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CADARN
CONSULTING ENGINEERS

DRAINAGE STRATEGY

PROPOSED RESIDENTIAL DEVELOPMENT AT LLANDEGAI ROAD, BANGOR

June 2020
Suitability S1
Revision P01

Prepared on Behalf of:
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SUITABILITY	REV	DATE	DESCRIPTION	Org.	Chk'd	App'd
S1	P01	11.05.2020	First Issue.			

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APPENDICES

1.0 Introduction

1.1 Project Background

1.1.1 Cadarn Consulting Engineers Ltd have been appointed by Macbryde Homes Ltd to provide a drainage strategy, for both surface water and foul, for the proposed residential development located on the parcel of land opposite Bangor Crematorium, Llandegai Road, Maesgeirchen, Bangor, Llandegai Rd, Bangor LL57 4HP (National Grid Reference **SH 59265 71957**). Refer to the drawing enclosed in **Appendix A** for the proposed site location plan.

1.1.2 Cadarn Consulting Engineers Ltd reserve the right to undertake further investigation into the adequacy of the proposed drainage strategy based on changes in regulations, if works on site have not commenced within twelve months of the issuing of this report.

1.2 Scope of Proposed Drainage Strategy

1.2.1 This report aims to provide a suitable drainage strategy for the discharge of surface water and foul effluent generated by the proposed development.

1.2.2 The purpose of the calculations and accompanying details enclosed within this report are to produce a drainage layout that complies with the relevant legislation of the Tan 15, CIRIA C753 '*The SuDS Manual*' and Approved Document H of the Building Regulations 2010.

1.3 Proposed Development

1.3.1 The proposal involves the construction of 65 no. residential dwellings with associated private car parking for each dwelling, landscaped areas, and Public open space and proposed adoptable highway. The proposed site will be accessed from the existing old Llandegai Rd which forms the western boundary of the site. The proposed site layout is illustrated within **Appendix B.**

2.0 Existing Site Baseline

2.1 Site Boundaries

2.1.1 The proposed development is located on the outskirts of Bangor, near the Maesgeirchen residential housing estate. The site is a narrow triangular shaped site with a maximum width of 100m (East-West) and a total length of Circa. 500m. The site is accessed from the Llandegai Road (A5) which forms the entire Western boundary of the site, to the east of the development is predominantly agricultural land, with the exemption of two cottages (, located just East of the site. the existing cottages have a right of way which passes through the proposed development site from Llandegai Road. The Northern boundary is bounded by the Historical railway line which has been converted into a public footpath with the Afon Cegin beyond. The boundaries described above are illustrated within **Figure 1.**

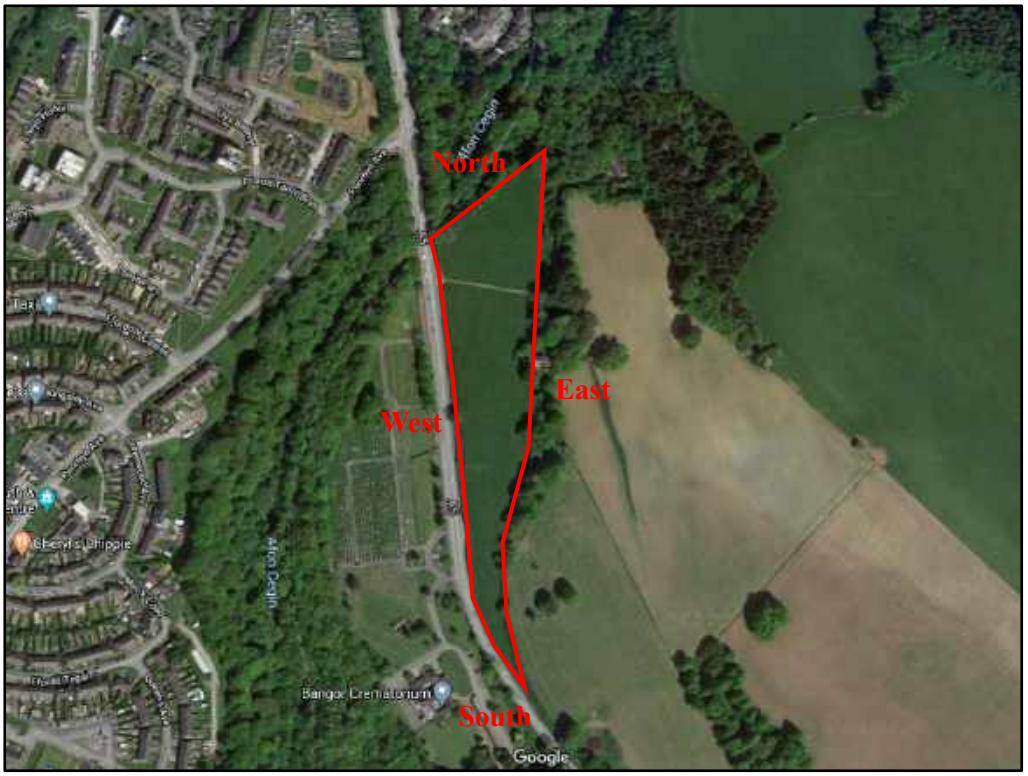

Figure 1. *Proposal Site Boundaries*

2.2 Site Hydrology

2.2.1 The site is a steeply sloping site which generally falls towards the northern and western boundaries, the northern area of the of the site falls towards the Northern boundary steeply at a gradient of between 1:5 and 1:7. There is a 1:2 to 1:3 batter along the western boundary between the entrance to the cottage through the site to the bus stop where the batter changes to a retaining structure to the Southern point of the site. The direction of the above ground surface water flood routing for the existing site is contained within **Appendix C**.

2.3 Existing Land Drainage Features / Watercourses.

2.3.1 As noted in **Section 2.1.1** the Afon Cegin is located to the North of the site with the line of the historical railway located between. There are is open land drainage feature within the North-east corner of the site which likely communicates with the Afon Cegin, based on the topography of the area, prior to the construction of the railway line surface water run-off would from the site would have run directly into the existing Afon Cegin, and therefore there is an established right to communicate flows into this under the land drainage act 1991.

2.4 Existing Nearby Drainage

2.4.1 The Dwr Cymru / Welsh Water (DCWW) apparatus map contained within **Appendix D** indicates there is two rising main sewers to the West of the site (Ø 125mm combined & Ø 100mm foul only) located beneath the public footpath between the Afon Cegin and Bangor Cemetery. These rising main sewers communicate with a combined chamber (Ref: SH59721397) located approximly 450m North of the site within the playing field.

2.4.2 There is also Ø 600mm surface water and Ø 450mm combined gravity sewer sewerage networks located a in close proximity to the junction into the Maesgeirchen residential housing estate.

2.4.3 There is a highway drainage network located beneath the A5 which accommodates the surface water run-off entering the gullies along the Western channel of the existing road, this is assumed to communicate flows into the Afon Cegin.

3.0 Design Criteria

3.1.1 The following design criteria will apply to the surface water run-off and foul discharge design for the site:

- Approved Document H, Building Regulations;
- BRE Digest 365;
- BS EN 752:2017;
- CIRIA C753 'The SuDS Manual' 2015;
- DEFRA / Environment Agency 'Preliminary Rainfall Runoff Management for Developments' Technical Report;
- Discharge Units from BS EN 12056: Part 2;
- Flood & Water Management Act 2010;
- Highways Act 1991;
- Institute of Hydrology Report (IHR) 124;
- Land Drainage Act 1991;
- Modified Rational Method;
- Sewers for Adoption 7th Edition;
- Statutory standards for sustainable drainage systems – designing, constructing, operating and maintaining surface water drainage systems
- Technical Advice Note (TAN) 15: Development and Flood Risk;
- Wallingford Procedure;
- Water Industries Act 1991.

4.0 Surface Water & Foul Drainage Strategy

4.1 Guiding Principles

4.1.1 The disposal of surface water has been designed in strict accordance with the provision of TAN 15, the Flood and Water Management Act 2010 and other best practice documents, such as CIRIA C753 'SuDS Manual' 2015.

4.2 Method of discharge

4.2.1 In accordance with the SuDS Manual 2015, surface water should be managed and discharged from a new development in line with the following hierarchy:

- Priority level 1: Re-use of water;
- Priority level 2: Infiltration into ground;
- Priority level 3: Discharge to a water body;
- Priority level 4: Discharge to a surface water run-off drain;
- Priority level 5: Discharge to a combined surface water run-off and foul drain.

4.2.2 Due to the nature of the development, there is unlikely to be a requirement for the re-use of large volumes of grey water within the building and a rainwater harvesting system would be unfeasible. However, it is proposed to have above ground water butts at the base of rainwater pipes to provide the homeowners the ability to re-use some rainwater, although this cannot be accounted for within the design.

4.2.3 The system also includes tree-pits/raingardens throughout the design which will soak up some rainwater and prevent it ever being released from the site, however this volume cannot be quantified and therefore is not included within the design.

4.2.4 Infiltration testing has been undertaken by Ground Solve Ltd (this report is not included as part of this strategy due to the size, however this can be issued upon request). A summary of the report is provided below.

- Soakaway testing was undertaken in four of the 10 trial pits excavated within the site;
- The depth of the trial pits varied from 2.0m to 3.0 m;
- No groundwater was encountered in any of the trial pits during the investigation.
- No infiltration was recorded within three of the tested trail pits and very slow rate of 3.15 x 10^{-6} was recorded in in one.

4.2.5 The report concludes that the use of infiltration systems such as soakaways for the disposal of surface water run-off generated from the proposed development is not suitable. and alternative methods of surface water disposal in line with the above hierarchy should be explored.

4.2.6 As noted within **Section 2.3** there is a land drainage feature located within the lowest point of the site, that being the North-east corner, which communicates flows into the Afon Cegin. Based on this, and in order to comply with the above hierarchy, the drainage philosophy for the site will focus on storing surface water in periods of heavy rainfall whilst releasing into the existing land drainage feature within the site boundary at the controlled discharge rates within **Table 3**.

4.3 Climate Change

4.3.1 TAN 15 states that an allowance for climate change should be provided within the on-site attenuation, without specifying what allowance should be made. The NPPF, which is the English equivalent of TAN 15, does however provide guidance derived from DEFRA FCDPAG3 'Economic Appraisal Supplementary Note to Operating Authorities – Climate Change Impacts' October 2006 (see **Table 1**). This document considers the effects of climate change for different design criteria.

4.3.2 The proposed development will have a design life of 100 years; based on the NPPF's guidance, the development therefore requires an allowance of 30% for climate change to be applied to the peak rainfall intensity.

Table 1 – *Climate change requirements.*

Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak Rainfall Intensity	+5%	+10%	+20%	**+30%**
Peak River Flow	+10%	+20%		
Offshore Wind Speed	+5%		+10%	
Extreme Wave Height	+5%		+10%	

5.0 Surface Water Drainage Design

5.1 Design Philosophy

5.1.1 Based upon existing site information and the details of the proposed development, an assessment of the site run-off has been undertaken utilising the 'Flow' hydraulic modelling package (refer to **Appendix E**). This has enabled the existing and proposed run-off flows to be assessed and quantified, in accordance with IHR 124.

5.1.2 The tables below summarise the existing and proposed effective areas with their corresponding run-off coefficients, as per the Wallingford procedure, IHR 124 and the Modified Rational Method.

Table 2 – *Existing and proposed areas.*

Surface	Total Area	Coefficient	Effective Area
Existing – Grass	25,049.275 m²	0.35	8,767.246 m²
Proposed – Roofs	4,387.536 m²	1.00	4,387.536 m²
Proposed – External Paths	1,319.030 m²	1.00	1,319.030 m²
Proposed - Highway	3,763.463 m²	0.75	2,822.597 m²
Proposed – Porous Parking	2,814.881 m²	0.75	985.208 m²
Proposed – Pumping Station	211.078 m²	0.75	158.309 m²
Proposed – Grass	12,764.365 m²	0.35	4,467.528 m²

5.1.3 The areas provided within **Table 2** are provided on the existing and proposed area drawings contained within **Appendix F .** Reference should be made to the attached hydraulic model output calculations containing the run-off rates for the site (**Appendix E**), which are summarised as follows:

Table 3 – *Run-off rates for different return periods.*

Reference	Qbar	1 in 1 Year	1 in 30 Year	1 in 100 Year
Existing	21.3 l/s	18.7 l/s	38.3 l/s	46.3 l/s

5.1.4 As noted in **Section 4.2** it is proposed to discharge surface water run-off from the proposed development into the existing land drainage feature on site at the controlled rates provided within **Table 3**.

5.2 Method of Storage

5.2.1 Surface water run-off generated up to the extreme event shall be attenuated onsite within combination of below and above ground storage structures, including pipework chambers, open swales and detention basins with a low flow channel and addition storages within a below ground granular trench. This section of the report should be read in conjunction with the proposed on-site drainage arrangement enclosed in **Appendix B**.

5.2.2 Surface water run-off generated from all proposed hardstanding areas for the 1 in 100-year return period plus an allowance of 30% for climate change is to be provided onsite within a combination of below and above ground storage structures located across the site with a number of flow control devices restricting flow throughout the site providing attenuation at source. The proposed surface water drainage layout illustrating this is contained within **Appendix G.**

5.2.3 The attenuation structures across the site are listed below with their flow control rate.

- System 1 – Detention Basin with low flow channel & Granuar trench below ground; providing 450 m³ and a flow control system controlling discharge rates to the mimicking greenfield run-off rates highlighted in **Table 3**.

- System 2 – Granular Sub-base to parking area of plots 32 - 38 – providing 12.620 m³ and a control discharge of 7.5 l/s

- System 3 - Granular Sub-base to parking area of plots 41 - 49 – providing 20 m³ of storage with a control discharge of 10 l/s

- System 4 – several open swale structures with undersized pipework downstream to reduce flow rate and cause water to back up during precipitation events.

5.2.4 As noted in **Section 4.2.3**, the system also includes tree-pits / raingardens throughout to help reduce the overall volumetric run-off and the rainwater from each property is to pass through the granular sub-base of the porous parking areas before entering the surface water drainage network via a perforated pipe this will help to reduce the rate of flow entering the system.

5.2.5 Open swales are used as drainage conduits along the Western boundary of the site, due to the roughness of the grassed banks the rate in which water is able to flow through these will be reduced as opposed to the flow through a pipe.

5.2.6 The proposed surface water drainage systems, including the open swales, detention basin, porous paved parking areas used as below ground storage, tree-pits and flow control devices are to be adopted and maintained by the Gwynedd SuDS Approval Body (SAB).

5.2.7 A low flow channel & below ground granular trench is included within the detention basin so that area can double up as public open space and remain dry during most rainfall events.

5.3 Drainage System Maintenance

5.3.1 The SuDS Manual 2015 requires appropriate measures to be in place for the maintenance of surface water drainage systems and sustainable drainage features.

5.3.2 The maintenance schedule shown in **Tables 4 & 5** have been derived in strict accordance with the SuDS Manual 2015 and from a risk-assessed approach during the design stage. These schedules are not exhaustive and should be reassessed at regular intervals to determine if any additional maintenance requirements are required to preserve the performance and condition of the site drainage system.

5.3.3 The highway gullies and the connections to the surface water sewer loacted beneath the highway are to be adopted under section 38 of the Highways Act 1980 and therefore will be maintained by the Highway Authority, a maintenance schedule for these components is contained within **Table 4**.

5.3.4 The surface water remainder of the drainage network (besides private drainage within a individual property boundary) is to be maintained by the SAB. The maintenance schedule for these each component of the proposed drainage network is contained within **Table 5 - 8**.

5.3.5 Provided preventive maintenance measures are undertaken in accordance with the frequencies recommended in **Table 4 & 5**, the need for corrective maintenance should rarely arise.

5.3.6 Maintenance activities should be detailed in the Principal Contractor's Health and Safety Plan and Risk Assessments and should be updated on a regular basis to ensure the continued performance and long-term condition of the drainage system.

Table 4 – *Operation and maintenance requirements for highway Gullies and connecting pipework.*

Maintenance Schedule	Required Action	Typical Frequency
Monitoring	Inspect silt traps in gullies and note rate of sediment accumulation.	Annually.
Regular Maintenance	Inspection for sediments and debris build up within base of Highway gullies.	Annually.
Occasional Maintenance	Removal of sediments and debris from sump within base of Highway gullies.	As required based upon inspection.
Remedial Actions/ Corrective Maintenance.	Jetting of pipework to remove silts and debris build up from pipework and removal of sediments and debris from base of Highway gullies.	As Required.

Table 5 – *Operation and maintenance requirements for pipework & chambers.*

Maintenance Schedule	Required Action	Typical Frequency
Monitoring	Inspect using CCTV drain surveys to ensure they are in good condition and operating as designed.	Every 5 years (or as required)
	Inspect chambers to ensure they are in good condition and that accumulation of sediment, debris etc. is not preventing them from operating as designed.	Annually
Regular Maintenance	Remove any accumulation of silt, sediment, leaves, debris etc.	Bi-annually
Occasional Maintenance	High-pressure water jet for removal of silt build up and avoid blockages, particularly at bends or changes in direction.	Every 5 years (or as required)
Remedial Actions/ Corrective Maintenance	High-pressure water jet to remove blockages.	As Required.

Table 6 – *Operation and maintenance requirements for detention basin & Swale in line with table 22.1 & 17.1 of the CIRIA C753 'The SuDS Manual 2015.*

Maintenance Schedule	Required Action	Typical Frequency
Monitoring	Inspect Inlets & Outlets for blockages and clear if required.	Every two months
	Inspect Banksides, structures (Headwalls) pipework etc for physical damage.	Bi-Annually
	Record rate of sediment accumulation and establish appropriate silt removal frequency/maintenance plan.	Two Monthly for first year, then annually or as required.
Regular Maintenance	Removal of litter and debris.	Two monthly for first year, then annually or as required.
	Cutting Grass in and around basin.	Bi-Annually (Spring – before nesting season and autumn)
	Manage vegetation and removal nuisance plants.	Two monthly for 6 months, then annually.
	Remove sediments from inlets and outlets.	Annually or as required.
Occasional Maintenance	Reseed areas of poor vegetation growth.	As required.
	Prune and trim any trees and remove cuttings.	Every 5 years or as required
Remedial Actions/ Corrective Maintenance	Repair erosion or other damage by reseeding or re-turfing.	As required.
	Repair/rehabilitation of inlets and outlets.	As required.
	Relevel uneven surfaces and reinstate design levels.	As required.

Table 7 – *Operation and maintenance requirements for Tree-pits, In line with table 19.3 of the CIRIA C753 'The SuDS Manual 2015.*

Maintenance Schedule	Required Action	Typical Frequency
Monitoring	Record rate of sediment accumulation and establish appropriate silt removal frequency/maintenance plan.	Two monthly for first year, then annually or as required.
	Check tree health and manage tree appropriately	Annually.
Regular Maintenance	Removal of litter and debris.	Two monthly or as required
	Manage vegetation and removal nuisance plants.	Two monthly for 6 months, then annually.
	Remove sediments from inlets and outlets.	Annually or as required.
Occasional Maintenance	Remove silt build-up from inltets and surface and replace mulch as necessary	Annually or as required.
	Water	As required (During periods of drought)

5.4 Surface Water Treatment

5.4.1 In accordance with the SuDS Manual 2015, Table 26.2, commercial yards and delivery areas are classified as having a 'medium' pollution hazard level. **Table 8** shows the pollution hazard indices for the land use.

Table 8 – *Pollution Hazard Indices*

Land Use	Pollution Hazard Level	Total Suspended Soils	Metals
Residential Roofs	Very Low	0.2	0.2
Low Traffic Roads / Residential Car Parks	Low	0.5	0.4

5.4.2 The SuDS Manual 2015 also provides pollution mitigation indices for different SuDS drainage features, as detailed in **Table 9** below. The increase in surface water pollution resulting from the hardstanding yard area during normal conditions is likely to be negligible. However, this risk increases during rainfall events of greater intensity. As previous noted the proposed design includes a series of swales, bioretention systems (tree-pits), Porous Paving, and a large detention basin with all surface water run-off from the site passing through at least two of these systems, therefore sufficient treatment will be provided prior to discharge into the existing land drainage network.

Table 9 – Pollution Mitigation Indices

SuDS Component	Pollution Mitigation Indices		
	Total Suspended Soils (PMI_{TSS})	Hydrocarbons (PMI_{HM})	Heavy Metals (PMI_{PAH})
Filter Strip	0.9	0.8	0.7
Filter Drain	0.6	0.8	0.7
Swale	**0.7**	**0.6**	**0.4**
Bioretention System	**0.8**	**0.8**	**0.8**
Porous Paving	**0.2**	**0.3**	**0.3**
Infiltration Basin	0.05	0.05	0.05
Detention Basin	**0.7**	**0.7**	**0.6**
Pond	0.7	0.7	0.5
Wet Land	0.8	0.8	0.8
Proprietary Treatment Systems	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1-year return period event, for inflow concentrations relevant to the contributing drainage.		

6.0 Foul Drainage Design

6.1 Method of Discharge

6.1.1 Design of the foul sewer included within the proposal has been carried out in accordance with BS EN 12056 Part 2, Approved Document H of the Building Regulations 2010 and other best practice documents, such as the 'Sewers for Adoption' 7th edition. In accordance with Approved Document H, the preference in terms of discharging foul effluent is to discharge into a public foul sewerage system. If a connection to the foul drainage network cannot be sought consideration should be given to the list below in order of priority;

- Discharge into a public combined sewerage system,
- Discharge into a private sewerage system,
- Discharge using treatment plant into an infiltration system,
- Discharge using treatment plant into a watercourse, and

6.1.2 As stated within **Section 2.3** there is a Ø 450mm combined gravity sewerage networks located near the entrance to the Maesgeirchen residential housing estate however pre-planning advice from DCWW has identified the proposed point of connection for the site as chamber reference SH59721303 situated approximately 350m to the North of the proposed development, due to capacity issues downstreme therefore it is proposed to communicate flows to this sewer,

6.1.3 The hierarchy outlined in Approved Document H of the Building Regulations 2010 can therefore be satisfied by connecting into this sewerage system. This shall be achieved by conveying the foul arising from the proposed development within a Ø 150mm gravity pipe.

6.1.4 In line with Sewers for adoption 7th all Ø 150mm foul pipework should be laid at gradients to suit the site's topography, whilst ensuring that a minimum gradient of 1:150 is achieved, and minimum of 1:80 for all 100mm pipework.

6.1.5 The design of the foul drainage system, along with the surface water system, for the proposed development is illustrated in the drawing enclosed in **Appendix G**.

7.0 Conclusion & Recommendations

7.1.1 This Drainage Strategy Report provides a suitable drainage strategy for the discharge of surface water run-off and foul effluent generated as a result of the proposed development.

7.1.2 Surface water run-off from the proposed hardstanding areas will be stored within a below ground soakaway structures and will be released into the ground at the natural infiltration rate.

7.1.3 All foul generated from the proposed development will discharged directly into the existing public foul sewerage network, via an proposed onsite adoptable pumping station.

APPENDICES

APPENDIX A
Site Location Plan

NOTES

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL LEVELS IN METERS UNLESS NOTED OTHERWISE ON DRAWING.
3. ALL DIMENSIONS AND LEVELS TO BE CHECKED ON SITE PRIOR TO UNDERTAKING ANY WORKS, ORDERING MATERIALS OR FABRICATING ANY COMPONENTS
4. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEER'S AND ARCHITECT'S DRAWINGS AND RELEVANT SPECIFICATION CLAUSES.

KEY

PROPOSED SITE BOUNDARY.

SUITABILITY	REV	DATE	DESCRIPTION	Org.	Chk'd	App'd	Auth'd
S1	P01	06.07.20	FIRST ISSUE				

DRAWING STATUS:

PROJECT TITLE:

LLANDYGAI ROAD, BANGOR

DRAWING TITLE:

SITE LOCATION PLAN

DRAWING No.:

PROJECT	ORIGINATOR	VOL.	LOC.	TYPE	ROLE
13320	CCE	V1	XX	40:40:01	C

CLASSIFICATION	No.	SUITABILITY	REVISION
50:30	0003	S1	P01

ORIGINATOR:	DATE:	SCALE:	ORIGINAL SIZE:
B.Thorne	06.07.2020	1:5000	A4

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APPENDIX B
Proposed Site Layout

Key:

- Site Boundary
- 1.8m high boundary fence
- 1.8m high screen wall / fence
- Private Drive
- Visibility Splays - 2.4x59m to Site Entrance
- Indicative Landscaping
- Number of parking spaces proposed to Semi-Detached and Detached Dwellings in accordance with Gwynedd's Parking Standards
- Parking space allocation to Frontage Parking Dwellings
- Knee rails to parking bays to Terraced Housetypes
- Affordable Housing
- Existing retained hedges/landscaping

SCHEDULE OF ACCOMMODATION

HOUSETYPE	DESCRIPTION	SQFT	NUMBER	PERCENTAGE
AH1B (Affordable)	2 Bed 2 Storey Mid/End-Terrace	660 SQFT	2	11.94
AH3B (Affordable)	2 Bed 2 Storey End-Terrace	999 SQFT	6	8.96
Oakley	2 Bed 2 Storey Mid-Terrace	705 SQFT	7	10.45
Highfield	3 Bed 2 Storey End-Terrace	822 SQFT	9	11.94
Marlow	3 Bed 2 Storey	979 SQFT	5	7.46
Grafton	3 Bed 2 Storey	1046 SQFT	5	7.46
Evesham	3 Bed 2 Storey	1125 SQFT	8	11.94
Rockwood	4 Bed 2 Storey	1253 SQFT	8	11.94
Canterbury	4 Bed 2 Storey	1329 SQFT	8	11.94
Salisbury	4 Bed 2 Storey	1515 SQFT	4	5.97
TOTAL		73491 SQFT	67	

Gross Site Area	6.19 Acres	2.51	Hectares
POS	1.47 Acres	0.59	Hectares
Underground/ater SSR, Cottages Access Route Pump Station	0.13 Acres	0.05	Hectares
NETT SITE AREA:	4.59 ACRES	1.86	HECTARES
Gross Density	10.82 Units/Acre	26.75	Units/Hectare
NETT DENSITY:	14.60 UNITS/ACRE	36.07	UNITS/HECTARE
Gross Floorage	113773.54 SQFT/Acre	2810.93	SQM/Hectare
NETT FOOTAGE:	16527.91 SQFT/ACRE	3923.06	SQM/HECTARE

Rev:	Description:	Date:
A:	General mix & layout amends.	18/03/20
B:	Pump Station added	09/06/20
C:	Additional Unit added	12/06/20

MACBRYDE HOMES

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Site:
Llandegai Road, Bangor

Title:
Site Layout

Scale: 1:500@A0

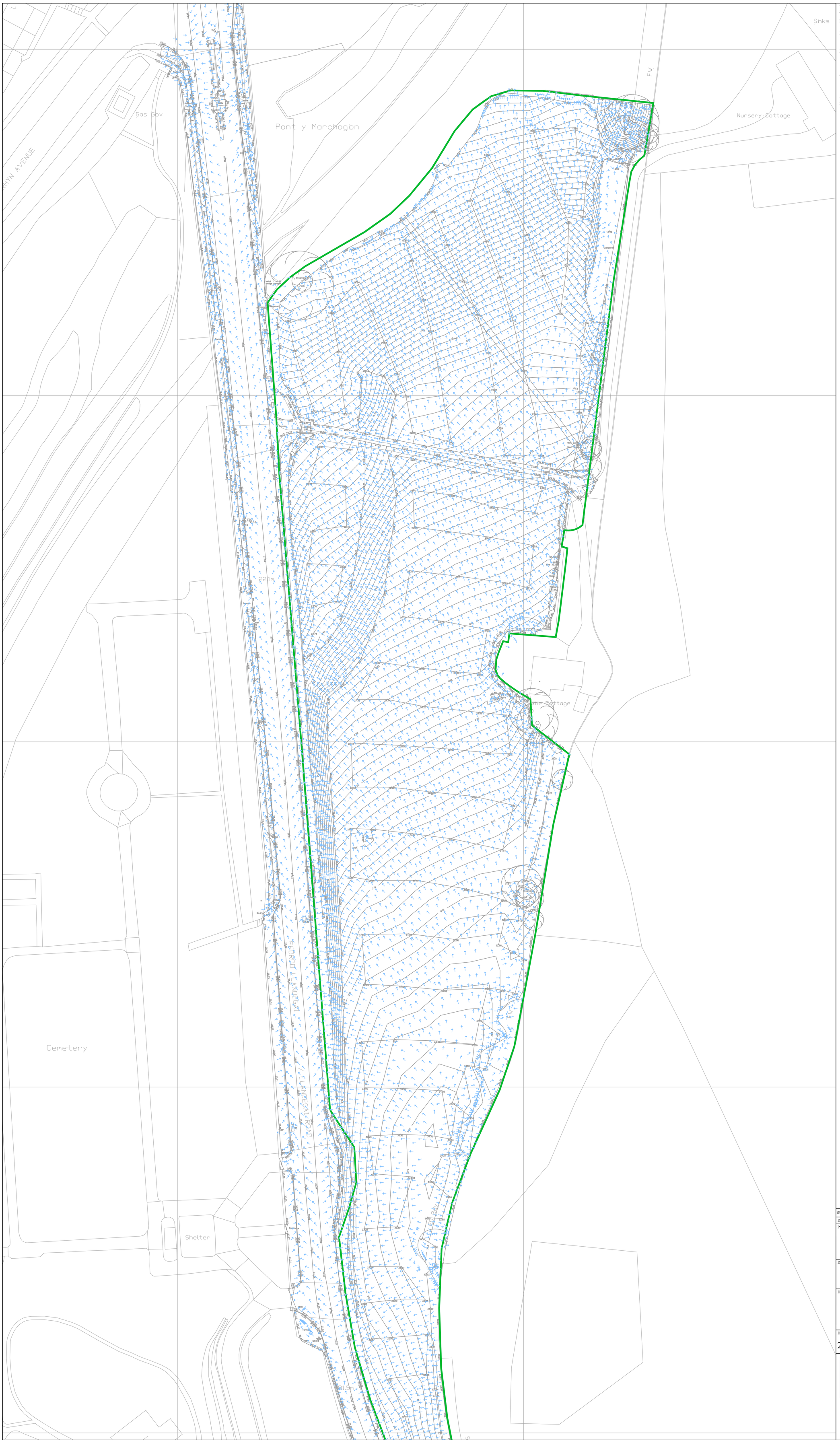
Date: 03/03/2020

Ref: LRBANG-SL.01

Rev: C

APPENDIX C

Existing & Proposed Above Ground Surface Water Flood Routing



NOTES

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KEY

DENOTES EXISTING DIRECTION OF ABOVE GROUND SURFACE WATER RUN-OFF.

SUITABILITY	REV	DATE	DESCRIPTION	Org.	Chk'd	App'd
DRAWING STATUS						

PROJECT TITLE:

LLANDYGAI ROAD, BANGOR

DRAWING TITLE:

EXISTING ABOVE GROUND FLOOD ROUTING

DRAWING No.:

PROJECT	ORIGINATOR	VOL.	LOC.	TYPE	ROLE
13320	CCE	V1	XX	40:40:01	C

CLASSIFICATION	No.	SUITABILITY	REVISION
50:30	0002	S1	P01

DATE:	ORIGINATOR:	SCALE:	ORIGINAL SIZE:
23.06.2020	B.Thorne	1:500	A1

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APPENDIX D

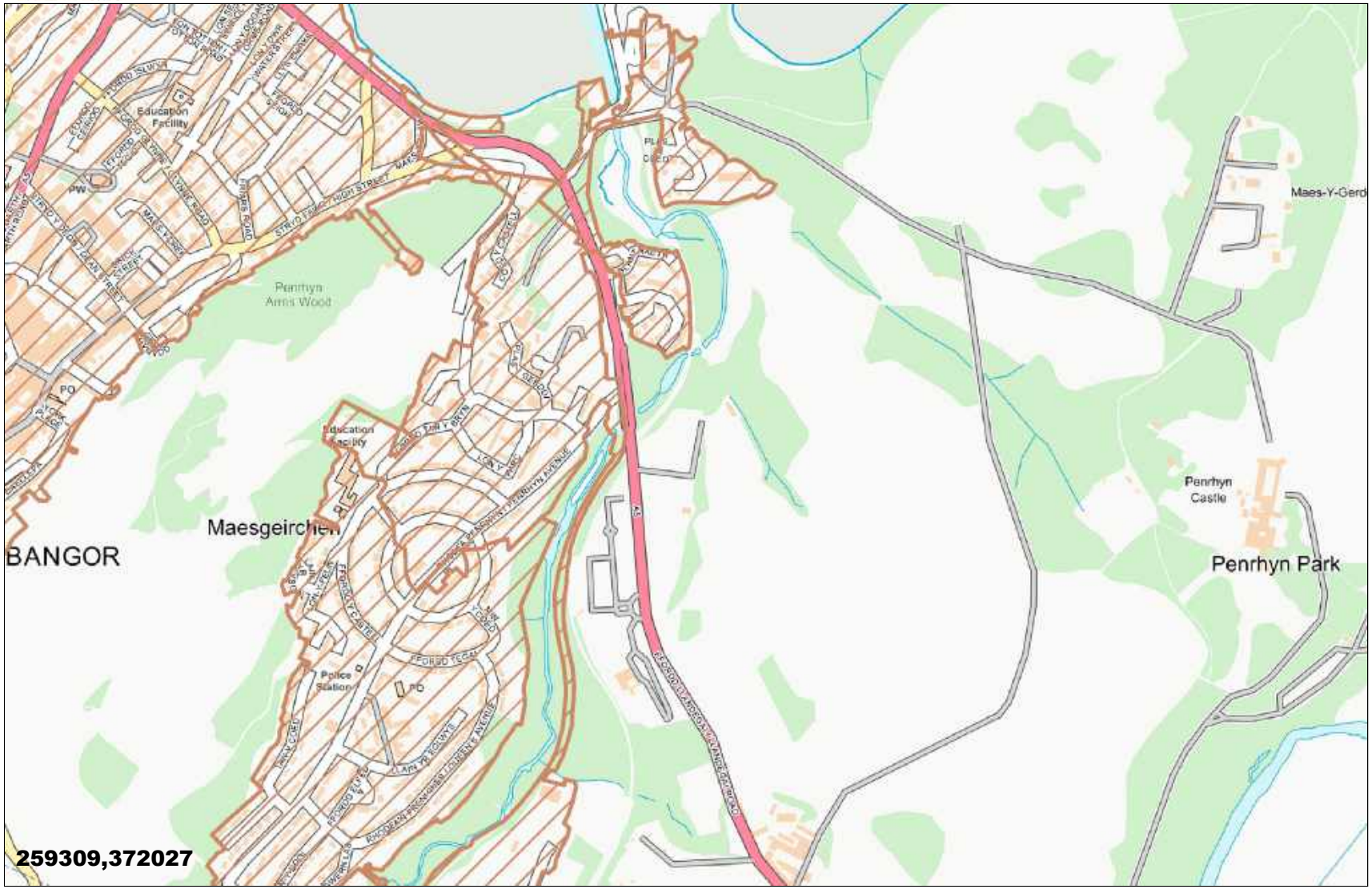
Dŵr Cymru / Welsh Water Apparatus Map

Dŵr Cymru
Welsh Water

013320-CCE-V1-XX-40.40.01-C-50.30-0004-S1-P01 - DCWW Maps

07/07/2020

Scale: 1: 10000



LEGEND

Clean Water

- Sluice Val
- Air Val, SINGLE
- Tap
- Pressure Reducing Valve
- Meter
- BULK Meter
- FH
- Cap
- Existing Main
- NON COMPANY

Sewerage External

- Foul
- Surface Water
- Combined
- Rising Main
- Private
- Treatment Works
- Pumping Station
- Special Purpose
- Unknown End
- Change, Combined Overflow
- Outfall, FOUL
- Lamp Hole, Foul
- Private Sewer Transfer
- Lateral Drain
- Inspection Chamber

EXACT LOCATION OF ALL APPARATUS TO BE DETERMINED ON SITE

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets, there is a possibility that in some cases pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be Asbestos Cement (AC) or Pitch Fibre (PF). It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation

APPENDIX E

'*Causeway Flow*' Hydraulic Modelling Output

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	30	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
EX			14.000	1200	259329.374	372079.940	1.460
S1			15.000	2400	259320.406	372073.202	2.200
S2	0.180	5.00	15.000	2400	259298.456	372063.214	1.900
S3	0.180	5.00	21.500	2400	259291.814	372012.117	2.000
S4	0.180	5.00	23.750	2400	259285.591	371973.444	1.950
S5	0.180	5.00	27.360	2400	259286.133	371921.502	1.960
S6	0.180	5.00	31.000	2400	259281.866	371869.762	2.000
S7	0.180	5.00	33.000	2400	259262.661	371799.336	2.000
S8			33.500	1200	259261.419	371772.128	1.000
S9	0.076	5.00	33.700	1200	259278.637	371767.777	0.975
S10	0.094	5.00	30.400	1200	259260.878	371862.617	1.000

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.008	S1	EX	11.217	0.600	12.800	12.540	0.260	43.1	450	6.73	50.0
1.007	S2	S1	24.116	0.600	13.100	12.800	0.300	80.4	450	6.67	50.0
1.006	S3	S2	51.527	0.600	19.500	13.100	6.400	8.1	450	6.49	50.0
1.005	S4	S3	39.170	0.600	21.800	19.500	2.300	17.0	450	6.37	50.0
1.004	S5	S4	51.945	0.600	25.400	21.800	3.600	14.4	300	6.24	50.0
1.003	S6	S5	51.916	0.600	29.000	25.400	3.600	14.4	300	6.03	50.0
1.002	S7	S6	72.998	0.600	31.000	29.000	2.000	36.5	300	5.82	50.0
1.001	S8	S7	27.236	0.600	32.500	31.000	1.500	18.2	150	5.36	50.0
1.000	S9	S8	17.759	0.600	32.725	32.500	0.225	78.9	300	5.17	50.0
2.000	S10	S6	22.171	0.600	29.400	29.000	0.400	55.4	225	5.21	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.008	3.101	493.3	220.2	1.750	1.010	1.250	0.0	210	3.018
1.007	2.269	360.8	220.2	1.450	1.750	1.250	0.0	254	2.376
1.006	7.197	1144.6	188.5	1.550	1.450	1.070	0.0	123	5.382
1.005	4.944	786.3	156.8	1.500	1.550	0.890	0.0	135	3.888
1.004	4.159	294.0	125.1	1.660	1.650	0.710	0.0	136	3.994
1.003	4.161	294.1	93.4	1.700	1.660	0.530	0.0	116	3.706
1.002	2.610	184.5	45.1	1.700	1.700	0.256	0.0	100	2.168
1.001	2.375	42.0	13.4	0.850	1.850	0.076	0.0	58	2.117
1.000	1.771	125.2	13.4	0.675	0.700	0.076	0.0	66	1.168
2.000	1.760	70.0	16.6	0.775	1.775	0.094	0.0	74	1.447

Pipeline Schedule

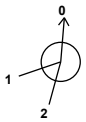
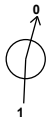
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.008	11.217	43.1	450	Circular	15.000	12.800	1.750	14.000	12.540	1.010
1.007	24.116	80.4	450	Circular	15.000	13.100	1.450	15.000	12.800	1.750
1.006	51.527	8.1	450	Circular	21.500	19.500	1.550	15.000	13.100	1.450
1.005	39.170	17.0	450	Circular	23.750	21.800	1.500	21.500	19.500	1.550
1.004	51.945	14.4	300	Circular	27.360	25.400	1.660	23.750	21.800	1.650
1.003	51.916	14.4	300	Circular	31.000	29.000	1.700	27.360	25.400	1.660
1.002	72.998	36.5	300	Circular	33.000	31.000	1.700	31.000	29.000	1.700
1.001	27.236	18.2	150	Circular	33.500	32.500	0.850	33.000	31.000	1.850
1.000	17.759	78.9	300	Circular	33.700	32.725	0.675	33.500	32.500	0.700
2.000	22.171	55.4	225	Circular	30.400	29.400	0.775	31.000	29.000	1.775

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.008	S1	2400	Manhole	Adoptable	EX	1200	Manhole	Adoptable
1.007	S2	2400	Manhole	Adoptable	S1	2400	Manhole	Adoptable
1.006	S3	2400	Manhole	Adoptable	S2	2400	Manhole	Adoptable
1.005	S4	2400	Manhole	Adoptable	S3	2400	Manhole	Adoptable
1.004	S5	2400	Manhole	Adoptable	S4	2400	Manhole	Adoptable
1.003	S6	2400	Manhole	Adoptable	S5	2400	Manhole	Adoptable
1.002	S7	2400	Manhole	Adoptable	S6	2400	Manhole	Adoptable
1.001	S8	1200	Manhole	Adoptable	S7	2400	Manhole	Adoptable
1.000	S9	1200	Manhole	Adoptable	S8	1200	Manhole	Adoptable
2.000	S10	1200	Manhole	Adoptable	S6	2400	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
EX	259329.374	372079.940	14.000	1.460	1200	1	1.008	12.540	450
S1	259320.406	372073.202	15.000	2.200	2400	1	1.007	12.800	450
						0	1.008	12.800	450
S2	259298.456	372063.214	15.000	1.900	2400	1	1.006	13.100	450
						0	1.007	13.100	450
S3	259291.814	372012.117	21.500	2.000	2400	1	1.005	19.500	450
						0	1.006	19.500	450
S4	259285.591	371973.444	23.750	1.950	2400	1	1.004	21.800	300
						0	1.005	21.800	450
S5	259286.133	371921.502	27.360	1.960	2400	1	1.003	25.400	300
						0	1.004	25.400	300

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S6	259281.866	371869.762	31.000	2.000	2400		1	2.000	29.000	225
							2	1.002	29.000	300
							0	1.003	29.000	300
S7	259262.661	371799.336	33.000	2.000	2400		1	1.001	31.000	150
							0	1.002	31.000	300
S8	259261.419	371772.128	33.500	1.000	1200		1	1.000	32.500	300
							0	1.001	32.500	150
S9	259278.637	371767.777	33.700	0.975	1200		0	1.000	32.725	300
S10	259260.878	371862.617	30.400	1.000	1200		0	2.000	29.400	225

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
FSR Region	England and Wales	Additional Storage (m³/ha)	20.0
M5-60 (mm)	20.000	Check Discharge Rate(s)	✓
Ratio-R	0.300	1 year (l/s)	18.7
Summer CV	0.750	30 year (l/s)	38.3
Winter CV	0.840	100 year (l/s)	46.3
Analysis Speed	Normal	Check Discharge Volume	x
Skip Steady State	x		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	30	0	0
30	30	0	0
100	30	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)	2.505	Betterment (%)	0
SAAR (mm)	1133	QBar	21.3
Soil Index	4	Q 1 year (l/s)	
SPR	0.47	Q 30 year (l/s)	
Region	9	Q 100 year (l/s)	
Growth Factor 1 year	0.85		

Node S1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	12.800	Product Number	CTL-SHE-0195-1870-0850-1870
Design Depth (m)	0.850	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	18.7	Min Node Diameter (mm)	1500

Node S1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	14.000	Product Number	CTL-SHE-0164-1300-1000-1300
Design Depth (m)	1.000	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	13.0	Min Node Diameter (mm)	1200

Node S8 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	32.500	Product Number	CTL-SHE-0128-7500-1000-7500
Design Depth (m)	1.000	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	7.5	Min Node Diameter (mm)	1200

Node S10 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	29.400	Product Number	CTL-SHE-0146-1000-1000-1000
Design Depth (m)	1.000	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	10.0	Min Node Diameter (mm)	1200

Node S2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	13.100
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	140

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	150.0	0.0	1.900	500.0	0.0

Node S8 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	32.500
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Time to half empty (mins)	34

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	19.0	0.0	0.551	91.0	0.0	0.801	0.0	0.0
0.550	19.0	0.0	0.800	91.0	0.0			

Node S10 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	29.400
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Time to half empty (mins)	23

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	19.0	0.0	0.551	200.0	0.0	0.801	0.0	0.0
0.550	19.0	0.0	0.800	200.0	0.0			

Results for 1 year +30% CC Critical Storm Duration. Lowest mass balance: 99.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	EX	1	12.540	0.000	18.7	0.0000	0.0000	OK
120 minute winter	S1	96	13.661	0.861	64.6	3.8961	0.0000	SURCHARGED
120 minute winter	S2	96	13.662	0.562	86.9	117.0978	0.0000	SURCHARGED
15 minute winter	S3	11	19.613	0.113	161.0	0.7115	0.0000	OK
15 minute winter	S4	11	21.932	0.132	132.0	0.8382	0.0000	OK
15 minute winter	S5	11	25.524	0.124	104.1	0.7899	0.0000	OK
15 minute winter	S6	11	29.102	0.102	75.7	0.6463	0.0000	OK
15 minute winter	S7	10	31.089	0.089	37.0	0.5656	0.0000	OK
15 minute winter	S8	13	32.723	0.223	12.5	1.7371	0.0000	SURCHARGED
15 minute winter	S9	10	32.789	0.064	12.7	0.1713	0.0000	OK
15 minute winter	S10	13	29.653	0.253	15.7	2.4420	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	S1	Hydro-Brake®	EX	18.8				228.9
120 minute winter	S1	Hydro-Brake®	EX	0.0				0.0
120 minute winter	S2	1.007	S1	64.6	0.575	0.179	3.8210	
15 minute winter	S3	1.006	S2	161.7	4.709	0.141	3.7728	
15 minute winter	S4	1.005	S3	132.9	3.831	0.169	1.3604	
15 minute winter	S5	1.004	S4	103.8	3.626	0.353	1.4869	
15 minute winter	S6	1.003	S5	74.7	3.072	0.254	1.2638	
15 minute winter	S7	1.002	S6	36.1	1.868	0.196	1.4131	
15 minute winter	S8	Hydro-Brake®	S7	7.4				
15 minute winter	S9	1.000	S8	12.5	0.889	0.100	0.5686	
15 minute winter	S10	Hydro-Brake®	S6	9.9				

Results for 30 year +30% CC Critical Storm Duration. Lowest mass balance: 99.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	EX	1	12.540	0.000	20.4	0.0000	0.0000	OK
180 minute winter	S1	140	14.355	1.555	68.6	7.0331	0.0000	SURCHARGED
180 minute winter	S2	140	14.359	1.259	137.6	343.0961	0.0000	SURCHARGED
15 minute winter	S3	10	19.674	0.174	374.4	1.0981	0.0000	OK
15 minute winter	S4	10	22.010	0.210	303.9	1.3384	0.0000	OK
15 minute winter	S5	10	25.609	0.209	234.0	1.3319	0.0000	OK
15 minute winter	S6	10	29.157	0.157	162.5	0.9912	0.0000	OK
15 minute winter	S7	10	31.137	0.137	80.8	0.8659	0.0000	OK
30 minute winter	S8	26	33.161	0.661	22.3	7.9305	0.0000	SURCHARGED
30 minute winter	S9	26	33.161	0.436	25.0	1.1738	0.0000	SURCHARGED
30 minute winter	S10	25	30.040	0.640	30.9	11.8672	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	S1	Hydro-Brake®	EX	24.9				493.4
180 minute winter	S1	Hydro-Brake®	EX	13.0				85.2
180 minute winter	S2	1.007	S1	68.6	0.601	0.190	3.8210	
15 minute winter	S3	1.006	S2	372.5	5.172	0.325	5.5316	
15 minute winter	S4	1.005	S3	301.6	4.701	0.384	2.5256	
15 minute winter	S5	1.004	S4	230.5	4.404	0.784	2.7329	
15 minute winter	S6	1.003	S5	160.5	3.566	0.546	2.3296	
15 minute winter	S7	1.002	S6	79.7	2.326	0.432	2.5018	
30 minute winter	S8	Hydro-Brake®	S7	7.5				
30 minute winter	S9	1.000	S8	22.3	0.931	0.178	1.2506	
30 minute winter	S10	Hydro-Brake®	S6	10.0				

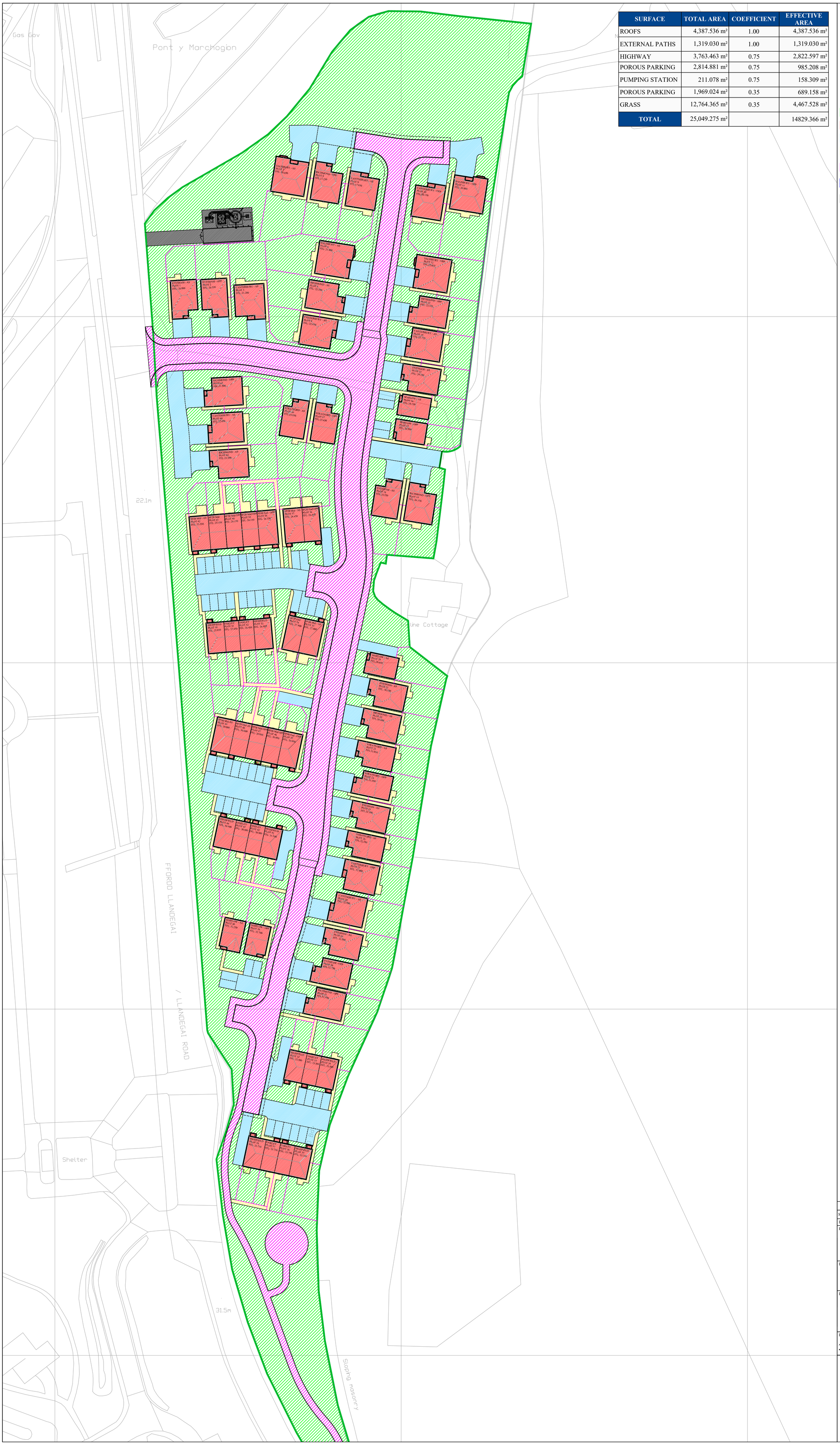
Results for 100 year +30% CC Critical Storm Duration. Lowest mass balance: 99.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	EX	1	12.540	0.000	21.9	0.0000	0.0000	OK
180 minute winter	S1	152	14.698	1.898	47.2	8.5843	0.0000	SURCHARGED
180 minute winter	S2	152	14.702	1.602	174.3	487.1691	0.0000	FLOOD RISK
15 minute winter	S3	10	19.698	0.198	475.4	1.2530	0.0000	OK
15 minute winter	S4	10	22.043	0.243	383.6	1.5508	0.0000	OK
15 minute winter	S5	11	25.678	0.278	297.1	1.7671	0.0000	OK
15 minute winter	S6	10	29.181	0.181	204.6	1.1454	0.0000	OK
15 minute winter	S7	10	31.157	0.157	101.8	0.9955	0.0000	OK
60 minute winter	S8	46	33.381	0.881	23.1	12.6202	0.0000	FLOOD RISK
60 minute winter	S9	46	33.382	0.657	22.9	1.7680	0.0000	SURCHARGED
30 minute winter	S10	27	30.128	0.728	40.4	18.2882	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	S1	Hydro-Brake®	EX	27.4				547.5
180 minute winter	S1	Hydro-Brake®	EX	13.0				141.1
180 minute winter	S2	1.007	S1	47.2	0.643	0.131	3.8210	
15 minute winter	S3	1.006	S2	473.3	5.337	0.414	5.8140	
15 minute winter	S4	1.005	S3	382.8	4.954	0.487	3.0305	
15 minute winter	S5	1.004	S4	292.6	4.560	0.995	3.3593	
15 minute winter	S6	1.003	S5	202.3	3.624	0.688	2.9017	
15 minute winter	S7	1.002	S6	100.6	2.457	0.545	2.9892	
60 minute winter	S8	Hydro-Brake®	S7	7.5				
60 minute winter	S9	1.000	S8	23.1	0.887	0.185	1.2506	
30 minute winter	S10	Hydro-Brake®	S6	10.0				

APPENDIX F

Existing & Proposed Impermeable Area Plan



SURFACE	TOTAL AREA	COEFFICIENT	EFFECTIVE AREA
ROOFS	4,387.536 m²	1.00	4,387.536 m²
EXTERNAL PATHS	1,319.030 m²	1.00	1,319.030 m²
HIGHWAY	3,763.463 m²	0.75	2,822.597 m²
POROUS PARKING	2,814.881 m²	0.75	985.208 m²
PUMPING STATION	211.078 m²	0.75	158.309 m²
POROUS PARKING	1,969.024 m²	0.35	689.158 m²
GRASS	12,764.365 m²	0.35	4,467.528 m²
TOTAL	25,049.275 m²		14829.366 m²

NOTES

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL LEVELS IN METERS UNLESS NOTED OTHERWISE ON DRAWING.
3. ALL DIMENSIONS AND LEVELS TO BE CHECKED ON SITE PRIOR TO UNDERTAKING ANY WORKS, ORDERING MATERIALS OR FABRICATING ANY COMPONENTS.
4. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEER'S AND ARCHITECT'S DRAWINGS AND RELEVANT SPECIFICATION CLAUSES.

KEY

- DENOTES AREA OF PROPOSED GRASS.
- DENOTES AREA OF PROPOSED HOUSES.
- DENOTES AREA OF PROPSOED PARKING.
- DENOTES AREA OF PROPOSED EXTERNAL PATHS.
- DENOTES AREA OF PROPOSED ADOPTABLE HIGHWAY.
- DENOTES AREA OF PROPOSED PRIVATE ROAD.
- DENOTES AREA OF PROPOSED SEWERAGE PUMPING STATION.

S1	P01	06.07.20	FIRST ISSUE			
SUITABILITY	REV	DATE	DESCRIPTION	Org.	Chk'd	App'd

DRAWING STATUS

PROJECT TITLE:

LLANDYGAI ROAD,
BANGOR

DRAWING TITLE:

PROPOSED IMPERMABLE
AREA PLAN

DRAWING No.:

PROJECT	ORIGINATOR	VOL.	LOC.	TYPE	ROLE
13320	CCE	V1	XX	40:40:01	C

CLASSIFICATION	No.	SUITABILITY	REVISION
50:30	0005	S1	P01

DATE:	ORIGINATOR:	SCALE:	ORIGINAL SIZE:
23.06.2020	B.Thorne	1:500	A1

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APPENDIX G

Proposed Section 104 Drainage Layout

CONNECTION TO CHAMBER WITH DCWW REFERANCE SH59721303

DENTENTION BASIN OR POND PROVIDING 500m³ OF ATTENUATION

HYDROBRAKE FLOW CONTROL DEVICE WITH VARYING FLOW BASED ON WATER HEAD INLINE WITH GREENFEILD RUN-OFF RATES REF TABLE.

HYDROBRAKE FLOW CONTROL DEVICE TO HEADWALL OF SWALE TO REDUCE FLOWS AND PROVIDE ADDITIONAL STORAGE.

HYDROBRAKE FLOW CONTROL DEVICE AND GRANULAR STORAGE BELOW PARKING AREA FOR PLOTS 41 - 49.

HYDROBRAKE FLOW CONTROL DEVICE AND GRANULAR STORAGE BELOW PARKING AREA FOR PLOTS 32 - 35.

DRAFT SCHEME FOR DISCUSSION

NOTES

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL LEVELS IN METERS UNLESS NOTED OTHERWISE ON DRAWING.
3. ALL DIMENSIONS AND LEVELS TO BE CHECKED ON SITE PRIOR TO UNDERTAKING ANY WORKS, ORDERING MATERIALS OR FABRICATING ANY COMPONENTS.
4. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEER'S AND ARCHITECT'S DRAWINGS AND RELEVANT SPECIFICATION CLAUSES.
5. PLEASE REFER TO ARCHITECTS DRAWINGS FOR FINAL BUILDING LOCATION.
6. THE LOCAL AUTHORITY AND SERVICE COMPANIES ARE TO BE NOTIFIED PRIOR TO COMMENCEMENT OF WORK ON SITE.
7. ALL DRAINAGE COMPONENTS ARE TO COMPLY WITH CURRENT BRITISH STANDARDS AND BUILDING REGULATIONS REQUIREMENTS.
8. ALL WORKS TO BE IN ACCORDANCE WITH THE LOCAL AUTHORITYS ROADS FOR ADOPTION SPECIFICATION.
9. ALL WORKS AND MATERIALS TO BE IN ACCORDANCE WITH THE SPECIFICATION FOR HIGHWAY WORKS (SHW SERIES 500).
10. DRAIN PIPE THROUGH WALLS OR BENEATH FOUNDATIONS (SPREAD ONLY) TO HAVE R.C BRIDGE LINTELS OVER AND PIPE SURROUNDED IN FLEXIBLE MATERIAL (50mm).
11. FINAL LOCATIONS AND DETAILS OF SOIL VENT PIPES, STUB STACKS, RAINWATER DOWN PIPES, GULLIES ETC. TO BE CONFIRMED BY REFERENCE TO ARCHITECT' DRAWINGS.
12. ALL THRESHOLD DRAIN DETAILS TO BE TO ARCHITECT' DETAILS.
13. ALL PIPES INTO CHAMBERS TO SOFFIT TO SOFFIT U.N.O.
14. AT ALL OUTFALL POINTS TO AN EXISTING NETWORK, THE POSITION AND INVERT LEVEL OF EXISTING DRAINS MUST BE CONFIRMED WELL IN ADVANCE OF THE PROGRAMMED DATE FOR INSTALLING ANY OF THE UPSTREAM DRAINAGE, OR ORDERING OF ANY MATERIALS IN ORDER TO ALLOW TIME FOR ANY NECESSARY REVISIONS TO THE HYDRAULIC DESIGN.
15. ALL GRAVITY UPVC PIPEWORK TO BE TO BS 4660 OR BS 5481 WHERE RELEVANT UNLESS NOTED OTHERWISE.
16. ALL NON ADOPTABLE DOMESTIC FOUL AND SURFACE WATER PIPE RUNS SHALL CONSIST OF 100mm DIA. PIPES LAID AT NO FLATTER THAN 1/80 FALLS U.N.O. A SEWER OR LATERAL DRAIN WITH A NOMINAL INTERNAL DIAMETER OF 100mm, OR A LATERAL DRAIN SERVING TEN OR LESS PROPERTIES IS LAID TO A GRADIENT NOT FLATTER THAN 1:80, WHERE THERE IS AT LEAST ONE WC CONNECTED AND 1:40 IF THERE IS NO WC CONNECTED.
17. ALL CONNECTIONS FROM HIGHWAY GULLIES TO BE 150mm DIA. LAID AT FALLS OF BETWEEN 1/20 AND 1/100 WITH TYPE S BED AND SURROUND TO ALL CONNECTIONS WITH MIN. 1.20m COVER, TYPE Z BED AND SURROUND TO ALL OTHER CONNECTIONS.
18. THERMOPLASTIC PIPES & FITTINGS:
THERMOPLASTIC PIPES, JOINTS & FITTINGS FOR GRAVITY SEWERS SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 1401-1, BS EN 1852 & BS EN 12666-1.
19. THERMOPLASTIC STRUCTURED WALL PIPE:
THERMOPLASTIC STRUCTURED WALL SEWER PIPE SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 13476-1 & WIS 4-35-01 AND BS EN 13476-2 OR BS EN 13476-3. PIPES SHALL BE BSI KITEMARKED OR HAVE EQUIVALENT THIRD PART CERTIFICATION. PIPES LESS THAN OR EQUAL TO 500mm IN DIAMETER SHALL HAVE NOMINAL SHORT-TERM RING STIFFNESS NOT LESS THAN 8KN/m² (SN8) OR BE SUBJECT TO A QUALITY SYSTEM FOR STORAGE & EMBEDMENT.

    Nom. SHORT TERM RING STIFFNESS OF 2KN/m² (SN2) IS ACCEPTABLE FOR PIPES GREATER THAN Ø500mm, SUBJECT TO SUPPORTING STRUCTURAL DESIGN LOAD CALCULATIONS BEING PROVIDED.

    TRANSPORTATION, HANDLING, STORAGE AND LAYING SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.

    WHERE A FITTING IS INSTALLED ON A SEWER LENGTH, IT SHALL HAVE THE SAME INTERNAL BORE AS THE SEWER. Max. LENGTH OF PIPE FOR LAYING IS 3.0m OR Ø x 10, WHICHEVER IS THE GREATER, UNLESS WELDED JOINTS ARE USED.
20. CONNECTION TO THE PUBLIC SEWER
A SECTION 106 APPLICATION TO CONNECT MUST BE MADE TO UNITED UTILITIES. THE DEVELOPER SHALL GIVE 21 DAYS NOTICE PRIOR TO CONNECTION, THE WORKS MAY ONLY BE UNDERTAKEN BY A UNITED UTILITIES HEALTH AND SAFETY APPROVED CONTRACTOR.
21. OPTIMUM TRENCH WIDTH
OPTIMUM TRENCH WIDTH = PIPE + 300mm. CONTRACTOR TO ENSURE TRENCH WALLS ARE SUITABLY PROPPED.
22. BACKFILLING TO PIPE TRENCHES BENEATH ROADS, CAR PARKING AND STRUCTURES TO BE M.O.T. TYPE 1 GRANULAR MATERIAL UP TO FORMATION LEVEL FROM THE TOP OF THE SPECIFIED PIPE SURROUND (WELL COMPACTED IN 150mm LAYERS).
23. BACKFILLING TO PIPE TRENCHES BENEATH LANDSCAPED AREAS TO BE SELECTED EXCAVATE MATERIAL FREE FROM LARGE STONES GREATER THAN 0mm, LUMPS OF CLAY OVER 100mm, ANY TIMBER, FROZEN MATERIAL OR VEGETATION MATTER UP TO FROMATION / GROUND LEVEL FROM THE TOP OF THE SPECIFIED PIPE SURROUND (WELL COMPACTED IN 150mm LAYERS).
24. GRANULAR MATERIAL NOMINAL SIZE 10mm SINGLE SIZED OR 14mm TO 5mm GRADED.
25. BACKFILL MUST NOT BE LACED ON CONCRETE BEDDING OR SURROUND UNTIL THE CONCRETE COMPRESSIVE STRENGTH HAS REACHED 15N/mm².
26. BRICKS OR BLOCKS MUST NOT BE PLACED IN THE BEDDING MORTAR FOR SETTING THE PIPES TO LEVEL .
27. ALL ROCKER PIPE LENGHTS TO BE MIN 600mm.
28. PROVIDE ROCKER PIPES AT TRANSITION FROM CONCRETE SURROUND TO GRANULAR SURROUND.
29. MAX DISTANCE FROM FACE OF CONCRETE SURROUND TO FIRST FLEXIBLE JOINT TO BE 150mm.
30. MANHOLE COVERS AND FRAMES
MANHOLE COVERS AND FRAMES SHALL COMPLY WITH THE RELEVANT PROVISIONS OF THE BS EN 124,M BS 7903 AND HIGHWAYS AGENCY GUIDANCE DOCUMENT HA 104/09. THEY SHALL BE OF NON ROCKING DESIGN WHICH DOES NOT RELAY TO THE CUSHION INSERTS.

    MANHOLE COVER ON FOUL ONLY SEWERS SHALL BE OF LOW LEAKAGE TYPES IN ORDER TOP PREVENT EXCESSIVE SURFACE WATER INGRESS

    AS A MINIMUM, CLASS D400 SHALL BE USED IN CARRIAGEWAYS OR ROADS (INCLUDING PEDESTRIAN STREETS), HARD SHOULDERS AND PARKING AREAS USED BY ALL TYPES OF VEHICLES.

KEY

- 25.550 — PROPOSED FINISH FLOOR LEVEL
- PROPOSED OPEN LAND DRAINAGE CONDUITE / DRY SWALE
- PROPOSED RAIN GARDEN / TREE PIT.
- PROPOSED POROUS PAVING WITH PERFORATED PIPE.
- PROPOSED SURFACE WATER CHAMBER AND PIPE RUN.

Existing Site			
Surface	**Area**	**Coefficients**	**Effective Area**
Grass	25049.275 m²	0.35	8,767.246 m²

Referance	Qbar	1:1-Year Return Period	1:30-Year Return Period	1:100-Year Return Period
Greenfeild Run-off	21.3 l/s	18.7 l/s	38.3 l/s	46.3 l/s

Proposed Site			
Surface	**Area**	**Coefficients**	**Effective Area**
Plots	4,387.536 m²	1.00	4,387.536 m²
Road	1,319.030 m²	0.75	989.273 m²
Private Road	3,763.463 m²	0.75	2,822.597 m²
Parking	2,814.881 m²	0.75	2,111.161 m²
Grass	12,764.365 m²	0.35	4,467.528 m²
Total	25,049.275 m²		14,778.094 m²

	1:1-Year Return Period	1:30-Year Return Period	1:100-Year Return Period
Storage Required	151.660	413.612	573.368

SUITABILITY	REV	DATE	DESCRIPTION	Org.	Chk'd	App'd
DRAWING STATUS						

PROJECT TITLE:

DRAWING TITLE:

DRAWING No.:
PROJECT ORIGINATOR VOL. LOC. TYPE ROLE

DATE:	ORIGINATOR:	SCALE:	ORIGINAL SIZE:
		1:500	A1

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