EXPEDITE
ENGINEERING SERVICES

PBSA (SHEME) ROSEMARY STREET, CARDIFF

FLOOD CONSEQUENCE ASSESSMENT AND DRAINAGE STRATEGEY

ISSUE01

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PRELIMINARY ASSESSMENT

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Project	PBSA, Rosemary Street, Cardiff	**Project Ref:**	ES23.060
Client	CNM Estates		
Prepared by	SJC		
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Revision Log

Rev	Explanation	Date	Prepared by	Checked by
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1.0 INTRODUCTION

1.1 Expedite Engineering Services have been commissioned by CNM Estates (applicant) to prepare a Flood Consequence Assessment (FCA) to facilitate a full planning application for the proposed development. This FCA has been prepared in accordance with the requirements set out in the Planning Policy Wales Technical Advice Note 15 (TAN15).

1.2 This FCA is intended to support a full planning application and as such the level of detail included is commensurate and subject to the nature of the proposals

2.0 POLICY & GUIDANCE

2.1 Technical Advice Note 15 (TAN15), in conjunction with Planning Policy Wales (PPW) and any local planning documentation forms the basis for assessment of flood risk in Wales and its risk mitigation and development control. For an application to be acceptable, it must pass both a Flood Risk justification test and the assessment/acceptability of flooding consequences tests.

Flood Risk Justification Test

2.2 The Flood Risk justification test is undertaken against both the Development Advice Maps (DAM) and the Land Use Vulnerability Classification, provided within TAN15.

2.3 The DAM contains 3 zones – A, B and C subdivided into C1 and C2, summarised in Table 1.

Table 1: Development Advice Map Zone Classifications

Description of Zone	Zone	Use within the precautionary framework
Considered to be at little or no risk of fluvial or tidal/coastal flooding.	A	Used to indicate that justification test is not applicable and no need to consider flood risk further
Areas known to have been flooded in the past evidenced by sedimentary deposits	B	Used as part of a precautionary approach to indicate where site levels should be checked against the extreme (0.1%) flood level. If site levels are greater than the flood levels used to define adjacent extreme flood outline there is no need to consider flood risk further
Based on Environment Agency extreme flood outline, equal to or greater than 0.1% (river, tidal or coastal)	C	Used to indicate that flooding issues should be considered as an integral part of decision making by the application of the justification test including assessment of consequences
Areas of the floodplain which are developed and served by significant infrastructure, including flood defences	**C1**	**Used to indicate that development can take place subject to application of justification test, including acceptability of consequences.**
Areas of the floodplain without significant flood defence infrastructure.	C2	Used to indicate that only less vulnerable development should be considered subject to application of justification test, including acceptability of consequences. Emergency services and highly vulnerable development should not be considered.

2.4 Interrogation of the NRW DAM shows that the proposed site is within Zone C1. Therefore, the development will be subject to application of the justification test, including acceptability of consequences.

2.5 The land use vulnerability classifications are presented in Table 2

Table 2: TAN15 Vulnerability Classifications

Development Category	Type
Emergency services	hospitals, ambulance stations, fire stations, police stations, coastguard stations, command centres, emergency depots and buildings used to provide emergency shelter in time of flood
Highly vulnerable development	all residential premises (including hotels and caravan parks), public buildings (e.g. schools, libraries, leisure centres), especially vulnerable industrial development (e.g. power stations, chemical plants, incinerators), and waste disposal sites
Less vulnerable development	General industrial, employment, commercial and retail development, transport and utilities infrastructure, car parks, mineral extraction sites and associated processing facilities, excluding waste disposal sites

2.6 The proposed development is for the construction of a residential dwelling, this would be classed as Highly Vulnerable. This category of development is permitted in Flood Zone C1, subject to the application of the justification test, including acceptability of consequences.

Assessment/Acceptability of Flooding Consequences Test

2.7 The Flood Risk justification test is undertaken against both the Development Advice Maps (DAM) and the Land Use Vulnerability Classification, provided within TAN15.

2.8 If a development is to be located within Zone C1 or Zone C2, having passed the initial Flood Risk Justification Test, then an assessment of flooding consequences will be required. This assessment will assess all potential flood mechanisms which could impact the development and establish if the consequences of flooding can be managed appropriately for the type of development being proposed.

2.9 Appendix 1 of the TAN 15 provides the criteria which should be met by the Acceptability Test.

2.10 The criteria will be addressed within this report to show that the proposed development passes the Acceptability Test.

2.11 Any points where action is required by the developer should be completed by the site developer separately and may not be explicitly mentioned within this report.

Strategic Flood Consequence Assessment (SFCA)

2.12 A SFCA was published in 2009 and provides the evidence base for the Local Planning Authority Cardiff Council Local Plan and guidance for consideration when determining planning applications. The SFCA seeks to place new development into areas of lower flood risk taking into account current flood risk, future flood risk, and the effect a proposed development would have on the risk of flooding.

Flood Risk Management Plan

2.13 This Flood Risk Management Plan (FRMP) builds upon the Preliminary Flood Risk Assessment and Local Flood Risk Management Strategy. The FRMP gives a greater focus on the areas at risk of flooding and identifies measures to reduce that risk.

Local Flood Risk Management Strategy (LFRMS)

2.14 The Local Flood Risk Management Strategy was published in 2014 and sets out roles and responsibilities for flood risk management. It also assesses the risk of flooding in the area, where funding can be found to manage flood risk, Lead Local Flood Authority polices and objectives and actions to manage flood risk.

3.0 EXISTING SITE DETAILS

Site Location

3.1 The site is located off Rosemary Street within Capital Quarter, Bluetown. The approximate site co-ordinates are E319125, N176088 and National Grid ST 19125 76088, with the nearest post code CF10 4BA. The proposed development is for the construction of a 12 storey residential building.

3.2 The site is currently made up of a combination of grassland and hardstanding and is classified as a Brownfield.

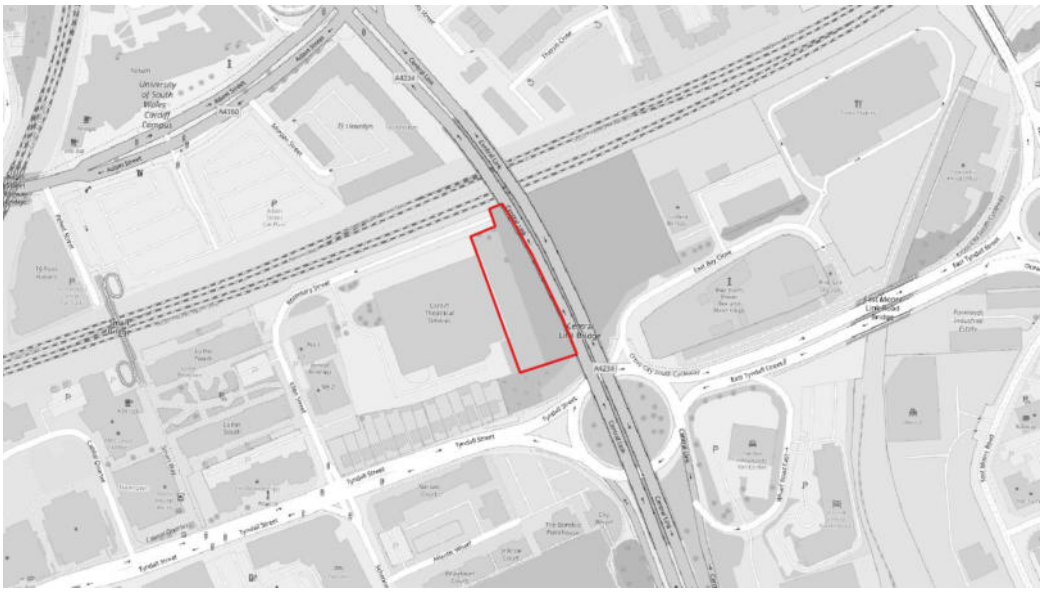


Figure 1: Site Location Base map and data from OpenStreetMap and OpenStreetMap Foundation (CC-BY-SA). © https://www.openstreetmap.org and contributors. Contains public sector information licensed under the Open Government Licence v3.0)

3.3 Data Map Wales (LiDAR) data (1m resolution) was used to review the existing ground levels at the site. Within the site boundary ground levels are shown to vary between 6.30m Above Ordnance Datum (m AOD) and 8.6m AOD.

3.4 Cardiff Council is the Local Planning Authority (LPA) for the site, and also the designated Lead Local Flood Authority (LLFA) and Sustainable Drainage Approving Body (SAB). The site sits within the Natural Resource Wales' South Wales Central region

Existing Ground Conditions

3.5 To get an understanding of the ground geology BGS (British Geological Survey) records were used. The BGS records show that the site is underlain by Mercia Mudstone Group - Mudstone bedrock with Tidal Flat Deposits – Clay, silt and sand superficial deposits.

3.6 The Cranfield Environment Centre (CEC), incorporating the National Soil Resources Institute (NSRI), is the largest UK national and international centre for research and development, consultancy and training in soils and their interaction with the atmosphere, land use, geology and water resources. The LandIS Soilscapes dataset map indicates the souths half of the site is underlain by 'Loamy and clayey soils of coastal flats with naturally high groundwater'. These soils are described as being 'Naturally

wet'. The northern half of the site is shown to be underlain by 'Freely draining slightly acid loamy soils'. These soils are described as 'Freely draining'.

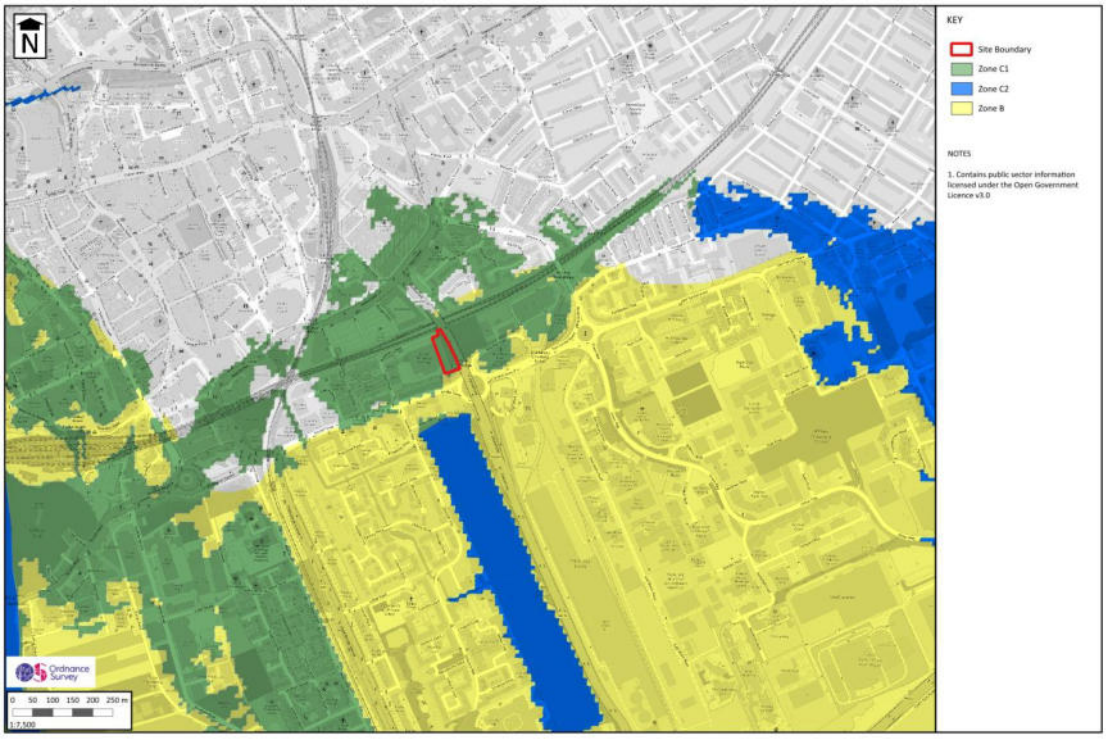
3.7 An extract from the geographic information map provided by Natural England indicates that the site is underlain by a Secondary B Aquifer bedrock. Secondary B aquifers are mainly lower permeability layers that may store and yield limited amounts of groundwater through characteristics like thin cracks (called fissures) and openings or eroded layers. No superficial drift Aquifers have been recorded within the site area.

3.8 The BGS (British Geological Survey) hydrogeology records inform on the Aquifers with significant intergranular flow and Aquifers in which flow is virtually all through fractures and other discontinuities. The proposed site falls within the '*Flow is virtually all through fractures and other discontinuities*' and is classified as a '*Low productivity aquifer'*. This area is summarised as having a '*largely argillaceous sequence with occasional sandstones yielding less than 0.5 L/s of water that can be highly mineralised and confines the underlying Sherwood Sandstone aquifer'*.

4.0 SOURCES OF FLOOD RISK

NRW Development Advice Map

4.1 The NRW Development Advice Map data shows that the proposed site lies within the NRW Zone C1. **This denotes areas of the floodplain which are developed and served by significant infrastructure, including flood defences**.



Flood Map for Planning

4.2 The Flood Zones within the Flood Map for Planning shows the **undefended** risk of flooding from Rivers and the Sea.

4.3 An inspection of the Flood Map data indicates that the site is located in Flood Zone 3 from the **undefended** risk of flooding from Rivers and seas.

4.4 Flood Zone 3 displays the extent of flooding from:

a) rivers with a 1% (1 in 100) chance or greater of happening in any given year, including an allowance for climate change.

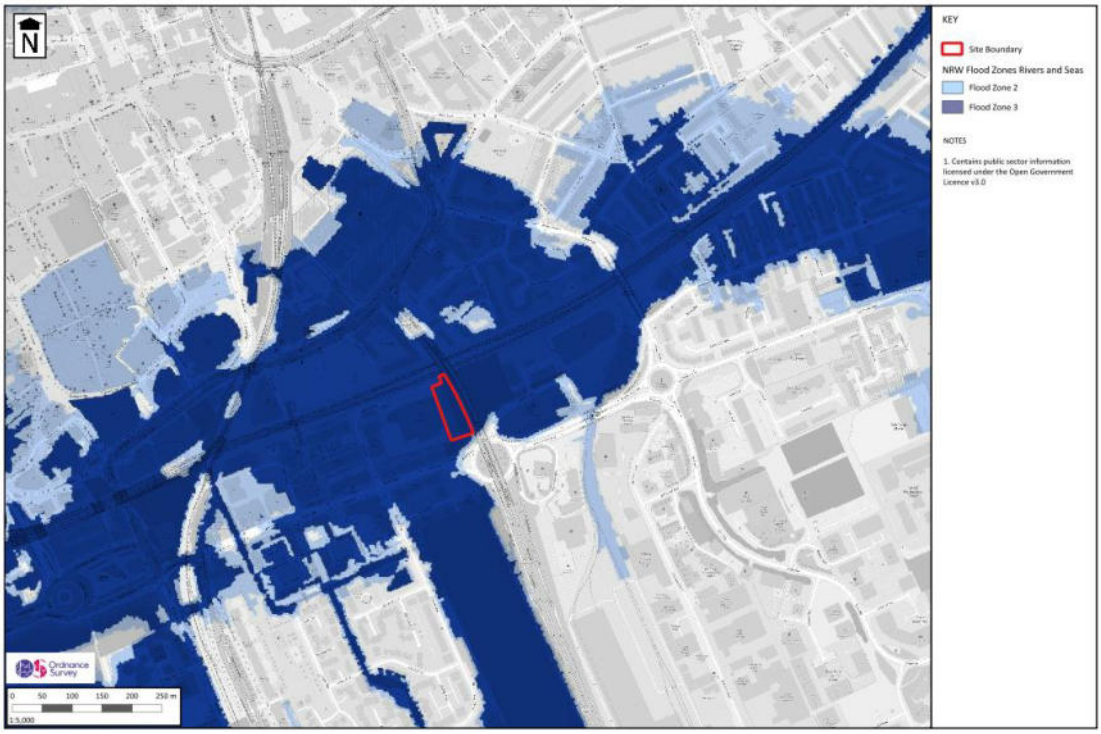
b) the sea with a 0.5% (1 in 200) chance or greater of happening in any given year, including an allowance for climate change.

4.5 Flood Zone 2 displays the extent of flooding from:

a) Rivers with less than 1% (1 in 100) but greater than or equal to 0.1% (1 in 1,000) chance of happening in any given year, including an allowance for climate change.

b) the Sea with less than 0.5% (1 in 200) but greater than or equal to 0.1% (1 in 1,000) chance of flooding in any given year, including an allowance for climate change.

4.6 An extract from the flood map data is shown in the figures below.



4.7 The site is shown to benefit from flood defences. This defence is maintained by the Natural Resources Wales and consists of high grounds and embankments to defend against fluvial and tidal flooding.

4.8 Product 4 data requested from NRW provided tidal data only. It is therefore assumed the main source of flooding within this area is coastal flooding from the Cardiff Flats to the south-east of the site.

4.9 the Coastal Design Sea Level Node tidal data has been given as the representation of tidal flood risk to the site. Review of the closest node within this has provided sea level flood levels as displayed in the table below.

4.10 NRW provided details on sea level rise due to climate change. The details provide estimated mean sea level rise (in metres) for relevant local authority areas by 2100 and 2120 with allowances based on RCP8.5 70th and 95th percentiles. For Cardiff, within the 95% percentile, the sea level rise up to the 2100 is 1.11m and up to the 2120 is 1.32m

Costal Design Sea Level Flood Levels (m AOD)			
T25	**T100**	**T200**	**T1000**
7.43	7.67	7.79	8.16
Costal Design Seal Level Flood Levels with an Allowance for Climate Change (m AOD) to 2100			
T25 + 1110mm	**T100 + 1110mm**	**T200 + 1110mm**	**T1000 + 1110mm**
8.54	8.78	8.9	9.27
Costal Design Seal Level Flood Levels with an Allowance for Climate Change (m AOD) to 2120			
T25 + 1320mm	**T100 + 1320mm**	**T200 + 1320mm**	**T1000 + 1320mm**
8.75	8.99	9.11	9.48

4.11 The site itself has a minimum elevation of 6.30m AOD which is below the above modelled flood levels. However, the flood defences within Cardiff are shown to have a level of 12.79m AOD from NRW LiDAR levels. As such, none of the shown modelled flood levels should impact the site as they are below the crest level of the flood defences. It is key to note however, the this analysis is based on levels only and doesn't take into account flood defences or any hydraulic connectivity between the floodplain and the source of flooding.

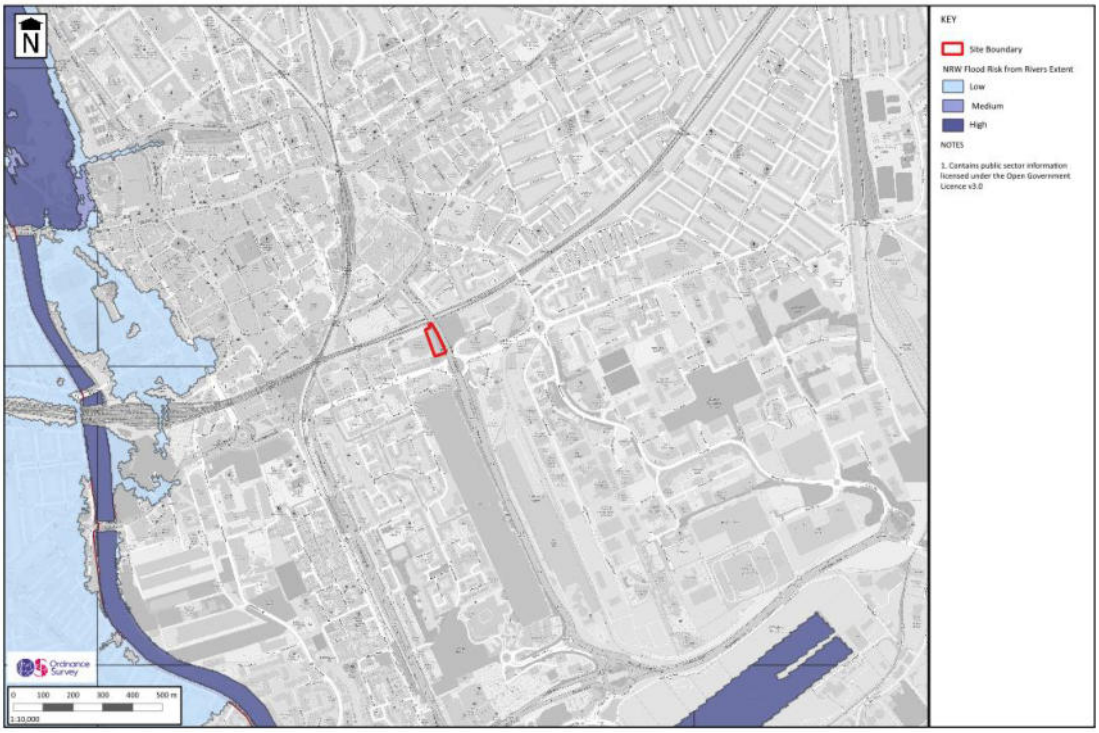
4.12 It should be noted that even with an allowance for climate change the levels would not overtop the defences and therefore, the site is expected to remain unaffected during these events.

Fluvial

4.13 Fluvial flooding occurs when the capacity of an existing watercourse is breached leading to water levels overtopping the banks into surrounding floodplain areas.

4.14 The nearest NRW main river is the Taff located approximately 1.1km west of the proposed development. The Taff flows from north to south out towards the Severn Estuary. The Dock Feeder Canal also lies within the vicinity of the site approximately 140m south of the boundary. There are no other ordinary watercourses within the vicinity of the site.

4.15 The site is located outside the extent of the low, medium and high flood risk from rivers extent in accordance with NRW mapping. An extract of the NRW flood data can be seen in the figure below.

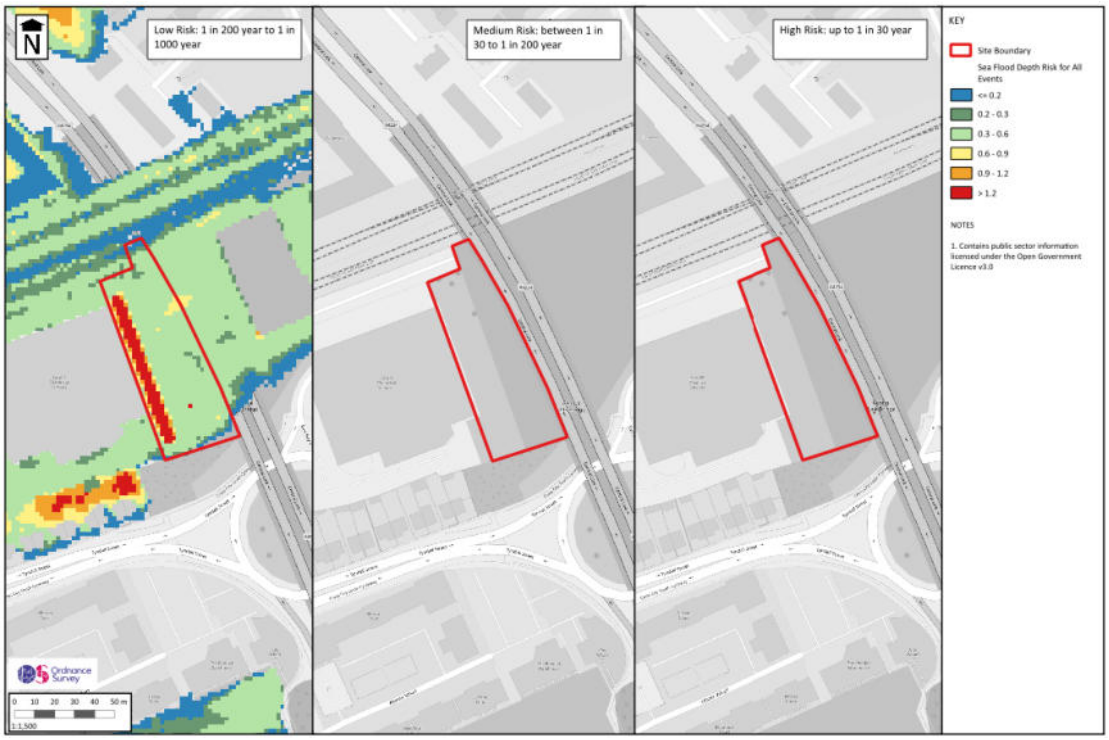


Tidal

4.16 Tidal flooding consists of low lying coastal areas can be impacted by tidal levels, wave overtop and storm surges. Some lower catchment Rivers are also influenced by tidal levels.

4.17 The site is shown to be located within an area at risk from flooding from the sea based on NRW mapping data shown below..

4.18 Further review of the NRW Flood Risk Hazard Mapping has determined that the site can be expected to experience flood depths of between 0.20m - >1.2m within the **low risk** (Low risk 1 in 200 year to 1 in 1000 year) flooding from the sea event. However this is understood to be an **undefended** scenario.



4.19 The site can be considered to be at **low** risk of tidal flooding when considering the impact of nearby flood defences.

Pluvial

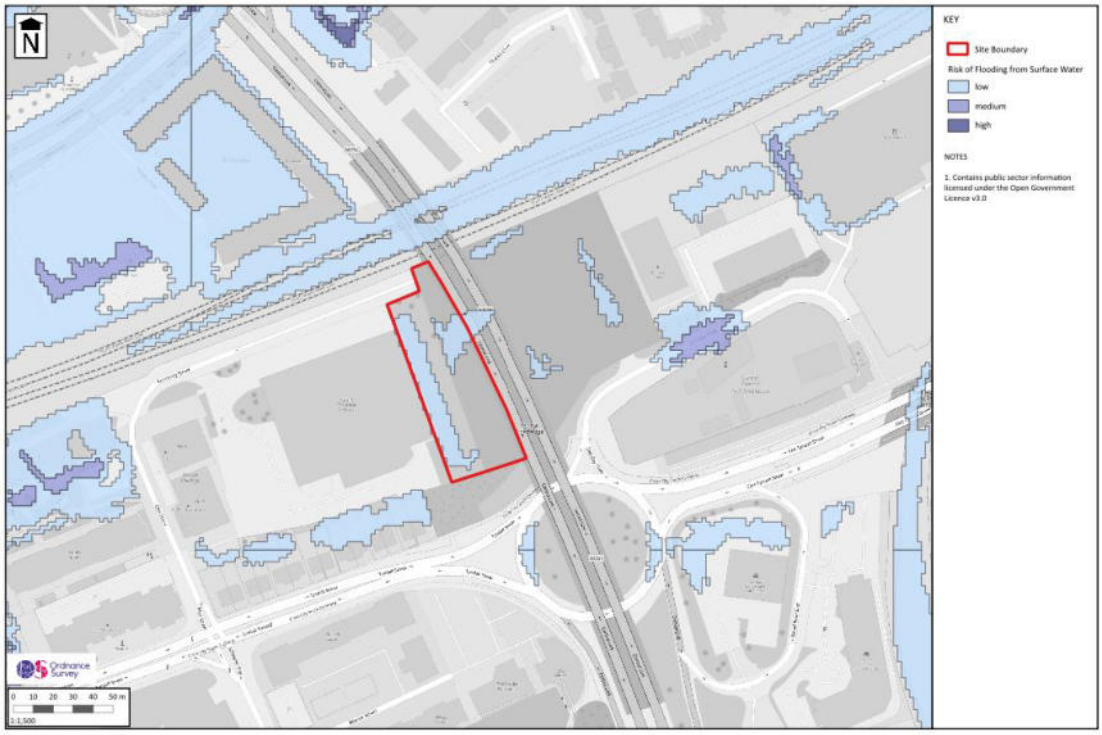
4.20 Pluvial flooding can occur when intense rainfall surpasses the capacity of the local drainage system, it can also be influenced by the current ground levels and elevations, the amount of rainfall, and the condition of the local drainage infrastructure. Additionally, it may arise when the ground's existing infiltration capacity is exceeded, leading to overland flows.

4.21 The NRW surface water flood data contains mapped areas believed vulnerable to surface water and small Watercourses flooding. An extract from the flood map is given in the Figure below.

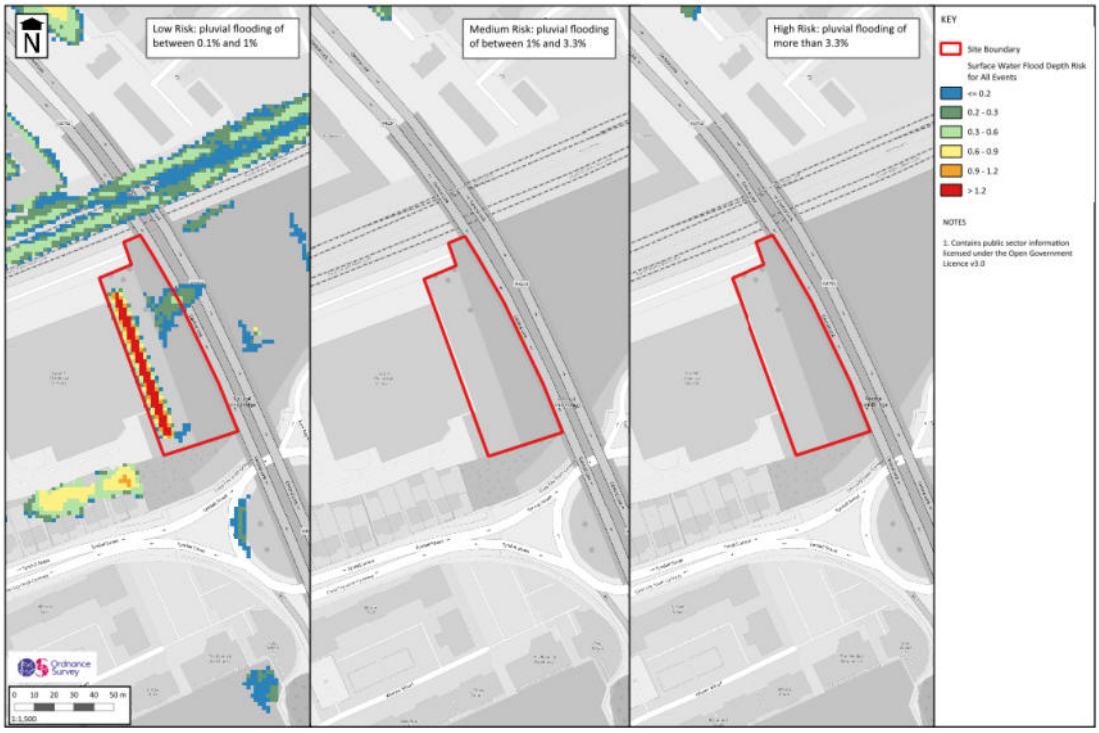
4.22 The figure shows that the majority of the site does not fall within a surface water flood risk area. The site is shown to have areas subject to Low chance of flooding.

a) Low Risk - each year in these areas there is a chance of pluvial flooding of between 1 in 1000 year (0.1%) and 1 in 100 (1%) year.

4.23 The areas of elevated surface water flooding are associated with low points on the site where surface water runoff could collect.



4.24 The areas subject to surface water flooding have been further assessed. In the figure below the NRW surface water flood risk depths affecting the site are shown. The flood depths the site are subject to range from 0.00m – >1.2m in depth. The surface water depths of 0.00m - >1.2m affecting the site are only shown to be present during low (0.1% - 1 in 1000 year) risk event and only appear to affect a small areas around the west of the site where there is a low point and in a small area in the north eastern area of the site.



4.25 Based on this information, the site has been considered to be at **low** risk from pluvial flooding.

Groundwater

4.26 Groundwater flooding is most likely to occur in low-lying areas underlain by permeable rocks (aquifers). These may be extensive regional aquifers (e.g. Chalk or Sandstone) or localised sands or river gravels in valley bottoms underlain by less permeable rocks.

4.27 Groundwater flooding occurs as a result of water rising from the underlying rocks or from water flowing from abnormal springs. This tends to occur after long periods of sustained high rainfall. Higher rainfall means more water will infiltrate into the ground and cause the water table to rise above normal levels.

4.28 The BGS records show that the site is underlain by Mercia Mudstone Group - Mudstone bedrock with Tidal Flat Deposits – Clay, silt and sand superficial deposits.

4.29 Historic BGS borehole (ref: ST17NE1177) within the site identified water as struck at around 7.62m below ground level.

4.30 Within the PFRA, SFCA, or Flood Management Plan there is no publicly accessible mapping which presents the susceptibility of groundwater flooding in the proposed development location. However, the LFRMS (2014) mentions the risk of groundwater flooding in Cardiff and states the following;

'*Groundwater Flooding occurs when water levels in the ground rise above the natural surface. Low lying areas underlain by permeable strata are particularly susceptible. There is little documented evidence of groundwater flooding in the area and therefore the risk of flooding from this source is considered to be small, and this is confirmed by the summary provided in the Taff and Ely Catchment Flood Management Plan (EAW 2009)*'

4.31 As such, based on the information above, the site is considered to be at a low risk of groundwater flooding.

Sewers

4.32 Flooding from existing sewers can occur if the capacity of the system is exceeded as a result of surcharging or blockages. Combined sewers can be influenced by extreme rainfall events and cause foul water flooding if surcharged.

4.33 Neither the PFRA, nor SFCA contain publicly available specific mapping to illustrate the number of historical sewer flooding incidents in the borough. However, the LFRMS (2014) does mention the following in relation to sewer flooding:

'Dŵr Cymru Welsh Water (DCWW) has two key responsibilities: to provide a high quality water supply to customers and; to take away wastewater and return it to the environment safely. In providing their basic function of containing, carrying and treating water and wastewater, these assets may present flood risks which can result from system failures, burst pipes and mains, or similar escapes from the sewer network and other assets, for which Welsh Water are responsible. Flooding from foul sewers is generally caused by blockages or the failure of pumped systems and usually affects only limited numbers of properties. Flood water containing foul sewage means that it does cause significant distress to those affected.'

4.34 The DCWW are responsible for the sewer system within the vicinity of the proposed site. Additionally, as stated above, usually only a limited number of properties could be affected in the event of flooding from the sewer network.

4.35 Based on the information above, the risk of sewer flooding to the proposed development is considered **low**.

Artificial Sources

4.36 Artificial sources include any water bodies not covered under other categories and typically include canals, lakes and reservoirs.

4.37 Flooding can occur from large waterbodies or reservoirs if they are impounded above the surrounding ground levels or are used to retain water in times of flood. Although unlikely, reservoirs and large waterbodies could overtop or breach leading to rapid inundation of the downstream floodplain.

4.38 The NRW Wales Flood Risk Assessment Map indicates the site is located within the modelled reservoir flood risk extent. However, as reservoirs are highly managed, the maximum flood extent provided in the NRW Risk of Flooding from Reservoir mapping is considered a worst case scenario. Therefore, given these criteria the site is deemed at a **low risk** of flooding from this source.

5.0 FLOOD RISK MITIGATION

Tidal

5.1 The proposed development has been considered to be at low risk of tidal flooding.

5.2 This site is shown to be located within an area that is shown to be impacted by flooding from the seas within the NRW Flood Risk Mapping. Review of the Coastal Design Sea Level Node data determined that the site should not be affected by tidal flooding and would remain unaffected when including an allowance for climate change. This is due to the defences present.

5.3 Flood risk mitigation is recommended to provide benefit over the residual risk of flooding. The following measures are recommended where applicable and possible over and above the flood protection systems:

a) Solid (i.e. concrete floors) with waterproof screed.
b) Raised wiring and power outlets at lower ground and ground level.
c) Air brick covers to be installed.
d) Damp Proof Membranes (d.p.m.) should be included in any design to minimise the passage of water through ground floors.
e) Non-return valves on any new sewer connection to prevent back flow.
f) All new plumbing insulation to be of closed cell design.
g) Site owners and residents required to sign up to the NRW flood warning service.

Other Sources Of Flooding

5.4 Flood risk from other sources is considered to be low, therefore mitigation is not required.

Increase to Flood Risk Elsewhere

5.5 The proposed development is for the construction of a new 12 storey residential flat building. The site may remain unaffected by tidal flooding due to the presence of defences and as such there should be no increase to flood risk elsewhere.

NRW Flood Warning Service

5.6 As a further precaution and risk reduction, tenants of the dwelling should sign up the ‘Coast from Aberthaw to Severn Bridge" NRW flood alert service (Quick dial number 502000). This service allows tenets to register an address, which is at risk of flooding, along with contact details so that in the event of a flood being forecast, the tenant will be sent an alert directly to their chosen method of contact.

5.7 Flood warnings/alerts can be enforced at any time. Signing up for this service provides occupants some notice before a flood event. The amount of time afforded before a flood occurs depends on the site-specific location (e.g. proximity to the source of flooding, topography of the surrounding area) and the flood mechanism (e.g. bank over topping versus a breach event). Flood alerts and warnings provide tenants with time to take necessary action, e.g. communication of the risk of flooding to occupants/employees etc, evacuation of occupants offsite or to a safe level, removal of valuable items out of reach of flooding and the mounting of site specific flood defences.

Flood Evacuation Procedures

5.8 A Flood Evacuation Management Plan will be prepared and made available to all users and occupants.

5.9 A copy will also be printed and located at the property.

6.0 SURFACE WATER DRAINAGE STRATEGY

Existing Regime

6.1 Based on Dwr Cymru Welsh Water's (DCWW) mapping it appears that there are no public surface water sewers in the area. However, the DCWW map indicates a 150mm dia. private surface water sewer located within the site boundary to the north, which discharges into a DCWW public combined sewer to the east of the site.

6.2 An existing balancing pond is located within the site and serves the adjacent warehouse to the west. The pond shall be relocated off site and filled in.

Proposed Strategy

6.3 A surface water strategy is proposed to manage and reduce the flood risk and surface water run-off from the development, with consideration to SuDS.

Hierarchy of Disposal

6.4 The SuDS hierarchy dictates that surface water run off should be managed as high up the following list as practically possible:

a) into the ground (via infiltration) and re-use, or then;

b) to a surface water body, or then;

c) to a surface water sewer, highway drain or another drainage system, or then;

d) to a combined sewer.

6.5 No infiltration tests have been undertaken to date. As stated within section 3.6 according to online soil mapping, it appears that the soils are relatively impermeable within the site area. It is therefore assumed that infiltration will likely not be a viable method of surface water drainage. Infiltration tests will need to be undertaken to confirm.

6.6 There are no rivers, streams or natural waterways within close proximity of the development, therefore these options have been discounted.

6.7 It is proposed to connect surface water flows from the proposed development into the existing on-site private drainage network.

Proposed Surface Water Drainage Strategy

6.8 The proposed SuDS techniques to be utilized for the development site are considered below

6.9 It is proposed that a modular plastic geo-cellular system with a high void ratio is used to create a below ground storage structure. Modular tanks can be used for runoff attenuation but require silt trap protection and a suitable means of access for cleaning and inspection.

6.10 It is also proposed that pervious paving be utilised in car parking areas. Pervious pavements provide a pavement suitable for pedestrian and/or vehicular traffic while allowing rainwater to infiltrate through the surface and into the underlying layers. The

water is temporarily stored between infiltration to the ground, reuse or discharge to a watercourse or other drainage system. Pavements with aggregate sub-bases can provide good water quality treatment

6.11 Bioretention Systems (including rain gardens) are shallow landscaped depressions that can reduce rates and volumes, and treat pollution through the use of engineered soils and vegetation. Runoff collected by the system ponds temporarily on the surface and then filters through the vegetation and underlying soils. The filtered runoff is either collected using an underdrain system or, if the site conditions allow, fully or partially infiltrated into the surrounding soil subject to suitable conditions. In general, the systems should not have impermeable liner, unless there is specific need to prevent water from infiltration, such as; locations close to structural foundations or for groundwater protection. Bioretention areas are proposed where there is landscaped areas within the design to convey the runoff towards the underground attenuation structure.

6.12 Filter drains are shallow trenches filled with stone/gravel that create temporary subsurface storage for the attenuation, conveyance and filtration of surface water runoff. A perforated pipe is provided near the base of the filter drain to collect and convey water to downstream drainage components. Filter drains have been incorporated into the drainage strategy to convey surface water runoff created by the development.

6.13 It is also proposed that a large part of the roof area will comprise of green roofs with attenuation provided within a blue roof system. Roof terraces for residents have been proposed where the green roof will improve the attractiveness and create enjoyable spaces. The blue roof system will also be placed under the hard paved roof areas joining the green roof systems.

6.14 The building roofs will discharge into the main drainage system. Surface flows will then discharge into an underground cellular storage tank to achieve the required attenuation volume for this development.

6.15 The on-site attenuation has been designed to provide storage for storms up to the 1 in 100-year + 40% climate change event. A flow control device will limit the discharge at a rate of 5 l/s. All flows exceeding 5 l/s will be attenuated within the onsite attenuation tank and SuDS features. The Drainage Strategy can be found with Appendix A.

Drainage Calculations

6.16 A simulation of all storm durations and events has been run using Causeway Flow design software with the following design values:

- Rainfall Catchment descriptor – FEH-22
- CV (Summer and Winter) – 1.0
- Storm Durations (mins) – 15 to 10080
- Storm events – up to and including 100 year plus 40% climate change

6.17 Refer to Appendix B for Drainage calculations outputs

7.0 MAINTENANCE AND MANAGEMENT

7.1 Maintenance of SuDS features is required in order to ensure that the surface water drainage system operates effectively, and the risk of flooding of the site and surrounding areas is reduced.

7.2 A maintenance schedule should be undertaken to ensure that the drainage system remains fully operational for the design lifetime. The below table summarises a maintenance plan for the drainage systems and components within the development.

7.3 The SuDS Manual (CIRIA C753) and specific product suppliers guidelines should also be referred to for further information on maintenance and frequency.

7.4 All on site drainage will be maintained and managed by a private management company.

Drainage Component	Required Action	Typical Frequency
General pipework, manholes, chambers, silt traps and headwalls	Stabilise adjacent areas	As required
	Remove weeds and vegetation	As required
	Clear/Jet any poor performing structures	As required
	Inspect all drainage features for poor operation	3 monthly, 48 hours after large storms in first six months
	Monitor inspection chambers and silt traps. Inspect silt accumulation and determine silt clearance frequencies	Annually
Permeable Paving	Surface visual inspection for ponding, damaged blocks and build up of silt/detritus	Annually or after major storm events
	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
	Remove litter, weeds and debris	Monthly
	Vacuum sweeping and brush replacement of approved jointing material	Annually
	Replace geotextile and bedding layer	Every 30 year
Cellular Storage, if required	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter: remove and replace surface infiltration medium as necessary	Annually
	Remove sediment from pre-treatment structures and/or internal forebays	Annually, or as required
	Repair/rehabilitate inlets, outlet, overflows and vents	As required
	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required
Bioretention Systems / Rain Gardens	Inspect infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain (if appropriate) to determine if maintenance is necessary	Quarterly

	Check operation of underdrains by inspection of flows after rain	Annually
	Assess plants for disease infection, poor growth, invasive species etc. and replace as necessary	Quarterly
	Inspect inlets and outlets for blockage	Quarterly
	Remove litter and surface debris and weeds	Quarterly (or more frequently for tidiness or aesthetic reasons)
	Replace any plants, to maintain planting density	As required
	Remove sediment, litter and debris build-up from around inlets or forebays	Quarterly to biannually
	Infill any holes or scour in the filter medium, improve erosion protection if required	As required
	Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium and replacing mulch	As required
	Remove and replace filter medium and vegetation above	As required but likely to be > 20 years
Filter Drain	Remove Litter and debris from filter drain surface, access chambers and pre-treatment devices	Monthly (or as required)
	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate frequencies	Six monthly
	Remove sediment from pre-treatment devices	Six monthly or as required
	Remove or control tree roots where they are encroaching the sides of the filter drain using recommended methods (eg NJUG, 2007 or BS 3998:2010)	As required
	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlaying filter medium.	Five yearly, or as required
	Clear perforated pipework of blockages	As required

8.0 PROPOSED FOUL DRAINAGE STRATEGY

8.1 Existing drainage plans, including DCWW sewer records, are included in Appendix C.

8.2 It is proposed to connect foul flows from the proposed development into the existing private drainage network prior to the outfall to the DCWW combined sewer.

EXPEDITE
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TERMS, CONDITIONS AND LIMITATIONS OF REPORT

1. General

This report is confined to an inspection of the structural elements of the property only. Therefore the report excludes any inspection or comment on electrical and mechanical installations, decorative conditions, damp proofing, non-structural timber fixtures, fittings, mouldings, coverings, windows, finishes, etc., and all other non-structural matters.

The purpose of this report is limited to an opinion on the structural condition of the property. We shall only report upon those structural defects that may materially affect the stability of the property provided that these defects are reasonably detectable at the time of our inspection. Whilst we will use all reasonable skill and care in preparing this report, it should be appreciated that we cannot offer any guarantee that the property will be free from future defects or that existing ones will not suffer from further deterioration.

2. Roof Structures

It should be noted that roofs and roof timbers can be subject to deterioration and it would be necessary for you to make specific arrangements for the inspection of this area if you require confirmation about the condition.

3. Unexposed Parts

Internal inspection is made within the limits of ready accessibility and it is not normal practice to lift floor coverings or floorboards, remove panels or plaster, or move heavier items of furniture. Consequently, we have not been able to inspect woodwork or any other parts of the structure which are covered, unexposed or inaccessible and we are therefore unable to report that any such part of the property is free from defect. Such unexposed parts may contain problems and you would need to make special arrangements for these areas to be investigated (where practicably possible) if you require confirmation about their condition.

4. Foundations

Where trial holes are excavated as part of a structural report, the condition of the footing and the founding soil relates only to the point of excavation and does not necessarily guarantee a continuation of the same conditions throughout the non-inspected areas of the structure. Whilst such trial pits will usually provide a reasonable indication as to the general state of the foundations and ground conditions, these cannot be determined with complete certainty. However, more detailed investigations could be carried out if we are so instructed.

5. Monitoring

Where the stability of a structure has been confirmed as a result of a series of monitoring readings during a given period of time, this does not guarantee the future stability of the structure beyond the monitoring period.

6. Disclosure to a Third Party

This report may not be relied upon by a third party for any purpose without the written consent of this practice. Furthermore, this report has been prepared and issued specifically for the benefit of the addressee and no responsibility will be extended to any third party for the whole or any part of its contents.

7. Methane/Radon

Testing for or enquiry about possible Methane presence from geological or organic sources, or the presence of or susceptibility to Radon Gas, have not been carried out as part of the structural report. Whilst the presence of such gases in harmful amounts is not a common occurrence, you should consider whether you wish such a test to be carried out since this may well affect the future value of the property/site and any prospects for future development.

8. Statutory Requirements

Enquiries with local or statutory authorities have not been carried out. Whilst attention may be drawn to any apparent breaches of statutory requirements relative to the building or site, the absence of any such comment does not imply compliance with such requirements.

9. Method of Inspection

External inspection of the building has been carried out from ground level by visual and optical sighting. This method means that parts of the structure may be incapable of inspection and we cannot confirm that they are free from defect. Special arrangements (where practicably possible) would need to be made before inspection of these areas could take place.

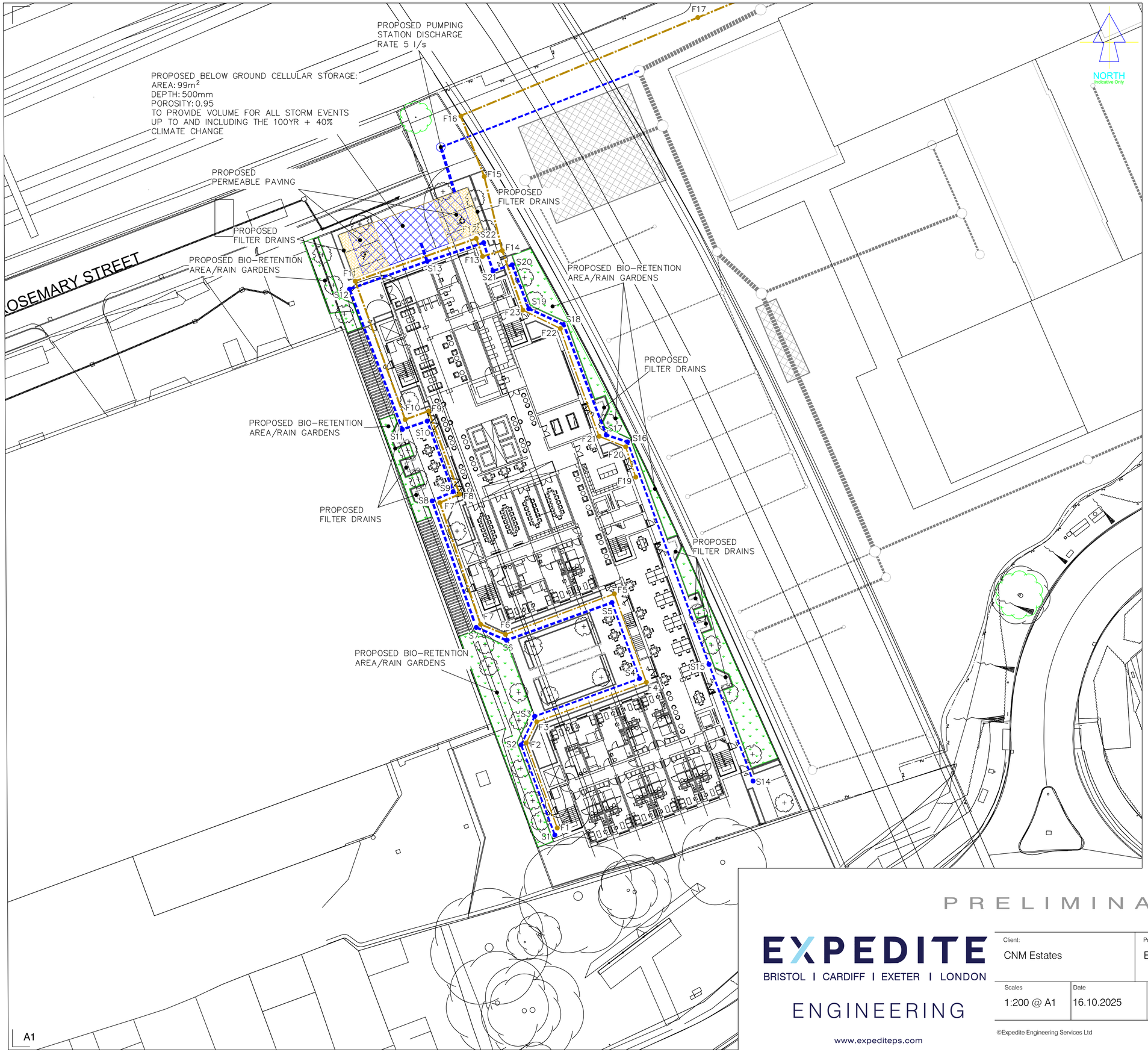
10. Contamination

The property and site have not been tested for any form of contamination, pollution or any other environmental impairment and we are unable to make any comment in this regard. However, such matters are an important consideration and may well affect the value of the property/site and any prospects for future development. Specific environmental audits can be arranged with appropriate specialists in this field.

11. Trees and Shrubs

Where there are trees and shrubs in close proximity to the property then there may be a risk of possible subsidence problems in the future and advice should be sought from an Arboricultural Association approved Tree Surgeon on the need for tree and shrub reduction or removal.

Appendix A



A1

PRELIMINARY

B	Drainage Update	SJC	31.10.25
A	Issued for comment	KT	18.10.25
CR	Description	Ch'kd	Date

EXPEDITE
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ENGINEERING
www.expediteps.com

Client:	Project:	Title:
CNM Estates	East Bay Close, Cardiff	Drainage Layout

Scales	Date	Drawn	Ch'kd	Project Reference	Drawing No.	Revision
1:200 @ A1	16.10.2025	KT	GJ	ES.03.03.00	C001	B

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Appendix B

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	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	0.230	5.00	7.900	30.826	81.756	1.500

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	x	Check Discharge Rate(s)	x
Summer CV	1.000	Drain Down Time (mins)	240	Check Discharge Volume	x
Winter CV	1.000	Additional Storage (m³/ha)	0.0		

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	0	0	0
100	40	0	0

Node Depth/Area 1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	6.400	Product Number	CTL-SHE-0098-5000-1500-5000
Design Depth (m)	1.500	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.0	Min Node Diameter (mm)	1200

Node Depth/Area 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	6.400
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	99.0	0.0	1.500	99.0	0.0	1.501	0.0	0.0

Results for 1 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
240 minute summer	Depth/Area 1	148	6.587	0.187	10.7	17.6272	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
240 minute summer	Depth/Area 1	Hydro-Brake®	4.4	39.6

Results for 30 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
180 minute summer	Depth/Area 1	148	7.144	0.744	35.8	70.0198	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
180 minute summer	Depth/Area 1	Hydro-Brake®	4.9	100.7

Results for 100 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
180 minute winter	Depth/Area 1	176	7.381	0.981	29.9	92.2911	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
180 minute winter	Depth/Area 1	Hydro-Brake®	4.9	102.7

Results for 100 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
240 minute winter	Depth/Area 1	232	7.890	1.490	34.3	140.1608	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
240 minute winter	Depth/Area 1	Hydro-Brake®	5.0	120.3

Appendix C

0 10 20 30 40 50 60 70 80 90 100

METRES

N

FOUL SEWER

(Army Reserve Centre)

PRIVATE SURFACE WATER SEWER

COMBINED SEWER

SITE BOUNDARY

Boro Const, Asly Const & ED Bdy

CR

Depot

Depot

Garage

Posts

EAST BAY CLOSE

TYNDALL STREET

Sloping masonry

14.9m

14.8m

8.2m

El Sub Sta

WB

Warehouse

Driscoll Buildings

ROSEMARY STREET SPS (PRIVATE)

BWK 1050 x 825 mm.

BWK 900 x 600 mm.

BWK 1125 x 750 mm.

BWK 2400 mm.

BWK 1200 x 825 mm.

CONC 1530 mm.

VC 900 mm.

VC 300 mm.

VC 150 mm.

VC 100 mm.

VC 225 mm.

ST19760204

ST19760205

ST19760219

ST19760220

ST19761205

ST19761206

ST19761207

ST19761208

ST19761209

ST19761210

ST19761211

ST19760223

ST19762010

ST19760101

ST19760102

ST19760103

ST19760001

ST19760002

ST19760003

ST19761001

ST19761003

ST19761004

ST19761005

ST19761102

ST19761103

ST19761104

ST19762001

ST19762004

ST18759930

ST19752901

f m h 19
ST18769104
c 7.376000
i 4.353000

74104

LEGEND(Representative of most common features)

Waste network:

- Foul chamber
- Surface water chamber
- Combined chamber
- Combined sewer overflow
- Special purpose chamber
- Treatment works
- Pumping station
- Outfall
- Lamphole
- Storm Overflow
- Rising main
- Gravity sewer
- Privatesewer
- Privatesewer subjectto Sect. 104 adoption agreement
- Private Sewer Transfer
- Lateral Drain
- Inspection Chamber

NB: Sewersymbol colour indicates the type.

RED -Combined
GREEN -Surface Water
BROWN -Foul
Purple -Former S24 sewers (for indicative purposes only)