SUDS Management Plan

Proposed Extension to Kiltipper Woods Care Home
At
Tallaght, Dublin

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Job No: 21-182 Date Created 05 January 23

Contents

Contents 3
Table of Figures 3
1.Introduction..... 4
2.Existing Site and Storm Water Drainage 5
3.Proposed SUDS System 7
4.SUDS Maintenance Plan 10
5.Conclusions and Recommendations 14
Appendix 1: Existing Drainage Plan 15
Appendix 2: Proposed Drainage Plan 17
Appendix 3: Existing and Proposed Areas Plans 18
Appendix 4: Existing Drainage Calculations 19
Appendix 5: Proposed Drainage Calculations 24

Table of Figures

Figure 2-1: Site Location Plan 5

1. Introduction

Kevin McShane Ltd. were commissioned to undertake a SUDS Management Plan in support of the planning application, reference number SD21A/0287, for a proposed extension of the Kiltipper Woods Care Home, located at an existing site at Tallaght, Dublin. The development comprises of the new building extension and associated drainage and hardstanding.

This SUDS Management Plan will provide an account of the design, construction and maintenance of the site's surface water and SUDS system. It will also address the points raised in point 1 of the South Dublin County Council Planning decision letter, dated 14 December 2021.

The storm water drainage has been designed in accordance with the Greater Dublin Regional Code of Practice, the SDCC Sustainable Drainage Explanatory, Design and Evaluation Guide 2022 and 'Sewers for Adoption' published by WRC, UK. To comply with the principles of Sustainable Urban Drainage Systems it is proposed to incorporate attenuation systems into the surface water drainage design which will assist in minimising the impact on the proposed discharge of surface waters from site and mimic greenfield runoff criteria.

It is proposed to introduce some additional SUDS features for the new extension in order to limit the surface water run-off from the proposed development to the River Dodder and to comprise of SUDS management train. These will also reduce the risk of pollution as they will filter surface water run-off from the higher risk car parking areas.

2. Existing Site and Storm Water Drainage

The proposed site is located on the northern east corner of the Kiltipper Woods Care Home, at Tallaght, Dublin. The existing site is 1.11Ha in area and is currently a care home. The Site Location Plan is presented in Figure 2-1.

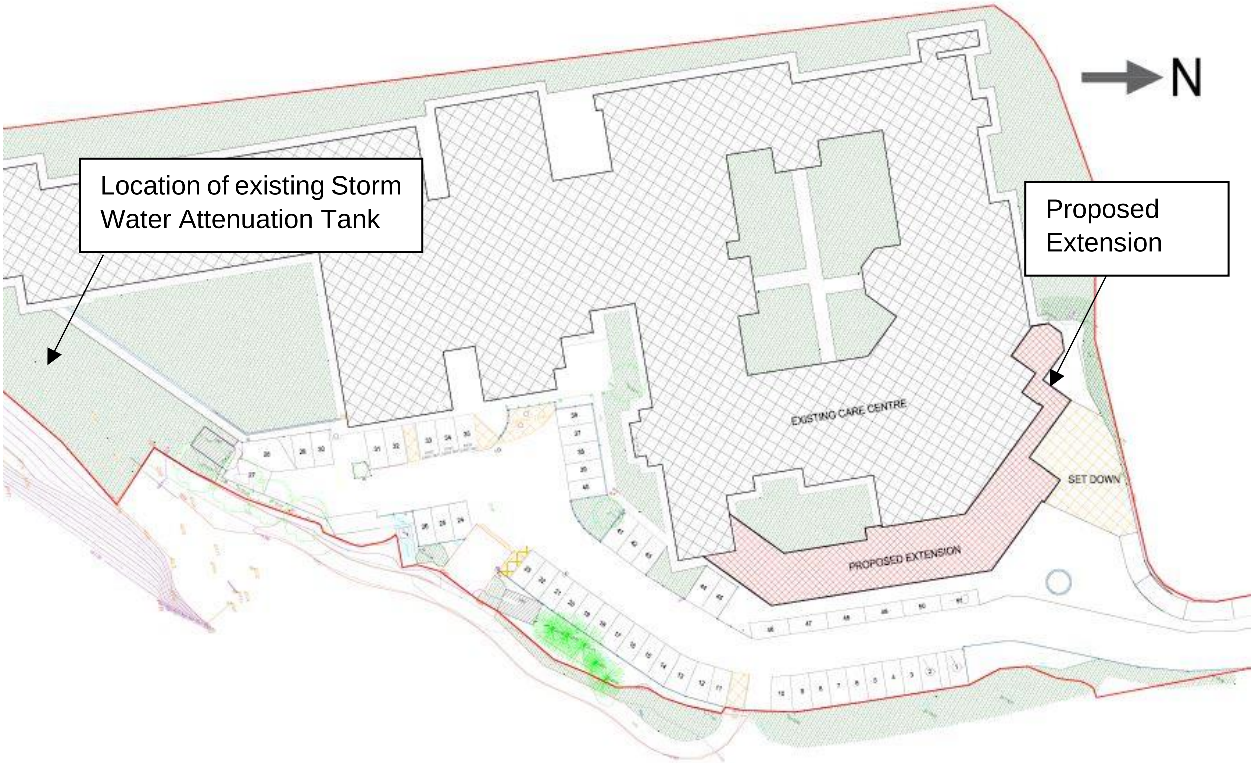


Figure 2-1: Site Location Plan

The proposed extension is currently located in an area of existing hard and soft landscaping. Levels are shown on the existing drainage plan in Appendix 1. The existing storm drainage on the site is collected and connected to two Storm Tec attenuation tanks located to the south of the site, each collecting storm from either side of the building. These operate with a constrained discharge in a 375mm diameter pipe (0.123m3/sec and the whole site at an agreed 6 l/s restriction on each tank (total of 12 l/s) with the drainage authority) to the adjacent River Dodder.

The existing site drainage system includes an underground Stomtec storm water attenuation tank in the south east corner. It is proposed retain this existing tank and include it as part of the proposed SUDS train for the new extension to the building and modifications to the car parking. Additional porous paving will also be added. Figure 2-2 below, and Figure 2-1 above, show the location of the existing storm water attenuation tanks and discharge manhole.

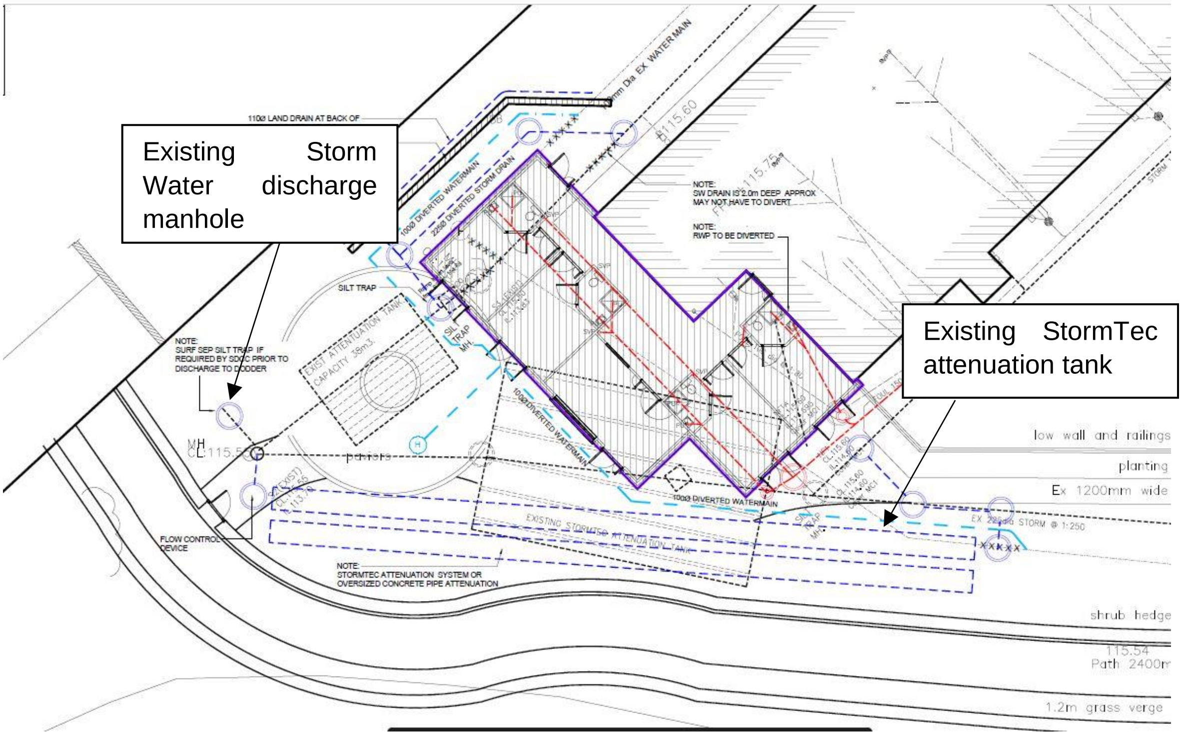


Figure 2-2: Existing Site Storm Drainage Tanks

3. Proposed SUDS System

The proposed surface water drainage system is designed to comply with the Local Authority requirements and the Greater Dublin Strategic Drainage Study (GDSDS). It is a requirement for all surface waters to be able to be retained, within the site boundaries, for up to the more extreme 1 in 100 year storm event, or 1.0% AEP. The performance of the proposed surface water drainage system will also ensure that there is no flooding under the 1 in 30 storm event. The GDSDS also requires that storm water is reviewed under four criteria – river water quality protection, river regime protection, level of service (flooding) site and river flood protection.

It is proposed to retain the two existing StormTec tanks, as shown in Figure 2-2 and Figure 2-1 above, which have an attenuation volume of 73m^3 and the existing 12 l/s surface water flow control as these currently serve the existing care home. However, some infiltration of surface water to the ground, by the provision of new porous paving in the car parking bays, will reduce the overall storm water discharge from the site.

For the proposed extension, it is proposed to enhance the existing surface water drainage system with a treatment train comprising Sustainable Urban Drainage Systems (SUDS) features such as new porous paving and filter trenches. Bio retention tree pits have been considered but the only new trees are contained within an inner courtyard. This report will also demonstrate how these new SUDS features will be incorporated into the existing storm drainage system to provide a SUDS train. Guidance on the long-term maintenance of the SUDS features will also be provided.

Other SUDS features such as ponds, swales and green roofs have been considered but due to the current site constraints on land-use, the extent of buildings, roads and car parking these can not be facilitated on the site for this proposed extension which only comprises a small proportion of the over all site.

SUDS has been considered for the seven small planters included in the building extension however as these are to be located within a small confided open space completely surrounded by the existing and new extension it is considered that it would be inappropriate to include an infiltration or open SUDS element.

The proposed drainage network has been modelled in Causeway FLOW drainage design software for a range of rainfall events and durations. The net increase of hardstanding area is 247m^2 and the storm water modelling indicates that an additional attenuation volume of 12m^3 is required. This volume will be provided within the new SUDS features.

Additional SUDS Features

It is proposed to convert car parking bays numbers 1 to 10, located adjacent to the new building extension to porous paving in order to remove a total of 324m^2 of hardstanding area from existing traditional surface water pipework system. Surface water runoff from this area will be partly infiltrated into the existing ground with a fin drain connecting a greenfield equivalent flow rate of 0.3 l/s (based on 10 litres/sec/Ha) back into proposed manhole S5.2. Refer to supporting drawing 21-182-P-100 included in Appendix 2 and Figure 3-1 below.

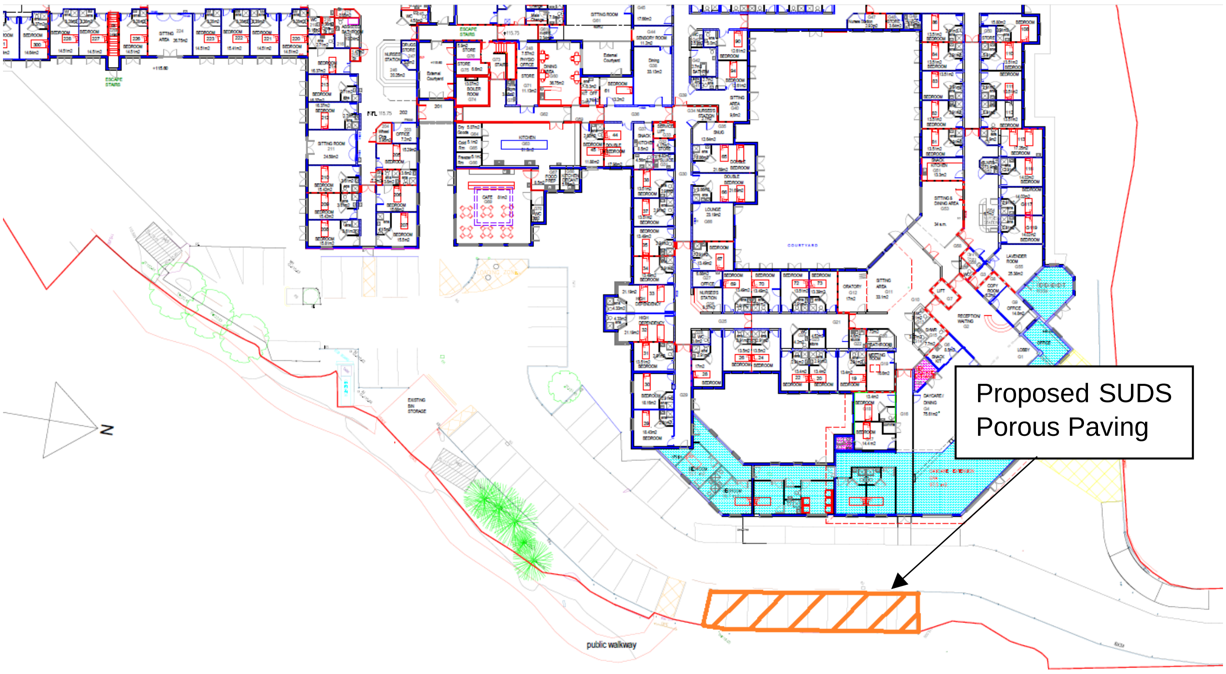


Figure 3-1: Proposed SUDS Drainage

The proposed drainage network, with the addition of 0.3 l/s greenfield flow from the proposed porous paving area, has been modelled in Causeway FLOW drainage design software for a range of rainfall events and durations. A copy of the results of this modelling is included in Appendix 5 and indicates that there is no flooding during either the design storm return period of 1 in 5 year storm event or the 1 in 30 year storm event.

The addition of infiltration in the unlined porous paving makeup will result in a small reduction of surface water into the existing network, which connects to the River Dodder.

This new area of porous paving will provide conveyance of runoff through the porous paving sub-base material before connecting a reduced rate to the main existing surface water drainage system. This will also reduce the risk of pollution for potential oil spillage in the parking area adjacent to the new extension. Although the CIRIA guidance would suggest that runoff pollution risk from parking areas are relatively low.

The SUDS management train for the hardstanding areas adjacent to the new extension will comprise porous paving with a restricted fin drain discharge to site surface water drainage system, with some limited infiltration to the existing ground, and storm water attenuation and restricted discharge rate provided by the existing Storm Tec tank and hydro-brake control.

4. SUDS Maintenance Plan

The proposed SUDS Maintenance Plan will comprise of firstly the overriding principles below and then followed by the specific works required to be undertaken to maintain each SUD feature as described overleaf.

The management plan overleaf includes a Schedule of Work covering the maintenance tasks identified, the frequency of these tasks, and any specific waste management requirements.

Introduction

Regular SUDS scheme inspections will:

- Help determine future maintenance activities
- Confirm hydraulic, water quality, amenity and ecological performance
- Allow identification of potential system failures, e.g. blockage, poor infiltration, poor water quality etc.

During the first year of operation, inspections should ideally be carried out after every significant storm event to ensure proper functionality.

Typical routine inspection questions that will indicate when occasional or remedial maintenance activities are required, and/or when water quality requires investigation include:

- Are inlets and outlets blocked?
- Does any part of the system appear to be leaking?
- Is there evidence of sedimentation build-up?
- Is there evidence of ponding above an infiltration surface?
- Is there evidence of structural damage which requires repair?

All those responsible for maintenance should take appropriate health and safety precautions and risk assessments should always be carried out.

4.1 **Infiltration Trench / Swale Specific Maintenance**

Regular inspection and maintenance is important for the effective operation of SUDS features and adequate access should be provided for the infiltration trench surfaces. Outlined below is a Schedule of Work for each assigned maintenance task and its frequency.

Maintenance schedule	Required action	Frequency
Regular maintenance	Litter and debris removal from trench surface, access chambers and pre-treatment devices.	Every 4 months
	Washing and removal of exposed stones on trench surface.	Annual (bi-annual the first year) or when silt is evident on the surface.
	Root trimming that may be causing blockages.	Annual (semi-annual the first year)
	Weed removal from trench surface.	Monthly (at start, then as required)
Occasional maintenance	Sediment removal from pre-treatment devices.	Six monthly
	Remove tree roots or trees that grow close to the trench.	As required.
Remedial actions	Clear perforated pipework of blockages.	As required.
	Rehabilitate infiltration or filtration surfaces.	As required.
	Replace geotextiles; clean and replace filter media, if clogging occurs.	As required.
	Excavate trench walls to expose clean soils if infiltration performance reduces to unacceptable levels.	As required.
	Inspect inlets, outlets and inspection points for blockages, clogging, standing water and structural damage.	Every 4 months.
Monitoring	Inspect pre-treatment systems, inlets, trench surfaces and perforated pipework for silt accumulation. Establish appropriate silt removal frequencies.	Half yearly.

1.1 Permeable Paving Specific Maintenance

Maintenance of permeable paving is generally required to ensure no blockage of pores occurs due to grit or gravel build-up which could lead to surface flooding. Outlined below is a Schedule of Work for each assigned maintenance task and its frequency.

The private maintenance contract terms should adhere to the paving manufacturer's requirements.

Maintenance schedule	Required action	Frequency
Regular maintenance	Brushing and vacuuming.	Three times/year at end of winter, mid-summer, after autumn leaf fall, or as required based on site-specific observations of clogging or manufacturers' recommendations.
Occasional maintenance	Stabilise and mow contributing and adjacent areas.	As required.
	Weed removal.	As required.
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving.	As required.
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users.	As required.
	Rehabilitation of surface and upper sub-structure.	As required (if infiltration performance is reduced as a result of significant clogging).
Monitoring	Initial inspection.	Monthly for 3 months after installation.
	Inspect for evidence of poor operation and/or weed growth. If required take remedial action.	3-monthly, 48 h after large storms.

	Inspect silt accumulation rates and establish appropriate brushing frequencies.	Annually.
	Monitor inspection chambers.	Annually.

Typically this may involve a mechanical road sweep / vacuum / power wash twice a year (one of which is usually to be immediately after the last leaf fall in the autumn).

As with conventional non-SUDS concrete block pavements, depressions, rutting and cracked or broken blocks, considered detrimental to the structural performance of the pavement or a hazard to users, will require appropriate and timely corrective action.

5. Conclusions and Recommendations

This SUDS Management Plan has been undertaken in accordance with best practice, with reference to the CIRIA guidance, the Greater Dublin Strategic Drainage Study (GDSDS) and the SDCC Sustainable Drainage Explanatory, Design and Evaluation Guide 2022 for acceptable SUDS tree pit details and the guidance set out in the Code of Practice for Wastewater Supply (July 2020) published by Irish Water

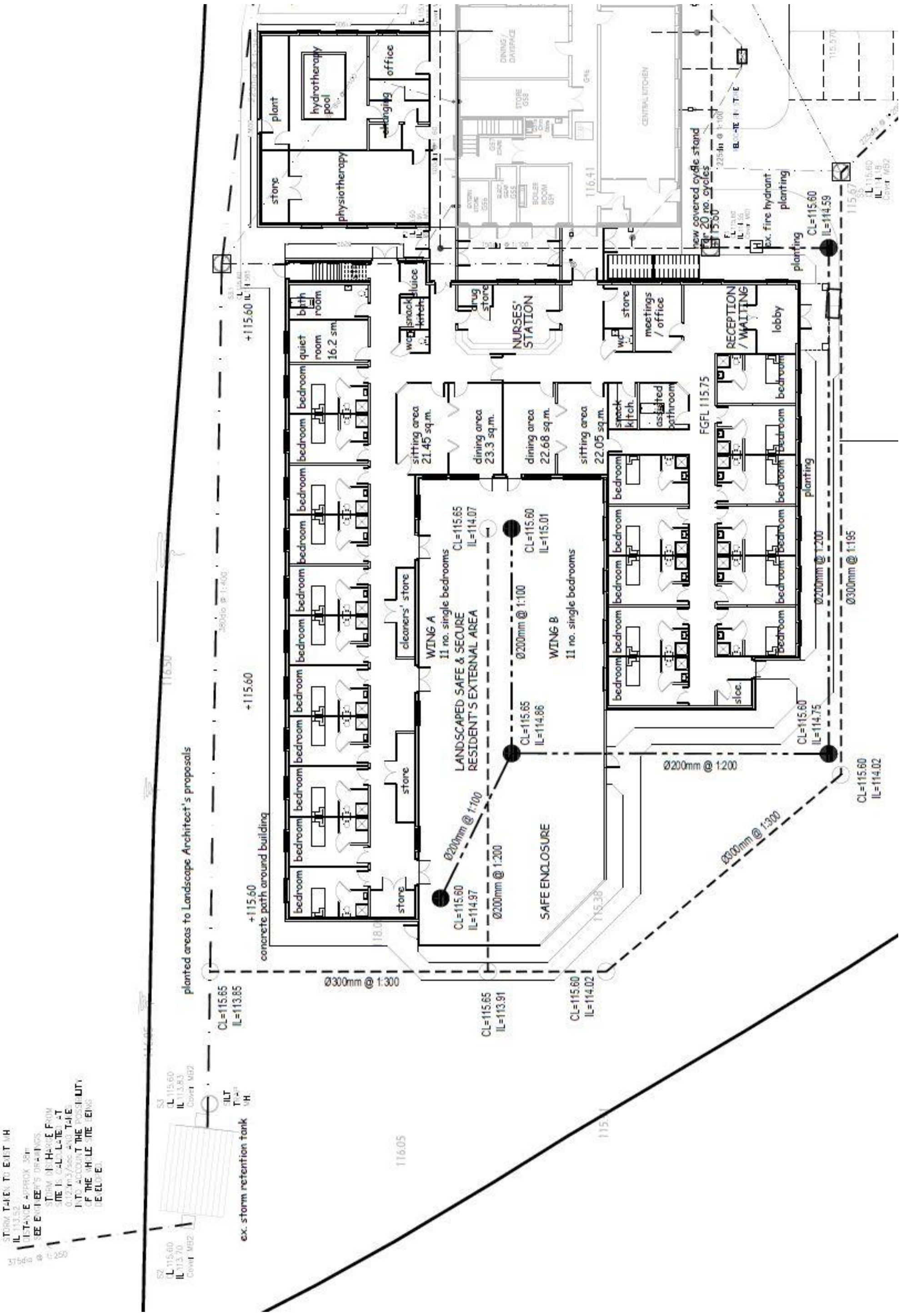
The SUDS Management report presented includes a summary of the existing storm drainage on the site and the enhancement of additional SUDS features mainly in the form of additional porous paving.

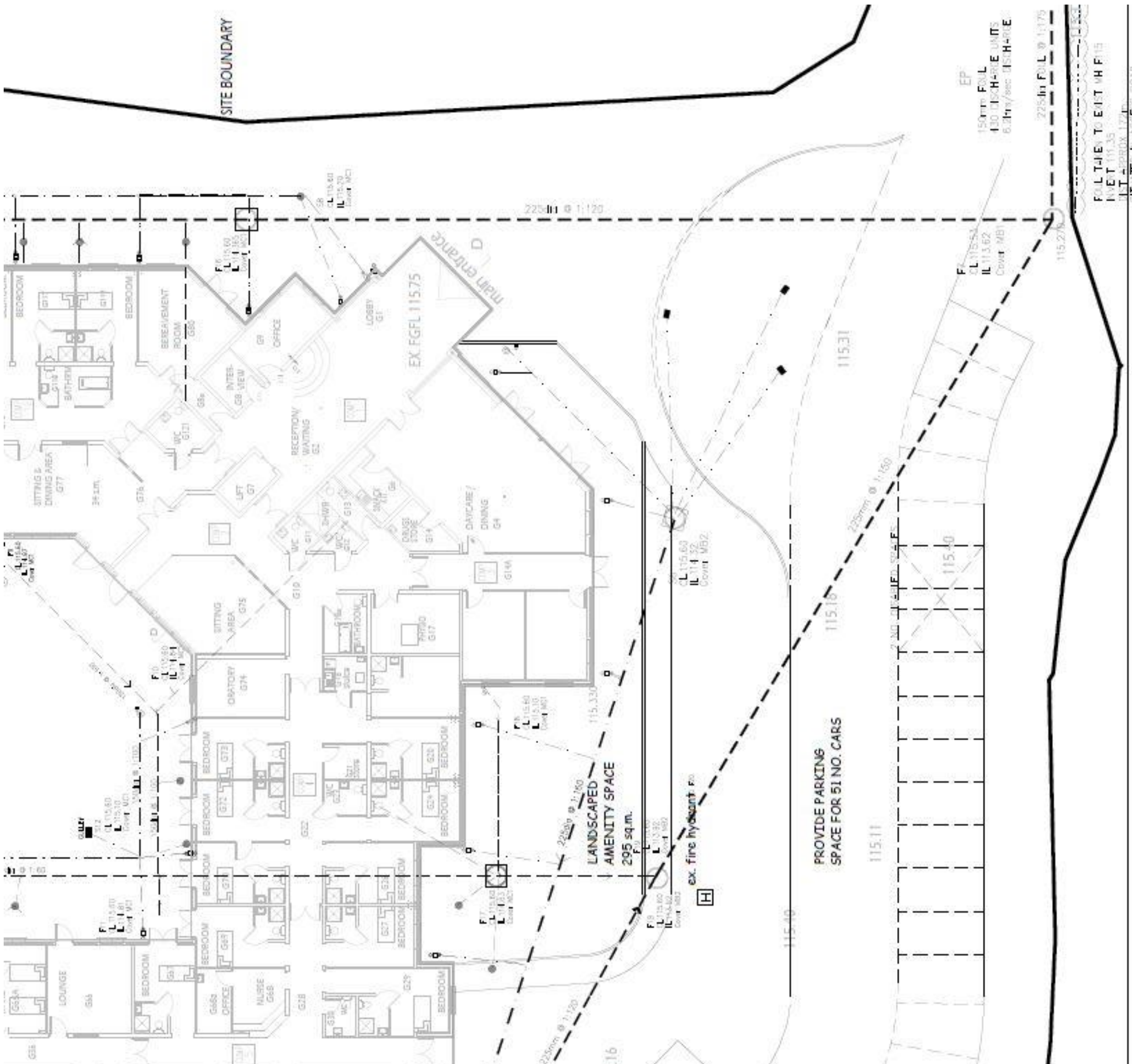
The proposed drainage modelling carried out as part of this report indicates that surface water from the proposed building extension can be attenuated (additional 12.0m^3) on site within the new porous paving area and a new 300mm diameter storm drains for the new extension. The existing surface water discharge rate from the site of 12 l/s remains unchanged but the volume of discharge has been reduced marginally by infiltration through the proposed porous paving in the car park bays.

Exceedance flows on the site have also been considered and storm run-off up to the 1 in 100 return period can be accommodated within the site in the hardstanding areas.

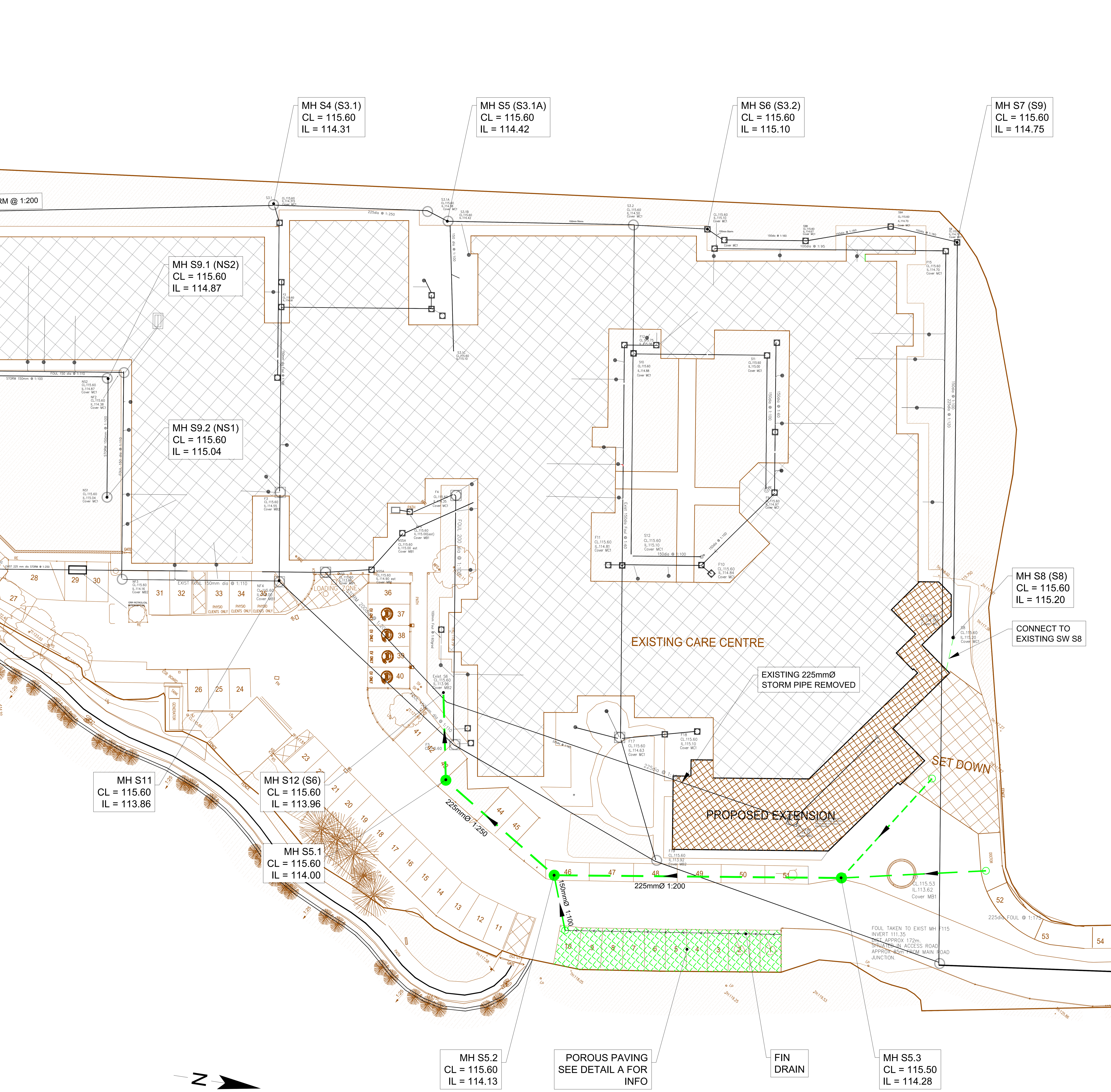
The Management Team of the site will be made aware of any residual drainage risks, mitigation measures, and the long-term maintenance requirements.

Appendix 1: Existing Drainage Plan

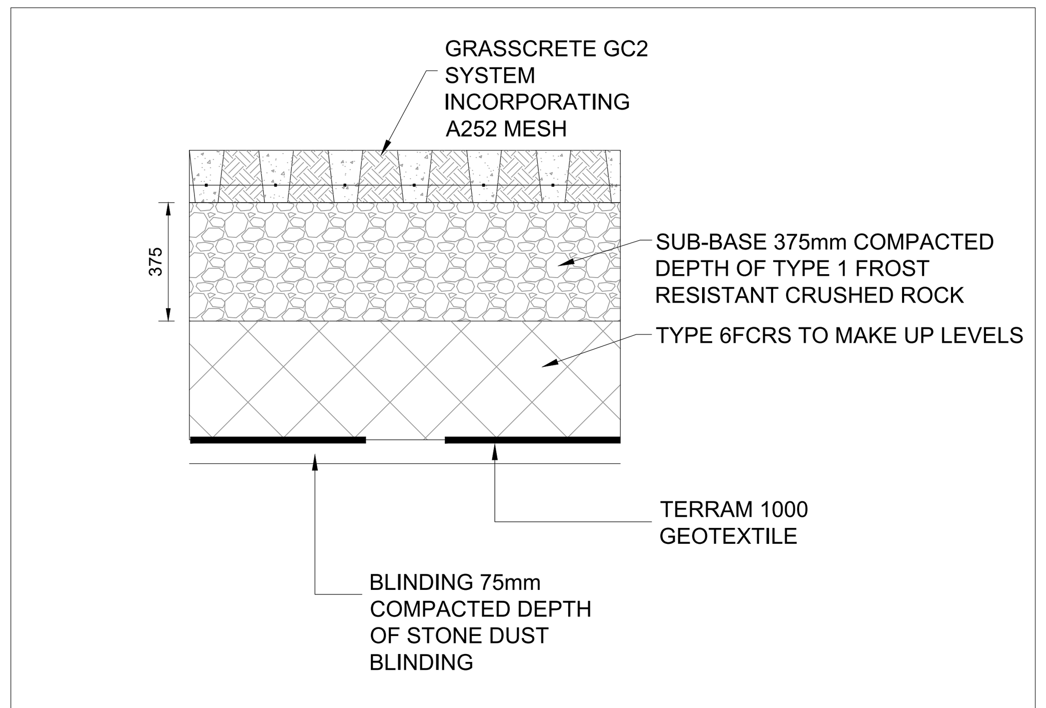



SITE BOUNDARY
main entrance
EX. FGFL 115.75
LANDSCAPED
AMENITY SPACE
295 sq.m.
ex. fire hydrant
PROVIDE PARKING
SPACE FOR 51 NO. CARS
planting
bin
store

Appendix 2: Proposed Drainage Plan



DETAIL A



POROUS PAVING CONSTRUCTION DETAIL (1:20)

NOTES:

1. EXISTING INFORMATION PROVIDED BY OTHERS AND NO GUARANTEE AS TO THE ACCURACY IS GIVEN BY KEVIN MCSHANE LTD.

LEGEND:

- TOPOGRAPHICAL SURVEY
- EXISTING DRAINAGE
- PROPOSED EXTENSION
- PROPOSED STORM DRAINAGE
- DOMESTIC STORM CONNECTION
- POROUS PAVING
- FIN DRAIN

SCALE 0 2.5 5 10 20m

PAGE SIZE (A1) 1:250 @ A1 1:500 @ A3

Rev.	Date	Description	By	Chk'd	App'd
A	04/01/2022	DRAINAGE UPDATED	SM	BP	BP

STATUS: DETAILED DESIGN

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project: KILTIPPER WOODS CARE CENTRE, KILTIPPER ROAD, DUBLIN

drawing: DRAINAGE LAYOUT, PROPOSED STORM WATER DRAINAGE

project no.	drg no.	rev no.
21-182	21-182-P-100	A

drawn	scale	date
SMG	1:250 @ A1	15-02-2022

Millimetres 0 10 100

21-182-P-100 PROPOSED STORM DRAINAGE
C:\Users\Kevin McShane Ltd PC\Kevin McShane\Shared Files - Documents\Company Files\KevinMcshaneLtd\2021\21-182 Kiltipper Woods Care Home, Tallaght, Dublin\Drawings\21-182-P-100 Proposed Storm Drainage

Appendix 3: Existing and Proposed Areas Plans

NOTES:

1. EXISTING INFORMATION PROVIDED BY OTHERS AND NO GUARANTEE AS TO THE ACCURACY IS GIVEN BY KEVIN MCSHANE LTD.

LEGEND:

- GRASS / VEGETATION = 2908m2
- ROAD / CAR PARKING = 2,151m2
- ROOFS = 4,573m2
- PEDESTRIAN AREAS = 1,506m2

TOTAL = 11,138m2

- PROPOSED EXTENSION

247m2 GRASS/VEGETATION REMOVED & REPLACED BY HARDSTANDING/ROOF

250.5m2 ROAD/CAR PARKING REMOVED & REPLACED BY HARDSTANDING/ROOF

110m2 PEDESTRIAN AREAS ADDED BY HARDSTANDING

Millimetres
100
10
0

21-182-SK004-SK005 SITE AREAS FOR DRAINAGE
C:\Users\Kevin McShane Ltd PC\Kevin McShane\Shared Files - Documents\Company Files\KevinMcshaneLtd\2021\21-182 Kiltipper Woods Care Home, Tallaght, Dublin\Drawings\21-182-SK004-SK005 Site Areas For Drainage

Rev.	Date	Description	By	Chk'd	App'd

STATUS: SKETCH

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project: KILTIPPER WOODS CARE CENTRE
KILTIPPER ROAD
DUBLIN

drawing: SITE AREAS FOR DRAINAGE
PROPOSED SITE

project no.	drg no.	rev no.
21-182	21-182-SK005	-
drawn	**scale**	**date**
SMG	1:500 @ A3	02-02-2022

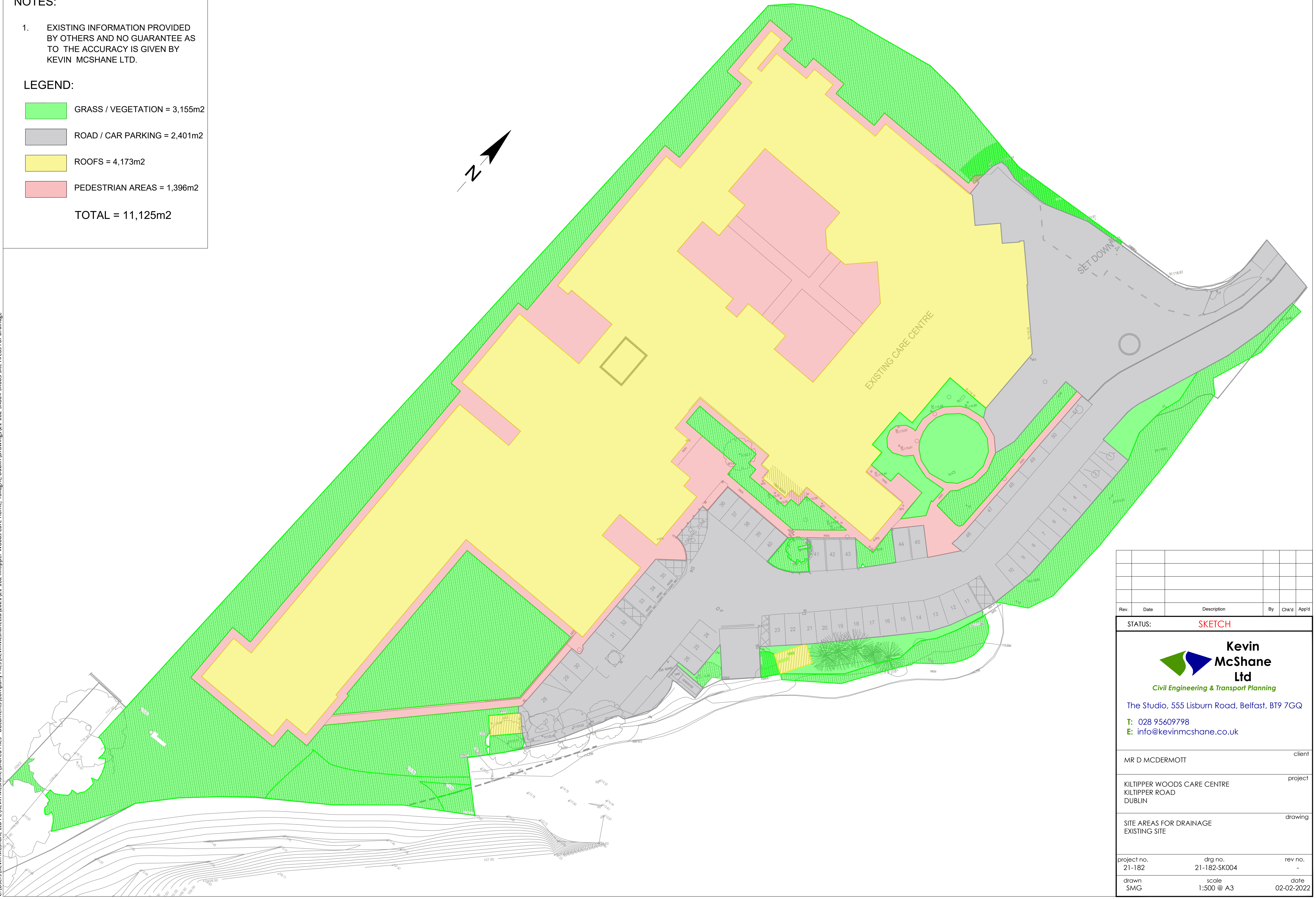
NOTES:

1. EXISTING INFORMATION PROVIDED BY OTHERS AND NO GUARANTEE AS TO THE ACCURACY IS GIVEN BY KEVIN MCSHANE LTD.

LEGEND:

- GRASS / VEGETATION = 3,155m2
- ROAD / CAR PARKING = 2,401m2
- ROOFS = 4,173m2
- PEDESTRIAN AREAS = 1,396m2

TOTAL = 11,125m2



Millimetres 0 10 100

21-182-SK004-SK005 SITE AREAS FOR DRAINAGE
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Rev.	Date	Description	By	Chk'd	App'd

STATUS: SKETCH

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project: KILTIPPER WOODS CARE CENTRE
KILTIPPER ROAD
DUBLIN

drawing: SITE AREAS FOR DRAINAGE
EXISTING SITE

project no.	drg no.	rev no.
21-182	21-182-SK004	-
drawn	**scale**	**date**
SMG	1:500 @ A3	02-02-2022

Appendix 4: Existing Drainage Calculations

CAUSEWAY

Rainfall Methodology	FSR
Return Period (years)	2
Additional Flow (%)	0
FSR Region	Scotland and Ireland
M5-60 (mm)	18.400
Ratio-R	0.270
CV	0.750
Time of Entry (mins)	3.00
Maximum Time of Concentration (mins)	30.00
Maximum Rainfall (mm/hr)	50.0
Minimum Velocity (m/s)	1.00
Connection Type	Level Soffits
Minimum Backdrop Height (m)	0.200
Preferred Cover Depth (m)	1.200
Enforce best practice design rules	

CAUSEWAY

Flow v7.0 Design Report: Nodes

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Node Type	Manhole Type	Diameter (mm)	Width (mm)	Easting (m)	Northing (m)	Depth (m)	Notes
s1.1				115.550	Manhole	Adoptable	1200				2.186	
s1				115.600	Manhole	Adoptable	1500				2.156	
s2				115.600	Manhole	Adoptable	1500				1.840	
s3	0.041	3.00		115.600	Manhole	Adoptable	1200				1.715	
s3.1	0.042	3.00		115.600	Manhole	Adoptable	1200				1.465	
s3.1a	0.041	3.00		115.600	Manhole	Adoptable	1200				1.355	
s3.2	0.041	3.00		115.600	Manhole	Adoptable	1200				1.215	
s9	0.042	3.00		115.600	Manhole	Adoptable	1200				0.850	
s8	0.041	3.00		115.600	Manhole	Adoptable	1200				0.400	
s10	0.073	3.00		115.600	Manhole	Adoptable	1500				2.021	
ns4	0.074	3.00		115.600	Manhole	Adoptable	1200				1.889	
ns5	0.073	3.00		115.600	Manhole	Adoptable	1200				1.634	
s5	0.074	3.00		115.600	Manhole	Adoptable	1200				1.542	
s6	0.073	3.00		115.600	Manhole	Adoptable	1200				1.280	
ns2				115.600	Manhole	Adoptable	1200				0.710	
ns1	0.073	3.00		115.600	Manhole	Adoptable	1200				0.560	
s9.3		3.00		115.600	Manhole	Adoptable	1500				1.700	
s2.1		3.00		115.600	Manhole	Adoptable	1500				1.500	

CAUSEWAY

Flow v7.0 Design Report: Links (Input)

	Name	US Node	DS Node	Length (m)	ks (mm) / n	Velocity Equation	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	T of C (mins)	Rain (mm/hr)	Con Offset (m)	Min DS IL (m)	Lateral Area (ha)	Lateral Ins Point (%)	Lateral T of E (mins)
?	1.000	s8	s9	45.000	0.600	Colebrook-White	115.200	114.750	0.450	100.0	150	Circular	3.75	50.0					
?	1.001	s9	s3.2	29.000	0.600	Colebrook-White	114.750	114.460	0.290	100.0	150	Circular	4.23	50.0					
?	1.002	s3.2	s3.1a	28.000	0.600	Colebrook-White	114.385	114.245	0.140	200.0	225	Circular	4.73	50.0					
?	1.003	s3.1a	s3.1	22.000	0.600	Colebrook-White	114.245	114.135	0.110	200.0	225	Circular	5.13	50.0					
?	1.004	s3.1	s3	50.000	0.600	Colebrook-White	114.135	113.885	0.250	200.0	225	Circular	6.04	50.0					
?	1.005	s3	s2	10.000	0.600	Colebrook-White	113.885	113.835	0.050	200.0	225	Circular	6.22	50.0					
	1.006	s2	s1	15.000	0.600	Colebrook-White	113.760	113.685	0.075	200.0	300	Circular	6.44	49.7					
?	2.000	s2.1	s2	60.000	0.600	Colebrook-White	114.100	113.920	0.180	333.0	900	Circular	3.58	50.0					
?	3.000	s6	s5	42.000	0.600	Colebrook-White	114.320	114.058	0.262	160.0	225	Circular	3.68	50.0					
?	3.001	s5	ns5	23.000	0.600	Colebrook-White	114.058	113.966	0.092	250.0	225	Circular	4.15	50.0					
?	3.002	ns5	ns4	45.000	0.600	Colebrook-White	113.966	113.786	0.180	250.0	225	Circular	5.06	50.0					
?	3.003	ns4	s10	33.000	0.600	Colebrook-White	113.711	113.579	0.132	250.0	300	Circular	5.61	50.0					
?	4.000	ns1	ns2	15.000	0.600	Colebrook-White	115.040	114.890	0.150	100.0	150	Circular	3.25	50.0					
?	4.001	ns2	s10	43.000	0.600	Colebrook-White	114.890	114.460	0.430	100.0	150	Circular	3.96	50.0					
?	5.000	s9.3	s10	65.000	0.600	Colebrook-White	113.900	113.770	0.130	500.0	1200	Circular	3.65	50.0					
?	3.004	s10	s1	20.000	0.600	Colebrook-White	113.579	113.519	0.060	333.0	300	Circular	6.00	50.0					
	1.007	s1	s1.1	20.000	0.600	Colebrook-White	113.444	113.364	0.080	250.0	375	Circular	6.74	48.8					

CAUSEWAY

Rainfall Methodology	FSR		Return Period (years)	Climate Change (%)
FSR Region	Scotland and Ireland		2	20
M5-60 (mm)	18.400		30	20
Ratio-R	0.270		100	0
Summer CV	0.750			
Winter CV	0.840			
Analysis Speed	Normal			
Drain Down Time (mins)	240			
Additional Storage (m³/ha)	20.0			
Storm Durations (mins)	15			
	30			
	60			
	120			
	180			
	240			
	360			
	480			
	600			
	720			
	960			
	1440			
Check Discharge Rate(s)	x			

CAUSEWAY

Depth/Flow									
Node	Flap Valve	Online / Offline	Replaces Downstream Link	Loop to Node	Invert Level (m)	Design Depth (m)	Design Flow (l/s)	Depth (m)	Flow (l/s)
s1.1	x	Online			113.364	1.000	12.0	1.000	12.000

Results for 2 year +20% Critical Storm Duration. Lowest mass balance: 99.21%

Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	s1.1	132	114.443	1.079	12.1	1.2201	0.0000	OK	Depth/Flow		12.0				161.0
180 minute winter	s1	132	114.444	1.000	12.3	1.7667	0.0000	SURCHARGED	1.007	s1.1	12.1	0.332	0.096	2.2059	
180 minute winter	s2	132	114.444	0.684	12.1	1.2090	0.0000	SURCHARGED	1.006	s1	5.7	0.500	0.073	1.0563	
180 minute winter	s3	132	114.445	0.560	12.9	0.9014	0.0000	SURCHARGED	1.005	s2	12.1	0.607	0.331	0.3977	
180 minute winter	s3.1	132	114.448	0.313	11.3	0.5331	0.0000	SURCHARGED	1.004	s3	10.7	0.610	0.294	1.9886	
15 minute winter	s3.1a	11	114.461	0.216	31.8	0.3744	0.0000	OK	1.003	s3.1	31.3	0.899	0.856	0.8684	
15 minute summer	s3.2	10	114.523	0.138	24.5	0.2495	0.0000	OK	1.002	s3.1a	24.7	0.824	0.675	0.8336	
15 minute summer	s9	10	114.871	0.121	17.9	0.2562	0.0000	OK	1.001	s3.2	16.6	1.119	0.933	0.4291	
15 minute summer	s8	9	115.273	0.073	9.3	0.2312	0.0000	OK	1.000	s9	8.5	0.752	0.477	0.5324	
180 minute winter	s10	132	114.445	0.866	22.3	2.1564	0.0000	SURCHARGED	3.004	s1	9.2	0.485	0.152	1.4084	
180 minute winter	ns4	132	114.446	0.735	14.8	1.4060	0.0000	SURCHARGED	3.003	s10	14.4	0.391	0.206	2.3238	
180 minute winter	ns5	128	114.448	0.482	11.1	0.9760	0.0000	SURCHARGED	3.002	ns4	10.8	0.539	0.329	1.7897	
180 minute winter	s5	128	114.449	0.391	8.1	0.8176	0.0000	SURCHARGED	3.001	ns5	7.2	0.531	0.220	0.9147	
180 minute winter	s6	128	114.449	0.129	4.0	0.2937	0.0000	OK	3.000	s5	4.0	0.437	0.097	1.3306	
15 minute summer	ns2	10	114.999	0.109	15.3	0.1235	0.0000	OK	4.001	s10	15.0	1.114	0.845	0.5792	
15 minute summer	ns1	9	115.157	0.117	16.5	0.4363	0.0000	OK	4.000	ns2	15.3	1.134	0.864	0.2104	
180 minute winter	s9.3	132	114.445	0.545	6.8	0.9631	0.0000	OK	5.000	s10	-6.8	-0.079	-0.004	37.3974	
180 minute winter	s2.1	132	114.444	0.344	4.4	0.6083	0.0000	OK	2.000	s2	-4.4	-0.057	-0.004	18.1839	

Results for 30 year +20% Critical Storm Duration. Lowest mass balance: 99.21%

Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute winter	s1.1	172	115.550	2.186	19.8	2.4724	3.7801	FLOOD	Depth/Flow		12.0				291.6
180 minute winter	s1	132	115.553	2.109	17.7	3.7269	0.0000	FLOOD RISK	1.007	s1.1	17.8	0.369	0.141	2.2059	
180 minute winter	s2	132	115.554	1.794	20.6	3.1700	0.0000	FLOOD RISK	1.006	s1	8.2	0.572	0.104	1.0563	
180 minute winter	s3	132	115.557	1.672	21.1	2.6895	0.0000	FLOOD RISK	1.005	s2	20.6	0.603	0.562	0.3977	
180 minute winter	s3.1	132	115.565	1.430	17.8	2.4365	0.0000	FLOOD RISK	1.004	s3	17.3	0.582	0.473	1.9886	
180 minute winter	s3.1a	132	115.568	1.323	14.6	2.2960	0.0000	FLOOD RISK	1.003	s3.1	13.9	0.711	0.381	0.8750	
180 minute winter	s3.2	132	115.570	1.185	11.8	2.1392	0.0000	FLOOD RISK	1.002	s3.1a	10.7	0.686	0.292	1.1136	
240 minute winter	s9	172	115.577	0.827	6.5	1.7515	0.0000	FLOOD RISK	1.001	s3.2	6.5	0.909	0.366	0.5105	
240 minute winter	s8	172	115.579	0.379	3.3	1.2043	0.0000	FLOOD RISK	1.000	s9	3.2	0.578	0.180	0.7922	
180 minute winter	s10	132	115.558	1.979	39.4	4.9265	0.0000	FLOOD RISK	3.004	s1	11.8	0.496	0.195	1.4084	
180 minute winter	ns4	132	115.561	1.850	25.9	3.5407	0.0000	FLOOD RISK	3.003	s10	25.3	0.447	0.362	2.3238	
180 minute winter	ns5	132	115.571	1.605	19.5	3.2476	0.0000	FLOOD RISK	3.002	ns4	18.8	0.556	0.577	1.7897	
180 minute winter	s5	132	115.573	1.515	13.3	3.1684	0.0000	FLOOD RISK	3.001	ns5	12.5	0.519	0.384	0.9147	
180 minute winter	s6	132	115.575	1.255	7.0	2.8507	0.0000	FLOOD RISK	3.000	s5	6.2	0.440	0.151	1.6704	
180 minute winter	ns2	132	115.566	0.676	7.0	0.7645	0.0000	FLOOD RISK	4.001	s10	7.1	0.930	0.399	0.7570	
180 minute winter	ns1	132	115.569	0.529	7.0	1.9770	0.0000	FLOOD RISK	4.000	ns2	7.0	0.919	0.393	0.2641	
180 minute winter	s9.3	132	115.558	1.658	13.6	2.9288	0.0000	FLOOD RISK	5.000	s10	-13.6	-0.041	-0.007	73.2361	
180 minute winter	s2.1	132	115.554	1.454	9.9	2.5691	0.0000	FLOOD RISK	2.000	s2	-9.9	-0.063	-0.009	38.0264	

Appendix 5: Proposed Drainage Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Soffits
M5-60 (mm)	18.400	Minimum Backdrop Height (m)	0.200
Ratio-R	0.270	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	3.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Diameter (mm)	Depth (m)
s1.1				115.550	1200	3.226
s1				115.600	1500	3.196
s2				115.600	1500	1.840
s3	0.041	3.00		115.600	1200	1.715
s3.1	0.042	3.00		115.600	1200	1.465
s3.1a	0.041	3.00		115.600	1200	1.355
s3.2	0.041	3.00		115.600	1200	1.215
s9	0.042	3.00		115.600	1200	0.850
s8	0.043	3.00		115.600	1200	0.400
s10	0.073	3.00		115.600	1500	3.136
ns4	0.074	3.00		115.600	1200	2.104
ns5	0.073	3.00		115.600	1200	1.924
s5	0.048	3.00		115.600	1200	1.788
s5.3	0.047	3.00		115.600	1200	1.300
ns2				115.600	1200	0.710
ns1	0.073	3.00		115.600	1200	0.560
s9.3		3.00		115.600	1500	1.700
s2.1		3.00		115.600	1500	1.500
s5.2	0.045	3.00		115.600	1200	1.594
s5.1	0.004	3.00		115.600	1200	1.729
s5.9		3.00	0.3	115.600	1200	1.350

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)
1.000	s8	s9	45.000	0.600	115.200	114.750	0.450	100.0	150	3.75	50.0
1.001	s9	s3.2	29.000	0.600	114.750	114.460	0.290	100.0	150	4.23	50.0
1.002	s3.2	s3.1a	28.000	0.600	114.385	114.245	0.140	200.0	225	4.73	50.0
1.003	s3.1a	s3.1	22.000	0.600	114.245	114.135	0.110	200.0	225	5.13	50.0
1.004	s3.1	s3	50.000	0.600	114.135	113.885	0.250	200.0	225	6.04	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)
1.000	1.005	17.8	5.8	0.250	0.700	0.043	0.0	59	0.899
1.001	1.005	17.8	11.5	0.700	0.990	0.085	0.0	88	1.069
1.002	0.921	36.6	17.1	0.990	1.130	0.126	0.0	108	0.904
1.003	0.921	36.6	22.6	1.130	1.240	0.167	0.0	128	0.967
1.004	0.921	36.6	28.3	1.240	1.490	0.209	0.0	149	1.014

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)
1.005	s3	s2	10.000	0.600	113.885	113.835	0.050	200.0	225	6.22	50.0
1.006	s2	s1	15.000	0.600	113.760	113.700	0.060	250.0	300	6.47	49.6
2.000	s2.1	s2	60.000	0.600	114.100	113.920	0.180	333.0	900	3.58	50.0
3.000	s5.3	s5.2	35.000	0.600	114.300	114.125	0.175	200.0	225	3.63	50.0
3.001	s5.2	s5.1	15.000	0.600	114.006	113.946	0.060	250.0	225	3.94	50.0
3.004	ns5	ns4	45.000	0.600	113.676	113.496	0.180	250.0	300	5.15	50.0
3.005	ns4	s10	33.000	0.600	113.496	113.364	0.132	250.0	300	5.71	50.0
4.000	ns1	ns2	15.000	0.600	115.040	114.890	0.150	100.0	150	3.25	50.0
4.001	ns2	s10	43.000	0.600	114.890	114.460	0.430	100.0	150	3.96	50.0
5.000	s9.3	s10	65.000	0.600	113.900	113.770	0.130	500.0	1200	3.65	50.0
3.006	s10	s1	20.000	0.600	112.464	112.404	0.060	333.0	1200	5.87	50.0
1.007	s1	s1.1	20.000	0.600	112.404	112.324	0.080	250.0	1200	6.61	49.2
3.002	s5.1	s5	10.000	0.600	113.871	113.812	0.059	169.5	300	4.08	50.0
3.003	s5	ns5	23.000	0.600	113.812	113.676	0.136	169.1	300	4.39	50.0
6.000	s5.9	s5.2	10.000	0.600	114.250	114.081	0.169	59.2	150	3.13	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)
1.005	0.921	36.6	33.9	1.490	1.540	0.250	0.0	172	1.041
1.006	0.990	70.0	33.6	1.540	1.600	0.250	0.0	147	0.981
2.000	1.711	1088.5	0.0	0.600	0.780	0.000	0.0	0	0.000
3.000	0.921	36.6	6.4	1.075	1.250	0.047	0.0	64	0.696
3.001	0.822	32.7	12.8	1.369	1.429	0.092	0.3	97	0.771
3.004	0.990	70.0	29.7	1.624	1.804	0.217	0.3	136	0.950
3.005	0.990	70.0	39.7	1.804	1.936	0.291	0.3	162	1.020
4.000	1.005	17.8	9.9	0.410	0.560	0.073	0.0	80	1.031
4.001	1.005	17.8	9.9	0.560	0.990	0.073	0.0	80	1.031
5.000	1.666	1884.1	0.0	0.500	0.630	0.000	0.0	0	0.000
3.006	2.044	2311.9	59.5	1.936	1.996	0.437	0.3	129	0.904
1.007	2.361	2670.5	91.9	1.996	2.026	0.687	0.3	149	1.140
3.002	1.205	85.1	13.3	1.429	1.488	0.096	0.3	80	0.885
3.003	1.206	85.2	19.8	1.488	1.624	0.144	0.3	98	0.988
6.000	1.310	23.1	0.3	1.200	1.369	0.000	0.3	12	0.448

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)
1.000	45.000	100.0	150	Circular	115.600	115.200	0.250	115.600	114.750	0.700
1.001	29.000	100.0	150	Circular	115.600	114.750	0.700	115.600	114.460	0.990
1.002	28.000	200.0	225	Circular	115.600	114.385	0.990	115.600	114.245	1.130
1.003	22.000	200.0	225	Circular	115.600	114.245	1.130	115.600	114.135	1.240
1.004	50.000	200.0	225	Circular	115.600	114.135	1.240	115.600	113.885	1.490

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	s8	1200	Manhole	Adoptable	s9	1200	Manhole	Adoptable
1.001	s9	1200	Manhole	Adoptable	s3.2	1200	Manhole	Adoptable
1.002	s3.2	1200	Manhole	Adoptable	s3.1a	1200	Manhole	Adoptable
1.003	s3.1a	1200	Manhole	Adoptable	s3.1	1200	Manhole	Adoptable
1.004	s3.1	1200	Manhole	Adoptable	s3	1200	Manhole	Adoptable

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)
1.005	10.000	200.0	225	Circular	115.600	113.885	1.490	115.600	113.835	1.540
1.006	15.000	250.0	300	Circular	115.600	113.760	1.540	115.600	113.700	1.600
2.000	60.000	333.0	900	Circular	115.600	114.100	0.600	115.600	113.920	0.780
3.000	35.000	200.0	225	Circular	115.600	114.300	1.075	115.600	114.125	1.250
3.001	15.000	250.0	225	Circular	115.600	114.006	1.369	115.600	113.946	1.429
3.004	45.000	250.0	300	Circular	115.600	113.676	1.624	115.600	113.496	1.804
3.005	33.000	250.0	300	Circular	115.600	113.496	1.804	115.600	113.364	1.936
4.000	15.000	100.0	150	Circular	115.600	115.040	0.410	115.600	114.890	0.560
4.001	43.000	100.0	150	Circular	115.600	114.890	0.560	115.600	114.460	0.990
5.000	65.000	500.0	1200	Circular	115.600	113.900	0.500	115.600	113.770	0.630
3.006	20.000	333.0	1200	Circular	115.600	112.464	1.936	115.600	112.404	1.996
1.007	20.000	250.0	1200	Circular	115.600	112.404	1.996	115.550	112.324	2.026
3.002	10.000	169.5	300	Circular	115.600	113.871	1.429	115.600	113.812	1.488
3.003	23.000	169.1	300	Circular	115.600	113.812	1.488	115.600	113.676	1.624
6.000	10.000	59.2	150	Circular	115.600	114.250	1.200	115.600	114.081	1.369

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.005	s3	1200	Manhole	Adoptable	s2	1500	Manhole	Adoptable
1.006	s2	1500	Manhole	Adoptable	s1	1500	Manhole	Adoptable
2.000	s2.1	1500	Manhole	Adoptable	s2	1500	Manhole	Adoptable
3.000	s5.3	1200	Manhole	Adoptable	s5.2	1200	Manhole	Adoptable
3.001	s5.2	1200	Manhole	Adoptable	s5.1	1200	Manhole	Adoptable
3.004	ns5	1200	Manhole	Adoptable	ns4	1200	Manhole	Adoptable
3.005	ns4	1200	Manhole	Adoptable	s10	1500	Manhole	Adoptable
4.000	ns1	1200	Manhole	Adoptable	ns2	1200	Manhole	Adoptable
4.001	ns2	1200	Manhole	Adoptable	s10	1500	Manhole	Adoptable
5.000	s9.3	1500	Manhole	Adoptable	s10	1500	Manhole	Adoptable
3.006	s10	1500	Manhole	Adoptable	s1	1500	Manhole	Adoptable
1.007	s1	1500	Manhole	Adoptable	s1.1	1200	Manhole	Adoptable
3.002	s5.1	1200	Manhole	Adoptable	s5	1200	Manhole	Adoptable
3.003	s5	1200	Manhole	Adoptable	ns5	1200	Manhole	Adoptable
6.000	s5.9	1200	Manhole	Adoptable	s5.2	1200	Manhole	Adoptable

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
s1.1	115.550	3.226	1200	1	1.007	112.324	1200
s1	115.600	3.196	1500	1	3.006	112.404	1200
				2	1.006	113.700	300
				0	1.007	112.404	1200
s2	115.600	1.840	1500	1	2.000	113.920	900
				2	1.005	113.835	225
				0	1.006	113.760	300

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
s3	115.600	1.715	1200	1	1.004	113.885	225
				0	1.005	113.885	225
s3.1	115.600	1.465	1200	1	1.003	114.135	225
				0	1.004	114.135	225
s3.1a	115.600	1.355	1200	1	1.002	114.245	225
				0	1.003	114.245	225
s3.2	115.600	1.215	1200	1	1.001	114.460	150
				0	1.002	114.385	225
s9	115.600	0.850	1200	1	1.000	114.750	150
				0	1.001	114.750	150
s8	115.600	0.400	1200	0	1.000	115.200	150
s10	115.600	3.136	1500	1	5.000	113.770	1200
				2	4.001	114.460	150
				3	3.005	113.364	300
				0	3.006	112.464	1200
ns4	115.600	2.104	1200	1	3.004	113.496	300
				0	3.005	113.496	300
ns5	115.600	1.924	1200	1	3.003	113.676	300
				0	3.004	113.676	300
s5	115.600	1.788	1200	1	3.002	113.812	300
				0	3.003	113.812	300
s5.3	115.600	1.300	1200	0	3.000	114.300	225
ns2	115.600	0.710	1200	1	4.000	114.890	150
				0	4.001	114.890	150
ns1	115.600	0.560	1200	0	4.000	115.040	150

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
s9.3	115.600	1.700	1500	0	5.000	113.900	1200
s2.1	115.600	1.500	1500	0	2.000	114.100	900
s5.2	115.600	1.594	1200	1	6.000	114.081	150
				2	3.000	114.125	225
				0	3.001	114.006	225
s5.1	115.600	1.729	1200	1	3.001	113.946	225
				0	3.002	113.871	300
s5.9	115.600	1.350	1200	0	6.000	114.250	150

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	Scotland and Ireland	Skip Steady State	x
M5-60 (mm)	18.400	Drain Down Time (mins)	240
Ratio-R	0.270	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	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 %)
2	20	0	0
30	20	0	0
100	0	0	0

Node s1.1 Online Depth/Flow Control

Flap Valve	x	Invert Level (m)	112.324	Design Flow (l/s)	12.0
Replaces Downstream Link	✓	Design Depth (m)	1.000		

Depth (m)	Flow (l/s)
1.000	12.000

Results for 2 year +20% CC Critical Storm Duration. Lowest mass balance: 66.51%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	s1.1	96	114.987	2.663	277.6	3.0114	0.0000	OK
120 minute winter	s1	80	114.332	1.928	1301.7	3.4060	0.0000	SURCHARGED
60 minute winter	s2	48	114.099	0.338	67.4	0.5980	0.0000	SURCHARGED
180 minute winter	s3	120	114.128	0.243	13.7	0.3906	0.0000	SURCHARGED
15 minute winter	s3.1	11	114.359	0.224	39.5	0.3815	0.0000	OK
15 minute summer	s3.1a	10	114.426	0.181	33.0	0.3145	0.0000	OK
15 minute summer	s3.2	10	114.525	0.140	24.9	0.2521	0.0000	OK
15 minute summer	s9	10	114.874	0.123	18.3	0.2616	0.0000	OK
15 minute summer	s8	10	115.275	0.075	9.7	0.2448	0.0000	OK
120 minute winter	s10	84	114.036	1.572	213.0	3.5099	0.0000	SURCHARGED
120 minute winter	ns4	84	114.034	0.538	27.6	0.9861	0.0000	SURCHARGED
120 minute winter	ns5	84	114.024	0.348	21.4	0.6581	0.0000	SURCHARGED
120 minute winter	s5	78	114.042	0.230	15.3	0.3829	0.0000	OK
15 minute summer	s5.3	10	114.380	0.080	10.6	0.1486	0.0000	OK
15 minute summer	ns2	10	114.999	0.109	15.3	0.1235	0.0000	OK
15 minute summer	ns1	9	115.157	0.117	16.5	0.4363	0.0000	OK
60 minute winter	s9.3	44	114.021	0.121	23.3	0.2137	0.0000	OK
180 minute summer	s2.1	112	114.100	0.000	0.0	0.0008	0.0000	OK
15 minute summer	s5.2	10	114.137	0.131	19.7	0.2219	0.0000	OK
120 minute winter	s5.1	78	114.054	0.183	15.0	0.2154	0.0000	OK
15 minute summer	s5.9	20	114.262	0.012	0.3	0.0137	0.0000	OK

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	s1.1	Depth/Flow		12.0				115.5
120 minute winter	s1	1.007	s1.1	-991.7	-1.064	-0.371	22.5342	
60 minute winter	s2	1.006	s1	-66.2	-1.076	-0.946	1.0101	
180 minute winter	s3	1.005	s2	28.3	0.956	0.774	0.3920	
15 minute winter	s3.1	1.004	s3	36.1	0.944	0.987	1.9874	
15 minute summer	s3.1a	1.003	s3.1	32.1	0.900	0.878	0.8006	
15 minute summer	s3.2	1.002	s3.1a	25.0	0.826	0.683	0.8419	
15 minute summer	s9	1.001	s3.2	16.9	1.123	0.951	0.4372	
15 minute summer	s8	1.000	s9	8.9	0.768	0.500	0.5458	
120 minute winter	s10	3.006	s1	446.1	0.399	0.193	22.5342	
120 minute winter	ns4	3.005	s10	37.0	0.859	0.529	2.3238	
120 minute winter	ns5	3.004	ns4	24.2	0.723	0.346	3.1689	
120 minute winter	s5	3.003	ns5	18.0	0.664	0.211	1.4751	
15 minute summer	s5.3	3.000	s5.2	9.8	0.781	0.267	0.4379	
15 minute summer	ns2	4.001	s10	15.0	1.114	0.845	0.5793	
15 minute summer	ns1	4.000	ns2	15.3	1.134	0.864	0.2104	
60 minute winter	s9.3	5.000	s10	-23.3	0.414	-0.012	7.2751	
180 minute summer	s2.1	2.000	s2	0.0	0.000	0.000	1.4847	
15 minute summer	s5.2	3.001	s5.1	19.5	0.875	0.595	0.3336	
120 minute winter	s5.1	3.002	s5	-12.8	0.619	-0.150	0.5143	
15 minute summer	s5.9	6.000	s5.2	0.3	0.453	0.013	0.0331	

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 66.51%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute summer	s1.1	272	115.356	3.032	705.7	3.4294	0.0000	OK
180 minute winter	s1	108	115.593	3.189	1662.0	5.6343	0.0000	FLOOD RISK
120 minute winter	s2	74	114.365	0.605	68.1	1.0687	0.0000	SURCHARGED
60 minute summer	s3	39	114.398	0.513	49.7	0.8256	0.0000	SURCHARGED
15 minute winter	s3.1	11	114.833	0.698	53.1	1.1901	0.0000	SURCHARGED
15 minute winter	s3.1a	11	115.000	0.755	42.8	1.3102	0.0000	SURCHARGED
15 minute winter	s3.2	11	115.106	0.720	33.4	1.3012	0.0000	SURCHARGED
15 minute winter	s9	11	115.443	0.693	28.9	1.4674	0.0000	FLOOD RISK
15 minute winter	s8	12	115.563	0.363	16.8	1.1903	0.0000	FLOOD RISK
60 minute winter	s10	45	114.290	1.826	1096.2	4.0784	0.0000	SURCHARGED
60 minute winter	ns4	45	114.288	0.792	53.0	1.4529	0.0000	SURCHARGED
60 minute winter	ns5	38	114.294	0.618	38.2	1.1686	0.0000	SURCHARGED
60 minute winter	s5	38	114.301	0.489	27.0	0.8160	0.0000	SURCHARGED
15 minute summer	s5.3	9	114.415	0.115	19.6	0.2127	0.0000	OK
15 minute winter	ns2	11	115.167	0.276	22.0	0.3127	0.0000	SURCHARGED
15 minute winter	ns1	11	115.426	0.386	28.5	1.4430	0.0000	FLOOD RISK
60 minute winter	s9.3	46	114.307	0.407	76.3	0.7185	0.0000	OK
60 minute winter	s2.1	44	114.356	0.255	45.1	0.4514	0.0000	OK
60 minute winter	s5.2	39	114.310	0.304	18.3	0.5158	0.0000	SURCHARGED
60 minute winter	s5.1	38	114.302	0.431	17.9	0.5068	0.0000	SURCHARGED
60 minute winter	s5.9	37	114.316	0.066	2.9	0.0743	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
480 minute summer	s1.1	Depth/Flow		12.0				251.9
180 minute winter	s1	1.007	s1.1	-1046.1	-0.929	-0.392	22.5342	
120 minute winter	s2	1.006	s1	83.1	1.197	1.188	1.0563	
60 minute summer	s3	1.005	s2	49.1	1.253	1.342	0.3977	
15 minute winter	s3.1	1.004	s3	52.3	1.315	1.429	1.9886	
15 minute winter	s3.1a	1.003	s3.1	40.4	1.015	1.103	0.8750	
15 minute winter	s3.2	1.002	s3.1a	29.7	0.819	0.812	1.1136	
15 minute winter	s9	1.001	s3.2	19.9	1.132	1.122	0.5105	
15 minute winter	s8	1.000	s9	13.2	0.812	0.745	0.7922	
60 minute winter	s10	3.006	s1	-1012.7	-0.899	-0.438	22.5342	
60 minute winter	ns4	3.005	s10	58.9	1.058	0.842	2.3238	
60 minute winter	ns5	3.004	ns4	47.0	0.865	0.672	3.1689	
60 minute winter	s5	3.003	ns5	25.0	0.819	0.293	1.6196	
15 minute summer	s5.3	3.000	s5.2	18.2	0.918	0.497	0.6945	
15 minute winter	ns2	4.001	s10	20.6	1.175	1.162	0.7289	
15 minute winter	ns1	4.000	ns2	22.0	1.249	1.238	0.2641	
60 minute winter	s9.3	5.000	s10	82.1	-0.512	0.044	23.0863	
60 minute winter	s2.1	2.000	s2	-45.1	-0.281	-0.041	13.1345	
60 minute winter	s5.2	3.001	s5.1	17.3	0.839	0.530	0.5966	
60 minute winter	s5.1	3.002	s5	17.9	0.746	0.210	0.7042	
60 minute winter	s5.9	6.000	s5.2	-2.6	0.453	-0.114	0.1251	