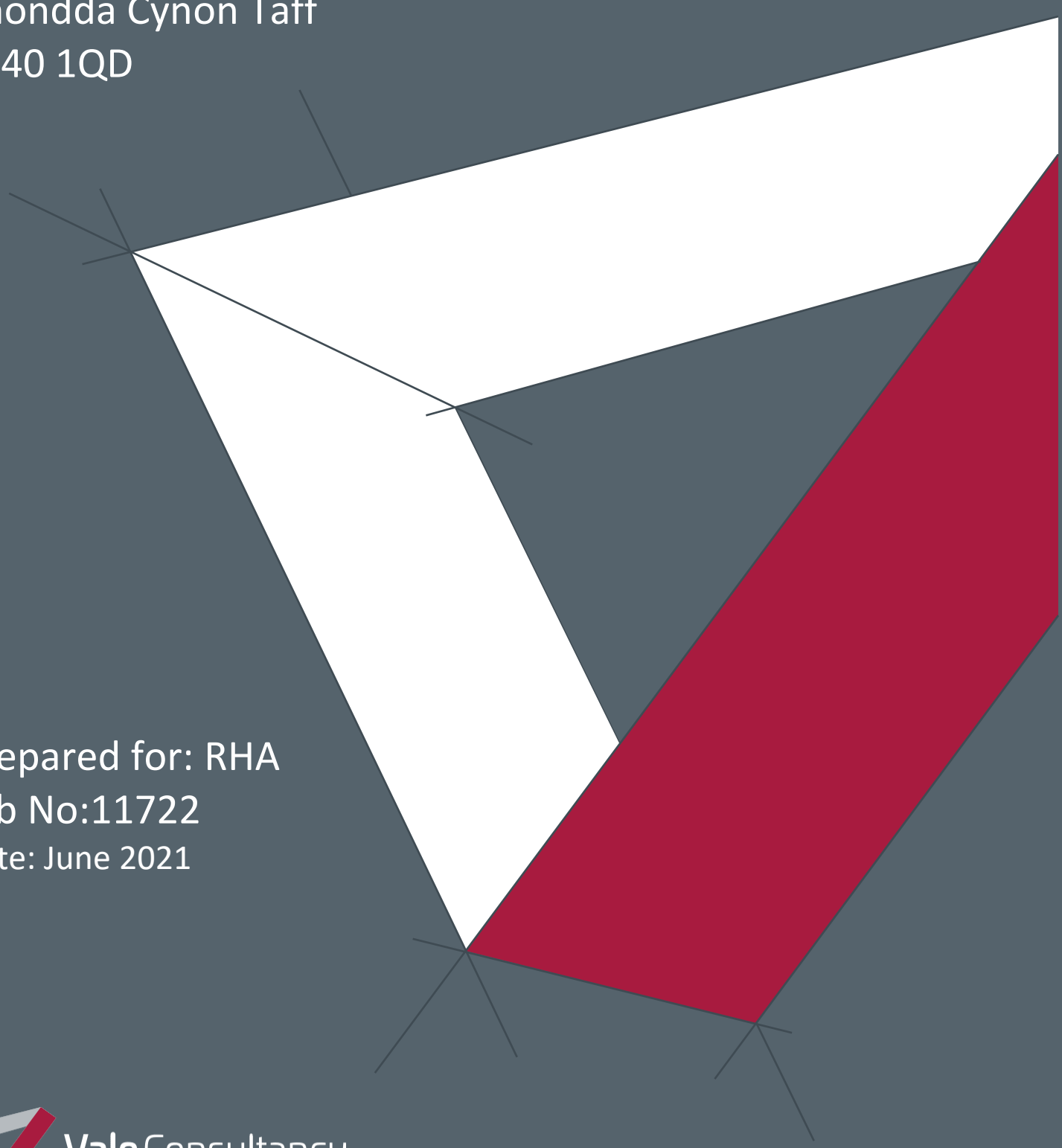
Drainage Strategy Report

Proposed Residential Development at:
122-126 Dunraven Street,
Tonypandy ,
Rhondda Cynon Taff
CF40 1QD



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Vale Consultancy
CONSULTING CIVIL & STRUCTURAL ENGINEERS

Document Control

Project	**Drainage Strategy, for a proposed residential development at: 122-126 Dunrvaen Street,Tonypandy.** **CF40 1QD**
Client	**RHA**
Vale Consultancy Ref:	**11722**

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1.0 Introduction

1.1 Purpose of the Assessment

Vale Consultancy have been appointed by Rhondda Housing Association (*the client*) to develop the drainage strategy in support of a future SAB application and a planning consent for the demolition of the existing buildings Nos 122-126 and the construction of a residential development and all associated infrastructure works at Dunraven Street, Tonypandy.CF40 1QD.

1.2 Limitations

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The findings and opinions expressed are based on the conditions encountered and/or the information reasonably available at the date of issue.

1.3 Scope of the Assessment

The scope of the assessment is as follows: -

Surface Water

- Obtain details of existing surface water sewers, ditch courses, watercourses, and any other water bodies within and adjacent to the site.
- Liaise with the Lead Local Flood Authority (RCTCBC) regarding points and rates of discharge and drainage constraints.
- Calculate expected surface water discharge flows based on likely development proposals.
- Obtain copies of available borehole records and geological maps to consider the feasibility of utilisation of sustainable drainage systems (SuDS) for the development site.
- Develop a surface water drainage strategy for the site using the principles of Sustainable Drainage Systems. The surface water drainage strategy will be in accordance with the RCTCBC requirements.
- The outline application will be in accordance with the requirements of Schedule 3 of the Flood and Water Management Act 2010.

Foul Water

- Obtain details of existing foul public water sewers from Dwr Cymru Welsh Water (DCWW).
- Assess existing foul water network and review current off-site discharge points.
- Calculate expected foul water discharge flows based on development proposals.
- Liaise with DCWW in relation to a Hydraulic Modelling Assessment to determine the impact of the development on the public sewer network.
- Develop a Foul Water Drainage Strategy for the site.

2.0 Development Site

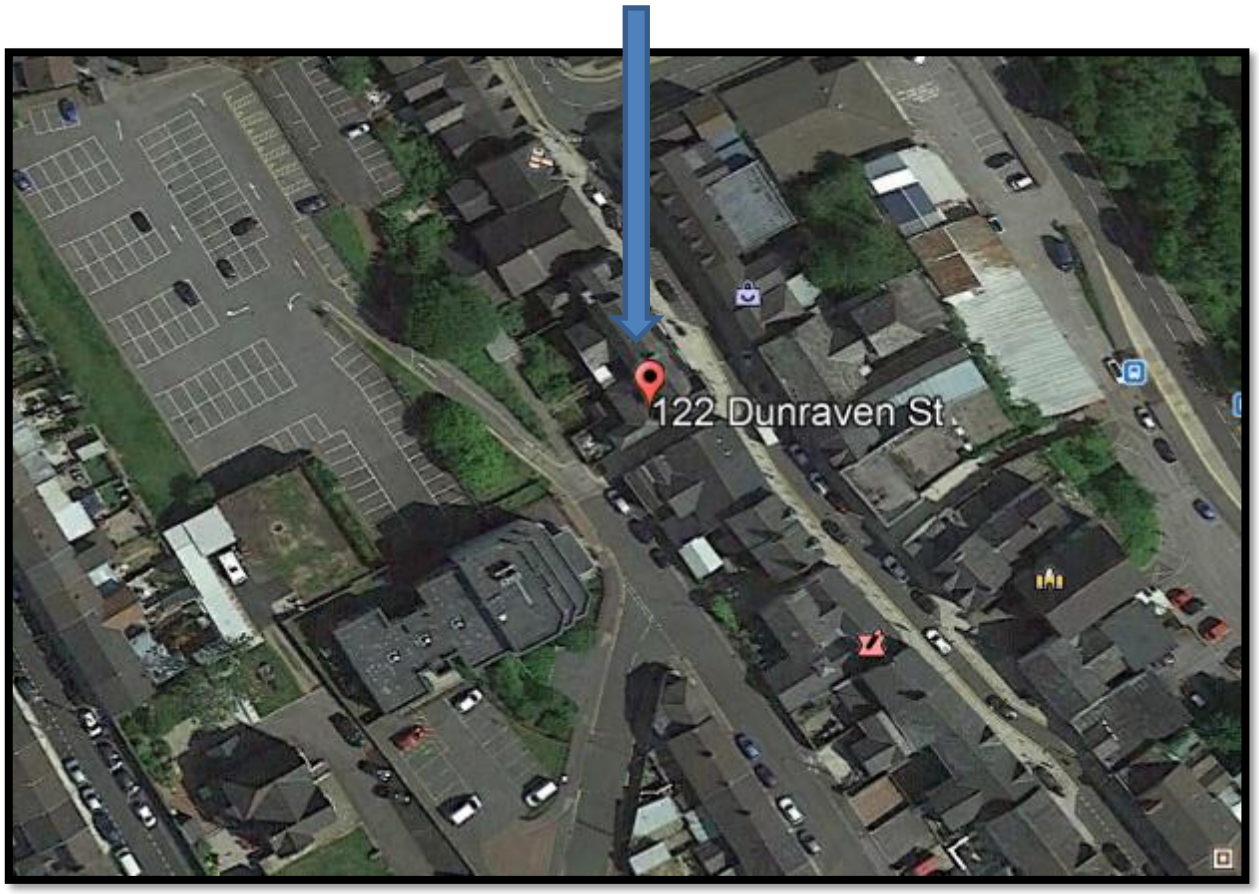
2.1 Site Location and Description

The site is located at 122-126 Dunraven Street, Tonypandy CF40 1QD, and comprises of two-

storey unoccupied split-level buildings with a car park to the north east.
The primary vehicular access entrance into the site will be off Dunraven Street.
The application site occupies a total area of approximately 0.74 hectares of developed land surrounded by well-established infrastructure and is centered on National Grid Reference Ref: SS99356 92518.
The site classification is previously developed land "*Brownfield "*
The candidate site is a parcel of developed land averaging 133.4 m AOD. A review of the available data indicates that the existing properties are served by a drainage connection and the to the main public sewerage asset, (*Dwr Cymru Welsh Water*) located in Dunraven Street. There is also a series of manholes and connecting pipes located within the site demise and routed under the existing buildings which will requires formal abandonment post demolition. The drainage design can take benefit from existing connection located in Dunraven Street.

The site location is indicated in ***Figure 1.***

The Site



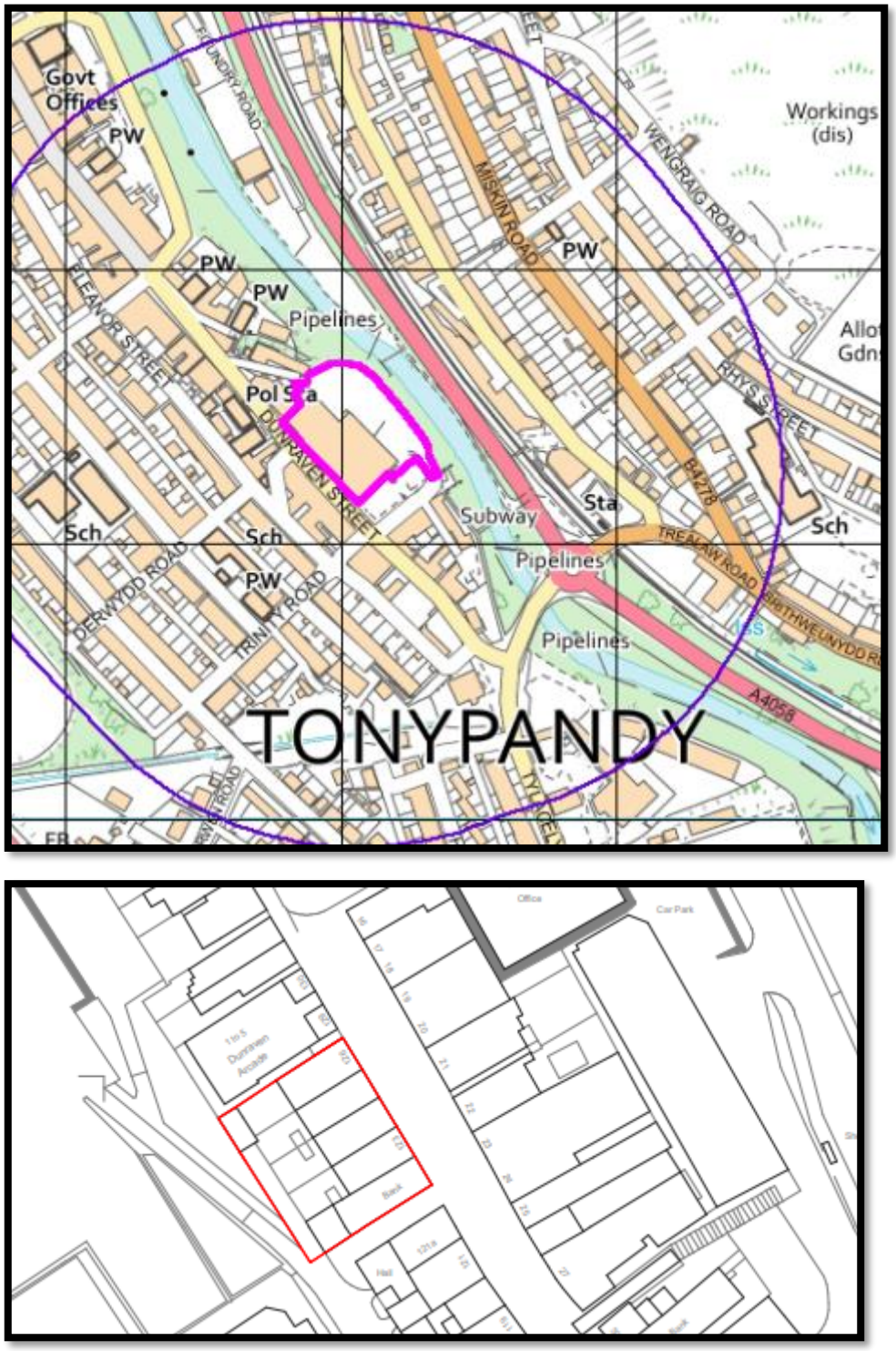


Figure 1 – Site Location

2.2 Site Proposals

The development proposals are to demolish the existing buildings that is currently unsafe and in a state of disrepair, the demolition will clear the site and make way for a purely residential led scheme with set-back frontages the Dunraven Street. The proposal is the and construction of 13 No residential apartments (11no- 1 beds and 2no -2beds) over 4 floors.

3.0 Existing Site

3.1 Topography

The candidate site is a parcel of developed land (*Brownfield*) which is a rectangular shaped in plan measuring approximately 0.08 ha and the topography of the site is fairly flat with the existing building *footprint* averaging 137.00 m AOD. It is presently a neglected 4 storey building with former retail use on the ground floor. The site is located in the semi-pedestrianised high street of Tonypandy.

3.2 Geology

A review of geological information provided online by the British Geological Society (BGS) ***Figure 3*** indicates that the site is underlain by Alluvium clay, silt, sand and gravel.Glaciofluvail deposits,Devansion sand and gravel superficial deposits.

A Consulting Geotechnical will be commission post demolition, by the developer/ planning applicant to undertake a Geotechnical and Geo-Environmental Assessment and percolation testing investigation of the site to assess the ground conditions in respect of the potential infiltration characteristics for soakaway drainage. The infiltration test results will show the viability of infiltration as a surface water destination in the from the trail pit to calculate a soil infiltration rate in accordance with BRE 365(2016).

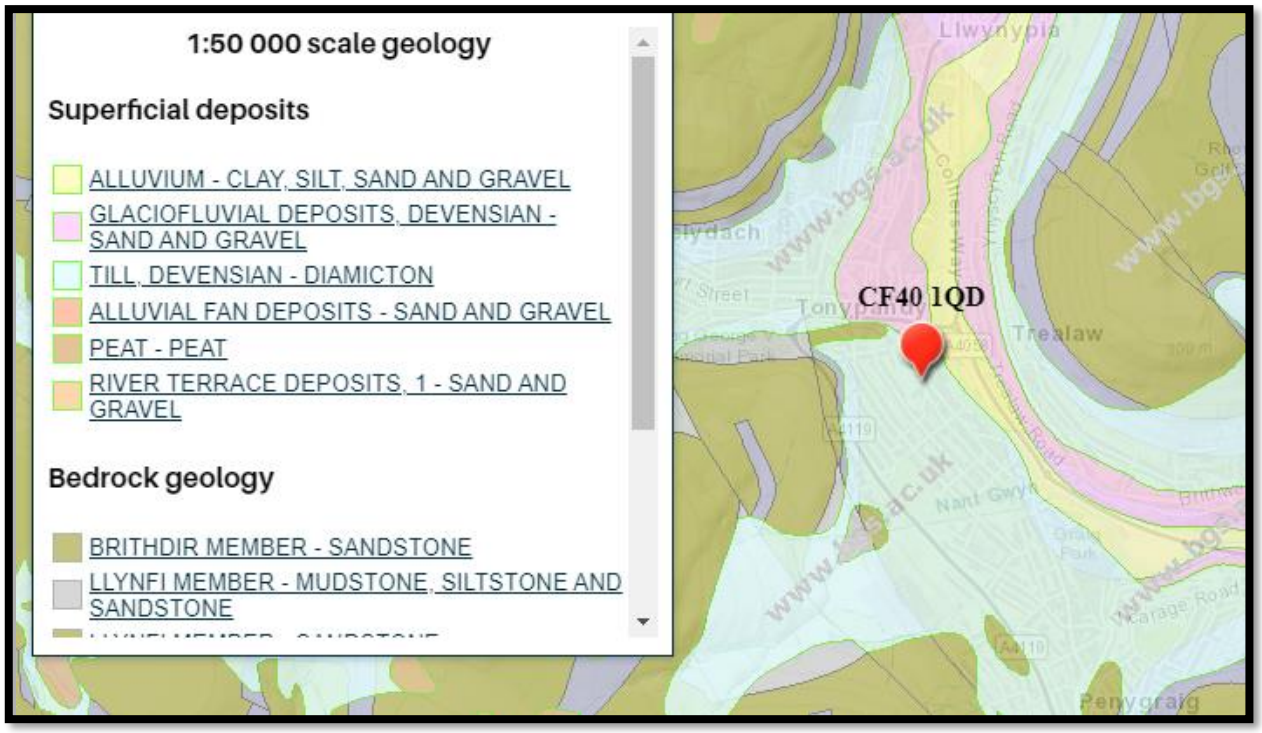


Figure 3: BGS Extract

3.3 Watercourses and Hydrology

Pluvial surface water unfettered run-off from the site currently discharges by means of a positive below ground piped into the public sewerage system.

3.4 Infiltration to Groundwater

As identified in Section 3.2, the underlying ground conditions on site percolation testing will be undertaken to determine the site infiltration characteristics which will influence the design philosophy for the disposal of the surface water emanating from the

development proposals.

3.5 Public Sewers and Existing Drainage: DCWW Pre-Planning Enquiry

Asset records have been obtained from Dwr Cymru Welsh Water (DCWW) which indicates outside the site demise there is an existing drainage system which serves the existing buildings. Routed under the existing building is a combined sewer network which will require formal closure and abandonment in order to realise the development expectations. A formal application under the provision a S185 WIA 91 has been submitted to DCWW.

3.6 Sewage Treatment

DCWW also confirmed that the development would overload the Wastewater Treatment Works WwTW

3.7 Water Supply

- DCWW have no objections to the proposals, and it is understood that a water supply can be made available to service the proposed development. The cost of providing a new on-site watermains will be calculated on receipt of detailed site layout by DCWW.
- Water supply requirement will be determined by the project Services Engineer.

4.0 Legislation

4.1 Environment (Wales) Act (2016)

This Act provides the legislation needed to plan and manage Wales' natural resources in a more proactive and sustainable way. The key parts of the Act relating to flood and water management are:

- Part 1 – sustainable management of natural resources.

- Part 7 – flood and coastal erosion committee and land drainage (clarifies the law for other environmental regulatory regimes including flood risk management and land drainage).

4.2 Wales Spatial Plan (2008)

The Wales Spatial Plan (Ref. 8-13) is a framework for ensuring that the development of places and the delivery of services work together at a local, regional, and national level to improve the lives and prosperity of the citizens of Wales. It ensures the principles of sustainable development are fully embedded in future design with flood risk a recognised area of concern which needs to be addressed going forward.

The Planning Directorate has begun work on the National Development Framework (NDF) (Ref. 8-14) which will set out a 20-year land use framework for Wales and will replace the current Wales Spatial Plan. This document will set out where nationally important growth and infrastructure is needed and will provide direction for Strategic and Local Development Plans.

4.3 Planning Policy Wales (Edition 10, 2018)

Planning Policy Wales (PPW) (Ref. 8-15), which is supplemented by a series of Technical Advice

Notes (TAN), sets out the land use planning policies for the Welsh Government. The PPW and TANs comprise national planning policy which should be considered in preparation of development plans. Meeting the Welsh Government's objective for sustainable development requires action through the planning system to move away from flood defense and towards a more positive avoidance of development in high-risk areas. Local planning authorities should consult with other authorities and NRW to ensure that, as well as not being at risk itself, the development does not increase the risk of flooding elsewhere.

4.4 TAN 15: Development and Flood Risk (2004)

TAN 15 provides guidance which supplements the policy set out in Planning Policy Wales in relation to development and flooding. It provides advice on matters including the use of DAMs to determine flood risk issues, how to assess the flooding consequences of proposed development and action that can be taken through development plans and development control (management) procedures to mitigate flood risk when planning for new development. This document is discussed in more detail within the site-specific Flood Consequence Assessment that accompanies the proposed development.

4.5 The Flood and Water Management Act (2010)

The Flood and Water Management Act takes forward some of the proposals from three previous strategy documents published by the UK Government - Future Water (2008), Making Space for Water (2008) and the UK Government's response to Sir Michael Pitt's Review of the summer 2007 floods.

In doing so, it gives the NRW a strategic overview role for flood risk and gives local authorities responsibility for preparing and putting in place strategies for managing flood risk from groundwater, surface water and ordinary watercourses in their areas.

Under Schedule 3 of the Flood and Water Management Act, Lead Local Flood Authorities (LLFAs) were to be required to establish SuDS Approval Bodies (SAB) which would have required Powys CC to approve and adopt SuDS for new developments. In December 2014, the Government announced that Schedule 3 would not be enacted, and SuDS would be dealt with by strengthening existing planning policy instead. This change, which took effect on April 6th, 2015, requires local planning authorities to ensure that SuDS are included on new developments.

On 7th January 2019, the Welsh Government enacted (Schedule 3 Sustainable Drainage) of the Flood and Water Management Act 2010. SUDs Approval Bodies (SABs) were set up to approve and adopt sustainable drainage systems. All planning applications submitted after 7th January 2019 must adhere to the requirements of this legislation.

4.6 Local Flood Risk Management Strategy

Under the Flood and Water Management Act, a duty has been placed on RCTCBC to develop and maintain a Local Flood Risk Management Strategy (LFRMS). The strategy gives a clear vision on how flood risk will be managed in the authority's boundary and deals with only local flood risk which is defined in the act as being from:

- Surface water runoff

- Groundwater
- Ordinary watercourses (Main River flooding remains the responsibility of NRW)

4.7 Statutory Standards for Sustainable Drainage–2018

As a requirement of the Flood and Water Management Act, the Government must publish Statutory Standards and consult on them prior to publication. These standards address the design, construction, maintenance, and operation of drainage systems. The Statutory Standards for sustainable drainage consultation came into effect on 7th January 2019, requiring all new developments to included Sustainable Drainage Systems (SuDS) features that comply with the national standards. These covers:
The runoff destination – with the public sewer as the last resort for the receiving system

- The peak rate of runoff.
- The volume of runoff.
- The visibility, adaptability and biodiversity of SuDS feature.
- The water quality treatment.

4.8 BS 8533: Assessing and managing flood risk in development – Code of practice.

The British Standard 8533 (BS8533) has been published by the British Standards Institution (BSI) in October 2011. This aims to provide further details, guidance and recommendations to the developers, planning authorities and flood risk managers in order to consider and identify the flood risk from all the potential sources of flooding and how to avoid, reduce and mitigate their likely impact in new or existing developments.

4.9 The SuDS Manual (2015) CIRIA C753

RCTCBC are now the statutory consultee for major developments which have surface water implications. This new responsibility will require LLFAs to provide comments in relation to surface water drainage aspects of planning applications within 21 days.

The latest guidance on the use of SuDS is provided in 'The SuDS Manual' by CIRIA (ref: C753, London 2015). The SuDS Manual states that.

"The philosophy of sustainable drainage systems is about maximising the benefits and minimising the negative impacts of surface water runoff from developed areas.

The SuDS approach involves slowing down and reducing the quantity of surface water runoff from a developed area to manage downstream flood risk and reducing the risk of that runoff causing pollution. This is achieved by harvesting, infiltrating, slowing, storing, conveying, and treating runoff on site and, where possible, on the surface rather than underground. Water then becomes a much more visible and tangible part of the built environment, which can be enjoyed by everyone".

4.10 Sewers for Adoption 7th Edition

Sewers for Adoption is the standard in England and Wales for the design and construction of sewers to adoptable standards. It is a guide to assist developers in preparing their submission to a Sewerage Undertaker prior to entering an Adoption Agreement under Section 104 of the Water Industry Act 1991.
Dwr Cymru Welsh Water also publish supplementary guidance to Sewers for Adoption to define their specific requirements, where appropriate.

5.0 Sustainable Drainage Systems (SuDS) Compliance

5.1 SuDS Objectives.

Powys CC Land Drainage have confirmed in an email dated 7th October 2020 that the proposed development will require SAB approval prior to any construction works commencing onsite.
Therefore a surface water drainage systems will be developed in line with the ideals of sustainable development are collectively referred to as Sustainable Drainage System (SuDS). These systems are designed both to manage the environmental risks resulting from urban runoff and to contribute wherever possible to environmental enhancement. It is proposed that SuDS techniques are utilised wherever possible to manage surface water runoff from the development. The following paragraphs describe how SuDS could be incorporated into the development proposals.

SuDS objectives are to minimise the adverse effects from the development on the quantity and quality of the runoff and maximise amenity and biodiversity opportunities." (CIRIA C753, 2015).

A strong design theme is essential if the maximum aesthetic benefits are to be gained from the SuDS approach. At a more local scale the SuDS should link with the individual plots' structure, planting, public open space requirements and amenity areas, gaining multiple benefits from a limited area of land. Multi-user green corridors could provide a linking theme through the area.

Enough space must be allowed for the SuDS features to appear as natural features and not be constrained by the development into inadequate, unattractive areas. Working with nature can ensure that SuDS are in keeping with their setting, minimising management requirements and costs.

The following reference guides will be reviewed and utilised, as appropriate, during the SuDS features design procedure.

- Planning for SuDS – making it happen (CIRIA C687)
- Site handbook for the construction of SUDS (CIRIA C698, 2007)
- Designing for exceedance in urban drainage: Good practice (CIRIA C635, 2006)
- Flood Risks to People, Defra /Environment Agency 2006
- The GRO Green Roof Guide
- Health and Safety Principles for SuDS (CIRIA RP992/17)

5.2 The SuDS Management Train

The drainage design within the development, will comply with the four pillars of SUDS: Water

Quality, Water Quantity, Amenity and Biodiversity.

The 'management train approach' should be central to the surface water drainage strategy for the proposed site. The main objective is treatment and control of runoff as near to the source as possible protecting downstream habitats and further enhancing the amenity value of the site. This concept uses a hierarchy of drainage techniques to incrementally reduce pollution, flow rates and volumes of stormwater discharge from the site, and is as follows:

Prevention - the use of good site design and housekeeping measures to prevent runoff and pollution and includes the use of rainwater reuse/harvesting.
Source Controls - control of runoff at source or as close to source as possible (e.g., soakaways, green roofs, pervious pavements)
Site Control - management of water in a local area and can include below ground storage/attenuation, detention basins, large infiltration devices.
Regional Control - management of water from a site or various sites and can include wetlands and balancing ponds.

SuDS Management Train.

5.3 Building Regulation Hierarchy

In line with current best practice, priority consideration for means of surface water discharge should be given firstly to the use of infiltration. There are two factors determining whether infiltration can be utilised onsite.

The first is the geological constraints determined by the underlying geology. Percolation field testing to BRE 365 will be undertaken across the site in all external areas post demolition. The number of tests will be specified to determine the infiltration characteristics of the made ground at shallow level. The high density of tests is required because the characteristics and composition of made ground can vary due to the nature of its unknown source and soil type.

The second is the physical constraints determined by land use and the proposed masterplan. Building regulations requires a minimum 5m standoff distance of point source soakaway from any structure, building or public highway. The drainage strategy does not propose the use of point source soakaways where infiltration can be concentrated to one specific location, sometimes resulting in localised sub-flows. Instead, shallow infiltration via permeable surfaces mimics the principle of natural infiltration of previous undeveloped parts of the site, i.e., covered by grass and gravels.
The elimination of point source soakaways removes the risk of the possibility of localised sub-flows and mimics the natural infiltration of a pre-developed site.

5.4 S1: Surface Water Runoff Destination

In compliance with the Welsh Government publication "*Statutory standards for sustainable drainage (SuDS) in Wales-designing, constructing, operating and maintaining surface water drainage systems."*

Surface water runoff destination have been considered in order of Priority Level.

The following receptors will be considered for surface water runoff in order of preference.

1. Water collected for re-use.

2.Discharge by infiltration into ground: To be determined if a viable option by infiltration testing to BRE 365. However, a review of the BGS indicates that the use of traditional soakaways as a means of surface water disposal by point drainage soakaways to be is non-viable as a means of managing surface water runoff from the impermeable areasindicates that soakaways are an unlikely option

3. Discharge into open surface water body:

Exception Criteria

- ***The nearest water course is the River Rhondda located approximately 100m from the site.***
- ***The conveyancing route would involve crossing considerable infrastructure and a number of third-party land ownerships, and the Tonypandy high street, on the intervening land between the site and the watercourses including rights of access which would be difficult to resolve and overcome.***
- ***The use of a pumped discharge system would be significantly more expensive and by discharging to the lower priority would deliver the surface water more cost effectively.***

- ***A pump solution is not the appropriate solution to discharge surface water from the site.***

4. Discharge into surface water sewer, highway drain, or other drainage system

Exception Criteria.

- ***The DCWW sewer records indicate that there is a 300mm dia public surface water sewer is available and routed in Dunraven Street. No highway drain is available.***
- ***Making the connection would involve exaction and considerable disruption to the Tonypandy High Street and a possible pump solution within the building footprint.***
- ***Pumping requirements would involve the use of ongoing energy and maintenance requirements of pumping surface water and the risks associated with pump failure.***
- ***The need for pumping surface water is not the right solution for the site and is in direct contradiction to the principals of sustainability.***
- ***A surface water destination can be delivered more cost-effectively by moving to the lower priority level as the existing building has the benefit of an unfettered runoff discharge existing connection to the combined sewer.***

5. Discharge into combined sewer.

- ***The surface water runoff will be managed and reduced to a 72% betterment rate for the 1 in 100 yr. event + climate change at a rate of 3.5 l/sec, with new below ground drainage system.***
- ***Provision will be made for the removal of sediment and oils before connection into the sewer.***

By exploring the Surface Water destination in line with the SuDS Standards which are aimed at ensuring that the most effective drainage scheme is delivered with the most preferred levels of surface water destination will be determined.

Discharge to a foul drainage will not be permitted.

5.5 SuDS Site Constraints

Not all SuDS techniques are suitable for all sites; therefore, an assessment of the existing site

is required, so that the SuDS limitations can be determined. This assessment considers the following:

Land Use Characteristics: The proposed density and land use of the development will influence the SUDS selection.
Site Characteristics: Geological, groundwater and contamination characteristics could all affect the suitability of infiltration SUDS techniques.
Catchment Characteristics: The site is currently greenfield and the discharge rate from the redeveloped site will need to be limited.
Environmental and Amenity Performance: Factors including maintenance regime, cost, safety, and habitat creation need to be considered to influence the SUDS selection for the site.

5.6 SuDS Design Philosophy

The SuDS philosophy for the development site is adding value to engineering design through habitat enhancement, landscape design, provision of an amenity resource and promotion of source control techniques. Landscape and ecological issues, where appropriate, should be given equal priority to the engineering issues and at times may have higher priority in the sizing and detailing options.

The following design philosophy is proposed:

- ***Surface Water Treatment using the 'Management Train' approach to remove and isolate contamination at source and site control facilities prior to conveyance from the site.***
- ***A minimum of two levels of treatment are provided.***
- ***Integrate SuDS with landscape.***
- ***Restrict development runoff peak flow rates to equivalent pre-development rates.***
- ***Site control treatment using attenuation of storm runoff and providing conditions for settlement of suspended solids (detention).***
- ***Use 'soft engineering' techniques to limit the visual impact of the facilities.***
- ***Use of a SuDS component system for the conveyance for building surface water runoff to a number of SuDS components such as attenuation dry basin storage facility with a flow controls, swales, permeable paving, raingardens/bioretention areas for a part of the building catchment areas is the proposed SuDS solution. The SuDS components will provide some settling of pollutants with the potential for the detention basin to have a dual land use and an easily maintainable recreational facility.***
- ***Aim to limit, where possible, the impermeable fraction of development.***
- ***Provide overland exceedance flood routes for extreme events where possible.***
- ***Landscape consultant to provide a planting schedule, with the use specified native plants.***

The drainage techniques proposed for this site include prevention, source controls and site controls. The following SuDS strategy is proposed for the development and the techniques are discussed in further detail in ***Section 6.***

Section7 of this document demonstrates the integration of sustainable drainage into the scheme, identifying the multiple benefits in accordance with the SuDS principals of Water Quantity, Water Quality, Amenity and Biodiversity.

First Level of Treatment – Source Control

The main objective of source control is the treatment and control of runoff as near to source as possible.

Prevention in the form of good housekeeping measures can help minimise the contaminants that may wash into the drainage system and extend the life of the system. Permeable surfaces utilising partial infiltration are prime examples of source control. However, partial infiltration will be a feasible method of drainage that permeable car parking areas and the rain garden on this site due to the geology and the absence of ground contaminants.
The system of water management will in part be a **partial infiltration storage system** for areas of the high-level parking bays which will allow a proportion of the rainwater that exceeds the infiltration capacity of the upper mantle of sub-soils to be conveyed by a perforated pipe to the watercourse. Direct infiltration through the surface and into the underlying structural layer and infiltrating through the voids of the storage stone drainage blanket prior discharging into sub-soils with exceedance flow conveyed by perforated pipes within the stone reservoir to prevent a build-up of water above the subgrade and mitigate risk to soil stability with the ultimate discharge to the watercourse at a regulated flow rate.

Other innovative source control solutions may be considered where possible as part of the overall approach to the Management Train, such as rainwater gardens/ bioretention, normally dry detention basins. Water from roofs and hard standings can be piped directly to the rain garden/detention basin. Screens on downpipes and oil traps on gullies should be considered for filtering the roof debris and preventing oil entering the detention basin.

Suggested Source Control Techniques for Specific Site Conditions

Source control techniques could include bioretention, permeable/porous surfaces and green roofs. These provide a means of slowing the runoff rate and treatment of the surface water by filtration, settlement, and bio- degradation.

Typical examples of source control systems to be included within the permanent works are briefly described below. The effectiveness of the various systems is inherently vulnerable to inadequate design. Hence particular care should be taken during detailed design.

5.7 Bioretention

Bioretention areas, also referred to as bioretention filters or rain gardens, are surface runoff controls that capture and treat stormwater runoff from frequent rainfall events. Excess runoff from extreme events is passed forward to other drainage facilities. The surface runoff is treated using soils and vegetation in shallow basins or landscaped areas to remove pollutants. The filtered runoff is then collected and returned to the conveyance system. Part of the runoff volume will be removed through evaporation and plant transpiration. Suitable flow routes or overflows are required to convey water more than the design volumes to appropriate receiving drainage systems safely.

Due to their nature, bioretention areas will be integrated into external areas within the site and are suited to fitting around parking bays without excessive land-take, as illustrated in the images above. They allow small areas of landscaping to be incorporated into what could otherwise be

a hard-landscaped site.

5.8 Soakaways

Conventional soakaways as a viable option at the site as a method of surface water disposal is to be confirmed by future programmed field testing.

5.8 Pervious Pavements

To mitigate the impact of site urbanisation the surface water drainage system for the development will be designed based on the principles of ***CIRIA SuDS Manual C753***, and to achieve a restricted and managed permissible discharge rate attenuation storage will be required.

Pervious pavements provide a pavement suitable for pedestrian and/or vehicular traffic that allow rainwater to infiltrate through the surface and into the underlying layers, where water is temporarily stored before infiltration to the ground, reuse or release to a drainage system. If the permeability of the soil is insufficient to allow infiltration, or if there are contamination or shallow groundwater issues, a lined system would be required with eventual connection onto the drainage system.

Pervious pavements can be made of porous material or constructed as a permeable surface as described below:

Porous pavements infiltrate water across their entire surface material, e.g., reinforced grass or gravel surfaces, porous concrete, and porous asphalt.

Permeable pavements are formed of material that is itself impervious. However, the materials are laid to allow surface water to infiltrate through the joints or voids between the blocks into the underlying pavement structure, intercepting surface water runoff and providing a pollutant treatment medium prior to discharge to the downstream system. Treatment processes that occur within the surface structure, the subsurface matrix and the geotextile layers include filtration, adsorption, biodegradation, and sedimentation.

The general hydraulic design will comply with the ***CIRIA SuDS Manual 2015, Section 20*** with a factor of safety of 10 applied to the permeable paving to allow for future reduction in performance. With a 10% allowance in the design for urban creep.

Typical Details of Permeable Paving

The use of pervious surfacing with full or partial infiltration within the site will be considered for the high-level parking bays serving the development.

5.10 Green Roofs

The use of a green roof has been considered and discounted for the main buildings due the structural implications and the imposed load on the buildings.

5.11 Rainwater Harvesting

The use of a proprietary rainwater harvesting system has been considered for each of the respective development plots and disconnected due to the disadvantage of capital cost/installation and maintenance requirement that a specialist system would impose on the home owners and in addition following reasons also have an influence on the level of service that could be expected from the provision of a RWH system,as there is no foreseeable demand for non- potable water within the development proposals. There is no foreseeable need to harvest water at the site as DCWW has not identified any potential stresses on the mains water supply.
The use of rainwater harvesting is not a cost-effective /viable option for managing surface water runoff in comparison to the water supply benefit by installing/maintaining such a system.

Indicative costs estimate for a capture-store-pump-use based on a 2,000 (2m3) litre tank serving the development (*Technical source University of Exeter/STW):*

- *Onsite installation costs (Inc of exaction/backfill, pipework electrical supply etc) =£1,300.00*
- *RWH system with a 2m3 tank delivered to site =£2,500-£3,000.00*

Capital Costs per system circa =£4,000.00 x 3 to serve each building =£12k

Average water potable/domestic consumption/ day = 197m3/annum
DCWW Standard volumetric measured rate /m3=£1.36/m3

Typical water bill /annum=£1.36 x 197m3 =£268.00

House with RWH system would provide a 25% reduction on water demand:
£268.00x25 %=£200.00/annum
Therefore a 25% saving set against the capital investment cost would result in a 58-year break even recovery of costs.

The obligation to provide such a system is not a mandatory requirement in so far as reuse/recycling has been given due consideration.

5.12 Water Butts

Water butts can be provided by the simple water conservation /rainwater harvesting technique of an off the self-water butt which will collect the roof water runoff from the rear of the property (min size 0.5 m3) and when full the overflow arrangement will convey excess water away from the building in an erosion constructed half channel arrangement to the rain garden.
Water butts can be provided as a simple water conservation technique, and although they are not generally designed to in terms of storm water management that can contribute to sustainable water management.

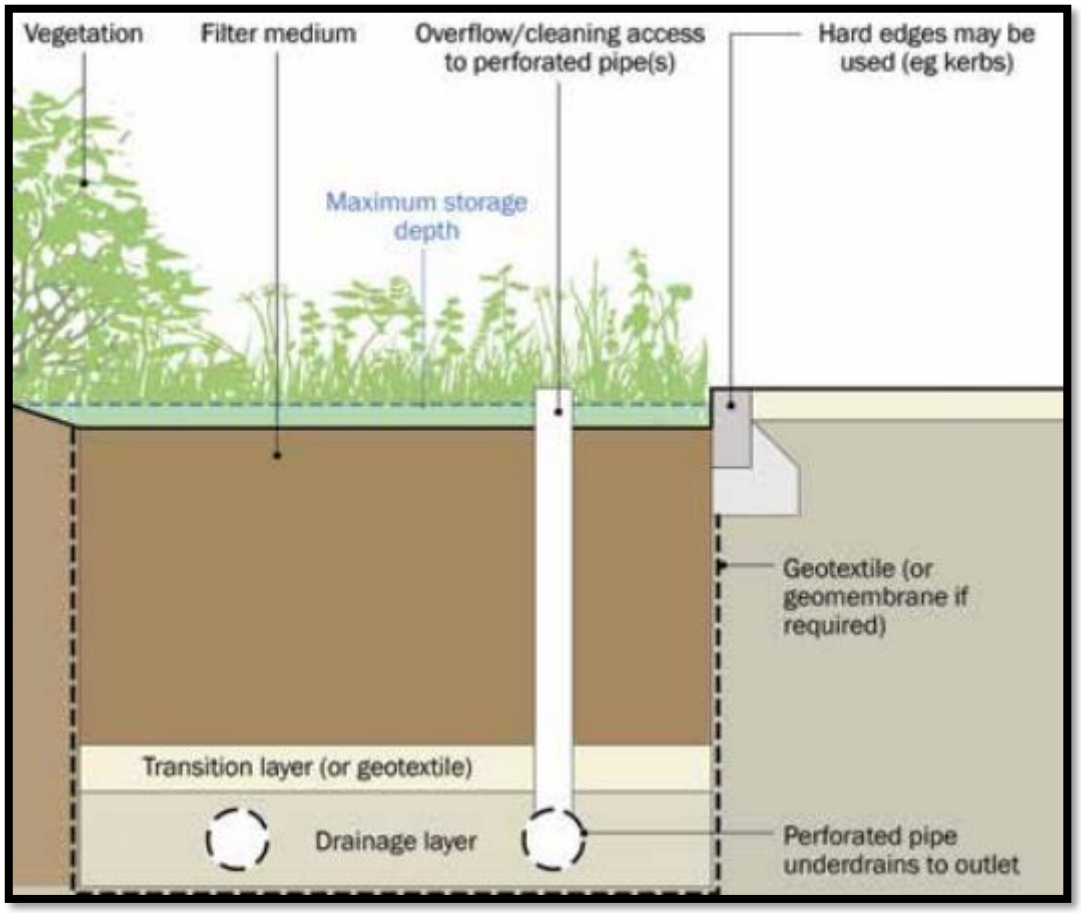
5.13 Rain Gardens/Raised Planters

The potential for surface water runoff capture and serve part the roof area of the building with a collection system , which would route the water of a rain garden, which in simple terms will be a specified layers of compost/sand amended free draining soil which will have a simple inflow where the rainwater enters the planter and have a maximum depth of standing water of 100mm with a simple underdrain/overflow to direct the exceedance to a downstream carrier pipe component to the surface water drain. The sizing of the rain garden will be approximately 20% of the roof contributing catchment area.

There will need to be a mechanism to ensure that the property owners carry out the necessary maintenance of the rain garden in order that they continue to function as part of the SuDS drainage which will be provided as a separate stand-alone document for the developer or the appointed management agents in an O/M pack. For guidance of planting suggestion.

Rain Garden Construction (Based on a 1m wide RG)	Volume of specified Material M3	Volume /m run
100mm of open surface storage zone	*0.10*	*0.268m3*
50mm of 2-6.3 granite grit	*0.015*	
500mm of topsoil	*0.017*	
100mm of 2-6.3 granite grit	*0.03*	
300mmof 4/20 stone with 100mm dia perf pipe	*0.045*	

Rain Garden Ref No (Ref Drg No:10700-501	Size	Volume m3
Typical RG Volume	*2.0m x1.0mx1.05 m deep*	*0.54*



Typical Rain Garden Detail

Typical Raised Planter Detail

Second Level of treatment – Site Control

Site control features such as detention basins and swales can be designed to attenuate storm runoff and provide conditions for settlement of suspended solids. The use of these types of attenuation within the development is proposed for some areas of the site where there is enough land available to provide this large feature.

5.14 Detention Basins

A detention basin will collect surface water runoff from part of the site. This SuDS

component will be a dry feature which can fill during significant storm events and then empty over time. Basins can also be mixed, including both a permanently wet area for wildlife or treatment of the runoff and an area that is usually dry to cater for flood attenuation.

The detention Basin will offer the opportunity for the landscape design.

Detention basins will attenuate flows from site by use of complex flow controls situated downstream of the basin.

5.15 Swale

The use of swales will be considered and possibly discounted due to the site constraints and land take.

6.0 S2: Surface Water Runoff Control and Drainage Strategy

The surface water from the development will be collected within the site and discharged using SuDS features to ground and the newly formed perimeter ditch. Where discharge to ditches is proposed, enhancement works may be necessary to ensure the appropriate capacity of the system can be achieved within the landscape proposals.

The objectives of sustainable drainage systems are threefold:

- To limit the peak run-off rate to that of the greenfield condition.
- To limit the volume of run-off to that of the greenfield condition.
- To maintain the quality of the surface water which is discharged to that of the greenfield condition.

The proposed drainage strategy is subject to liaison and approval with RCTCBC SAB.

6.1 Peak Run-off Flow Rate

In accordance with best practice CIRIA C753: Chapter 24, the rate of run-off for the developed site should be no greater than the estimated peak runoff rate and runoff volumes from the site in its greenfield state. The approach for estimating runoff rates and volumes from the proposed impermeable catchment areas will calculated using the FEH ReFH2 method. This method allows estimation of the amount of runoff likely to be generated from the development proposals from a range of storm returns.

An assessment of the site will be completed through sub-division of the site to smaller development parcels linked to the likely phasing of the scheme.

The calculation will include for the anticipated impermeable development area based on an initial estimated impermeable development for the residential catchment areas with a 10% allowance for urban creep.

6.2 Three Annual Rainfall Probabilities (*merit specific consideration: 100%, 3.33% and 1%)*

The **100% annual probability** (once in one-year event) is the highest probability event to be specifically considered to ensure that the flows to the ordinary watercourse are tightly controlled for these frequent events.

The **3.33% annual probability** (1 in 30-year event) is of importance because of the linkage with the level of service requirements of Sewers for Adoption that requires surface water sewers can convey this storm event within the drainage network without causing flooding to any part of the site.

The **1% annual probability** (1 in 100-year event) has been selected since it represents the boundary between high and medium risk of fluvial flooding defined in TAN 15 and recognises it is not practicable to fully limit flows for the most extreme storm events. Also, during storm events of this magnitude, the capacity of the surface water drainage system may be inadequate, however the. floor levels of the proposed buildings will be flood free.

Flood flows up to 1% annual probability are contained within the site and will have little material impact in terms of nuisance and damage. Overland flood flows within the site have been assessed for the short high intensity rainfall events of between 15 mins and 1-hour duration.

6.3 Surface Water Drainage Strategy

As part of the new drainage strategy, the following is proposed:

- The system is designed not to flood any part of the site in a 1:100+cc year return period design storm.
- The development drainage system will be a non-infiltration system with a few SuDS components within the development demise.
- **During the detailed design process**, the proposed network will be simulated by the industry standard drainage design computer software, analysing each drainage component on an individual basis for all storm durations between 15 and 1440 mins (1 day)

Assumptions:
- Design Criteria site with average ground slope less than 1%
- Global time of entry 5 mins
- Minimum velocity 0.75m/sec
- All roof areas and hardscaping to be 100%impermeabilty.
- Hydraulic pipe roughness 0.6 Ks.

Part H of the Building Regulations and current best practice requires a sequential approach for the disposal of surface water and requires the first choice of surface water disposal to be discharge to infiltration systems where practicable.

The drainage strategy for the development will therefore seek to limit flow rates to those calculated above to minimise the impact on peak flows during storm events. As such, it will be necessary to provide attenuation within the site drainage systems to accommodate the increased run-off from the development.

An assessment of the site has been completed through sub-division of the site to smaller development parcels linked to the likely phasing of the scheme.

The calculation has been completed for the anticipated impermeable development area based on an initial estimated impermeable development for the residential catchment areas with a 10% allowance for urban creep.

Runoff Pre-development impermeable =0.08 ha of which 100% is hard area
Area =0.08ha x 0.014= 11 l/sec

Existing surface water runoff from the site 11 l/sec
Discharging into the combined sewer routed in Dunraven Street

Runoff Post -development:
Post Developed flow with a 72% Betterment= 3.5 l/sec
The post development discharge from the site represents a Betterment of approx. 72% (*In accordance with best practice and the* Welsh Government Publication Titled:" S*tatutory standards for sustainable drainage (SUDs) in Wales -designing, constructing, operating and maintaining surface water drainage*" systems: *G2:23 and G2:24. Runoff rate* for *previously developed sites should replicate the predeveloped site (Greenfield) or* ***at least a 30% betterment*** *should be considered as an absolute minimum from the runoff rate from the previously developed site contributing catchment area).*

6.4 Volumetric Run-off

Wherever possible, the volumes of run-off should also be assessed and maintained at existing equivalent rates where possible.

The volume comparison is generally made for a 1 in 100-year storm of 6 hours duration; this storm has been assessed as having the most severe effect on downstream watercourses. Given the increased impermeable area associated with the proposed development, this volume will increase for the same storm in the post-developed condition.

Given the topography of the site, it will not be possible to provide separate attenuation for long-term storage within the site boundary. Therefore, the drainage system will be designed to provide enough attenuation to limit flows to the equivalent of Q_{Bar} for all storm return periods. The use of Sustainable Drainage Systems (SuDS) is which could include features such as Biorientation areas or permeable pavements to provide treatment and attenuation of peak flows to mimic the existing hydrological regime. The initial outline drainage strategy for the scheme subdivides the overall site into smaller catchment areas to suit the phasing plans which will be drained locally to features within each catchment area. In general, surface water in part will be collected via gravity systems with discharge to a detention basin and bioretention/rain garden area provided by a raised planter.

6.5 Initial Attenuation Sizing

The design intent will be to restrict flows from the individual catchments to the Q_{Bar} flow rate for all storms up to the 1 in 100-year return period, plus 40% allowance for climate change +UC to provide alleviation to existing off-site flooding. The underlying ground conditions are unlikely to allow for all run-off to be discharged via infiltration. As such, it is proposed to install liner to any of the basin area to allow water to dissipate naturally by evapotranspiration in addition to the regulated outflow.

Initial modelling of the site drainage has been undertaken within ***Micro Drainage*** to determine the runoff volumes required to achieve the discharge parameters. This has been based on controlling the flows from upstream catchment areas within the catchment boundary, with discharge being routed through SuDS drainage.

7.0 Site Specific SuDS Design Process

7.1 Site Description

Medium density residential development. The site will be developed with a surface water discharging via multiple SuDS components (rain gardens., porous surfaces, dry detention/bioretention basins. A strategic drainage system will collect runoff from the sites sub-catchments and local surfaces and convey by pipework to the RGs and detention basins storage for the site prior to discharging to the surface water sewer at a regulated flow rate. pipework to the surface water sewer.

7.2 Strategic Surface Water Management Objectives

Table 1: Strategic surface water management objectives.

Delivery Area	Strategic Objectives
Water resources	There are insufficient drivers for residential rainwater harvesting systems. The site is not in an area of water stress and there are no infiltration opportunities for much of the site.:
Flood risk	Rates and volumes of surface water discharge from the site to be controlled by a series of SuDs components 30% min less than the existing development (brownfield) values.
Water quality	The site will discharge surface water sewer into the SuDS attenuation system, rain gardens, porous surface bioretention areas and the appropriate treatment measures of surface water will be required and implemented with the permanent works.
Amenity.	For providing appropriate amenity value in the SuDS design, opportunities include: Planting features to the to the site's rain gardens and soft landscaping areas.
Habitat and the biodiversity	Due to the site constraints a limited site-specific biodiversity has identified the need within development proposals and the planting opportunity within the site demise associated with the SuDS components.
Climate resilience	The development is in a low-key suburban environment. Urban cooling is not a factor. However, water resources, flood risk, habitat and biodiversity of the development proposal will all contribute to climate resistance.
Approval/adoption	RCTCBC are the approving body for the surface water management system and will approve the scheme against the Welsh Government mandatory standards. The adoption of some of the system components is to be agreed in those areas of the development that are considered to the eligible for maintenance by the local authority. The site drainage within the development plot will be owned and maintained by the school or relevant management company and included within a property O & M manual.

7.3 Development characterisation outcomes

The proposed land use will form part of an existing building footprint with limited landscaping and given the limited opportunity and constraints of the development characteristics a bespoke site-specific surface water management system of integrated SuDS components.

Table 2: Site characterisation outcomes

Delivery Area	Strategic Objectives
Site topography	The areas of the site are described in Section 3.1
Potential for infiltration	Field testing will be undertaken by specialist geotech consultant to BRE 365
S.W. destination	To priority level 5 (combined sewer)
Site flood risk	There is no known existing groundwater, coastal/fluvial or pluvial flood risk adjacent to the site: ***Ref NRW DAMs***
Existing land use	Previously developed site- Brownfield classification.
Site infrastructure	The buildings will have a separate foul and surface water drainage system to a confluence manhole prior to connection to the manhole in Dunraven Street.
Existing Soils	The existing subsoil may be suitable for partial shallow Infiltration SuDS components, testing to confirm .
Biodiversity	The level of urbanisation with the site in a principally suburban zone has a low ecosystem/habitat.

7.4 SuDS delivery design criteria for the site

7.4.1 Water quantity

- The use of rainwater harvesting is an unlikely driver.
- Control peak runoff rates for the critical 1:100-year event (to meet the water quantity control standard) using appropriate sub-catchment and strategic system flow controls to include 40% climate chance urban creep has not been factored into the assessment as the developed are of the site has been maximised.
- Control runoff volumes from the site for an appropriate 1:100-year event (to meet water quality standards)
- Control peak runoff rates for the site for 1:1-year return period event (to meet water quantity standard)
- Deliver interception of all hard surfaces on the site (to meet water quantity standards)
- Ensure the SuDS components drain sufficiently quickly so that the system is prepared to manage further rainfall.
- Ensure that all surface water is retained within the SuDS components for events up to the critical 1:100-year event and contained within appropriate exceedance routes.

7.4.2 S3: Water quality

- Provide treatment of surface water runoff to meet the requirements of the water quality standards.
- Ensure that the impact of periodic extended wet and dry periods (potentially more likely under climate change condition scenarios) but would not invalidate the treatment performance.
- The use of drought tolerant grasses and shrubs in the rain garden/detention basin planting.

7.4.3 S4: Amenity

- The porous paving will provide amenity in the form of flexibly and the visual aspect of surface material.
- Integrate the high-level car parking area with the surface water management train.
- Use water to support the vegetation.
- Keep water on the surface where practicable.
- The porous paving will provide amenity in the form of flexibly and the visual aspect of surface material.
- The use of multiple SuDS components across the site some of which are linked in series. The system has been designed to keep the water as close to the surface as is possible to promote amenity benefit, with the use of smaller catchment distribution features.
- Surface water runoff from the buildings is conveyed to a series of strategically positioned Bio-retention landscaped areas which would provide an enhanced visual character and provide a specific amenity and aesthetic benefit to the property.
- in addition, the scheme will deliver interception and volume control via evapotranspiration, treatment, and a degree of biodiversity (Standard S6)

7.4.4 S5: Biodiversity

- Enhance planting areas with suitable and selected planting.
- The scheme makes best use of the site are having regard to the need to priorities' a compliant SuDS system.
- The bio-diversity benefits of the scheme have been created by a surface and visible with vegetative/biodiverse planting self-sustaining SuDS components position within the proposed development area.
- The precise landscaping form and planting in the rain gardens will be developed to meet the amenity and biodiversity objectives.

Water Quantity	Runoff collection standard downpipe to the raised planter. Interception: permeable paving and planter Storage: Detention basin (1:100+cc) Conveyance: pipework to SuDS components Exceedance: overland flow for events over and above the 100year +cc	Direct rainfall collection by detention basins /bioretention and raised planters. For small events less than 5mm would be lost through infiltration within the SuDS components through infiltration/evapotranspiration and runoff from these frequent small events for all surfaces will usually pass through the attenuation systems with limited mor no control. Storm events for 100 years + 40% attenuated in the detention basin, rain garden/porous surfacing and connecting pipes.
Water Quality	Discharge to surface water sewer Ground water protection measures	Priority Level 5 Low hazard indices with slit traps prior to discharge into attenuation basins.
Amenity	Green space to the building with the formation of rain gardens/dry detention basins.	
Biodiversity	Planting within the rain gardens/dry detention basin and tree planting will provide biodiversity	

7.4.5 Design Approach

The existing predeveloped site has a 0.08ha area of which 40% is undeveloped, and the standard is set for 1:1 year and 1:100 year +40%--- urban creep has not been factored as the developed are has been maximised.

As the candidate site is smaller the 50ha the approach and method used to calculate the pre-developed peak runoff rate (GFR) from the site is: **The ICP SuDS function in the *Micro Drainage* software**. This uses the IH Report 124 method for site up to 50ha, adjusted pro-rata by area for specific site (0.1ha) as recommended in Code of Practice for Sustainable Drainage Systems.

The hydrological characteristics for the Newport Region area

SAAR (mm)	***1500***
SOIL factor	***0.320***
Hydrometric Area	***9***

7.4.6. Permeable Pavement

Pavement design

- **Sub-base strength=Assume 5% CBR**
- **Loading capacity= C 5-1 Allow 1 large goods vehicle /week**
- **Construction thickness = 80mm block, 50mm bedding layer 2/6.3 aggregate,300 mm 4/20 stone aggregate drainage reservoir, 32% voids ratio.**

7.4. 7Interception Design

The proposed rain garden will be normally dry and will deliver interception because there is usually no runoff from them for most small rainfall events. Although there is no infiltration capacity apart from the natural imported or re- engineered soils which will have a water storage capacity and evapotranspiration assuming the rainfall is evenly distributed through the year, the effective monthly runoff contribution for 1 m² of paved area:

30-days x (1500mm/365 days) x 50% runoff = 62 mm

Based on the evaporative capacity of 1 m2 of vegetative surface for the peak summer months approximates to:

30 days x 3mm /day = 90 mm of effective rainfall

Therefore, the effective area for which interception can be delivered by 1 m2 of vegetation in a peak summer month is:
90/62 = 1.45 m2

8.0 Pollution Control /Water Treatment

The design of the drainage system will need to consider treatment of the surface water run-off to allow for removal of pollution from the flow prior to discharge from the site. The selection of separate stages of treatment will be necessary to ensure enough removal of pollutants based on the designation of the area being drained.

Initial capture of the run-off from impermeable areas is likely to be completed using bioretention within highway buildouts where acceptable.

The proposed surface water drainage system will improve the water quality from the development proposals, entering the public sewer. This will be done by using a treatment chain where each subsequent system within the proposed drainage network is treated to improve water quality.

Infiltration drainage methods are unsuitable for this development and therefore treatment of surface water prior to entering the SuDS components has been considered and that the use of the gullies and silt traps will provide a degree of treatment.

The surface water treatment stage will depend on the potential hazards on the site and the sensitivity of the receiving surface water drain to possible pollution.

SuDS Component Management Train Approach

Do the SuDS /Treatment Practices achieve the following water quality treatment processes.

SuDS/Treatment Practices	Pollution Prevention /Interception	Primary Treatment Process	Secondary Treatment Process	Tertiary Treatment Process
Permeable pavement/surface	Yes	Yes		
Infiltration systems	Yes	Yes	Yes	Yes
Green Roof	N/A	N/A		
Rainwater Harvesting System	N/A			
Filter Strips	N/A	N/A		
Swale	N/A	N/A	N/A	
Bioretention Surface	Yes	Yes	Yes	
Detention Basin	Yes	Yes	Yes	
Pond			N/A	
Wetland			N/A	N/As
Attenuation Storage	Yes			

Water Quality Standard

Land Use	Pollution Hazard Level	Water Quality Treatment for Discharges for Development *(CIRIAC753: Table 26.2)*
Residential Roofs	Very Low	TSS=0.2. Metals=0.2. Hydrocarbons 0.05
Hard standing Areas surrounding the buildings	Low	TSS=0.3. Metals=0.2. Hydrocarbons=0.005

SuDS Mitigation Indices for discharge to Groundwater *(CIRIA C753 Table 26.4)*

Characteristics of the material overlying the proposed partial infiltration surface through which the runoff percolates	TSS	Metals	Hydrocarbons
Constructed permeable paving (where a suitable filtration layer is included to provide treatment, including geotextile at the base separating the 4/20 granular stone reservoir from the subgrade) underlain by soil with good contaminant attenuation of at least 300mm deep	***0.5***	***0.5***	***0.6***

Bioretention (Raingarden) underlain by soil with good contaminant attenuation of at least 400 mm in depth	***0.8***	***0.8***	***0.8***

SuDS components for the management train for the development site exceeds the pollution hazard index.

Therefore, the SuDS mitigation indices for discharging to surface water within the management train will capture, convey and store surface water runoff while delivering interception and pollution risk management.

SuDS components for the management train for the development site exceeds the pollution hazard index**.**

Residential roof water is considered low risk and by discharging the roof water into the various SuDS components within the drainage system i.e., permeable paving, rain gardens filter trench will capture the pollutants provides further pollutant removal and treatment and a gradual improvement to the water quality entering the offsite system and is therefore deemed to be sufficient.

The various SuDS components within the drainage system will capture the pollutants for removal and treatment i.e., Rain Garden, catch pits /gullies.

9.0 Exceedance Flow

In line with the design criteria of dealing with exceedance flows the proposed building will not flood for storm events with a return period grater that 100 years plus climate change.

In accordance with best practice (CIRIA C635 Designing for Exceedance), flood waters from storm events that exceed the design storm of 100years +cc will be channelled toward highway curtilage adjacent to the site boundary. The proposed network modelling results based on the Simulation Criteria for a 100-year storm return period for a range of storm durations with the network at pipe full capacity, will indicate the points of storm water escape from the proposed drainage network.

The exceedance overland surface conveyance of the flood pathways (default pathways) is directed by design to effectively convey exceedance flow away from the buildings to areas in the development low spots where temporary storage can be incorporated.

The potential points of exceedance escape would be from the interaction between the major and minor drainage system which is as follows:

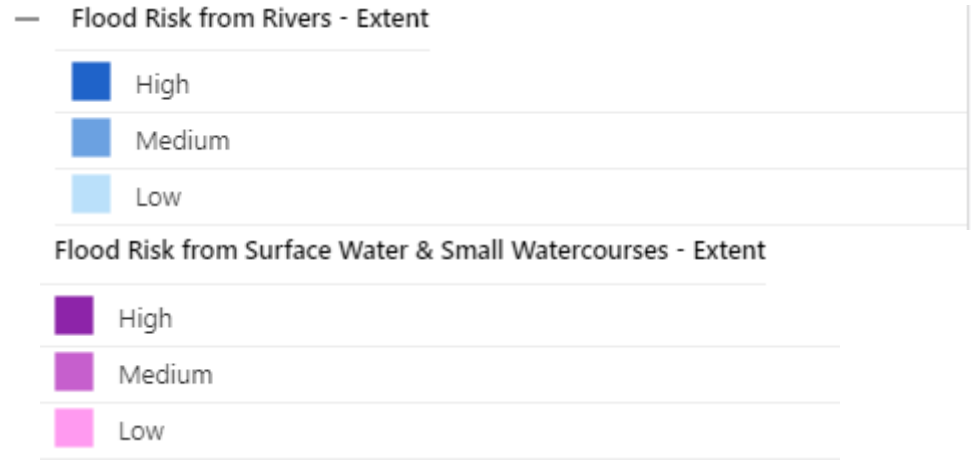
- Flooding from manholes and other connections to the minor drainage system due to blockage or other defects.
- Excess surface water runoff that cannot enter the system due to the limited capacity.
- Flooding caused by the high levels of surface water in the onsite/offsite sewer preventing the site from drainage.

10.0 Status of Ownership of SuDS Drainage System

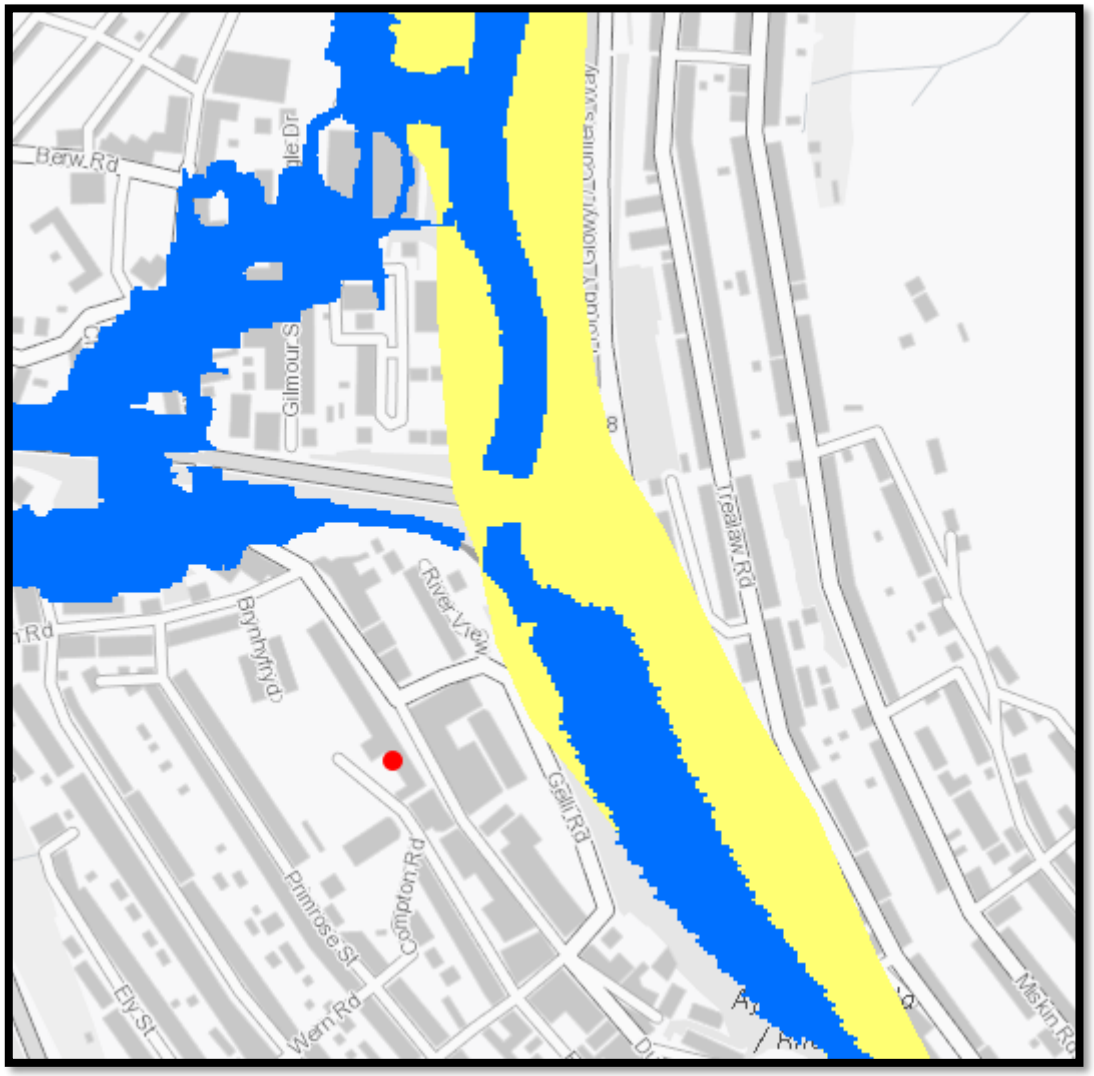
The Welsh Government Statutory Standards for SuDS places a duty on authorities to adopt SuDS features that serve more than one property, therefore the communal areas serving the development proposal including the estate road should it remain in private ownership will be eligible for a commuted sum arrangement and if in the future the road becomes a publicly maintained road then the relevant highway authority will be responsible for maintenance**.**

11.0 Flooding

The NRW Development Advice Map for the site indicate that site area is outside the C2 flood envelope, in an area of little to no flood risk**.**



Extract from NRW Development Advice Maps (DAMs)



12.0 Foul Water Drainage Strategy

12.1 Foul Drainage Principles

The foul water drainage system serving the development proposals with be offered for

adoption under Section 104 WIA 91
The proposed foul water layout serving the development expectations will be based on Sewers for Adoption 7TH Edition where the offsite gravity drain will be a demarcation chamber at the site boundary and will be offered for adoption under the provisions of a Section 104 Water Industry Act 1991 (WIA91).
The legal right of connection under a Section 106 of the WIA91 will not exist until a Section 104 Agreement is in place for the lateral drain.

"When drawing up sewerage proposals for any development, the first presumption must always be to provide a system of foul drainage discharging into a public sewer. This should be done in consultation with the Sewerage Undertaker of the area.

If, by taking into account the cost and/or practicability, it can be shown to the satisfaction of the local planning authority that connection to a public sewer is not feasible, a package sewage treatment plant incorporating a combination of treatment processes should be considered.

Only if it can be clearly demonstrated by the developer that the sewerage and sewage disposal methods are not feasible, considering cost and/or practicability, should a system incorporating septic tank(s) be considered and proposed if appropriate." (DETR Circular 03/99).

12.2 Public Sewers

The sewer records obtained from Dwr Cymru Welsh Water (DCWW) indicate the existing building is connected to the combined sewer in Dunraven Street. A copy of the sewer records is included within the **Appendix B.**

There are existing offsite DCWW sewerage assets available to support the development proposals.

12.3 Existing Site Dry Weather Flow Discharge Rate

There is a combined sewerage network serving the development, at the site boundary in Dunraven Street ,the new foul water drainage serving the development will communicate to the identified manhole and invert levels have been established by a specialist drainage survey company and a gravity system and connection is achivable.

12.4 Proposed Site Dry Weather Flow Discharge Rate

The new foul water system drainage will be designed in accordance Part H1 and H2 of the Building Regulations and BS EN 752:2008.
In the proposed scheme, no surface water drainage will be discharging into proposed foul water drainage system.
Two approaches have been considered to estimate the peak flow.

- A fixed 6 DWF multiple to BS EN 752-4 or
- Discharge Unit Method.

The choice of method used is the population method as the probability method to BSEN 752-4 will result in pipe sizes larger than DN 150mm e.g.
Calculate the design flow rate using the Discharge Unit Method, assuming frequency of use is ***kdu 0.5.***

The choice of method used is the population method as the probability method to BSEN 752-4 will result in pipe sizes larger than DN 150mm e.g.
Calculate the design flow rate using the Discharge Unit Method, assuming frequency of use is ***kdu 0.5.***

- *Discharge Unit for Appliances /dwelling= (1 no wc=5.7., 1no whb=0. 9, sink=1. 0.6. bath=1.3, washing m/c=0.6) =x 13 no apartments = 110 DU*

Q = 0.5 kdu √110 =5.2 l/sec therefore use water consumption/capita

The hydraulic design of the domestic water component generated by the development proposal has been based on the current code of practice produced by the British Water flows and loads-sizing criteria, treatment capacity for sewage treatment systems, which is based on the relationship between water usage and wastewater production. Adequate cover and protection will be provided to the proposed foul water drainage system.

The residential units with a peak flow multiple for sewage treatment plant of 6 DWF (Dry Weather Flow) and 10% infiltration based on 4000 litres per dwelling per day (based on 3 persons/dwelling 200 litres per head per day): 0.046 litres/second: ***Sewers for Adoption 7TH Edition B5.1***

Dwr Cymru Welsh Water wastewater profile assessment use the design figure per capita return to sewer flow of 180l/hd/day design standard.:0.042 l/sec**

Therefore, applying the same maxim to the proposed development

12.5 Design Flow Rates from Proposed Development

Category of Building: Residential House
Wastewater Flows based
Total Number of apartments
13 No residential dwellings @ 0.042/sec =0.55 l/sec.

Total daily flow = 47,174. litres per day

Therefore, the total daily foul water flow emanating from the building based on 90% of cold-water demand is:47,174 l/day x 0.90 =42,457 l/day (0.042 l/sec) ***This figure is a design peak flow rate and not an average water usage and represents the peak flow rate from a number of appliances.***

42,457 l/day total flow / 1000 = 42 cubic metres per day effluent discharge to public sewerage system

Design note:
Peak flow rate may also be determined by the application of a diurnal wastewater flow pattern resulting in a variable peak factor so that attenuation and diversification effects tend to reduce peak flow, and so the ratio of peak to average flow generally decreases from top to bottom of the new drainage network.

After site clearance, a new gravity drainage system serving the development proposals will be constructed. The design options for the proposed foul water layout serving the development expectations are as follows:

13.0 Conclusions & Recommendations

13.1 Surface Water

Details of the existing sewer network, and any other water bodies have been obtained.

A detailed surface water drainage scheme will be developed. Surface water discharge flows have been calculated based on the development proposals.
Discharge flows from the development will be limited to 72% betterment of the Brownfield discharge rate for the contributing area of the development proposals for all storms due to limited opportunities within the site to provide long term storage.

The scheme includes a SuDS management train approach including porous surfacing, partial infiltration, raingardens, landscaping/tree planting and bioretention basins.
A surface water drainage scheme will be developed in accordance with these principles of Statutory Standards for Sustainable Drainage (SNSSDS).

Foul Water

Details of the existing public sewer network have been obtained from Dwr Cymru Welsh Water.

The expected foul water discharge flows have been determined based on the development proposals.

Recommendations

This document should be reviewed and updated as the design develops.

A detailed Ground Investigation will be carried out to inform geological, hydrological, and ground conditions on the site.

Surface water discharge from the site should be limited to the permissible discharge rate of 3.5l/sec rate for all design storms pro-rata from the site.

The development of SuDS captures, and conveyance of flows should be developed in conjunction with the SAB in accordance with Schedule 3 of the Flood and Water Management Act.

The layout of the proposed development and the design of the new on-site surface water drainage system should allow for the excess runoff from an exceptionally intense local rainstorm to be confined for the duration of the storm within the site.

The detailed design of the on-site surface water drainage system should consider the possible effects of climate change on storm runoff over the next one hundred years.

14.0 S6: Surface Water Drainage Operation and Maintenance Strategy

The operation and maintenance of the approved SuDS system and the inspections and the maintenance required for the SuDS components within the system to function as designed in meeting the required performance levels will be detailed in a standalone document *Titled*: *Management and Maintenance Plan For Sustainable Drainage (SuDS*) which sets out that the homeowner is responsible for inspection and maintenance required during the establishment

of the vegetative components with the rain gardens and the long-term management of that vegetation, and all other SuDS components the surface water drainage system.

Conventional surface water drainage features such as gullies, channels, and manholes should be inspected as an absolute minimum annually, and where practicable after intense storm events, with silt remo

S1 -Surface Water Destination

The proposed SuDS features to the proposed building will discharge to a combination of partial infiltration through permeable paving, attenuation basins and rain garden and ultimately to a surface water drain: Priority Level 4.

S2 -Surface Water Runoff Hydraulic Control

Part 1 of this standard (interception) will be adequately dealt with by the proposed SuDS scheme as detention basin and rain gardens, are all interception mechanisms with assumed compliance.

S3 -Treatment

Given the low pollution hazard levels of the proposed development and the introduction of the SuDS components the water treatment is satisfied.

S4- Amenity

Given the nature of the site and the land use of the development expectations with the use of a management train providing pollution prevention, interception, and treatment the standard set out in Table G3:1 of S4 is deemed to be satisfied with the SAB National Standards

S5 -Biodiversity

Given the nature of the site and the land use of the development expectations the design of the surface water system has maximised the biodiversity benefits with the use of an improved local environment of planting within the rain gardens and the low-level planting to the building perimeter and the standard S5 is deemed to be satisfied with the SAB National Standards.

S6 -Design for Construction, operation, and maintenance.

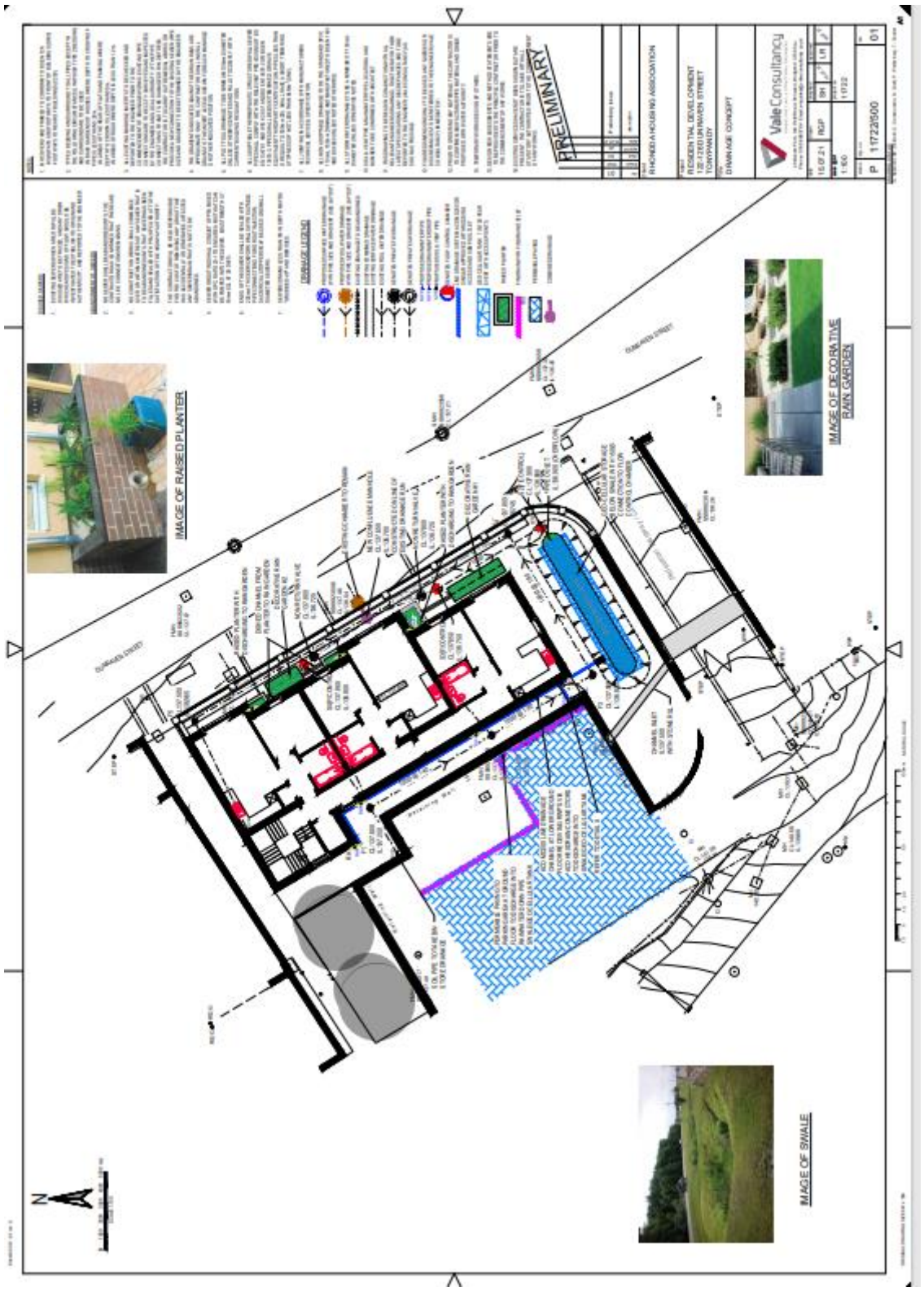
Maintenance plan for the proposed SuDS system is contained within a standalone document titled:" Management and Maintenance Plan". The maintenance and management of all the SuDS components applicable to the surface water drainage is contained within the referenced document.

Construction: ***It is anticipated the proposed development will be a D & B form of procurement for 3 no buildings with the sequence and timings for section of construction work forming part of the successful contractor overall construction programme, and given the nature of the construction project on a site with boundary constraints the position of a tower crane, site accommodation ,material lay -down areas and construction access and H+S Plan will be a primary consideration .As a consequences compliance with Standards S6 of the WGSNSSuDS should be developed by the contractor and therefore this SAB element can be conditioned under G6.3 and the condition to be satisfied prior to the commencement of construction work.***

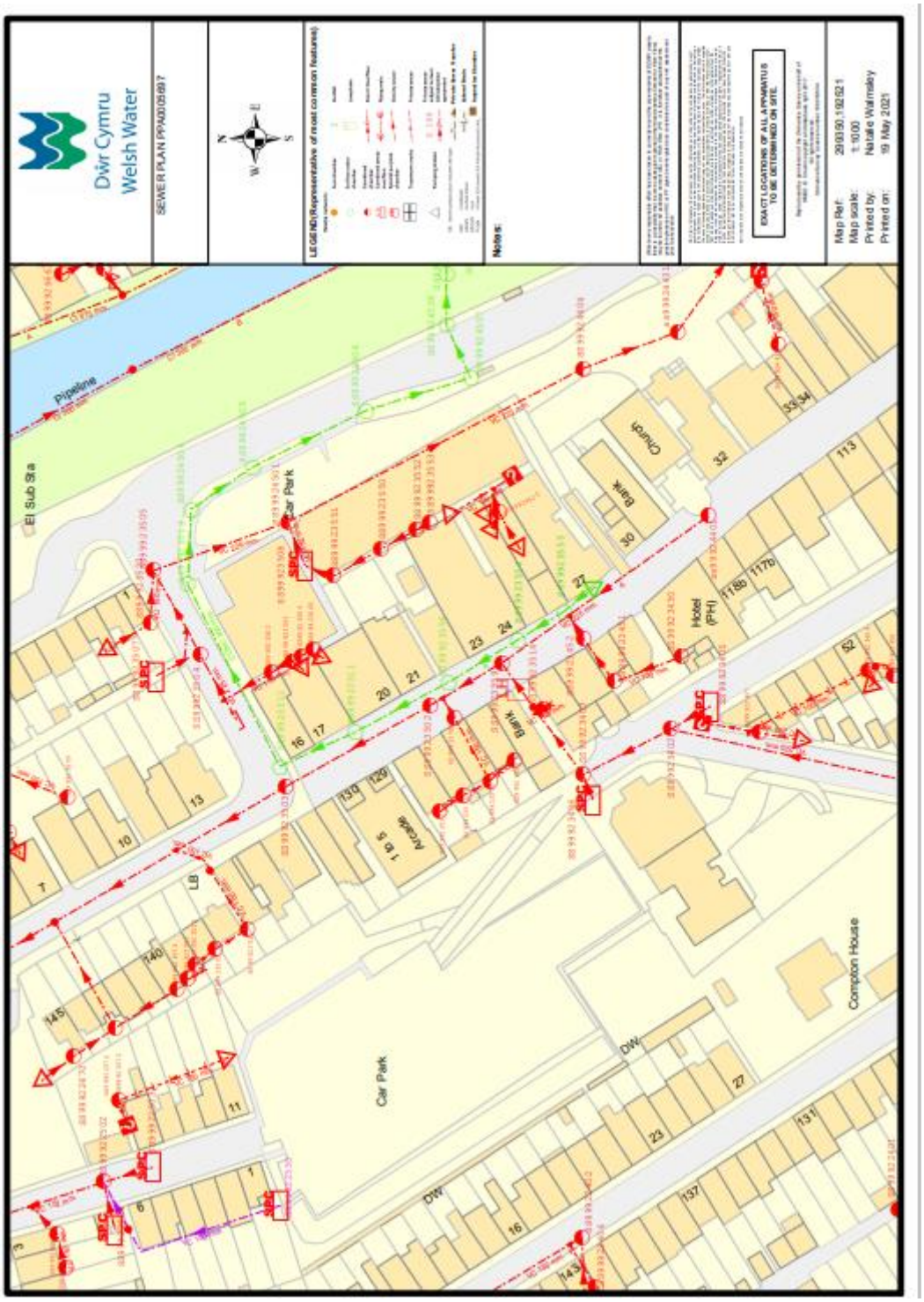
Note.

SAB site inspections will be taken as necessary during the SuDS construction, but the minimum inspections are identified within Appendix F.

Appendix A
Development Drainage Concept Plan



Appendix B
Dwr Cymru Welsh Water Sewer Records



DCWW Sewer Map Ref :299350 192521