Drainage Strategy and Flood Consequences Assessment

Clydesmuir Industrial Estate
Cardiff

Affordable Homes

Job Number:	Clydesmuir
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Contents

Appendices

Revision	Date	Description	Author(s)	Reviewer(s)	Approval
D100	10.01.26	First Issue	MJ	MJ	AH

1.0 Introduction

Pegasus Developments have prepared this document to support a planning application for a redevelopment at Clydesmuir Industrial Estate, Cardiff.

The brownfield development will require the demolition of the existing light industrial and warehouse buildings and change of use of the site to residential, in accordance with Cardiff's strategic objectives for housing delivery, brownfield regeneration, and sustainable placemaking.

The proposed development comprises of 96 affordable homes, together with associated access, parking, landscaping, and sustainable drainage.

The report will demonstrate how surface and foul water drainage can be discharged from the site without affecting the downstream catchments detrimentally. The report also demonstrates how the development will be protected from flooding for its lifetime and will ensure flood risk is not increased elsewhere.

This report also contains an assessment of flood risk and associated consequences.

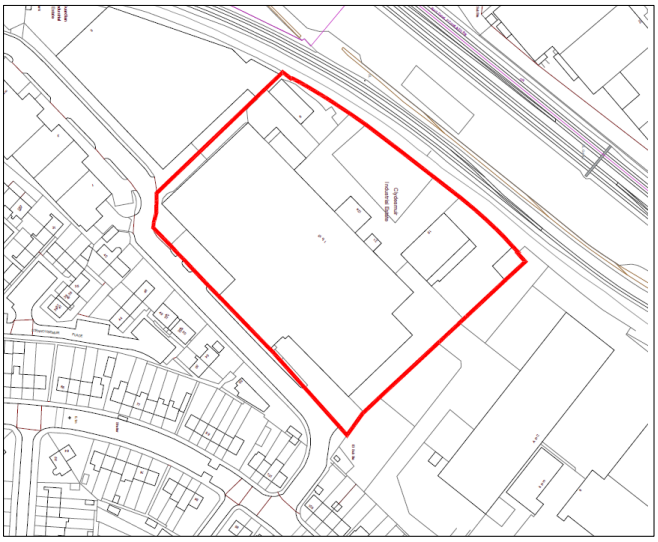
Before construction, the development will require sustainable drainage systems (SuDS) approval by the SuDS Approving Body (SAB). This report is not intended to form part of the required SAB submission however a SAB section is included which demonstrates how standards can be met.

2.0 Site description

Clydesmuir Industrial Estate is in East Cardiff and centres on an approximate National Grid Reference of 320640 177440, the site occupies a plan area of approximately 1.84 Hectares.

The site is occupied by several light industrial and/or office buildings, accessed from Clydesmuir Road and is entirely positively drained, covered by structures and associated hardstanding.

The topography is flat, with a typical existing gradient from north to south of 1:200 (falling towards Clydesmuir Road) and flatter in parallel with Clydesmuir road.



3.0 Drainage Strategy

Surface Water Variables

Point Data	320688,177519
National Grid Reference	ST 20688 77519
Site area	1.84HA
Predevelopment positively drained hardstanding (PPDH)	1.84HA
PPDH factored	1.6HA
Proposed Hardstanding	1.057HA
Bfihost19 (2019)	0.805
Propwet	0.47
SAAR6190 (average rainfall 1961-1990)	1010mm
SAAR9120 (average rainfall 1991-2020)	1124mm

Proposed run off rate

For previously developed brownfield sites such as Clydesmuir Industrial Estate post development runoff rates should be reduced with a betterment of at least 30% to flows considered as a minimum requirement.

The existing, positively drained area has been taken as 1.6HA, this is based on actual 1.84HA with a reduction of circa 10% applied as a conservative approach.

The peak flow for a QBar event has been calculated at approximately 143 l/s for 1.6 ha, verified using FEH22 data (see Appendix B). To ensure significant betterment, an 80% reduction in discharge rate was agreed with Cardiff Council SAB officers.

20% (80% betterment) of 143l/s = **28l/s**

Email correspondence from Cardiff Council and DCWW confirming acceptance of this rate is included in Appendix C.

For comparison purposes, a predevelopment catchment response was also calculated using the rainfall run off software (FEH REFH2) for urbanised areas. This is catchment level analysis that factors in the influence impervious areas have within wider existing catchments rather than factoring in increased flow impacts of positively drained networks.

A predevelopment peak of circa 30l/s was calculated which provides confidence that the rate proposed is also a good approximation of the natural response for this urbanised catchment. An REFH2 output report is included in Appendix B.

Preliminary Surface Water Design

The proposed site comprises of approximately 1.057HA (10570m2) which will drain to the DCWW surface water network, limited to no more than 28l/s for all storm events.

The site has been modelled for storm events up to the 1:100-year return period with a 45% climate change allowance, indicating an estimated storage requirement of approximately 600 m^3.

- Cellular Storage at north of site, approximately 75m3
- Attenuation Swale at south of site, directly adjacent to Clydesmuir Road, approximately 500m3 with approx. 560m3 available.
- In pipe and inspection chamber storage 25m3

Calculations and a network schematic are provided in Appendix B

A preliminary Engineering Arrangement and areas and flows included in this drainage report are included in Appendix D

The calculations provided are based on planning information however, if additional storage is required at detailed design stage cellular storage could also be incorporated under the swale feature and this zone is identified on the Engineering Arrangement drawing.

The proposals ensure compliance with SAB standards and provide sufficient capacity for extreme events.

SuDS Approving Body (SAB) Standards

Standard 1 – (S1) Surface Water Destination.

The Welsh Ministers' Statutory Standards for SuDS require that surface water should be discharged to minimise negative impact of the development on flood risk, the morphology and water quality of receiving waters and the associated ecology.

Standard S1 comprises of 5 priority levels in a hierarchical standard and runoff should be considered at each priority level before a lower priority destination is considered.

Priority Level 1: Runoff collected for use.

The benefit of reusing rainwater is limited in residential developments. Most of the water demand is for drinking water (potable) and the non-potable uses, such as toilet flushing, are a small fraction of water consumption. The costs of tanks, pumps, filtration, dual plumbing etc are not considered viable relative to benefit.

The use of water butts to store water for garden irrigation can be implemented and should be considered at detailed design stage.

Priority Level 2: Runoff infiltrated to ground.

The potential for infiltration has not yet fully been explored, and it is acknowledged that further work is required in this area, however we do have site investigation evidence that demonstrates

made ground with firm clays below, and furthermore, in tested locations ground water encountered at 0.3m of the surface (see Appendix D). Cardiff SAB have agreed that although soakaway testing should be undertaken at the right time infiltration is not likely to be part of the drainage solution for this site due to ground conditions.

Priority Level 3: Discharged to a surface water body

Discounted as there are no suitable watercourse in local area.

Priority Level 4: Discharged to a surface water sewer, highway drain, or another drainage system.

This is the solution for the site and has been agreed in with Cardiff SAB and in principle with DCWW (see emails Appendix C).

Priority Level 5: Discharged to a combined sewer

Not required, however note that the surface water network connects to a combined sewer near the site. DCWW records are included in Appendix D

Destination Summary

Surface water will discharge to the public Welsh Water surface water system at a peak rate of 28 l/s. This represents a Priority Level 4 connection and has been agreed in principle with Cardiff SAB officers and Welsh Water (DCWW).

Standard 2 – (S2) Surface Water runoff hydraulic control

The aim of Standard S2 is to manage the surface water runoff from and on a site to protect people on the site from flooding from the drainage system for events up to a suitable return period, to mitigate any increased flood risk to people and property downstream of the site as a result of the development, and to protect the receiving water body from morphological damage.

Surface water should be managed to prevent, as far as possible, any discharge from the site for the majority of rainfall events of less than 5mm.

The design incorporates permeable surfaces, bioretention, vegetated areas and attenuation features that will intercept the first flush of rainfall and reduce direct runoff.

Preliminary interception areas are included in Appendix D which demonstrate how the site will comply with the criteria. Poor ground infiltration can often make the interception criteria more difficult, particularly if lined drainage systems are used, on brownfield sites and/or permeability is poor.

Cardiff SAB are willing to consider systems as unlined, for the purposes of interception for brownfield sites.

Discharge Rate

As discussed above a betterment of 80% compared to the existing QBar – 1 hour event has been provided, and the peak discharge rate of 28l/s has been agreed with Cardiff SAB officers.

Pre and post development volume

The predevelopment volume of runoff for a 1:100-year 6-hour event has been assessed using Causeway FLOW software with the ReFh2 catchment descriptors. A volume of 1128m^3 has been calculated for a site area of 1.84HA, calculation summary Appendix B.

The proposed site has also been modelled for the same event which confirms a reduced discharge volume of 607.5m^3

There is a significant reduction in post development volume for the 1:100 year 6-hour event.

Runoff for the 1% (1:100 year) event

The network will be designed for the 1:100 year plus climate change event, with no off-site flooding.

All surface water runoff will be managed within the development boundary with no flooding of third-party land.

See calculations Appendix B.

Runoff for events greater than the 1% (1:100 year) event

This site is currently positively drained and close to 100% hardstanding whereas the proposals reduce the amount of hardstanding, off site volumes and peak flows.

Overland flood risk is also significantly reduced when compared to existing arrangements.

Notwithstanding this, in extreme events greater than the 1% event, or in the event of a network failure off site flooding could occur, runoff will spill south on to Clydesmuir Road which is a positively drained network.

A drawing is included in Appendix D which shows overland flood routing.

Summary, Pre and Post development flows and volumes

The tables below compare pre and post development peaks flows off site for the 1:30 and 1:100-year return rate for various storm durations.

This table assumes the same reduced 1.6HA existing area used above (would be higher if actual 1.84 HA was used)

Average offsite flow* for a variety of return periods and durations 1.6HA					
Storm Event	30min storm duration (existing)	1hour storm duration (existing)	2hour storm duration (existing)	6-hour storm duration (existing)	Proposed discharge rate for all events (Proposed)
1:30	214 l/s	140 l/s	91 l/s	42 l/s	28 l/s
1:100	270 l/s	177 l/s	112 l/s	50 l/s	28 l/s

*For the existing scenarios these are average flows rather than peaks (which will be higher)

In practice the existing network is unlikely to be able to accommodate the peak flows from the shorter duration (higher intensity) storms as the peaks from those events would exceed the network capacity.

The proposed 28l/s can be safely managed by the existing network sewers.

Volume discharged from site for a variety of return periods and durations				
Storm Event	30min volume	1-hour volume	2-hour volume	6-hour volume
1:30 existing	386m3	502m3	652m3	908m3
1:100 existing	486m3	638m3	804m3	1090m3
28l/s proposed	50m3	101m3	201m3	607.5m3

Discharge volumes are significantly reduced for a range of storms.

Standard – (S3) Water Quality

Residential development is characterised as having a low pollution hazard level.

Residential roofs are very low hazard level, and no treatment is required beyond removing gross solids and sediment. It is envisaged that roof run off will discharge directly to the attenuation swale.

Property drives and roads for this scheme will have a low hazard level and will require some level of treatment in accordance with the simple index approach outlined in the Welsh Suds Standards. Permeable paving, Bio retention, and Swales will control runoff and ensure there is no determent to water quality.

Standard – (S4, and S5) Amenity and Biodiversity

SuDS features will create amenity and biodiversity value for the proposed site users and the wider site design submitted as part of this application provides further detail.

The scheme is designed to provide 100% affordable housing providing much needed facilities for the area.

Standard – (S6) Construction, Operation and Maintenance of systems

The SuDS system as designed will provide robust surface water drainage systems that can be easily and safely constructed, maintained, and operated.

Detailed management plans will be required at the right time and must form part of the detailed SAB application.

Foul Drainage

Foul water from the proposed development will discharge to the existing combined sewer in Clydesmuir Road, consistent with current arrangements.

Peak design flows are estimated at approximately 3.7 l/s, based on an anticipated daily usage of 4,000 litres.

This arrangement will be confirmed with Welsh Water during the detailed design stage.

4.0 Flood Consequences Assessment

Flood Consequences Assessment is required for any development proposal located fully or partly in Flood Zones 2 and 3 and/or subject to surface water flooding.

The objective of a Flood Consequences Assessment is to develop a full appreciation of the risk and consequences of flooding and the risk and consequences of the development on flood risk elsewhere.

This FCA follows Welsh Government guidance on development and flood risk set out in Technical Advice Note 15 (TAN 15).

Existing flood data

Rivers
The flood maps included in Appendix E include an allowance for climate change and confirm that the site is entirely within Flood Zone 1 which means that there is a less than 1 in 1000 (0.1%) chance of flooding in a given year.

The site is at **very low** risk of flooding from rivers.

Sea (Tidal)
The flood maps included in Appendix E include an allowance for climate change and confirm that the site is partially within Flood Zone 1 and partially within Flood Zone 2.

Flood Zone 1 means that there is a less than 1 in 1000 (0.1%) chance of flooding in a given year.

Flood Zone 2 (Tidal) means that there is between a 1:1000 (0.1%) and 1:200 (0.5%) chance of flooding from the sea in a given year.

The site is also defended by Flood risk management infrastructure which provides a minimum standard of protection against flooding from the sea of 1:200 (plus climate change and freeboard).

The site is indicated at **low** risk of flooding from the sea; this is discussed further in the sources of potential flooding section.

Surface Water and Small Watercourse

The flood maps included in Appendix E confirm that the site is entirely within Flood Zone 1 which means that there is a less than 1 in 1000 (0.1%) chance of flooding in a given year.

The site is at **very low** risk of flooding from Surface Water and Small Watercourses.
Reservoirs

The flood maps included in Appendix E confirm that the site is partially in an area that could be affected by a reservoir flood, in this case Llanishen Reservoir, approximately 3 miles northwest of the site. The shading on the map shows the worst-case scenario for the area that could be flooded if a large reservoir were to fail and release the water it holds.

Reservoir flooding is extremely unlikely to happen. There has been no loss of life in the UK from reservoir flooding since 1925. All large reservoirs must be inspected and supervised by reservoir panel engineers. Natural Resources Wales ensure that reservoirs are inspected regularly and essential safety work is carried out.

The site is at **very low risk** of flooding from reservoirs.

Sewers

The site is at **very low risk** of flooding from Sewers.

Source of flooding	Risk present	Description
Rivers (fluvial)	No	**Very low** risk of flooding (Flood Zone 1)
Sea (tidal)	Yes	**Low** risk of flooding (Flood Zone 2)
Surface Water and Small Water Courses	No	**Very low** risk of flooding (Flood Zone 1)
Reservoirs	Yes	**Very low** risk of flooding
Sewers	No	**Very low** risk of flooding

Flood History

We have included local Flood History maps in Appendix E; there is no history of flooding recorded on the Natural Resources Wales database.

Flood Risk Assessment Wales (FRAW) mapping

These plans, included in Appendix E, do not include climate change and are used to help identify current flood risk.

The site is in Flood Zone 1, very low risk, for all sources of flooding on the FRAW maps.

Additional information

We have contacted Natural Resources Wales data distribution to confirm if any further modelling or data is available for this site and they have confirmed that they do not hold any detailed models for this site.

We have also included Flood Warning Zone maps in Appendix E; the site is not included in a flood warning zone.

Existing and Proposed Levels

A plan is included in Appendix D which confirms existing and proposed levels. These levels are set for planning approval and may change during detailed design but will not be lower than stipulated minimums confirmed in this report.

Existing levels vary across the site between 9.50m to 10.00m with lower levels closer to Clydesmuir road, rising slightly towards North.

Finished floor levels are set between 10.10m and 10.60m

Sources of Potential Flooding

TAN 15 categorises residential development as highly vulnerable development which must remain flood free in the 1% (1:100 year) event for river and surface water flooding, and also in the 0.5% (1:200 year) event for tidal flooding.

In more extreme events up to 0.1% (1:1000) it is imperative that that flooding does not endanger life and so it also needs to be demonstrated that conditions will be tolerable during an extreme event.

A minimum flood depth of 600mm and a maximum flood water velocity of 0.15m/s is identified for the extreme event.

The site meets these criteria; however tidal flooding risk is identified and requires further analysis.

Flood mapping indicates that the site is in flood zone 2 (defended) for tidal flooding during the extreme event.

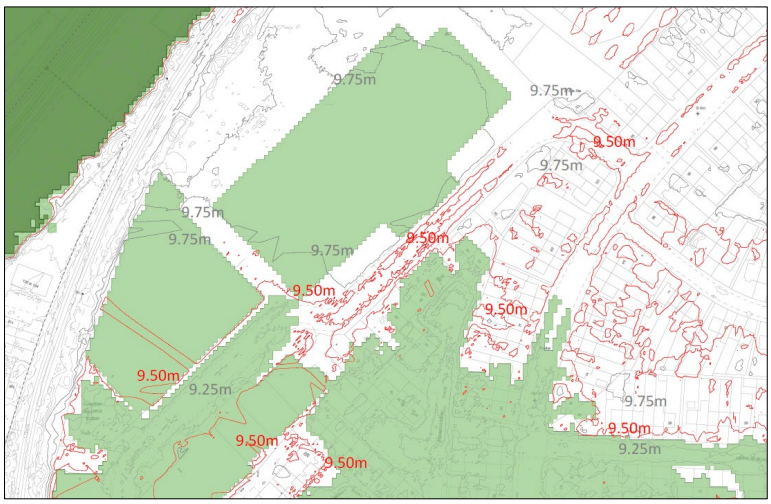
As can be seen from flood mapping, extracted below, the Flood Zone 2 mapping enters the site, although the unusual pattern of flooding on the site does suggest that there might be a modelling discrepancy in this area.

The mapping indicates that flood zone 2 (light green) enters the site, shaped to the footprint of the industrial unit.

The building slab level is at approximately 9.95m whereas the surrounding area and Clydesmuir Road is lower at 9.50-9.85, with Clydesmuir road itself at 9.50m.

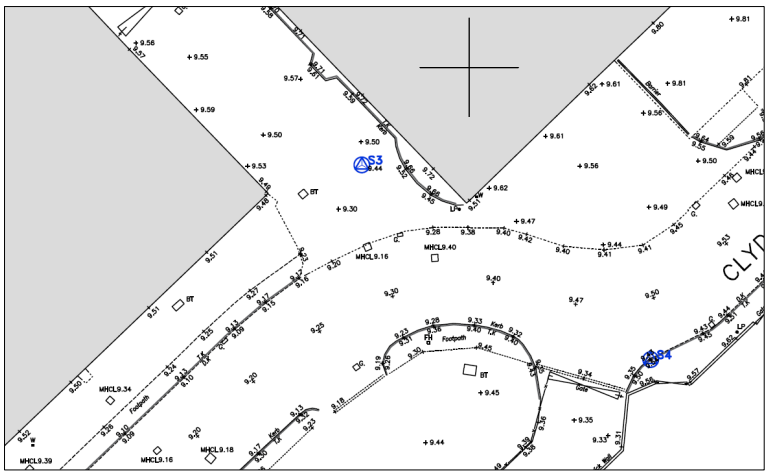
A comparison of flood zone 2, with latest LIDAR data has been carried out to find the correlation with the flood zone extent and level. A drawing is included in Appendix E.

The extract below confirms that the extent of flood zone 2 is approximately 9.50m, with good correlation across this area of the flood plain.



The site is assessed as being at very low risk of flooding from all sources, including the extreme tidal event (0.1%). The predicted flood extent corresponds to an elevation of approximately 9.50 m, which remains below existing site levels.

A topographical survey is also included in Appendix E and provides some indication of how this modelling representation might have occurred. Clydesmuir Road is below the suggested 9.50m to the south of the proposed development, rising to 9.50m or so in the southwest corner of the proposed site. There are some locally low levels in that corner, and the modelling tool appears to have assume a spill into the site at that point.



In the event that our analysis is not wholly accepted, it is clear that the site is situated at the limit of the extreme flood zone, and any flood water present will be shallow, and mitigated by a modest raise in proposed levels.

We have approached NRW Data Distribution for additional information, but none is available and so this is the most accurate assessment we can make.

Peak flood depth and velocities on site

As there is a very low risk of flooding predicted for this development.

The level of 9.50m represents the upper boundary of the 1:1000 (0.1%) extreme event and at this level the existing site is flood free, with potential minor encroachment at the boundary low point in the southwest corner.

The site itself, and Clydesmuir Road as principal access are both flood free in the extreme event.

Runoff likely to be generated from the development

This is discussed in detail above, peak flows and volumes will be significantly reduced post development due to the reduction in positively drained hardstanding, implementation of sustainable drainage, and on-site surface water attenuation and flow control.

Flood risk elsewhere

Notwithstanding the flood zone query (The site is not in FZ2) the proposed raising of levels (to 10.10m-10.60m) will not result in significant displaced flood water increasing flood levels elsewhere.

The flood plain, if present on site, will be very shallow, and any volume of water displaced would not be significant in the context of the tidal flood plain.

The surface water strategy for the proposed site will reduce flows and volumes of surface water from the site offering significant downstream betterment.

Overland flow routes

Overland flow routing will be south, off the site and onto Clydesmuir road, which is flood free during events up the 0.1% event. (See drawing in Appendix D)

Access/evacuation routes from the proposed development

Although Clydesmuir Road, South and to the East of the development, remains flood free, even during the extreme tidal event the road network may experience flooding elsewhere.

In the event of an extreme flood, Clydesmuir Industrial Estate is a comparatively safe location locally, and unless there is an emergency residents might be better advised to stay there until flood water subsides.

Flood avoidance, mitigation, and resilience measures to be implemented

Extreme flood levels are predicted, with climate change, to reach a level of approximately 9.50m.

A minimum finished floor level of 9.80m would provide a 300mm freeboard during this extreme event, finished floor levels should be 150mm above proposed external levels save for flush thresholds for plot access.

Residents should also be made aware of the local flood risk, and sign up for flood warnings by telephoning 0345 988 1188, residents can also sign up online:

Natural Resources Wales / Sign up to receive flood warnings

5.0 Conclusion

This document supports the planning application for the redevelopment of Clydesmuir Industrial Estate, Cardiff, to deliver 96 affordable homes. The proposal aligns with Cardiff's strategic objectives for housing delivery, brownfield regeneration, and sustainable placemaking.

Drainage

Surface water runoff will discharge through SuDS features, into an existing public Surface Water sewer in Clydesmuir Road. The proposed discharge rate of 28l/s has been justified and agreed with Cardiff SAB officers and will provide significant downstream improvements.

Off-site surface water volumes are also reduced during the critical 1:100 year 6-hour event.

Detailed surface water drainage design will be agreed through a Full-SAB application with Cardiff City Council.

Foul water will drain to the public combined sewer in Clydesmuir Road.

Flood Risk

The site is located in Flood Zone 1 and partially Flood Zone 2 for tidal flooding.

The site is flood free for the critical fluvial 1% (1:100) and tidal 0.5% (1:200) events and is also defended by flood risk management infrastructure providing a standard of protection against flooding from the sea of 1:200 (plus climate change and freeboard).

Tan 15 also requires an assessment during extreme storms, up to the 0.1% (1:1000 year) plus climate change event. The site will be flood free during this event and minimum plot levels of 9.80m are recommended to provide 300mm of freeboard above extreme levels.

There are no significant offsite flooding impacts as a consequence of this development.

Residents should be made aware of the flood risks that could be present in this area of Cardiff and be encouraged to make use of Natural Resources Wales flood warning services.

Appendices

Appendix A

Proposed layout

1 **Proposed Site Plan**
1 : 1000

10 0 10 20 30 40 50
SCALE 1:1000 m

Rev	Status	Date	Check	Description
P02	S0	03.12.25	AP	Adjustment to Bin/ Bike stores and external works
P01	S0	25.11.25	BE	First Issue

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Title
Proposed Site Plan

Job No	Scale at A3	Classification	Status Revision
4594	1 : 1000		S0 P02

Project - Originator - Functional Breakdown - Spatial Breakdown - Form - Discipline - Number
CMWW-HMA-ZZ-ZZ-D-A-90002

Appendix B

Calculations

UK Design Flood Estimation

Generated on 09 January 2026 12:53:29 by mjessop
Printed from the ReFH2 Flood Modelling software package, version 4.2.9348.27749

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH2)

Site details Checksum: F78A-9FE1

Site name: FEH_Point_Descriptors_320688_177519_v5_1_0

Easting: 320688

Northing: 177519

Country: England, Wales or Northern Ireland

Catchment Area (km²): 0.02 [0.5]*

Using plot scale calculations: Yes

Model: 2.3

Site description: None

Model run: 2 year

Summary of results

Rainfall - FEH22 (mm):	18.79	Total runoff (ML):	0.17
Total Rainfall (mm):	17.93	Total flow (ML):	0.20
Peak Rainfall (mm):	6.35	Peak flow (m³/s):	0.03

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH22)

Name	Value	User-defined?
Duration (hh:mm:ss)	02:15:00	No
Timestep (hh:mm:ss)	00:15:00	No
SCF (Seasonal correction factor)	0.96	No
ARF (Areal reduction factor)	0.99	No
Seasonality	Summer	No

Loss model parameters

Name	Value	User-defined?
Cini (mm)	32.79	No
Cmax (mm)	842.54	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

**The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

Name	Value	User-defined?
Tp (hr)	1.12 [1]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0	No
BL (hr)	36.15	No
BR	3.66	No

Urbanisation parameters

Name	Value	User-defined?
Sewer capacity (m^3/s)	0	No
Exporting drained area (km^2)	0	No
Urban area (km^2)	0.02 [0]	Yes
Effective URBEXT2000	0.64	n/a
Impervious runoff factor	1 [0.7]	Yes
Imperviousness factor	0.5 [0.4]	Yes
Tp scaling factor	0.75	No
Depression storage depth (mm)	0.5	No

**The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m^3/s)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
00:00:00	0.5297	0.0000	0.2753	0.0000	0.000125	0.000125
00:15:00	0.8670	0.0000	0.4509	0.0002	0.000124	0.000283
00:30:00	1.4961	0.0000	0.7791	0.0007	0.000123	0.00086
00:45:00	2.8945	0.0000	1.5110	0.0020	0.000123	0.00215
01:00:00	6.3543	0.0000	3.3346	0.0045	0.000124	0.00465
01:15:00	2.8945	0.0000	1.5269	0.0093	0.000127	0.00942
01:30:00	1.4961	0.0000	0.7912	0.0159	0.000135	0.0161
01:45:00	0.8670	0.0000	0.4591	0.0222	0.000148	0.0224
02:00:00	0.5297	0.0000	0.2807	0.0260	0.000165	0.0262
02:15:00	0.0000	0.0000	0.0000	0.0251	0.000187	0.0253
02:30:00	0.0000	0.0000	0.0000	0.0220	0.000211	0.0222
02:45:00	0.0000	0.0000	0.0000	0.0179	0.000234	0.0182
03:00:00	0.0000	0.0000	0.0000	0.0141	0.000254	0.0144
03:15:00	0.0000	0.0000	0.0000	0.0107	0.000271	0.0109
03:30:00	0.0000	0.0000	0.0000	0.0076	0.000285	0.00791
03:45:00	0.0000	0.0000	0.0000	0.0050	0.000296	0.00528
04:00:00	0.0000	0.0000	0.0000	0.0028	0.000304	0.00308
04:15:00	0.0000	0.0000	0.0000	0.0013	0.00031	0.0016
04:30:00	0.0000	0.0000	0.0000	0.0006	0.000314	0.000884
04:45:00	0.0000	0.0000	0.0000	0.0002	0.000316	0.000528
05:00:00	0.0000	0.0000	0.0000	0.0000	0.000317	0.000366
05:15:00	0.0000	0.0000	0.0000	0.0000	0.000317	0.000317
05:30:00	0.0000	0.0000	0.0000	0.0000	0.000315	0.000315
05:45:00	0.0000	0.0000	0.0000	0.0000	0.000313	0.000313
06:00:00	0.0000	0.0000	0.0000	0.0000	0.000311	0.000311
06:15:00	0.0000	0.0000	0.0000	0.0000	0.000309	0.000309
06:30:00	0.0000	0.0000	0.0000	0.0000	0.000307	0.000307
06:45:00	0.0000	0.0000	0.0000	0.0000	0.000305	0.000305
07:00:00	0.0000	0.0000	0.0000	0.0000	0.000303	0.000303
07:15:00	0.0000	0.0000	0.0000	0.0000	0.000301	0.000301
07:30:00	0.0000	0.0000	0.0000	0.0000	0.000299	0.000299
07:45:00	0.0000	0.0000	0.0000	0.0000	0.000297	0.000297
08:00:00	0.0000	0.0000	0.0000	0.0000	0.000294	0.000294
08:15:00	0.0000	0.0000	0.0000	0.0000	0.000292	0.000292

**The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m^3/s)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
08:30:00	0.0000	0.0000	0.0000	0.0000	0.00029	0.00029
08:45:00	0.0000	0.0000	0.0000	0.0000	0.000288	0.000288
09:00:00	0.0000	0.0000	0.0000	0.0000	0.000286	0.000286
09:15:00	0.0000	0.0000	0.0000	0.0000	0.000284	0.000284
09:30:00	0.0000	0.0000	0.0000	0.0000	0.000283	0.000283
09:45:00	0.0000	0.0000	0.0000	0.0000	0.000281	0.000281
10:00:00	0.0000	0.0000	0.0000	0.0000	0.000279	0.000279
10:15:00	0.0000	0.0000	0.0000	0.0000	0.000277	0.000277
10:30:00	0.0000	0.0000	0.0000	0.0000	0.000275	0.000275
10:45:00	0.0000	0.0000	0.0000	0.0000	0.000273	0.000273
11:00:00	0.0000	0.0000	0.0000	0.0000	0.000271	0.000271
11:15:00	0.0000	0.0000	0.0000	0.0000	0.000269	0.000269
11:30:00	0.0000	0.0000	0.0000	0.0000	0.000267	0.000267
11:45:00	0.0000	0.0000	0.0000	0.0000	0.000265	0.000265
12:00:00	0.0000	0.0000	0.0000	0.0000	0.000264	0.000264
12:15:00	0.0000	0.0000	0.0000	0.0000	0.000262	0.000262
12:30:00	0.0000	0.0000	0.0000	0.0000	0.00026	0.00026
12:45:00	0.0000	0.0000	0.0000	0.0000	0.000258	0.000258
13:00:00	0.0000	0.0000	0.0000	0.0000	0.000256	0.000256
13:15:00	0.0000	0.0000	0.0000	0.0000	0.000255	0.000255
13:30:00	0.0000	0.0000	0.0000	0.0000	0.000253	0.000253
13:45:00	0.0000	0.0000	0.0000	0.0000	0.000251	0.000251
14:00:00	0.0000	0.0000	0.0000	0.0000	0.000249	0.000249
14:15:00	0.0000	0.0000	0.0000	0.0000	0.000248	0.000248
14:30:00	0.0000	0.0000	0.0000	0.0000	0.000246	0.000246
14:45:00	0.0000	0.0000	0.0000	0.0000	0.000244	0.000244
15:00:00	0.0000	0.0000	0.0000	0.0000	0.000243	0.000243
15:15:00	0.0000	0.0000	0.0000	0.0000	0.000241	0.000241
15:30:00	0.0000	0.0000	0.0000	0.0000	0.000239	0.000239
15:45:00	0.0000	0.0000	0.0000	0.0000	0.000238	0.000238
16:00:00	0.0000	0.0000	0.0000	0.0000	0.000236	0.000236
16:15:00	0.0000	0.0000	0.0000	0.0000	0.000234	0.000234
16:30:00	0.0000	0.0000	0.0000	0.0000	0.000233	0.000233
16:45:00	0.0000	0.0000	0.0000	0.0000	0.000231	0.000231
17:00:00	0.0000	0.0000	0.0000	0.0000	0.00023	0.00023

**The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m^3/s)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
17:15:00	0.0000	0.0000	0.0000	0.0000	0.000228	0.000228
17:30:00	0.0000	0.0000	0.0000	0.0000	0.000226	0.000226
17:45:00	0.0000	0.0000	0.0000	0.0000	0.000225	0.000225
18:00:00	0.0000	0.0000	0.0000	0.0000	0.000223	0.000223
18:15:00	0.0000	0.0000	0.0000	0.0000	0.000222	0.000222
18:30:00	0.0000	0.0000	0.0000	0.0000	0.00022	0.00022
18:45:00	0.0000	0.0000	0.0000	0.0000	0.000219	0.000219
19:00:00	0.0000	0.0000	0.0000	0.0000	0.000217	0.000217
19:15:00	0.0000	0.0000	0.0000	0.0000	0.000216	0.000216
19:30:00	0.0000	0.0000	0.0000	0.0000	0.000214	0.000214
19:45:00	0.0000	0.0000	0.0000	0.0000	0.000213	0.000213
20:00:00	0.0000	0.0000	0.0000	0.0000	0.000211	0.000211
20:15:00	0.0000	0.0000	0.0000	0.0000	0.00021	0.00021
20:30:00	0.0000	0.0000	0.0000	0.0000	0.000208	0.000208
20:45:00	0.0000	0.0000	0.0000	0.0000	0.000207	0.000207
21:00:00	0.0000	0.0000	0.0000	0.0000	0.000206	0.000206
21:15:00	0.0000	0.0000	0.0000	0.0000	0.000204	0.000204
21:30:00	0.0000	0.0000	0.0000	0.0000	0.000203	0.000203
21:45:00	0.0000	0.0000	0.0000	0.0000	0.000201	0.000201
22:00:00	0.0000	0.0000	0.0000	0.0000	0.0002	0.0002
22:15:00	0.0000	0.0000	0.0000	0.0000	0.000199	0.000199
22:30:00	0.0000	0.0000	0.0000	0.0000	0.000197	0.000197
22:45:00	0.0000	0.0000	0.0000	0.0000	0.000196	0.000196
23:00:00	0.0000	0.0000	0.0000	0.0000	0.000194	0.000194
23:15:00	0.0000	0.0000	0.0000	0.0000	0.000193	0.000193
23:30:00	0.0000	0.0000	0.0000	0.0000	0.000192	0.000192
23:45:00	0.0000	0.0000	0.0000	0.0000	0.00019	0.00019
24:00:00	0.0000	0.0000	0.0000	0.0000	0.000189	0.000189
24:15:00	0.0000	0.0000	0.0000	0.0000	0.000188	0.000188
24:30:00	0.0000	0.0000	0.0000	0.0000	0.000187	0.000187
24:45:00	0.0000	0.0000	0.0000	0.0000	0.000185	0.000185
25:00:00	0.0000	0.0000	0.0000	0.0000	0.000184	0.000184
25:15:00	0.0000	0.0000	0.0000	0.0000	0.000183	0.000183
25:30:00	0.0000	0.0000	0.0000	0.0000	0.000181	0.000181
25:45:00	0.0000	0.0000	0.0000	0.0000	0.00018	0.00018

**The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m^3/s)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
26:00:00	0.0000	0.0000	0.0000	0.0000	0.000179	0.000179
26:15:00	0.0000	0.0000	0.0000	0.0000	0.000178	0.000178
26:30:00	0.0000	0.0000	0.0000	0.0000	0.000177	0.000177
26:45:00	0.0000	0.0000	0.0000	0.0000	0.000175	0.000175
27:00:00	0.0000	0.0000	0.0000	0.0000	0.000174	0.000174
27:15:00	0.0000	0.0000	0.0000	0.0000	0.000173	0.000173
27:30:00	0.0000	0.0000	0.0000	0.0000	0.000172	0.000172
27:45:00	0.0000	0.0000	0.0000	0.0000	0.000171	0.000171
28:00:00	0.0000	0.0000	0.0000	0.0000	0.000169	0.000169
28:15:00	0.0000	0.0000	0.0000	0.0000	0.000168	0.000168
28:30:00	0.0000	0.0000	0.0000	0.0000	0.000167	0.000167
28:45:00	0.0000	0.0000	0.0000	0.0000	0.000166	0.000166
29:00:00	0.0000	0.0000	0.0000	0.0000	0.000165	0.000165
29:15:00	0.0000	0.0000	0.0000	0.0000	0.000164	0.000164
29:30:00	0.0000	0.0000	0.0000	0.0000	0.000162	0.000162
29:45:00	0.0000	0.0000	0.0000	0.0000	0.000161	0.000161
30:00:00	0.0000	0.0000	0.0000	0.0000	0.00016	0.00016
30:15:00	0.0000	0.0000	0.0000	0.0000	0.000159	0.000159
30:30:00	0.0000	0.0000	0.0000	0.0000	0.000158	0.000158
30:45:00	0.0000	0.0000	0.0000	0.0000	0.000157	0.000157
31:00:00	0.0000	0.0000	0.0000	0.0000	0.000156	0.000156
31:15:00	0.0000	0.0000	0.0000	0.0000	0.000155	0.000155
31:30:00	0.0000	0.0000	0.0000	0.0000	0.000154	0.000154
31:45:00	0.0000	0.0000	0.0000	0.0000	0.000153	0.000153
32:00:00	0.0000	0.0000	0.0000	0.0000	0.000152	0.000152
32:15:00	0.0000	0.0000	0.0000	0.0000	0.000151	0.000151
32:30:00	0.0000	0.0000	0.0000	0.0000	0.00015	0.00015
32:45:00	0.0000	0.0000	0.0000	0.0000	0.000149	0.000149
33:00:00	0.0000	0.0000	0.0000	0.0000	0.000147	0.000147
33:15:00	0.0000	0.0000	0.0000	0.0000	0.000146	0.000146
33:30:00	0.0000	0.0000	0.0000	0.0000	0.000145	0.000145
33:45:00	0.0000	0.0000	0.0000	0.0000	0.000144	0.000144
34:00:00	0.0000	0.0000	0.0000	0.0000	0.000143	0.000143
34:15:00	0.0000	0.0000	0.0000	0.0000	0.000142	0.000142
34:30:00	0.0000	0.0000	0.0000	0.0000	0.000141	0.000141

**The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m^3/s)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
34:45:00	0.0000	0.0000	0.0000	0.0000	0.000141	0.000141
35:00:00	0.0000	0.0000	0.0000	0.0000	0.00014	0.00014
35:15:00	0.0000	0.0000	0.0000	0.0000	0.000139	0.000139
35:30:00	0.0000	0.0000	0.0000	0.0000	0.000138	0.000138
35:45:00	0.0000	0.0000	0.0000	0.0000	0.000137	0.000137
36:00:00	0.0000	0.0000	0.0000	0.0000	0.000136	0.000136
36:15:00	0.0000	0.0000	0.0000	0.0000	0.000135	0.000135
36:30:00	0.0000	0.0000	0.0000	0.0000	0.000134	0.000134
36:45:00	0.0000	0.0000	0.0000	0.0000	0.000133	0.000133
37:00:00	0.0000	0.0000	0.0000	0.0000	0.000132	0.000132
37:15:00	0.0000	0.0000	0.0000	0.0000	0.000131	0.000131
37:30:00	0.0000	0.0000	0.0000	0.0000	0.00013	0.00013
37:45:00	0.0000	0.0000	0.0000	0.0000	0.000129	0.000129
38:00:00	0.0000	0.0000	0.0000	0.0000	0.000128	0.000128
38:15:00	0.0000	0.0000	0.0000	0.0000	0.000128	0.000128

**The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.84	No
BFIHOST19	0.81	No
PROPWET	0.47	No
SAAR (mm)	1010	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

**The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.840	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	x	Check Discharge Rate(s)	x
Rainfall Events	Singular	Drain Down Time (mins)	240	Check Discharge Volume	x
Summer CV	0.840	Additional Storage (m³/ha)	20.0		
Analysis Speed	Normal	Starting Level (m)			

Storm Durations

60

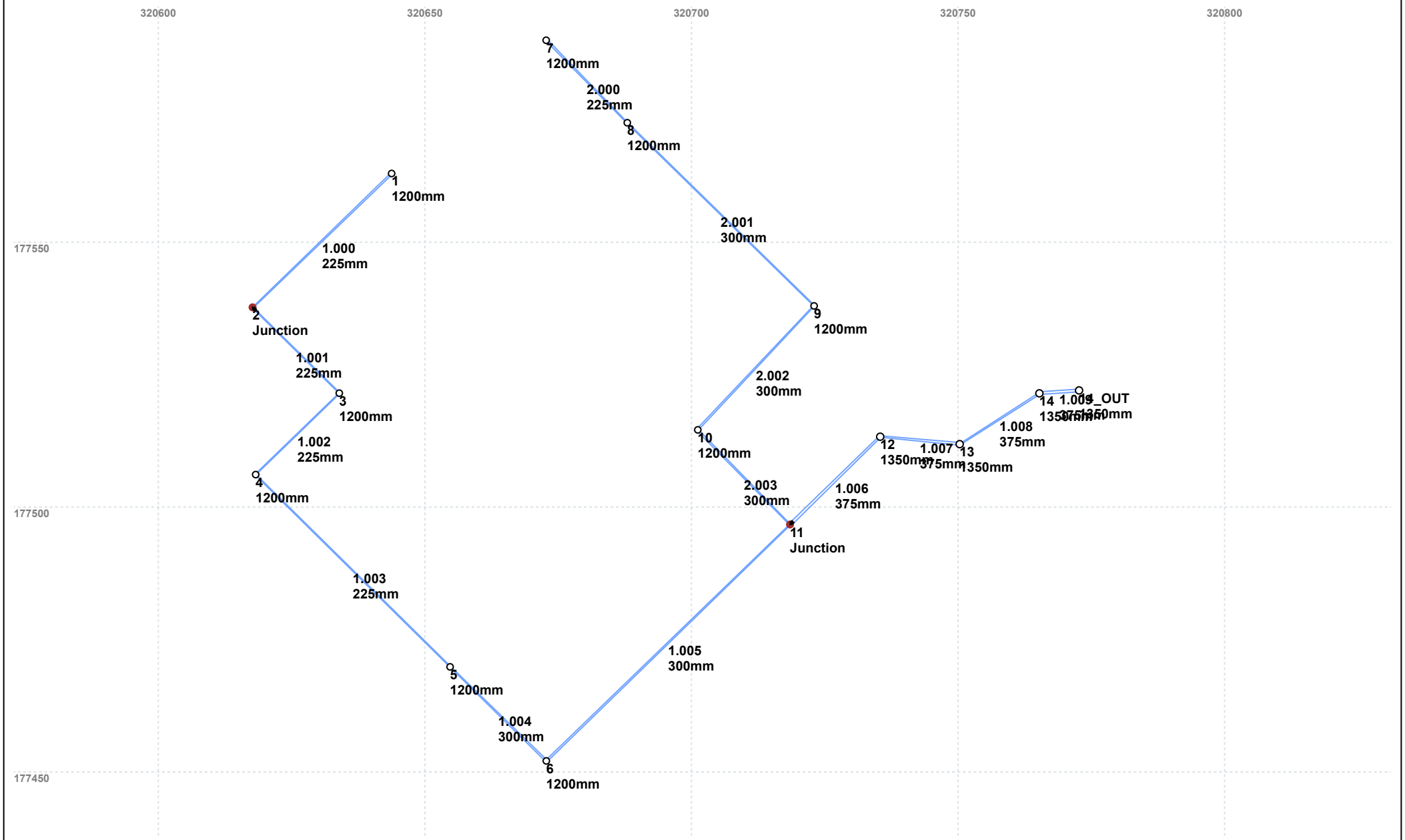
Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0

Results for 2 year 60 minute summer. 300 minute analysis at 1 minute timestep. Mass balance: 99.90%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute summer	2	33	8.003	0.178	72.3	2.0585	0.0000	OK
60 minute summer	1	33	8.172	0.177	72.3	2.0518	0.0000	OK
60 minute summer	3	33	7.591	0.266	143.6	0.3804	0.0000	OK
60 minute summer	3_OUT	33	7.470	0.232	143.3	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute summer	2	2.000	3	72.4	1.350	0.444	3.4346	
60 minute summer	1	1.000	3	71.2	1.432	0.437	3.5006	
60 minute summer	3	1.001	3_OUT	143.3	1.596	0.544	1.1709	152.9

Causeway	Pegasus	File: Site model 09.01.26.pfd Network: Storm Network 1 Matthew Jessop 09/01/2026	Page 1 Clydesmuir Industrial



Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.900	Preferred Cover Depth (m)	0.900
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.113	5.00	10.400	1200	320643.759	177562.984	0.950
2			10.500		320617.678	177537.715	1.250
3	0.059	5.00	10.320	1200	320633.944	177521.513	1.223
4	0.070	5.00	10.485	1200	320618.260	177506.142	1.498
5	0.200	5.00	10.260	1200	320654.725	177469.841	1.605
6			9.800	1200	320672.775	177452.085	1.272
7	0.050	5.00	10.315	1200	320672.750	177588.136	1.115
8	0.150	5.00	10.531	1200	320687.963	177572.566	1.515
9	0.200	5.00	10.269	1200	320723.000	177537.985	1.499
10	0.210	5.00	9.904	1200	320701.189	177514.584	1.294
11			9.600		320718.491	177496.725	1.300
12			9.798	1350	320735.407	177513.290	1.656
13			9.548	1350	320750.311	177511.890	1.506
14			9.555	1350	320765.259	177521.482	1.631
14_OUT			9.492	1350	320772.702	177522.028	1.618

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	320643.759	177562.984	10.400	0.950	1200	0	1.000	9.450	225
2	320617.678	177537.715	10.500	1.250		1 0	1.000 1.001	9.250 9.250	225 225
3	320633.944	177521.513	10.320	1.223	1200	1 0	1.001 1.002	9.097 9.097	225 225
4	320618.260	177506.142	10.485	1.498	1200	1 0	1.002 1.003	8.987 8.987	225 225
5	320654.725	177469.841	10.260	1.605	1200	1 0	1.003 1.004	8.730 8.655	225 300
6	320672.775	177452.085	9.800	1.272	1200	1 0	1.004 1.005	8.528 8.528	300 300
7	320672.750	177588.136	10.315	1.115	1200	0	2.000	9.200	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
8	320687.963	177572.566	10.531	1.515	1200	1	2.000	9.091	225
						0	2.001	9.016	300
9	320723.000	177537.985	10.269	1.499	1200	1	2.001	8.770	300
						0	2.002	8.770	300
10	320701.189	177514.584	9.904	1.294	1200	1	2.002	8.610	300
						0	2.003	8.610	300
11	320718.491	177496.725	9.600	1.300		1	2.003	8.375	300
						2	1.005	8.300	300
						0	1.006	8.300	375
12	320735.407	177513.290	9.798	1.656	1350	1	1.006	8.142	375
						0	1.007	8.142	375
13	320750.311	177511.890	9.548	1.506	1350	1	1.007	8.042	375
						0	1.008	8.042	375
14	320765.259	177521.482	9.555	1.631	1350	1	1.008	7.924	375
						0	1.009	7.924	375
14_OUT	320772.702	177522.028	9.492	1.618	1350	1	1.009	7.874	375

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	✓	Check Discharge Rate(s)	x
Summer CV	0.900	Drain Down Time (mins)	240	Check Discharge Volume	x
Winter CV	0.900	Additional Storage (m³/ha)	0.0		

Storm Durations

180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
30	0	0	0	100	45	0	0

Node 2 Online Orifice Control

Flap Valve	x	Design Depth (m)	1.000	Discharge Coefficient	0.600
Replaces Downstream Link	x	Design Flow (l/s)	3.0		
Invert Level (m)	9.250	Diameter (m)	0.038		

Node 11 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	8.300	Product Number	CTL-SHE-0226-2800-1300-2800
Design Depth (m)	1.300	Min Outlet Diameter (m)	0.300
Design Flow (l/s)	28.0	Min Node Diameter (mm)	1800

Node 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	9.250
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	150.0	0.0	0.500	150.0	0.0	0.510	0.0	0.0

Node 11 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	8.300
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	204

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	87.0	87.0	0.200	188.0	188.3	0.700	491.0	493.0	1.300	873.0	878.9

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.85%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute summer	1	96	9.550	0.100	15.9	0.1129	0.0000	OK
360 minute summer	2	272	9.521	0.271	10.3	38.5620	0.0000	SURCHARGED
180 minute summer	3	96	9.174	0.077	9.4	0.0870	0.0000	OK
180 minute summer	4	96	9.102	0.115	19.3	0.1298	0.0000	OK
180 minute summer	5	100	9.036	0.381	47.5	0.4307	0.0000	SURCHARGED
180 minute summer	6	124	9.027	0.499	46.6	0.5649	0.0000	SURCHARGED
180 minute summer	7	96	9.269	0.069	7.1	0.0777	0.0000	OK
180 minute summer	8	96	9.139	0.123	28.3	0.1393	0.0000	OK
180 minute summer	9	96	9.114	0.344	56.5	0.3889	0.0000	SURCHARGED
180 minute summer	10	112	9.029	0.419	84.9	0.4740	0.0000	SURCHARGED
180 minute summer	11	128	9.021	0.721	130.8	207.6605	0.0000	SURCHARGED
480 minute winter	12	288	8.254	0.112	28.0	0.1602	0.0000	OK
360 minute winter	13	304	8.153	0.111	28.0	0.1591	0.0000	OK
360 minute winter	14	304	8.039	0.115	28.0	0.1649	0.0000	OK
360 minute winter	14_OUT	304	7.978	0.104	28.0	0.0000	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)
180 minute summer	1	1.000	2	15.9	0.902	0.414	0.9157	
360 minute summer	2	1.001	3	1.5	0.471	0.035	0.1331	
180 minute summer	3	1.002	4	9.4	0.582	0.256	0.3549	
180 minute summer	4	1.003	5	19.3	0.878	0.526	1.5464	
180 minute summer	5	1.004	6	46.6	0.925	0.594	1.7830	
180 minute summer	6	1.005	11	46.3	0.715	0.701	4.4995	
180 minute summer	7	2.000	8	7.1	0.708	0.194	0.2182	
180 minute summer	8	2.001	9	28.3	0.707	0.361	2.4035	
180 minute summer	9	2.002	10	55.3	1.035	0.706	2.2526	
180 minute summer	10	2.003	11	84.6	1.201	0.783	1.7510	
180 minute summer	11	1.006	12	28.0	1.053	0.172	0.6295	
480 minute winter	12	1.007	13	28.0	1.021	0.172	0.4106	
360 minute winter	13	1.008	14	28.0	1.000	0.172	0.4972	
360 minute winter	14	1.009	14_OUT	28.0	1.049	0.172	0.1992	508.5

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.85%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute summer	1	216	10.044	0.594	23.8	0.6717	0.0000	SURCHARGED
240 minute summer	2	216	10.043	0.793	23.5	71.9625	0.0000	SURCHARGED
180 minute summer	3	96	9.814	0.717	14.7	0.8113	0.0000	SURCHARGED
180 minute summer	4	96	9.799	0.812	29.7	0.9184	0.0000	SURCHARGED
180 minute summer	5	96	9.615	0.960	78.9	1.0854	0.0000	SURCHARGED
180 minute summer	6	100	9.456	0.928	78.5	1.0496	0.0000	SURCHARGED
180 minute summer	7	96	10.072	0.872	12.4	0.9865	0.0000	FLOOD RISK
180 minute summer	8	96	10.058	1.042	49.3	1.1782	0.0000	SURCHARGED
180 minute summer	9	96	9.946	1.176	98.5	1.3302	0.0000	SURCHARGED
180 minute summer	10	96	9.636	1.026	150.3	1.1607	0.0000	FLOOD RISK
180 minute winter	11	176	9.419	1.119	158.5	458.4890	0.0000	FLOOD RISK
600 minute summer	12	285	8.254	0.112	28.0	0.1602	0.0000	OK
600 minute summer	13	285	8.153	0.111	28.0	0.1591	0.0000	OK
720 minute summer	14	345	8.039	0.115	28.0	0.1649	0.0000	OK
720 minute summer	14_OUT	345	7.978	0.104	28.0	0.0000	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)
240 minute summer	1	1.000	2	22.8	0.999	0.594	1.4442	
240 minute summer	2	1.001	3	2.4	0.511	0.056	0.9131	
180 minute summer	3	1.002	4	12.3	0.580	0.335	0.8734	
180 minute summer	4	1.003	5	29.2	0.862	0.798	2.0463	
180 minute summer	5	1.004	6	78.5	1.115	1.001	1.7830	
180 minute summer	6	1.005	11	78.1	1.109	1.182	4.4995	
180 minute summer	7	2.000	8	12.0	0.699	0.327	0.8657	
180 minute summer	8	2.001	9	48.8	0.704	0.624	3.4666	
180 minute summer	9	2.002	10	98.1	1.394	1.253	2.2526	
180 minute summer	10	2.003	11	149.9	2.129	1.388	1.7510	
180 minute winter	11	1.006	12	28.0	1.053	0.172	0.6295	
600 minute summer	12	1.007	13	28.0	1.021	0.172	0.4106	
600 minute summer	13	1.008	14	28.0	1.000	0.172	0.4972	
720 minute summer	14	1.009	14_OUT	28.0	1.049	0.172	0.1992	1039.6

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.900	Preferred Cover Depth (m)	0.900
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	✓	Check Discharge Rate(s)	x
Summer CV	0.900	Drain Down Time (mins)	240	Check Discharge Volume	✓
Winter CV	0.900	Additional Storage (m³/ha)	0.0	100 year 360 minute (m³)	1128

Storm Durations

360

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

Pre-development Discharge Volume

Site Makeup	Brownfield	CV	0.900	Betterment (%)	0
Brownfield Method	MRM	Return Period (years)	100	PR	0.900
Contributing Area (ha)	1.840	Climate Change (%)	0	Runoff Volume (m³)	1128
PIMP (%)	100	Storm Duration (mins)	360		

Approval Settings

Node Size	x	Cover Depth	x	Time to Half Empty	x
Node Losses	x	Backdrops	x	Discharge Rates	x
Link Size	x	Full Bore Velocity	x	Discharge Volume	✓
Link Length	x	Proportional Velocity	x	100 year 360 minute (m³)	1128
Coordinates	x	Surcharged Depth	x		
Crossings	x	Flooding	x		

Results for 100 year 360 minute summer. 600 minute analysis at 8 minute timestep. Mass balance: 99.93%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute summer	1	272	9.580	0.130	12.5	0.1466	0.0000	OK
360 minute summer	2	280	9.579	0.329	12.4	46.9386	0.0000	SURCHARGED
360 minute summer	3	184	9.166	0.069	7.7	0.0785	0.0000	OK
360 minute summer	4	224	9.106	0.119	15.4	0.1346	0.0000	OK
360 minute summer	5	232	9.100	0.445	37.3	0.5036	0.0000	SURCHARGED
360 minute summer	6	232	9.097	0.569	36.5	0.6430	0.0000	SURCHARGED
360 minute summer	7	184	9.260	0.060	5.5	0.0677	0.0000	OK
360 minute summer	8	184	9.123	0.107	21.9	0.1211	0.0000	OK
360 minute summer	9	224	9.103	0.333	43.9	0.3765	0.0000	SURCHARGED
360 minute summer	10	232	9.097	0.487	63.8	0.5512	0.0000	SURCHARGED
360 minute summer	11	240	9.090	0.790	99.6	244.2242	0.0000	SURCHARGED
360 minute summer	12	384	8.254	0.112	28.0	0.1602	0.0000	OK
360 minute summer	13	384	8.153	0.111	28.0	0.1591	0.0000	OK
360 minute summer	14	384	8.039	0.115	28.0	0.1649	0.0000	OK
360 minute summer	14_OUT	384	7.978	0.104	28.0	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute summer	1	1.000	2	12.4	0.806	0.323	1.1521	
360 minute summer	2	1.001	3	1.6	0.486	0.039	0.1491	
360 minute summer	3	1.002	4	7.7	0.562	0.210	0.3058	
360 minute summer	4	1.003	5	15.3	0.802	0.417	1.5712	
360 minute summer	5	1.004	6	36.5	0.832	0.466	1.7830	
360 minute summer	6	1.005	11	36.3	0.621	0.550	4.4995	
360 minute summer	7	2.000	8	5.5	0.658	0.149	0.1804	
360 minute summer	8	2.001	9	21.8	0.703	0.279	2.2384	
360 minute summer	9	2.002	10	40.6	0.989	0.519	2.2526	
360 minute summer	10	2.003	11	63.3	0.899	0.586	1.7510	
360 minute summer	11	1.006	12	28.0	1.053	0.172	0.6295	
360 minute summer	12	1.007	13	28.0	1.021	0.172	0.4106	
360 minute summer	13	1.008	14	28.0	1.000	0.172	0.4971	
360 minute summer	14	1.009	14_OUT	28.0	1.049	0.172	0.1992	607.5

Results for 100 year 360 minute winter. 600 minute analysis at 8 minute timestep. Mass balance: 99.96%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	1	288	9.579	0.129	8.1	0.1455	0.0000	OK
360 minute winter	2	288	9.578	0.328	8.1	46.7920	0.0000	SURCHARGED
360 minute winter	3	184	9.155	0.058	5.4	0.0657	0.0000	OK
360 minute winter	4	184	9.068	0.081	10.4	0.0920	0.0000	OK
360 minute winter	5	248	9.057	0.402	24.7	0.4552	0.0000	SURCHARGED
360 minute winter	6	248	9.054	0.526	23.7	0.5947	0.0000	SURCHARGED
360 minute winter	7	184	9.248	0.048	3.6	0.0546	0.0000	OK
360 minute winter	8	184	9.102	0.086	14.4	0.0974	0.0000	OK
360 minute winter	9	248	9.059	0.289	28.7	0.3271	0.0000	OK
360 minute winter	10	248	9.055	0.445	42.4	0.5028	0.0000	SURCHARGED
360 minute winter	11	256	9.048	0.748	65.2	221.3381	0.0000	SURCHARGED
360 minute winter	12	376	8.254	0.112	28.0	0.1602	0.0000	OK
360 minute winter	13	376	8.153	0.111	28.0	0.1591	0.0000	OK
360 minute winter	14	376	8.039	0.115	28.0	0.1649	0.0000	OK
360 minute winter	14_OUT	376	7.978	0.104	28.0	0.0000	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute winter	1	1.000	2	8.1	0.784	0.210	1.1478	
360 minute winter	2	1.001	3	1.6	0.486	0.039	0.1240	
360 minute winter	3	1.002	4	5.4	0.521	0.148	0.2310	
360 minute winter	4	1.003	5	10.4	0.774	0.284	1.3446	
360 minute winter	5	1.004	6	23.7	0.796	0.303	1.7830	
360 minute winter	6	1.005	11	23.6	0.624	0.357	4.4995	
360 minute winter	7	2.000	8	3.6	0.586	0.098	0.1335	
360 minute winter	8	2.001	9	14.4	0.650	0.184	1.9832	
360 minute winter	9	2.002	10	27.7	0.931	0.354	2.2402	
360 minute winter	10	2.003	11	41.7	0.892	0.386	1.7510	
360 minute winter	11	1.006	12	28.0	1.053	0.172	0.6295	
360 minute winter	12	1.007	13	28.0	1.021	0.172	0.4106	
360 minute winter	13	1.008	14	28.0	1.000	0.172	0.4972	
360 minute winter	14	1.009	14_OUT	28.0	1.049	0.172	0.1992	609.6

Appendix C

Email correspondence

From: SAB / CCDC <SAB@cardiff.gov.uk>
Sent: 27 October 2025 11:53
To: Matthew Jessop [redacted]
Subject: Re: SAB - Clydesmuir Industrial Estate

Hi Matt,

Many thanks for the below summary of discussion, I can confirm we support the key points you have identified.

Cofion Cynnes / Kind Regards,
Ffion Edwards

Swyddog Cynaliadwyedd (Rheoli Perygl Llifogydd ac Arfordirol) Sustainability Officer (Flood and Coastal Risk Management)
Cyngor Caerdydd / Cardiff Council
E-bost/Email: ffion.edwards@caerdydd.gov.uk / ffion.edwards@cardiff.gov.uk
[redacted]
Ystafell 301, Neuadd y Sir, Glanfa'r Iwerydd, Caerdydd, CF10 4UW
Room 301, County Hall, Atlantic Wharf, Cardiff CF10 4UW

From: Matthew Jessop [redacted]
Sent: 24 October 2025 13:31
To: SAB / CCDC <SAB@cardiff.gov.uk> [redacted]
Cc: [redacted]
Subject: SAB - Clydesmuir Industrial Estate

EXTERNAL: This email originated from outside Cardiff Council, take care when clicking links.
ALLANOL: Daw'r e-bost hwn o'r tu allan i Gyngor Caerdydd, cymerwch ofal wrth glicio ar ddolenni.

Thanks for today's meeting Ffion, Simon

Just a note to confirm they key points.

1. The proposed flow rate of 28l/s to the surface water/combined sewer remains acceptable to you
2. I will need DCWW confirmation of the same before we rely on this figure
3. Cardiff SAB allow us to utilise unlined interception parameters when pond/swale lining is required.
4. NRW to be consulted on flood risk
5. Drainage and flood risk report to include records of correspondence with DCWW and NRW.

If you could drop me a quick confirmation, I would be grateful and if you feel I have left anything out or want to add something please do.

Thanks again,

Matt
Acting for Pegasus Developments
[redacted]

From: Matthew Jessop
Sent: 24 September 2025 10:01
To: SAB@cardiff.gov.uk; [redacted]

Cc: [redacted]
Subject: SAB - Clydesmuir Industrial Estate

Good morning, Simon

CF24 2QT – Clydesmuir Industrial Estate –
CONFIDENTIAL, lease holders might not be aware of site vendors proposals.

I called last week but we didn't manage to speak.

In March last year you and I met to discuss Cardiff at Clydesmuir Industrial Estate, back then I was working for Jessop Reynolds.

We agreed a proposed discharge rate of 28l/s but with the request that I also seek DCWW approval as the surface water destination is a surface water sewer, that directly connects to a combined sewer.

My conversations with DCWW were also positive however they requested CCTV evidence of current drainage connections and areas draining which I now have.

Attached are the documents I sent you in March 2023 and a new ZIP file of CCTV evidence.(photos and site plan, videos available too but large files).

I am satisfied that the site does fully drain to the public sewer system.

Before I re-engage with DCWW I wanted to afford you the opportunity to review and confirm your position is unchanged.

I would also like to meet, Teams fine, to discuss the following (please advise of any costs associated)

- Confirm rates before I speak to DCWW
- Discuss other Cardiff SAB criteria, such as interception.
- Show you layout as it now stands, although somewhat dependant on attenuation solution which is why I am keen to resolve the discharge rate early.

Finally, our planning consultant, Arcadis [redacted] are arranging a planning pre app with the planning department, I don't have a date yet but ideally, we could catch up before.

Matt Jessop MICE CEng.
M: [redacted]
On behalf of Pegasus Developments
****

From: Bridget Jones <Bridget.Jones@dwrcymru.com>
Sent: 24 November 2025 13:53
To: Matthew Jessop
Cc: Dooley, Simon <simon.dooley@cardiff.gov.uk>
Subject: RE: DCWW Clydesmuir Industrial Estate

Thanks Matt.

Once all the information has been collated together, we will be able to provide formal comments. If you could ensure that details on existing flow rates and proposed flow rates are included including how these rates were obtained as well the other details, we spoke about that would be ideal.

Kind Regards,

Bridget Jones
Lead Development Planning Officer – Developer services
Dwr Cymru Welsh Water
Linea | Fortran Road | St Mellons | CF3 0LT
www.dwrcymru.com

From: Matthew Jessop
Sent: 24 November 2025 13:51
To: Bridget Jones <Bridget.Jones@dwrcymru.com>
Cc: Dooley, Simon <simon.dooley@cardiff.gov.uk>
Subject: Re: DCWW Clydesmuir Industrial Estate

******** External Mail ********

Thanks for the call,

I appreciate that the advice you give at this stage is preliminary until formalised through planning and pre app.

In general, though, I understand that you are satisfied with the betterment approach we have taken (80-84% by area betterment) and the resulting flow rate of 28l/s to the combined sewer.

This flow rate will be maintained for all storms up to 1:100 + climate change (I think an additional 40% allowance for CC but will check with the LFA/SAB).

I will put the information and calculations together in the pack for PAC and forward to you for more formal pre app at the appropriate time.

Kind regards

Matt

From: Matthew Jessop
Sent: 12 November 2025 15:52
To: Bridget Jones <Bridget.Jones@dwrcymru.com>; SAB / CCDC <sab@cardiff.gov.uk>; Dooley, Simon <simon.dooley@cardiff.gov.uk>
Subject: DCWW Clydesmuir Industrial Estate

******** External Mail ********

Bridget

Thank you for your email.

I am working for Pegasus one day a week and Edenstone for the rest of the week.

Clydesmuir is not an Edenstone project so if you could respond to my [redacted] address I would be really grateful; sorry about this, but it will save me some embarrassment

With regard to your comments:

1 In the documents I sent you I have provided confirmation from Cardiff SAB that they are content with the destination and also the discharge rate. (SAB are copied in). I have had two meetings with SAB to establish this, including calculations, site visits and investigations.

2. I have also carried out dye and camera testing on site and the sewers in the road are where all of the current flows connect. Highway drains to same SW system.

3. The discharge rate of 28l/s is also agreed with SAB

Crucially, this is in fact an **80% reduction** (not 30%) and furthermore its only 80% of the existing area.

I calculated flows from 80% of the site area first I then applied 80% betterment on that figure for a discharge rate of 28l/s which is going to offer a significant betterment.

4. We will certainly ensure Surface and Foul are separate on site. We can also make Surface Water connections to the Surface water sewer and foul to the combined if you prefer although both connect shortly downstream.

Kind regards

Matt

From: Bridget Jones <Bridget.Jones@dwrcymru.com>
Sent: 12 November 2025 13:47
To: Matthew Jessop [redacted]
Cc: Matthew Lord <Matthew.Lord@dwrcymru.com>
Subject: RE: Clydesmuir Industrial Estate

Good afternoon Matthew,

My apologies for the time it's taken to respond to you. Due to staff absences, including myself, I have seen an influx of email traffic as I'm playing catch up and covering other people's areas.

I note you and Chris have previous spoken about the site below and that you are in the early design stages for the proposal. I write the below response on our position for surface water to discharge to the combined and what we would require you and your client to explore as part of any forthcoming SAB/Planning application. As I'm sure you can appreciate one of our key objectives as a company is to support new development whilst ensuring this is not to the detriment of our customer & the environment. Also aligning with national legislation on surface water management including Schedule 3 of the Flood & Water Management Act 2010 by Welsh Government and Part H of the 'Building Regulations 2000'. We wish to ensure that communities & the environment are protected from flooding and pollution (particularly given the challenges of climate change). It also assists us in managing our sewerage infrastructure so that it is utilised for the maximum benefit.

We need confirmation from the SAB department that PL1 – PL3 have been fully explored and discounted before we can consider any request to connect to our assets.

If you are proposing demolition as part of your proposal you will lose the automatic right to connect to the public sewerage system and as such, we will assess any forthcoming SAB application like a Greenfield site. I therefore suggest that as part of your investigations into Priority Level 4, you explore the possibility of discharging to the highway drains in the road to the front of the development site. Does the highway drain discharge back into the public sewer or is it its own separate network that has a positive outfall?

If after the above investigations the SAB authority are satisfied that PL 1 – 4 have been fully explored and discounted, we can look into Priority level 5 as an indirect connection via the existing surface water sewer (PL4). As part of PL5 we will require surface water and foul water to discharge separately from the site to allow us, in the future, to disconnect the surface water from the combined and redirect the flow to a more sustainable location.

We will also require the lowest discharge rate to be provided and details on pre and post development impermeable areas. I wish to politely state that a commonly thought 30% betterment does not apply to public sewers, this is only in regard to watercourses. Therefore, the lowest discharge rate is required along with details as to how and why this is the lowest.

As part of any forthcoming application any request to discharge to the combined must be taken for an internal review for director sign off and as such, wish to say that this email does not provide any agreements in principle to connect to our public sewerage system.

I'm in back-to-back meetings all day today and I'm out away from my desk tomorrow so will be unable to take any calls but I hope the above assists you in your pre-app meeting tomorrow. Any questions that arise from that meeting you'd like to discuss further let me know and we cans set up a meeting that's convenient for the both of us.

Kind Regards,

Bridget Jones
Lead Development Planning Officer – Developer services
Dwr Cymru Welsh Water
Linea | Fortran Road | St Mellons | CF3 0LT
www.dwrcymru.com

From: Matthew Jessop
Sent: 30 October 2025 11:43
To: Chris Scourfield <Chris.Scourfield@dwrcymru.com>; Matthew Lord <Matthew.Lord@dwrcymru.com>
Cc: SAB / CCDC <sab@cardiff.gov.uk>

Subject: Clydesmuir Industrial Estate

******** External Mail ********

Chirs,

CF24 2QT – Clydesmuir Industrial Estate

It has been some time since we discussed our proposed development at Clydesmuir Industrial Estate in Cardiff. (May 2023)

@matthew.lord@dwrcymru.com also copied in, perhaps you could re direct me to the appropriate contact at DCWW if it is no longer your area Chris.

I have included our email history below; but in summary:

1. Cardiff SAB have agreed to a surface water destination and flow rate, with the condition that I also sought DCWW approval of the same. **The connection is to a combined sewer (via Surface Water sewer) at 28l/s.**
2. Chris, your team at DCWW wanted evidence that Cardiff SAB were content in principle, you also requested evidence that the site connected to the sewers in question.

I have met with Cardiff SAB to ensure that their position is unchanged, and I have attached an email confirmation following my meeting last week which re-confirms their acceptance. They area also copied in to this email.

I also visited site and undertaken sufficient CCTV survey and dye testing to demonstrate that all of the site drains to the surface and combined sewers at the front of the site, I have not included the videos here but there is a site plan marked up with sewer routes and some site photographs.

A note on flow calculations

More information in the email trail below but again to summarise.

I have arrived at 28l/s by taking flow from 80% of the existing site area and then taking 20% of that figure to provide betterment.

FEH data for an arbitrary 2-year storm event duration of 1 hour.

The flow rate is 143.00 l/s for 80% of the area (1.8Ha x 0.8 = 1.6HA)

20% of 143 = 28l/s

I would be grateful if you could confirm your acceptance of a proposed connection to your assets so that we can move forward with more detailed design and SAB pre app.

I understand you might want soakaway testing in due course and so I appreciate your response might be caveated on this point. We will of course do the infiltration testing when the site is clear but looking at the SI information that we do have and my/SAB local experience, I think soakaways are very unlikely to be practicable.

Kind regards

Matt Jessop MICE CEng

Acting for Pegasus Developments

Appendix D

Drawings and Report Extracts

The fieldwork was supervised by Terra Firma (Wales) Limited, who logged the exploratory holes to the requirements of BS 5930:2015+A1:2020. The proposed locations of the exploratory holes were determined by Terra Firma (Wales) Ltd in general accordance with BS 10175:2011+A2:2017 in order to assess the findings of the preliminary conceptual site model.

Windowless sampling boreholes were formed using a Terrier 2000 rig. Dynamic sampling techniques were employed from surface to produce a continuous disturbed sample. Standard penetration tests (SPT) were carried out at regular intervals in general accordance with BS1377: Part 9:1990:3.3. SPT results summarised as N values are presented on the borehole log.

The cable percussive borehole was formed using a light cable tool (shell and auger) drilling rig. Boreholes were advanced from surface using 200mm tools and casing with the occasional use of a heavy chisel to assist boring. Standard penetration tests (SPT) were carried out at regular intervals in general accordance with BS1377: Part 9:1990:3.3. SPT results summarised as N values are presented on the borehole log. Boreholes were monitored for groundwater ingress as drilling proceeded.

4.2 Ground Conditions

The ground conditions encountered by the exploratory holes can in general be summarised as shown in **Table 4.1**.

Table 4.1 Summary of Typical Ground Conditions

Depth (m)			Thickness (m)	Stratum
0.00	-	0.05/0.2	0.05/0.2	**TARMAC/CONCRETE/PAVING**
0.05/0.2	-	0.25/0.75	0.17/0.65	**MADE GROUND: SAND and GRAVEL or GRAVEL SUB-BASE** or **HARDCORE**/ Firm brown or red brown gravelly **CLAY/ SAND /** Grey **SAND and GRAVEL** of slag
0.25/1.4*	-	1.5/2.5	-	Firm becoming stiff red brown sandy gravelly cobbly **CLAY**
1.5/2.5	-	4.5	-	Very dense **GRAVEL and COBBLE** **BH1 ONLY**

*In WS2 a band of soft red brown sandy slightly gravelly clay was encountered between 0.6m and 1.4m depth.

Copies of the windowless sampling borehole logs may be found in **Annex C**. The cable percussive borehole log is provided in **Annex D**.

4.3 Groundwater

Groundwater was encountered in WS5, levelling at 0.3m below the surface. The groundwater was within the sub-base layer between 0.1m and 0.45m depth.

4.4 Stability and Obstructions

The windowless sampling boreholes were terminated at depths of between 1.5m and 2.5m due to impenetrable underlying hard strata. This hard strata is interpreted to be the top of the very dense gravel and cobble confirmed to be present in BH1 below 1.5m depth.

KEY:

+10.00 EXTERNAL LEVEL

10.00m FINISHED FLOOR LEVEL - PLANNING MAY VARY IN DETAILED DESIGN + OR - 500mm

FLUSH THRESHOLD, WITH 1.2M FLAT LANDING

FLUSH THRESHOLD, AGAINST FOOTPATH

RAINGARDEN / BIORETENTION, CARE NEEDED WITH SPECIES

PERMEABLE PAVING

SMALL DITCH / SWALE

SUDS BASIN

SUDS ACCESS ENVISAGED FROM HIGHWAY WITH 1M ACCESS STRIP (YELLOW HATCH) PROVIDED ON THE DEVELOPMENT SIDE.

DISHED CHANNEL OR SIMILAR-DIRECT WATER TO SUDS

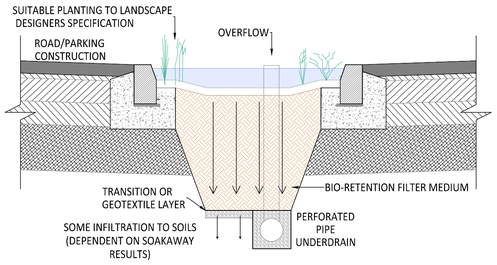
PROPOSED SURFACE WATER DRAINAGE (ILLUSTRATIVE)

PROPOSED FOUL WATER DRAINAGE (ILLUSTRATIVE)

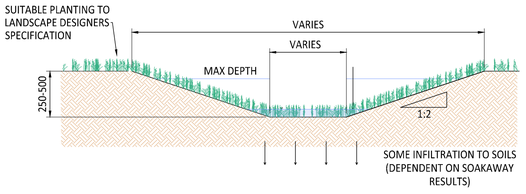
EXISTING SURFACE WATER DRAINAGE (DCWW)

EXISTING FOUL/COMBINED DRAINAGE (DCWW)

CELLULAR SURFACE WATER STORAGE



ILLUSTRATIVE RAIN GARDEN / BIORETNTION SYSTEM



SMALL DITCH / SWALE - CONVEYANCE

SUDS ATTENUATION DITCH IS A DRY DITCH AND WILL BE LINED. LANDSCAPING SHOULD NOT IMPEDE FLOW OR RISK DAMAGE TO LINER.

NOTES

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4. Any discrepancies to be reported immediately to Pegasus.
5. This drawing to be read in conjunction with all relevant architects, subcontractors and specialists drawings and specifications.
6. This drawing is copyright property of Pegasus Development
7. Levels are set for planning purposes and may vary + or - 400mm but not lower than stipulated in the flood consequences report.

Rev	Revision details	Chkd	Appd	Date

Drawn:	MJ	Preliminary	✓
Design:	-	For comment	
Chkd:	-	For tender	
Appd:	MJ	For construction	
Date:	21.08.25	As constructed	
		PRELIMINARY	

pegasus

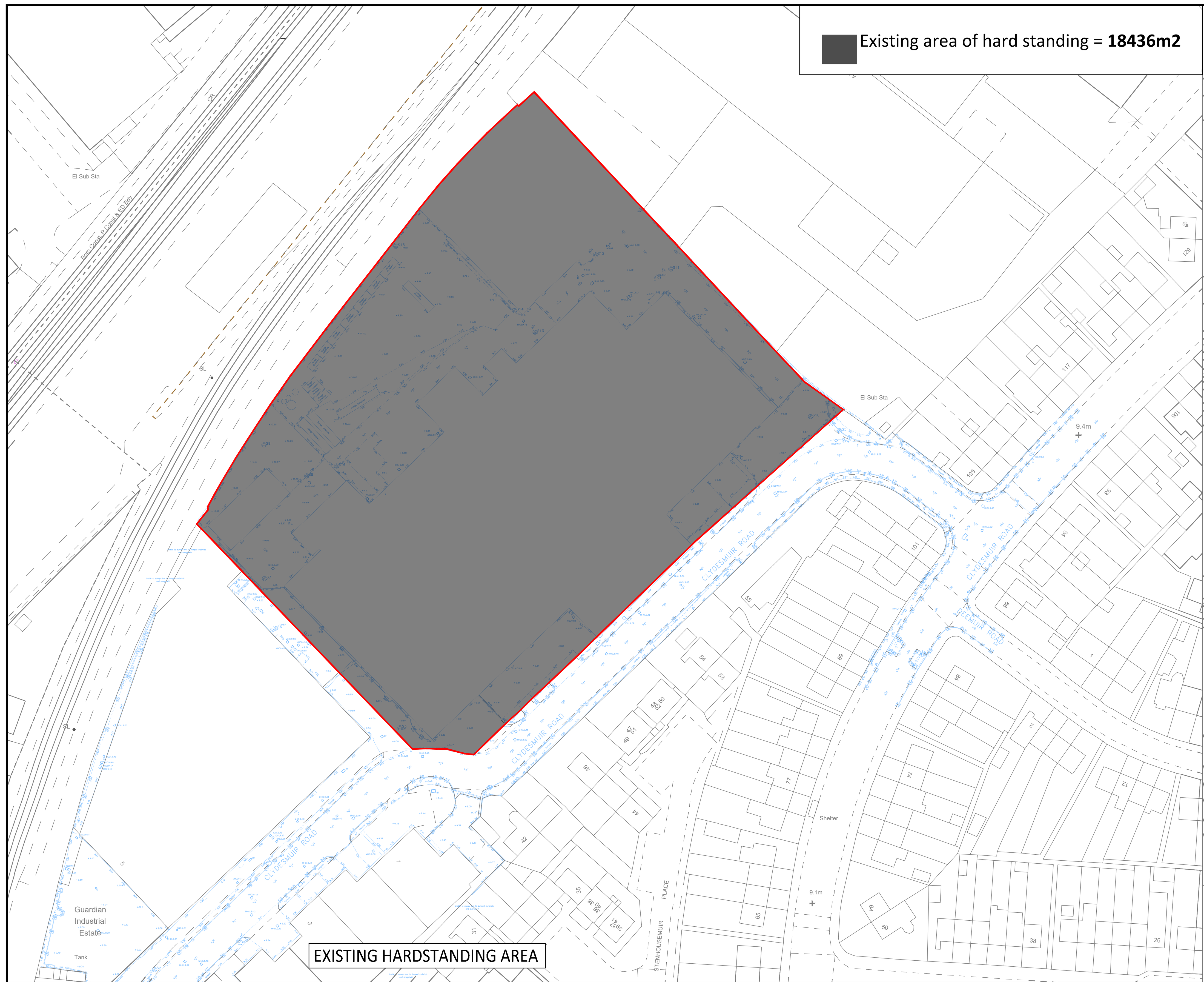
Project Name
CLYDESMUIR INDUSTRIAL ESTATE

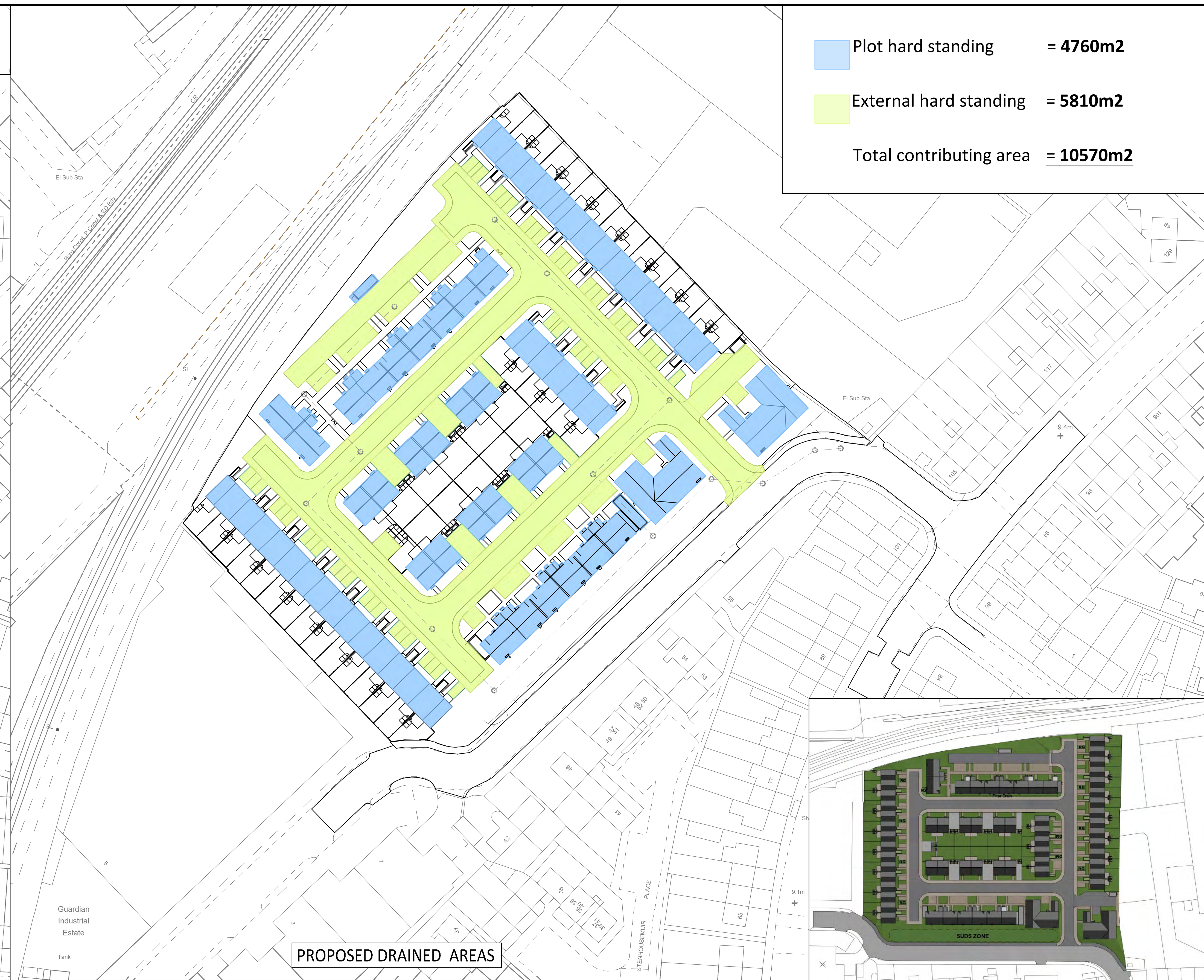
Drawing Title
CIVILS
Engineering Arrangement

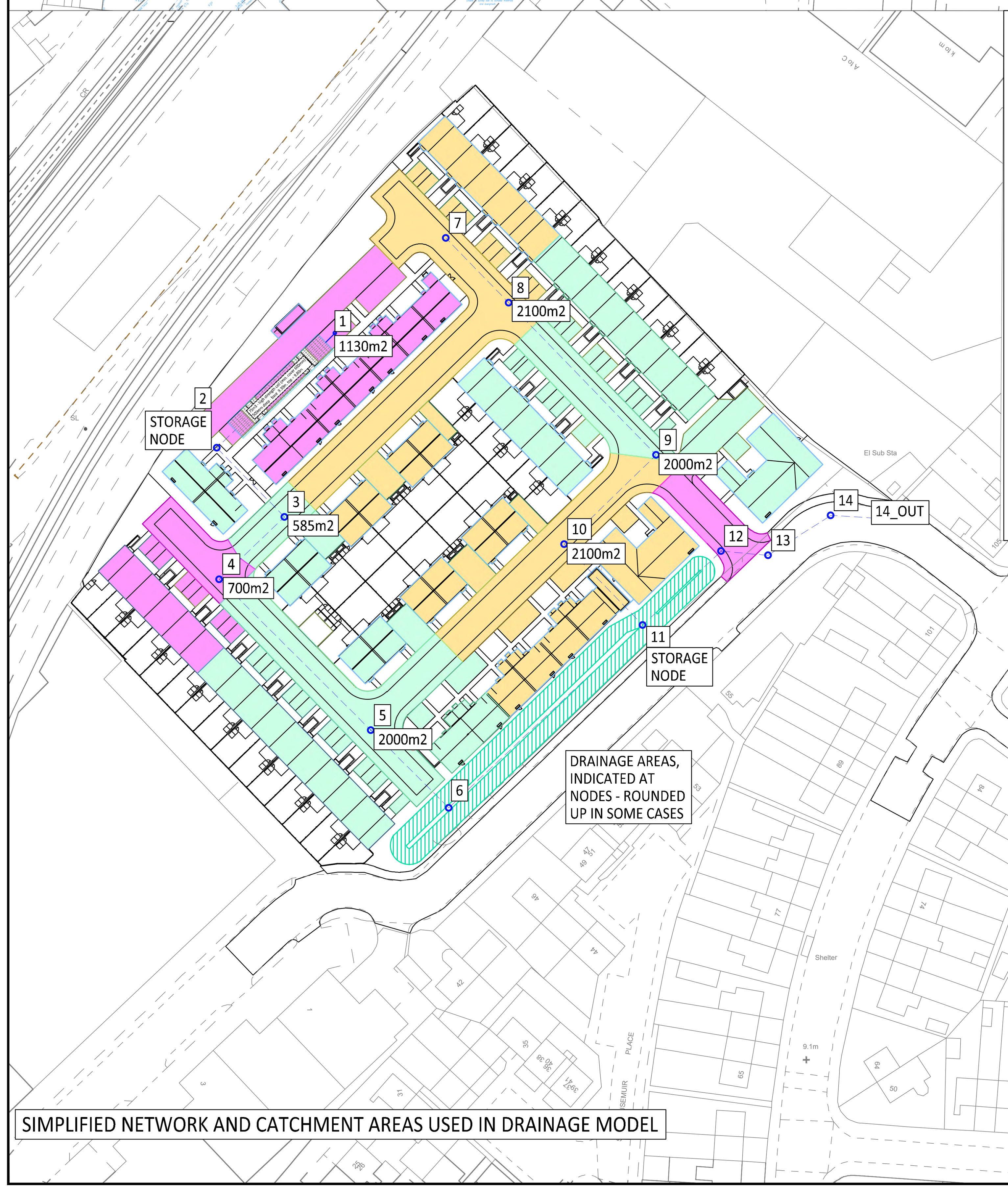
Original Drawing Size : A1
Scale : 1:500 inserts NTS

Drawing No
25000/101

Rev
P1







The proposed run off rate for all storm events is calculated at 28l/s.

This flow rate has been agreed in pre application correspondence with Cardiff SAB and provisionally agreed with DCWW.

This flow rate (28l/s) is effectively an 80% betterment of a 1:2 year storm event. As a further precautionary measure the proposed flow rate is based on an assumption that only 90% of the existing site area drains to the DCWW sewers.

Existing area 18426 x 0.9 (90%)=say 1.6Ha
Peak flow for 1.6Ha during 1:2 year 60min storm = 143l/s
80% betterment = 28l/s.

Proposed attenuation has been calculated for all 1:100 year events including an allowance of 45% for climate change.

REFH2 FEH-22 data

- ST 20688 77519
- BFI HOST 0.828
- SAAR6190 1010mm
- SAAR9120 1124mm

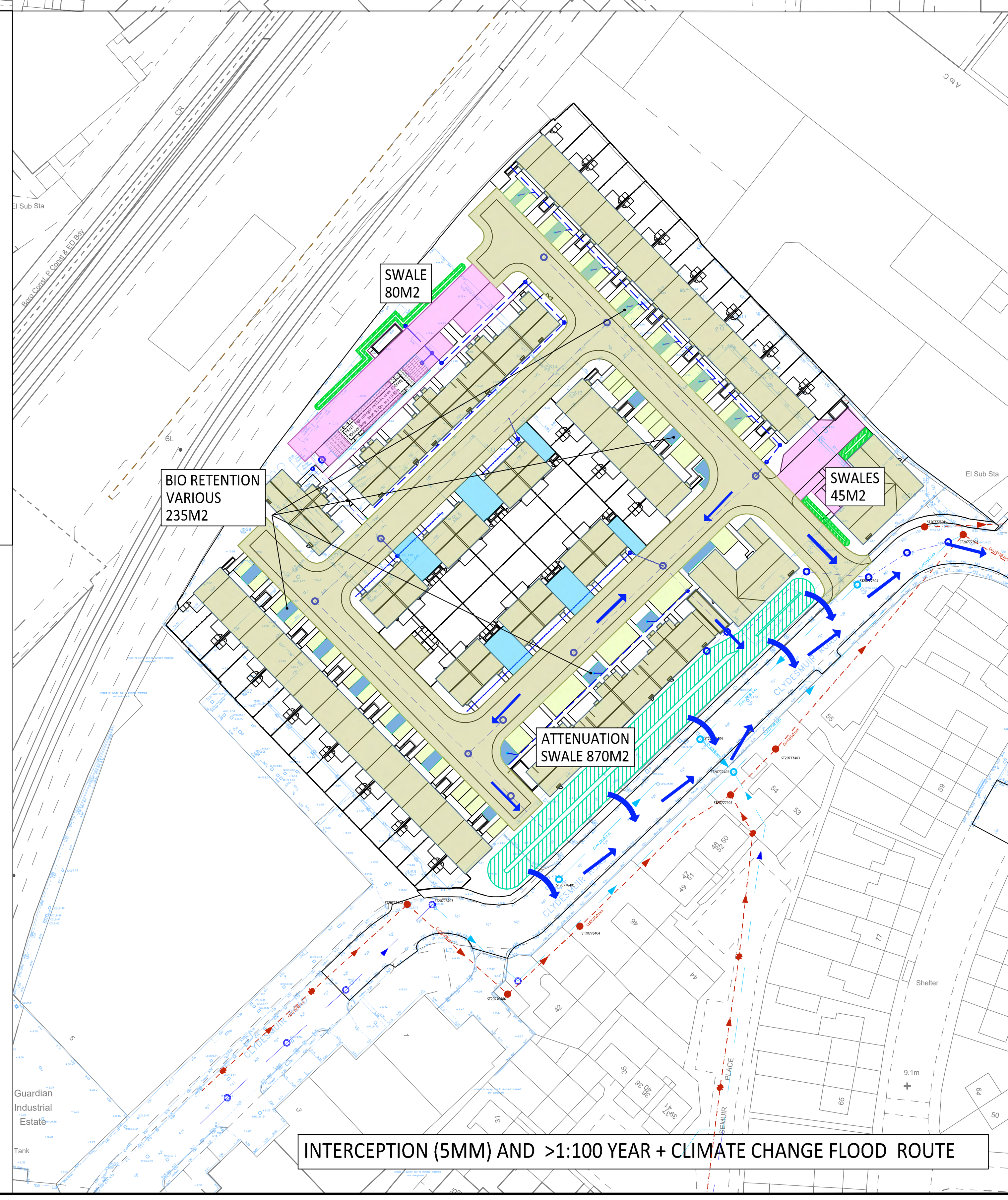


TABLE G2.1 SUDS MANUAL INTERCEPTION

PERMEABLE SURFACES
DRAINED AREA=335M2
SWALE AREA= 335M2
AREA FACTOR = 1

SWALES
SUITABLE FOR INTERCEPTION UP TO 25X AREA
DRAINED AREA=850M2
SWALE AREA= 125M2
AREA FACTOR = 6.8, <25

BIO RETENTION
SUITABLE FOR INTERCEPTION UP TO 5X AREA
DRAINED AREA= 810m2
BIO RETENTION AREA=235M2
AREA FACTOR = 3.4 <5

ATTENUATION SWALE
SUITABLE FOR INTERCEPTION UP TO 25X AREA
DRAINED AREA= 8570m2
SWALES AREA= 870m2
AREA FACTOR = 9.85 <25

OVERLAND FLOOD ROUTE

NOTES

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Rev	Revision details	Chkd	Appd	Date

Drawn	MJ	Status	✓
Checked	-		
Approved	-		
Designed	MJ		
Date	21.08.25		PRELIMINARY

pegasus

Project Name
CLYDESMUIR INDUSTRIAL ESTATE

Drawing Title
CIVILS
DRAINAGE REPORT

Original Drawing Size: A1
Scale: As Noted

Drawing No.: 25000/SK600
Rev: P0

Clydesmuir Road – Job No 21008 - Sheet 2

Scale: 1:1250

19/05/2021

EXACT LOCATION OF ALL APPARATUS TO BE DETERMINED ON SITE

Dŵr Cymru Welsh Water

LEGEND

- Sluice Valve
- Air Valve SINGLE
- Tap
- Pressure Reducing Valve
- Meter
- Bulk Meter
- Fire Hydrant
- Cap
- Non Dwr Cymru
- Existing Distribution Main
- Inspection Chamber
- Gravity Sewer
- Rising Main
- Outfall
- Pumping Station
- Lamphole
- Combined Sewer Overflow
- Special Purpose Chamber
- Treatment Works
- Private Sewer Transfer
- Lateral Drain

NB: Sewer symbol colour indicates the sewer type.

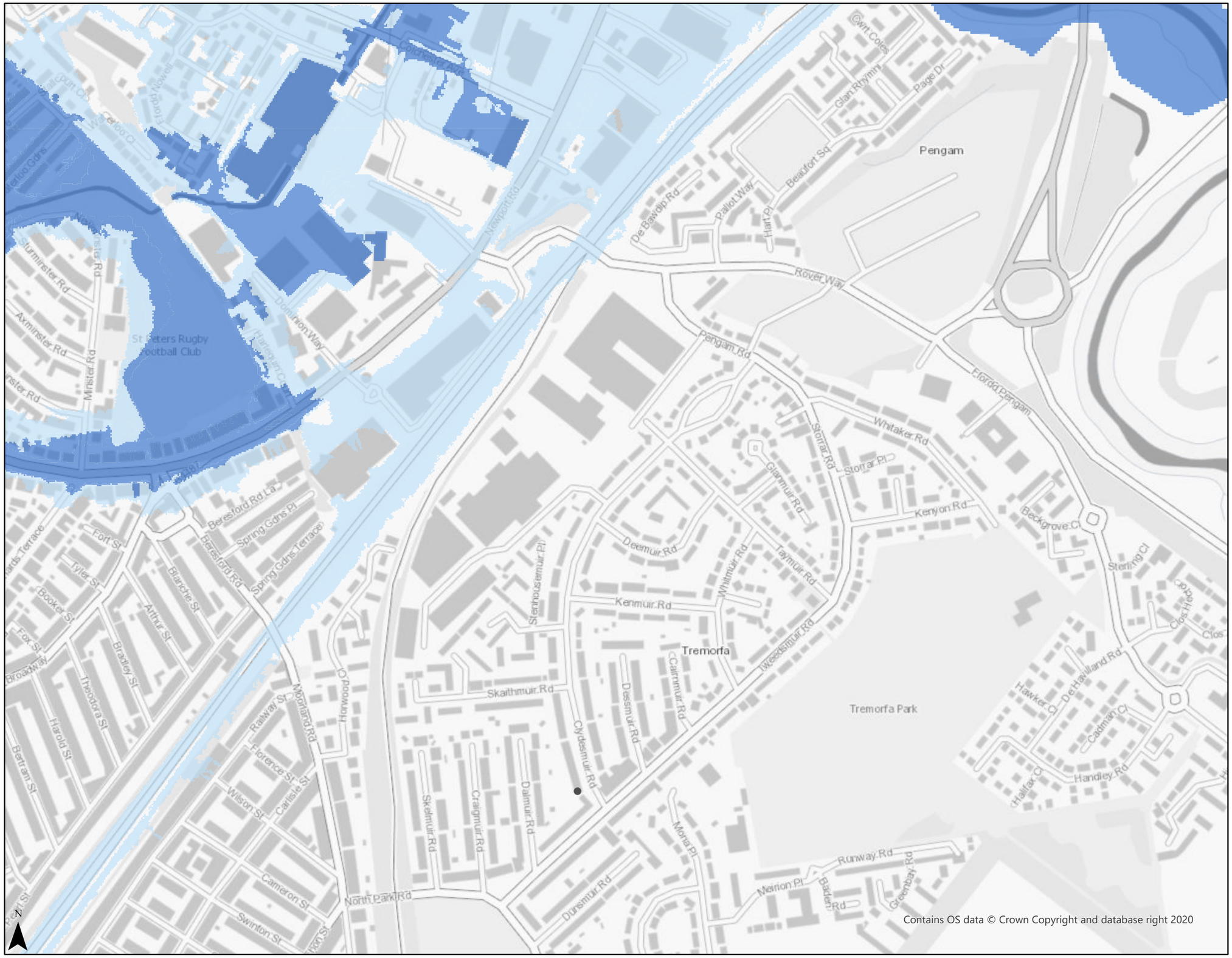
RED - Combined
GREEN - Surface Water
BROWN - Foul

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

Dwr Cymru Cyfyngedig ('the Company') gives this infirmation as to the position of its underground apparatus by way of general guidance only and on the strict understanding that it is based on the best information available and no warranty as to its correctness is relied upon in the event of excavations or other works made in the vicinity of the company's apparatus and any onus of locating the apparatus before carrying out any excavations rests entirely on you. The information which is supplied hereby by the company, is done so in accordance with statutory requirements of sections 198 and 199 of the Water Industry Act 1991 based particular, but without prejudice to be generality of that foregoing, it should be noted that the records that are available to the company may not disclose the existence of a drain sewer or disposal main laid before 1 September 1989, or if they do, the particulars thereof including their position underground may not be accurate. It must be understood that the furnishing of thisinformation is entirely without prejudice to the provision of the New Roads and Street Works Act 1991 and the company's right to be compensated for any damageto its apparatus.

Appendix E

Flood Maps and Surveys



Cyfoeth Naturiol Cymru
Natural Resources Wales

Flood Map for Planning - Detail

Rivers

Legend

Rivers

- Flood Zone 3
- Flood Zone 2

Scale at A3: 1:5,000

Date: 12/01/2026

0.2 0.1 0 0.2

km

British National Grid

Disclaimer

https://naturalresources.wales/flooding/disclaimer-for-our-flood-and-coastal-erosion-risk-maps/?lang=en

Cyfoeth Naturiol Cymru
Natural Resources Wales

Flood Map for Planning - Detail

Sea

Legend

TAN15 Defended Zones

- Rivers
- Sea
- Rivers and Sea

Sea

- Flood Zone 3
- Flood Zone 2

Scale at A3: 1:5,000

Date: 12/01/2026

0.2 0.1 0 0.2

km

British National Grid

Disclaimer

https://naturalresources.wales/flooding/disclaimer-for-our-flood-and-coastal-erosion-risk-maps/?lang=en

Cyfoeth Naturiol Cymru
Natural Resources Wales

Flood Map for Planning - Detail

Surface Water

Legend

Surface Water and Small Watercourses

- Flood Zone 3
- Flood Zone 2

Scale at A3: 1:5,000

Date: 12/01/2026

0.2 0.1 0 0.2

km

British National Grid

Disclaimer

https://naturalresources.wales/flooding/disclaimer-for-our-flood-and-coastal-erosion-risk-maps/?lang=en

Cyfoeth Naturiol Cymru
Natural Resources Wales

Flood Map for Planning - Detail

Reservoir

Legend

Flood Risk from Reservoirs

Scale at A3: 1:5,000

Date: 12/01/2026

0.2 0.1 0 0.2

km

British National Grid

Disclaimer

https://naturalresources.wales/flooding/disclaimer-for-our-flood-and-coastal-erosion-risk-maps/?lang=en

Cyfoeth Naturiol Cymru
Natural Resources Wales

Flood Map for Planning - Detail

Flood History

Legend

Recorded Flood Extents

Scale at A3: 1:5,000

Date: 12/01/2026

0.2 0.1 0 0.2

km

British National Grid

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Cyfoeth Naturiol Cymru
Natural Resources Wales

Flood Risk Maps

Enter title (max 35 characters)

Legend

Areas Benefitting from Flood Defences
- Rivers
- Sea
- Rivers and Sea

Flood Risk from Rivers
- High
- Medium
- Low

Flood Risk from the Sea
- High
- Medium
- Low

Flood Risk from Surface Water & Small Watercourses
- High
- Medium
- Low

Risk Level Under Review

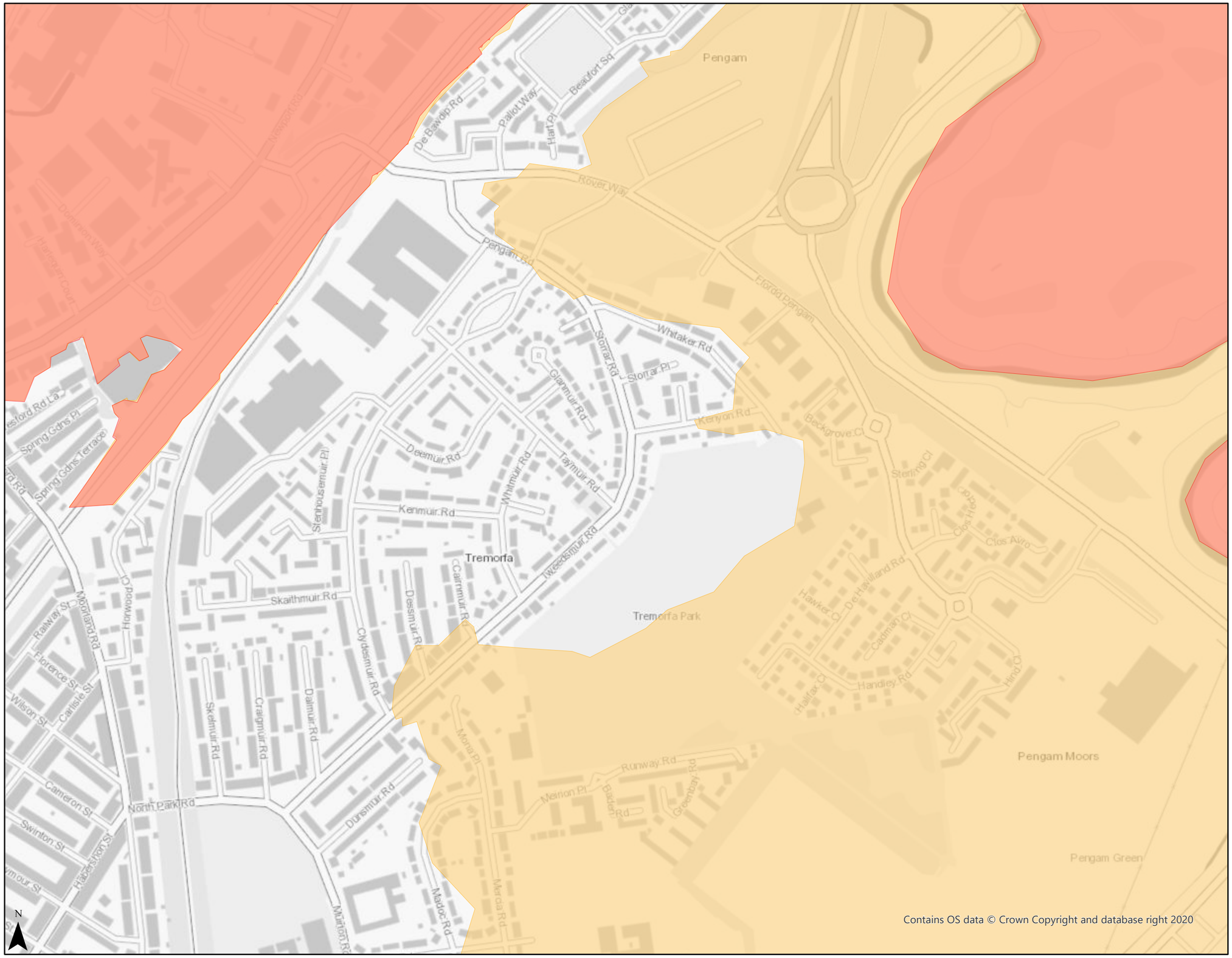
Scale at A3: 1:5,000

Date: 13/01/2026

0.2 0.1 0 0.2
km
British National Grid

Disclaimer

https://naturalresources.wales/flooding/disclaimer-for-our-flood-and-coastal-erosion-risk-maps/?lang=en



Cyfoeth Naturiol Cymru
Natural Resources Wales

Flood Warning and Alert Areas

Enter title (max 35 characters)

Legend

- Flood Warning Areas
- Flood Alert Areas

Scale at A3: 1:5,000

Date: 13/01/2026

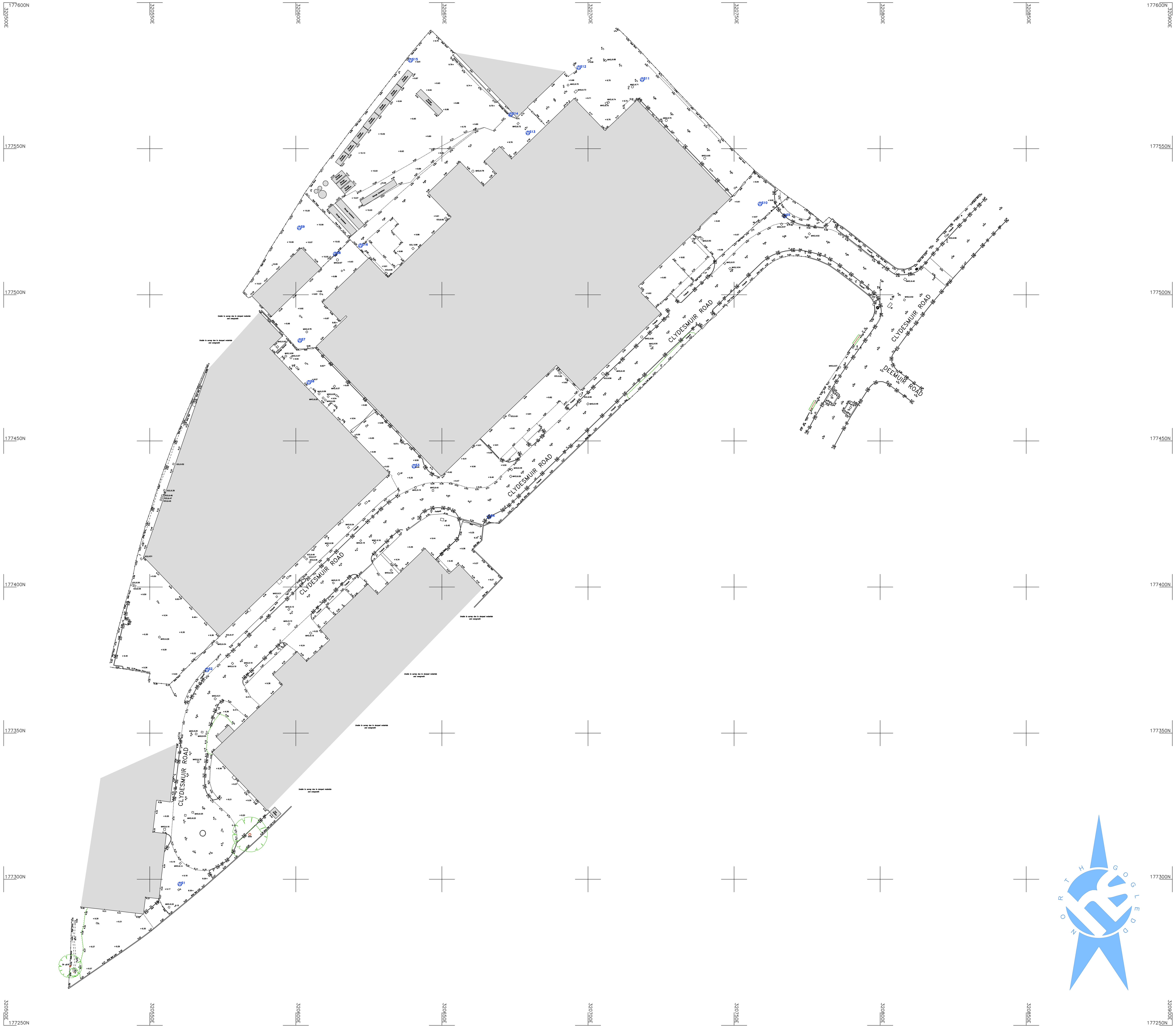
0.2 0.1 0 0.2

km

British National Grid

Disclaimer

https://naturalresources.wales/flooding/disclaimer-for-our-flood-and-coastal-erosion-risk-maps/?lang=en



Legend:

- Kerb line (& top of kerb).
- Drop Kerb (& top of kerb).
- Surface edge (type of surface annotated).
- Embankment (with slope demarkation).
- Fenceline (type and height as annotated).
- Wall (type and height as annotated).
- Hedgeline.
- Barrier (type as annotated).
- Gate.
- Stile.
- Building.
- TP Telegraph pole (and overhead wires).
- EP Electricity pole (and overhead wires).
- LP Lighting Column
- G. Road Gully.
- MHCL 50.00 Manhole and cover level.
- ICCL 50.00 Inspection Chamber and cover level.
- BT Telecomms. service box.
- CATV Cable TV service box.
- EB Electricity / BT Control Gear Box.
- W. Stop Tap (Water).
- SV Stop Valve (Water).
- AV Air Valve (Water).
- FH Fire Hydrant.
- Gas Gas Valve.
- Foliage (Ground vegetation) extent.
- Foliage (Overhanging canopy) extent.
- RS Road Sign (multiple).
- RS Road Sign (single).
- Mkr Marker Post.
- S10.0 G 1.2 Oak Tree with Spread/Girth/Species.
- S1 Survey Station and Reference.

Notes:

Any surveyed features not shown above are annotated appropriately. Tree species is only annotated where known. Service covers are surveyed where accessible. Healer Surveys cannot accept liability for missing covers due to them being buried or obscured by parked vehicles at the time of site visit.

Station Table:

Station	Easting	Northing	Level
S1	320560.284	177298.334	9.234
S2	320569.611	177371.609	9.189
S3	320640.439	177441.312	9.438
S4	320666.176	177424.003	9.549
S5	320767.335	177526.962	9.660
S6	320604.452	177469.999	9.578
S7	320601.375	177484.324	9.680
S8	320613.475	177513.949	9.996
S9	320601.171	177522.893	10.152
S10	320758.877	177531.074	9.572
S11	320718.543	177573.621	9.696
S12	320696.826	177577.705	9.690
S13	320679.424	177555.384	9.761
S14	320673.496	177561.628	9.690
S15	320639.239	177580.190	9.727
S16	320622.117	177516.791	9.973

Grid Origin and Level Datum:

Ordnance Survey GPS OSGB36(15) Grid and Levels used.

Revisions:

A:	
B:	
C:	
D:	
E:	
F:	
G:	
H:	

Client:

PEGASUS DEVELOPMENTS

healer surveys
Land Surveyors
8 Oldfield Road, Bocam Park, Pencoed, Bridgend, CF35 5LJ
tel. 01656 865566
web. www.healersurveys.co.uk

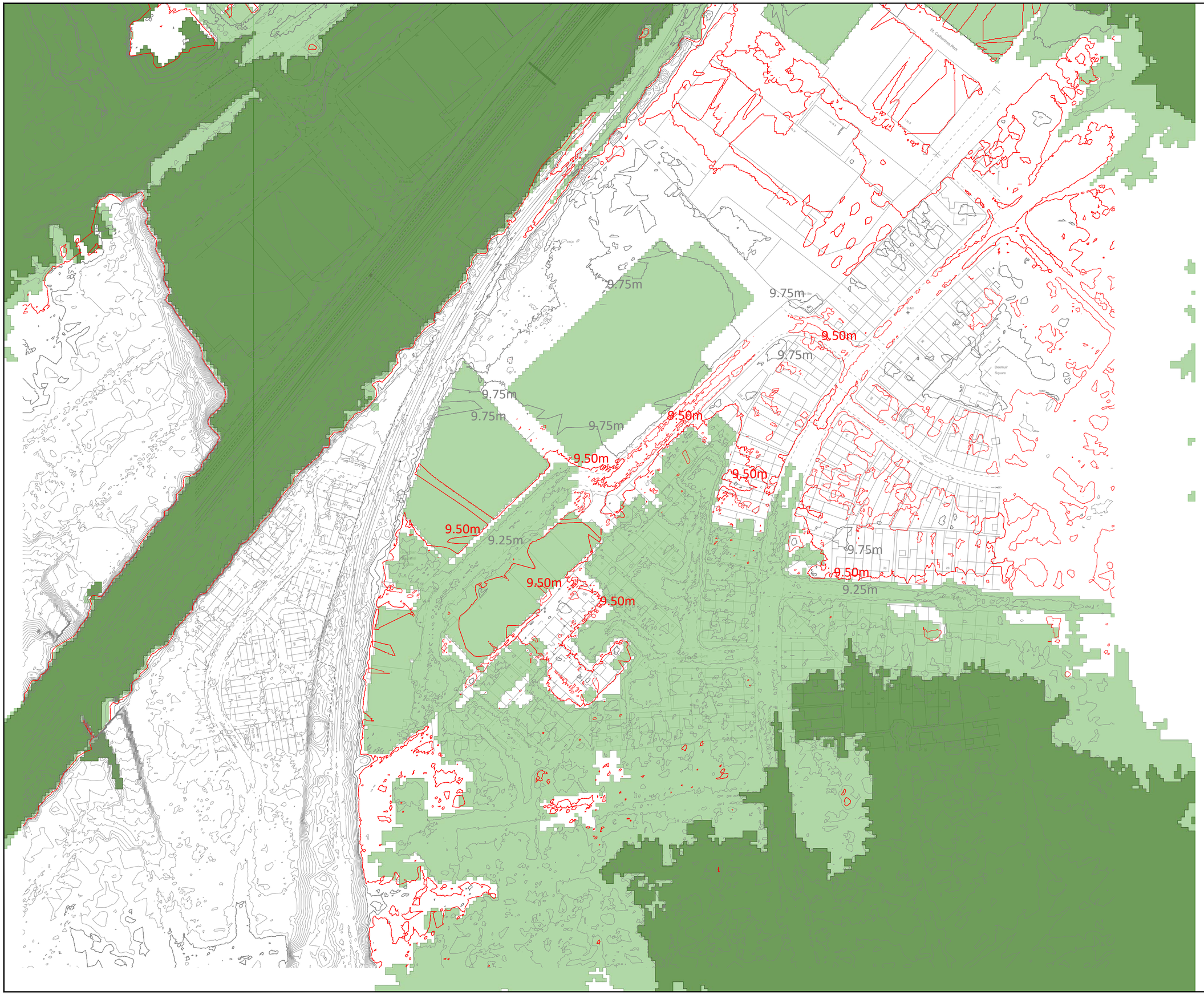
Project: Clydesmuir Industrial Estate, Cardiff

Drawing: Topographic Survey

Date:	February 2021
Surveyed:	JDE
Drawn:	JDE
Checked:	RE

Scale:	Sheet Size:	Sheet No:
1:500	A0	1 of 1

Job No:	Rev.
P3390	



NOTES

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TIDAL FLOODZONE 2 DEFENDED

TIDAL FLOODZONE 3 DEFENDED

9.50m — 9.50m CONTOUR, LIDAR

9.75m — OTHER CONTOURS, LIDAR

Rev	Revision details	Chkd	Appd	Date

Drawn:	MJ	Preliminary	✓
Design:	-	For comment	
Chkd:	-	For tender	
Appd:	MJ	For construction	
Date:	12.01.25	As constructed	
		PRELIMINARY	

pegasus

CLYDESMUIR INDUSTRIAL ESTATE

CIVILS

FLOOD ZONE 2 LEVEL TIDAL (DEFENDED)

NTS

25000/SK700 | Rev P0

Appendix A

Proposed layout

Appendix B

Calculations

Appendix C

Email correspondence

Appendix D

Drawings and Report Extracts

Appendix E

Flood Maps and Surveys