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Flood Risk Assessment

Strategic Housing Development

Clonkeen College, Clonkeen Road, Blackrock, Co. Dublin

Client: Clonkeen Investments DAC

Job No. W012

September 2021

PAC/SHD/162/20

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FLOOD RISK ASSESSMENT

STRATEGIC HOUSING DEVELOPMENT

CLONKEEN COLLEGE, CLONKEEN ROAD, BLACKROCK, CO. DUBLIN

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BS 1192 FIELD	**W012-CSC-ZZ-XX-RP-C-0002-P3**

Job Ref.	Author	Reviewed By	Authorised By	Issue Date	Rev. No.
W012	RFM	NB	NB	06.09.2021	P3
W012	RFM	NB	NB	01.09.2021	P2
W012	RFM	NB	NB	02.07.2020	P1

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1.0 INTRODUCTION

Cronin & Sutton Consulting Engineers (CS Consulting) have been commissioned D|RES Developments Ltd. to prepare an Engineering Services Report for a proposed residential development at Clonkeen College, Clonkeen Rd, Blackrock, Co. Dublin.

In preparing this report, CS Consulting has referred to the following:

- Dún Laoghaire-Rathdown County Development Plan 2016–2022, (including Strategic Flood Risk Assessment)
- Deansgrange Local Area Plan 2010-2020
- Greater Dublin Regional Code of Practice for Works
- Office of Public Works Flood Maps
- Department of the Environment Flooding Guidelines, 2009.
- Geological Survey of Ireland Maps
- Local Authority Drainage Records.

The Flood Risk Assessment is to be read in conjunction with the engineering drawings and documents submitted by CS Consulting and with the various additional information submitted by the other members of the design team.

2.0 SITE LOCATION AND PROPOSED DEVELOPMENT

2.1 Site Location

The proposed development site is located at Clonkeen College, Clonkeen Road, Blackrock, Co. Dublin. The site is located in the administrative jurisdiction of Dún Laoghaire-Rathdown County Council and has a total area of approximately 3.3ha.

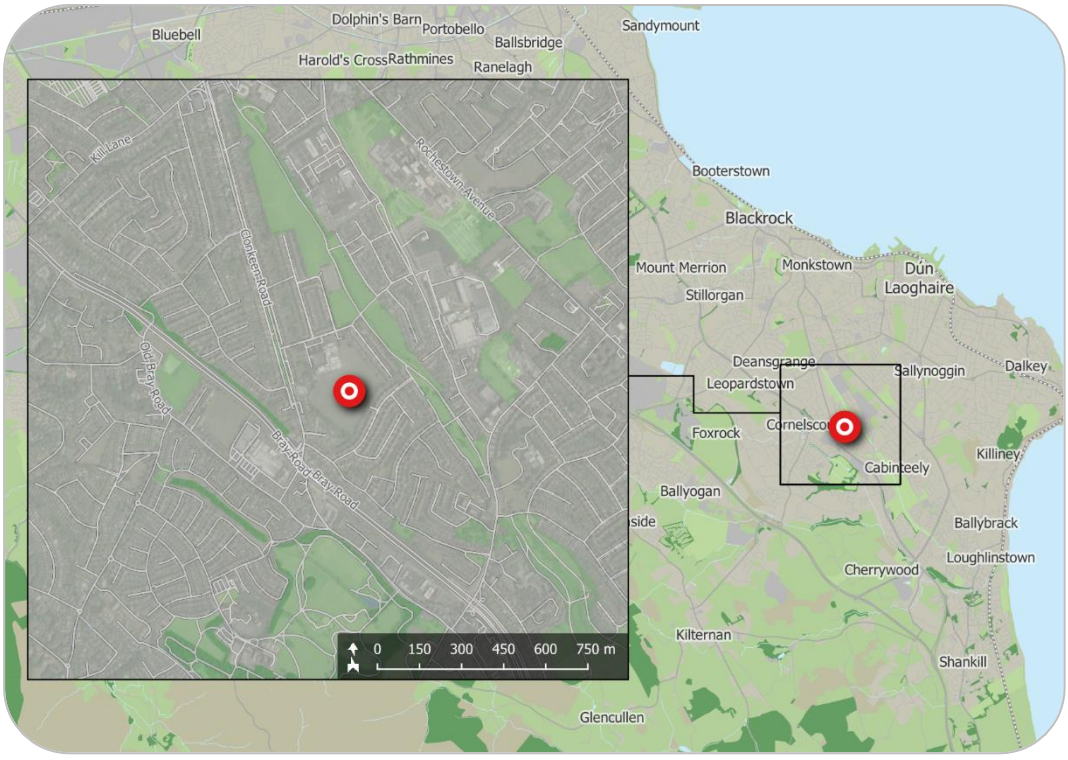

Figure 1 – Location of proposed development site
(*map data & imagery: EPA, OSM Contributors, Google*)

The location of the proposed development site is shown in Figure 1 above; the indicative extents of the development site, as well as relevant elements of the surrounding road network, are shown in more detail in Figure 2.

The site is bounded to the north-west by Clonkeen College, an existing filling station, and residential properties, to the north-east, south-east and south-

west by existing residential properties. The site has street frontage of approx. 23m on Meadow Vale, at its northernmost corner.

Figure 2 – Site extents and environs
(*map data & imagery: NTA, OSM Contributors, Google*)

2.2 Existing Land Use

The subject site is generally greenfield, having formed part of the grounds of Clonkeen College. To the south of the subject lands along the site boundary is an existing ditch. In addition, a public 375mm combined sewer crosses the site from west to east.

2.3 Description of Proposed Development

The proposed Strategic Housing Development, with a total gross floor area of c 33,851 sq m, will provide 299 no. residential units and a 1 no. storey 353 sq m childcare facility with dedicated play area 231 sq m. The development will consist of 18 no. ground floor 3 bedroom duplex

apartments and 18 no. 2 bedroom apartments above and 12 no. ground floor 2 bedroom apartments with 12 no. 3 bedroom duplex apartments above. The 60 no. duplex units are arranged in 6 no. three storey blocks. The development will also consist of 239 no. apartment units (111 no. 1 bedroom apartments, 120 no. 2 bedroom apartments and 8 no. 3 bed apartments) arranged in 4 no. 6 storey blocks over 1 no. storey basement; public open space, communal open space and private open space (including all balconies, terraces and individual unit gardens at all levels); 614 sq m communal resident facilities including concierge and welcome area (195 sq m), residents' flexible work facility (219 sq m), residents' lounge (100 sq m) and residents' gym area (100 sq m).

The development will also provide for the demolition of the 2 no. storey office building ('St. Helen's', Meadow Vale - 470 sq m) to facilitate new vehicular, pedestrian and cyclist access to the site, to the north of the proposed development via Meadow Vale.

The development will also include the provision of 2 no. designated play areas; internal roads and pathways; bin stores; 248 no. car parking spaces, including 167 no. at basement level and 2 no. shared vehicle (GoCar) spaces, 388 no. bicycle parking spaces, and 10 no. motorcycle parking spaces at basement and surface level; hard and soft landscaping; plant; boundary treatments including the repair and replacement of some existing boundary treatments; the provision of new surface water and foul drainage pipes and any required pipe diversion works or build over works; internal foul pumping station; a new internal access road and paths; changes in level; services provision and related pipework, ducting and cabling; electric vehicle charging points; 4 no. stormwater attenuation tanks; 1 no. ESB substation; photovoltaic panels; SUDS including green roof provision; signage; provision for future pedestrian access to Monaloe Park to the east of the development, including the provision of a pedestrian bridge, extending over the drainage ditch; public lighting and all site

development and excavation works above and below ground. The application contains a statement setting out how the proposal will be consistent with the objectives of the Dún Laoghaire-Rathdown County Development Plan 2016-2022. The application contains a statement indicating why permission should be granted for the proposed development, having regard to a consideration specified in section 37(2)(b) of the Planning and Development Act 2000, notwithstanding that the proposed development materially contravenes a relevant development plan or local area plan other than in relation to the zoning of the land.

3.0 LEVEL OF SERVICE

There is an existing inherent risk of any flood event occurring during any given year. Typically, this likelihood of occurrence was traditionally expressed as a 1-in-100 chance of a 100-year storm event happening in any given year.

A less ambiguous expression of probability is the Annual Exceedance Probability (AEP), which may be defined as the probability of a flood event being exceeded in any given year. Therefore a 1-in-100-year event has a 1% AEP; similarly, a 100% AEP can be expressed as a 1-in-1-year event.

The *Planning System and Flood Risk Management, Guidelines for Planning Authorities* set out the best practice standards for flood risk assessment in Ireland. These are summarised in **Table 1** below.

Flooding Source	Drainage	River	Tidal/Coastal
Residential	1% AEP	0.1% AEP	0.1% AEP
Water-compatible (docks, marinas)	-	>1% AEP	>0.5% AEP

Table 1 - Summary of Level of Service – Flooding Source.

Under these guidelines, a proposed development site has first to be assessed to determine the flood zone category it falls under.

It is a requirement of both Dún Laoghaire-Rathdown County Council's and the Department of the Environment, community & Local Government flooding guidelines, *The Planning System and Flood Risk Management, Guidelines for Planning Authorities,* that the predicted effects of climate change are incorporated into any proposed design. Table 2 below indicates the predicted climate change variations.

Design Category	Predicted Impact of Climate Change
Drainage	20% Increase in rainfall
Fluvial (River flows)	20% Increase in flood flow

Table 2 - The predicted climate change variations

The flooding guidelines categorise the risks associated with flooding into three areas, Zone A, B & C. This categorisation is indicated below.

- **Zone A** – High Probability of Flooding. Where the average probability of flooding from rivers and sea is highest (greater than 1% annually or 1 in 100 for river flooding or 0.5% annually or 1 in 200 for coastal flooding).
- **Zone B** – Moderate Probability of Flooding. Where the average probability of flooding from rivers and sea is moderate (risk between 0.1% annually or 1 in 1000 years and 1% annually or 1 in 100 years for river flooding, and between 0.1% or 1 in 1000 years and 0.5% annually or 1 in 200 for coastal flooding).
- **Zone C** – Low Probability of Flooding. Where the probability of flooding from rivers and sea is moderate (risk is less than 0.1% annually or 1 in 1000 years for both rivers and coastal flooding).

Reviewing the Dún Laoghaire County Council flood maps, the subject lands are located in **Flood Zone C** (see **Appendix A**). An extract of same is given below in Figure 3. It should also be noted that the Draft Development Plan, 2022 – 2028 does not propose to change the subject lands flood designation, draft flood map is also included in **Appendix A**.

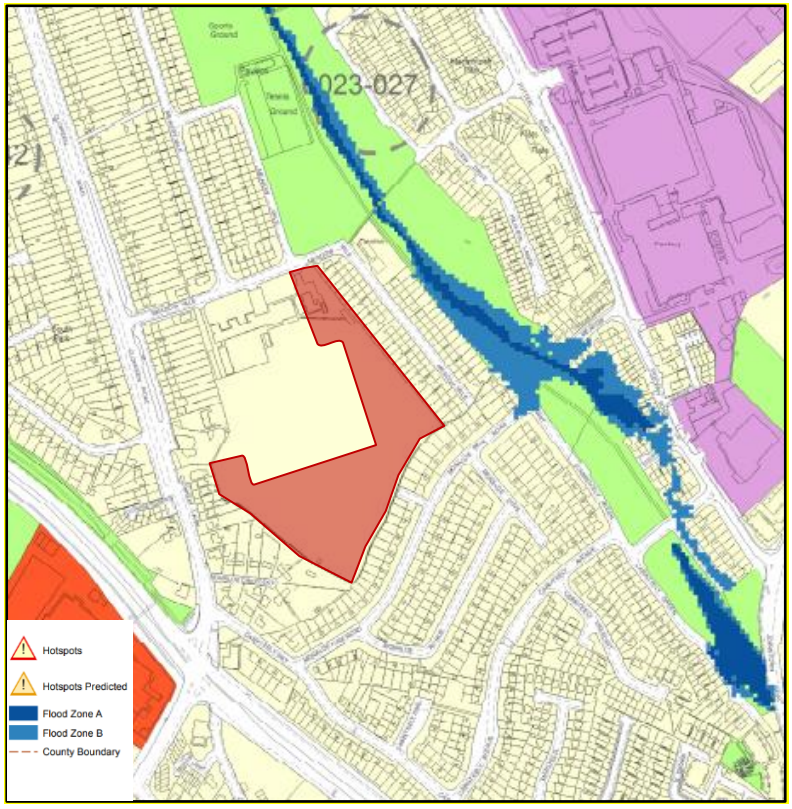

Figure 3 – Extract From Dún Laoghaire-Rathdown County Council Flood Map, Indicating Site Location, in red.

(Dún Laoghaire County Council Strategic Flood Risk Assessment)

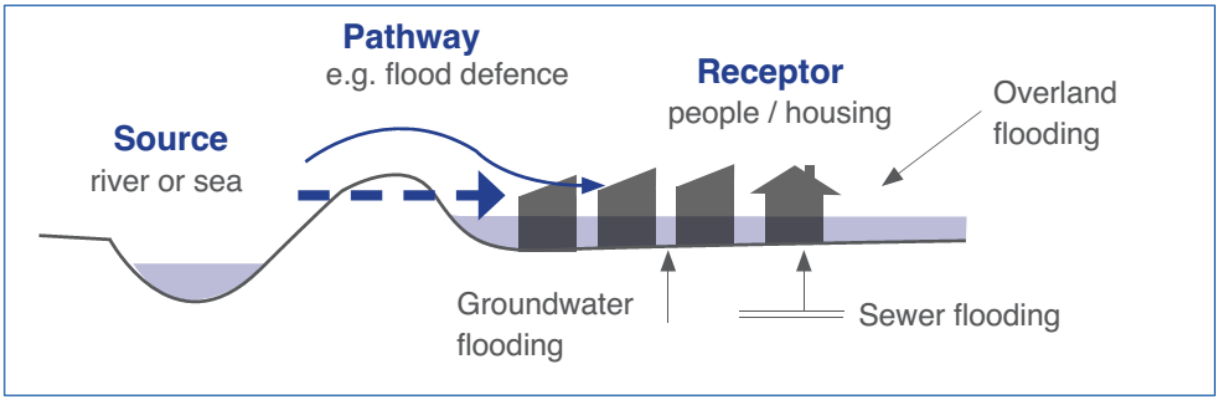

Figure 4 – Source-pathway-receptor model Site location

(Flood Risk Management Guidelines)

The flooding guidelines have developed an 'appropriateness' matrix for various developments and their potential risk factors. The table indicates if further analysis is required in the form of a justification test. Table 3 below outlines the conditions that require a justification test.

	Flood Zone A	Flood Zone B	Flood Zone C
Highly Vulnerable Development	***Justification Test***	***Justification Test***	Appropriate
Less Vulnerable Development	***Justification Test***	Appropriate	Appropriate
Water-compatible Development	Appropriate	Appropriate	Appropriate

- Table 3 - Flood Zone Vs Justification Test Matrix

- As noted above, a proportion of the site is located within **Flood Zone C.** As such, a justification test is *not* required.

4.0 FLOOD RISKS & MITIGATION MEASURES

4.1 Fluvial Flooding

The site is located approximately 100m to the south-west of the Deansgrange River. A review of the Office of Public Works flood maps database, (www.floodmaps.ie) for the area does not indicate any previous flood events affecting the subject lands. Refer to the OPW map report in **Appendix B**. Also note CFRAM Mapping in **Appendix C**. The risk of flooding is very low in the subject lands occupied by the proposed development.

4.2 Tidal Flooding

The subject lands' distance from the coast is such that the potential for on-site flooding due to tidal action need not be considered.

4.3 Pluvial Flooding

Pluvial flooding is flooding which has originated from overland flow resulting from high intensity rain fall. A review of the historical flood maps does not indicate past on site flooding events from pluvial sources.

4.4 Potential for Site to Contribute To Off-Site Flooding

In accordance with the requirements of Dún Laoghaire-Rathdown County Council, the proposed developed will contain an attenuation system designed to retain storm water generated on site for the predicted 1-in-100-year extreme storm event, increased by 20% for the predicted effects of climate change. The storm water will be restricted to a flow of 2l/Ha/sec for all storm events. As such the proposed development will limit the possibility of flooding due to extreme storm events.

4.5 Existing Off Site Drainage

As the proposed development will limit storm water discharge rates for all extreme storm water events, the propose development will increase the local areas hydraulic capacity by providing on site storage during extreme storm events.

4.6 Groundwater Flooding

According to the Geological Survey of Ireland (GSI) interactive maps, the subject site is underlain with Granite. The groundwater vulnerability assessment of the site shows that the vulnerability of groundwater in the area is *low*. The local aquifer is described as *a poor aquifer* and the bed rock is *generally unproductive* except for local zones. The nature and type of the proposed development with its basement indicates that, to prevent any potential risk of groundwater intrusion into the lower structure, the basement will be constructed as a water tight box. The proposed structural integrity of the basement and its ability to prevent groundwater intrusion into the site is deemed sufficient to mitigate the potential risk to acceptable limits. See **Appendix D** for GSI mapping information for background groundwater & geology data for the subject lands.

5.0 RESPONSE TO ABP OPINION

As part of the SHD process plans were submitted to An Bord Pleanála (ABP) to allow them to prepare and give feedback on the potential scheme. As part of the feedback received were comments from the Council relating to the Site Specific Flood Risk Assessment. The Council's query is noted below and CS Consulting's response beneath same.

Site Specific Flood Risk Assessment

It is acknowledged that the applicant has submitted a Site Specific Flood Risk Assessment, (SSFRA), however, it does not fully address the watercourse to the south of the site and any possible flood risk it may pose. The applicant should note that no highly vulnerable development is allowed in either Flood Zones A or B (existing, under development scenario). This assessment also does not address failure of the proposed surface water system and its impact on the development and adjacent lands.

1. *The applicant is required to resubmit their SSFRA with a more comprehensive assessment of the watercourse to the south of the site, this assessment may require hydraulic modelling, including an accurate survey of existing channel bed and bank. Any alteration of existing topography within the flood extents zone must be accounted for in the modelling exercise. The following as a minimum must be included in the SSFRA, in accordance with Appendix 13 (Strategic Flood Risk assessment) of Dun-Laoghaire-Rathdown County Development Plan 2016 – 2022;*

    a. *Flood extents and depth maps for the 1.0% AEP and 0.1% AEP flood events for both existing and proposed scenarios, with the development footprint superimposed.*

    b. *Cross sections are required at regular intervals and at a suitable legible scale to show the extent and depth of out of bank flood*

flooding, if any, for the 0.1% AEP and 0.1% AEP flood events for both existing and proposed development scenarios.

c. *Sections at the outflows from the site that show they are above the 1.0% AEP flood depth.*

2. *The applicant must ensure that the flood flow-path areas do not contain any Engineering, Architectural, or Landscape features, (other then proposals submitted as part of the planning application) that would have the potential for obstruction of flowpaths.*

3. *The applicant must locate attenuation storage systems outside flood Zones A & B.*

4. *The applicant is requested to comment on the proposed surface water drainage system in the event of blockage or partial blockage of the system, commenting on any surcharging or flood risk that may be identified. The applicant is requested to submit a drawing identifying and showing details of safe overland flow routes both with and without the site. The overland flow route plan should identify drop kerbs or ramps required for challenging the flow, should address low point areas in the site and should detail how properties, both within the development and on adjacent lands, will be protected in the event of excessive overland flows.*

Response

1. CS Consulting looked at the ditch to the south of the south and developed cross sections for same to allow an accurate calculation of the conveyance capacity of the ditch. In addition, the surrounding catchment which feed into the inlet pipe entering the ditch was also established and modelled to check the hydraulic capacity of the existing public drainage network. Drawing **W012-SK01** in **Appendix E** give the location and area of

the offsite catchment modelled. Drawing **W012-SK02** gives a simplified flow path route based on the cover levels of the manholes on the storm water system. Also, as requested cross sections for the ditch were generated allowing the cross-surface area to be accurately determined to aid in modelling the capacity in the ditch, see drawing **W012-SK03**.

The existing public storm water catchment to the west of the subject lands, as indicated in W012/SK01, was modelled using WinDes hydraulic software. The model was run for the 1.0% AEP (annual exceedance probability of 1-in-100 years) & for the 0.1% AEP (1-in-1000 years) both the modelling events were factored up by 20% for the predicted affects of climate change. Refer to **Appendix F** for WinDes model calculations.

The modelling indicated that a number of the existing sewer runs would not only surcharge but would flood during a range of modelled storm durations. The 'worst' case critical storm being established as the 60 minute duration event. During this event the existing storm systems would be under considerable hydraulic pressure which would lead to surface flooding.

Flooding From Existing Storm system

The modelling established that for the critical 60 minute duration storm:

- the 1.0% AEP event this flood volume would be 2303m^3;
- for the 0.1% AEP, it would be 5285m^3.

Flow Into Ditch

The model indicated that the 750mm diameter storm sewer entering the ditch to the south west of the subject lands would discharge:

- 1609l/sec during the 1.0% AEP event;

- 2282l/sec during the 0.1% AEP.

Runoff Into Ditch From Subject Lands

In addition to these volumes under the current physical conditions of the subject lands runoff into the ditch would also be expected.

- 398.84l/sec during the 1.0% AEP event;
- 565l/sec during the 0.1% AEP.

It is highly unlikely that 100% of the flood waters which would come from the surcharged existing system would drain into the subject lands. Therefore, it has been assumed that 50% of the flooding predicted via the hydraulic model would drain via overland flow into the ditch on the subject lands.

Table 5.1 – 1.0% AEP flows Into Ditch

	Sewer discharge	***Overland flow***	***Site runoff***	***Total***
Existing	1609l/sec	*639l/sec*	*398l/sec*	***2646l/sec***
Proposed	*1609l/sec*	*639l/sec*	*3.3l/sec*	***2251.3l/sec***

Table 5.2 – 0.1% AEP flows Into Ditch

	Sewer discharge	***Overland flow***	***Site runoff***	***Total***
Existing	2282l/sec	*1468l/sec*	*565l/sec*	***4315l/sec***
Proposed	*2282l/sec*	*1468l/sec*	*3.3l/sec*	***3753l/sec***

The modelled ditch has a varying convenance capacity. The average volume of water which can be moved through the ditch is 6247l/sec. this is greater than the proposed post development flow which could potentially entre the ditch, which has been calculated at 3753l/sec.

Therefore, the modelling indicates that even during a 1-in-1000 year event, increased for climate change and taking 50% of the predicated overland flood volumes the existing ditch has adequate conveyance capacity and no out of bank flooding is predicated. This ties in with the historical mapping for the site from the office of Public works, as well as the CFRAM mapping, the current local authority mapping and the draft strategic Flood Mapping all of which indicates that the site is located in Flood Zone 'C', the modelling equally indicates same.

a. No on site flooding predicted for the 1.0% or 0.1% flood events.

b. See drawing **W012/SK03** for cross sections of the ditch, but no 1.0% or 0.1% out of bank flooding predicted.

2. Potential flood flow paths, as required should the network experience a storm intensity of a greater magnitude affect the site or should the site infrastructure fail are indicated on drawing **W012-CSC-ZZ-XX-DR-C-0034** Potential Flood Route. The risk noted of objects blocking a flow path are acknowledged and have been mitigated against.

3. All proposed attenuation storage systems are located in Flood Zone 'C' as the site is not within Flood zones 'A' or 'B'.

4. As noted in point 2, a review of the proposed drainage layout was carried out to ensure that flow routs across the site are not impleaded. Refer to drawing **W012-CSC-ZZ-XX-DR-C-0034_Potential Flood Route** & **Appendix F** for Windes calculations for assessing the area where site flooding would occur should the storm water system suffer a 50% blockage.

6.0 CONCLUSION

- Historically, the site has not been subject to flooding events, as noted by the OPW's historical flood maps.
- Dún Laoghaire-Rathdown County Council's Development Plan locates the site in **Flood Zone C**. Due to the proposed nature of the development, a Justification Test is not required.
- Pluvial flooding has been assessed and the proposed use of an attenuation tank to limit the storm water discharge rate from the site to 2l/s/Ha will aid in increasing the capacity of the public combined sewer adjacent to the site. The increased capacity will allow the public drainage system to deal with pluvial flows during extreme storm events.
- Tidal mapping for the current 1-in-200-year flood & the predicted 1-in-200-year flood (based on the predicted effect of climate change) indicates that no dwelling will have a finished floor level in the tidal zone.
- The risk of the site contributing to offsite flooding, or the site's vulnerability to flooding from the public drainage network, is mitigated by the installation of an attenuation tank to retain the storm volumes experienced on site during high intensity storm events & the existing topography of the site.
- The sites local geology & hydrogeological conditions do not indicate that flooding from groundwater is an issue at the site.

On behalf of Cronin & Sutton Consulting

Robert Fitzmaurice
Chartered Engineer
BEng (Hons), PG Dip EE, MIE, MIE.

Appendix A

Dún Laoghaire-Rathdown County Council Flood Zone Mapping and Draft 2022 – 2028 Flood Map

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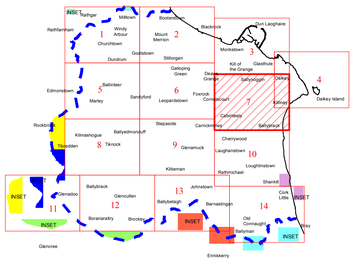
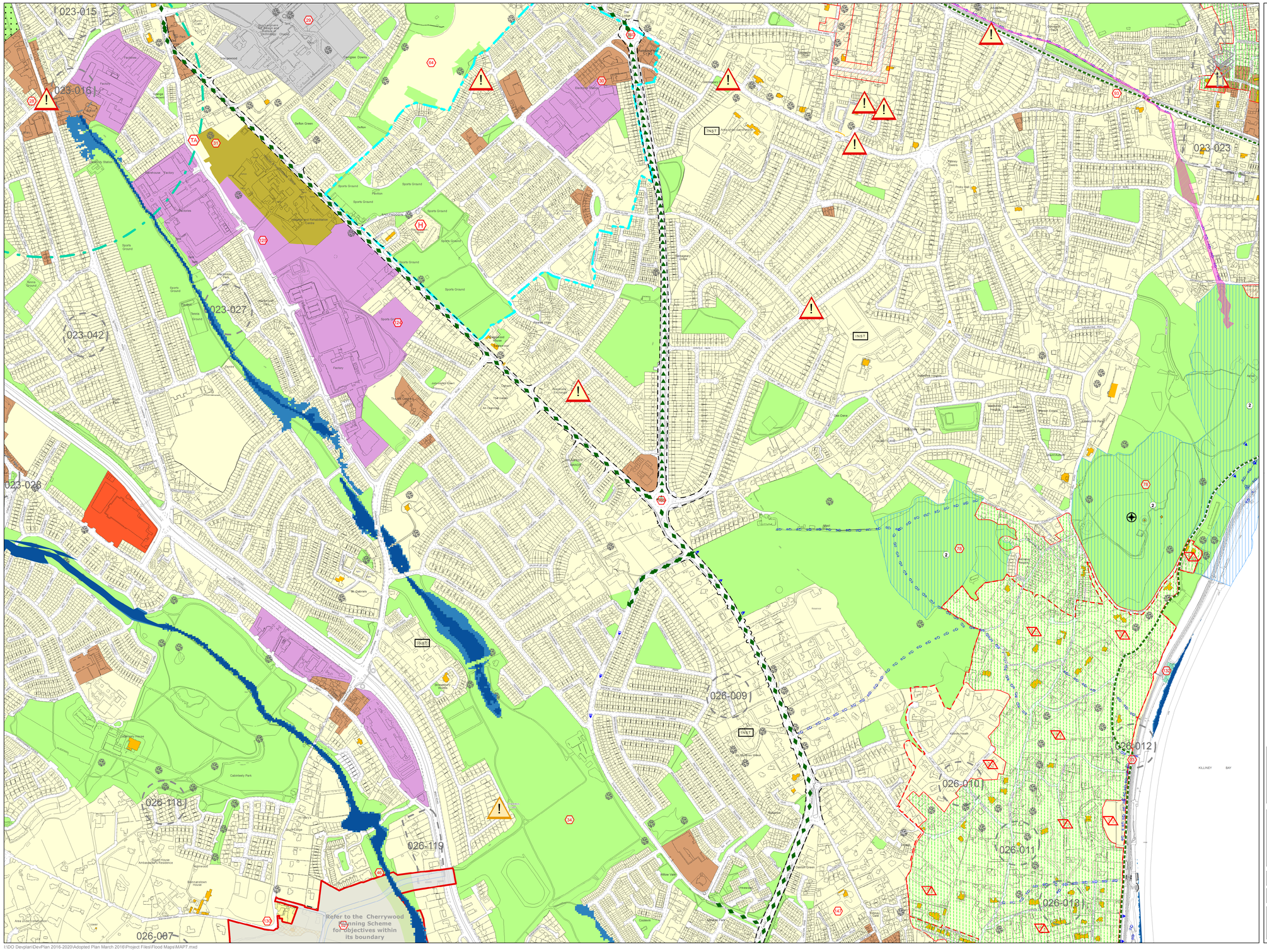
Planning and Organisational Innovation Department

COMHAIRLE CHONTAE DHÚN LAOGHAIRE-RÁTH AN DÚIN

DÚN LAOGHAIRE-RATHDOWN COUNTY COUNCIL

Flood Zone Maps





Hotspots

Hotspots Predicted

Flood Zone A

Flood Zone B

County Boundary

0 0.1 0.2 0.3 0.4 0.5

Kilometres

Planning and Organisational Innovation

M Henchy
Director

dlr Comhairle Contae County Council

Flood Zone Maps

Senior Planner: D. Irvine	Acting Chief Technician: M. Hevehan
Prepared By: Louise McGauran	Drawn By: B. Mwenelupembe

Date:	Scale:	Map No.
March 2016	1:5,000	MAP7

I:\DO Devplan\DevPlan 2016-2020\Adopted Plan March 2016\Project Files\Flood Maps\MAP7.mxd

Mapping Notes

1. When printing this map, colours may vary depending on type of printer used. Please refer to dlr website for definitive colours.

Flood Zone Map

COMHAIRLE CHONTAE DHÚN LAOGHAIRE-RÁTH AN DÚIN

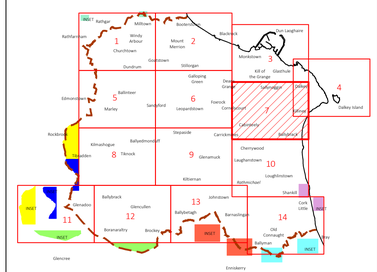
DÚN LAOGHAIRE-RATHDOWN COUNTY COUNCIL

COUNTY DEVELOPMENT PLAN 2022-2028

Draft County Development Plan January 2021

dlr Comhairle Contae County Council

dlr Comhairle Contae County Council



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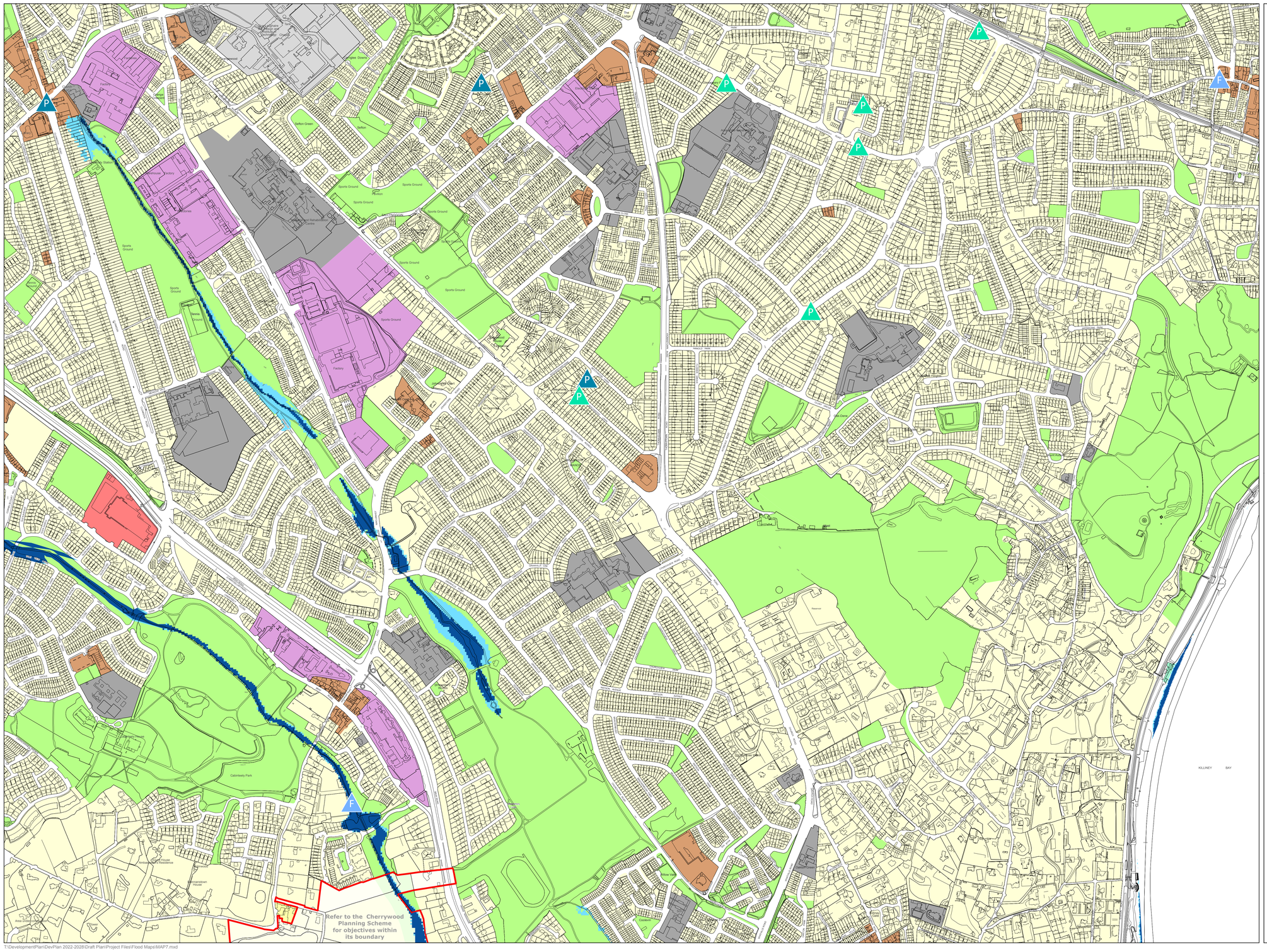

Land Use Zonings

Objective A	To provide residential development and/or protect and improve residential amenity.
Objective A1	To provide for new residential communities and Sustainable Neighbourhood Infrastructure in accordance with approved local area plans.
Objective A2	To provide for the creation of sustainable residential neighbourhoods and preserve and protect residential amenity.
Objective B	To protect and improve rural amenity and to provide for the development of agriculture.
Objective DC	To protect, provide for and-or improve mixed-use district centre facilities.
Objective E	To provide for economic development and employment.
Objective F	To preserve and provide for open space with ancillary active recreational amenities.
Objective G	To protect and improve high amenity areas.
Objective GB	To protect and enhance the open nature of lands between urban areas.
Objective LIW	To improve and provide for low density warehousing/light industrial warehousing uses
Objective MIC	To consolidate and complete the development of the mixed use inner core to enhance and reinforce sustainable development.
Objective MOC	To provide for a mix of uses which complements the inner core, but with less retail and residential and more emphasis on employment and services.
Objective MTC	To protect, provide for and-or improve major town centre facilities.
Objective NC	To protect, provide for and-or improve mixed-use neighbourhood centre facilities.
Objective OE	To provide for office and enterprise development.
Objective TLI	To facilitate, support and enhance the development of third level education institutions.
Objective W	To provide for waterfront development and harbour related uses.
Objective SNI	To protect, improve and encourage the provision of sustainable neighbourhood infrastructure

Areas of Flood Risk Concern

Fluvial - Surface Water

Pluvial - Surface Water

Pluvial - Foul

Flood Zone A

Flood Zone B

County Boundary

Boundary of Adopted Cherrywood Planning Scheme

Metres

0 50 100 200 300 400 500

Director of Planning: M Henchy
Senior Planner: L McGauran

T:\DevelopmentPlan\DevPlan 2022-2028\Draft Plan\Project Files\Flood Maps\MAP7.mxd

Appendix B

Office of Public Works Historic Flood Report

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OPW National Flood Hazard Mapping

Summary Local Area Report

This Flood Report summarises all flood events within 2.5 kilometres of the map centre.

The map centre is in:

County: Dublin

NGR: O 231 257

Map Scale 1:7,766

Map Legend	
	Flood Points
	Multiple / Recurring Flood Points
	Areas Flooded
	Hydrometric Stations
	Rivers
	Lakes
	River Catchment Areas
	Land Commission *
	Drainage Districts *
	Benefiting Lands *

* Important: These maps do not indicate flood hazard or flood extent. Thier purpose and scope is explained in the Glossary.

17 Results

1. Shanganagh Carrickmines Nov 2002
County: Dublin
Start Date: 26/Nov/2002
Flood Quality Code:3
Additional Information: Reports (1) More Mapped Information

2. Shanganagh Carrickmines Dec 1997
County: Dublin
Start Date: 18/Dec/1997
Flood Quality Code:3
Additional Information: Reports (1) More Mapped Information

3. Shanganagh Carrickmines May 1993
County: Dublin
Start Date: 26/May/1993
Flood Quality Code:1
Additional Information: Photos (3) Reports (4) More Mapped Information

4. Shanganagh Carrickmines Nov 1982
County: Dublin
Start Date: 06/Nov/1982
Flood Quality Code:3
Additional Information: Reports (3) More Mapped Information

5. Flooding at Little Meadow, Pottery Road, Cabinteely, Dublin 18 on 24th Oct 2011
County: Dublin
Start Date: 24/Oct/2011
Flood Quality Code:2

Additional Information: Reports (1) More Mapped Information

---

6. Flooding at O'Rourke Park, Sallynoggin, Co. Dublin. on 24th Oct 2011
County: Dublin
Start Date: 24/Oct/2011
Flood Quality Code:2

Additional Information: Reports (1) More Mapped Information

---

7. Flooding at Deansgrange Village, Deansgrange, Co. Dublin on 24th Oct 2011
County: Dublin
Start Date: 24/Oct/2011
Flood Quality Code:3

Additional Information: Reports (1) More Mapped Information

---

8. O Rourke Park Sallynoggin Oct 2002
County: Dublin
Start Date: 21/Oct/2002
Flood Quality Code:4

Additional Information: Reports (1) More Mapped Information

---

9. Ramore Leopardstown Road May and June 1993
County: Dublin
Start Date: 01/May/1993
Flood Quality Code:3

Additional Information: Reports (2) More Mapped Information

---

10. Torquay Road Foxrock Nov 1982
County: Dublin
Start Date: 05/Nov/1982
Flood Quality Code:3

Additional Information: Reports (1) More Mapped Information

---

11. Deansgrange Johnstown Pottery Road Nov 1982
County: Dublin
Start Date: 05/Nov/1982
Flood Quality Code:3

Additional Information: Reports (1) More Mapped Information

---

12. Coolevin Ballybrack Feb 1980
County: Dublin
Start Date: 09/Feb/1980
Flood Quality Code:4

Additional Information: Reports (1) More Mapped Information

---

13. Brighton Terrace Jan 1980
County: Dublin
Start Date: 01/Jan/1980
Flood Quality Code:3

Additional Information: Reports (1) More Mapped Information

---

14. Brighton Cottages Dec 1978
County: Dublin
Start Date: 26/Dec/1978
Flood Quality Code:3

Additional Information: Reports (2) More Mapped Information

---

15. Torquay Road Recurring
County: Dublin
Start Date:
Flood Quality Code:3

Additional Information: Reports (4) More Mapped Information

---

16. Brighton Cottages Foxrock Recurring
County: Dublin
Start Date:
Flood Quality Code:3

Additional Information: Reports (7) More Mapped Information

---

17. Dunedin Monkstown Recurring
County: Dublin
Start Date:
Flood Quality Code:4

Additional Information: Reports (4) More Mapped Information

Appendix C

Office of Public Works CFRAM Mapping

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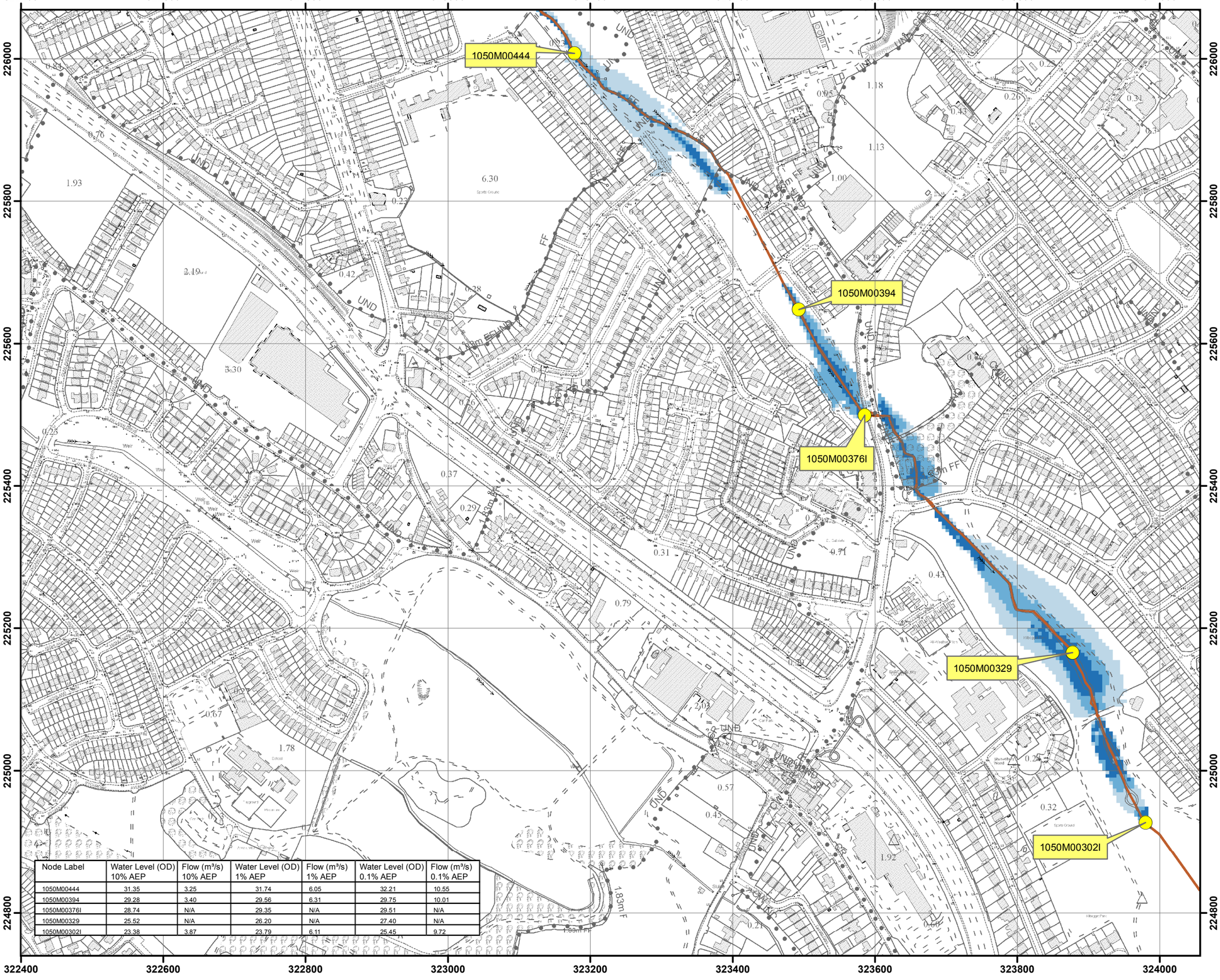
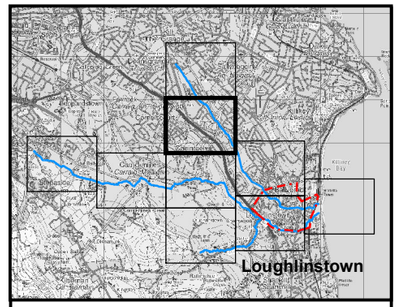


Node Label	Water Level (OD) 10% AEP	Flow (m³/s) 10% AEP	Water Level (OD) 1% AEP	Flow (m³/s) 1% AEP	Water Level (OD) 0.1% AEP	Flow (m³/s) 0.1% AEP
1050M00444	31.35	3.25	31.74	6.05	32.21	10.55
1050M00394	29.28	3.40	29.56	6.31	29.75	10.01
1050M00376I	28.74	N/A	29.35	N/A	29.51	N/A
1050M00329	25.52	N/A	26.20	N/A	27.40	N/A
1050M00302I	23.38	3.87	23.79	6.11	25.45	9.72

0 50 100 200 300 400 500 Metres



IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

Legend

- 10% Fluvial AEP Event
- 1% Fluvial AEP Event
- 0.1% Fluvial AEP Event
- Modelled River Centreline
- AFA Extents
- Embankment
- Wall
- Defended Area
- 1% AEP / 1% AEP — Standard of Protection of Flood Defence (Walls / Embankments)
- Node Point
- Node ID — Node Label

FINAL

REV:	NOTE:	DATE:

EASTERN CFRAM STUDY
CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT

OPW
Oifig na nOibreacha Poiblí
The Office of Public Works
The Office of Public Works
Jonathan Swift Street
Trim
Co Meath

RPS
Elmwood House
74 Boucher Road
Belfast
BT12 6RZ
T +44(0) 28 90 667914
F +44(0) 28 90 668286
W www.rpsgroup.com
E ireland@rpsgroup.com

Map: Deansgrange Stream Fluvial Flood Extents

Map Type:	EXTENT
Source:	FLUVIAL
Map Area:	HPW
Scenario:	CURRENT
Drawn By : C.C.	Date : 27 July 2016
Checked By : A.S.	Date : 27 July 2016
Approved By : G.G.	Date : 27 July 2016
Drawing No. :	E10LOU_EXFCD_F0_08
Map Series :	Page 8 of 9
Drawing Scale :	1:5,000 @ A3

Appendix D

Geological Survey of Ireland – Hydrogeology & Bedrock Geology Maps

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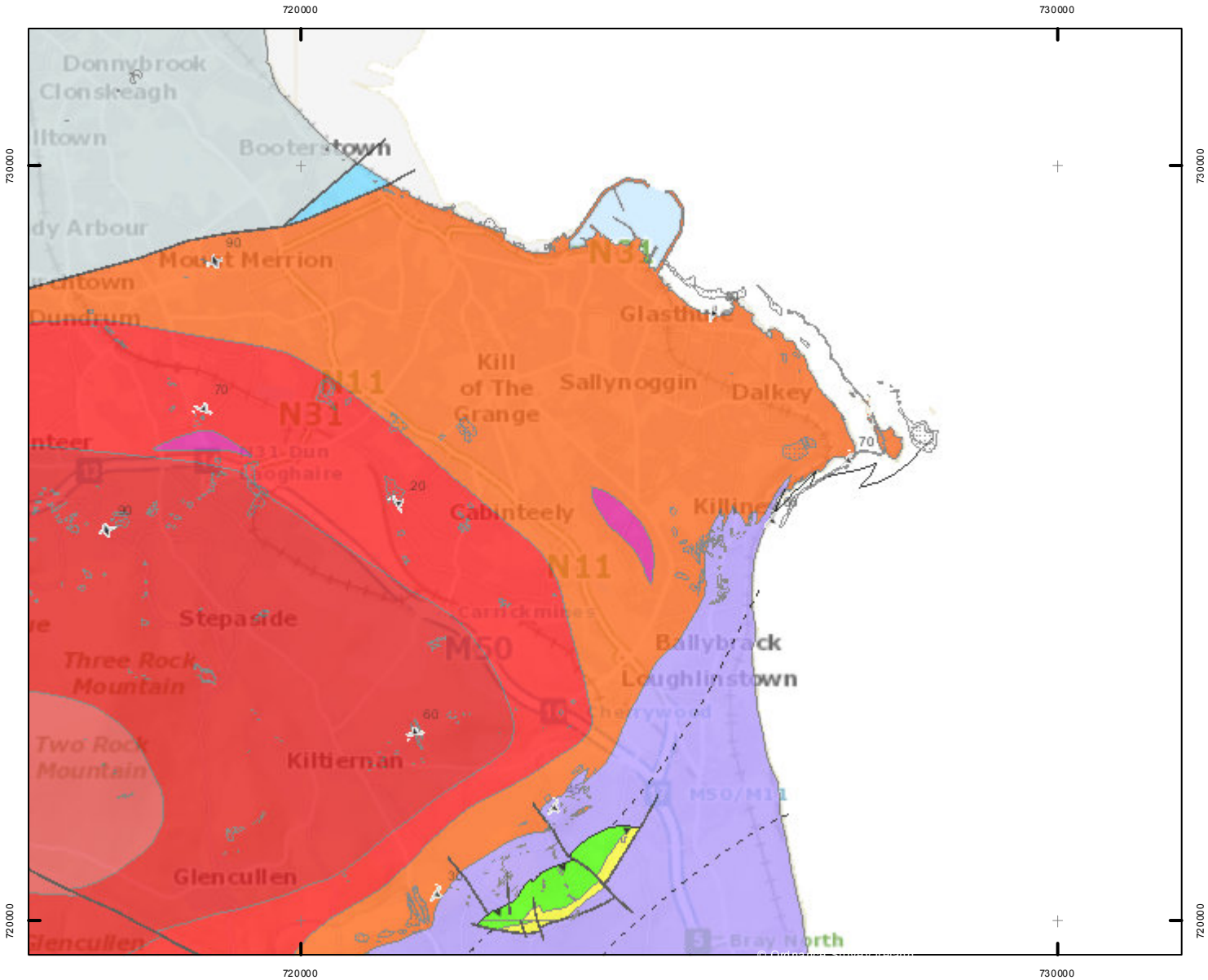
Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann

Geology



Scale: 1:81,463

Geological Survey Ireland

0 0.5 1 2 mi

0 0.75 1.5 3 km

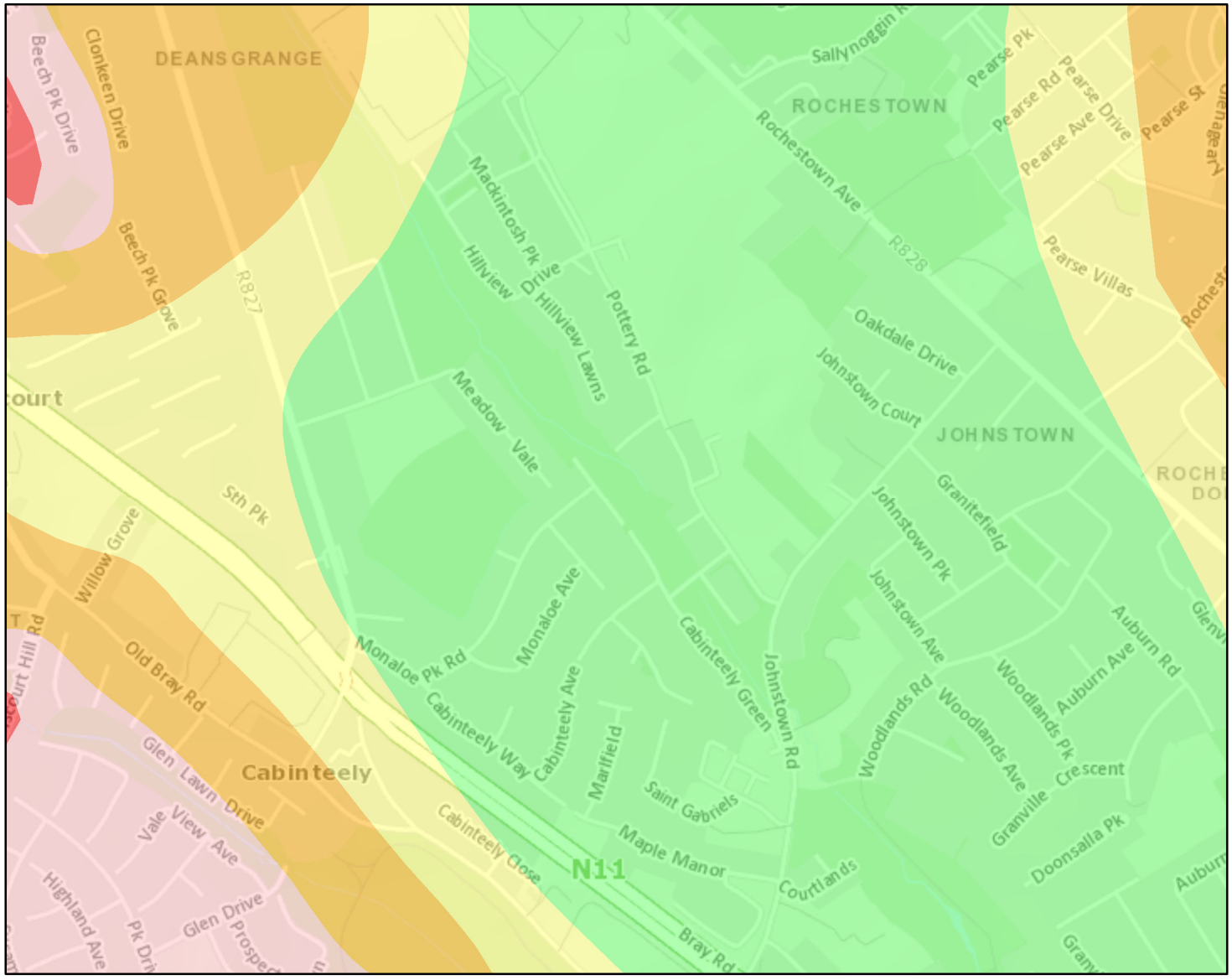
Map Centre Coordinates (ITM) 724,016 725,688

7/9/2019, 1:01:12 PM

Legend

Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann

Groundwater Data



Legend

National Groundwater Vulnerability Ireland

- Rock at or near Surface or Karst
- Extreme
- High
- Moderate
- Low

Scale: 1:10,000

Geological Survey Ireland

N W E S

0 0.05 0.1 0.2 mi
0 0.1 0.2 0.4 km

Map Centre Coordinates (ITM) 723,266 725,872
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Appendix E

CS Consulting Sketch Drawings

CS CONSULTING
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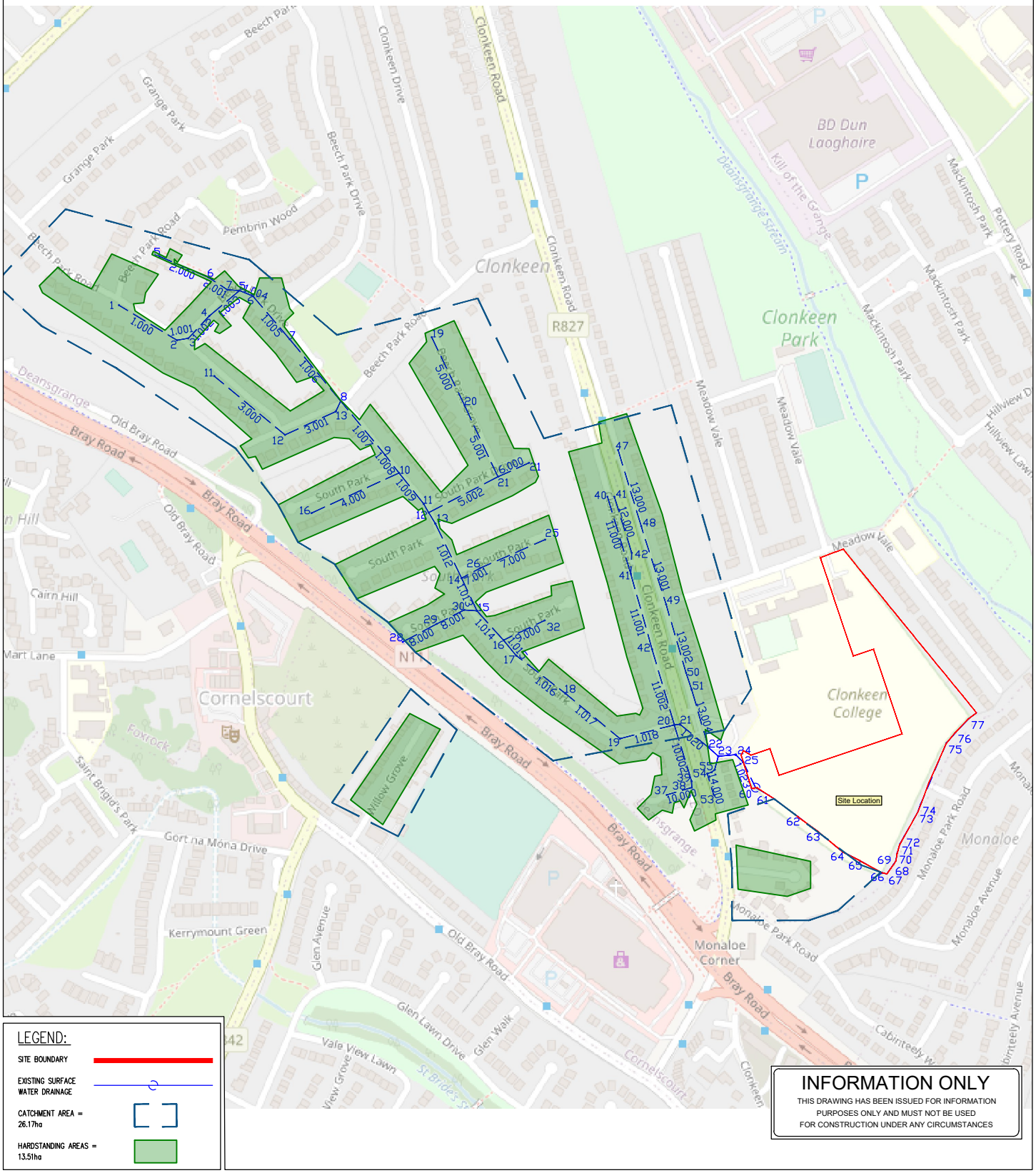

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CS Consulting Group

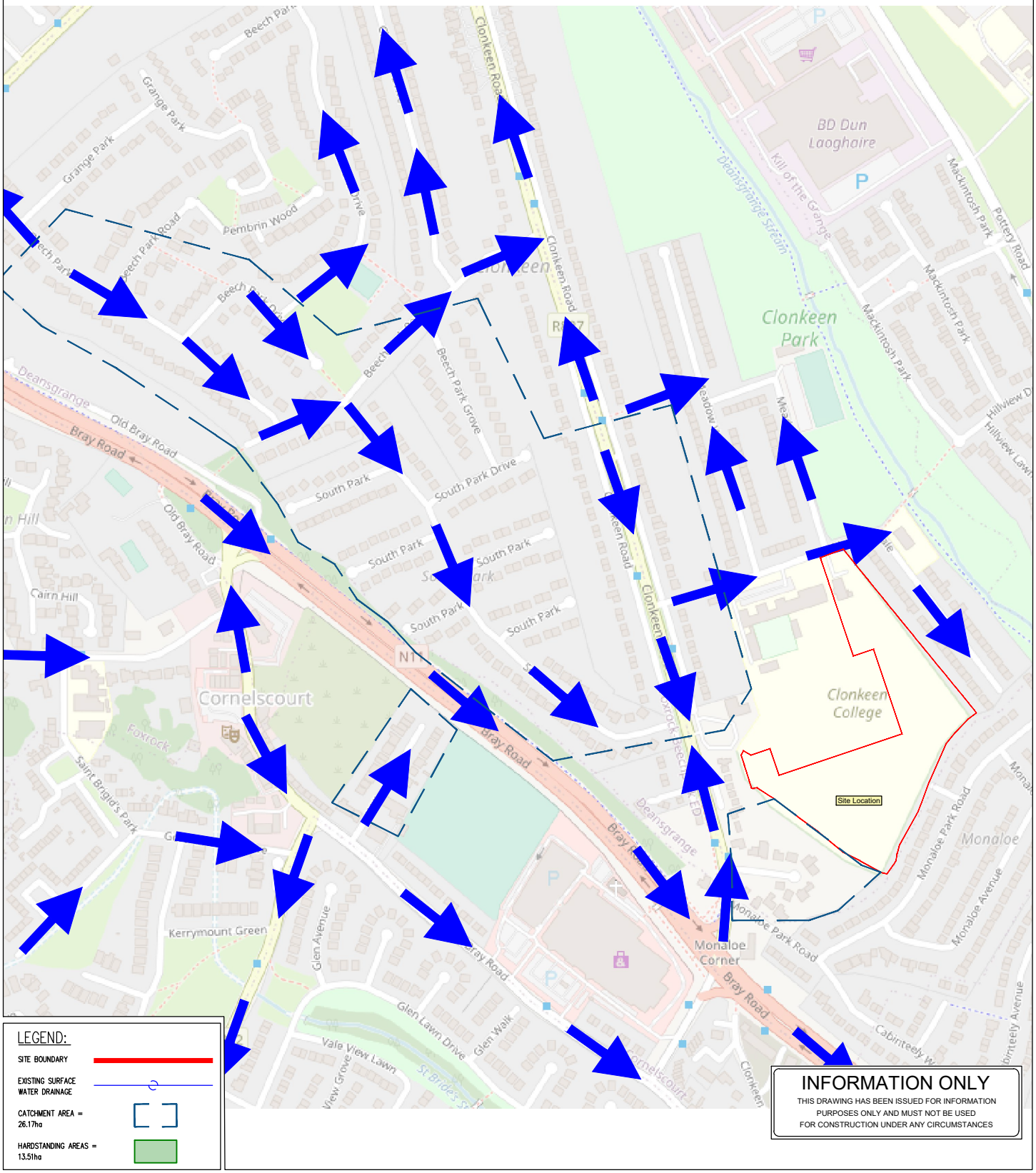
DUBLIN | LONDON | LIMERICK

Head Office
19-22 Dame Street, Dublin 2.
T: +353 (0)1 5480863
e: info@csconsulting.ie
w: www.csconsulting.ie

NSAI Certified

Quality	I.S. EN ISO 9001:2008
Environment	I.S. EN ISO 14001:2004
Energy	I.S. EN ISO 50001:2011
Health & Safety	OHSAS 18001:2007

Architect	Scott Tallon Walker			
Project	Proposed Development at Clonkeen Road			
Title	Drainage Ditch Assessment Drainage Catchment Area			
Drn by JMC	Chkd by RFM	Aprvd by RFM	Dwg. No. W012-SK01	Revision
Date Jun 2021	Scale			



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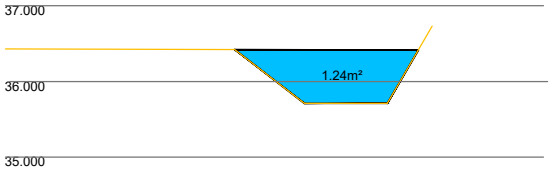
Environment	I.S. EN ISO 14001:2004
Energy	I.S. EN ISO 50001:2011
Health & Safety	OHSAS 18001:2007

Architect	Scott Tallon Walker			
Project	Proposed Development at Clonkeen Road			
Title	Overland Flow Routes Drainage Catchment Area			
Drn by JMC	Chkd by RFM	Aprvd by RFM	Dwg. No. W012-SK02	Revision
Date Jun 2021	Scale			



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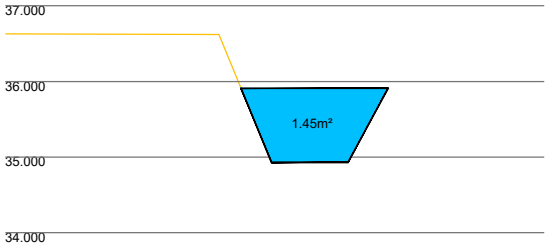

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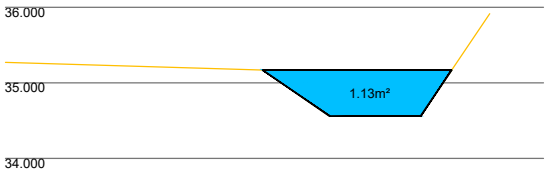

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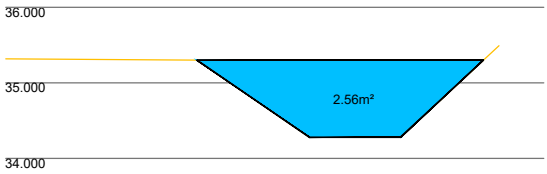

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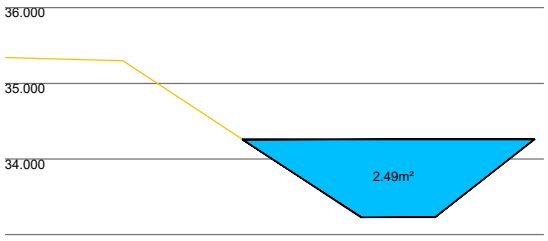

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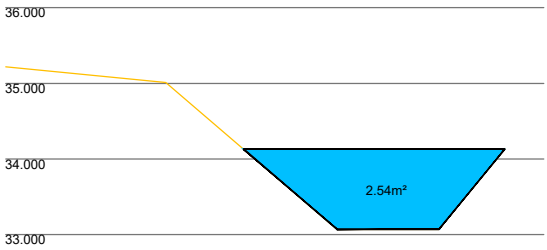

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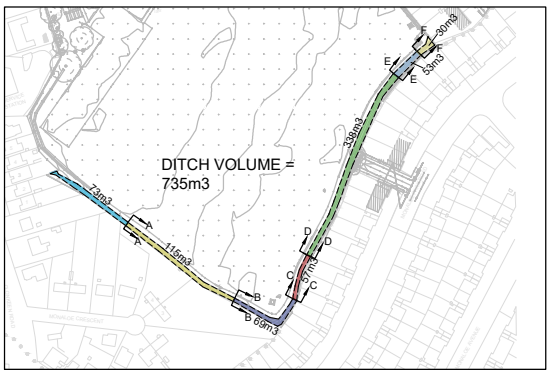

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Energy	I.S. EN ISO 50001:2011
Health & Safety	OHSAS 18001:2007

Architect	Scott Tallon Walker			
Project	Proposed Development at Clonkeen Road			
Title	Drainage Ditch Assessment Drainage Ditch Volume			
Drn by JMC	Chkd by RFM	Aprvd by RFM	Dwg. No. **W012-SK03**	Revision
Date Jun 2021	Scale			

Appendix F

WinDes Modelling Calculations

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	17.200	Add Flow / Climate Change (%)	0
Ratio R	0.300	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	77.284	1.984	39.0	0.904	5.00	0.0	0.600		o	225	Pipe/Conduit	
1.001	12.964	0.330	39.3	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.002	35.127	1.240	28.3	0.170	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.003	44.898	1.130	39.7	0.145	0.00	0.0	0.600		o	225	Pipe/Conduit	
2.000	60.773	2.830	21.5	0.040	5.00	0.0	0.600		o	225	Pipe/Conduit	
2.001	25.980	1.210	21.5	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
2.002	13.664	0.300	45.5	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.004	16.673	0.220	75.8	0.052	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.005	64.521	1.960	32.9	0.297	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.006	91.545	2.160	42.4	0.162	0.00	0.0	0.600		o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.61	49.854	0.904	0.0	0.0	0.0	2.10	83.6«	122.4
1.001	50.00	5.72	47.870	0.904	0.0	0.0	0.0	2.09	83.2«	122.4
1.002	50.00	5.95	47.540	1.074	0.0	0.0	0.0	2.47	98.1«	145.5
1.003	50.00	6.31	46.300	1.219	0.0	0.0	0.0	2.08	82.8«	165.1
2.000	50.00	5.36	49.510	0.040	0.0	0.0	0.0	2.84	112.8	5.4
2.001	50.00	5.51	46.680	0.040	0.0	0.0	0.0	2.84	112.8	5.4
2.002	50.00	5.63	45.470	0.040	0.0	0.0	0.0	1.94	77.3	5.4
1.004	50.00	6.47	45.170	1.311	0.0	0.0	0.0	1.81	127.8«	177.5
1.005	50.00	6.86	44.950	1.608	0.0	0.0	0.0	2.75	194.4«	217.8
1.006	50.00	7.49	42.990	1.770	0.0	0.0	0.0	2.42	171.2«	239.7

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
3.000	104.934	1.850	56.7	0.669	5.00	0.0	0.600		o	225	Pipe/Conduit	
3.001	63.803	2.800	22.8	0.402	0.00	0.0	0.600		o	225	Pipe/Conduit	
3.002	13.040	0.652	20.0	0.079	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.007	79.408	0.780	101.8	0.197	0.00	0.0	0.600		o	375	Pipe/Conduit	
1.008	26.085	0.210	124.2	0.093	0.00	0.0	0.600		o	375	Pipe/Conduit	
4.000	109.789	5.489	20.0	0.658	5.00	0.0	0.600		o	225	Pipe/Conduit	
1.009	45.145	0.650	69.5	0.194	0.00	0.0	0.600		o	375	Pipe/Conduit	
1.010	11.420	0.100	114.2	0.000	0.00	0.0	0.600		o	375	Pipe/Conduit	
5.000	86.488	0.450	192.2	0.533	5.00	0.0	0.600		o	225	Pipe/Conduit	
5.001	89.726	0.360	249.2	0.397	0.00	0.0	0.600		o	225	Pipe/Conduit	
6.000	38.926	0.740	52.6	0.174	5.00	0.0	0.600		o	150	Pipe/Conduit	
5.002	88.918	0.970	91.7	0.378	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.011	14.706	0.020	735.3	0.000	0.00	0.0	0.600		o	450	Pipe/Conduit	
1.012	69.005	0.200	345.0	0.659	0.00	0.0	0.600		o	450	Pipe/Conduit	
7.000	81.042	1.090	74.4	0.515	5.00	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	50.00	6.01	47.050	0.669	0.0	0.0	0.0	1.74	69.2«	90.6
3.001	50.00	6.39	45.200	1.072	0.0	0.0	0.0	2.75	109.5«	145.1
3.002	50.00	6.47	42.400	1.151	0.0	0.0	0.0	2.94	116.9«	155.9
1.007	50.00	8.22	40.830	3.118	0.0	0.0	0.0	1.80	198.3«	422.2
1.008	50.00	8.49	40.050	3.211	0.0	0.0	0.0	1.62	179.4«	434.8
4.000	50.00	5.62	46.380	0.658	0.0	0.0	0.0	2.94	116.9	89.1
1.009	50.00	8.84	39.840	4.064	0.0	0.0	0.0	2.18	240.4«	550.3
1.010	50.00	8.95	39.190	4.064	0.0	0.0	0.0	1.69	187.2«	550.3
5.000	50.00	6.53	40.870	0.533	0.0	0.0	0.0	0.94	37.4«	72.2
5.001	50.00	8.35	40.420	0.930	0.0	0.0	0.0	0.82	32.7«	126.0
6.000	50.00	5.47	40.800	0.174	0.0	0.0	0.0	1.39	24.6	23.5
5.002	50.00	9.43	40.060	1.482	0.0	0.0	0.0	1.37	54.3«	200.7
1.011	50.00	9.76	39.090	5.546	0.0	0.0	0.0	0.74	118.0«	751.0
1.012	47.97	10.82	38.980	6.205	0.0	0.0	0.0	1.09	173.2«	806.0
7.000	50.00	5.89	40.200	0.515	0.0	0.0	0.0	1.52	60.4«	69.7

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
7.001	23.827	0.330	72.2	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.013	41.140	0.140	293.9	0.234	0.00	0.0	0.600		o	450	Pipe/Conduit	
8.000	15.230	0.762	20.0	0.233	5.00	0.0	0.600		o	225	Pipe/Conduit	
8.001	52.036	1.850	28.1	0.222	0.00	0.0	0.600		o	225	Pipe/Conduit	
8.002	17.535	0.150	116.9	0.062	0.00	0.0	0.600		o	225	Pipe/Conduit	
8.003	61.711	2.180	28.3	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
8.004	66.510	0.399	166.7	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
8.005	43.790	1.640	26.7	0.184	0.00	0.0	0.600		o	225	Pipe/Conduit	
8.006	35.430	1.850	19.2	0.168	0.00	0.0	0.600		o	225	Pipe/Conduit	
8.007	14.334	1.060	13.5	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.014	45.215	0.370	122.2	0.155	0.00	0.0	0.600		o	600	Pipe/Conduit	
9.000	52.031	0.540	96.4	0.455	5.00	0.0	0.600		o	225	Pipe/Conduit	
1.015	22.834	0.120	190.3	0.085	0.00	0.0	0.600		o	600	Pipe/Conduit	
1.016	70.676	0.750	94.2	0.249	0.00	0.0	0.600		o	600	Pipe/Conduit	
1.017	80.780	0.390	207.1	0.433	0.00	0.0	0.600		o	600	Pipe/Conduit	
1.018	63.948	0.200	319.7	0.202	0.00	0.0	0.600		o	600	Pipe/Conduit	
10.000	29.867	0.260	114.9	0.272	5.00	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)
7.001	50.00	6.15	39.110	0.515	0.0	0.0	0.0	1.54	61.3«	69.7
1.013	46.72	11.40	38.780	6.954	0.0	0.0	0.0	1.18	187.8«	880.0
8.000	50.00	5.09	49.010	0.233	0.0	0.0	0.0	2.94	116.9	31.6
8.001	50.00	5.44	47.750	0.455	0.0	0.0	0.0	2.48	98.5	61.6
8.002	50.00	5.68	45.900	0.517	0.0	0.0	0.0	1.21	48.0«	70.0
8.003	50.00	6.10	45.750	0.517	0.0	0.0	0.0	2.47	98.2	70.0
8.004	50.00	7.19	43.570	0.517	0.0	0.0	0.0	1.01	40.2«	70.0
8.005	50.00	7.48	43.190	0.701	0.0	0.0	0.0	2.54	101.1	95.0
8.006	50.00	7.68	41.550	0.869	0.0	0.0	0.0	3.00	119.4	117.7
8.007	50.00	7.74	39.700	0.869	0.0	0.0	0.0	3.58	142.2	117.7
1.014	46.03	11.74	38.640	7.978	0.0	0.0	0.0	2.20	622.6«	994.5
9.000	50.00	5.65	38.810	0.455	0.0	0.0	0.0	1.33	53.0«	61.6
1.015	45.60	11.96	38.270	8.518	0.0	0.0	0.0	1.76	498.2«	1052.0
1.016	44.71	12.43	38.150	8.768	0.0	0.0	0.0	2.51	709.4«	1061.5
1.017	43.28	13.23	37.400	9.200	0.0	0.0	0.0	1.69	477.4«	1078.4
1.018	41.98	14.01	37.010	9.402	0.0	0.0	0.0	1.36	383.5«	1078.4
10.000	50.00	5.41	37.720	0.272	0.0	0.0	0.0	1.22	48.5	36.9

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
10.001	7.192	0.070	102.7	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
10.002	67.269	0.580	116.0	0.245	0.00	0.0	0.600		o	225	Pipe/Conduit	
11.000	91.833	0.530	173.3	0.624	5.00	0.0	0.600		o	225	Pipe/Conduit	
12.000	67.010	0.370	181.1	0.000	5.00	0.0	0.600		o	225	Pipe/Conduit	
12.001	23.917	0.160	149.5	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
11.001	89.469	0.230	389.0	0.372	0.00	0.0	0.600		o	225	Pipe/Conduit	
11.002	89.890	0.480	187.3	0.378	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.019	6.458	0.010	645.8	0.000	0.00	0.0	0.600		o	750	Pipe/Conduit	
1.020	41.809	0.100	418.1	0.100	0.00	0.0	0.600		o	750	Pipe/Conduit	
13.000	90.689	0.280	323.9	0.461	5.00	0.0	0.600		o	225	Pipe/Conduit	
13.001	93.659	0.350	267.6	0.370	0.00	0.0	0.600		o	225	Pipe/Conduit	
13.002	81.236	0.100	812.4	0.280	0.00	0.0	0.600		o	225	Pipe/Conduit	
13.003	19.956	0.060	332.6	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
13.004	68.848	0.220	312.9	0.282	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.021	15.121	0.120	126.0	0.000	0.00	0.0	0.600		o	750	Pipe/Conduit	
14.000	25.408	0.317	80.2	0.211	5.00	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)
10.001	50.00	5.50	37.460	0.272	0.0	0.0	0.0	1.29	51.3	36.9
10.002	50.00	6.43	37.390	0.517	0.0	0.0	0.0	1.21	48.2«	70.0
11.000	50.00	6.55	38.050	0.624	0.0	0.0	0.0	0.99	39.4«	84.6
12.000	50.00	6.15	38.050	0.000	0.0	0.0	0.0	0.97	38.5	0.0
12.001	50.00	6.53	37.680	0.000	0.0	0.0	0.0	1.07	42.4	0.0
11.001	50.00	8.82	37.520	0.996	0.0	0.0	0.0	0.66	26.1«	134.9
11.002	48.94	10.39	37.290	1.374	0.0	0.0	0.0	0.95	37.9«	182.1
1.019	41.82	14.11	36.810	11.294	0.0	0.0	0.0	1.09	483.2«	1279.3
1.020	41.04	14.62	36.800	11.394	0.0	0.0	0.0	1.36	601.8«	1279.3
13.000	50.00	7.10	37.710	0.461	0.0	0.0	0.0	0.72	28.7«	62.4
13.001	50.00	9.06	37.430	0.830	0.0	0.0	0.0	0.79	31.6«	112.4
13.002	45.40	12.06	37.080	1.110	0.0	0.0	0.0	0.45	17.9«	136.5
13.003	44.52	12.53	36.980	1.110	0.0	0.0	0.0	0.71	28.3«	136.5
13.004	41.85	14.09	36.920	1.392	0.0	0.0	0.0	0.73	29.2«	157.8
1.021	40.88	14.72	36.700	12.786	0.0	0.0	0.0	2.49	1100.8«	1415.7
14.000	50.00	5.29	37.217	0.211	0.0	0.0	0.0	1.46	58.1	28.6

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
14.001	5.141	0.150	34.3	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
14.002	4.676	0.070	66.8	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
14.003	15.872	0.200	79.4	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.022	19.882	0.090	220.9	0.000	0.00	0.0	0.600		o	750	Pipe/Conduit	
1.023	12.024	0.060	200.4	0.000	0.00	0.0	0.600		o	750	Pipe/Conduit	
1.024	32.320	0.150	215.5	0.000	0.00	0.0	0.600		o	750	Pipe/Conduit	
1.025	17.255	0.230	75.0	0.000	0.00	0.0		0.030	\/	31	Pipe/Conduit	
1.026	41.421	0.310	133.6	0.000	0.00	0.0		0.030	\/	31	Pipe/Conduit	
1.027	28.828	0.190	151.7	0.000	0.00	0.0		0.030	\/	31	Pipe/Conduit	
1.028	35.505	0.490	72.5	0.000	0.00	0.0		0.030	\/	31	Pipe/Conduit	
1.029	22.742	0.100	227.4	0.000	0.00	0.0		0.030	\/	31	Pipe/Conduit	
1.030	26.662	0.250	106.6	0.000	0.00	0.0		0.030	\/	31	Pipe/Conduit	
1.031	7.369	0.170	43.3	0.000	0.00	0.0		0.030	\/	31	Pipe/Conduit	
1.032	13.189	0.040	329.7	0.000	0.00	0.0		0.030	\/	31	Pipe/Conduit	
1.033	5.383	0.110	48.9	0.000	0.00	0.0		0.030	\/	31	Pipe/Conduit	
1.034	8.605	0.001	8605.0	0.000	0.00	0.0		0.030	\/	31	Pipe/Conduit	
1.035	10.867	0.250	43.5	0.000	0.00	0.0		0.030	\/	31	Pipe/Conduit	
1.036	10.525	0.060	175.4	0.000	0.00	0.0		0.030	\/	31	Pipe/Conduit	
1.037	30.836	0.200	154.2	0.000	0.00	0.0		0.030	\/	31	Pipe/Conduit	
1.038	9.914	0.010	991.4	0.000	0.00	3.3		0.030	\/	31	Pipe/Conduit	
1.039	75.817	0.230	329.6	0.000	0.00	0.0		0.030	\/	31	Pipe/Conduit	
1.040	16.224	0.610	26.6	0.000	0.00	0.0		0.030	\/	31	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
14.001	50.00	5.33	36.900	0.211	0.0	0.0	0.0	2.24	89.2	28.6
14.002	50.00	5.38	36.850	0.211	0.0	0.0	0.0	1.60	63.7	28.6
14.003	50.00	5.56	36.780	0.211	0.0	0.0	0.0	1.47	58.4	28.6
1.022	40.62	14.90	36.580	12.997	0.0	0.0	0.0	1.88	830.0«	1429.9
1.023	40.47	15.00	36.490	12.997	0.0	0.0	0.0	1.97	871.8«	1429.9
1.024	40.07	15.28	36.430	12.997	0.0	0.0	0.0	1.90	840.5«	1429.9
1.025	39.92	15.39	36.280	12.997	0.0	0.0	0.0	2.75	7321.8	1429.9
1.026	39.45	15.72	36.020	12.997	0.0	0.0	0.0	2.06	5486.4	1429.9
1.027	39.12	15.97	35.710	12.997	0.0	0.0	0.0	1.93	5148.5	1429.9
1.028	38.84	16.18	35.520	12.997	0.0	0.0	0.0	2.80	7450.2	1429.9
1.029	38.52	16.42	35.030	12.997	0.0	0.0	0.0	1.58	4205.3	1429.9
1.030	38.28	16.62	34.930	12.997	0.0	0.0	0.0	2.31	6141.0	1429.9
1.031	38.23	16.65	34.680	12.997	0.0	0.0	0.0	3.62	9632.4	1429.9
1.032	38.02	16.82	34.510	12.997	0.0	0.0	0.0	1.31	3492.5	1429.9
1.033	37.99	16.85	34.670	12.997	0.0	0.0	0.0	3.40	9065.6	1429.9
1.034	37.31	17.40	34.560	12.997	0.0	0.0	0.0	0.26	683.7«	1429.9
1.035	37.25	17.45	34.559	12.997	0.0	0.0	0.0	3.61	9619.0	1429.9
1.036	37.13	17.55	34.340	12.997	0.0	0.0	0.0	1.80	4788.3	1429.9
1.037	36.82	17.82	34.280	12.997	0.0	0.0	0.0	1.92	5107.4	1429.9
1.038	36.57	18.04	34.080	12.997	3.3	0.0	0.0	0.76	2014.1	1429.9
1.039	35.52	19.00	34.070	12.997	3.3	0.0	0.0	1.31	3493.0	1429.9
1.040	35.45	19.06	33.840	12.997	3.3	0.0	0.0	4.62	12297.0	1429.9

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.041	21.679	0.160	135.5	0.000	0.00	3.3	0.030		\/	31	Pipe/Conduit	
1.042	10.844	0.280	38.7	0.000	0.00	0.0	0.030		\/	31	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)
1.041	35.27	19.24	33.230	12.997	6.6	0.0	0.0	2.05	5448.2	1429.9
1.042	35.22	19.29	33.070	12.997	6.6	0.0	0.0	3.83	10190.6	1429.9

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	120
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	2

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	5	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	17.200	Storm Duration (mins)	60
Ratio R	0.300		

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.300
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	17.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100, 1000
Climate Change (%)	0, 0, 20, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	30 Winter	1000	+20%	1/15 Summer	30/15 Summer			54.460
1.001	2	120 Winter	1000	+20%	1/15 Summer	30/15 Summer			49.390
1.002	3	120 Winter	1000	+20%	1/15 Summer	30/15 Summer			48.701
1.003	4	60 Winter	1000	+20%	1/15 Summer	30/15 Summer			47.459
2.000	5	15 Winter	1000	+20%					49.586
2.001	6	15 Winter	1000	+20%					46.758
2.002	7	15 Winter	1000	+20%	30/15 Summer				46.476
1.004	5	30 Winter	1000	+20%	30/15 Summer	100/15 Summer			46.435
1.005	6	30 Winter	1000	+20%	30/15 Summer	100/15 Summer			46.290
1.006	7	60 Winter	1000	+20%	1/15 Summer	30/15 Summer			44.900
3.000	11	30 Winter	1000	+20%	1/15 Summer	30/15 Summer			48.349
3.001	12	60 Winter	1000	+20%	30/15 Summer	30/15 Summer			46.266
3.002	13	180 Winter	1000	+20%	1/15 Summer	1/15 Winter			43.784
1.007	8	180 Winter	1000	+20%	1/15 Summer	100/15 Summer			43.550
1.008	9	180 Winter	1000	+20%	1/15 Summer	30/15 Summer			42.799
4.000	16	30 Winter	1000	+20%	30/15 Summer	100/15 Summer			47.593
1.009	10	120 Winter	1000	+20%	1/15 Summer	30/15 Summer			42.562
1.010	11	120 Winter	1000	+20%	1/15 Summer	30/15 Summer			41.933
5.000	19	120 Winter	1000	+20%	1/15 Summer	30/15 Summer			42.807
5.001	20	30 Winter	1000	+20%	1/15 Summer	30/15 Summer			43.109
6.000	21	240 Winter	1000	+20%	1/15 Summer	1/30 Winter			42.010
5.002	21	120 Winter	1000	+20%	1/15 Summer	30/15 Summer			42.143
1.011	12	30 Winter	1000	+20%	1/15 Summer	30/30 Summer			41.728

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

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
1.000	1	4.381	180.086	1.61			130.6	FLOOD	22
1.001	2	1.295	70.297	1.51			108.3	FLOOD	27
1.002	3	0.936	151.851	1.00			92.6	FLOOD	35
1.003	4	0.934	99.143	1.28			101.0	FLOOD	39
2.000	5	-0.149	0.000	0.25			26.9	OK	
2.001	6	-0.147	0.000	0.26			26.8	OK	
2.002	7	0.781	0.000	0.40			27.0	FLOOD RISK	
1.004	5	0.965	14.752	1.28			139.6	FLOOD	13
1.005	6	1.040	39.533	0.86			160.0	FLOOD	14
1.006	7	1.610	119.968	0.81			134.7	FLOOD	39
3.000	11	1.074	158.629	1.06			72.0	FLOOD	28
3.001	12	0.841	105.681	1.00			105.5	FLOOD	30
3.002	13	1.159	444.899	1.52			153.7	FLOOD	51
1.007	8	2.345	19.821	1.01			190.9	FLOOD	9
1.008	9	2.374	168.539	1.31			204.1	FLOOD	40
4.000	16	0.988	112.970	0.97			111.2	FLOOD	15
1.009	10	2.347	263.612	1.26			277.4	FLOOD	47
1.010	11	2.368	183.925	2.33			288.5	FLOOD	38
5.000	19	1.712	327.100	1.24			45.3	FLOOD	54
5.001	20	2.464	58.687	1.72			55.1	FLOOD	18
6.000	21	1.060	210.061	1.51			35.8	FLOOD	56
5.002	21	1.858	202.572	1.49			79.2	FLOOD	48
1.011	12	2.188	77.856	5.34			307.2	FLOOD	21

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.012	13	30 Winter	1000	+20%	1/15 Summer	100/15 Summer			41.693
7.000	25	60 Winter	1000	+20%	1/15 Winter	30/15 Summer			41.328
7.001	26	60 Winter	1000	+20%	1/15 Summer	30/15 Winter			41.030
1.013	14	15 Winter	1000	+20%	1/15 Summer	1000/15 Summer			41.335
8.000	28	15 Winter	1000	+20%	30/15 Winter	1000/15 Summer			50.537
8.001	29	30 Winter	1000	+20%	30/15 Summer	100/15 Summer			49.633
8.002	29	60 Winter	1000	+20%	1/15 Summer	30/15 Winter			47.810
8.003	30	60 Winter	1000	+20%	30/15 Summer	30/15 Winter			47.299
8.004	31	15 Winter	1000	+20%	1/15 Summer	1000/15 Summer			47.100
8.005	28	15 Winter	1000	+20%	30/15 Summer	1000/15 Summer			46.795
8.006	29	30 Winter	1000	+20%	30/15 Summer	100/15 Summer			43.848
8.007	30	30 Winter	1000	+20%	30/15 Summer	100/15 Summer			41.418
1.014	15	15 Summer	1000	+20%	30/15 Summer				41.116
9.000	32	120 Winter	1000	+20%	1/15 Summer	30/15 Summer			40.008
1.015	16	15 Winter	1000	+20%	1/15 Summer	1000/15 Summer			40.743
1.016	17	15 Winter	1000	+20%	30/15 Summer	1000/15 Summer			40.623
1.017	18	15 Winter	1000	+20%	1/15 Summer	1000/15 Summer			40.164
1.018	19	30 Winter	1000	+20%	1/15 Summer	1000/15 Summer			38.931
10.000	37	30 Winter	1000	+20%	30/15 Summer	100/15 Summer			38.962
10.001	38	60 Winter	1000	+20%	1/15 Summer	30/15 Summer			38.370
10.002	39	120 Winter	1000	+20%	1/15 Summer	30/15 Summer			38.319
11.000	40	60 Winter	1000	+20%	1/15 Summer	30/15 Summer			39.766
12.000	41	180 Winter	1000	+20%	1/15 Summer				38.840
12.001	42	240 Winter	1000	+20%	1/15 Summer	1000/180 Winter			38.840
11.001	41	240 Winter	1000	+20%	1/15 Summer	1/15 Summer			38.841
11.002	42	120 Winter	1000	+20%	1/15 Summer	30/15 Summer			38.494
1.019	20	60 Winter	1000	+20%	1/30 Summer	30/15 Summer			38.082
1.020	21	60 Winter	1000	+20%	30/15 Summer				37.935
13.000	47	60 Winter	1000	+20%	1/15 Summer	30/15 Summer			38.927
13.001	48	240 Winter	1000	+20%	1/15 Summer	1/15 Winter			38.556
13.002	49	360 Winter	1000	+20%	1/15 Summer	1/15 Summer			38.203
13.003	50	240 Winter	1000	+20%	1/15 Summer	30/15 Summer			37.942
13.004	51	30 Winter	1000	+20%	1/15 Summer	30/15 Summer			37.926
1.021	22	60 Winter	1000	+20%	30/15 Summer				37.768
14.000	53	30 Winter	1000	+20%	30/15 Summer	100/15 Winter			37.972
14.001	54	15 Summer	1000	+20%	1/15 Winter				37.832
14.002	55	15 Summer	1000	+20%	1/15 Summer				37.757
14.003	56	60 Winter	1000	+20%	1/15 Summer				37.687
1.022	23	60 Winter	1000	+20%	30/15 Summer				37.589
1.023	24	60 Winter	1000	+20%	30/15 Summer				37.390
1.024	25	15 Summer	1000	+20%	30/15 Winter				37.194
1.025	60	60 Winter	1000	+20%					36.652
1.026	61	60 Winter	1000	+20%					36.426
1.027	62	60 Winter	1000	+20%					36.130
1.028	63	60 Winter	1000	+20%					35.864
1.029	64	60 Winter	1000	+20%					35.498
1.030	65	60 Winter	1000	+20%					35.313
1.031	66	60 Winter	1000	+20%					35.119
1.032	67	60 Winter	1000	+20%					35.113
1.033	68	60 Winter	1000	+20%					35.086
1.034	69	60 Winter	1000	+20%					35.080

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

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
1.012	13	2.263	83.206	2.14			344.8	FLOOD	15
7.000	25	0.903	167.607	0.89			52.1	FLOOD	39
7.001	26	1.695	60.273	1.41			79.6	FLOOD	22
1.013	14	2.105	15.113	2.31			386.5	FLOOD	4
8.000	28	1.302	6.902	1.11			114.3	FLOOD	4
8.001	29	1.658	63.210	1.00			94.5	FLOOD	14
8.002	29	1.685	50.073	1.91			82.0	FLOOD	18
8.003	30	1.324	39.003	0.92			87.5	FLOOD	19
8.004	31	3.305	0.141	2.25			87.7	FLOOD	2
8.005	28	3.380	4.638	1.35			129.6	FLOOD	4
8.006	29	2.073	37.596	1.15			129.1	FLOOD	15
8.007	30	1.493	28.010	1.11			138.4	FLOOD	17
1.014	15	1.876	0.000	0.99			532.7	FLOOD RISK	
9.000	32	0.973	278.731	1.29			65.5	FLOOD	41
1.015	16	1.873	22.608	1.53			532.0	FLOOD	4
1.016	17	1.873	3.369	0.90			577.1	FLOOD	3
1.017	18	2.164	4.377	1.78			781.0	FLOOD	3
1.018	19	1.321	30.902	2.25			777.3	FLOOD	6
10.000	37	1.017	32.424	1.54			69.9	FLOOD	12
10.001	38	0.685	40.157	1.37			51.2	FLOOD	20
10.002	39	0.704	139.379	1.02			47.5	FLOOD	41
11.000	40	1.491	166.163	1.48			57.1	FLOOD	34
12.000	41	0.565	0.000	0.00			0.1	SURCHARGED	
12.001	42	0.935	0.114	0.19			7.3	FLOOD	2
11.001	41	1.096	451.382	1.82			46.4	FLOOD	74
11.002	42	0.979	154.031	1.59			58.8	FLOOD	48
1.019	20	0.522	241.791	1.97			638.8	FLOOD	47
1.020	21	0.385	0.000	1.29			639.2	FLOOD RISK	
13.000	47	0.992	136.563	1.27			35.6	FLOOD	41
13.001	48	0.901	235.713	1.07			33.2	FLOOD	63
13.002	49	0.898	292.795	2.38			41.5	FLOOD	77
13.003	50	0.737	162.288	1.93			49.4	FLOOD	55
13.004	51	0.781	45.844	1.69			47.7	FLOOD	25
1.021	22	0.318	0.000	1.09			663.8	FLOOD RISK	
14.000	53	0.530	32.191	0.89			48.0	FLOOD	14
14.001	54	0.707	0.000	1.02			55.8	FLOOD RISK	
14.002	55	0.682	0.000	1.42			53.0	FLOOD RISK	
14.003	56	0.682	0.000	0.73			37.8	SURCHARGED	
1.022	23	0.259	0.000	1.19			696.7	SURCHARGED	
1.023	24	0.150	0.000	1.31			697.0	SURCHARGED	
1.024	25	0.014	0.000	1.12			676.6	SURCHARGED	
1.025	60	-0.835	0.000	0.13			697.3	OK	
1.026	61	-0.801	0.000	0.13			696.8	OK	
1.027	62	-0.787	0.000	0.14			696.7	OK	
1.028	63	-0.863	0.000	0.11			697.1	OK	
1.029	64	-0.739	0.000	0.17			697.1	OK	
1.030	65	-0.824	0.000	0.11			696.9	OK	
1.031	66	-0.768	0.000	0.11			696.1	OK	
1.032	67	-0.604	0.000	0.21			696.2	OK	
1.033	68	-0.791	0.000	0.11			696.5	OK	

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

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
1.034	69	-0.687	0.000	0.27			696.6	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.035	70	60 Winter	1000	+20%					34.850	-0.916
1.036	71	60 Winter	1000	+20%					34.776	-0.771
1.037	72	60 Winter	1000	+20%					34.714	-0.773
1.038	73	60 Winter	1000	+20%					34.623	-0.664
1.039	74	60 Winter	1000	+20%					34.591	-0.686
1.040	75	60 Winter	1000	+20%					34.089	-0.958
1.041	76	60 Winter	1000	+20%					33.639	-0.798
1.042	77	60 Winter	1000	+20%					33.352	-0.925

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.035	70	0.000	0.11			696.7	OK	
1.036	71	0.000	0.15			696.6	OK	
1.037	72	0.000	0.14			696.3	OK	
1.038	73	0.000	0.32			699.1	OK	
1.039	74	0.000	0.20			699.1	OK	
1.040	75	0.000	0.09			698.7	OK	
1.041	76	0.000	0.13			701.9	OK	
1.042	77	0.000	0.11			702.1	OK	

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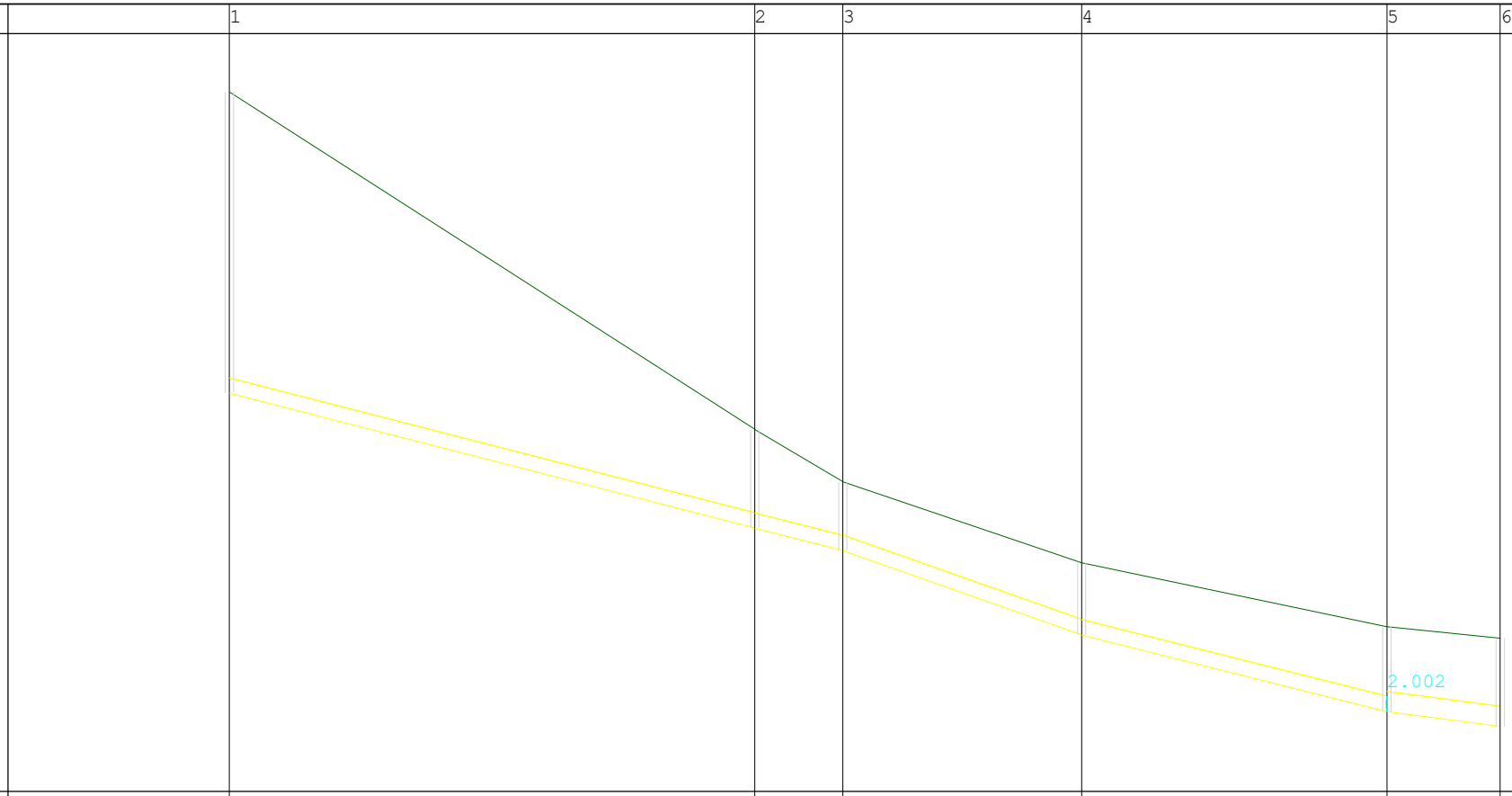

Hor Scale 1000

Ver Scale 100

Datum (m) 44.000

MH Name		1	2	3	4	5	6
PN		1.000	1.001	1.002	1.003	1.004	
Dia (mm)		225	225	225	225	300	
Slope (1:X)		39.0	39.3	28.3	39.7	75.8	
Cover Level (m)		54.280	49.320	48.550	47.360	46.420	46.250
Invert Level (m)		49.854	47.870 / 47.870	47.540 / 47.540	46.300 / 46.300	45.170 / 45.170	44.950
Length (m)		77.284	12.964	35.127	44.898	16.673	

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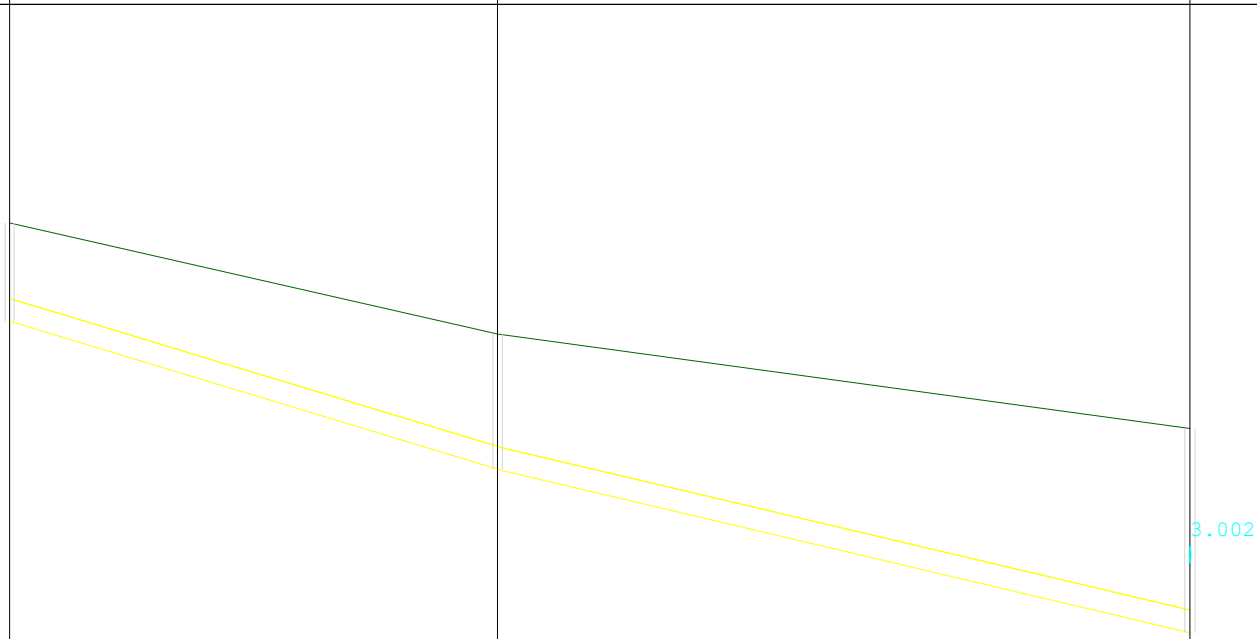
MH Name		6	7	8
Hor Scale 1000 Ver Scale 100 Datum (m) 38.000				
PN		1.005	1.006	
Dia (mm)		300	300	
Slope (1:X)		32.9	42.4	
Cover Level (m)		46.250	44.780	43.530
Invert Level (m)		44.950	42.990 / 42.990	40.830
Length (m)		64.521	91.545	

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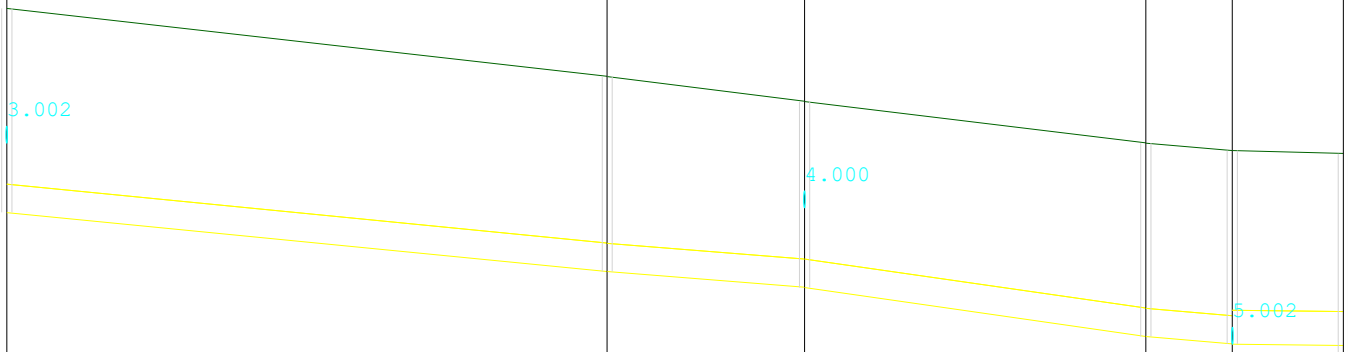

Hor Scale 1000

Ver Scale 100

Datum (m) 36.000

MH Name		8	9	10		12	13
PN		1.007	1.008	1.009		1.011	
Dia (mm)		375	375	375		450	
Slope (1:X)		101.8	124.2	69.5		735.3	
Cover Level (m)		43.530	42.630	42.300	41.750	41.650	41.610
Invert Level (m)		40.830	40.050 / 40.050	39.840 / 39.840	39.190 / 39.190	39.090 / 39.090	39.070
Length (m)		79.408	26.085	45.145		14.706	

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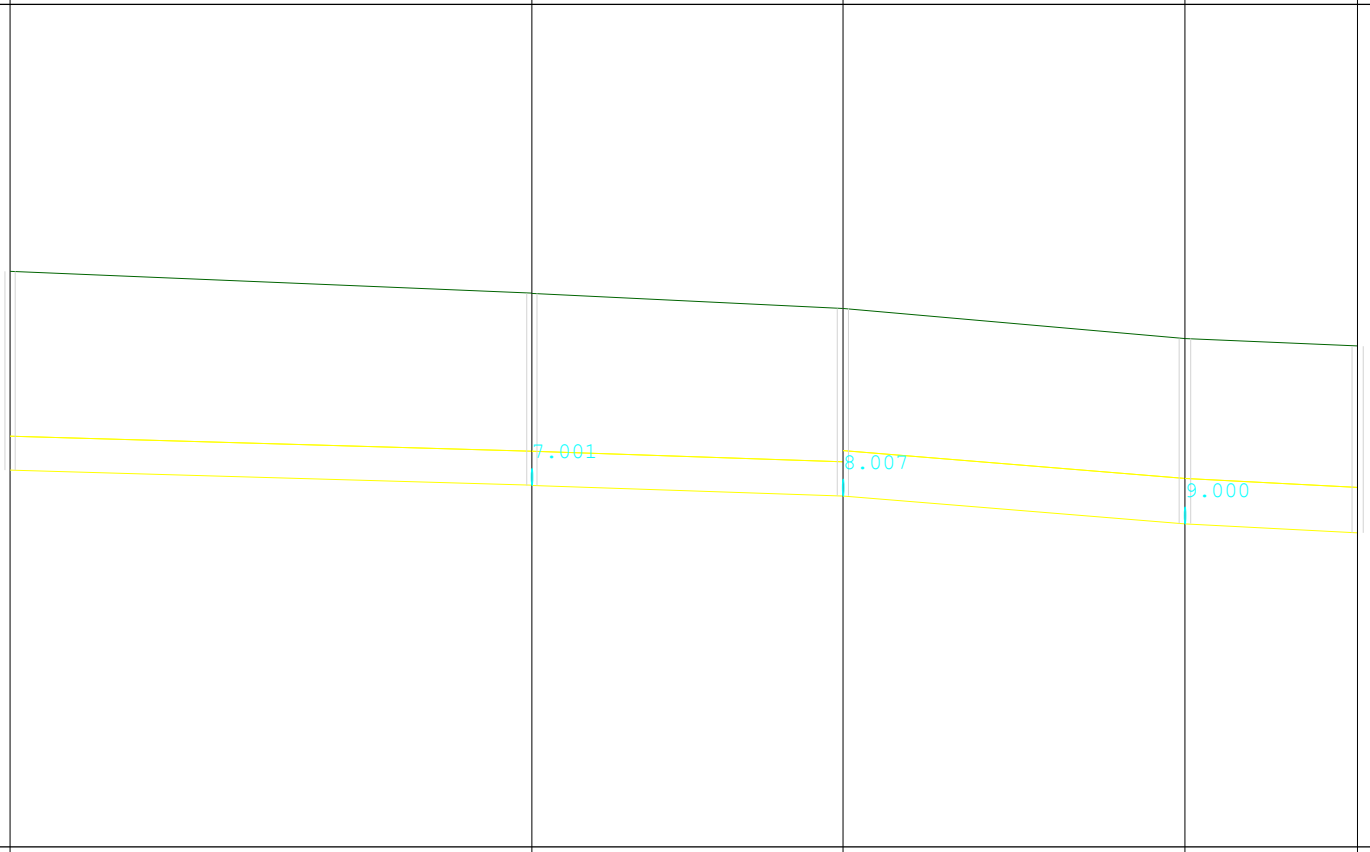

Hor Scale 1000

Ver Scale 100

Datum (m) 34.000

MH Name		13	14	15	16	17
PN		1.012	1.013	1.014	1.015	
Dia (mm)		450	450	600	600	
Slope (1:X)		345.0	293.9	122.2	190.3	
Cover Level (m)		41.610	41.320	41.120	40.720	40.620
Invert Level (m)		38.980	38.780 / 38.780	38.640 / 38.640	38.270 / 38.270	38.150
Length (m)		69.005	41.140	45.215	22.834	

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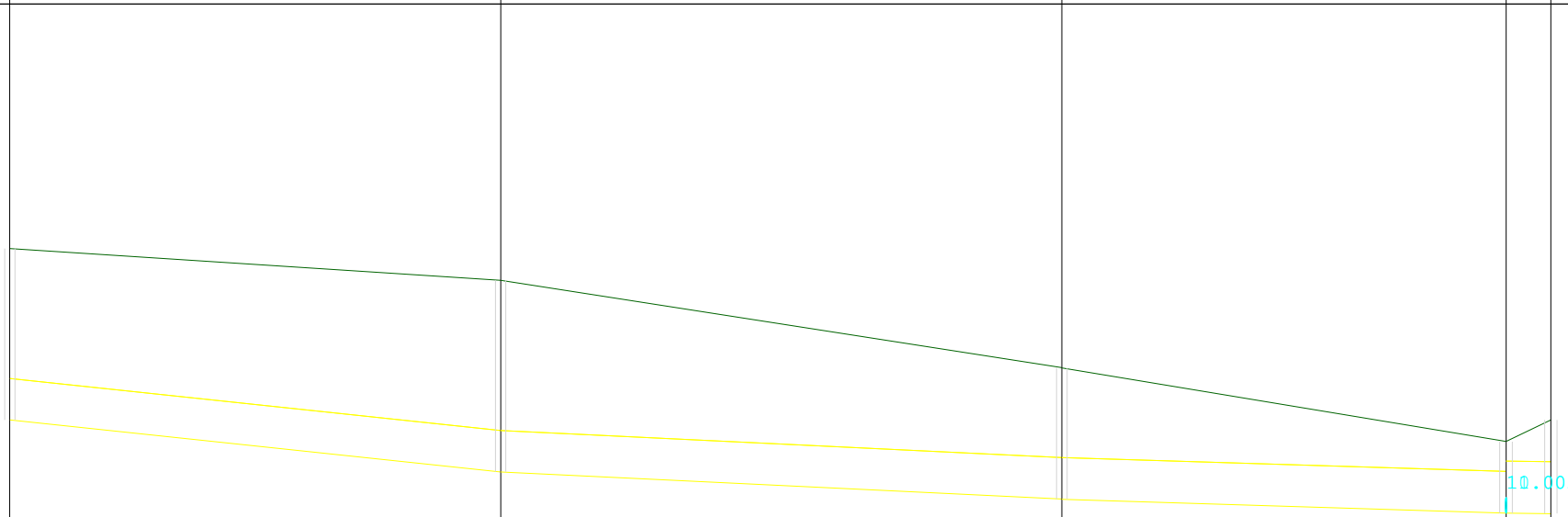

Hor Scale 1000

Ver Scale 100

Datum (m) 33.000

MH Name		17	18	19		21
PN		1.016	1.017	1.018		
Dia (mm)		600	600	600		
Slope (1:X)		94.2	207.1	319.7		
Cover Level (m)		40.620	40.160	38.900	37.840	38.150
Invert Level (m)		38.150	37.400 / 37.400	37.010 / 37.010	36.810	36.810
Length (m)		70.676	80.780	63.948		

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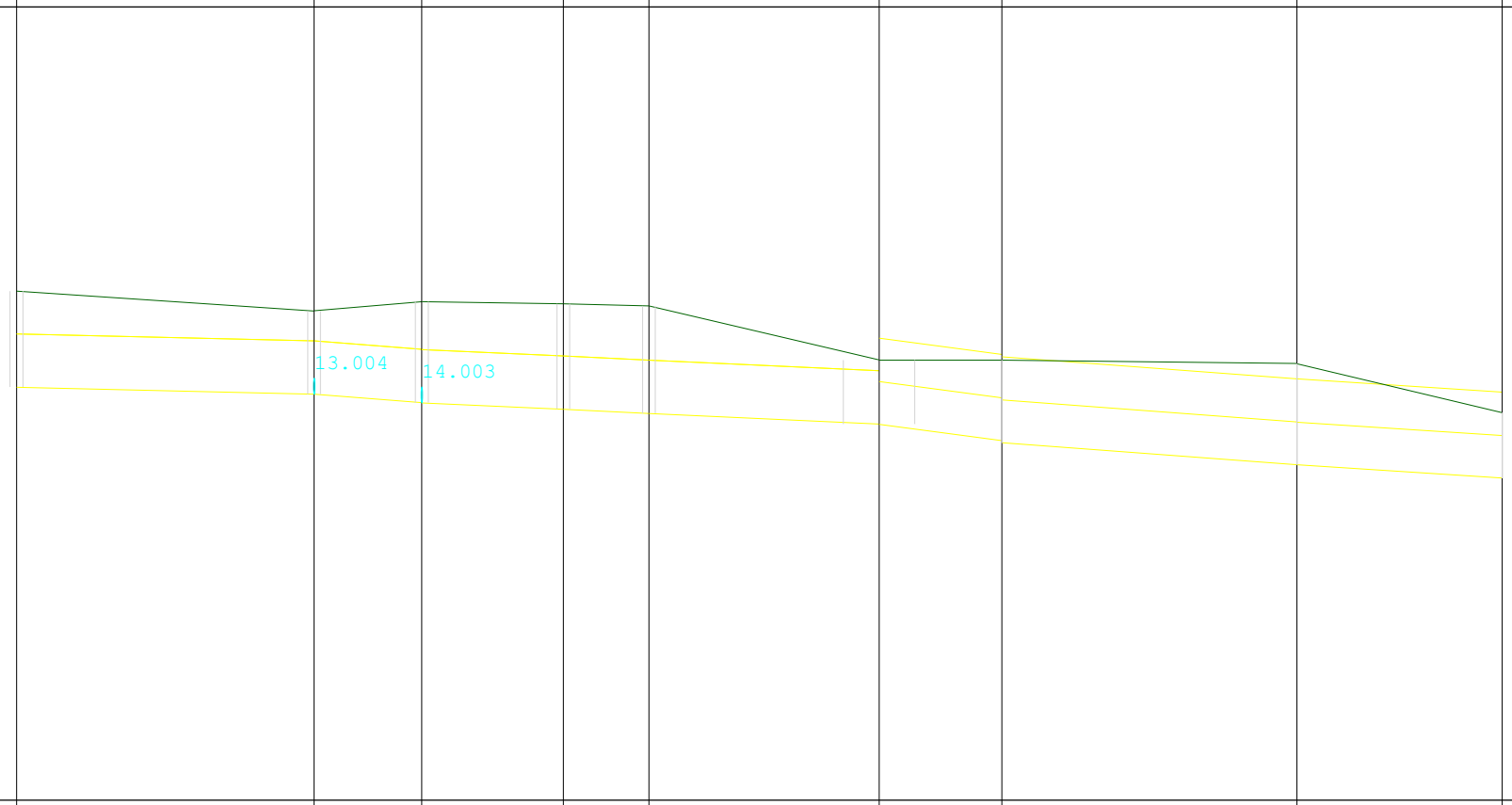

Hor Scale 1000

Ver Scale 100

Datum (m) 31.000

MH Name		21	22	23		25	60	61	62	63
PN		1.020	1.021	1.022		1.024	1.025	1.026	1.027	
Dia (mm)		750	750	750		750	31	31	31	
Slope (1:X)		418.1	126.0	220.9		215.5	75.0	133.6	151.7	
Cover Level (m)		38.150	37.870	38.000	37.970	37.940	37.180	37.180	37.130	36.440
Invert Level (m)		36.800	36.700 / 36.700	36.580 / 36.580	36.490 / 36.490	36.430 / 36.430	36.280 / 36.280	36.050 / 36.020	35.710 / 35.710	35.520
Length (m)		41.809	15.121	19.882		32.320	17.255	41.421	28.828	

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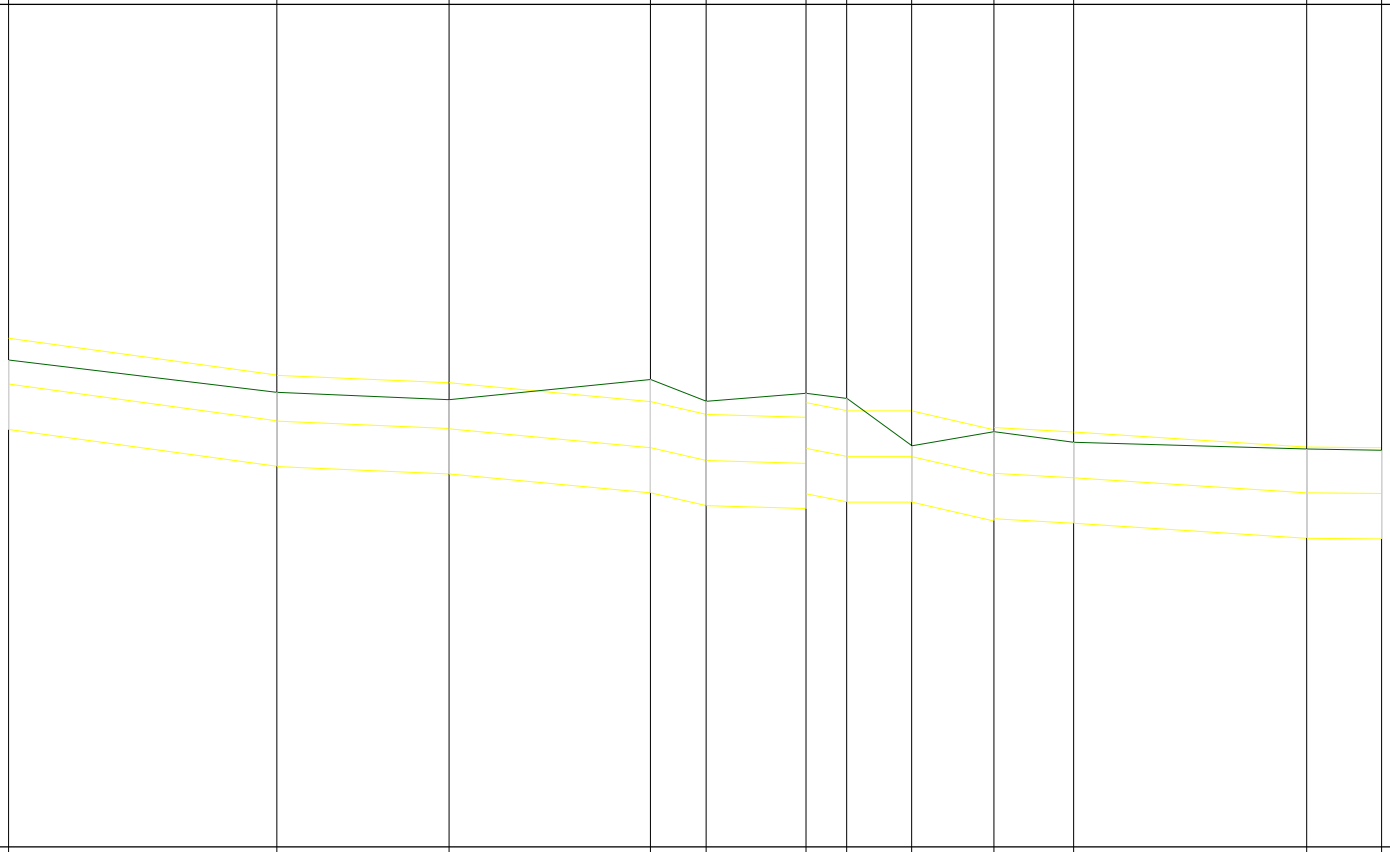

MH Name		63	64	65		67					72		74
Hor Scale 1000 Ver Scale 100 Datum (m) 30.000													
PN		1.028	1.029	1.030		1.032					1.037		
Dia (mm)		31	31	31		31					31		
Slope (1:X)		72.5	227.4	106.6		329.7					154.2		
Cover Level (m)		36.440	36.010	35.910	36.180	35.890	36.000	35.930	35.300	35.490	35.350	35.260	35.240
Invert Level (m)		35.520 35.030	35.030 34.930	34.930 34.680	34.680 34.510	34.510 34.470	34.670	34.560 34.559	34.559 34.309	34.340 34.280	34.280 34.080	34.080 34.070	
Length (m)		35.505	22.742	26.662		13.189					30.836		

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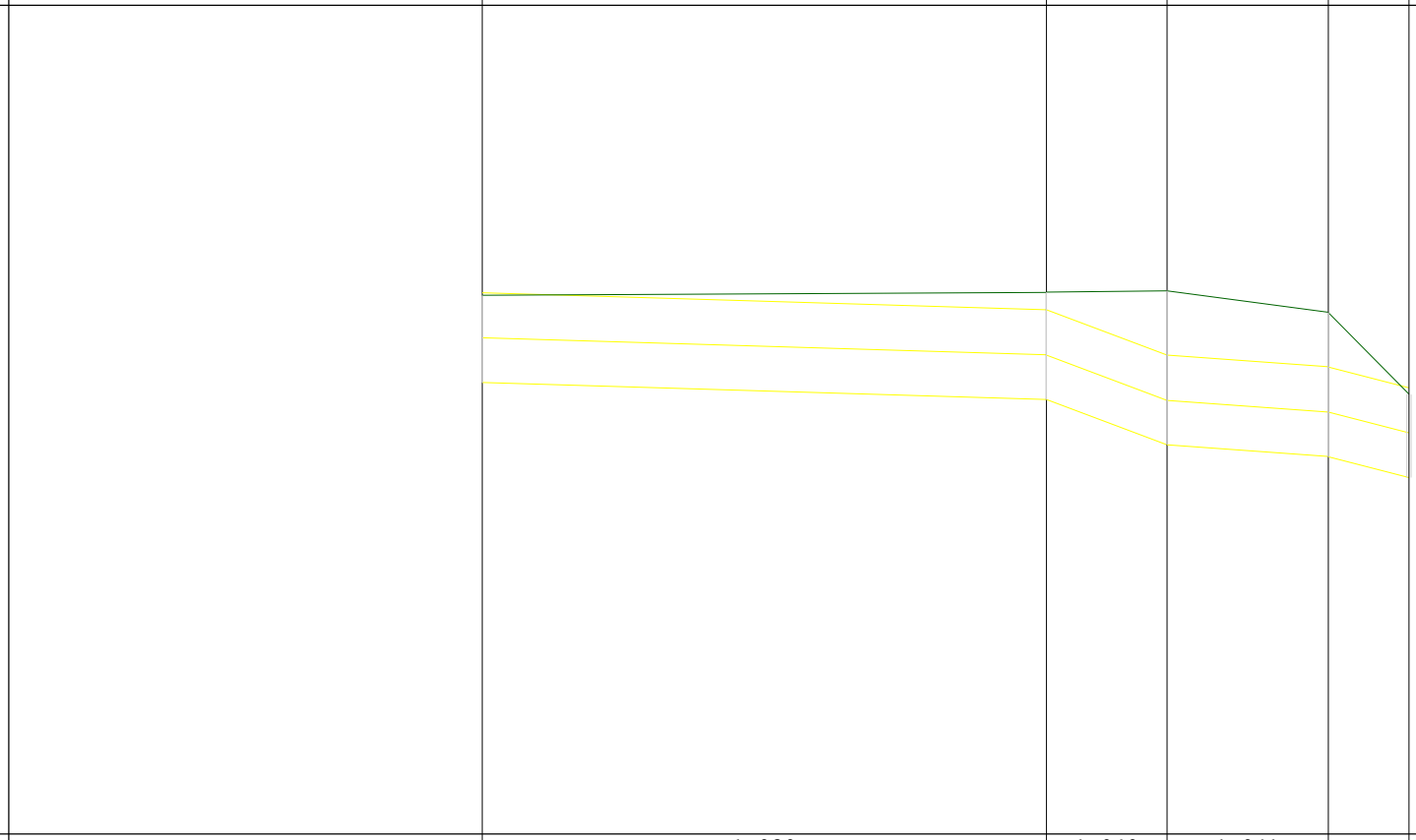

MH Name		74		75	76		
Hor Scale 1000 Ver Scale 100 Datum (m) 28.000							
PN		1.039		1.040	1.041		
Dia (mm)		31		31	31		
Slope (1:X)		329.6		26.6	135.5		
Cover Level (m)		35.240		35.280	35.300	35.010	33.910
Invert Level (m)		34.070	33.840	33.840	33.230	33.230	33.070	33.070	32.790
Length (m)		75.817		16.224	21.679		

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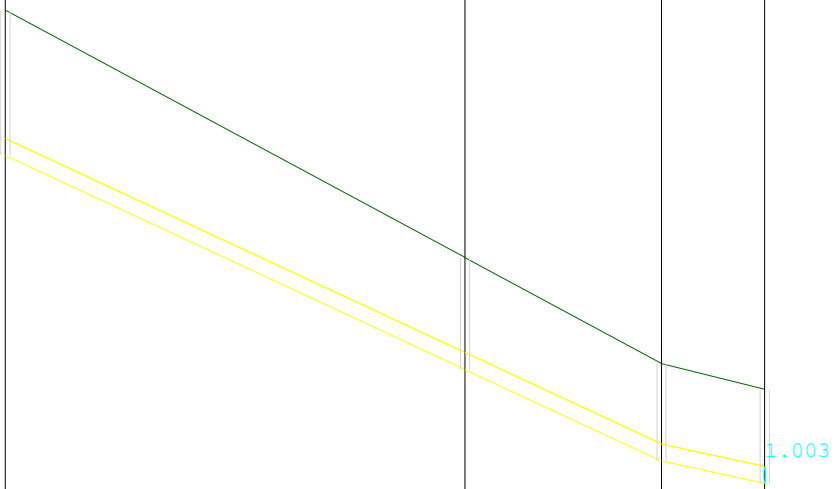

Hor Scale 1000

Ver Scale 100

Datum (m) 43.000

MH Name		5	6	7	5
PN		2.000	2.001	2.002	
Dia (mm)		225	225	225	
Slope (1:X)		21.5	21.5	45.5	
Cover Level (m)		51.430	48.160	46.760	46.420
Invert Level (m)		49.510	46.680 / 46.680	45.470 / 45.470	45.170
Length (m)		60.773	25.980	13.664	

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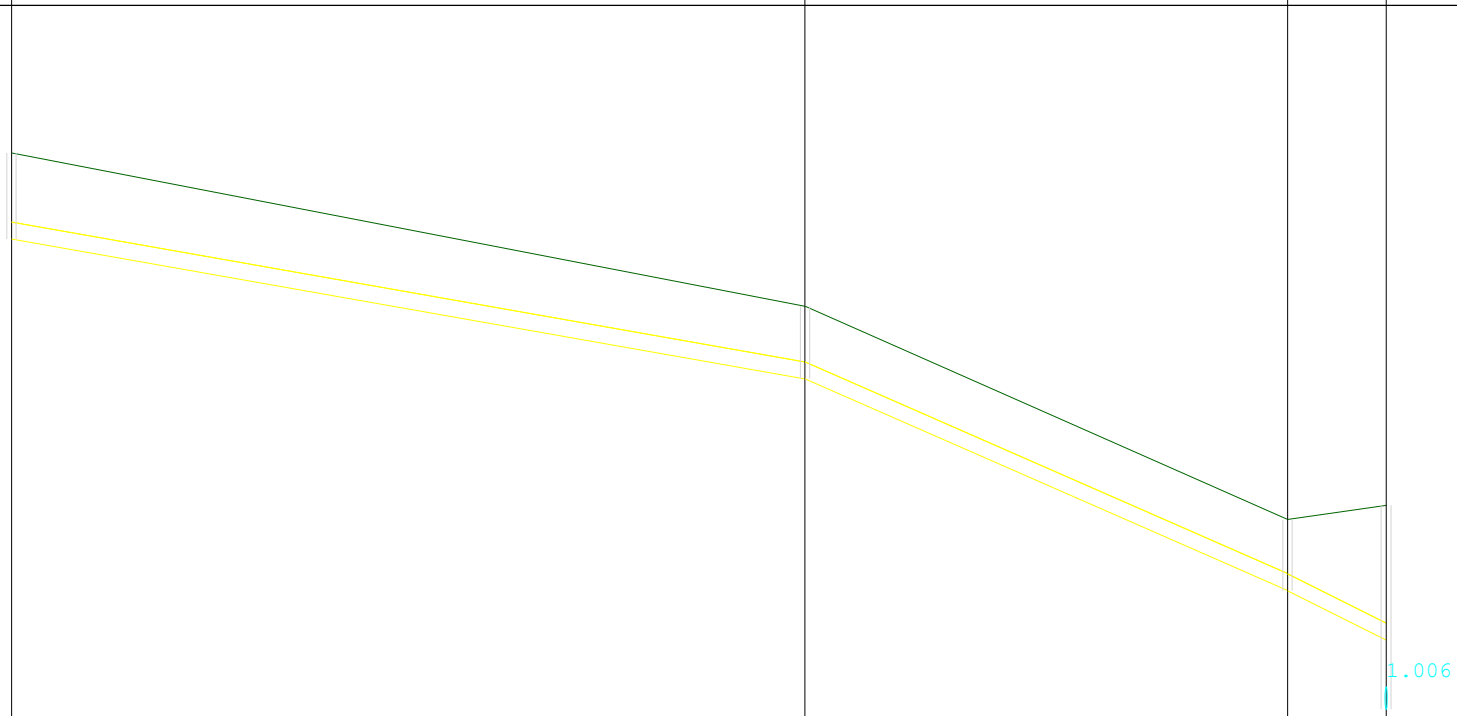

Hor Scale 1000

Ver Scale 100

Datum (m) 39.000

MH Name		11	12	13	8
PN		3.000	3.001	3.002	
Dia (mm)		225	225	225	
Slope (1:X)		56.7	22.8	20.0	
Cover Level (m)		48.190	46.160	43.340	43.530
Invert Level (m)		47.050	45.200 / 45.200	42.400 / 42.400	41.748
Length (m)		104.934	63.803	13.040	

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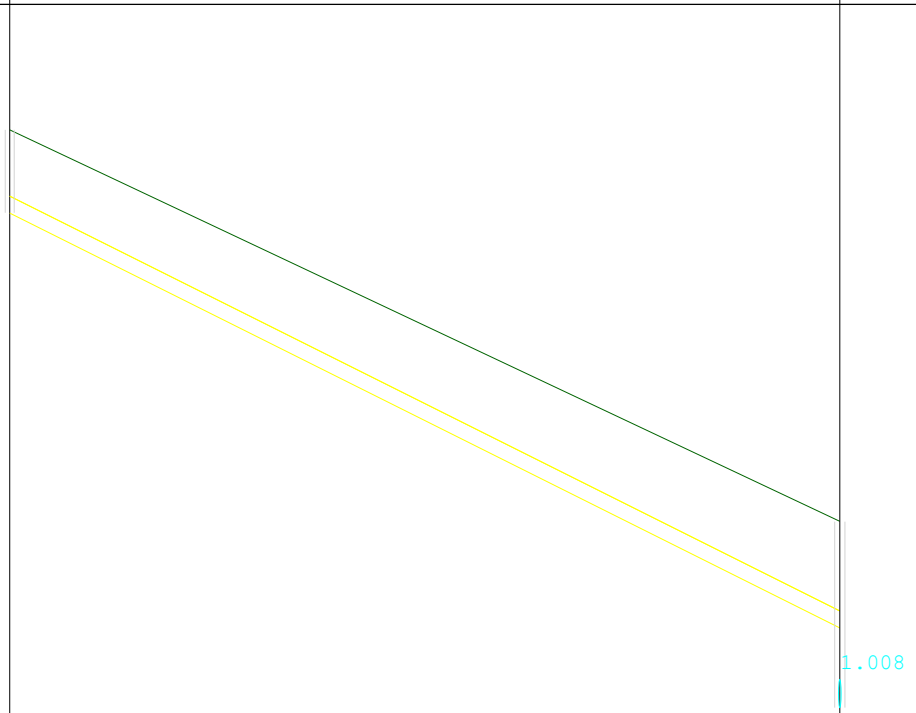
MH Name		16	10
Hor Scale 1000 Ver Scale 100 Datum (m) 38.000			
PN		4.000	
Dia (mm)		225	
Slope (1:X)		20.0	
Cover Level (m)		47.480	42.300
Invert Level (m)		46.380	40.891
Length (m)		109.789	

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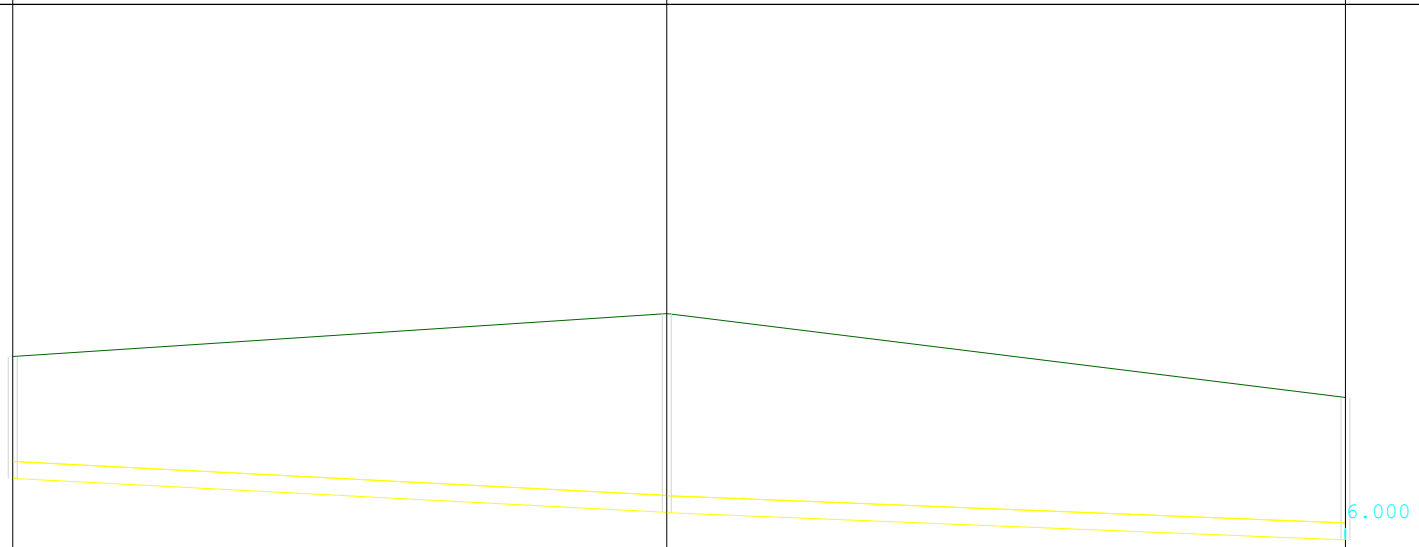
MH Name		19	20	21
				
PN		5.000	5.001	
Dia (mm)		225	225	
Slope (1:X)		192.2	249.2	
Cover Level (m)		42.480	43.050	41.940
Invert Level (m)		40.870	40.420 / 40.420	40.060
Length (m)		86.488	89.726	

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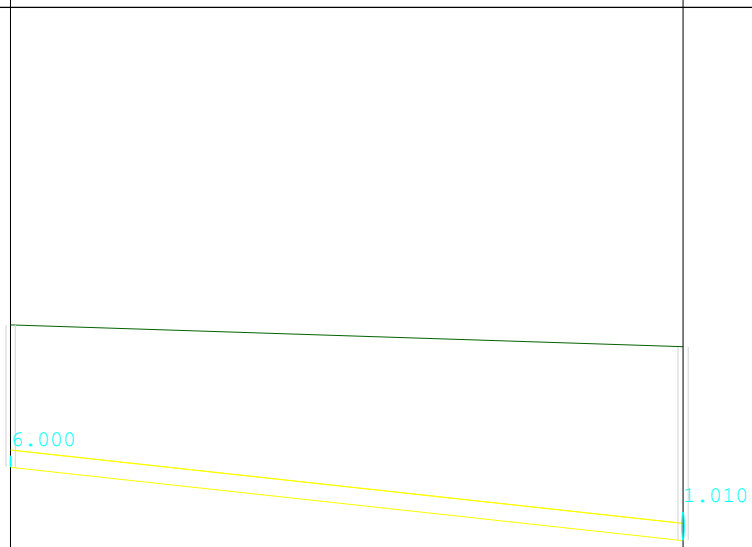
MH Name		21	12
Hor Scale 1000 Ver Scale 100 Datum (m) 35.000			
PN		5.002	
Dia (mm)		225	
Slope (1:X)		91.7	
Cover Level (m)		41.940	41.650
Invert Level (m)		40.060	39.090
Length (m)		88.918	

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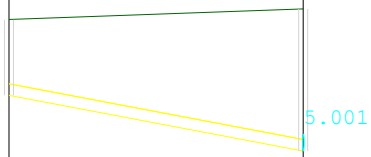
MH Name		21	21
			
Hor Scale 1000 Ver Scale 100 Datum (m) 35.000			
PN		6.000	
Dia (mm)		150	
Slope (1:X)		52.6	
Cover Level (m)		41.800	41.940
Invert Level (m)		40.800	40.060
Length (m)		38.926	

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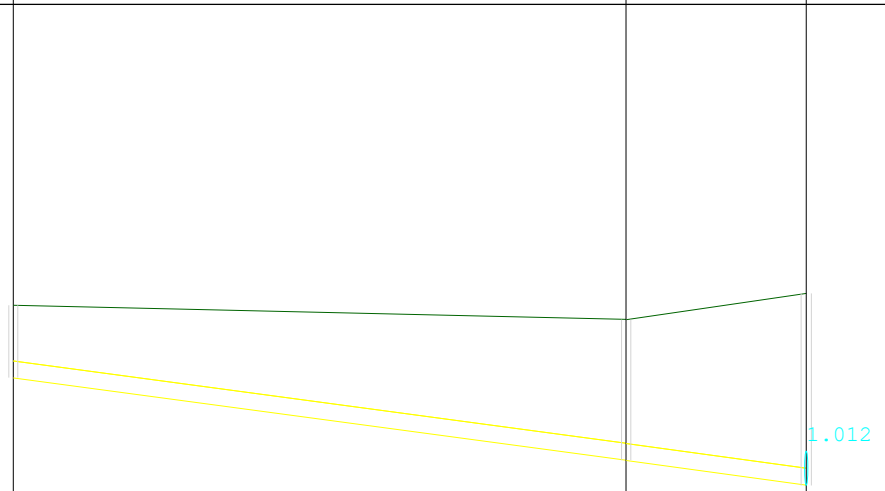
MH Name		25	26	14
Hor Scale 1000 Ver Scale 100 Datum (m) 34.000				
PN		7.000	7.001	
Dia (mm)		225	225	
Slope (1:X)		74.4	72.2	
Cover Level (m)		41.160	40.970	41.320
Invert Level (m)		40.200	39.110 / 39.110	38.780
Length (m)		81.042	23.827	

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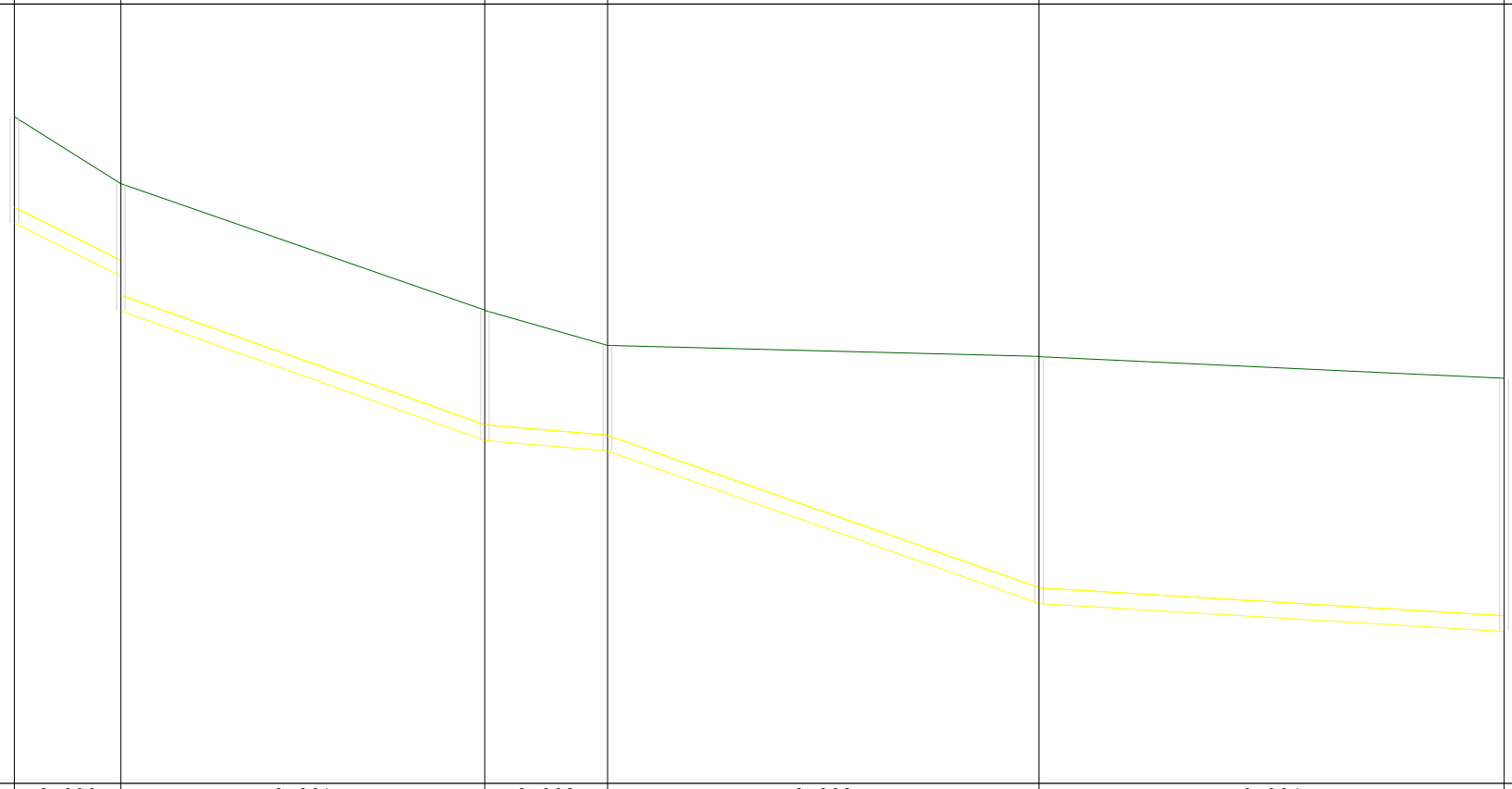

MH Name		28	29	29	30	31	28
PN		8.000	8.001	8.002	8.003	8.004	
Dia (mm)		225	225	225	225	225	
Slope (1:X)		20.0	28.1	116.9	28.3	166.7	
Cover Level (m)		50.530	49.570	47.760	47.260	47.100	46.790
Invert Level (m)		49.010	48.249 / 47.750	45.900	45.900 / 45.750	45.750 / 43.570	43.570 / 43.171
Length (m)		15.230	52.036	17.535	61.711	66.510	

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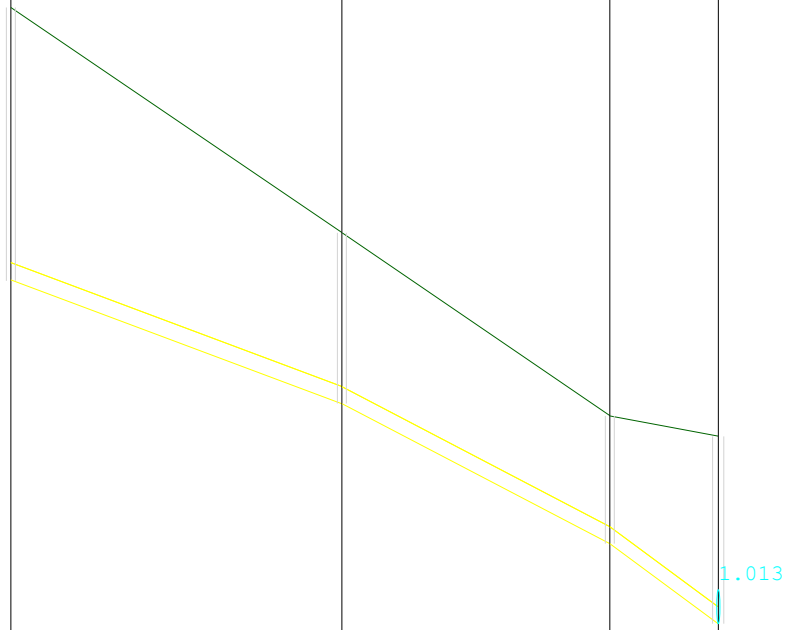
MH Name		28	29	30	15
Hor Scale 1000 Ver Scale 100 Datum (m) 37.000					
PN		8.005	8.006	8.007	
Dia (mm)		225	225	225	
Slope (1:X)		26.7	19.2	13.5	
Cover Level (m)		46.790	43.810	41.390	41.120
Invert Level (m)		43.190 / 41.550	41.550 / 39.700	39.700 / 38.640	
Length (m)		43.790	35.430	14.334	

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Dublin
D02 N500, Ireland

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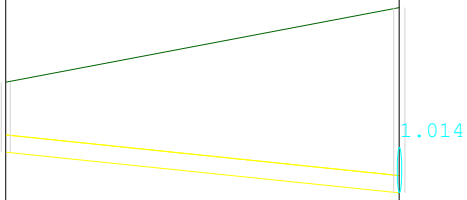
MH Name		32	16
			
Hor Scale 1000 Ver Scale 100 Datum (m) 34.000			
PN		9.000	
Dia (mm)		225	
Slope (1:X)		96.4	
Cover Level (m)		39.730	40.720
Invert Level (m)		38.810	38.270
Length (m)		52.031	

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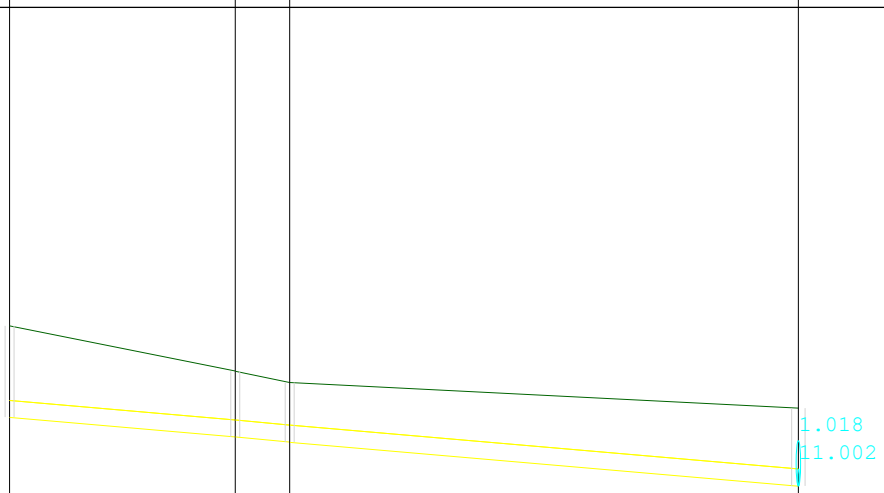
MH Name		37		39	20
					
PN		10.000		10.002	
Dia (mm)		225		225	
Slope (1:X)		114.9		116.0	
Cover Level (m)		38.930	38.330	38.180	37.840
Invert Level (m)		37.720	37.460 / 37.460	37.390	36.810
Length (m)		29.867		67.269	

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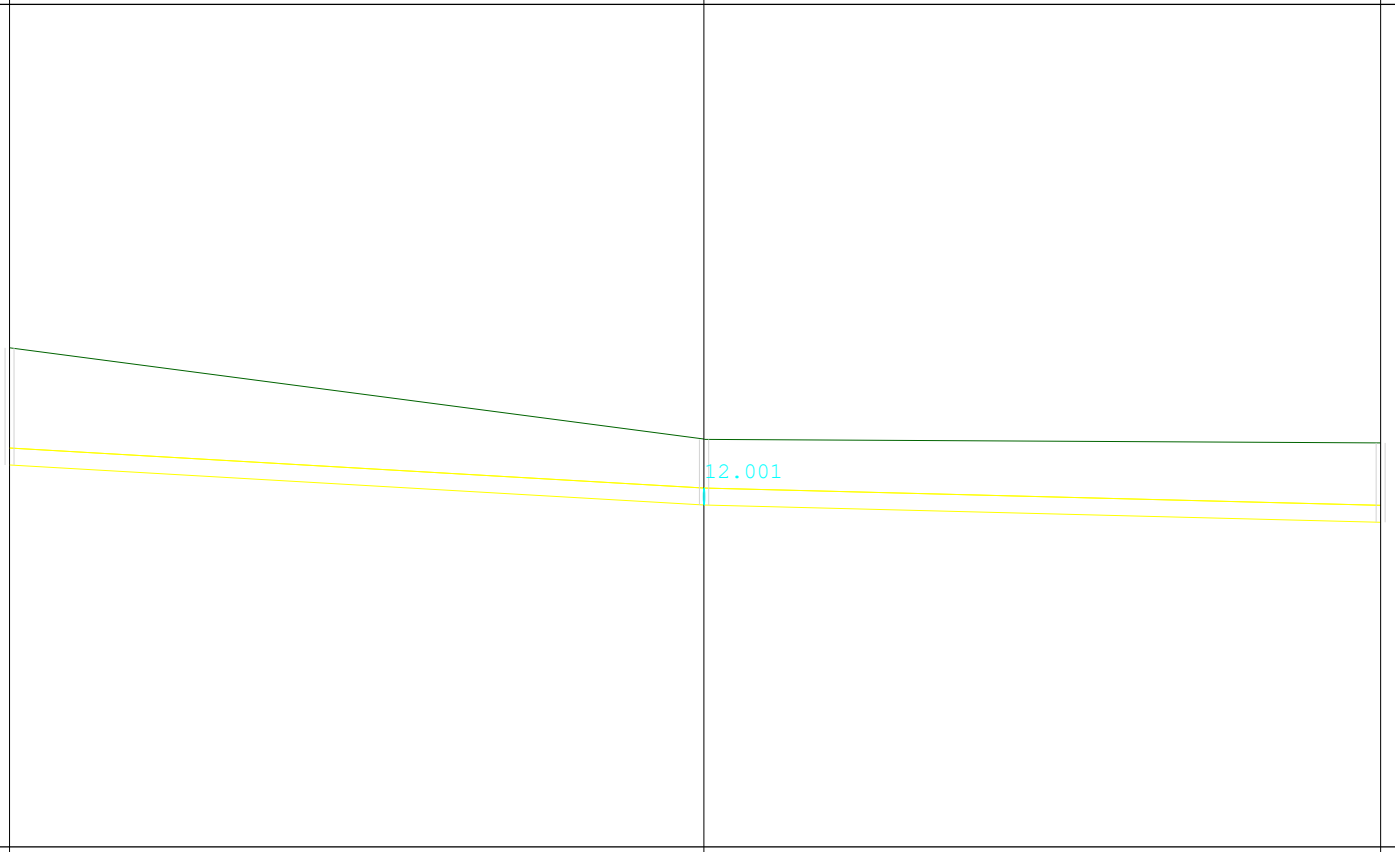
MH Name		40	41	42
Hor Scale 1000 Ver Scale 100 Datum (m) 33.000				
PN		11.000	11.001	
Dia (mm)		225	225	
Slope (1:X)		173.3	389.0	
Cover Level (m)		39.600	38.390	38.340
Invert Level (m)		38.050	37.520 / 37.520	37.290
Length (m)		91.833	89.469	

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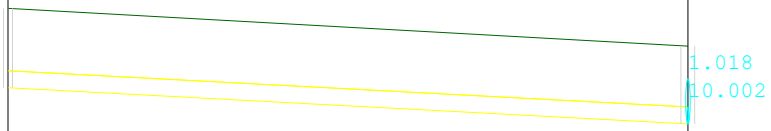
MH Name		42	20
Hor Scale 1000 Ver Scale 100 Datum (m) 32.000			
PN		11.002	
Dia (mm)		225	
Slope (1:X)		187.3	
Cover Level (m)		38.340	37.840
Invert Level (m)		37.290	36.810
Length (m)		89.890	

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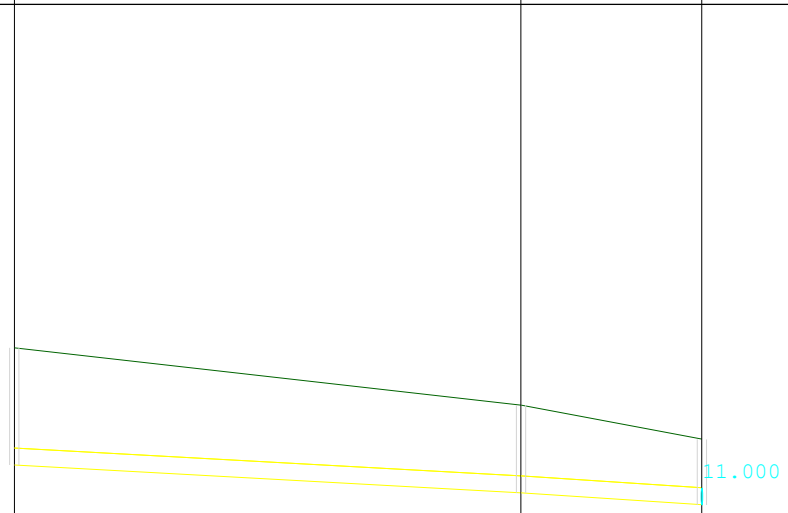
MH Name		41	42	41
				
PN		12.000	12.001	
Dia (mm)		225	225	
Slope (1:X)		181.1	149.5	
Cover Level (m)		39.600	38.840	38.390
Invert Level (m)		38.050	37.680 / 37.680	37.520
Length (m)		67.010	23.917	

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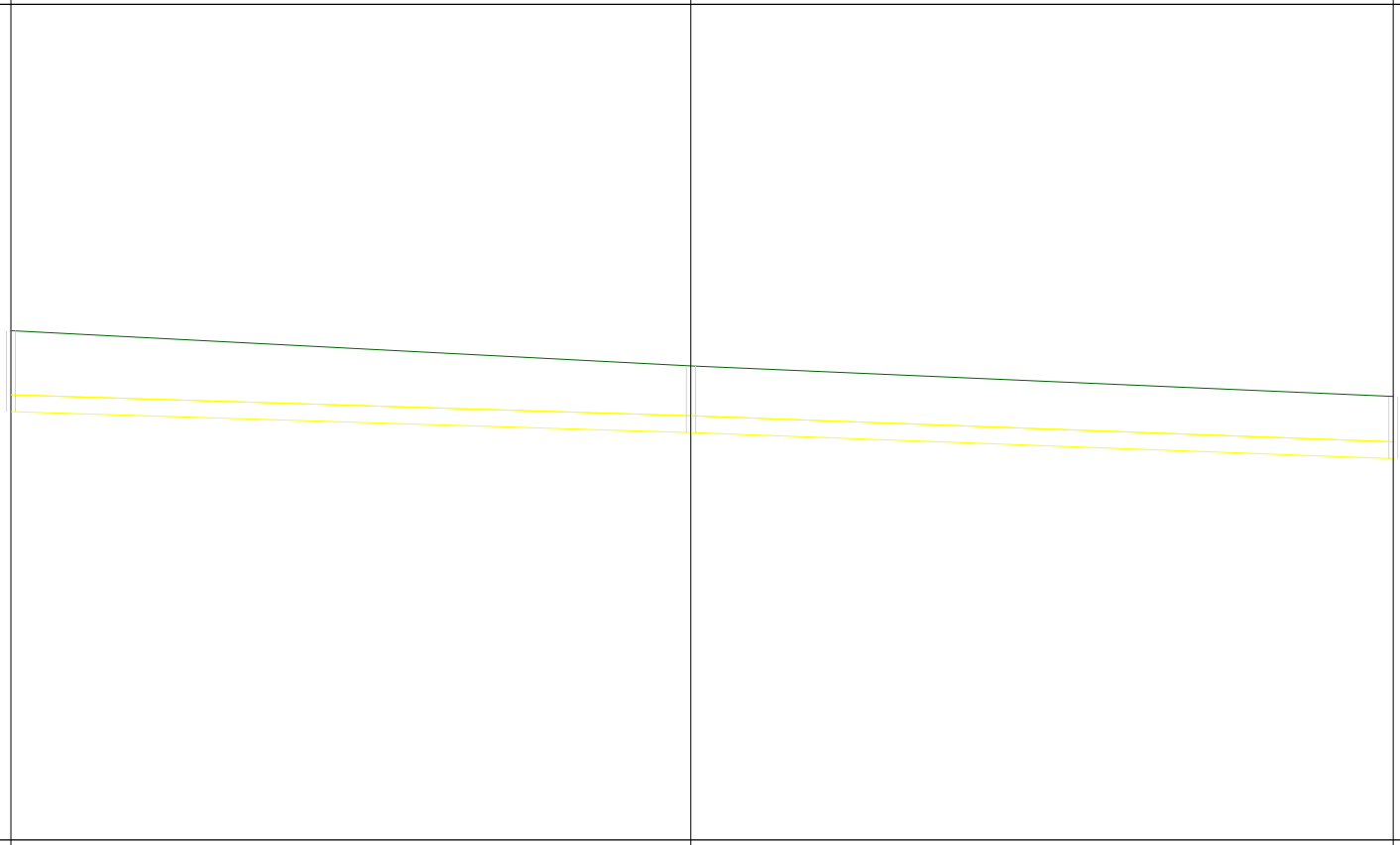
MH Name		47	48	49
Hor Scale 1000 Ver Scale 100 Datum (m) 32.000				
PN		13.000	13.001	
Dia (mm)		225	225	
Slope (1:X)		323.9	267.6	
Cover Level (m)		38.790	38.320	37.910
Invert Level (m)		37.710	37.430 / 37.430	37.080
Length (m)		90.689	93.659	

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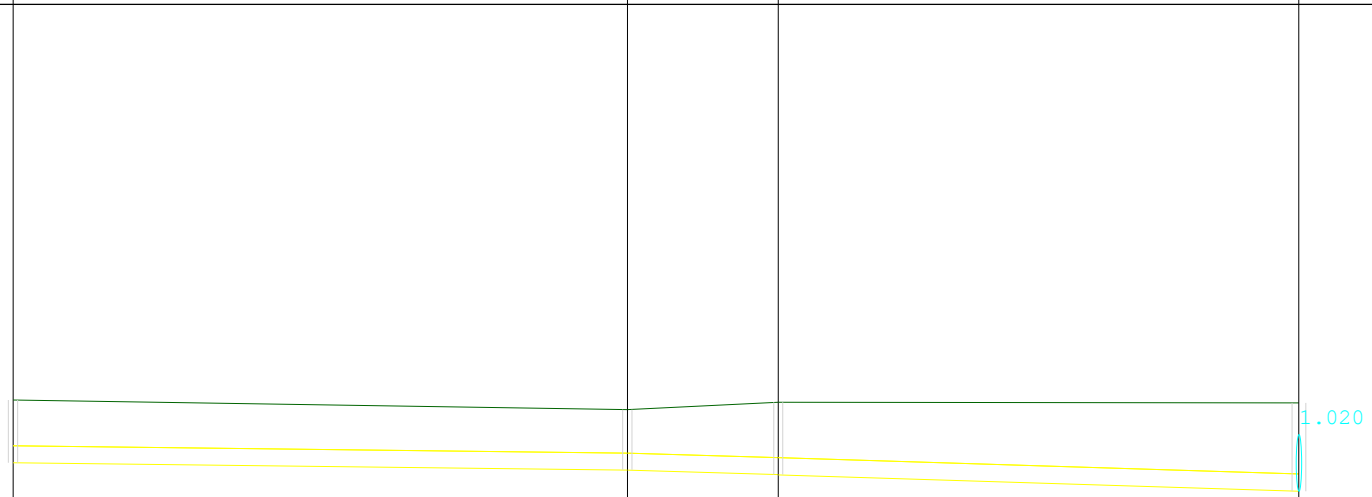
MH Name		49	50	51	22
					
PN		13.002	13.003	13.004	
Dia (mm)		225	225	225	
Slope (1:X)		812.4	332.6	312.9	
Cover Level (m)		37.910	37.780	37.880	37.870
Invert Level (m)		37.080	36.980 / 36.980	36.920 / 36.920	36.700
Length (m)		81.236	19.956	68.848	

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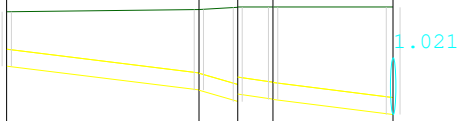
MH Name		53			56	23
Hor Scale 1000 Ver Scale 100 Datum (m) 32.000						
PN		14.000			14.003	
Dia (mm)		225			225	
Slope (1:X)		80.2			79.4	
Cover Level (m)		37.940	37.970	38.000	38.000	38.000
Invert Level (m)		37.217	36.900	36.900	36.850	36.780	36.580
Length (m)		25.408			15.872	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	16.000	Add Flow / Climate Change (%)	20
Ratio R	0.272	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	500	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	300	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	1.000	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.241	4-8	0.541	8-12	0.068

Total Area Contributing (ha) = 0.850

Total Pipe Volume (m³) = 36.596

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	19.716	0.110	179.4	0.061	2.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	14.247	0.143	99.9	0.009	2.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	3.681	0.030	123.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	15.671	0.090	175.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	5.112	0.051	100.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	21.109	0.120	176.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.005	15.553	0.100	155.5	0.007	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.006	33.882	0.100	340.0	0.111	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)
S1.000	60.27	2.34	35.800	0.061	0.0	0.0	2.7	0.97	38.7	15.9
S2.000	61.27	2.18	36.100	0.009	0.0	0.0	0.4	1.31	52.0	2.4
S1.001	59.95	2.39	35.690	0.070	0.0	0.0	3.0	1.18	46.8	18.2
S1.002	58.36	2.65	35.660	0.070	0.0	0.0	3.0	0.99	39.2	18.2
S1.003	57.99	2.72	35.571	0.070	0.0	0.0	3.0	1.31	51.9	18.2
S1.004	56.04	3.08	35.520	0.070	0.0	0.0	3.0	0.98	39.1	18.2
S1.005	54.78	3.33	35.400	0.077	0.0	0.0	3.0	1.05	41.6	18.3
S1.006	51.72	3.99	35.300	0.188	0.0	0.0	7.0	0.85	59.9	42.1

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.007	37.529	0.110	341.5	0.171	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.008	35.916	0.106	340.0	0.151	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.009	20.989	0.052	400.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.010	19.887	0.020	1000.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
S1.011	16.350	0.055	297.3	0.010	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.012	18.342	0.092	199.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.013	23.737	0.091	262.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.014	4.240	0.050	84.8	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.015	46.972	0.391	120.0	0.308	0.00	0.0	0.600	o	375	Pipe/Conduit	
S3.000	11.329	0.114	99.8	0.022	2.00	0.0	0.600	o	225	Pipe/Conduit	
S3.001	10.341	0.103	100.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.016	25.884	0.026	995.5	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.017	11.662	0.343	34.0	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)
S1.007	49.15	4.63	35.200	0.359	0.0	0.0	12.7	0.97	107.7	76.5
S1.008	46.98	5.25	35.090	0.510	0.0	0.0	17.3	0.98	107.9	103.8
S1.009	45.86	5.59	34.985	0.510	0.0	0.0	17.3	1.01	160.7	103.8
S1.010	44.42	6.07	34.932	0.510	0.0	0.0	17.3	0.70	151.5	103.8
S1.011	43.40	6.43	34.912	0.520	0.0	0.0	17.3	0.75	29.9«	103.8
S1.012	42.51	6.76	34.857	0.520	0.0	0.0	17.3	0.92	36.7«	103.8
S1.013	41.61	7.12	34.765	0.520	0.0	0.0	17.3	1.11	123.1	103.8
S1.014	41.53	7.15	34.674	0.520	0.0	0.0	17.3	1.97	217.4	103.8
S1.015	40.40	7.62	34.567	0.828	0.0	0.0	24.2	1.65	182.6	145.0
S3.000	61.52	2.14	35.000	0.022	0.0	0.0	1.0	1.31	52.0	5.9
S3.001	60.66	2.28	34.886	0.022	0.0	0.0	1.0	1.31	52.0	5.9
S1.016	38.75	8.39	34.176	0.850	0.0	0.0	24.2	0.57	62.5«	145.0
S1.017	38.62	8.45	34.150	0.850	0.0	0.0	24.2	3.12	344.2	145.0

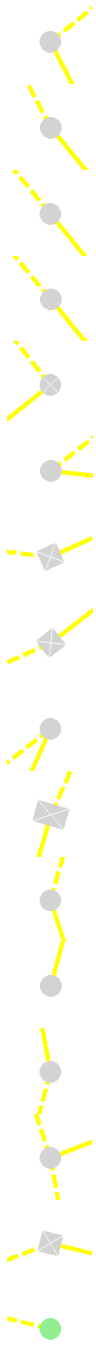
Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S17	37.100	1.300	Open Manhole	1200	S1.000	35.800	225				
S18	37.600	1.500	Open Manhole	1200	S2.000	36.100	225				
S19	37.400	1.710	Open Manhole	1200	S1.001	35.690	225	S1.000	35.690	225	
								S2.000	35.957	225	267
S20	37.400	1.740	Open Manhole	1200	S1.002	35.660	225	S1.001	35.660	225	
S21	37.300	1.729	Sealed Manhole	1800 x 1800	S1.003	35.571	225	S1.002	35.571	225	
S22	37.300	1.780	Open Manhole	1200	S1.004	35.520	225	S1.003	35.520	225	
S23	37.500	2.100	Open Manhole	1200	S1.005	35.400	225	S1.004	35.400	225	
S24	37.650	2.350	Open Manhole	1200	S1.006	35.300	300	S1.005	35.300	225	
S25	37.210	2.010	Open Manhole	1350	S1.007	35.200	375	S1.006	35.200	300	
S26	36.760	1.670	Open Manhole	1350	S1.008	35.090	375	S1.007	35.090	375	
S27	36.260	1.275	Sealed Manhole	1500	S1.009	34.985	450	S1.008	34.985	375	
S28	36.400	1.468	Open Manhole	1500	S1.010	34.932	525	S1.009	34.932	450	
S29	36.100	1.188	Sealed Manhole	2400 x 2400	S1.011	34.912	225	S1.010	34.912	525	
S30	36.100	1.243	Sealed Manhole	2400 x 2400	S1.012	34.857	225	S1.011	34.857	225	
S31	36.500	1.735	Open Manhole	1350	S1.013	34.765	375	S1.012	34.765	225	
S32	36.500	1.826	Sealed Manhole	2400 x 3000	S1.014	34.674	375	S1.013	34.674	375	
S33	36.190	1.623	Open Manhole	1350	S1.015	34.567	375	S1.014	34.624	375	57
S34	36.470	1.470	Open Manhole	1200	S3.000	35.000	225				
S35	36.580	1.694	Open Manhole	1200	S3.001	34.886	225	S3.000	34.886	225	
S36	36.650	2.474	Open Manhole	1350	S1.016	34.176	375	S1.015	34.176	375	
								S3.001	34.783	225	457
S37	36.700	2.550	Sealed Manhole	2400 x 2400	S1.017	34.150	375	S1.016	34.150	375	
SS38	35.500	1.693	Open Manhole	1500		OUTFALL		S1.017	33.807	375	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S17	722958.026	726028.646	722958.026	726028.646	Required	
S18	722965.936	725995.623	722965.936	725995.623	Required	
S19	722962.333	726009.407	722962.333	726009.407	Required	
S20	722965.862	726010.453	722965.862	726010.453	Required	
S21	722978.649	726019.513			No Entry	
S22	722981.739	726015.440	722981.739	726015.440	Required	

Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S23	722965.190	726002.337	722965.190	726002.337	Required	
S24	722972.416	725988.564	722972.416	725988.564	Required	
S25	722994.039	725962.478	722994.039	725962.478	Required	
S26	723017.897	725933.510	723017.897	725933.510	Required	
S27	723040.398	725905.515			No Entry	
S28	723023.897	725892.543	723023.897	725892.543	Required	
S29	723043.658	725890.300			No Entry	
S30	723058.611	725896.911			No Entry	
S31	723073.107	725908.149	723073.107	725908.149	Required	
S32	723063.414	725886.482			No Entry	
S33	723062.241	725882.407	723062.241	725882.407	Required	
S34	723076.042	725816.717	723076.042	725816.717	Required	
S35	723078.948	725827.667	723078.948	725827.667	Required	
S36	723077.057	725837.833	723077.057	725837.833	Required	
S37	723101.234	725847.078			No Entry	
SS38	723112.578	725844.369			No Entry	



PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	225	S17	37.100	35.800	1.075	Open Manhole	1200
S2.000	o	225	S18	37.600	36.100	1.275	Open Manhole	1200
S1.001	o	225	S19	37.400	35.690	1.485	Open Manhole	1200
S1.002	o	225	S20	37.400	35.660	1.515	Open Manhole	1200
S1.003	o	225	S21	37.300	35.571	1.504	Sealed Manhole	1800 x 1800
S1.004	o	225	S22	37.300	35.520	1.555	Open Manhole	1200
S1.005	o	225	S23	37.500	35.400	1.875	Open Manhole	1200
S1.006	o	300	S24	37.650	35.300	2.050	Open Manhole	1200
S1.007	o	375	S25	37.210	35.200	1.635	Open Manhole	1350
S1.008	o	375	S26	36.760	35.090	1.295	Open Manhole	1350
S1.009	o	450	S27	36.260	34.985	0.825	Sealed Manhole	1500
S1.010	o	525	S28	36.400	34.932	0.943	Open Manhole	1500
S1.011	o	225	S29	36.100	34.912	0.963	Sealed Manhole	2400 x 2400
S1.012	o	225	S30	36.100	34.857	1.018	Sealed Manhole	2400 x 2400
S1.013	o	375	S31	36.500	34.765	1.360	Open Manhole	1350
S1.014	o	375	S32	36.500	34.674	1.451	Sealed Manhole	2400 x 3000
S1.015	o	375	S33	36.190	34.567	1.248	Open Manhole	1350
S3.000	o	225	S34	36.470	35.000	1.245	Open Manhole	1200
S3.001	o	225	S35	36.580	34.886	1.469	Open Manhole	1200
S1.016	o	375	S36	36.650	34.176	2.099	Open Manhole	1350
S1.017	o	375	S37	36.700	34.150	2.175	Sealed Manhole	2400 x 2400

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	19.716	179.4	S19	37.400	35.690	1.485	Open Manhole	1200
S2.000	14.247	99.9	S19	37.400	35.957	1.218	Open Manhole	1200
S1.001	3.681	123.0	S20	37.400	35.660	1.515	Open Manhole	1200
S1.002	15.671	175.0	S21	37.300	35.571	1.504	Sealed Manhole	1800 x 1800
S1.003	5.112	100.2	S22	37.300	35.520	1.555	Open Manhole	1200
S1.004	21.109	176.0	S23	37.500	35.400	1.875	Open Manhole	1200
S1.005	15.553	155.5	S24	37.650	35.300	2.125	Open Manhole	1200
S1.006	33.882	340.0	S25	37.210	35.200	1.710	Open Manhole	1350
S1.007	37.529	341.5	S26	36.760	35.090	1.295	Open Manhole	1350
S1.008	35.916	340.0	S27	36.260	34.985	0.900	Sealed Manhole	1500
S1.009	20.989	400.0	S28	36.400	34.932	1.018	Open Manhole	1500
S1.010	19.887	1000.0	S29	36.100	34.912	0.663	Sealed Manhole	2400 x 2400
S1.011	16.350	297.3	S30	36.100	34.857	1.018	Sealed Manhole	2400 x 2400
S1.012	18.342	199.4	S31	36.500	34.765	1.510	Open Manhole	1350
S1.013	23.737	262.0	S32	36.500	34.674	1.451	Sealed Manhole	2400 x 3000
S1.014	4.240	84.8	S33	36.190	34.624	1.191	Open Manhole	1350
S1.015	46.972	120.0	S36	36.650	34.176	2.099	Open Manhole	1350
S3.000	11.329	99.8	S35	36.580	34.886	1.469	Open Manhole	1200
S3.001	10.341	100.0	S36	36.650	34.783	1.642	Open Manhole	1350
S1.016	25.884	995.5	S37	36.700	34.150	2.175	Sealed Manhole	2400 x 2400
S1.017	11.662	34.0	SS38	35.500	33.807	1.318	Open Manhole	1500

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.061	0.061	0.061
2.000	-	-	100	0.009	0.009	0.009
1.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.007	0.007	0.007
1.006	-	-	100	0.111	0.111	0.111
1.007	-	-	100	0.171	0.171	0.171
1.008	-	-	100	0.151	0.151	0.151
1.009	-	-	100	0.000	0.000	0.000
1.010	-	-	100	0.000	0.000	0.000
1.011	-	-	100	0.010	0.010	0.010
1.012	-	-	100	0.000	0.000	0.000
1.013	-	-	100	0.000	0.000	0.000
1.014	-	-	100	0.000	0.000	0.000
1.015	-	-	100	0.308	0.308	0.308
3.000	-	-	100	0.022	0.022	0.022
3.001	-	-	100	0.000	0.000	0.000
1.016	-	-	100	0.000	0.000	0.000
1.017	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.850	0.850	0.850

Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
S1.000	S17	225	1.075	1.485	Unclassified	1200	0	1.075	Unclassified
S2.000	S18	225	1.218	1.275	Unclassified	1200	0	1.275	Unclassified
S1.001	S19	225	1.485	1.515	Unclassified	1200	0	1.485	Unclassified
S1.002	S20	225	1.504	1.515	Unclassified	1200	0	1.515	Unclassified
S1.003	S21	225	1.504	1.555	Unclassified	1800	1800	1.504	Unclassified
S1.004	S22	225	1.555	1.875	Unclassified	1200	0	1.555	Unclassified
S1.005	S23	225	1.875	2.125	Unclassified	1200	0	1.875	Unclassified
S1.006	S24	300	1.710	2.050	Unclassified	1200	0	2.050	Unclassified
S1.007	S25	375	1.295	1.635	Unclassified	1350	0	1.635	Unclassified
S1.008	S26	375	0.900	1.295	Unclassified	1350	0	1.295	Unclassified
S1.009	S27	450	0.825	1.018	Unclassified	1500	0	0.825	Unclassified
S1.010	S28	525	0.663	0.943	Unclassified	1500	0	0.943	Unclassified
S1.011	S29	225	0.963	1.018	Unclassified	2400	2400	0.963	Unclassified
S1.012	S30	225	1.018	1.510	Unclassified	2400	2400	1.018	Unclassified
S1.013	S31	375	1.360	1.451	Unclassified	1350	0	1.360	Unclassified
S1.014	S32	375	1.191	1.451	Unclassified	2400	3000	1.451	Unclassified
S1.015	S33	375	1.248	2.099	Unclassified	1350	0	1.248	Unclassified
S3.000	S34	225	1.245	1.469	Unclassified	1200	0	1.245	Unclassified
S3.001	S35	225	1.469	1.642	Unclassified	1200	0	1.469	Unclassified
S1.016	S36	375	2.099	2.175	Unclassified	1350	0	2.099	Unclassified
S1.017	S37	375	1.318	2.175	Unclassified	2400	2400	2.175	Unclassified

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.017	SS38	35.500	33.807	33.100	1500	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	1.000	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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 3 Number of Storage Structures 4 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	1.000
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.000	Storm Duration (mins)	30
Ratio R	0.272		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S21, DS/PN: S1.003, Volume (m³): 6.2

Unit Reference	MD-SHE-0055-1000-0400-1000
Design Head (m)	0.400
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	55
Invert Level (m)	35.571
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.400	1.0	Kick-Flo®	0.273	0.8
Flush-Flo™	0.117	1.0	Mean Flow over Head Range	-	0.9

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)	Depth (m)	Flow (l/s)
0.100	1.0	0.800	1.4	2.000	2.1	4.000	2.8	7.000	3.8
0.200	1.0	1.000	1.5	2.200	2.2	4.500	3.0	7.500	3.9
0.300	0.9	1.200	1.6	2.400	2.2	5.000	3.2	8.000	4.0
0.400	1.0	1.400	1.8	2.600	2.3	5.500	3.3	8.500	4.1
0.500	1.1	1.600	1.9	3.000	2.5	6.000	3.5	9.000	4.3
0.600	1.2	1.800	2.0	3.500	2.7	6.500	3.6	9.500	4.4

Hydro-Brake® Optimum Manhole: S32, DS/PN: S1.014, Volume (m³): 15.6

Unit Reference	MD-SHE-0079-3000-1200-3000
Design Head (m)	1.200
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	79
Invert Level (m)	34.674
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	3.0	Kick-Flo®	0.707	2.4
Flush-Flo™	0.348	2.9	Mean Flow over Head Range	-	2.6

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)	Depth (m)	Flow (l/s)
0.100	2.3	0.400	2.9	0.800	2.5	1.400	3.2	2.000	3.8
0.200	2.8	0.500	2.8	1.000	2.8	1.600	3.4	2.200	4.0
0.300	2.9	0.600	2.7	1.200	3.0	1.800	3.6	2.400	4.1

Hydro-Brake® Optimum Manhole: S32, DS/PN: S1.014, Volume (m³): 15.6

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
2.600	4.3	4.000	5.2	5.500	6.1	7.000	6.8	8.500	7.5
3.000	4.6	4.500	5.5	6.000	6.3	7.500	7.0	9.000	7.7
3.500	4.9	5.000	5.8	6.500	6.6	8.000	7.3	9.500	7.9

Hydro-Brake® Optimum Manhole: S37, DS/PN: S1.017, Volume (m³): 17.3

Unit Reference	MD-SHE-0053-1500-1450-1500
Design Head (m)	1.450
Design Flow (l/s)	1.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	53
Invert Level (m)	34.150
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.450	1.5	Kick-Flo®	0.472	0.9
Flush-Flo™	0.233	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)	Depth (m)	Flow (l/s)
0.100	1.0	0.800	1.1	2.000	1.7	4.000	2.4	7.000	3.1
0.200	1.1	1.000	1.3	2.200	1.8	4.500	2.5	7.500	3.2
0.300	1.1	1.200	1.4	2.400	1.9	5.000	2.6	8.000	3.3
0.400	1.0	1.400	1.5	2.600	2.0	5.500	2.8	8.500	3.4
0.500	0.9	1.600	1.6	3.000	2.1	6.000	2.9	9.000	3.5
0.600	1.0	1.800	1.7	3.500	2.2	6.500	3.0	9.500	3.6

Storage Structures for Storm

Tank or Pond Manhole: S20, DS/PN: S1.002

Invert Level (m) 35.660

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	56.3	0.780	56.3

Tank or Pond Manhole: S28, DS/PN: S1.010

Invert Level (m) 34.932

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	190.0	1.000	190.0

Tank or Pond Manhole: S31, DS/PN: S1.013

Invert Level (m) 34.765

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	277.0	1.000	277.0

Tank or Pond Manhole: S36, DS/PN: S1.016

Invert Level (m) 34.176

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	284.0	1.700	284.0

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

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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 3 Number of Storage Structures 4 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	16.000
Region	Scotland and Ireland	Ratio R	0.272
Cv (Summer)	0.750		
Cv (Winter)	0.840		

Margin for Flood Risk Warning (mm) 50.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 180, 360, 720, 1440, 2880
Return Period(s) (years)	1, 30, 100
Climate Change (%)	20, 20, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S17	2880 Summer	100	+20%	100/15 Summer				36.833
S2.000	S18	2880 Summer	100	+20%	100/2880 Summer				36.836
S1.001	S19	2880 Summer	100	+20%	30/60 Winter				36.837
S1.002	S20	2880 Summer	100	+20%	30/60 Summer				36.842
S1.003	S21	2880 Summer	100	+20%	30/15 Summer				36.991
S1.004	S22	2880 Summer	100	+20%	100/15 Summer				36.878
S1.005	S23	2880 Summer	100	+20%	30/15 Summer				36.881
S1.006	S24	2880 Summer	100	+20%	30/15 Summer				36.881
S1.007	S25	2880 Summer	100	+20%	30/15 Summer				36.881
S1.008	S26	2880 Summer	100	+20%	1/2880 Winter	100/2880 Summer			36.881
S1.009	S27	2880 Summer	100	+20%	1/2880 Winter				36.260
S1.010	S28	2880 Summer	100	+20%	1/2880 Winter	100/1440 Summer			36.934
S1.011	S29	2880 Summer	100	+20%	1/1440 Summer				36.100
S1.012	S30	2880 Summer	100	+20%	1/1440 Summer				36.100
S1.013	S31	2880 Summer	100	+20%	1/1440 Summer	100/2880 Summer			36.980
S1.014	S32	2880 Summer	100	+20%	1/1440 Summer				36.500
S1.015	S33	2880 Summer	100	+20%	1/1440 Summer	100/1440 Winter			36.501
S3.000	S34	2880 Summer	100	+20%	1/2880 Winter	100/2880 Summer			36.494
S3.001	S35	2880 Summer	100	+20%	1/1440 Summer				36.507
S1.016	S36	2880 Summer	100	+20%	1/360 Summer				36.523
S1.017	S37	2880 Summer	100	+20%	1/360 Summer				35.959

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
S1.000	S17	0.808	0.000	0.04			1.6	SURCHARGED	
S2.000	S18	0.511	0.000	0.01			0.2	SURCHARGED	
S1.001	S19	0.922	0.000	0.06			1.8	SURCHARGED	
S1.002	S20	0.956	0.000	0.03			1.0	SURCHARGED	
S1.003	S21	1.196	0.000	0.03			1.0	SURCHARGED*	
S1.004	S22	1.133	0.000	0.03			1.0	SURCHARGED	

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

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
S1.005	S23	1.257	0.000	0.03			1.1	SURCHARGED	
S1.006	S24	1.282	0.000	0.07			4.0	SURCHARGED	
S1.007	S25	1.306	0.000	0.09			8.3	SURCHARGED	
S1.008	S26	1.416	122.794	0.12			12.0	FLOOD	1
S1.009	S27	0.825	0.000	0.09			11.8	FLOOD RISK*	
S1.010	S28	1.477	119.865	0.27			20.4	FLOOD	2
S1.011	S29	0.963	0.000	0.31			8.2	FLOOD RISK*	
S1.012	S30	1.018	0.000	0.24			8.0	FLOOD RISK*	
S1.013	S31	1.840	138.516	0.03			3.5	FLOOD	1
S1.014	S32	1.451	0.000	0.03			2.8	FLOOD	2
S1.015	S33	1.559	311.372	0.05			8.3	FLOOD	3
S3.000	S34	1.269	24.221	0.01			0.5	FLOOD	1
S3.001	S35	1.396	0.000	0.01			0.4	SURCHARGED	
S1.016	S36	1.972	0.000	0.05			1.8	SURCHARGED	
S1.017	S37	1.434	0.000	0.01			1.9	SURCHARGED*	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	16.000	Add Flow / Climate Change (%)	20
Ratio R	0.272	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	500	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	300	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	1.000	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.886	4-8	0.397

Total Area Contributing (ha) = 1.283

Total Pipe Volume (m³) = 42.460

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	9.017	0.060	150.3	0.093	2.00	0.0	0.600	o	300	Pipe/Conduit	
S1.001	9.432	0.063	149.7	0.013	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	37.062	0.185	200.3	0.075	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.003	13.964	0.070	199.5	0.028	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.004	18.073	0.090	200.8	0.024	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.005	38.763	0.194	199.8	0.270	0.00	0.0	0.600	o	375	Pipe/Conduit	
S2.000	48.607	0.324	150.0	0.168	2.00	0.0	0.600	o	300	Pipe/Conduit	
S2.001	5.653	0.038	148.8	0.018	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.006	13.639	0.068	200.6	0.139	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	61.70	2.12	35.550	0.093	0.0	0.0	4.1	1.28	90.5	24.9
S1.001	60.89	2.24	35.490	0.106	0.0	0.0	4.7	1.28	90.7	28.0
S1.002	57.55	2.80	35.427	0.181	0.0	0.0	7.5	1.11	78.3	45.1
S1.003	56.56	2.98	35.242	0.209	0.0	0.0	8.5	1.28	141.3	51.2
S1.004	55.33	3.22	35.172	0.233	0.0	0.0	9.3	1.27	140.8	55.9
S1.005	52.91	3.72	35.081	0.503	0.0	0.0	19.2	1.28	141.2	115.3
S2.000	58.49	2.63	35.400	0.168	0.0	0.0	7.1	1.28	90.6	42.6
S2.001	58.07	2.71	35.076	0.186	0.0	0.0	7.8	1.29	91.0	46.8
S1.006	52.21	3.88	34.887	0.828	0.0	0.0	31.2	1.43	227.7	187.3

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S3.000	38.115	0.127	300.1	0.147	2.00	0.0	0.600	o	300	Pipe/Conduit	
S3.001	17.117	0.057	300.3	0.136	0.00	0.0	0.600	o	375	Pipe/Conduit	
S3.002	49.935	0.166	300.8	0.172	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.007	8.743	0.058	150.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
S1.008	42.462	0.160	265.4	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
S1.009	16.293	0.133	122.5	0.000	0.00	0.0	0.600	o	525	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)
S3.000	58.08	2.70	35.254	0.147	0.0	0.0	6.2	0.90	63.8	37.0
S3.001	56.57	2.98	35.127	0.283	0.0	0.0	11.6	1.04	114.9	69.4
S3.002	52.66	3.78	35.070	0.455	0.0	0.0	17.3	1.04	114.8	103.8
S1.007	51.86	3.96	34.819	1.283	0.0	0.0	48.1	1.83	395.4	288.3
S1.008	49.76	4.48	34.761	1.283	0.0	0.0	48.1	1.37	296.6	288.3
S1.009	49.24	4.61	34.753	1.283	0.0	0.0	48.1	2.02	437.9	288.3

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	37.100	1.550	Open Manhole	1200	S1.000	35.550	300				
S2	37.120	1.630	Open Manhole	1200	S1.001	35.490	300	S1.000	35.490	300	
S3	37.200	1.773	Open Manhole	1200	S1.002	35.427	300	S1.001	35.427	300	
S4	37.480	2.238	Open Manhole	1350	S1.003	35.242	375	S1.002	35.242	300	
S5	37.320	2.148	Open Manhole	1350	S1.004	35.172	375	S1.003	35.172	375	
S6	37.140	2.059	Open Manhole	1350	S1.005	35.081	375	S1.004	35.082	375	1
S7	36.600	1.200	Open Manhole	1200	S2.000	35.400	300				
S8	36.650	1.574	Open Manhole	1200	S2.001	35.076	300	S2.000	35.076	300	
S9	36.860	1.973	Open Manhole	1350	S1.006	34.887	450	S1.005	34.887	375	
								S2.001	35.038	300	1
S10	36.600	1.346	Sealed Manhole	1350	S3.000	35.254	300				
S11	36.830	1.703	Open Manhole	1350	S3.001	35.127	375	S3.000	35.127	300	
S12	37.030	1.960	Open Manhole	1350	S3.002	35.070	375	S3.001	35.070	375	
S13	37.000	2.181	Open Manhole	1500	S1.007	34.819	525	S1.006	34.819	450	
								S3.002	34.904	375	
S14	36.500	1.739	Sealed Manhole	1800 x 1800	S1.008	34.761	525	S1.007	34.761	525	
S15	36.800	2.199	Sealed Manhole	3600 x 3000	S1.009	34.753	525	S1.008	34.601	525	
S16	35.500	0.880	Open Manhole	1350		OUTFALL		S1.009	34.620	525	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1	722879.419	725769.364	722879.419	725769.364	Required	
S2	722887.940	725772.312	722887.940	725772.312	Required	
S3	722891.821	725763.715	722891.821	725763.715	Required	
S4	722921.432	725741.426	722921.432	725741.426	Required	
S5	722932.598	725733.040	722932.598	725733.040	Required	
S6	722948.867	725725.168	722948.867	725725.168	Required	
S7	723029.304	725707.381	723029.304	725707.381	Required	
S8	722987.418	725732.044	722987.418	725732.044	Required	
S9	722985.646	725737.412	722985.646	725737.412	Required	

Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S10	723071.522	725805.638			No Entry	
S11	723056.656	725770.541	723056.656	725770.541	Required	
S12	723046.107	725757.062	723046.107	725757.062	Required	
S13	722998.639	725741.560	722998.639	725741.560	Required	
S14	723001.492	725733.296			No Entry	
S15	723042.524	725744.220			No Entry	
S16	723058.442	725747.695			No Entry	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	300	S1	37.100	35.550	1.250	Open Manhole	1200
S1.001	o	300	S2	37.120	35.490	1.330	Open Manhole	1200
S1.002	o	300	S3	37.200	35.427	1.473	Open Manhole	1200
S1.003	o	375	S4	37.480	35.242	1.863	Open Manhole	1350
S1.004	o	375	S5	37.320	35.172	1.773	Open Manhole	1350
S1.005	o	375	S6	37.140	35.081	1.684	Open Manhole	1350
S2.000	o	300	S7	36.600	35.400	0.900	Open Manhole	1200
S2.001	o	300	S8	36.650	35.076	1.274	Open Manhole	1200
S1.006	o	450	S9	36.860	34.887	1.523	Open Manhole	1350
S3.000	o	300	S10	36.600	35.254	1.046	Sealed Manhole	1350
S3.001	o	375	S11	36.830	35.127	1.328	Open Manhole	1350
S3.002	o	375	S12	37.030	35.070	1.585	Open Manhole	1350
S1.007	o	525	S13	37.000	34.819	1.656	Open Manhole	1500
S1.008	o	525	S14	36.500	34.761	1.214	Sealed Manhole	1800 x 1800
S1.009	o	525	S15	36.800	34.753	1.522	Sealed Manhole	3600 x 3000

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	9.017	150.3	S2	37.120	35.490	1.330	Open Manhole	1200
S1.001	9.432	149.7	S3	37.200	35.427	1.473	Open Manhole	1200
S1.002	37.062	200.3	S4	37.480	35.242	1.938	Open Manhole	1350
S1.003	13.964	199.5	S5	37.320	35.172	1.773	Open Manhole	1350
S1.004	18.073	200.8	S6	37.140	35.082	1.683	Open Manhole	1350
S1.005	38.763	199.8	S9	36.860	34.887	1.598	Open Manhole	1350
S2.000	48.607	150.0	S8	36.650	35.076	1.274	Open Manhole	1200
S2.001	5.653	148.8	S9	36.860	35.038	1.522	Open Manhole	1350
S1.006	13.639	200.6	S13	37.000	34.819	1.731	Open Manhole	1500
S3.000	38.115	300.1	S11	36.830	35.127	1.403	Open Manhole	1350
S3.001	17.117	300.3	S12	37.030	35.070	1.585	Open Manhole	1350
S3.002	49.935	300.8	S13	37.000	34.904	1.721	Open Manhole	1500
S1.007	8.743	150.0	S14	36.500	34.761	1.214	Sealed Manhole	1800 x 1800
S1.008	42.462	265.4	S15	36.800	34.601	1.674	Sealed Manhole	3600 x 3000
S1.009	16.293	122.5	S16	35.500	34.620	0.355	Open Manhole	1350

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.093	0.093	0.093
1.001	-	-	100	0.013	0.013	0.013
1.002	-	-	100	0.075	0.075	0.075
1.003	-	-	100	0.028	0.028	0.028
1.004	-	-	100	0.024	0.024	0.024
1.005	-	-	100	0.270	0.270	0.270
2.000	-	-	100	0.168	0.168	0.168
2.001	-	-	100	0.018	0.018	0.018
1.006	-	-	100	0.139	0.139	0.139
3.000	-	-	100	0.147	0.147	0.147
3.001	-	-	100	0.136	0.136	0.136
3.002	-	-	100	0.172	0.172	0.172
1.007	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
1.009	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				1.283	1.283	1.283

Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
S1.000	S1	300	1.250	1.330	Unclassified	1200	0	1.250	Unclassified
S1.001	S2	300	1.330	1.473	Unclassified	1200	0	1.330	Unclassified
S1.002	S3	300	1.473	1.938	Unclassified	1200	0	1.473	Unclassified
S1.003	S4	375	1.773	1.863	Unclassified	1350	0	1.863	Unclassified
S1.004	S5	375	1.683	1.773	Unclassified	1350	0	1.773	Unclassified
S1.005	S6	375	1.598	1.684	Unclassified	1350	0	1.684	Unclassified
S2.000	S7	300	0.900	1.274	Unclassified	1200	0	0.900	Unclassified
S2.001	S8	300	1.274	1.522	Unclassified	1200	0	1.274	Unclassified
S1.006	S9	450	1.523	1.731	Unclassified	1350	0	1.523	Unclassified
S3.000	S10	300	1.046	1.403	Unclassified	1350	0	1.046	Unclassified
S3.001	S11	375	1.328	1.585	Unclassified	1350	0	1.328	Unclassified
S3.002	S12	375	1.585	1.721	Unclassified	1350	0	1.585	Unclassified
S1.007	S13	525	1.214	1.656	Unclassified	1500	0	1.656	Unclassified
S1.008	S14	525	1.214	1.674	Unclassified	1800	1800	1.214	Unclassified
S1.009	S15	525	0.355	1.522	Unclassified	3600	3000	1.522	Unclassified

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.009	S16	35.500	34.620	34.070	1350	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 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)	16.000	Storm Duration (mins)	30
Ratio R	0.272		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S15, DS/PN: S1.009, Volume (m³): 30.7

Unit Reference	MD-SHE-0065-2300-1600-2300
Design Head (m)	1.600
Design Flow (l/s)	2.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	65
Invert Level (m)	34.753
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.600	2.3	Kick-Flo®	0.577	1.4
Flush-Flo™	0.284	1.8	Mean Flow over Head Range	-	1.8

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)	Depth (m)	Flow (l/s)
0.100	1.5	0.800	1.7	2.000	2.5	4.000	3.5	7.000	4.6
0.200	1.7	1.000	1.9	2.200	2.7	4.500	3.7	7.500	4.7
0.300	1.8	1.200	2.0	2.400	2.8	5.000	3.9	8.000	4.9
0.400	1.7	1.400	2.2	2.600	2.9	5.500	4.1	8.500	5.0
0.500	1.6	1.600	2.3	3.000	3.1	6.000	4.2	9.000	5.1
0.600	1.5	1.800	2.4	3.500	3.3	6.500	4.4	9.500	5.3

Storage Structures for Storm

Tank or Pond Manhole: S14, DS/PN: S1.008

Invert Level (m) 34.761

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	808.0	1.600	808.0

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm) 16.000	Cv (Summer) 0.750
Region	Scotland and Ireland	Ratio R 0.272	Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 50.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 180, 360, 720, 1440, 2880
Return Period(s) (years)	1, 30, 100
Climate Change (%)	20, 20, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.000	S1	15 Winter	100	+20%	100/15 Summer				36.212	0.362
S1.001	S2	15 Winter	100	+20%	30/15 Winter				36.199	0.409
S1.002	S3	15 Winter	100	+20%	30/15 Summer				36.184	0.457
S1.003	S4	15 Winter	100	+20%	30/15 Summer				36.095	0.478
S1.004	S5	15 Winter	100	+20%	30/15 Summer				36.065	0.518
S1.005	S6	15 Winter	100	+20%	30/15 Summer				36.027	0.571
S2.000	S7	2880 Winter	100	+20%	30/1440 Winter				35.944	0.244
S2.001	S8	2880 Winter	100	+20%	30/15 Summer				35.939	0.563
S1.006	S9	2880 Winter	100	+20%	30/15 Summer				35.940	0.603
S3.000	S10	15 Winter	100	+20%	30/15 Summer				36.024	0.470
S3.001	S11	15 Winter	100	+20%	30/15 Summer				35.952	0.450
S3.002	S12	2880 Winter	100	+20%	30/15 Summer				35.941	0.496
S1.007	S13	2880 Winter	100	+20%	30/15 Summer				35.940	0.596
S1.008	S14	2880 Winter	100	+20%	30/360 Summer				35.939	0.653
S1.009	S15	2880 Winter	100	+20%	30/360 Summer				36.800	1.522

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.000	0.64			39.3	SURCHARGED	
S1.001	S2	0.000	0.64			40.3	SURCHARGED	
S1.002	S3	0.000	0.79			57.0	SURCHARGED	
S1.003	S4	0.000	0.57			60.9	SURCHARGED	
S1.004	S5	0.000	0.60			69.5	SURCHARGED	
S1.005	S6	0.000	1.18			150.6	SURCHARGED	
S2.000	S7	0.000	0.03			2.6	SURCHARGED	
S2.001	S8	0.000	0.04			2.7	SURCHARGED	
S1.006	S9	0.000	0.07			11.9	SURCHARGED	
S3.000	S10	0.000	0.86			51.0	SURCHARGED*	
S3.001	S11	0.000	0.98			92.3	SURCHARGED	
S3.002	S12	0.000	0.06			6.6	SURCHARGED	

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

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.007	S13	0.000	0.07			18.4	SURCHARGED	
S1.008	S14	0.000	0.08			19.8	SURCHARGED*	
S1.009	S15	0.000	0.01			2.0	FLOOD RISK*	2