

11 HYDROLOGY AND FLOODING

11.1 INTRODUCTION

- 11.1.1 This Environmental Statement (ES) chapter assesses the hydrological impacts associated with the development site located off Rover Way and opposite the junction off rover Way and Seawall Road, within the administrative boundary of Cardiff Council. It incorporates a summary of the surface water drainage, foul drainage and flood risk.
- 11.1.2 The chapter describes the policy context and the methods used to identify the baseline conditions at the application site and within the surrounding area. It identifies and reviews flood risks and sensitivities, and then addresses the direct and indirect impacts of the development on these flood risks.
- 11.1.3 The chapter also examines the potential for flood risk in accordance with national guidance and the requirements of the Natural Resources Wales. A Flood Consequences Assessment/ (FCA) has been compiled that addresses the relevant flood risk and drainage issues and is contained in Technical Appendix 11.1. Mitigation measures for surface water runoff and potential increase in foul drainage discharge are addressed and any residual impacts have been identified.
- 11.1.4 Whilst assessed afresh, this element of the scheme proposals is common to, and consistent with, the previous (approved) development for the site. The principal conclusions drawn and set out in the consideration and determination (approval) of the previous (bio-mass and related development) scheme for the site record the following:
- There is an opportunity through this development to introduce sustainable drainage solutions and address existing site issues which will protect the Severn Estuary marine sites from contaminated material known to be in the ground.
 - recommend conditions be attached to any planning permission that will be granted to secure a hydraulic modelling assessment and full details of the proposals for foul and surface water drainage;
 - details of the management of this leachate during construction and segregating this from the surface water run-off will be important. Relevant conditions are attached to secure these details;
 - The part of the site that falls within Zone C2 on flood defence maps includes part of the access road that could be affected by a tidal event. However, the site has a secondary/emergency access at Tide Fields Road in the southwest which could be utilised in an extreme tidal event. Natural Resources Wales have no objection in this regard; and
 - It is considered that satisfactory drainage solutions can be designed to ensure compliance with LDP Policies EN11 (Protection of Water Resources) and EN14 (Flood Risk).

11.2 CONTEXT

PLANNING POLICY

Planning Policy Wales 11

11.2.1 The Planning Policy Wales (PPW) sets out the Government's planning policies for Wales and how they are expected to be applied. PPW, Technical Advice Notes (TAN's), circulars and policy clarification letters comprise national planning policy. PPW states that:

- 'Previously developed (also referred to as brownfield) land should, whenever possible, be used in preference to greenfield sites where it is suitable for development'.
- 'Well planned water services provide a range of benefits and services for society. The water industry itself is a source of green jobs and water services support energy and food production, recreation and tourism and connect homes and businesses to the infrastructure networks upon which they depend'.
- 'The Welsh Government aims to secure the provision of water services whilst minimising adverse impacts on the environment, amenity, health and communities, in light of the consequences of climate change'.
- 'Water resources and quality must be taken into account from an early stage in the process of identifying land for development and redevelopment. The protection of water resources should be based on ensuring sustainable use in the future. Meeting short term needs should be balanced against ability to protect water resources over the long term. This may mean that the location of new development, and its type, requires careful consideration.'
- 'Planning authorities should adopt a precautionary approach of positive avoidance of development in areas of flooding from the sea or from rivers. Surface water flooding will affect choice of location and the layout and design of schemes and these factors should be considered at an early stage of formulating development proposals'.
- 'The Welsh Governments aims to secure the provision of water services whilst minimising adverse impacts on the environment, amenity, health and communities, in light of the consequences of climate change. Development which is poorly designed or badly located can exacerbate problems associated with resource depletion, exposure to surface water flooding and diffuse pollution. The planning system should:
 - Protect and improve water resources by promoting and encouraging increased efficiency and demand management of water as part of new developments, particularly in those areas where water resources may be under pressure or may not be available;
 - Ensure that the infrastructure on which communities and businesses depend is adequate to accommodate proposed development so as to minimise risk to human health and the environment and prevent pollution at source;
 - Ensure sustainable drainage systems are an integral part of design approaches for new development; and

- Ensure the protection of the quantity and quality of surface and ground water supplies is taken into account as part of development proposals’.
- ‘Development proposals in sewered areas must connect foul drainage to the main sewer, and it will be necessary for developers to demonstrate to planning authorities that their proposal site can connect to the nearest main sewer. To ensure consistency of design and facilitate long-term maintenance, sewers should be built to Welsh Government standards and adopted’.

11.2.2 Technical Advice Note (TAN) 15 provides technical guidance which supplements the policy set out in Planning Policy Wales in relation to development and flooding.

11.2.3 The relevant hydrology and flood risk related issues covered by the TAN 15 have been considered within this chapter of the ES. The Flood Consequences Assessment, contained in Appendix 11.1, has been undertaken in accordance with the TAN15, CIRIA C624: Development and Flood Risk Guidance and NRW guidance for Development in Flood Zone B.

Technical Advice Note – TAN15

11.2.4 National Assembly for Wales produced the ‘Technical Advice Note (TAN15)’ in July 2004. The proposed development is located in flood zone C, where TAN 15 requirement below is applicable.

‘For proposals located in zone C developers will need to demonstrate, to the satisfaction of the planning authority, that the development can be justified in that location (section 6) and that the consequences associated with flooding are acceptable’

The key objective of a flood consequences assessment includes:

- *The consequences of flooding on the development*
- *The consequences (i.e. the overall impacts) of the development on flood risk elsewhere within the catchment for a range of potential flooding scenarios up to that flood having a probability of 0.1%.*
- *The assessment can be used to establish whether appropriate mitigation measures can be incorporated within the design of the development to ensure that development minimises risk to life, damage to property and disruption to people living and working on the site or elsewhere in the floodplain*

11.2.5 In relation to new development within flood zone B, it states that,

‘When considering allocations in zone B, local planning authorities should consult the Environment Agency to ascertain whether flooding raises a significant constraint in terms of land use. It is not expected that an assessment of the consequences be undertaken at the plan preparation stage but should flooding be considered an issue then policies outlining the appropriate requirements should be included in the plan, in accordance with sections 6 and 7 and appendix 1.’

11.2.6 TAN 15 also requires new developments to reduce the causes and impacts of surface water flooding by implementing the Sustainable Drainage System (SuDS) (Appendix 4_TAN 15).

11.2.7 With respect to surface water runoff from new development, TAN15 states that:

'SuDS can perform an important role in managing run-off from a site and should be implemented, wherever they will be effective, in all new development proposals, irrespective of the zone in which they are located.'

'Development in one part of a catchment may increase run-off and hence flood risk elsewhere, therefore, the aim should be for new development not to create additional run-off when compared with the undeveloped situation, and for redevelopment to reduce run-off where possible. It is accepted that there may be practical difficulties in achieving this aim.'

11.2.8 The proposed surface water attenuation measures are discussed in section 5 of Flood Consequences Assessment (Technical Appendix 11.1).

National Strategy for Flood and Coastal Erosion Risk Management in Wales

11.2.9 In accordance with the Flood and Water Management Act 2010, the Welsh Government has prepared the 'National Strategy for Flood and Coastal Erosion Risk Management in Wales' in November 2011.

11.2.10 In relation to flood defences, it states that,

'Most of Wales' cities, like Cardiff, Swansea and Newport, have been protected from flooding by a combination of river defences in the form of embankments and walls and local piped drainage systems.'

11.2.11 In relation to flood risk management, it states that:

'Drainage and defence still have a place within a flood and coastal erosion system based on the principles of risk management, but we also need to consider other options that could reduce both the likelihood of an event occurring and the consequences of those events'

11.2.12 Other options could include:

- *deploying sustainable drainage systems much more widely;*
- *incorporating greater resilience into the design of developments;*
- *ensuring wider awareness of individual risk to increase levels of preparedness and planning for flooding events.*

- 11.2.13 It also required that Development of Local Development Plans to include adequate provisions in respect of flood and coastal erosion risk in compliance with the requirements of Planning Policy Wales and relevant Technical Advice Note (TAN15).

Strategic Flood Consequences Assessment

- 11.2.14 A Strategic Flood Consequences Assessment (SFCA) for Cardiff Council was carried out by Atkins. The aim of the SFCA was to inform the revision of flooding policies, including the allocation of land for future development and to guide the production of individual FCA's by developers as part of the development control process.

- 11.2.15 With respect to the flood risk from groundwater, the SFCA states that,

'The brief for this SFCA did not include the requirement to consider risk of flooding from groundwater sources. It is anticipated that the risk of groundwater flooding is low, which states that groundwater flooding is not considered to be a significant issue within the catchment.

However, this does not negate that fact that risks associated with groundwater ought to be investigated as part of any site-specific FCAs carried out in the future'

- 11.2.16 The risks associated with each possible source of flooding are discussed in the relevant sections of the Flood Consequence Assessment (Technical Appendix 11.1).

Cardiff LDP

- 11.2.17 In relation to flood risk and drainage, followings are included within the objectives of the LDP.

Objective 3 - To deliver economic and social needs in a coordinated way that respects Cardiff's environment and responds to the challenges of climate change

- To protect, manage and enhance Cardiff's natural environmental assets, including geodiversity, the best soils, water and air quality including, the reduction of pollution.
- To have full regard to flood risk when considering the acceptability of development proposals and considering mitigation and adaptation measures

Objective 4 - To create sustainable neighbourhoods that form part of a sustainable city;

- Minimise water usage and maximise sustainable drainage - to carefully manage the consumption and drainage of water to avoid unnecessary wastage and minimise rapid run-off. To seek opportunities to maximise the positive amenity and biodiversity benefits that sustainable drainage solutions can offer

- 11.2.18 In relation to new development, Policy KP5: 'High Quality and Sustainable Design' states that:

'To help support the development of Cardiff as a world-class European Capital City, all new development will be required to be of a high quality, sustainable design and make a positive contribution to the creation of distinctive communities, places and spaces by

- *Using innovative approaches to achieve a resource efficient and climate responsive design that provides sustainable water and waste management solutions'.*

11.2.19 In relation to long term sustainable development of Cardiff, Policy KP18: 'Natural Resources' states that:

'In the interests of the long-term sustainable development of Cardiff, development proposals must take full account of the need to minimise impacts on the city's natural resources and minimise pollution'

11.2.20 This is further explained by:

'Cardiff's rivers, lakes, ponds and water bodies are important for a wide range of uses and users. Development has the potential to affect water quality and quantity. It is important that development is only allowed where there would be no unacceptable harm to the quality or quantity of water resources and where provision can be made for any infrastructure required to safeguard water quality and quantity. New developments should have an adequate water supply and sewerage system to serve the development. This policy, which is aimed in part at improving water resource use efficiency, will ensure adequate water supply without adverse impacts on the River Usk and River Wye SACs, thereby helping to avoid the likelihood that this LDP will have a significant effect upon European designated sites'.

11.2.21 In relation to planning and design, Policy EN10: 'Innovative water solutions' states that:

'Development should demonstrate the incorporation of water sensitive urban design solutions (the process of integrating water cycle management with the built environment through planning and urban design). To include the management of

- *Waste water and pollution;*
- *Rainfall and runoff;*
- *Watercourses and water resource;*
- *Flooding; and*
- *Water pathways*

11.2.22 The above is further explained by:

'There is a need for an approach where the whole urban water cycle is incorporated into a holistic system. Water sensitive design focuses on managing water locally and reducing demands on the strategic network.

Such examples of integrated water cycle management include Sustainable Urban Drainage Systems (SUDS); water recycling; and the holistic integration of surface water systems designed into the development layout, as well as into networks of green spaces applicable at a range of spatial scales, such as gardens, green roofs, streets, car parks and river corridors'

11.2.23 In relation to permitted developments, Policy EN11: 'protection of water resources' states that:

'Development will only be allowed where provision is made for the necessary infrastructure to protect water quality and quantity. Planning permission may be granted subject to conditions to secure the necessary measures, or developers may be required to enter into planning obligations. Applications that cannot provide adequate protection of watercourses, ground and surface water will be refused. New development that:

- Poses an unacceptable risk to ground water or water courses;*
- Poses an unacceptable risk to ground water pollution, depletion or obstruction; and*
- Incorporates inappropriate measures to prevent pollution*

will be refused planning permission, unless appropriate measures to prevent pollution can be incorporated into the development proposal''.

Planning permission will not be granted for development that, in the opinion of the Council, following consultation with NRW and the Caldicot and Wentlooge Levels Internal Drainage Board, would adversely affect the quality, quantity or supply of surface water or groundwater as a result of:

- The nature of the surface or waste water discharge; or*
- Unsatisfactory agreements for the disposal of foul sewerage, trade effluent or surface water; or*
- The spillage or leakage of stored oil or chemicals*

'Developments that improve the quality of the water environment or help to prevent water pollution or flooding will be favoured'

11.2.24 According to Policy EN14: 'Flood Risk', development will not be permitted:

- Within tidal or fluvial flood plains unless existing or proposed flood prevention and/or protection measures are acceptable; or*
- Where it would increase the risk of flooding; or*
- Where it would hinder future maintenance or improvement schemes of flood defences and watercourses; or*
- Where it would cause adverse effects on the integrity of tidal or fluvial defences; or*

- *Where ground floor bedrooms are proposed in areas at high risk of flooding.*

KEY LEGISLATION

11.2.25 Water quality within the local area of the Proposed Development is currently regulated according to the following key European Commission (EC) Directives. These Directives set out standards for water quality and impose monitoring requirements:

Freshwater Fish Directive

11.2.26 The European Commission's Freshwater Fish Directive (European Commission, 78/659/EEC) (recodified 2006/44/EC) was originally adopted on 18th July 1978, but consolidated in 2006. The Directive seeks to protect fresh water bodies identified as waters suitable for sustaining fish populations. For those waters identified, physical and chemical water quality objectives are set for salmonid waters and cyprinid waters. Waters protected under the Directive are formally designated through the issue of a notice. In Wales the notice is issued by the Department for Environment, Food and Rural Affairs (DEFRA) and it places an obligation on the Natural Resources Wales (NRW) to ensure that designated waters meet their objectives.

Nitrates Directive

11.2.27 The European Commission's Nitrates Directive (European Commission, 91/676/EEC) aims to reduce water pollution by nitrate from agricultural sources and to prevent such pollution occurring in the future. The directive requires DEFRA and the Welsh Assembly Government to identify surface or groundwaters that are, or could be high in nitrate from agricultural sources. Nitrogen is one of the nutrients that can affect plant growth. Surface waters also have to be identified if too much nitrogen has caused a change in plant growth which affects existing plants and animals and the use of the water. Once a water body has been identified, all land draining to that water is designated as a Nitrate Vulnerable Zone.

Water Framework Directive

11.2.28 The European Commission's Water Framework Directive (WFD) (European Commission, 2000/60/EC) seeks to protect, improve and maintain the environmental condition of surface and ground waters. Under the WFD, all inland, estuarial and coastal waters must aim to achieve "good ecological status" by 2015. The WFD aims to do this through the implementation of River Basin Management Plans (RBMPs). The RBMPs set out environmental objectives for all groundwater and surface water bodies and Protected Areas within an RBD. The plans include a programme of measures to meet these objectives. There will be a further cycle of review and planning in 2015 and every six years thereafter. Existing directives have already brought into force measures that are relevant to the implementation of the WFD and some of these are new since the WFD was implemented, some have been re-codified, and some repealed.

11.3 METHODOLOGY

11.3.1 This chapter considers three main elements;

1. existing drainage characteristics,
2. flood risk and;
3. a drainage assessment for the surface & foul water runoff from the proposed development.

11.3.2 The methodology utilised for the assessment of these elements is outlined below and further detail is provided within the associated Technical Appendix 11.1 (Flood Consequences Assessment).

11.3.3 The hydrological site conditions and flooding were determined by assessing maps and other published information regarding topography, soils, geology and hydrology.

Existing Drainage Characteristics

11.3.4 A review of the topographic survey and Welsh Water sewer records was undertaken to assess the existing drainage system of the site. Welsh Water sewer records indicates that there no public surface water sewers within the site boundary that will/can be utilised and therefore discharge to the sea is the most appropriate receptor for the surface water.

11.3.5 This review of the existing site drainage enables the consideration of Sustainable Drainage Systems (SuDS) techniques, where possible, into the surface water drainage designs for the proposed development. The results of this exercise are set out in the FCA/DS produced.

Flood Risk

11.3.6 The flood risk assessment has been undertaken in accordance with the guidance produced by the NRW, TAN 15, Cardiff Council, and using the parameters set out in national standards and guidelines.

11.3.7 The Flood Consequences Assessment considers whether the proposed development is appropriate in planning terms and the impact of the proposed development on the local hydraulic regime. This also includes a review of proposed development proposals and an identification of any areas likely to be at risk of flooding.

11.3.8 All the sources of flooding referred to within the guidance have been assessed. This includes:

- Fluvial flooding
- Tidal flooding
- Groundwater flooding
- Overland flow flooding
- Failure of the urban drainage system

- Failure of the local infrastructure

Proposed Drainage

11.3.9 The use of sustainable drainage systems is promoted within national and local guidance to manage surface water on new developments. SuDS are an alternative approach to managing surface water runoff, which strike a balance between the management of surface water and the need to conserve natural resources. The three main principles are:

- reduction of quantity, in particular the large peak runoffs during a storm event which cause flooding of the receiving waters;
- improvement of quality, by reducing the level of pollution entering the receiving waters; and
- enhanced amenity, such as community facilities, landscaping potential.

11.3.10 A conceptual surface water drainage strategy for the proposed development is described within the FCA (Appendix 11.1).

Environmental impact assessment approach

11.3.11 The EIA Regulations require the description of the forecasting methods used to assess the effects on the environment. The EIA has been based on a widely used and accepted 'significance matrix assessment approach' which is based on the characteristics of the impact (magnitude and nature) and the sensitivity of the receptor. This allows the relative significance of effects to be determined on a scale and ultimately the significant effects determined, as explained in the following subsections.

11.3.12 The framework methodology used in this assessment is described in the following subsections.

11.3.13 The EIA Regulations require a description of the likely effects of the development and whether they are significant or not. Therefore, environmental effects are described as:

- Adverse or beneficial
- Direct or indirect
- Temporary and reversible, or permanent and irreversible
- Short, medium or long term
- Cumulative

Assessment of significance

Receptor Types and Locations

11.3.14 An assessment of the potential effects of the development on the hydrology, water quality and flood risk to the site, surrounding areas and relevant receptors has been undertaken.

11.3.15 There is potential for any changes to surface water runoff or groundwater levels to affect the hydraulic regime of the site. The two types of receptors potentially at risk from a change in hydraulic regime are the proposed commercial receptors on site and the receptor of the surface water discharge.

11.3.16 The receptors used will be classed as follows:

- on-site – premises within the proposed development;
- site-adjacent – premises & various water bodies adjacent to the proposed development;
- site-distant – premises away from the local area at or en route to the water processing/disposal point

Magnitude of Impact

11.3.17 The assessment of the magnitude of impact will be undertaken by calculating the scale at which the proposed development impacts upon the existing hydrology, drainage and water quality.

11.3.18 The magnitude of an impact will be determined by looking at the following criteria:

- The number and activities of the population affected
- The type and sensitivity of the receptor
- The type of impact/benefit

11.3.19 The magnitude of an impact can be neutral or either beneficial or adverse and will be classified according to the following scale:

- Substantial.
- Moderate
- Slight
- Negligible

Receptor Sensitivity

11.3.20 The sensitivity to any change in environmental conditions of a receptor will be classified according to the following scale:

- Very High
- High
- Medium
- Low

Significance Criteria

11.3.21 The overall significance of an impact can then be determined by looking at the following criteria:

- Impact magnitude;
- Sensitivity of receptor;

Significance of impacts

11.3.22 Table 9.1 shows a matrix that demonstrates how the significance of impact has been assessed:

Receptor Sensitivity	Magnitude of Impact			
	Substantial	Moderate	Slight	Negligible
Very High	Major	Major – Moderate	Moderate	Minor
High	Major – Moderate	Moderate	Moderate - Minor	negligible
Medium	Moderate	Moderate - Minor	Minor	negligible
Low	Moderate - Minor	Minor	Minor - negligible	negligible

11.4 BASELINE CONDITIONS

- 11.4.1 The closest body of water River Rhymney located 900m east of the site, where it outfalls into the Severn Estuary. The mouth of the River Taff is located approximately 3km to the south west of the site.
- 11.4.2 Existing surface and foul water
- 11.4.3 Generally, the majority of the principal site area is open space. There are no significant existing impermeable areas located within the site. Hence, the overall site area can be described as having 'natural' drainage.
- 11.4.4 DCWW network maps have been acquired for the site. The network map shows that there is a public sewer crossing the site where the proposed north entrance to the site is proposed. This sewer is of a combined nature and is shown to be 2.4m diameter. The sewer runs from a north east to south west direction and ultimately ends in the treatment works. The sewer will have a designated easement (3m meters on either side of the sewer as a minimum) which will need to be respected and discussions with DCWW should be undertaken once the proposals become more final to ensure that there is no detrimental impact to the sewer.
- 11.4.5 There are also a series of further DCWW sewers on the most northern corner of the site with combined sewers and surface water sewers located in the vicinity. These are located in an area that is not likely to impact the development proposals.

Flood data

NRW Flood Map

- 11.4.6 Under the guidance in TAN15, Development Advice Maps (DAMs) are used to determine whether the consequences of a particular frequency of flood event are acceptable for the location of a specific type of development or land use.
- 11.4.7 There are three DAM Flood Zones (A, B and C) to which are attributed different planning actions, as summarised in the extract of Figure 3.1 from TAN15 on the FCA section 3.

Tidal flooding

- 11.4.8 Tidal flooding happens when there is an exceptional high tide due to a storm surge. Storm surge is generally associated with increases in water levels due to the changes in atmospheric pressure and wind generated by storm.
- 11.4.9 There is no evidence that the site is at risk of Tidal flooding.

Fluvial flooding

11.4.10 The site is located in flood zone B and it is not at risk of any fluvial flooding.

Surface Water Flooding

11.4.11 Intense rainfall, often of short duration, that is unable to soak into the ground or enter drainage systems can run quickly off land and result in local flooding. Increased run-off from developed areas consisting of impermeable surfaces can increase overland flows. If the flow paths of these overland flows are not carefully considered during the detail design and planning of the drainage design, flooding from overland flows is also a potential source of flooding.

11.4.12 The land use and the topography of the surrounding land indicate that there would be limited potential for overland flow from off-site sources. Therefore, surface water flooding is not considered to be a significant risk at the development site location.

Groundwater Flood Risk

11.4.13 Groundwater flooding can occur when water levels in the ground rise above surface levels. Severe storm events or prolonged rainfall could cause groundwater to rise above ground level. Underlying geology is the principal factor that effects groundwater flooding. Groundwater flooding most commonly occurs in low lying areas which are underlain by permeable rocks or aquifers.

11.4.14 The surrounding areas are not at risk from groundwater flooding. Therefore, groundwater flooding is not considered to be a significant risk at the development site location.

Water Quality and Pollution Incidents

11.4.15 The River Basin Management Plan (RBMP) shows the current overall status of the waters in the South-East Valleys Catchment as 'Moderate' with the classification of the individual elements as follows:

- Biological element – 13% of rivers are at good status
- Biological element – 22% of rivers are at good status
- Chemical status – does not require assessment

11.5 POTENTIAL IMPACTS

11.5.1 Specific impacts arising from the proposed development are described as occurring either during the construction or the operational phase of the development in the following section.

Sources of hydraulic impact

11.5.2 Table 9.2 below shows the potential sources of impact that have been identified:

Table 9.2 – Sources of Hydraulic Impact

Stage	Activity
Construction	General Construction activities
	Construction activities adjacent to waters
Operation	Change to drainage regime
	Change to foul drainage system

Construction Phase

11.5.3 The potential for contamination of controlled waters from site plant and activities during the works can occur from intrusive works or general construction activities.

Surface Water Runoff

11.5.4 The construction phase could potentially lead to ponding of water on site, accidental runoff and increased runoff rates as the impermeable areas are increased. This may impact on local watercourses.

11.5.5 The adverse impacts associated with the surface water runoff on local watercourses of medium sensitivity, with no mitigation, are likely to be local, temporary, of moderate magnitude and of moderate-minor significance (see section 9.15-9.24 and table 9.1 for assessment approach).

Water Quality

11.5.6 Should no mitigation be incorporated and the runoff waters be allowed to preferentially flow offsite then the construction phase of the development could potentially impact the water quality of the surrounding water features through a potential increase in fine sediments, hydrocarbons and other chemical loads, the introduction of cement, accidental spills and/or other wastes discharged from the site to the Severn Estuary.

11.5.7 The adverse impacts associated with the site runoff on the water quality of the Severn Estuary of medium sensitivity, with no mitigation, are likely to be local, temporary, of moderate magnitude and of moderate-minor significance.

Operation

Surface Water Runoff

- 11.5.8 The main potential impacts relate to changes to the current drainage regime, which may result in increases in the volume of surface water runoff. This may impact on the local surface water flooding.
- 11.5.9 The adverse impacts associated with the surface water runoff on the local sewers of medium sensitivity, with no mitigation, are likely to be local, permanent, of moderate magnitude and of moderate-minor significance (see section 9.15-9.24 and table 9.1 for assessment approach).

Water Quality

- 11.5.10 There is potential for the operational phase of the development to impact upon the water quality of the surrounding waters. The operational causes are likely to be significantly different than those experienced during the construction phases. As a result of the development there is potential for an increase in hydrocarbons and other chemical loads, accidental spills and/or other wastes discharged to the water receptors. This may impact on the water quality of Severn Estuary.
- 11.5.11 The adverse impacts associated with the site runoff on the water quality of Severn Estuary of medium sensitivity, with no mitigation, are likely to be local, permanent, of moderate magnitude and of moderate-minor significance (see section 9.15-9.24 and table 9.1 for assessment approach).

Foul Drainage

- 11.5.12 Welsh Water have been approached to seek capacity in their network for foul only discharge in the adopter sewer system. They have indicated that the treatment works can accept these flows but still awaiting a response on the connection point and capacity.
- 11.5.13 The impacts associated with the increased foul drainage discharge on the local sewers of medium sensitivity, with no mitigation, are likely to be local, permanent, of moderate magnitude and of moderate-minor significance (see section 13.26-13.28 and table 13.1 for assessment approach).

11.6 PROPOSED MITIGATION AND ENHANCEMENT

11.6.1 The following section highlights those elements which have been incorporated within the design of the development to reduce any potential for adverse impacts on flood risk and water quality both for the development and the surrounding environment.

Design

11.6.2 SuDS have been investigated for incorporation into the outline drainage design. The assessment considers the impact on the environment of introducing these methods into the development with respect to environmental and ecological benefits.

11.6.3 The preliminary design process has involved a technical assessment of the forms of SuDS which are most appropriate to the Site and masterplan and the adoption issues associated with their use.

11.6.4 The SuDS techniques which have been investigated with a view to potential inclusion in the development include:

Source and Site Control Measures

- Swales,
- bio-retention areas,
- porous/permeable paving,

Site and Regional Control Measures

- balancing ponds,
- attenuation basins and
- wetlands.

11.6.5 The proposed SuDS layout will incorporate storm water attenuation measures, where surface water discharges from the Proposed Development will be unrestricted due to the fact we are discharging directly to the sea.

11.6.6 Careful consideration will be given to the development design levels to channel overland flow away from the development.

11.6.7 The development will contain two principal drainage networks, consisting of separate foul water and surface water systems, with the surface water being discharged into the sea.

11.6.8 The surface water runoff from potentially polluted areas (e.g. parking areas) will be discharged via source control measures. This effectively reduces total suspended solids, heavy metals and hydrocarbons from the runoff, providing water quality treatment.

Proposed Surface Water Management Measures

- 11.6.9 A The natural underlying ground is not formed of material that would readily allow significant infiltration into the ground. Furthermore, it is known that some contamination is located on site and leachates is considered as a risk and mitigation is proposed as described in paragraph 5.3. In addition to the aforementioned, we are proposing to discharge to the sea which would not require attenuated flows and/or any requirement to utilise the SuDS hierarchy.

Attenuation Pond

- 11.6.10 A pond can provide both storm water attenuation and water quality treatment. Runoff from each rain event is detained and treated in the pool. The retention time promotes pollutant removal through sedimentation and the opportunity for biological uptake mechanisms to reduce nutrient concentrations. Ponds also provide good ecological and amenity values to developments. Runoff from the roofs and access/internal roads could be collected by traditional gully and conveyed via pipe connections to attenuation ponds.

Permeable pavement

- 11.6.11 Permeable paving is an effective SuDS method of providing a structural pavement suitable for pedestrians and vehicular traffic whilst allowing water to pass straight through the surface into the pavement construction for temporary storage, storm attenuation and dispersal to the ground, or collection. Permeable paving would be beneficial as it allows for a reduction of the occurrence of runoff flooding. Permeable paving would also improve water quality by filtration through the pavement as they are an effective 'first flush' method of removing total suspended solids, heavy metals and hydrocarbons from runoff.
- 11.6.12 It is proposed that any private car parking areas within the proposed development will be constructed using permeable paving. These could be constructed as 'pervious paving with infiltration to ground' or 'attenuation pervious paving with discharge into the pipe network'.

Swales

- 11.6.13 Swales are linear vegetated drainage features in which surface water can be stored or conveyed. Swales can provide pre-treatment upstream of the attenuation ponds whilst increasing the retention time.
- 11.6.14 Instead of using traditional pipe system, swales will be utilised to convey the runoff to main attenuation ponds within this drainage strategy. Where possible, swales will be constructed along the existing land drainage ditches.
- 11.6.15 Due to the gradient of the existing topography and the type of development it may be necessary to provide check dams at regular intervals along the swale alignment, if conveyance swales are used. Check dams will help to achieve the shallow gradients that are preferable in swale design. This will also increase the storage capacity of the swale and promote low

velocities to allow much of the suspended particulate load in the storm water to settle out, thus providing effective pollutant removal.

Design Criteria

- 11.6.16 The positive drainage will be designed in accordance with Sewers for Adoption 7th Edition, and BS EN 752 – Drain and sewer systems outside buildings and the Building Regulations - Part H.
- 11.6.17 The pipe velocities are such that self-cleansing is achieved at lesser, more moderate, storm intensities: -
- Pipe roughness (ks) = 0.6
 - Minimum pipe velocity at full flow = 0.75m/s
 - Percentage Impermeable areas
 - Roads and car parking areas = 100%
 - Roofs = 100%
 - Other (Soft) Area = Nil

Construction Phase

- 11.6.18 Potentially significant impacts during the construction phase are associated with intrusive works on site. By employing appropriate site management practices, the potential for contamination of controlled waters from site plant and activities during the works can be minimised. A range of mitigation measures are suggested which may form part of a site-specific Construction and Environmental Management Plan (CEMP) within which all contractor activities will be undertaken.
- 11.6.19 The following measures to control ground and water pollution impacts from construction have been collated from the CIRIA publications 'Control of Water Pollution from Construction Sites' and would form part of the CEMP:
- Management of construction works so as to comply with the necessary standards and consent conditions to be identified by the EA, Natural Resources Wales (NRW) and Cardiff Council.
 - Consideration will be given to the appropriate storage of materials in wet weather and certain site activities may be postponed during heavy rainfall to prevent pollution entering watercourses;
 - The environmental regulator will be consulted before any mains or tanked water, even if not contaminated, is discharged to the local watercourse;
 - Any oil, fuel lubrication and other potential pollutants shall be handled on the site in such a manner as to prevent pollution of any watercourse or aquifer. For any liquid other than uncontaminated water, this shall include storage in suitable, bunded tanks;
 - No extraction, tipping or temporary storage of materials shall take place within an agreed distance of any watercourse unless part of the approved works. Under

no circumstances shall tipped material enter any watercourse or culvert without prior consent;

- Effective wheel/body washing facilities to be provided and used as necessary;
- A road sweeper to be available whenever the need for road cleaning arises;
- Vehicles carrying waste material off-site to be sheeted.
- The potential for localised noise and air quality impact from the utilities trenching, laying and reinstatement works will be mitigated by employing appropriate site management practices.

11.6.20 All contractors and sub-contractors will also be required to go beyond best practice site management principles, as defined by the Considerate Constructors scheme.

11.6.21 The surface water runoff during the construction phase will be managed through a temporary drainage network strategy incorporating sediment controls, whilst the operational strategy is being constructed. The early phasing of the operational surface water drainage strategy and additional temporary construction measures will ensure that the surface runoff is controlled and discharged so as not to increase the overall runoff rate.

Water Quality

11.6.22 The temporary mitigation measures will be incorporated into a CEMP, and be applied across the development.

Operational Phase

Surface Water Runoff

11.6.23 A positive drainage management of SuDS will be incorporated into the development layout. This will be further detailed in the Flood Consequences Assessment.

11.6.24 An emergency shutoff valve will be incorporated within the surface drainage outfall arrangement(s) to allow discharge to the receiving watercourse to be closed off in the case of an emergency, such as an accidental spillage.

Surface Water quality

11.6.25 The early phasing of the operational surface water quality elements in addition to temporary water quality treatment measures will minimise the risk of the pollutants entering the surface water receptors.

11.6.26 The surface water runoff from potentially polluted areas will be discharged via source control measures, which effectively reduces total suspended solids, heavy metals and hydrocarbons from the runoff, providing water quality treatment. Final attenuation will be provided via ponds/wetlands, which will be located within the proposed landscaped areas.

11.7 RESIDUAL IMPACTS

Construction

- 11.7.1 A site-specific 'Construction and Environmental Management Plan' will be implemented and the contractor is required to use all best engineering practices to minimise construction impacts.

Flooding

- 11.7.2 The completed development will not be required to provide on-site retention of surface water to restrict flows due to discharging into the sea. Therefore, the impact on this medium sensitivity receptor will be negligible, resulting in a neutral effect which is not considered to be significant.

Surface water runoff

- 11.7.3 With the incorporation of the Enhancement and Mitigation Proposals described in Sections above the residual impact of magnitude would be negligible. The potential significance of impacts during the construction phase on surface water runoff, on and off site, would be considered to be reduced from moderate-minor adverse to negligible.

Water quality

- 11.7.4 With the incorporation of the Enhancement and Mitigation Proposals described in Sections above the residual impact magnitude would be slight. The potential significance of impacts of the construction on water quality on and off site would be considered to be reduced from moderate-minor adverse to minor adverse.

Operation

Surface water runoff

- 11.7.5 The proposed drainage design and master planning for the site ensures that the runoff from the site is maintained by incorporating principles of SuDS techniques.
- 11.7.6 With the incorporation of the Enhancement and Mitigation Proposals described in Sections above the residual impact of surface water runoff rate would be negligible. The potential significance of impacts during the operation phase on surface water runoff, on and off site, would be considered to be reduced from moderate-minor adverse to negligible.
- 11.7.7 Similarly, significance of impacts from the reduction of volume generated from the proposed development on the local watercourses will be negligible.

Water quality

- 11.7.8 Due to the implementation of SuDS (at source and locally), surface water runoff from the proposed development will be subjected to minimum of two levels of treatment prior to discharging into the watercourse.
- 11.7.9 With the incorporation of the Enhancement and Mitigation Proposals described in Sections above, the potential impacts of the operation phase of the development on water quality on and off site would be considered to be reduced from moderate-minor to negligible.

Foul Drainage

- 11.7.10 Should DCWW conclude that mitigation/upgrades are required to serve the development, those Mitigation/upgrades in the local network would be carried out prior to the completion of the development. Therefore, the potential significance of impacts during the operation phase on local sewer network, would expect to be reduced from moderate-minor to negligible.

11.8 CONCLUSION

- 11.8.1 The construction and operation of the proposed development may have moderate to slight adverse impacts on the surrounding water environment (in terms of surface water runoff and water quality) should suitable mitigation not be incorporated. However, with the mitigation outlined in sections above, the significance of impacts upon the local water environment can be considered to be minor adverse to negligible.
- 11.8.2 In relation to the bordering developments there will be no significant cumulative impacts arising from the proposed development. Similarly, there will be no significant cumulative impacts for the site distance developments.
- 11.8.3 Table below summarises the finding of this assessment.

Table 9.3: Summary of Residual Impacts

Resource	Phase	Nature of Effect	Significance	Duration	Mitigation/ Enhancement	Significance of Residual Impact	Geographical Level of Importance of Issue				
							I	N	R	D	L
Surface water runoff and Water quality	Construction	Surface water runoff - Temporary Direct	Moderate-minor- Adverse	Short-term	appropriate site management practices will be employed in accordance with a site-specific Construction and Environmental Management Plan (CEMP)	negligible				x	x
		Water quality - Temporary Direct	Moderate-minor- Adverse	Short-term	appropriate site management practices will be employed in accordance with a site-specific Construction and Environmental Management Plan (CEMP)	minor adverse				x	x
	Operation	Surface water runoff - Permanent Direct	Moderate-minor- Adverse	Long-term	SuDS will be used to attenuate the surface water runoff from the site to pre-development (greenfield) rates.	negligible				x	x
		Water quality – Permanent Direct	Moderate-minor- Adverse	Long-term	SuDS will be used to provide water quality treatment	negligible				x	x
Foul water discharge	Operation	Foul drainage – permanent Direct	Moderate-minor- Adverse	Long-term	Depend on the outcome of the Welsh Water, appropriate mitigation measures will be implemented to overcome potential impacts.	negligible				x	x