51, 118.39 m
Finish node, gully, reference: S15

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Section Inspection - 26/04/2022 - S14X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
14	1	26/04/22	11:50	Athgoe Newcastl	No Rain Or Snow	No	S14X

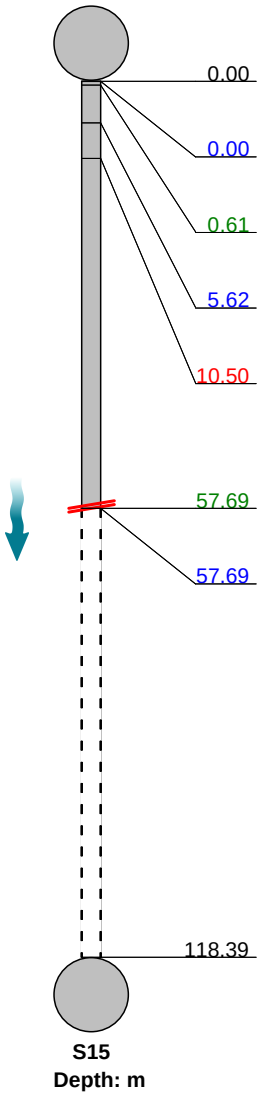
Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	0.70 m	Public Sewer	Not Specified

Town or Village:	Newcastle	**Inspection Direction:**	Downstream	**Upstream Node:**	S14
Road:	Athgoe	**Inspected Length:**	57.69 m	**Upstream Pipe Depth:**	
Location:	Road	**Total Length:**	118.39 m	**Downstream Node:**	S15
Surface Type:	Asphalt Highway	**Joint Length:**	6.00 m	**Downstream Pipe Depth:**	

Use:	Surface water	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	225 mm
Flow Control:	No flow control	**Material:**	Polyvinyl chloride
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:1021



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node, manhole, reference: S14	00:00:00	1	
0.00	WL	Water level, 10% of the vertical dimension	00:00:05		
0.61	DES	Settled deposits, fine, 10% cross-sectional area loss	00:00:14		3
5.62	WL	Water level, 5% of the vertical dimension	00:01:01		
10.50	JDM	Joint displaced, medium	00:01:26	2	1 / 3
57.69	DES	Settled deposits, fine, 20% cross-sectional area loss	00:05:55	3	4
57.69	SA	Survey abandoned: NEEDS JETTING	00:05:58	4	
118.39		End of pipe			

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	**STR Peak**	**STR Mean**	**STR Total**	**STR Grade**	**SER No. Def**	**SER Peak**	**SER Mean**	**SER Total**	**SER Grade**
1	1.0	0.0	1.0	1.0	3	5.0	0.0	9.0	4.0

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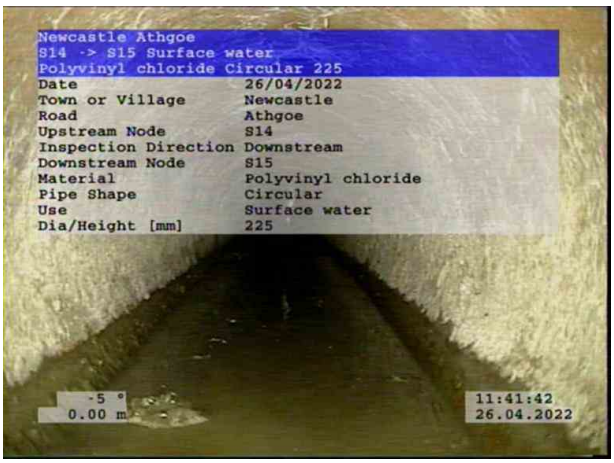
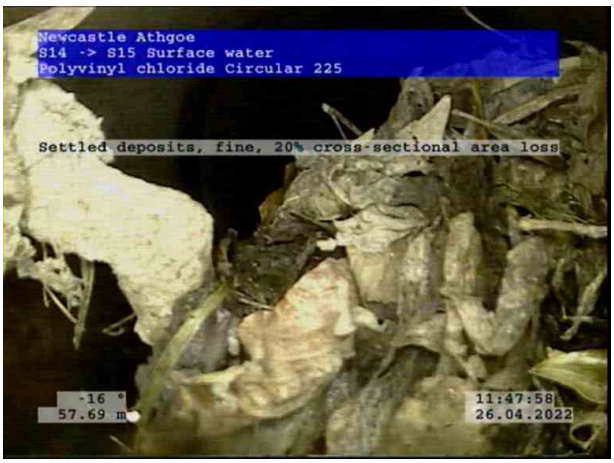
Section Pictures - 26/04/2022 - S14X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
14	Downstream	S14X	Athgoe Newcastl	DBFL



1, 00:00:00, 0.00 m
Start node, manhole, reference: S14

2, 00:01:26, 10.50 m
Joint displaced, medium



3, 00:05:55, 57.69 m
Settled deposits, fine, 20% cross-sectional area loss

4, 00:05:58, 57.69 m
Survey abandoned, NEEDS JETTING

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Section Inspection - 27/04/2022 - S15X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
15	1	27/04/22	9:40	Athgoe Newcastl	No Rain Or Snow	No	S15X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	0.70 m	Public Sewer	Not Specified

Town or Village:	Newcastle	**Inspection Direction:**	Downstream	**Upstream Node:**	S15
Road:	Athgoe	**Inspected Length:**	13.45 m	**Upstream Pipe Depth:**	
Location:	Road	**Total Length:**	13.45 m	**Downstream Node:**	S16
Surface Type:	Asphalt Highway	**Joint Length:**	0.90 m	**Downstream Pipe Depth:**	

Use:	Surface water	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	225 mm
Flow Control:	No flow control	**Material:**	Concrete
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:116 Position [m]		Code	Observation	MPEG	Photo	Grade
0.00		MH	Start node, manhole, reference: S15	00:00:00	1	
0.00		WL	Water level, 5% of the vertical dimension	00:00:06		
1.94		JDM	Joint displaced, medium	00:00:36	2	1 / 3
2.97		JDM	Joint displaced, medium	00:00:44	3	1 / 3
3.95	S01	JDM	Joint displaced, medium, start	00:00:53	4	
13.45	F01	JDM	Joint displaced, medium, finish	00:02:05		1 / 3
13.45		MHF	Finish node, manhole, reference: S16: BURIED	00:02:06	5	

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	**STR Peak**	**STR Mean**	**STR Total**	**STR Grade**	**SER No. Def**	**SER Peak**	**SER Mean**	**SER Total**	**SER Grade**
3	2.0	0.0	12.0	1.0	3	4.0	0.0	24.0	3.0

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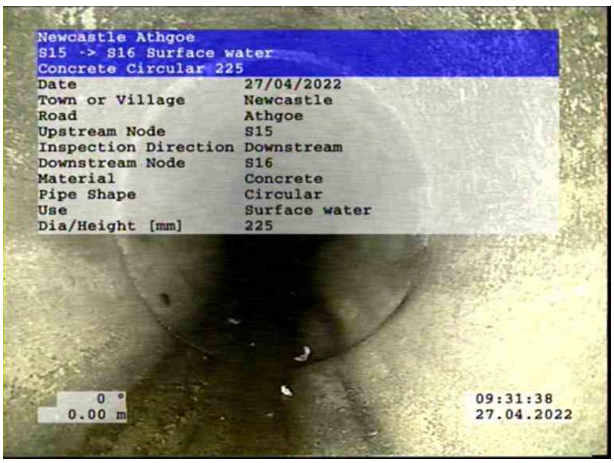
Section Pictures - 27/04/2022 - S15X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
15	Downstream	S15X	Athgoe Newcastl	DBFL



1, 00:00:00, 0.00 m
Start node, manhole, reference: S15

2, 00:00:36, 1.94 m
Joint displaced, medium

3, 00:00:44, 2.97 m
Joint displaced, medium

4, 00:00:53, 3.95 m
Joint displaced, medium, start

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Section Pictures - 27/04/2022 - S15X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
15	Downstream	S15X	Athgoe Newcastl	DBFL

5, 00:02:06, 13.45 m
Finish node, manhole, reference: S16, BURIED

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Section Inspection - 27/04/2022 - S17X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
16	2	27/04/22	14:59	Athgoe Newcastl	No Rain Or Snow	Yes	S17X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	Not Specified	Public Sewer	Not Specified

Town or Village:	Newcastle	**Inspection Direction:**	Upstream	**Upstream Node:**	S17
Road:	Athgoe	**Inspected Length:**	7.56 m	**Upstream Pipe Depth:**	
Location:	Footway	**Total Length:**	7.62 m	**Downstream Node:**	S18
Surface Type:	Concrete Footway	**Joint Length:**	0.90 m	**Downstream Pipe Depth:**	

Use:	Surface water	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	225 mm
Flow Control:	No flow control	**Material:**	Concrete
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:66

Position [m]		Code	Observation	MPEG	Photo	Grade
0.00		MH	Start node, manhole, reference: S18	00:00:00	1	
0.00		WL	Water level, 5% of the vertical dimension	00:00:05		
0.00		REM	General remark: SIGNS OF A DYE	00:00:06	2	
0.11	S02	JDM	Joint displaced, medium, start	00:00:09	3	
4.36		CL	Crack, longitudinal at 1 o'clock	00:00:31	4	2 / 2
5.18		CL	Crack, longitudinal at 1 o'clock	00:00:40	5	2 / 2
7.55	F02	JDM	Joint displaced, medium, finish	00:01:12	6	1 / 3
7.56		MHF	Finish node, manhole, reference: S17: BURIED	00:01:18	7, 8	

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
3	20.0	0.0	28.0	2.0	3	3.0	0.0	18.0	3.0

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Section Pictures - 27/04/2022 - S17X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
16	Upstream	S17X	Athgoe Newcastl	DBFL

1, 00:00:00, 0.00 m
Start node, manhole, reference: S18

2, 00:00:06, 0.00 m
General remark, SIGNS OF A DYE

3, 00:00:09, 0.11 m
Joint displaced, medium, start

4, 00:00:31, 4.36 m
Crack, longitudinal at 1 o'clock

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Section Pictures - 27/04/2022 - S17X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
16	Upstream	S17X	Athgoe Newcastl	DBFL

5, 00:00:40, 5.18 m
Crack, longitudinal at 1 o'clock

6, 00:01:12, 7.55 m
Joint displaced, medium, finish

7, 00:01:18, 7.56 m
Finish node, manhole, reference: S17, BURIED

8, 00:01:18, 7.56 m
Finish node, manhole, reference: S17, BURIED

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Section Inspection - 27/04/2022 - S18X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
17	1	27/04/22	15:04	Athgoe Newcastl	No Rain Or Snow	No	S18X

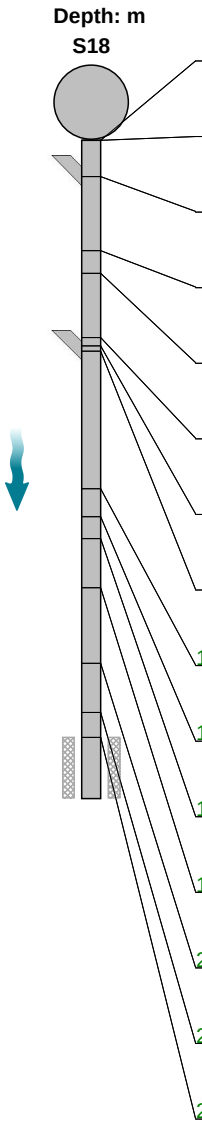
Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	Not Specified	Public Sewer	Not Specified

Town or Village:	Newcastle	**Inspection Direction:**	Downstream	**Upstream Node:**	S18
Road:	Hazelhatch Road	**Inspected Length:**	81.93 m	**Upstream Pipe Depth:**	
Location:	Footway	**Total Length:**	81.93 m	**Downstream Node:**	S19
Surface Type:	Concrete Footway	**Joint Length:**	0.90 m	**Downstream Pipe Depth:**	

Use:	Surface water	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	300 mm
Flow Control:	No flow control	**Material:**	Concrete
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:305



Position [m]		Code	Observation	MPEG	Photo	Grade
0.00		MH	Start node, manhole, reference: S18	00:00:00	1	
0.00		WL	Water level, 5% of the vertical dimension	00:00:05		
1.48		CXI	Connection defective, connecting pipe is intruding at 3 o'clock, 150mm dia, intrusion: 5%	00:00:11	2	3
4.46		FL	Fracture, longitudinal at 1 o'clock	00:00:25	3	3 / 2
5.37		FL	Fracture, longitudinal at 12 o'clock	00:00:34	4	3 / 2
7.99		CL	Crack, longitudinal at 12 o'clock	00:00:50	5	2 / 2
8.30		H	Hole in drain or sewer from 11 o'clock to 1 o'clock	00:00:59	6	4
8.53		CN	Connection other than junction at 2 o'clock, 150mm dia	00:01:02	7	
14.06		RF	Roots, fine	00:01:35	8	2
15.19		RF	Roots, fine	00:01:44	9	2
16.08		RFJ	Roots, fine at joint	00:01:52	10	2
18.07		RMJ	Roots, mass at joint, 10% cross-sectional area loss	00:02:03	11	3
21.12		RFJ	Roots, fine at joint	00:02:29	12	2
23.12		RFJ	Roots, fine at joint	00:02:42	13	2
24.11	S01	RFJ	Roots, fine at joint, start	00:02:49	14	

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Section Inspection - 27/04/2022 - S18X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
17	1	27/04/22	15:04	Athgoe Newcastl	No Rain Or Snow	No	S18X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	Not Specified	Public Sewer	Not Specified

Scale: 1:305	Position [m]		Code	Observation	MPEG	Photo	Grade
	29.05		JDM	Joint displaced, medium	00:03:16	15	1 / 3
	48.37		JDM	Joint displaced, medium	00:05:01	16	1 / 3
	50.93		RMJ	Roots, mass at joint, 10% cross-sectional area loss	00:05:19	17	3
	57.22		RMJ	Roots, mass at joint, 15% cross-sectional area loss	00:05:53	18	3
	62.74		CXI	Connection defective, connecting pipe is intruding at 2 o'clock, 150mm dia, intrusion: 20%	00:06:20	19	4
	62.94		FC	Fracture, circumferential from 12 o'clock to 12 o'clock	00:06:28	20	3 / 2
	81.93	F01	RFJ	Roots, fine at joint, finish	00:08:15	21	2
	81.93		MHF	Finish node, manhole, reference: S19: SILT TRAP MANHOLE	00:08:17	22	

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
7	90.0	0.0	212.0	4.0	17	6.0	0.0	90.0	4.0

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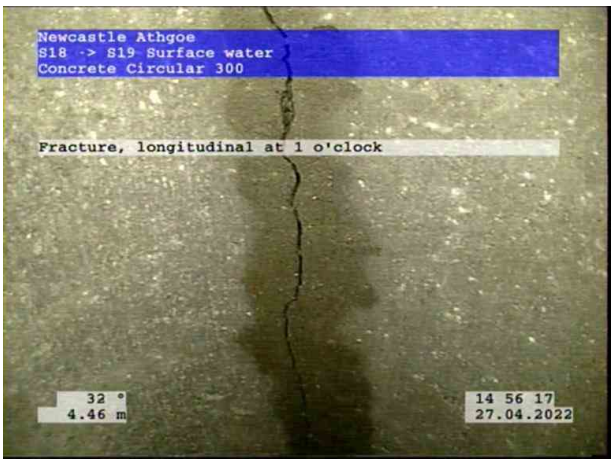
Section Pictures - 27/04/2022 - S18X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
17	Downstream	S18X	Athgoe Newcastl	DBFL

1, 00:00:00, 0.00 m
Start node, manhole, reference: S18

2, 00:00:11, 1.48 m
Connection defective, connecting pipe is intruding at 3 o'clock, 150mm dia, intrusion: 5%



3, 00:00:25, 4.46 m
Fracture, longitudinal at 1 o'clock

4, 00:00:34, 5.37 m
Fracture, longitudinal at 12 o'clock

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Section Pictures - 27/04/2022 - S18X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
17	Downstream	S18X	Athgoe Newcastl	DBFL

5, 00:00:50, 7.99 m
Crack, longitudinal at 12 o'clock

6, 00:00:59, 8.30 m
Hole in drain or sewer from 11 o'clock to 1 o'clock

7, 00:01:02, 8.53 m
Connection other than junction at 2 o'clock, 150mm dia

8, 00:01:35, 14.06 m
Roots, fine

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Section Pictures - 27/04/2022 - S18X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
17	Downstream	S18X	Athgoe Newcastl	DBFL

9, 00:01:44, 15.19 m
Roots, fine

10, 00:01:52, 16.08 m
Roots, fine at joint

11, 00:02:03, 18.07 m
Roots, mass at joint, 10% cross-sectional area loss

12, 00:02:29, 21.12 m
Roots, fine at joint

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Section Pictures - 27/04/2022 - S18X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
17	Downstream	S18X	Athgoe Newcastl	DBFL

13, 00:02:42, 23.12 m
Roots, fine at joint

14, 00:02:49, 24.11 m
Roots, fine at joint, start

15, 00:03:16, 29.05 m
Joint displaced, medium

16, 00:05:01, 48.37 m
Joint displaced, medium

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Section Pictures - 27/04/2022 - S18X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
17	Downstream	S18X	Athgoe Newcastl	DBFL

17, 00:05:19, 50.93 m
Roots, mass at joint, 10% cross-sectional area loss

18, 00:05:53, 57.22 m
Roots, mass at joint, 15% cross-sectional area loss

19, 00:06:20, 62.74 m
Connection defective, connecting pipe is intruding at 2 o'clock, 150mm dia, intrusion: 20%

20, 00:06:28, 62.94 m
Fracture, circumferential from 12 o'clock to 12 o'clock

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Section Pictures - 27/04/2022 - S18X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
17	Downstream	S18X	Athgoe Newcastl	DBFL

21, 00:08:15, 81.93 m
Roots, fine at joint, finish

22, 00:08:17, 81.93 m
Finish node, manhole, reference: S19, SILT TRAP MANHOLE

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Section Inspection - 28/04/2022 - S20X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
18	1	28/04/22	11:22	Athgoe Newcastl	No Rain Or Snow	Yes	S20X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	Not Specified	Public Sewer	Not Specified

Town or Village:	Newcastle	**Inspection Direction:**	Downstream	**Upstream Node:**	S20
Road:	Hazelhatch Road	**Inspected Length:**	71.19 m	**Upstream Pipe Depth:**	
Location:	Fields, farmland etc	**Total Length:**	71.19 m	**Downstream Node:**	S21
Surface Type:	Grass	**Joint Length:**		**Downstream Pipe Depth:**	

Use:	Surface water	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	300 mm
Flow Control:	No flow control	**Material:**	Concrete
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:614

Position [m]		Code	Observation	MPEG	Photo	Grade
0.00		MH	Start node, manhole, reference: S20	00:00:00	1	
0.00		WL	Water level, 5% of the vertical dimension	00:00:05		
26.13		RFJ	Roots, fine at joint	00:01:35	2	2
28.11	S01	RFJ	Roots, fine at joint, start	00:01:48	3	
32.68		RMJ	Roots, mass at joint, 15% cross-sectional area loss	00:02:13	4	3
38.28	F01	RFJ	Roots, fine at joint, finish	00:02:44		2
47.78		H	Hole in drain or sewer from 11 o'clock to 1 o'clock	00:03:57	5	4
59.19		WL	Water level, 10% of the vertical dimension	00:04:48		
71.19		MHF	Finish node, manhole, reference: S21: BURIED. NO COVER. GULLY CONNECTED	00:06:21	6, 7	

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	**STR Peak**	**STR Mean**	**STR Total**	**STR Grade**	**SER No. Def**	**SER Peak**	**SER Mean**	**SER Total**	**SER Grade**
1	80.0	0.0	80.0	4.0	3	5.0	0.0	16.0	4.0

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Section Pictures - 28/04/2022 - S20X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
18	Downstream	S20X	Athgoe Newcastl	DBFL

1, 00:00:00, 0.00 m
Start node, manhole, reference: S20

2, 00:01:35, 26.13 m
Roots, fine at joint

3, 00:01:48, 28.11 m
Roots, fine at joint, start

4, 00:02:13, 32.68 m
Roots, mass at joint, 15% cross-sectional area loss

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Section Pictures - 28/04/2022 - S20X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
18	Downstream	S20X	Athgoe Newcastl	DBFL

5, 00:03:57, 47.78 m
Hole in drain or sewer from 11 o'clock to 1 o'clock

6, 00:06:21, 71.19 m
Finish node, manhole, reference: S21, BURIED. NO COVER. GULLY CONNECTED

7, 00:06:21, 71.19 m
Finish node, manhole, reference: S21, BURIED. NO COVER. GULLY CONNECTED

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Project

Project Name:	Athgoe Newcastle Foul Water 26-04-22
Project Description:	CCTV Survey
Project Number:	CES 9404
Project Status:	Complete
Project Date:	26/04/2022
Inspection Standard:	MSCC5 Sewers & Drainage GB (SRM5 Scoring)

ENVIRONMENTAL SERVICES

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Table of Contents

Project Name	Project Number	Project Date
Athgoe Newcastle Foul Water 26-04-22	CES 9404	26/04/2022

CES Environmental Services Ltd.
Tracklands Business Park, Clonroad More, Ennis
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Project Information

Project Name	Project Number	Project Date
Athgoe Newcastle Foul Water 26-04-22	CES 9404	26/04/2022

Client

Company: DBFL
Description: Consulting Engineers
Contact: Conor O Loughlin
Department: Civil Engineer
Street: Ormond House
Town or City: Upper Ormond Quay
County: Dublin 7
Post Code: D07W704
Phone: 01 - 400 4000
Mobile: 085 - 169 8141
Email: conor.oloughlin@dbfl.ie

Manager

Company: Cairn Homes
Description: Planning Investigation Works
Contact: Conor O'Loughlin
Department: Civil Engineer
Street: Athgoe Road
Town or City: Newcastle
County: Dublin
Post Code: D22XV29
Phone: 01 - 400 4000
Email: conor.oloughlin@dbfl.ie

Contractor

Company: CES Environmental Services Ltd.
Description: CCTV Survey
Contact: Kieran Murphy
Department: CCTV & Rehabilitation
Street: Tracklands Business Park
Town or City: Clonroad More, Ennis
County: Clare
Post Code: V95A598
Phone: 065 - 6866850
Mobile: 085 - 2521556
Email: kmurphy@cesenvironmental.ie

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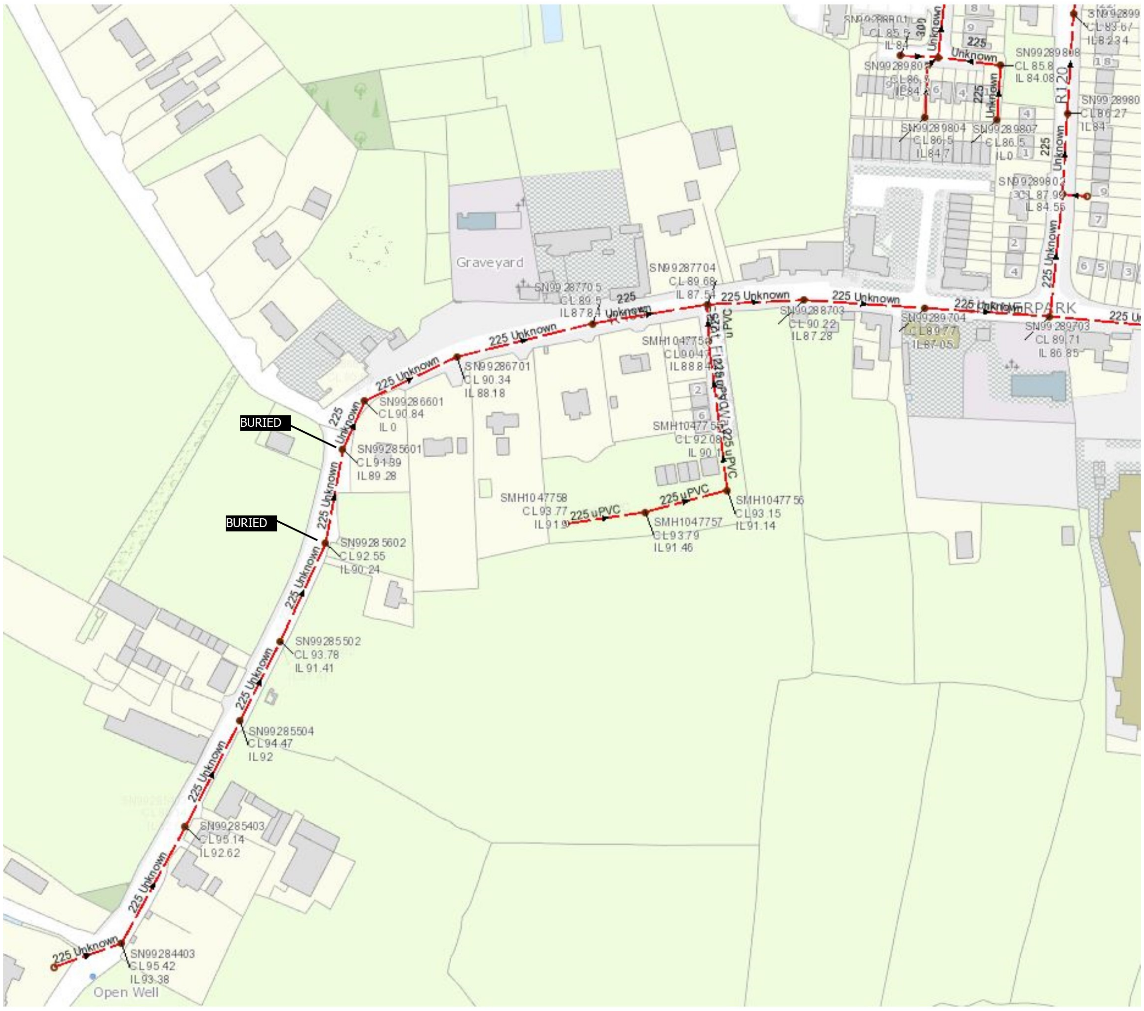
Project Information

Project Name	Project Number	Project Date
Athgoe Newcastle Foul Water 26-04-22	CES 9404	26/04/2022

Project Drawing, Page 'Athgoe Newcastle Foul Water DBFL 260422'



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Scoring Summary

Project Name	Project Number	Project Date
Athgoe Newcastle Foul Water 26-04-22	CES 9404	26/04/2022

Structural Defects

Section	PLR	Grade	Description
All inspected pipes are in an acceptable structural condition (< grade 3).			

Service / Operational Condition

Grade 3: Best practice suggests consideration should be given to maintenance activities in the medium term.

Grade 4: Best practice suggests consideration should be given to maintenance activity to avoid potential blockages.

Grade 5: Best practice suggests that this pipe is at a high risk of backing up or causing flooding.

Section	PLR	Grade	Description
1	SN99285403X	4	Settled deposits, fine, 30% cross-sectional area loss
2	SN99285504X	5	Ingress of gravel from 4 o'clock to 8 o'clock, 30% cross-sectional area loss
3	SN99284403X	3	Multiple defects
4	SN99285502X	4	Settled deposits, hard or compacted, 20% cross-sectional area loss

Abandoned Surveys

Section	PLR	Description
1	SN99285403X	Survey abandoned
1	SN99285403X	Survey abandoned
1	SN99285403X	Survey abandoned
4	SN99285502X	Survey abandoned

Information

These scoring summaries are based on the SRM grading from the WRc.

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Section Profile

Project Name	Project Number	Project Date
Athgoe Newcastle Foul Water 26-04-22	CES 9404	26/04/2022

Circular, 225 mm

Item No.	Upstream Node	Downstream Node	Date	Road	Material	Total Length	Inspected Length
2	SN99285504	SN99285502	27/04/2022	Athgoe	Concrete	41.74 m	**41.74 m**
3	SN99284403	SN99285403	27/04/2022	Athgoe	Concrete	68.00 m	68.00 m

Total: 2 Inspections x Circular 225 mm = 109.74 m Total Length and 109.74 m Inspected Length

Total: 2 Inspections = 109.74 m Total Length and 109.74 m Inspected Length

ENVIRONMENTAL SERVICES

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Project Summary

Project Name	Project Number	Project Date
Athgoe Newcastle Foul Water 26-04-22	CES 9404	26/04/2022

Inspection Summary

Pipe No.	Insp. No.	Upstream Node	Downstream Node	Dir.	Operator	Insp. Date	Insp. Time	Str	Ser	Final Observation	Length
1	**1**	**SN99285403**	**SN99285504**	**DS**	**Aaa**	**27/04/2022**	**10:25**	**1**	**4**	**SA, GRAVEL IN LINE. ECXTENSIVE JETTING REC**	**19.19 m**
1	**2**	**SN99285403**	**SN99285504**	**US**	**Aaa**	**26/04/2022**	**16:37**	**1**	**4**	**INGG**	**12.66 m**
1	**3**	**SN99285403**	**SN99285504**	**US**	**Aaa**	**26/04/2022**	**15:21**	**1**	**3**	**SA, unable to survey. jetting required.**	**7.77 m**
2	1	SN99285504	SN99285502	US	Aaa	27/04/2022	12:29	1	5	MHF, MANHOLE FULL OF GRAVEL	41.74 m
3	1	SN99284403	SN99285403	US	Aaa	27/04/2022	10:32	2	3	MHF	68.00 m
4	**1**	**SN99285502**	**SN99285602**	**DS**	**Aaa**	**27/04/2022**	**13:04**	**2**	**4**	**SA, settled depositts. cutting required**	**47.96 m**
										Total:	**197.33 m**

Defect Summary

				CCTV Drainage Survey Observation Count																			
				General				Structural Condition									Service Condition						Misc	
Sect. No.	Insp. No.	Upstream Node	Downstream Node	Insp. Length (m)	No. Grade 4/5 Obs.	Survey Abandoned	Camera Under Water	Cracks	Fractures	Broken	Deformed	Collapsed	Holes	Surface Damage	Displaced Joints	Open Joints	Roots	Infiltration	Encrustation	Silt	Grease	Obstruction	Water Level	Line Deviates
1	**1**	**SN99285403**	**SN99285504**	**19.2**		**1**												**1**	**1**	**3**			**4**	
1	**2**	**SN99285403**	**SN99285504**	**12.7**		**1**												**2**		**1**			**1**	
1	**3**	**SN99285403**	**SN99285504**	**7.8**		**1**													**1**				**1**	
2	1	SN99285504	SN99285502	41.7														2	3				4	
3	1	SN99284403	SN99285403	68.0				1											9		1		3	
4	**1**	**SN99285502**	**SN99285602**	**48.0**		**1**		**1**										**3**	**4**				**1**	
			Total:	**197.3**		**4**		**2**										**8**	**18**	**4**	**1**		**14**	

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Section Inspection - 27/04/2022 - SN99285403X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
1	3	27/04/22	10:25	Athgoe Newcastl	No Rain Or Snow	Yes	SN99285403X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	Not Specified	Public Sewer	Not Specified

Town or Village:	Newcastle	**Inspection Direction:**	Downstream	**Upstream Node:**	SN99285403
Road:	Athgoe	**Inspected Length:**	19.19 m	**Upstream Pipe Depth:**	
Location:	Road	**Total Length:**	19.19 m	**Downstream Node:**	SN99285504
Surface Type:	Asphalt Highway	**Joint Length:**	6.00 m	**Downstream Pipe Depth:**	

Use:	Foul	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	225 mm
Flow Control:	No flow control	**Material:**	Concrete
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:166 **Depth: m**

Position [m]		Code	Observation	MPEG	Photo	Grade
0.00		MH	Start node, manhole, reference: SN99285403	00:00:00	1	
0.00		WL	Water level, 5% of the vertical dimension	00:00:07	2	
0.00	S01	DES	Settled deposits, fine, 5% cross-sectional area loss, start	00:00:09		
2.13		DEEJ	Attached deposits, encrustation at joint from 11 o'clock to 2 o'clock, 5% cross-sectional area loss	00:00:27	3	3
2.13		IS	Infiltration, seeping at 1 o'clock	00:00:29	4	
15.38		WL	Water level, 10% of the vertical dimension	00:01:55		
16.77		WL	Water level, 15% of the vertical dimension	00:02:07		
17.57		WL	Water level, 20% of the vertical dimension	00:02:16		
19.19		DES	Settled deposits, fine, 30% cross-sectional area loss	00:02:37	5	4
19.19	F01	DES	Settled deposits, fine, 5% cross-sectional area loss, finish	00:02:39		3
19.19		SA	Survey abandoned: GRAVEL IN LINE. ECXTENSIVE JETTING REQUIRED	00:02:42	6	

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	**STR Peak**	**STR Mean**	**STR Total**	**STR Grade**	**SER No. Def**	**SER Peak**	**SER Mean**	**SER Total**	**SER Grade**
0	0.0	0.0	0.0	1.0	3	5.0	0.0	47.0	4.0

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Section Pictures - 27/04/2022 - SN99285403X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
1	Downstream	SN99285403X	Athgoe Newcastl	DBFL

1, 00:00:00, 0.00 m
Start node, manhole, reference: SN99285403

2, 00:00:07, 0.00 m
Water level, 5% of the vertical dimension

3, 00:00:27, 2.13 m
Attached deposits, encrustation at joint from 11 o'clock to 2 o'clock, 5% cross-sectional area loss

4, 00:00:29, 2.13 m
Infiltration, seeping at 1 o'clock

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Section Pictures - 27/04/2022 - SN99285403X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
1	Downstream	SN99285403X	Athgoe Newcastl	DBFL

5, 00:02:37, 19.19 m
Settled deposits, fine, 30% cross-sectional area loss

6, 00:02:42, 19.19 m
Survey abandoned, GRAVEL IN LINE. ECXTENSIVE JETTING REQUIRED

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Section Inspection - 26/04/2022 - SN99285403X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
1	2	26/04/22	16:37	Athgoe Newcastl	No Rain Or Snow	Yes	SN99285403X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	0.70 m	Public Sewer	Not Specified

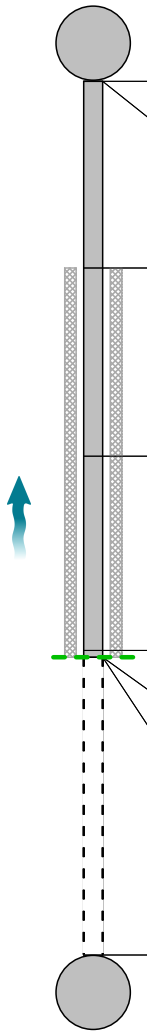
Town or Village:	Newcastle	**Inspection Direction:**	Upstream	**Upstream Node:**	SN99285403
Road:	Athgoe	**Inspected Length:**	12.66 m	**Upstream Pipe Depth:**	
Location:	Road	**Total Length:**	19.19 m	**Downstream Node:**	SN99285504
Surface Type:	Asphalt Highway	**Joint Length:**	6.00 m	**Downstream Pipe Depth:**	

Use:	Foul	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	225 mm
Flow Control:	No flow control	**Material:**	Concrete
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:166

Depth: m
SN99285504



SN99285403
Depth: m

Position [m]		Code	Observation	MPEG	Photo	Grade
0.00		MH	Start node, manhole, reference: SN99285504	00:00:00	1	
0.00		WL	Water level, 5% of the vertical dimension	00:00:05		
4.11	S01	INGG	Ingress of gravel from 5 o'clock to 7 o'clock, 5% cross-sectional area loss, start	00:00:32	2	
8.24		DES	Settled deposits, fine, 15% cross-sectional area loss	00:01:21	3	3
12.51		DEZ	Attached deposits, other from 5 o'clock to 7 o'clock, 15% cross-sectional area loss: stones.	00:03:04	4	3
12.66		SA	Survey abandoned: unable to survey. ecxtensive jetting required	00:03:09	5	
12.66	F01	INGG	Ingress of gravel from 5 o'clock to 7 o'clock, 5% cross-sectional area loss, finish	00:02:57	6	3
19.19			End of pipe			

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	3	6.0	0.0	40.0	4.0

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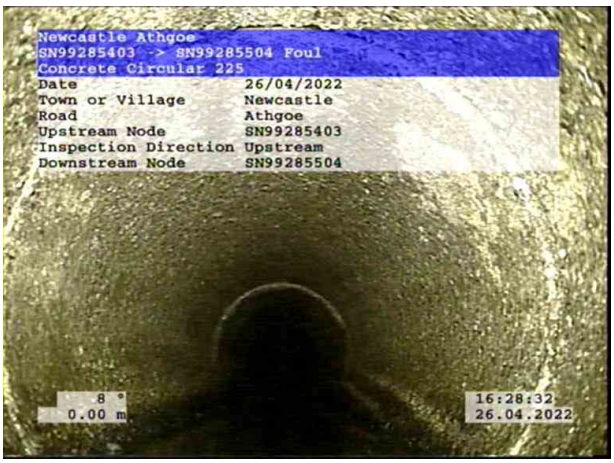
Section Pictures - 26/04/2022 - SN99285403X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
1	Upstream	SN99285403X	Athgoe Newcastl	DBFL



1, 00:00:00, 0.00 m
Start node, manhole, reference: SN99285504

2, 00:00:32, 4.11 m
Ingress of gravel from 5 o'clock to 7 o'clock, 5% cross-sectional area loss, start

3, 00:01:21, 8.24 m
Settled deposits, fine, 15% cross-sectional area loss

4, 00:03:04, 12.51 m
Attached deposits, other from 5 o'clock to 7 o'clock, 15% cross-sectional area loss, stones.

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Section Pictures - 26/04/2022 - SN99285403X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
1	Upstream	SN99285403X	Athgoe Newcastl	DBFL

5, 00:03:09, 12.66 m
Survey abandoned, unable to survey. ecxtensive jetting required

6, 00:02:57, 12.66 m
Ingress of gravel from 5 o'clock to 7 o'clock, 5% cross-sectional area loss, finish

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Section Inspection - 26/04/2022 - SN99285403X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
1	1	26/04/22	15:21	Athgoe Newcastl	No Rain Or Snow	No	SN99285403X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	0.70 m	Public Sewer	Not Specified

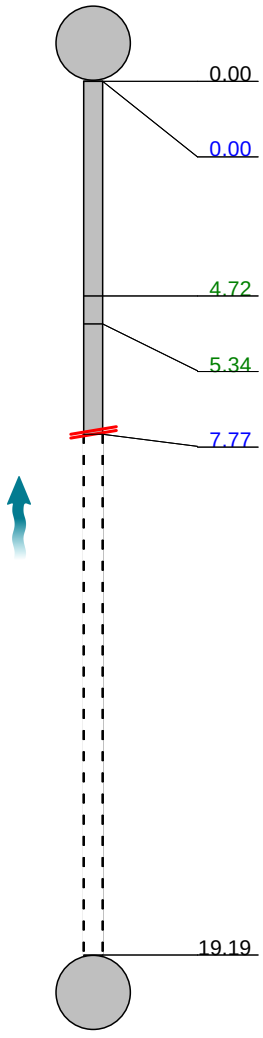
Town or Village:	Newcastle	**Inspection Direction:**	Upstream	**Upstream Node:**	SN99285403
Road:	Athgoe	**Inspected Length:**	7.77 m	**Upstream Pipe Depth:**	
Location:	Road	**Total Length:**	19.19 m	**Downstream Node:**	SN99285504
Surface Type:	Asphalt Highway	**Joint Length:**	6.00 m	**Downstream Pipe Depth:**	

Use:	Foul	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	225 mm
Flow Control:	No flow control	**Material:**	Concrete
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:166

Depth: m
SN99285504



SN99285403
Depth: m

Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node, manhole, reference: SN99285504	00:00:00	1	
0.00	WL	Water level, 5% of the vertical dimension	00:00:05		
4.72	DEEJ	Attached deposits, encrustation at joint from 12 o'clock to 12 o'clock, 5% cross-sectional area loss	00:00:57	2	3
5.34	DEF	Attached deposits, fouling from 5 o'clock to 7 o'clock, 10% cross-sectional area loss	00:01:10	3	3
7.77	SA	Survey abandoned: unable to survey. jetting required.	00:01:34	4	
19.19		End of pipe			

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	**STR Peak**	**STR Mean**	**STR Total**	**STR Grade**	**SER No. Def**	**SER Peak**	**SER Mean**	**SER Total**	**SER Grade**
0	0.0	0.0	0.0	1.0	2	2.0	0.0	4.0	3.0

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Section Pictures - 26/04/2022 - SN99285403X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
1	Upstream	SN99285403X	Athgoe Newcastl	DBFL

1, 00:00:00, 0.00 m
Start node, manhole, reference: SN99285504

2, 00:00:57, 4.72 m
Attached deposits, encrustation at joint from 12 o'clock to 12 o'clock, 5% cross-sectional area loss

3, 00:01:10, 5.34 m
Attached deposits, fouling from 5 o'clock to 7 o'clock, 10% cross-sectional area loss

4, 00:01:34, 7.77 m
Survey abandoned, unable to survey. jetting required.

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Section Inspection - 27/04/2022 - SN99285504X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
2	2	27/04/22	12:29	Athgoe Newcastl	No Rain Or Snow	Yes	SN99285504X

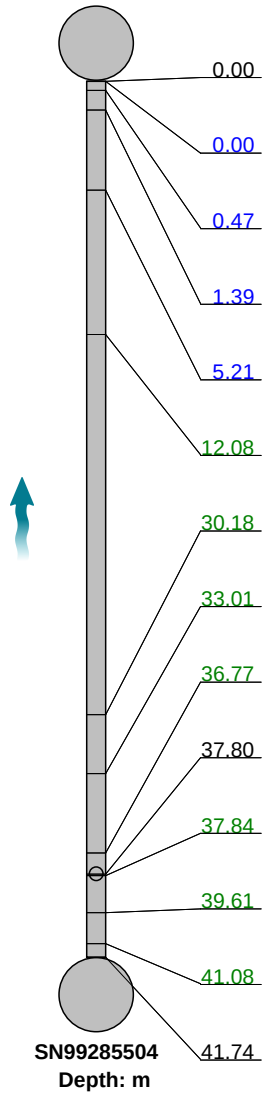
Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	Not Specified	Public Sewer	Not Specified

Town or Village:	Newcastle	**Inspection Direction:**	Upstream	**Upstream Node:**	SN99285504
Road:	Athgoe	**Inspected Length:**	41.74 m	**Upstream Pipe Depth:**	
Location:	Road	**Total Length:**	41.74 m	**Downstream Node:**	SN99285502
Surface Type:	Asphalt Highway	**Joint Length:**		**Downstream Pipe Depth:**	

Use:	Foul	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	225 mm
Flow Control:	No flow control	**Material:**	Concrete
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:360



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node, manhole, reference: SN99285502	00:00:00	1	
0.00	WL	Water level, 20% of the vertical dimension	00:00:07		
0.47	WL	Water level, 30% of the vertical dimension	00:00:14		
1.39	WL	Water level, 20% of the vertical dimension	00:00:23		
5.21	WL	Water level, 10% of the vertical dimension	00:00:52		
12.08	DEEJ	Attached deposits, encrustation at joint from 7 o'clock to 11 o'clock, 5% cross-sectional area loss	00:01:24	2	3
30.18	DEEJ	Attached deposits, encrustation at joint from 5 o'clock to 7 o'clock, 5% cross-sectional area loss	00:02:55	3	3
33.01	DEEJ	Attached deposits, encrustation at joint from 12 o'clock to 12 o'clock, 10% cross-sectional area loss	00:03:10	4	3
36.77	DEC	Settled deposits, hard or compacted, 5% cross-sectional area loss	00:03:43	5	3
37.80	JN	Junction at 12 o'clock, 100mm dia	00:03:54	6	
37.84	DEC	Settled deposits, hard or compacted, 15% cross-sectional area loss	00:04:06	7	3
39.61	INGG	Ingress of gravel from 5 o'clock to 7 o'clock, 10% cross-sectional area loss	00:04:19	8	3
41.08	INGG	Ingress of gravel from 4 o'clock to 8 o'clock, 30% cross-sectional area loss	00:04:30	9, 10	5
41.74	MHF	Finish node, manhole, reference: SN99285504: MANHOLE FULL OF GRAVEL	00:04:49	11	

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	**STR Peak**	**STR Mean**	**STR Total**	**STR Grade**	**SER No. Def**	**SER Peak**	**SER Mean**	**SER Total**	**SER Grade**
0	0.0	0.0	0.0	1.0	7	10.0	0.0	24.0	5.0

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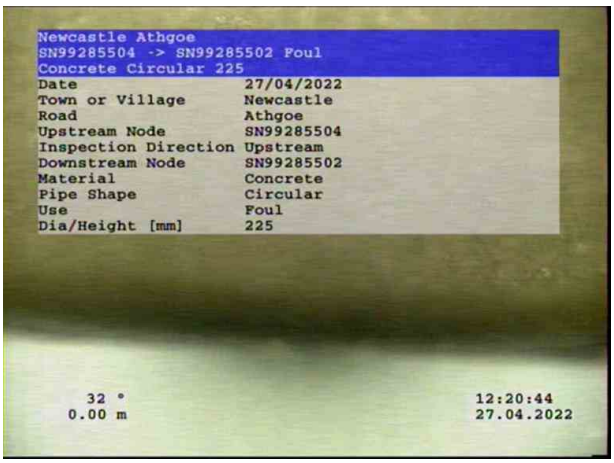
Section Pictures - 27/04/2022 - SN99285504X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
2	Upstream	SN99285504X	Athgoe Newcastl	DBFL



1, 00:00:00, 0.00 m
Start node, manhole, reference: SN99285502

2, 00:01:24, 12.08 m
Attached deposits, encrustation at joint from 7 o'clock to 11 o'clock, 5% cross-sectional area loss

3, 00:02:55, 30.18 m
Attached deposits, encrustation at joint from 5 o'clock to 7 o'clock, 5% cross-sectional area loss

4, 00:03:10, 33.01 m
Attached deposits, encrustation at joint from 12 o'clock to 12 o'clock, 10% cross-sectional area loss

ENVIRONMENTAL SERVICES

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Section Pictures - 27/04/2022 - SN99285504X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
2	Upstream	SN99285504X	Athgoe Newcastl	DBFL

5, 00:03:43, 36.77 m
Settled deposits, hard or compacted, 5% cross-sectional area loss

6, 00:03:54, 37.80 m
Junction at 12 o'clock, 100mm dia

7, 00:04:06, 37.84 m
Settled deposits, hard or compacted, 15% cross-sectional area loss

8, 00:04:19, 39.61 m
Ingress of gravel from 5 o'clock to 7 o'clock, 10% cross-sectional area loss

ENVIRONMENTAL SERVICES

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Section Pictures - 27/04/2022 - SN99285504X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
2	Upstream	SN99285504X	Athgoe Newcastl	DBFL

9, 00:04:30, 41.08 m
Ingress of gravel from 4 o'clock to 8 o'clock, 30% cross-sectional area loss

10, 00:04:30, 41.08 m
Ingress of gravel from 4 o'clock to 8 o'clock, 30% cross-sectional area loss

11, 00:04:49, 41.74 m
Finish node, manhole, reference: SN99285504, MANHOLE FULL OF GRAVEL

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Section Inspection - 27/04/2022 - SN99284403X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
3	1	27/04/22	10:32	Athgoe Newcastl	No Rain Or Snow	Yes	SN99284403X

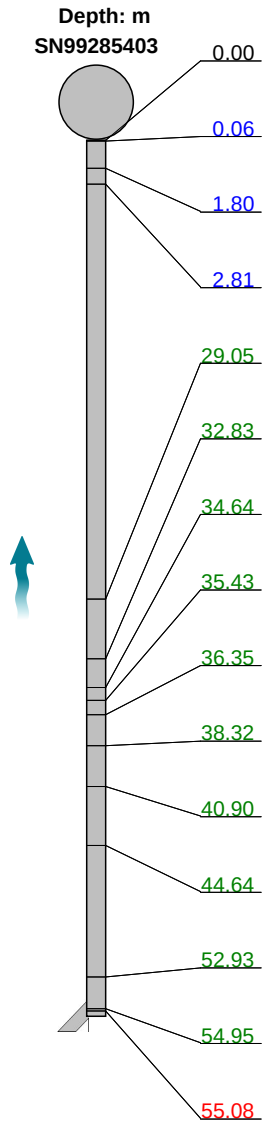
Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	0.70 m	Public Sewer	Not Specified

Town or Village:	Newcastle	**Inspection Direction:**	Upstream	**Upstream Node:**	SN99284403
Road:	Athgoe	**Inspected Length:**	68.00 m	**Upstream Pipe Depth:**	
Location:	Road	**Total Length:**	68.00 m	**Downstream Node:**	SN99285403
Surface Type:	Asphalt Highway	**Joint Length:**		**Downstream Pipe Depth:**	

Use:	Foul	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	225 mm
Flow Control:	No flow control	**Material:**	Concrete
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:478



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node, manhole, reference: SN99285403	00:00:00	1	
0.06	WL	Water level, 15% of the vertical dimension	00:00:07	2	
1.80	WL	Water level, 10% of the vertical dimension	00:00:22		
2.81	WL	Water level, 5% of the vertical dimension	00:00:30		
29.05	DEEJ	Attached deposits, encrustation at joint from 12 o'clock to 12 o'clock, 10% cross-sectional area loss	00:02:54	3	3
32.83	DEE	Attached deposits, encrustation from 11 o'clock to 4 o'clock, 5% cross-sectional area loss	00:03:25	4	3
34.64	DEE	Attached deposits, encrustation from 12 o'clock to 5 o'clock, 5% cross-sectional area loss	00:03:46	5	3
35.43	DEEJ	Attached deposits, encrustation at joint from 3 o'clock to 9 o'clock, 15% cross-sectional area loss	00:03:56	6	3
36.35	DEEJ	Attached deposits, encrustation at joint from 12 o'clock to 6 o'clock, 10% cross-sectional area loss	00:04:08	7	3
38.32	DEEJ	Attached deposits, encrustation at joint from 12 o'clock to 6 o'clock, 5% cross-sectional area loss	00:04:25	8	3
40.90	DEG	Attached deposits, grease at 4 o'clock, 15% cross-sectional area loss	00:04:44	9	3
44.64	DEE	Attached deposits, encrustation from 10 o'clock to 5 o'clock, 5% cross-sectional area loss	00:05:08	10	3
52.93	DEE	Attached deposits, encrustation from 2 o'clock to 5 o'clock, 5% cross-sectional area loss	00:05:57	11	3
54.95	CXI	Connection defective, connecting pipe is intruding at 3 o'clock, 150mm dia, intrusion: 5%	00:06:19	12	3
55.08	CL	Crack, longitudinal at 1 o'clock	00:06:26	13	2 / 2

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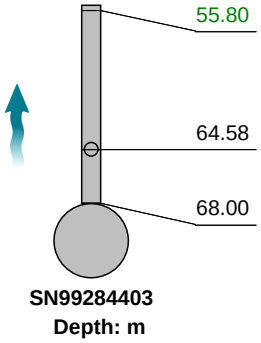
Section Inspection - 27/04/2022 - SN99284403X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
3	1	27/04/22	10:32	Athgoe Newcastl	No Rain Or Snow	Yes	SN99284403X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	0.70 m	Public Sewer	Not Specified



Scale: 1:478	Position [m]	Code	Observation	MPEG	Photo	Grade
	55.80	DEE	Attached deposits, encrustation from 6 o'clock to 12 o'clock, 10% cross-sectional area loss	00:06:47	14	3
	64.58	CN	Connection other than junction at 12 o'clock, 100mm dia	00:07:38	15	
	68.00	MHF	Finish node, manhole, reference: SN99284403	00:08:12	16	

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
1	10.0	0.0	10.0	2.0	12	4.0	0.0	25.0	3.0

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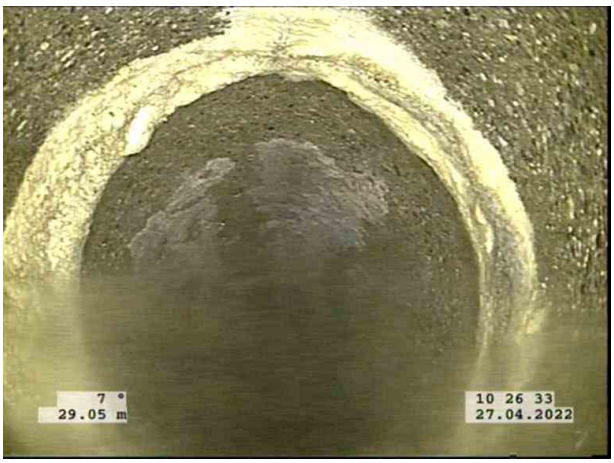
Section Pictures - 27/04/2022 - SN99284403X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
3	Upstream	SN99284403X	Athgoe Newcastl	DBFL

1, 00:00:00, 0.00 m
Start node, manhole, reference: SN99285403

2, 00:00:07, 0.06 m
Water level, 15% of the vertical dimension



3, 00:02:54, 29.05 m
Attached deposits, encrustation at joint from 12 o'clock to 12 o'clock, 10% cross-sectional area loss

4, 00:03:25, 32.83 m
Attached deposits, encrustation from 11 o'clock to 4 o'clock, 5% cross-sectional area loss

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Section Pictures - 27/04/2022 - SN99284403X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
3	Upstream	SN99284403X	Athgoe Newcastl	DBFL

5, 00:03:46, 34.64 m
Attached deposits, encrustation from 12 o'clock to 5 o'clock, 5% cross-sectional area loss

6, 00:03:56, 35.43 m
Attached deposits, encrustation at joint from 3 o'clock to 9 o'clock, 15% cross-sectional area loss

7, 00:04:08, 36.35 m
Attached deposits, encrustation at joint from 12 o'clock to 6 o'clock, 10% cross-sectional area loss

8, 00:04:25, 38.32 m
Attached deposits, encrustation at joint from 12 o'clock to 6 o'clock, 5% cross-sectional area loss

ENVIRONMENTAL SERVICES

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Section Pictures - 27/04/2022 - SN99284403X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
3	Upstream	SN99284403X	Athgoe Newcastl	DBFL

9, 00:04:44, 40.90 m
Attached deposits, grease at 4 o'clock, 15% cross-sectional area loss

10, 00:05:08, 44.64 m
Attached deposits, encrustation from 10 o'clock to 5 o'clock, 5% cross-sectional area loss

11, 00:05:57, 52.93 m
Attached deposits, encrustation from 2 o'clock to 5 o'clock, 5% cross-sectional area loss

12, 00:06:19, 54.95 m
Connection defective, connecting pipe is intruding at 3 o'clock, 150mm dia, intrusion: 5%

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Section Pictures - 27/04/2022 - SN99284403X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
3	Upstream	SN99284403X	Athgoe Newcastl	DBFL

13, 00:06:26, 55.08 m
Crack, longitudinal at 1 o'clock

14, 00:06:47, 55.80 m
Attached deposits, encrustation from 6 o'clock to 12 o'clock, 10% cross-sectional area loss

15, 00:07:38, 64.58 m
Connection other than junction at 12 o'clock, 100mm dia

16, 00:08:12, 68.00 m
Finish node, manhole, reference: SN99284403

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Section Inspection - 27/04/2022 - SN99285502X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
4	1	27/04/22	13:04	Athgoe Newcastl	No Rain Or Snow	No	SN99285502X

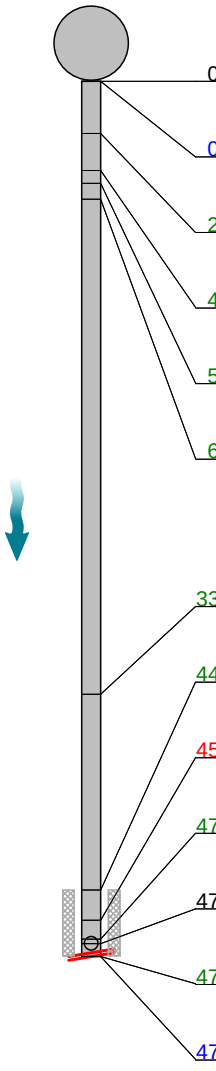
Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
AAA	142-RN-104	Ipek Rcx 90 Crawler	0.70 m	Public Sewer	Not Specified

Town or Village:	Newcastle	**Inspection Direction:**	Downstream	**Upstream Node:**	SN99285502
Road:	Athgoe	**Inspected Length:**	47.96 m	**Upstream Pipe Depth:**	
Location:	Road	**Total Length:**	47.96 m	**Downstream Node:**	SN99285602
Surface Type:	Asphalt Highway	**Joint Length:**		**Downstream Pipe Depth:**	

Use:	Foul	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	225 mm
Flow Control:	No flow control	**Material:**	Concrete
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Sample condition survey	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:414



Position [m]		Code	Observation	MPEG	Photo	Grade
0.00		MH	Start node, manhole, reference: SN99285502	00:00:00	1	
0.00		WL	Water level, 5% of the vertical dimension	00:00:06		
2.86		DEEJ	Attached deposits, encrustation at joint from 12 o'clock to 12 o'clock, 5% cross-sectional area loss	00:00:29	2	3
4.92		DEEJ	Attached deposits, encrustation at joint from 12 o'clock to 12 o'clock, 5% cross-sectional area loss	00:00:47	3	3
5.61		DEEJ	Attached deposits, encrustation at joint from 4 o'clock to 8 o'clock, 10% cross-sectional area loss	00:00:55	4	3
6.47		DEEJ	Attached deposits, encrustation at joint from 4 o'clock to 10 o'clock, 5% cross-sectional area loss	00:01:02	5	3
33.61		INGG	Ingress of gravel from 5 o'clock to 7 o'clock, 5% cross-sectional area loss	00:03:11	6	3
44.33	S01	INGG	Ingress of gravel from 5 o'clock to 7 o'clock, 10% cross-sectional area loss, start	00:04:20	7	
45.99		CC	Crack, circumferential from 9 o'clock to 12 o'clock	00:04:45	8	2 / 2
47.03		DEC	Settled deposits, hard or compacted, 20% cross-sectional area loss	00:05:19	9	4
47.26		JN	Junction at 12 o'clock, 100mm dia	00:05:32	10	
47.96	F01	INGG	Ingress of gravel from 5 o'clock to 7 o'clock, 10% cross-sectional area loss, finish	00:05:41		3
47.96		SA	Survey abandoned: settled depositts. cutting required	00:05:42	11	

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	**STR Peak**	**STR Mean**	**STR Total**	**STR Grade**	**SER No. Def**	**SER Peak**	**SER Mean**	**SER Total**	**SER Grade**
1	10.0	0.0	10.0	2.0	8	9.0	0.0	34.0	4.0

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Section Pictures - 27/04/2022 - SN99285502X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
4	Downstream	SN99285502X	Athgoe Newcastl	DBFL

1, 00:00:00, 0.00 m
Start node, manhole, reference: SN99285502

2, 00:00:29, 2.86 m
Attached deposits, encrustation at joint from 12 o'clock to 12 o'clock, 5% cross-sectional area loss

3, 00:00:47, 4.92 m
Attached deposits, encrustation at joint from 12 o'clock to 12 o'clock, 5% cross-sectional area loss

4, 00:00:55, 5.61 m
Attached deposits, encrustation at joint from 4 o'clock to 8 o'clock, 10% cross-sectional area loss

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Section Pictures - 27/04/2022 - SN99285502X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
4	Downstream	SN99285502X	Athgoe Newcastl	DBFL

5, 00:01:02, 6.47 m
Attached deposits, encrustation at joint from 4 o'clock to 10 o'clock, 5% cross-sectional area loss

6, 00:03:11, 33.61 m
Ingress of gravel from 5 o'clock to 7 o'clock, 5% cross-sectional area loss

7, 00:04:20, 44.33 m
Ingress of gravel from 5 o'clock to 7 o'clock, 10% cross-sectional area loss, start

8, 00:04:45, 45.99 m
Crack, circumferential from 9 o'clock to 12 o'clock

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Section Pictures - 27/04/2022 - SN99285502X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
4	Downstream	SN99285502X	Athgoe Newcastl	DBFL

9, 00:05:19, 47.03 m
Settled deposits, hard or compacted, 20% cross-sectional area loss

10, 00:05:32, 47.26 m
Junction at 12 o'clock, 100mm dia

11, 00:05:42, 47.96 m
Survey abandoned, settled depositts. cutting required