



TRANSPORT PLANNING

1 HENFAES ROAD, TONNA, NEATH

Flood Consequences Assessment

December 2024

IMA-24-077



TRANSPORT PLANNING

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REVISIONS

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CONTENTS

1	INTRODUCTION	1
1.1	Background.....	1
1.2	Scope of work	1
1.3	Site Description.....	1
2	REVIEW OF SOURCES OF FLOODING	3
2.1	Rivers/Fluvial and Sea/Tidal	3
2.2	Groundwater	4
2.3	Surface water.....	5
2.4	Sewers	6
2.5	Reservoirs, Canals and Other artificial sources	6
2.6	Recorded flood extents data	6
2.7	Strategic Flood Consequence Assessment (SFCA).....	6
2.8	Access and Egress to development	6
2.9	Summary of Flood Risk	7
3	DEVELOPMENT PROPOSALS	8
3.1	Site Layout	8
3.2	Existing Surface Water Conditions: Brownfield Run-off.....	8
3.3	Surface Water Drainage - Planning Policy	9
3.4	Surface Water Drainage – Development Proposals	10
3.5	Water Quality	13
3.6	Foul Drainage.....	14
4	FUTURE MAINTENANCE.....	15
5	RECOMMENDATIONS AND CONCLUSIONS.....	16
5.1	Recommendations.....	16
5.2	Conclusions.....	16

APPENDICES	
Appendix A	Site Location Plan
Appendix B	Topographical Survey
Appendix C	Welsh Water Asset Location Mapping
Appendix D	Natural Resources Wales – Flood Risk Mapping
Appendix E	Illustrative Site Layout
Appendix F	Impermeable Drainage Areas
Appendix G	Conceptual Drainage Layout
Appendix H	Greenfield runoff rate; Flow - Attenuation volume calculation
Appendix J	Infiltration Testing

1 Introduction

1.1 Background

- 1.1.1 IMA Transport Planning Ltd have been appointed to prepare a Flood Consequences Assessment (FCA) and drainage strategy to support the planning application for the development of 8 dwellings.
- 1.1.2 This assessment is undertaken in accordance with guidance as set out in Technical Advice Note 15 (TAN15) and associated technical guidance.
- 1.1.3 Reference has been made to Natural Resource Wales (NRW) and Welsh Water (DCWW) advice and flood/asset mapping.

1.2 Scope of work

- 1.2.1 The site is identified in relation to its topographical and geographical location, identifying any drainage outfalls and watercourses within the vicinity of the development site. Refer to Appendix A for the site location plan.
- 1.2.2 The flood risk from river, tidal, land/surface, groundwater, sewer and artificial sources will be assessed and, where necessary and feasible, appropriate mitigation measures suggested.
- 1.2.3 The existing surface water drainage mechanisms will be assessed together with the sources of any potential flooding.
- 1.2.4 A proposal for a surface water drainage system serving the development site will be assessed in the context of identifying any site constraints. Sustainable Drainage Systems (SuDS) will be recommended and employed to reduce or remove any flood risks, as required and where possible.
- 1.2.5 The existing foul drainage system will be assessed together with recommendations on new connections and or diversions that may be required as a result of the redevelopment of the site.

1.3 Site Description

- 1.3.1 The development site is located within a residential area of Neath, located south off the B4434 Henfaes/Neath Road. The site has an area of 0.64ha and is centred about OS Grid reference 276961, 198661. A plan showing the location of the site can be found in Appendix A.

The development site is bounded by development on three sides, with accesses directly off the northern boundary on the B4434 Neath Road. There are a number of existing dilapidated buildings on the site. Levels vary across the site with low points of approximately 32.50 in the southwestern area. A topographical survey is included at Appendix B of this report.

- 1.3.2 With regard to Ordnance Datum levels, these are indicated on the topographical survey in Appendix B. The highest point of the site is in the western section having a level of approximately 34.5m AOD. The levels vary quite considerably across the site with the lowest point on site being approximately 32.50m AOD at the southern and eastern ends of the site.
- 1.3.3 There is an existing stream located to the northeastern corner of the site running in a northwesterly direction along the boundary. The stream has headwalls located to the north and southern boundary. The stream appears to drain into the adjacent property to the north of the development site..
- 1.3.4 The development site lies within the catchment of the River Neath, which flows south-west bound approximately 180m to the north-west of the site.

2 Review of Sources of Flooding

There are several different ways in which flooding can occur. These different ways reflect the source of the floodwater and how it moves across the landscape. The different sources of flooding can occur individually, or they can be combined together.

This section investigates the risks associated with all sources of flooding at the development site and surrounding catchment area. Associate flood mapping can be found in Appendix D.

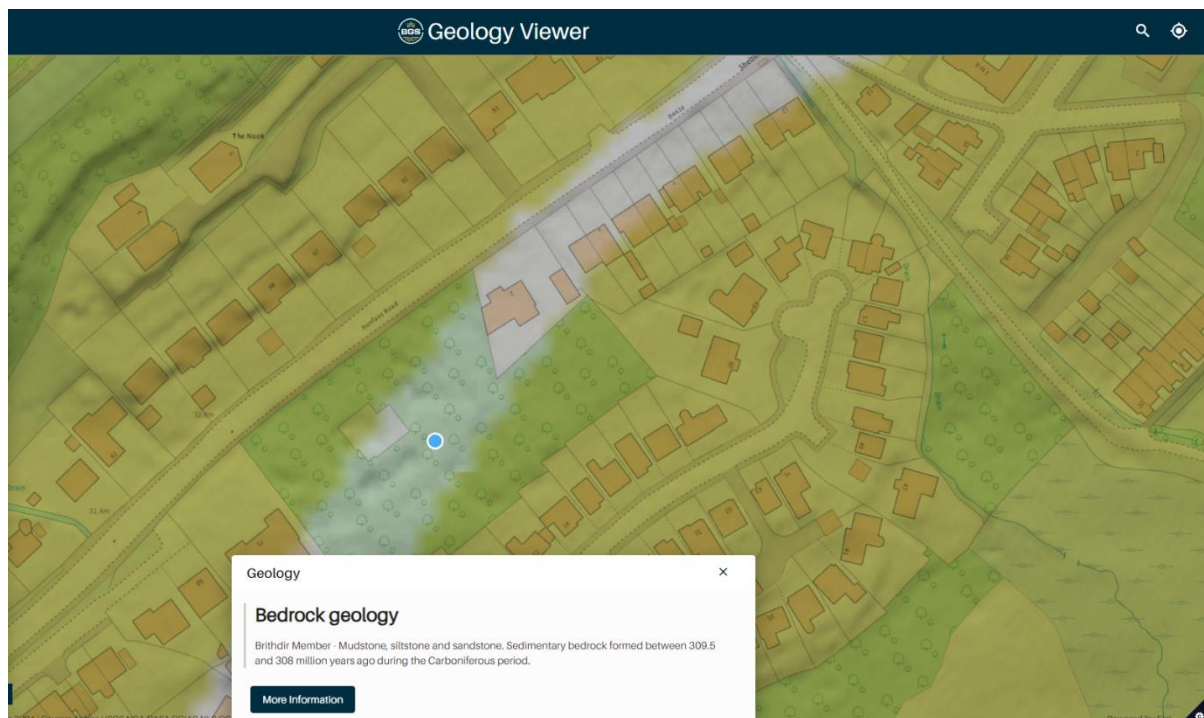
2.1 Rivers/Fluvial and Sea/Tidal

- 2.1.1 Flooding from rivers occurs when the water levels in the river rise to a point that the river cannot cope with the amount of water draining into it from the surrounding land, leading to overtopping or breach of the river bank.
- 2.1.2 The development site is located approximately 8km from the nearest coastline and at an approximately level of 32.5mAoD, therefore the risk of flooding from sea/tidal sources is not considered to present a risk to the development site.
- 2.1.3 The NRW Flood Mapping identifies the extent of flooding from rivers and sea, taking into account the effects of flood defences, and categorises them according to the risk of flooding. The risk assessment scale contains four levels from 'High' to 'Very Low'.
- 2.1.4 With reference to the NRW Flood Mapping for Rivers and Sea, the site is located within a '**Very Low**' risk zone, with an annual probability of exceedance [AEP] less than 0.1%. Refer to Appendix D.
- 2.1.5 Flooding from river sources is therefore not considered a risk to the development site.
- 2.1.6 It is important to note that under TAN15 guidance it is stated that existing flood defences are aimed at reducing the risk of flooding to existing development and are not available to provide defence in anticipation of future developments. Therefore, the assessment of the risk of flooding from sea/river for a proposed development should be undertaken with the effects of existing flood defences excluded.
- 2.1.7 NRW provide alternative mapping, in the form of Development Advice Mapping (DAM), to cover this assessment requirement. The mapping provides four zones, A, B, C1 and C2, with zone A representing the areas with the lowest risk of flooding from rivers and seas. Refer to Appendix D.
- 2.1.8 With reference to the NRW DAM, the site is located within Zone A.
- 2.1.9 In tandem with the DAM mapping, a vulnerability category is assigned to the proposed development, based on the nature of the development. All residential developments are considered to be highly vulnerable and therefore the development in question is highly vulnerable.
- 2.1.10 A matrix in Section 9 of TAN15 confirms the acceptability of development based upon the DAM zoning and vulnerability category.
- 2.1.11 The site, being located in DAM Zone A and considered highly vulnerable, is **acceptable**, subject to condition that flood risk is not increased elsewhere as a result of the development.

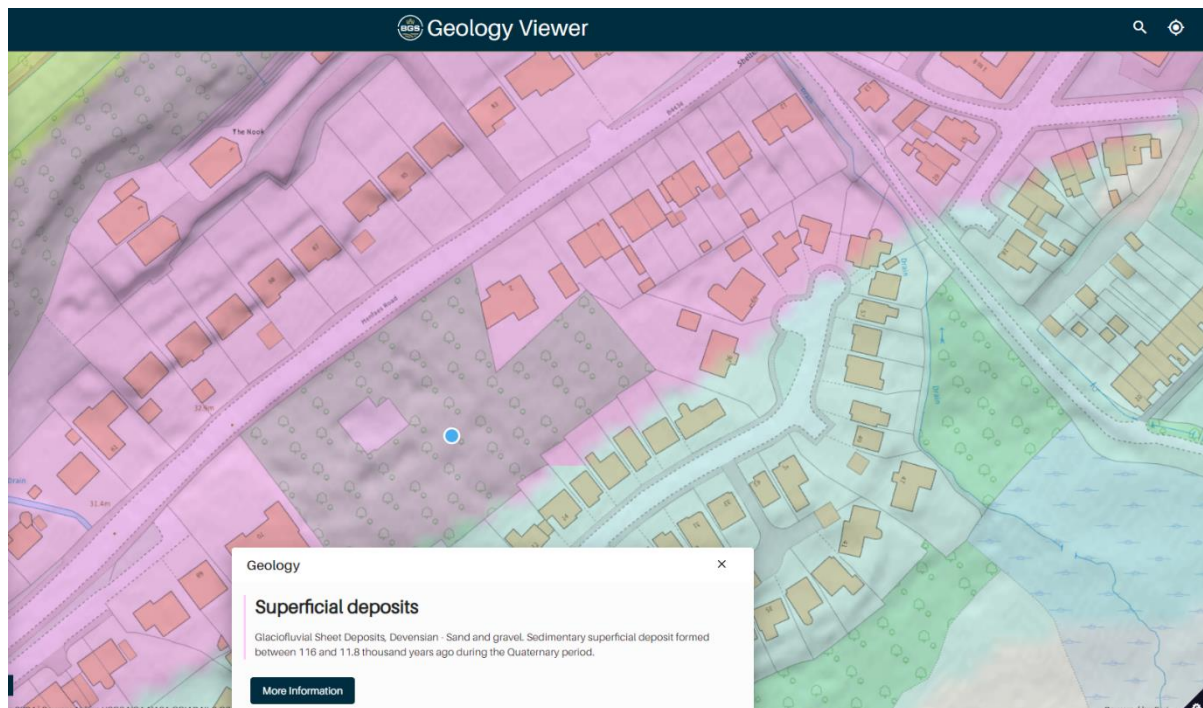
2.2 Groundwater

- 2.2.1 Groundwater flooding is caused by a rise in water table levels and the emergence of water originating from sub-surface permeable strata at the surface. Groundwater floods may emerge from either single point, or multiple widespread locations, and are usually long duration events.
- 2.2.2 With reference to BGS Maps superficial deposits have been recorded as Glaciofluvial Sheet Deposits, Devensian Sand and Gravel. Bedrock has been recorded as Brithdir Member – Mudstone, siltstone and sandstone.

BGS Maps - Bedrock



BGS Maps – Superficial Deposits



2.2.3 The site investigation confirms the superficial deposits comprising of boulder to gravel size pebbles with some sub angular and angular rock debris. Groundwater was not encountered during excavation of any of the trial holes and the report notes that there is unlikely to be a general standing water table at a depth likely to affect the development.

2.2.4 Flood risk from ground water is therefore considered to be low.

2.3 Surface water

2.3.1 Surface flooding is primarily caused by surface water running off the land, often when intense, short duration storms occur and rainfall is unable to enter drainage systems or soak into the ground.

2.3.2 NRW mapping for this source of flooding contains data on three risk bands of surface water flooding: High, Medium and Low. Within each risk band, data is available on the potential depth, velocity and direction of flooding. Areas not included within these risk bands are considered very low risk, with an annual probability of flooding of less than 0.1% (1 in 1000).

2.3.3 Reference to the NRW Mapping confirms that there is low surface water flood risk beyond the site boundary on the northeastern corner of the development site where the existing stream discharges onto the adjacent land. Please note this is external to the development site boundary and levels within this area will be unchanged.

2.3.4 There are areas of high surface water flood risk for an area to the southwest of the site and then on the southwestern boundary external to the site boundary. The area within the site is likely due to this being a localised low point on the site. A site visit concluded that there was no standing water noted during a site walkover. Trial pits concluded that the area also has good infiltration potential. Flow exceedance routing and a positive drainage network will

be provided as part of the proposals so surface water flood risk is therefore considered to be low.

2.4 Sewers

- 2.4.1 Flooding from sewers can result when the sewer is overwhelmed by heavy rainfall resulting in surcharging, becomes blocked or is of inadequate capacity. Flooding from sewers is defined as flooding in an urban area with a comprehensive sewer network.
- 2.4.2 Welsh Water Asset Mapping, found in Appendix C, confirms that there are public sewers located within the site boundary however topographically, the site is located at a higher level than the sewers located within Henfaes Road. There will be a new drainage network provided for the site.
- 2.4.3 Based on the above information it is considered that the flood risk to the development site from sewer sources is low.

2.5 Reservoirs, Canals and Other artificial sources

- 2.5.1 Artificial sources include reservoirs, canals and lakes where water is retained above natural ground level. Overtopping, leakage or a breach in the canal/reservoir structure is considered an artificial source of flooding.
- 2.5.2 Breach is a catastrophic failure of a water retaining structure, normally leading to rapid loss of all impounded water unless emergency measures are taken. Breach is considered to be of low probability, but of high consequence and for this reason it is identified as a most significant flood mechanism.
- 2.5.3 Reference to the NRW Mapping indicates that the site is not at risk from flooding from reservoirs.

2.6 Recorded flood extents data

- 2.6.1 Recorded flood extents mapping obtained from NRW Recorded Flood Extents mapping indicates that the proposed development site has no recorded history of flooding. Refer to Appendix D.

2.7 Strategic Flood Consequence Assessment (SFCA)

- 2.7.1 A strategic flood risk assessment for the South West Wales area was prepared in November 2022 by JBA Consulting. This details specific food risk information for the area and helps assist the council in managing and reducing flood risk for its residents and businesses.

2.8 Access and Egress to development

- 2.8.1 During flood events safe access to and egress from the site shall be achievable via the main site accesses off Henfaes Road.

2.9 Summary of Flood Risk

Receptor	Residential Development						
	Source	Rivers/ Fluvial	Sea/ Tidal	Surface/ Pluvial	Groundwater	Sewers	Artificial
Vulnerability Class	Low	✓	✓	✓	✓	✓	✓
	Medium						
	High						

- 2.9.1 From the above table, the overall flood risk associated with the development site is considered to be low.

3 Development Proposals

3.1 Site Layout

- 3.1.1 An illustrative site layout based upon an 8-unit development can be found in Appendix E.
- 3.1.2 Based upon the illustrative plans that accompany this application, the impermeable surface areas for roofs, hardstanding, and parking have been measured for the proposed development site and are indicated on the drainage areas plan in Appendix F of the report.
- 3.1.3 The proposed surface water and foul drainage scheme can be found within Appendix G.
- 3.1.4 As a minimum, in accordance with Building Regulations, all external levels shall be set a minimum of 150mm below the building level. Based on this information, overland flow strategies for the site have been shown on the drainage layout.

3.2 Existing Surface Water Conditions: Brownfield Run-off

- 3.2.1 For the purposes of this assessment, as the site was previously developed, it is classified as a brownfield site.
- 3.2.2 In order to provide a betterment upon the brownfield runoff regime of the existing site, and make allowances for future climate change predications, the proposed development should afford a minimum of 30% betterment over existing brownfield flows as a minimum.
- 3.2.3 To achieve this, we propose that most of the development utilises infiltration with the proposed highway drainage to utilise the pre-development greenfield run-off rates set out below as the performance target. (refer 3.2.5 below)
- 3.2.4 The FEH method has been used to determine the greenfield runoff rate for the area of proposed adoptable highway.
- 3.2.5 Using this method, the existing runoff from the development site has been calculated and the results shown in the table below.

Site Catchment Characteristics					
Area (Ha)	0.070	SAAR (mm)	1480	Region	9
Results					
	Return Period		Run-off		
	Q _{bar}		1.02 l/s		
	Q _{1 year}		0.9 l/s		
	Q _{30 year}		1.82 l/s		
	Q _{100 year}		2.23 l/s		

- 3.2.6 As per Welsh Government guidance in “Recommended non-statutory standards for SuDS” the rate of storm water runoff for a new development should mimic the existing flow regime. This is equivalence rule is achieved by assessing and designing to the 1 in 1 year and 1 in 100 year events. There are three storage types should be used to control the discharge offsite. These are:

- Interception Storage – Runoff from storm events of less than 5mm should be discharged onsite. (*Designed to increase water **quality** and reduce pollution to receiving waters*)
- Attenuation Storage – Runoff from intermediate storms should be temporarily retained onsite to limit discharge rate offsite. (*Designed to reduce the **rate** of runoff, matching greenfield conditions*)
- Long-term Storage (LTS) – Runoff from large storms (greater than 1 in 100, 6hr storm) should be retained and discharged onsite, or discharged at a low rate of 2l/s/ha. (*Designed to prevent additional runoff **volume** reaching receiving waters, matching greenfield conditions*)

3.2.7 The requirement for LTS is accepted as being difficult to meet in some circumstances. For this development site, due to its small size and assumed poor/low infiltration rate, it is considered to be unfeasible to provide LTS. As a trade-off for non-compliance, the discharge limit for 1 in 100 year storm is set to Q_{BAR} , in effect 'over attenuating' on site in place of preventing an increase in runoff volume.

3.3 Surface Water Drainage - Planning Policy

- 3.3.1 The future development of this site should in no way cause a greater flood risk to the site, or the downstream catchment area that already exists and should where practicable reduce flood risk, both now and in the future.
- 3.3.2 Natural Resource Wales guidance states that residential developments should be allocated a minimum 100 year design life, therefore any storm water attenuation features should be designed to meet this requirement.
- 3.3.3 There are indications that the climate in the UK is already changing. Current expert opinion suggests that higher intensity, short duration storms will occur more frequently as a result of climate change. Periods of prolonged rainfall are also likely to occur more frequently. The potential impacts of climate change on the site are likely to be as a result of increased rainfall intensity and duration.

- 3.3.4 Natural Resource Wales have undertaken assessments of the effect of climate change on natural water systems. TAN 15 (Section 2.5) states that by 2080, winter precipitation may increase by up to 30%. It is on this basis that the climate change allowance has been applied for the site.
- 3.3.5 The proposed development should be approached with a view to managing the surface water run-off, taking in to account water quantity (flooding), water quality (pollution) and amenity issues, all being collectively referred to as Sustainable Drainage Systems (SuDS).
- 3.3.6 SuDS are generally regarded as a management train, consisting of control structures and strategies that are designed to efficiently and sustainably drain surface water run-off, while minimising pollution and managing the impact on water quality of local water bodies and groundwater aquifers below.
- 3.3.7 Therefore, in the first instance and in keeping with SuDS planning hierarchy, the proposed drainage scheme for the development site should be designed with a view to utilising SuDS drainage techniques, returning as much of the surface water run-off to ground as close to the source as possible, i.e. utilising infiltration.
- 3.3.8 Where this is not feasible, a discharge to a surface water body, such as a main river, ordinary watercourse or local land drainage feature is the preferred approach to surface water treatment. Where a surface water body is not available, a connection to a surface water sewer, highway drain or suitable receiving drainage system may be considered. Ultimately, although prior approval will be required, a connection to a combined sewer may be considered although this should be considered a last resort.
- 3.3.9 The proposed SuDS features may also be considered for adoption by the Local Authority for adoption, as the Lead Local Flood Authority (LLFA), and should be designed in accordance with current LLFA guidance and advice/requirements.
- 3.3.10 The design of all SuDS infrastructure shall be approved by the LLFA or relevant approving body at the time of design, prior to commencing construction and may then subsequently be considered for adoption. Where adoption of the SuDS features does not take place, a management/maintenance company shall be set up or appointed to manage the ongoing maintenance of these features.
- 3.3.11 The design/sizing of the SuDS features and drainage network shall be confirmed at detailed design, following modelling of the proposed development drainage system and shall be designed to at meet the greenfield performance of the site.

3.4 Surface Water Drainage – Development Proposals

- 3.4.1 With reference to the infiltration testing undertaken by Geo-testing in November 2024 soakage tests were undertaken in accordance with BRE 365. Testing confirmed that infiltration is a suitable discharge method for surface water flows where possible. In accordance with their report average rates of 1.0×10^{-2} are to be used for the soakaway design.
- 3.4.2 The drainage strategy is split into two separate sections:

3.4.3 Section 1

The proposed houses are intended to discharge to ground by collecting roof water via traditional guttering with down pipes discharging into the subbase of the permeable paving via permeavoid diffusers where possible.

3.4.4 Utilising Flow to run an attenuated storage estimate, the impermeable surface area comprising roof, and permeable parking areas has been measured as 0.174 ha.

3.4.5 For minimum subbase reservoir depths refer to Appendix F -Catchment areas and Appendix H for hydraulic calculations. All calculations have been based upon an infiltration rate of $1 \times 10^{-2} \text{m/s}$.

3.4.6 A 10% allowance for urban creep has been allowed for.

3.4.7 Section 2

The proposed adoptable road located to the east of the development site is intended to either discharge to ground subject Neath and Port Talbot Council approval or discharge into the existing highway sewer network located within Henfaes Road subject to confirmation of suitable depth and capacity.

3.4.8 Utilising Flow to run an attenuated storage estimate, the impermeable surface area of the road and footway areas has been measured as 0.07 ha.

3.4.9 The allowable surface water discharge rate (Q_{BAR}) from the proposed development for the road, as noted in section 3.2, is 1.0 l/s. This has determined (as can be seen as in Appendix H) that between 37m^3 and 64m^3 of attenuation volume is required.

3.4.10 For the discharge to highway sewer a restricted attenuated discharge has been proposed utilising oversized pipes beneath the access road.

3.4.11 The final proposed drainage scheme will be confirmed at the detail design stage, however, the below strategy provides a feasible scheme based on the assumptions stated in this report.

3.4.12 The proposed scheme shall use a combination of interception features such as raingardens, permeable paving, conveyance features such as pipes, and attenuation features such as oversize pipes and sub-base replacement in parking bays to achieve the SuDS objectives of water quality, quantity and amenity.

- Where possible it is suggested to connect rainwater downpipes to a shallow swale / rill or raingardens within the soft landscaped areas. This will provide interception storage and an amenity feature for the future residents, as well as providing attenuation storage.
- Access road runoff will be directed towards gullies with sumps for silt interception prior to discharging to the existing highway sewer.
- All surface water systems will then be connected to a flow control chamber at the outfall which will contain a hydrobrake, or similar, to restrict the discharge from the site. During heavy rainfall events the system will surcharge and fill the attenuation structures and pipes.

- Runoff during exceedance events (ie greater than 1 in 100 + 45%) will be directed safely through the site and towards Henfaes Road as shown on the conceptual drainage layout.

3.5 Water Quality

3.5.1 Using the guidance within table 4.3 of Ciria C753 'The SuDS Manual', it has been determined that given the site's residential nature, proposed runoff will have a **low** pollution hazard level. As the site will be discharging to ground, it follows that the simple index approach is an appropriate assessment method.

3.5.2 The pollution hazard indices of the development proposals have been summarised below in line with the guidance in table 26.2 of the SuDS Manual:

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential Roofs	Very Low	0.2	0.2	0.05
Residential CarPark	Low	0.5	0.4	0.4

3.5.3 Table 2 below summarises the pollution mitigation indices assigned to each individual SuDS component. This table is based on the C753 Table 26.4 for discharge to ground.

Types of SuDS features	Total suspended solids (TSS)	Metals	Hydro-carbons
Permeable Pavement	0.7	0.6	0.7

Each of the proposed surface water treatment train permutations are as follows:

SuDS Treatment Train	Total suspended solids	Metals	Hydro-carbons
Permeable Pavement	0.7	0.6	0.7
Residential roof	0.2	0.2	0.05
Pass/fail	Pass	Pass	Pass

3.5.4 As all permutations of SuDS proposals and pollution hazards are acceptable for the receiving groundwater the drainage strategy is considered to meet the desirable water quality requirements.

3.5.5 Highway drainage discharge water quality to be addressed at detailed design stage and through agreement with Neath and Port Talbot Highways with possible bioretention areas to be utilised.

3.6 Foul Drainage

- 3.6.1 With reference to the Welsh Water asset map shown in Appendix C there is an existing 100mm private foul sewer serving properties to the south of the development site. It is shown entering the site approximately halfway along the southern site boundary and then runs in a northwesterly direction across the development site. This is noted on the asset plans as a private sewer transfer in the key. This sewer then joins a section of 150mm adoptable combined sewer which then runs towards the northeast and towards 2 Henfaes Road where it then crosses underneath Henfaes Road towards the northwest.
- 3.6.2 As indicated on the drainage strategy we are intended to divert a section of the private foul sewer which will be diverted north along the new site access road and then reconnect into Henfaes Road. The existing drainage network is to be traced on site to confirm the line and level of the existing sewers onsite and through to proposed new connection prior to detailed design. For a feasible strategy we have noted required minimum tie-in levels.
- 3.6.3 The sewer is to be designed in accordance with Building Regulations and Design & Construction Guidance (DCG) for new sewers, connecting the proposed development to the existing 150mm combined sewer in Henfaes Road.
- 3.6.4 Based upon the proposed layout, it is estimated that the new residential development proposal will have a peak discharge rate of 0.37l/s from the 8 houses. This rate has been based on the DCG assumption of a design flow rate of 4000L / dwelling / day. However, the foul sewers will need to be sized to include the existing from the properties to the south development.
- 3.6.5 A capacity check will need to be undertaken on the existing public sewer by Welsh Water, to confirm that the existing sewer network has capacity to receive foul flows from the proposed development.
- 3.6.6 Details of the foul water drainage strategy can be found in Appendix G.

4 Future Maintenance

- 4.1.1 It is intended that part of the new foul and surface water drainage system serving the development will remain private at this stage and that the owners of the site will be responsible for the ownership and maintenance of the private drainage system.
- 4.1.2 However, the sewers within the road will be offered for adoption under a S104 agreement.
- 4.1.3 It is proposed that a maintenance regime / schedule will be provided with the sales particulars. We would propose that any such sales particulars and maintenance manuals should outline the following information:
- 4.1.4 We would propose that the following information is included as a minimum:
- i. Clear details of ownership and responsibilities of drainage systems across the site.
 - ii. Copy of the installed as built drainage drawings.
 - iii. Copies of standard product specifications used for relevant drainage elements including *(but not limited to)*:
 - a. Inspection chambers/ manholes
 - b. Pipework
 - c. Access covers
 - d. Soakaways
 - e. Flow Control Devices
 - f. Channel Drainage
 - iv. Information relating to the SuDS features provided:
 - a. Manufacturers' details and specifications including design life.
 - b. Recommendation for inspections and maintenance.
 - c. Details of intended proper operation.
 - d. Potential safety issues.
 - v. Notes on warranties offered by the contractor as may be appropriate – for call out service.
 - vi. Contact details for Maintenance Company in event of blockage and emergency.
 - vii. Contact details for local pipe jetting / cleaning companies in event of blockage

5 Recommendations and Conclusions

5.1 Recommendations

- 5.1.1 A CCTV Drainage survey should be carried out to confirm the location and routing of the foul and combined sewers within the site boundary. CCTV drainage survey will also be required to confirm the outfall levels for the highway and foul drainage outfall levels to confirm the current strategy.
- 5.1.2 Consultation with Welsh Water will be required. It is not envisaged that the routes of the sewers will differ greatly from the records provided but manhole positions should be located as this will inform requirements for any diversions.

5.2 Conclusions

- 5.2.1 The development site has been fully appraised in accordance with the guidance provided for assessing flood risk under the TAN15.
- 5.2.2 It has been concluded that the overall risk of flooding to the site is low.
- 5.2.3 Roof areas and parking areas are to utilise permeable paving to infiltrate into the ground in accordance with the SuDS hierarchy where possible with plot 1 utilising an attenuation crate and permeable paving.
- 5.2.4 The access road which is intended to be offered for adoption, is to drain to ground subject to Neath and Port Talbot Highways approval or via an attenuated restricted discharge to the existing highway sewer located within Henfaes Road (as shown on the drainage strategy drawing) subject to confirmation on the outfall depth. The discharge will be restricted to greenfield run off rate (Qbar) and attenuated with oversized pipes which have been designed to accommodate the 1:100 year + 45% climate change event.
- 5.2.5 The foul drainage design utilises a gravity network. Part of the existing private foul drainage is to be diverted through the site and along a new section of foul sewer to connect back into the public foul drainage system in Henfaes Road. The foul network is subject to confirmation of outfall depth/capacity and Welsh Water consent.
- 5.2.6 In line with Welsh Government interim advice, Sustainable Drainage Systems (SuDS) shall be implemented within the development proposals to manage surface water runoff from the proposed development and achieve greenfield runoff rates, representing a significant improvement upon the current brownfield contribution.
- 5.2.7 Based on this Flood Consequence Assessment, the proposed development is achievable in a sustainable manner, without increasing flood risk, and likely reducing flood risk, on the development site or the greater catchment area.

Appendix A

Site Location Plan



The red line indicates the boundary for the new development



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CLIENT:	Emily Byrne
PROJECT:	1 Henfaes Road Neath, Tonna

TITLE:	Site Location Plan
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SCALE: (A3) 1:1000	CHECKED: DS	APPROVED: DS
CAD FILE: IMA-24-077_SL01.dwg	DESIGN/DRAWN: PDI	DATE: December 2024
PROJECT No: IMA-24-077	DRAWING No: SL-01	REV: -

Appendix B

Topographical Survey



DRAWING STATUS:				for Planning	
SCALE: 0/1		CHECKED:	APPROVED:		
1:250		DS	DS		
LOAD FILE: IMA-24-077_000.dwg		DESIGN/DRAWN: PDI		DATE: December 2024	
PROJECT No:		DRAWING No:			REV:
IMA-24-077		000			-

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Appendix C

Welsh Water Asset Location Mapping



Dŵr Cymru
Welsh Water

Ty'n Yr Heol, Neath



LEGEND(Representative of most common features)

Waste networks:

- | | | |
|---|--|---|
| Foul chamber | Surface water chamber | Outfall |
| Combined sewer chamber | Combined sewer overflow | Storm Overflow |
| Special purpose chamber | Treatment works | Rising main |
| Pumping station | Private sewer | Private sewer subject to Sect. 104 adoption agreement |
| NB: Sewer symbol colour indicates the type. | Private Sewer Transfer | Lateral Drain |
| RED - Combined | BROWN - Former S24 sewers (for indicative purposes only) | Inspection Chamber |
| GREEN - Surface Water | | |
| PURPLE - Foul | | |

Notes:

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.

Dŵr Cymru Cymru (the Company) gives this information as to the position of its underground apparatus by way of general guidance only and on the 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. The user of this information is advised to carry out any excavations made within its own site. The information which is supplied by the Company is done so in accordance with statutory requirements of sections 195 and 196 of the Water Industry Act 1991 which in turn opens the best information available and, in particular, but without prejudice to the generality of the foregoing, it should be noted that the records that are available to the Company may not disclose the existence of a water main, service pipe, sewer, lateral drain or discharge pipe and any associated apparatus, but before 1 September 1992, or if they do, the particular detail relating to their position, depth and/or size, and it is recommended that the user of this information is advised to consult the records of the New Roads and Street Works Act 1991 and the Company's rights to be compensated for any damage to its apparatus.

Service pipes are not generally shown but their presence should be anticipated.

**EXACT LOCATIONS OF ALL APPARATUS
TO BE DETERMINED ON SITE.**

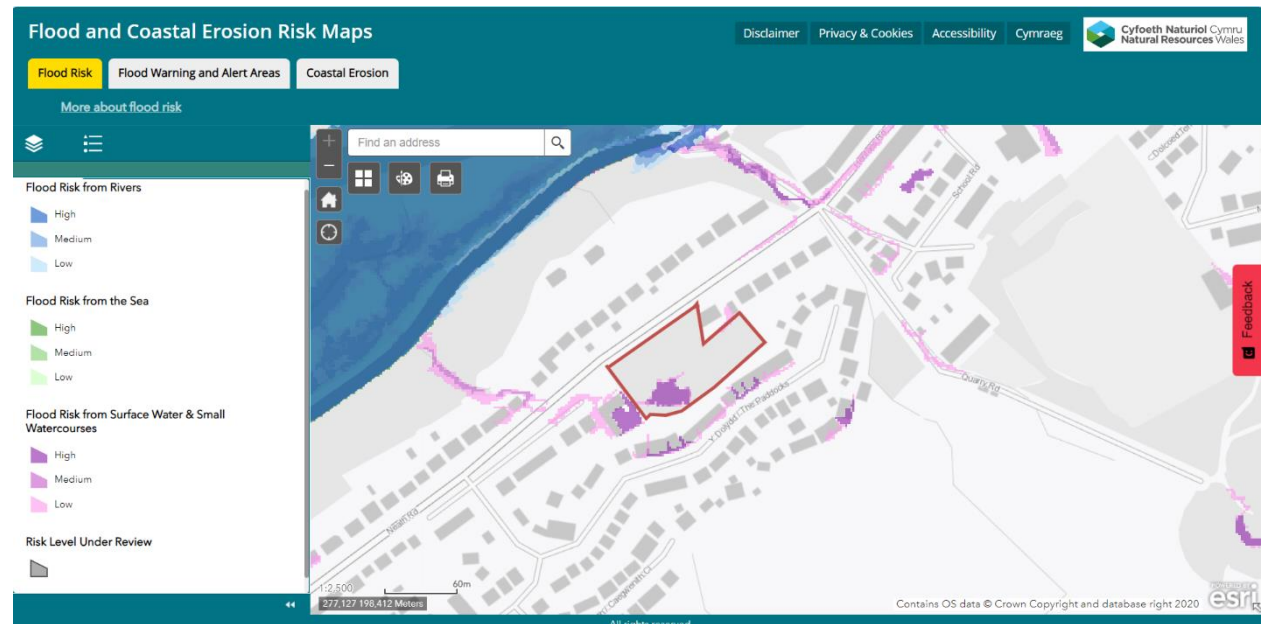
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Map Ref: 276922,198613
Map scale: 1:2500
Printed by: Emily Marsden
Printed on: 11 Dec 2024

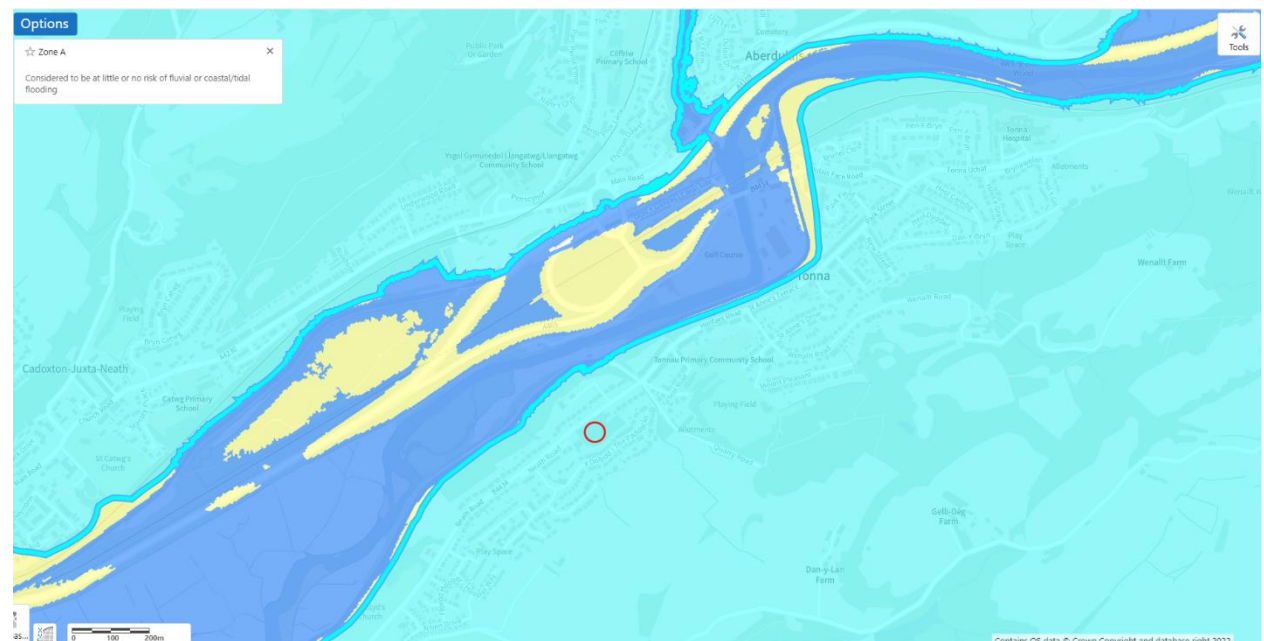
Appendix D

Natural Resources Wales – Flood Risk Mapping

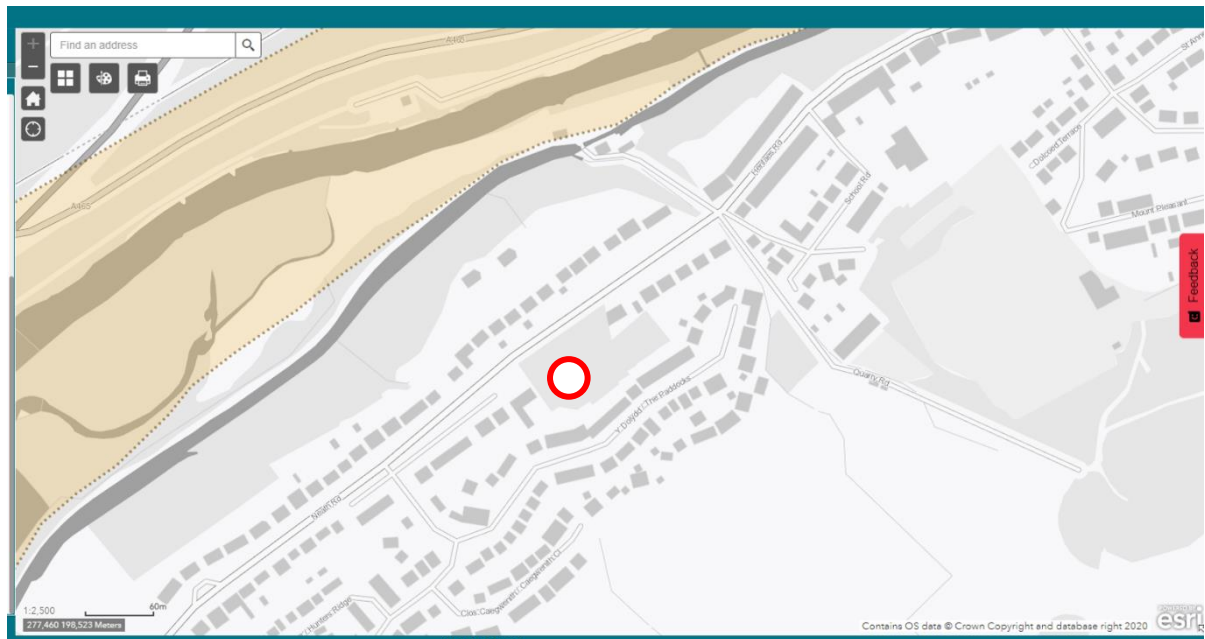
National Resources Wales - Flood Maps



Development Advice Map (DAM)



National Resource Wales – Recorded Flood Extents



Appendix E

Proposed Site Layout



Key

New proposed tree

Existing tree

TPO tree

Root protection zone

A

18-12-2024

Issued for Planning

P1

13-12-2024

Issued for Information

Client

Emily Byrne

Project

Tyn Yr Heol, Neath

Title

Site Plan as Proposed (Roof Plan)

Drawn

PS

Checked

KLM

Dwg No.

1566 028 A

Scale

1:200 @ A1

Date

NOV.24

RIBA

Chartered Practice

Aaron Evans Architects Ltd

3 Gay Street, Bath, BA1 2PH

www.aaronevans.com

e: office@aaronevans.com

01225 466234

This drawing is copyright. Only figured dimensions to be used. Contractors not to scale from this drawing and must check all dimensions before proceeding.

AARON

EVANS

ARCHITECTS

Appendix F

Impermeable Drainage Areas

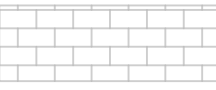
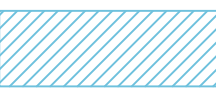


This drawing has been based on survey information supplied by an independent surveying company. Whilst the information provided is believed to be accurate, IMA Transport Planning Ltd shall not be liable for any inaccuracies or deficiencies arising from it.

Legend:

Drainage Catchments

	Roof drained area:	
	Plot 1(incl garage)	0.030
	Plot 2	0.013
	Plot 3	0.016
	Plot 4	0.013
	Plot 5	0.013
		0.055
	Plot 6-8	0.016
	Total roof area	0.101

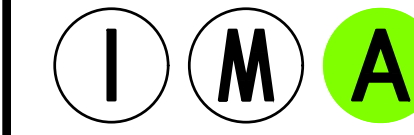
	Areas of permeable paving	
	Highway and footapths	0.071
	Existing hardstandings to be demolished	0.073

Totals (ha)

0.055
0.016
0.101

0.071

0.073



TRANSPORT PLANNING

MONTREUX HOUSE, 18A JAMES STREET WEST

BATH BA1 2BT

T: 01225 444 011

www.ima-tp.com

REV	DATE	BY	DESCRIPTION	CHK	APP

NOTES:

CLIENT:

Emily Byrne

PROJECT:

1 Henfaes Road
Tonna, Neath

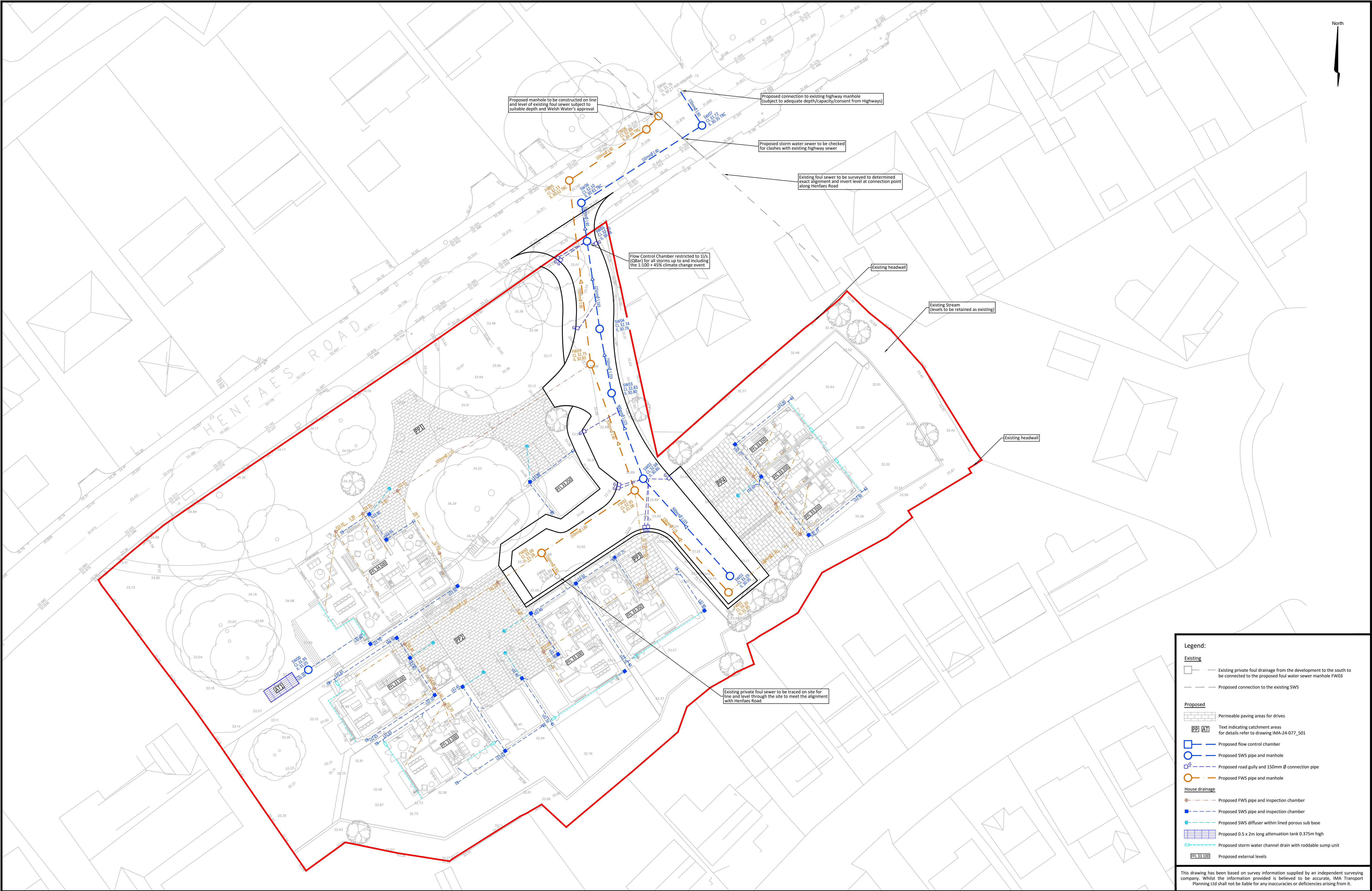
TITLE:

Catchment Areas

DRAWING STATUS:		
for Planning		
SCALE (A0):	CHECKED:	APPROVED:
1:250	DS	DS
CAD FILE:	DESIGN/DRAWN:	DATE:
IMA-24-077_501.dwg	PDI	December 2024
PROJECT NO:	DRAWING NO:	REV:
IMA-24-077	501	-

Appendix G

Conceptual Drainage Layout



Legend:

Existing

- Existing private foul drainage from the development to the south to be connected to the proposed foul water sewer manhole FW03
- Proposed connection to the existing SWS

Proposed

- Permeable paving areas for drives
- Text indicating catchment areas for details refer to drawing IMA-24-077_501
- Proposed flow control chamber
- Proposed SWS pipe and manhole
- Proposed road gully and 150mm Ø connection pipe
- Proposed FWS pipe and manhole

House drainage

- Proposed FWS pipe and inspection chamber
- Proposed SWS pipe and inspection chamber
- Proposed SWS diffuser within lined porous sub base
- Proposed 0.5 x 2m long attenuation tank 0.375m high
- Proposed storm water channel drain with roddable sump unit
- Proposed external levels

This drawing has been based on survey information supplied by an independent surveying company. Whilst the information provided is believed to be accurate, IMA Transport Planning Ltd shall not be liable for any inaccuracies or deficiencies arising from it.

I M A TRANSPORT PLANNING MONTREUX HOUSE, 18A JAMES STREET WEST BATH BA1 2BT T: 01225 444 011 www.ima-tp.com									NOTES:			CLIENT: Emily Byrne			TITLE: Conceptual Drainage Strategy			DRAWING STATUS: for Planning								
												PROJECT: 1 Henfaes Road Tonna, Neath						SCALE (A1): 1:250			CHECKED: DS			APPROVED: DS		
																		CAD FILE: IMA-24-077_500.dwg			DESIGN/DRAWN: PDI			DATE: December 2024		
																		PROJECT NO: IMA-24-077			DRAWING NO: 500			REV: -		
REV			DATE			BY			DESCRIPTION			CHK			APD											

Appendix H

Greenfield runoff rate and Attenuation volume calculations

Calculated by:

neil doble

Site name:

24-077 – Tonna Neath

Site location:

Neath

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:

51.67273° N

Longitude:

3.78134° W

Reference:

1462214986

Date:

Dec 16 2024 10:54

Runoff estimation approach

FEH Statistical

Site characteristics

Total site area (ha):

0.07

Methodology

Q_{MED} estimation method:

Calculate from BFI and SAAR

BFI and SPR method:

Specify BFI manually

HOST class:

N/A

BFI / BFIHOST:

0.458

Q_{MED} (l/s):

Q_{BAR} / Q_{MED} factor:

1.08

Hydrological characteristics

	Default	Edited
SAAR (mm):	1527	1480
Hydrological region:	9	9
Growth curve factor 1 year:	0.88	0.88
Growth curve factor 30 years:	1.78	1.78
Growth curve factor 100 years:	2.18	2.18
Growth curve factor 200 years:	2.46	2.46

Notes

(1) Is $Q_{\text{BAR}} < 2.0$ l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is $\text{SPR}/\text{SPRHOST} \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q _{BAR} (l/s):		1.02
1 in 1 year (l/s):		0.9
1 in 30 years (l/s):		1.82
1 in 100 year (l/s):		2.23
1 in 200 years (l/s):		2.52

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

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)	1.000
CV	0.750	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		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S1	0.070	5.00	33.189	1800	276965.864	198600.337	2.242
S2			32.989	1800	276953.916	198615.062	2.126
S3			32.841	1800	276948.066	198627.176	2.038
S4			32.724	1800	276946.694	198636.713	1.964
S5			32.108	1350	276944.838	198649.618	1.425

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	0.750	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.840	Drain Down Time (mins)	240	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	0	0	0
30	0	0	0
100	45	0	0

Node S5 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	30.683	Product Number	CTL-SHE-0045-1000-1140-1000
Design Depth (m)	1.140	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.0	Min Node Diameter (mm)	1200

Results for 2 year Critical Storm Duration. Lowest mass balance: 92.54%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	S1	264	31.065	0.118	2.3	0.3008	0.0000	OK
360 minute winter	S2	264	31.065	0.202	2.3	0.5145	0.0000	OK
360 minute winter	S3	264	31.065	0.262	1.8	0.6673	0.0000	OK
360 minute winter	S4	264	31.065	0.305	1.4	0.7768	0.0000	SURCHARGED
360 minute winter	S5	264	31.065	0.382	1.0	0.5469	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)
360 minute winter	S1	1.000	S2	2.3	0.372	0.002	1.4712	
360 minute winter	S2	1.001	S3	1.8	0.335	0.001	1.7464	
360 minute winter	S3	1.002	S4	1.4	0.275	0.002	1.4704	
360 minute winter	S4	1.003	S5	1.0	0.236	0.025	0.5185	
360 minute winter	S5	Hydro-Brake®		0.8				19.1

Results for 30 year Critical Storm Duration. Lowest mass balance: 92.54%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	S1	288	31.313	0.366	3.9	0.9314	0.0000	OK
360 minute winter	S2	288	31.313	0.450	3.2	1.1452	0.0000	OK
360 minute winter	S3	288	31.313	0.510	2.2	1.2979	0.0000	OK
360 minute winter	S4	288	31.313	0.553	1.5	1.4074	0.0000	SURCHARGED
360 minute winter	S5	288	31.313	0.630	1.0	0.9015	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)
360 minute winter	S1	1.000	S2	3.2	0.391	0.002	5.2992	
360 minute winter	S2	1.001	S3	2.2	0.327	0.002	4.6246	
360 minute winter	S3	1.002	S4	1.5	0.259	0.002	3.2128	
360 minute winter	S4	1.003	S5	1.0	0.188	0.025	0.5185	
360 minute winter	S5	Hydro-Brake®		0.8				24.7

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 92.54%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	S1	320	31.826	0.879	5.5	2.2362	0.0000	OK
480 minute winter	S2	320	31.844	0.981	5.9	2.4972	0.0000	SURCHARGED
360 minute winter	S3	248	31.846	1.043	17.0	2.6557	0.0000	SURCHARGED
240 minute winter	S4	188	31.827	1.067	8.8	2.7164	0.0000	SURCHARGED
240 minute winter	S5	184	31.810	1.127	2.6	1.6131	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 winter	S1	1.000	S2	4.8	0.343	0.004	11.9724	
480 minute winter	S2	1.001	S3	4.2	0.312	0.003	8.5262	
360 minute winter	S3	1.002	S4	5.6	0.311	0.007	4.2406	
240 minute winter	S4	1.003	S5	2.6	0.352	0.066	0.5185	
240 minute winter	S5	Hydro-Brake®		1.0				24.1

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	0.750	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		

Nodes

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
Depth/Area 1	0.045	5.00	0.0	34.400	22.919	70.136	0.600

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	0.750	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.840	Drain Down Time (mins)	240	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	0	0	0
30	40	0	0
100	45	0	0

Node Depth/Area 1 Carpark Storage Structure

Base Inf Coefficient (m/hr)	36.00000	Invert Level (m)	33.800	Slope (1:X)	20.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	
Safety Factor	1.5	Width (m)	6.450	Inf Depth (m)	
Porosity	0.30	Length (m)	37.700		

Results for 2 year Critical Storm Duration. Lowest mass balance: 96.56%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	Depth/Area 1	10	33.806	0.006	5.5	0.0012	0.0000	OK
Link Event (Upstream Depth)		US Node	Link	Outflow (l/s)				
15 minute winter		Depth/Area 1	Infiltration	5.7				

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 96.56%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	Depth/Area 1	9	33.820	0.020	17.3	0.0095	0.0000	OK
Link Event (Upstream Depth)		US Node		Link	Outflow (l/s)			
15 minute winter		Depth/Area 1		Infiltration	17.3			

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 96.56%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	Depth/Area 1	10	33.825	0.025	21.7	0.0147	0.0000	OK
Link Event (Upstream Depth)		US Node	Link	Outflow (l/s)				
15 minute winter		Depth/Area 1	Infiltration	20.7				

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	0.750	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		

Nodes

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
Depth/Area 1	0.089	5.00	0.0	32.900	22.919	70.136	0.600

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	0.750	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.840	Drain Down Time (mins)	240	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	0	0	0
30	40	0	0
100	45	0	0

Node Depth/Area 1 Carpark Storage Structure

Base Inf Coefficient (m/hr)	36.00000	Invert Level (m)	32.300	Slope (1:X)	80.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	
Safety Factor	1.5	Width (m)	16.350	Inf Depth (m)	
Porosity	0.30	Length (m)	16.400		

Results for 2 year Critical Storm Duration. Lowest mass balance: 95.57%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
15 minute summer	Depth/Area 1	11	32.303	0.003	10.3	0.0026	0.0000	OK
Link Event (Upstream Depth)		US Node		Link	Outflow (l/s)			
15 minute summer		Depth/Area 1		Infiltration	10.5			

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 95.57%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	Depth/Area 1	11	32.313	0.013	32.5	0.0356	0.0000	OK
Link Event (Upstream Depth)		US Node		Link	Outflow (l/s)			
15 minute summer		Depth/Area 1		Infiltration	40.0			

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 95.57%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	Depth/Area 1	12	32.328	0.028	40.8	0.1533	0.0000	OK
Link Event (Upstream Depth)		US Node		Link	Outflow (l/s)			
15 minute summer		Depth/Area 1		Infiltration	59.0			

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	0.750	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		

Nodes

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
Depth/Area 1	0.005	5.00	0.0	33.200	22.919	70.136	0.600

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	0.750	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.840	Drain Down Time (mins)	240	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	0	0	0
30	40	0	0
100	45	0	0

Node Depth/Area 1 Carpark Storage Structure

Base Inf Coefficient (m/hr)	36.00000	Invert Level (m)	32.600	Slope (1:X)	21.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	
Safety Factor	1.5	Width (m)	6.280	Inf Depth (m)	
Porosity	0.30	Length (m)	7.800		

Results for 2 year Critical Storm Duration. Lowest mass balance: 97.78%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	Depth/Area 1	9	32.601	0.001	0.6	0.0001	0.0000	OK
Link Event (Upstream Depth)		US Node		Link	Outflow (l/s)			
15 minute summer		Depth/Area 1		Infiltration	0.6			

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 97.78%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	Depth/Area 1	10	32.602	0.002	1.9	0.0003	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)					
15 minute winter	Depth/Area 1	Infiltration	2.0					

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 97.78%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	Depth/Area 1	10	32.602	0.002	2.4	0.0004	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)					
15 minute winter	Depth/Area 1	Infiltration	2.5					

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	0.750	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		

Nodes

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
Depth/Area 1	0.034	5.00	0.0	33.200	22.930	70.136	0.600

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	0.750	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.840	Drain Down Time (mins)	240	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440
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Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	40	0	0
100	45	0	0

Node Depth/Area 1 Carpark Storage Structure

Base Inf Coefficient (m/hr)	36.00000	Invert Level (m)	32.600	Slope (1:X)	45.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	
Safety Factor	1.5	Width (m)	19.000	Inf Depth (m)	
Porosity	0.30	Length (m)	9.210		

Results for 2 year Critical Storm Duration. Lowest mass balance: 98.85%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	Depth/Area 1	17	32.603	0.003	3.4	0.0015	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)					
30 minute winter	Depth/Area 1	Infiltration	3.4					

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 98.85%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	Depth/Area 1	39	32.604	0.004	8.0	0.0027	0.0000	OK
Link Event (Upstream Depth)		US Node		Link	Outflow (l/s)			
60 minute winter		Depth/Area 1		Infiltration	8.2			

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 98.85%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute summer	Depth/Area 1	28	32.604	0.004	12.7	0.0026	0.0000	OK
Link Event (Upstream Depth)		US Node		Link	Outflow (l/s)			
60 minute summer		Depth/Area 1		Infiltration	13.0			

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	0.750	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		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
Depth/Area 1	0.019	5.00	33.250	17.489	66.742	0.900

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	0.750	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.840	Drain Down Time (mins)	240	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440
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Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	40	0	0
100	45	0	0

Node Depth/Area 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	36.00000	Safety Factor	1.5	Invert Level (m)	32.350
Side Inf Coefficient (m/hr)	36.00000	Porosity	0.95	Time to half empty (mins)	0

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	1.0	1.0	0.375	1.0	3.0	0.376	0.0	3.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	Depth/Area 1	10	32.367	0.017	2.3	0.0163	0.0000	OK
Link Event (Upstream Depth)		US Node	Link	Outflow (l/s)				
15 minute winter		Depth/Area 1	Infiltration	2.3				

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	Depth/Area 1	10	32.412	0.062	7.3	0.0585	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)					
15 minute winter	Depth/Area 1	Infiltration	7.1					

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	Depth/Area 1	10	32.454	0.104	9.1	0.0987	0.0000	OK
Link Event (Upstream Depth)		US Node		Link	Outflow (l/s)			
15 minute winter		Depth/Area 1		Infiltration	8.9			