



Environmental Statement Chapter 17. Hydrology and Flood Risk

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17.0 Hydrology and Flood Risk

17.1 Introduction

- 17.1.0.1 This Chapter presents an assessment of the potential hydrological and flood risk impacts of the Project, both within the Project area and the immediate surrounding area. It should be noted that some of the impacts relating to the hydrogeology underlying the area of the Project are assessed within Chapter 18: Land Quality and Hydrogeology Assessment of this ES. This is due to the close interrelationship between the two technical disciplines.
- 17.1.0.2 This Chapter identifies key water resources and sensitivities, and addresses the direct and indirect impacts of the Project on these resources. The assessment of impacts is made in the context of existing conditions (baseline conditions), predicted conditions during site preparation and construction works, those expected once the Project is completed and those associated with the decommissioning options. The need for mitigation measures is addressed, where appropriate, and any residual impacts are identified.
- 17.1.0.3 This Chapter, within the EIA, is supported by a Flood Consequence Assessment (FCA), which has been produced as a standalone document. The FCA assesses the potential flood risk to the existing area of the Project, identifies the potential impacts the Project may have upon flood risk and sets out mitigation measures to reduce the identified potential impacts and to allow management of associated risk, where appropriate. The FCA also fulfils the requirement under Regulation 5(2)(e) of the APFP Regulations (2009) that an application for development consent should be accompanied by a flood risk assessment.
- 17.1.0.4 Consultation in relation to hydrology and flood risk has been undertaken, where required, as part of the EIA process. In the preparation of this Chapter, the Environment Agency Wales (EAW, now Natural Resources Wales (NRW)), Dwr Cymru-Welsh Water (DCWW), City and County of Swansea Council (CCSC), Neath Port Talbot County Borough Council (NPTCBC) and the Countryside Council of Wales (CCW) were consulted. In addition, a variety of data sources have been consulted, such as published maps. Each data source used is referenced as appropriate.

17.2 Legislative and policy context

17.2.1 National legislation

- 17.2.1.1 The Water Resources Act 1991 (WRA 1991) sets out the relevant regulatory controls that provide protection to water bodies and water resources. The WRA 1991 was amended by the introduction of the Water Act 2003 (WA 2003). The WRA 1991 governs the control of water abstraction, discharge to water bodies, water impoundment, conservation and drought provision. The WRA 1991 originally excluded dewatering from engineering activities subject to controls. However, the WA 2003 now lists this activity as requiring a 'Temporary' or 'Transfer' licence.
- 17.2.1.2 There are other Acts of relevance to this assessment:
- I. the Environment Act 1995, which established the Environment Agency (EA - now Natural Resources Wales in Wales); and

- II. the Environmental Protection Act 1990, which provides for integrated pollution control.

17.2.1.3 A number of relevant regulations have also been made. These regulations include:

- i. the Anti-Pollution Works Regulations 1999 - which contains regulatory powers to control the pollution risk from various stored products;
- ii. the Groundwater Regulations (England and Wales) 2009 which transposed the EU Groundwater Directive (2006/118/EC) into UK law;
- iii. the Environmental Damage Regulations 2009;
- iv. the Water Resources Act (Amendment) (England and Wales) Regulations 2009;
- v. the Environmental Permitting (England and Wales) Regulations 2010 which control discharge of water to surface water and groundwater; and
- vi. the Water Supply (Water Quality) Regulations 2010.

17.2.1.4 The Flood and Water Management Act 2010 (FWMA 2010) received Royal Assent on the 8 April 2010. It is largely aimed at delivering the recommendations of the Pitt Review following the 2007 floods. Amongst other recommendations, FWMA 2010 states that Sustainable Drainage Systems (SUDS) must be the first choice for all new developments, and provides for adoption of SUDS by the Lead Local Flood Authority, which is either the County Council or the County Borough Council for the area.

17.2.1.5 FWMA 2010 also introduces changes to the rights to connect to sewers. Automatic connection rights are restricted only to adopted sewer schemes constructed to the new National Sewer Standard or approved SUDS schemes constructed to the new National SUDS Standard (expected October 2014).

National Policy – The Wales Spatial Plan (Nov. 2004 and 2008 update)

17.2.1.6 The Wales Spatial Plan (WSP) considers the potential impact of climate change and states that action must be taken to protect communities from the unavoidable consequences of climate change, as most of Wales' population lives close to either rivers or the sea.

17.2.1.7 The document was updated during 2008 and takes account of the Welsh Government's priorities set out in the One Wales agreement¹. The WSP identifies six distinctive areas within Wales. The Project lies within 'Swansea Bay – Waterfront & Western Valleys'.

17.2.1.8 Key priorities for the 'Swansea Bay - Waterfront and Western Valleys' include ensuring that environmental protection and enhancement are fully integrated. This includes activities such as ensuring local communities are resilient to flood risk, aligning strategic infrastructure investment to spatial development aspirations (in particular for waste and sewerage), and protecting and enhancing the quality of rivers and bathing waters.

National Policy – Planning Policy Wales (2012)

17.2.1.9 Planning Policy Wales (PPW) sets out the land use planning policies of the Welsh Government (WG). It states that key policy objectives, which should be incorporated into planning policies and proposals, include minimising the risks posed by, or to,

¹ See <http://wales.gov.uk/legislation/referendumpowers/referendumjourney/one-wales/?lang=en>

development on, or adjacent to, land liable to flooding. This includes managing and seeking to mitigate the effects of climate change. It also encourages opportunities to reduce waste and all forms of pollution and to promote good environmental management and best environmental practice.

17.2.1.10 There are a series of objectives relating to infrastructure and services; which include the protection and improvement of water resources through increased efficiency and demand management of water, particularly in those areas where additional water resources may not be available.

17.2.1.11 Objectives relating to minimising and managing environmental risks and pollution include maximising environmental protection for people, natural and cultural resources; and prevention or managing pollution and promoting good environmental practice.

National Policy – Technical Advice Note (TAN) 15: Development and Flood Risk (July 2004)

17.2.1.12 TAN 15 supplements policies set out in PPW and provides guidance in relation to development and flood risk, which is intended for use by Local Planning Authorities. It provides a precautionary framework from which risks associated with river, coastal and surface water flooding can be assessed.

17.2.1.13 The aim of the precautionary framework is, in order of preference, to:

- i. direct new development away from those areas which are at high risk of flooding; and
- ii. where development has to be considered in high-risk areas, only those developments that pass the Justification Test contained in Section 6 of TAN 15, and the consequences of flooding are deemed acceptable, will be permitted in such areas.

National Legislation - Water Framework Directive (Directive 2000/60/EC)

17.2.1.14 The Water Framework Directive (WFD) establishes a framework for a European wide approach to action in the field of water policy. Its ultimate aim is to ensure no deterioration from current status for all inland and near shore watercourses and water bodies (including groundwater) and to ensure attainment of 'Good' status or better, in terms of ecological, but also chemical, biological and physical parameters, by the year 2015. Therefore, any activities or developments that could cause detriment to a nearby water resource, or prevent the future ability of a water resource to reach its target status, must be mitigated so as to reduce the potential for harm and allow the aims of the WFD to be realised.

17.2.2 Regional Planning Policy (September 2001)

17.2.2.1 Regional Planning Guidance (South West Wales Strategic Planning Group - SWWSPG) recognises that the coastal zone is under pressure not only from a conservation perspective, but also through recreational, leisure, tourism, urban and economic development. It states that pollution, flooding, coastal erosion and offshore dredging pose further threats.

17.2.2.2 SWWSPG re-iterates that national planning policy guidance advises that proposals for major development in the coastal zone should only be permitted where the need for a

coastal location has been clearly demonstrated. The policy guidance recommends that other planning considerations should be that there is no adverse impact on the landscape or nature conservation interests; and no risk posed by the development to surrounding areas in terms of flooding, erosion and land instability.

- 17.2.2.3 Until the adoption of Local Development Plans, the Regional Planning Guidance remains a material consideration within the planning process.

17.2.3 Local Planning Policy

Swansea Local Development Plan (LDP)

- 17.2.3.1 The CCSC Unitary Development Plan (UDP) is to be replaced within the next few years by a new form of Development Plan known as the LDP. The LDP will provide a new approach to promoting and controlling change across the CCSC. It will emphasise the need to promote sustainable development in Swansea through the use of land and control of development.

Local Planning Policy – City and County of Swansea Unitary Development Plan (UDP)

- 17.2.3.2 The CCSC UDP adopted in November 2008 sets out policies and proposals for future development, use of land and environmental conservation within the area up to 2016. The main purpose of the UDP is to promote sustainable development, protect the environment, facilitate regeneration and support community planning.
- 17.2.3.3 The WSP and UDP emphasise that the revitalisation of significant brownfield sites in and around the Swansea Port area should be delivered by a waterfront regeneration masterplan which promotes sustainable growth of the local and regional economy. This would be intended to revitalise the economy in South West Wales. The Swansea Port / Swansea Bay area is identified as a key area for future development in the UDP.
- 17.2.3.4 In relation to flood risk within the area, Policy EV36 states that: *"New development, where considered appropriate within flood risk areas, will only be permitted where developers can demonstrate to the satisfaction of CCSC that its location is justified and the consequence associated with flooding are acceptable"*.
- 17.2.3.5 Following the precautionary framework, CCSC aims to direct development away from areas considered to have high flood risk. Development will only be justified in these high flood risk areas, if it meets the criteria and tests specified within TAN 15. Should a proposal meet the relevant criteria, CCSC requests that the developer submits a Flood Consequence Assessment (FCA) with any planning application.
- 17.2.3.6 When considering surface water runoff, Policy EV35 states that:
- 17.2.3.7 *"Development that would have an adverse impact on the water environment due to:*
- I. Additional surface water runoff leading to a significant risk of flooding on site or an increase in flood risk elsewhere, and/or*
 - II. A reduction in the quality of surface water runoff will only be permitted where it can be demonstrated that appropriate alleviating measures can be implemented.*
- 17.2.3.8 *Sustainable drainage systems (SUDS) will be encouraged wherever they would be effective and practicable, so as to ensure that development does not increase run off, and*

potentially damage important landscape features and protected species and habitats. Where SUDS are not provided then any conventional drainage system utilised must improve the status quo."

Local Planning Policy – Port Tawe and Swansea Dock - Supplementary Planning Guidance (SPG) (September 2002)

- 17.2.3.9 The SPG for Port Tawe and Swansea Port aims to provide an overall strategic framework to assist more detailed master planning and to promote sustainable development of the area for the economic, social and environmental benefit of Swansea.
- 17.2.3.10 The guidance states that Port Tawe / Swansea Port can provide highly attractive sites for economic development that will be essential to Swansea's future prosperity whilst also providing opportunities for high quality housing developments.
- 17.2.3.11 Action Plan - Swansea Bay Strategy (2008) was initially identified as a potentially relevant SPG for this assessment. However; as the Swansea Bay Strategy does not cover the site of the Project it has not been considered further within this ES.

Local Planning Policy – Neath Port Talbot County Borough Council Local Development Plan (LDP)

- 17.2.3.12 The UDP currently in force for Neath Port Talbot is to be replaced within the next few years by a LDP.

Local Planning Policy – Neath Port Talbot Unitary Development Plan (UDP) (March 2008)

- 17.2.3.13 The NPTCBC UDP sets out policies and proposals for future development, use of land and environmental conservation within the area up to 2016. The main purpose is to promote sustainable development, protect the environment, facilitate regeneration and support community planning.
- 17.2.3.14 It is noted that most of the Project's onshore development will be based within the CCSC's administrative area. However, a review of relevant NPTCBC UDP policies is provided below.
- 17.2.3.15 In relation to flood risk within the area, Policy ENV11 states that:
- 17.2.3.16 *" a. Proposals located in an area of floodplain or tidal wash area, where floodwater is currently unobstructed will be resisted unless a flood risk assessment can demonstrate that:*
 - i) it is wholly exceptional and limited to essential transport and utilities infrastructure;*
 - ii) it would remain operational at times of flood;*
 - iii) it would not result in a net loss of flood plain/ wash area storage;*
 - iv) it would not impede water flows; and*
 - v) it would not increase flood risk elsewhere.*

b. Proposals located in areas identified as being at high risk from flooding and other areas where the Authority is satisfied there is a significant risk from flooding will not be permitted unless a flood risk assessment demonstrates that:

- i. The development could be justified in the location;*
- ii. The proposal would not result in the intensification of existing development which may itself be at risk or would increase the potential adverse impacts of flooding; and*
- iii. The proposal can be properly protected by engineering works and /or other flood protection measures, which are committed expenditure or would be provided as part of the proposal, and could be expected to be effective for the lifetime of the development.*

c. Proposals for development will be resisted unless they have taken all reasonable steps to ensure that surface water run-off is controlled as near to the source as possible by the use of sustainable drainage systems."

17.2.3.17 In relation to water resources within the area, Policy ENV12 states that:

"Proposals that would be prejudicial to or would materially affect the quality or quantity of controlled waters, fresh water, or seawater will not be permitted."

17.2.4 Other relevant policy

Strategic Flood Consequence Assessment (SFCA) (Level 2)

17.2.4.1 A Stage 2 SFCA was completed for CCSC by URS in 2012 (URS, 2012). This report was produced to inform the Sustainability Appraisal (SA) and Local Development Plan (LDP) process and to ensure that proposed development is steered towards the lowest possible flood risk area, as required by TAN15.

17.2.4.2 The Stage 2 SFCA provides a more detailed assessment of flood risk posed to 30 Candidate Areas that have been identified by the CCSC. One of these areas, Fabian Way Corridor, is potentially affected by the Project. The SFCA indicates that the entire onshore element of the Project lies within Development Advice Map (DAM) Zone C2, with the majority lying within the Environment Agency Flood Zone 3. There are isolated areas at risk of surface water flooding identified, but these are not considered to impact future development. The SFCA also suggests that there have been no historical or sewer flooding incidents in the Project area.

Lavernock Point to St Ann's Shoreline Management Plan 2 (Halcrow, January 2012)

17.2.4.3 A Shoreline Management Plan (SMP) provides a large-scale assessment of the risks associated with coastal erosion and flooding at the coast, including Swansea Bay. It also provides policies to help manage these risks in a sustainable manner.

17.2.4.4 Policy Scenario Area 8 (Sker Point to Swansea Docks) and Policy Scenario Area 9 (Swansea Docks to Mumbles Head) aim to maintain and upgrade existing defences in an attempt to reduce the risk of coastal erosion and flooding. It is considered that this will help prevent the erosion of potentially contaminated material into Swansea Bay.

River Basin Management Plan (RBMP)

- 17.2.4.5 The first Western Wales RBMP was published by Environment Agency Wales in 2009, which includes Swansea and its surrounding area, is currently being updated by NRW. The RBMP focuses on the protection, improvement and sustainable use of the water environment. River basin management is a continuous process of planning and delivery. Waterbody Action Plans (WAPs) are available and these summarise the key features and objectives of the water body along with updated information on the current WFD status between revisions of the RBMPs.
- 17.2.4.6 The Project falls within the Ogmere - Tawe catchment. According to the RBMP 37% of rivers and lakes have a good ecological status (or potential) compared to 30% of coastal waters and estuaries. With regards to the coastal areas, the main pressures include morphological alterations, nutrient and microbiological contamination from runoff and sewage, chemical contamination.
- 17.2.4.7 Management schemes proposed to address the issues discussed above include managed realignment schemes and pollution prevention campaigns to protect coastal areas.

Catchment Flood Management Plan (CFMP)

- 17.2.4.8 In 2010, a CFMP was produced by the Environment Agency for the Ogmere - Tawe catchment, addressing the scale and extent of flooding both now and in the future, and setting policies for managing flood risk. In the area considered in relation to the Project, the CFMP addresses the risk posed by the River Tawe, the tidal risk within the lower reaches and surface water. It should be noted that in flood management terms the Project does not affect any of the rivers within the catchment. Therefore, there will be no detriment in terms of flood management to the river system. The tidal influence upon the onshore element of the Project has been discussed in Section 17.5.

Relevant pollution prevention guidelines (Environment Agency Pollution Prevention Guidance Notes)

- 17.2.4.9 The Environment Agency (now Natural Resources Wales) provides a range of pollution prevention guidance notes (PPGs) to advise industry and the public on legal responsibilities and good environmental practice. The key guidance which are considered relevant to the Project are outlined below.
- 17.2.4.10 Pollution Prevention Guidelines Note 1 (PPG1) – 'General Guide to the Prevention of Pollution' provides an introduction to, and the key principles of, the prevention of pollution from a variety of sources.
- 17.2.4.11 PPG2 – 'Above Ground Oil Storage Tanks' offers advice on storage options, equipment and its maintenance and how to deal with spills.
- 17.2.4.12 PPG3 – 'Use and Design of Oil Separators in Surface Water Drainage Systems' provides guidance on when oil separators are appropriate and what size and type of separator are required.
- 17.2.4.13 PPG4 – 'Disposal of Sewage where no Mains Drainage is available' offers advice if connection to the local sewage network is not possible and offers guidance on alternative means of wastewater disposal.

- 17.2.4.14 PPG5 – 'Works in, near or liable to affect watercourses' provides guidance on general precautions to take when working in the vicinity of a watercourse, along with more specific measures to take to prevent contamination and to minimise any impacts.
- 17.2.4.15 PPG6 – 'Working at construction or demolition sites' repeats much of PG5 but concentrates specifically on the situations likely to occur at demolition and construction sites.
- 17.2.4.16 PPG7 – 'Refuelling Activities' provides information on the correct delivery, storage and dispensing of fuel to help reduce the risk of pollution.
- 17.2.4.17 PPG21 - 'Pollution Incident Response Planning' provides advice for those developing site specific pollution incident response plans to help prevent and mitigate damage to the environment caused by accidents such as spillage and fire.

Construction Industry Research and Information Association (CIRIA) Guidance

- 17.2.4.18 Guidance C532 'Control of Water Pollution from Construction Sites: Guidance for Consultants and Contractors' (2001) brings together the above guidance. However, it also goes into more detail with regard to sources of water on construction sites, pollutants and pathways in addition to providing guidance on planning for the type and location of suitable control measures.
- 17.2.4.19 Guidance C697 'The SUDS Manual' (2007) provides best practice guidance on the planning, design, construction, operation and maintenance of SUDS to facilitate their effective implementation within developments. This supersedes previously issued guidance including C521.

17.3 Assessment methodology and significance criteria

17.3.1 Assessment methodology

- 17.3.1.1 The study area (as encompassed by the application boundary) for this assessment is the onshore area of the Project, between the western and eastern seawall landfall, and a corridor 100m either side of the cable and electrical grid connection route options running from the Project to the National Grid Substation at Baglan (Figure 17.1).

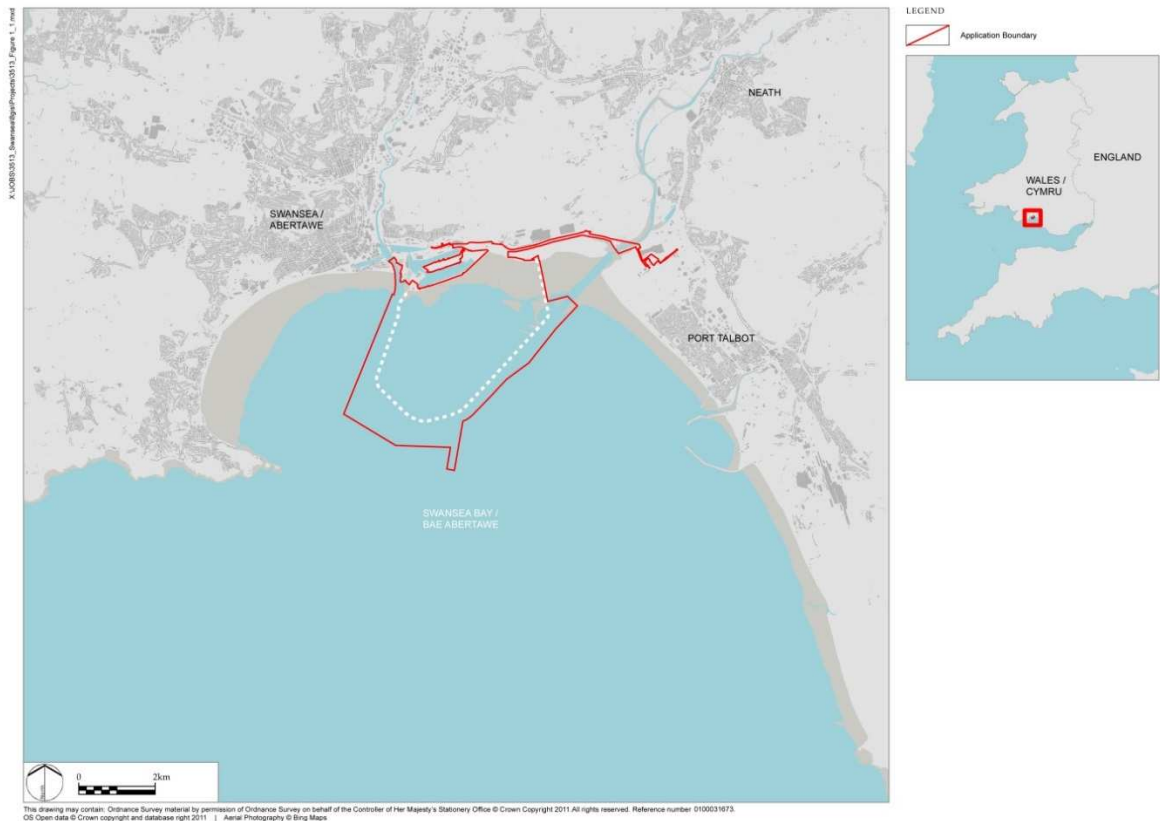


Figure 17.1 Study area

- 17.3.1.2 This section presents the general methodology used to assess the potential impact of the Project on the hydrology and flood risk of the study area and area surrounding the Project. The following were undertaken for the assessment:
- consultation with statutory and non-statutory bodies to identify the interests and concerns regarding the water environment (predominantly, but not limited to, NRW (formerly CCW), DCWW, CCSC and NPTCBC;
 - desktop study to obtain baseline and historical data;
 - field surveys to ascertain baseline conditions;
 - identification of the potential impacts from the Project and assessment of their significance based on the magnitude of the potential impact and the sensitivity of the receiving environment; and
 - identification of options for mitigation of potential impacts in accordance with relevant legislation, policies and guidance.
- 17.3.1.3 An initial desk based study was conducted in January 2013 comprising a desk-based review of the Project, which included the collation of information from Ordnance Survey, the Environment Agency, WG's Development Advice Maps and a Landmark Envirocheck report.
- 17.3.1.4 A site visit was undertaken on 19 December 2012 to identify water features, flood defences, on-site surface water management measures and record any other potentially relevant and readily identifiable features of hydrological interest.

- 17.3.1.5 This ES proceeds on the basis of the outline construction programme as discussed in Chapter 4, Section 4.5.2, which anticipates construction starting in 2015 and with the main construction lasting for about three years. The assessments contained in this chapter are not materially sensitive to works commencing within the anticipated validity of the DCO, which is five years, or to an extension of (say) a further year-or-so

17.3.2 Significance criteria – water resources

- 17.3.2.1 Significance criteria for water resources have been based on the methodology given in the Department for Transport's (DfT) 'The Water Environment Sub-Objective' Transport Assessment Guidance (TAG) UNIT 3.3.11 (DoT, 2003), which brings together the 'New Approach to Transport Appraisal' (NATA) (DETR, 1998) and the 'Guidance on the Methodology for Multi-Modal Studies' (GOMMMS) (DETR, 2000). These criteria take into account the sensitivity and vulnerability of the water resource and the nature of the Project.
- 17.3.2.2 Mustow, Burgess and Walker expanded the GOMMMS methodology in 2005 (Mustow *et al*, 2005) to make the application of the method more standardised and less open to the subjectiveness of the assessor. This is the method that has been used in this assessment. The use of the DfT TAG guidance is appropriate, notwithstanding its genesis in assessments of transport projects, because it provides an assessment methodology and assessment criteria of general application.
- 17.3.2.3 There are three stages to the assessment of the effect on water resources as follows:
- i. a level of importance / sensitivity (Low to Very High) is assigned to the water resource based on a number of attributes such as water supply, biodiversity, transport and dilution of waste products, recreation and conveyance (Table 17.1);
 - ii. the magnitude of the potential impact on the receptor is determined based on Table 17.2, the assessor's knowledge of the Project and also taking into account mitigation measures; and
 - iii. finally, an overall predicted impact significance is given (Table 17.3).

Table 17.1 Derivation of importance of water resource

Importance	Criteria	Example
Very High	Water resource with an importance and rarity at an international level with limited potential for substitution.	Principal aquifer providing potable water to a large population; and Deterioration in WFD classification.
High	Water resource with a high quality and rarity at a national or regional level and limited potential for substitution.	Principal aquifer providing potable water to a small population.
Medium	Water resource with a high quality and rarity at a local scale or water resource with a medium quality and rarity at a regional or national scale.	Secondary aquifer providing water to a small population.
Low	Water resource with a low quality and rarity at a local scale.	A non 'main' river or stream without significant ecological habitat.
Negligible	Water resource with very low quality and rarity at a local scale.	Discharges to ordinary watercourse with minimal loss in quality, fishery productivity or biodiversity.

Table 17.2 Derivation of magnitude of impact

Magnitude of Impact	Criteria	Example
Major	Impacts results in a shift in potential attributes of a water body.	Pollution / remediation of potable source of abstraction resulting in failure / recovery above drinking water standards.
Moderate	Results in impact on integrity of attribute or loss of part of attribute.	Loss / gain in productivity of a fishery. Contribution / reduction of a significant proportion of the effluent in a receiving river, but insufficient to change its WFD status.
Minor	Results in minor impact on attributes of a water body.	Pollution / remediation of secondary aquifer providing water to a small population.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect the use /integrity.	Physical impact to a water resource but no significant reduction / increase in quality, productivity or biodiversity; no significant impact on the economic value of the feature; and no increase in flood risk.

17.3.2.4 The potential impact on the receptor is assessed giving consideration to the following aspects:

- i. **Positive or negative** – is the impact likely to be good or bad for the feature?
- ii. **Magnitude** – what size or 'amount' of an impact is there?
- iii. **Extent** – the extent of the impact.
- iv. **Duration** – the duration over which the impact is expected to last prior to recovery or replacement of the feature.
- v. **Reversibility** – is it an irreversible (permanent) impact from which recovery is not possible or is it a reversible (temporary) impact from which spontaneous recovery is possible?

- vi. **Timing and frequency** – some changes may only cause an impact if they happen to coincide with critical life-stages or seasons. The frequency is how often the activity/impact will happen.

17.3.2.5 Based on the importance/sensitivity of the receptor and the predicted magnitude of the potential impact, the significance of an impact is then determined according to Table 17.3. Residual impact is the significance of impact considered after mitigation measures have been taken into account.

Table 17.3 Derivation of impact significance

Importance of Water Resource (receptor)	Magnitude of Potential Effect				
	Major Negative	Moderate Negative	Minor Negative	Neutral	Positive
Very High	Major Adverse	Major Adverse	Moderate to Minor Adverse	No Impact	Major Beneficial
High	Major Adverse	Major to Moderate Adverse	Minor Adverse	No Impact	Major – Moderate Beneficial
Medium	Moderate Adverse	Moderate to Minor Adverse	Minor Adverse	No Impact	Moderate Beneficial
Low	Minor Adverse	Minor Adverse	Insignificant	No Impact	Minor beneficial
Negligible	Minor / Insignificant	Insignificant	Insignificant	No Impact	Insignificant

17.3.3 Significance criteria – flood risk

- 17.3.3.1 The specific methodology for defining and assessing flood risk is dictated by the requirements of TAN 15. This states that a FCA must be undertaken for developments in Flood Zone C2, to highlight and assess the significance of flooding to the development and to assess any potential the development may have for increasing flooding in other areas.
- 17.3.3.2 The FCA for the Project focuses on the onshore elements of the Project and assesses potential flood risks both to and from the Project. Unlike the impact assessment methodology applied for other water resources, the flood consequence methodology used in an FCA assumes that the ‘receptors’ in the Source-Pathway-Receptor model are any areas of land or development potentially at risk both as a result of the Project but also within the Project itself.
- 17.3.3.3 In a sense, the application of the Source-Pathway-Receptor model can be considered as reversed, in that the water resources themselves are the potential ‘sources’ of effect. Nevertheless, the principle of the model is the same in that an effect is only considered if all three elements of the model (Source-Pathway-Receptor) are identified.
- 17.3.3.4 Using the FCA methodology, sites at risk are not graded by a ‘value’ as it is assumed that all areas affected by flooding are equally important. TAN15 simply requires that the Project should not increase flood risk elsewhere (i.e. it has no adverse effect) and should reduce flood risk where possible. In the absence of an assigned ‘value’ for receptors, the significance of effect will be based on a qualitative assessment of the likely magnitude of the flood consequences.

17.4 Baseline conditions

17.4.1 Study area and surface water resources

- 17.4.1.1 The seawalls comprised in the Offshore Works that surround the Lagoon will extend into Swansea Bay enclosing an area of water with a surface area of approximately 11.5km². The mouths of the River Neath and River Tawe are both located within relatively close proximity to the Project (see Figure 17.2).

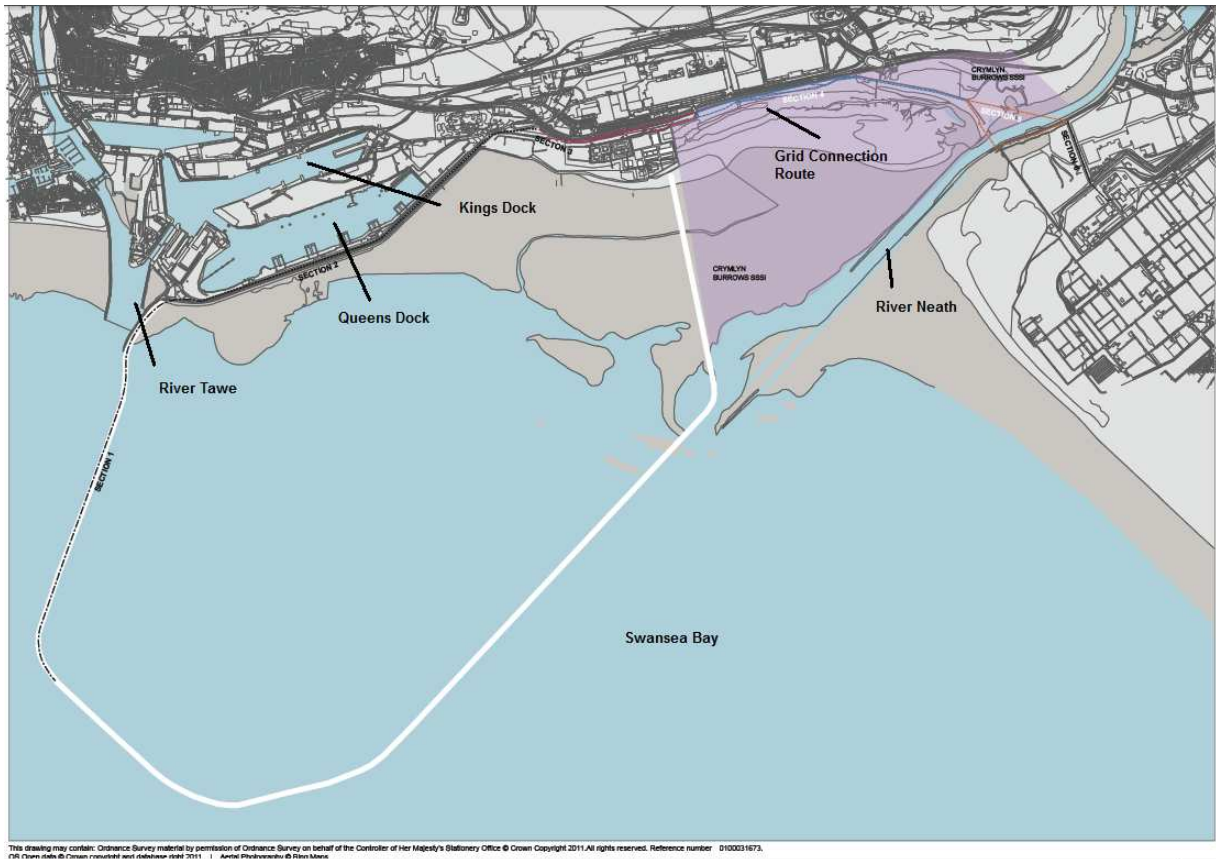


Figure 17.2 Location of key water features in study area

- 17.4.1.2 The River Tawe rises in the Black Mountains, South Powys, flowing south through Swansea. Its estuary runs through the eastern outskirts of Swansea and enters Swansea Bay immediately adjacent to the western boundary of Swansea Port. A small section of the lower reaches of the River Tawe are tidally dominated. Those sections are within the vicinity of the Project, but are not classified within the RBMP of the River Tawe for the purposes of the WFD. Therefore, the effects on those sections of the River Tawe and the fluvial River Tawe (which are above the Swansea Barrage) in relation to hydrology and flood risk, are not considered further within this assessment because the Project will have no effect upon them. The tidal reach of the River Tawe is considered as part of Swansea Bay for assessment purposes.
- 17.4.1.3 The River Neath flows from its source in the Brecon Beacons National Park and discharges into the eastern region of Swansea Bay. The mouth of this river, which is estuarine, is located approximately 2km east of the proposed onshore elements of the Project. The proposed grid connection will cross beneath the Neath estuary and as such, it falls within the boundary of the Grid Connection Works. However, the upper reaches (non-tidally dominated) of the River Neath are distant from the Project and will not be

affected by the Project. As such the effects on the fluvial River Neath are not considered further within this assessment.

- 17.4.1.4 Queens Dock and Kings Dock (see Figure 17.2) are located within the Swansea Port area. Water levels within the docks are controlled by a series of locks. The Project will have onshore infrastructure located within and adjacent to the Swansea Port area, in particular, on the land surrounding Queens Dock. Queens Dock, Kings Dock, Prince of Wales Dock, the reach located between the downstream weir on the River Tawe, and the end of Western Pier/Eastern Breakwater are classified as Estuarine Waters with 'Good Ecological' Status within the RBMP for the purposes of the WFD.
- 17.4.1.5 The nearest part of the Tennant Canal to the Project is situated approximately 400m to the north, beyond Fabian Way (A483). The Tennant Canal is classified as a river with 'Good Ecological' Status within the RBMP and WAP for the purposes of the WFD. However, it is considered that the Project will not affect surface water resources within the Tennant Canal due to its distance and elevation from the Project, therefore the Tennant Canal is not considered further within this part of the assessment.

17.4.2 Water quality

- 17.4.2.1 NRW, CCSC and NPTCBC currently monitor the water quality in Swansea Bay. According to the Environment Agency website (accessed January 2014) the Ecological status of coastal waters within Swansea Bay is classified as 'Bad'. However, chemical status is classified as 'Good'. It is predicted that in 2015, there will be no changes in either the ecological or chemical quality standards.

17.4.3 Surface water abstractions and discharges

- 17.4.3.1 An Envirocheck report was obtained in January 2013 for the Project, centred at NGR 267280; 192450, on the inside of the entrance to the Kings Dock. This indicates that there are 4 surface water abstractions (all of which are from the same location on the Kings Dock) located within 0 - 250m of the Project. These are all for J W Aquaculture Ltd, which undertakes shellfish farming within the Kings Dock area.
- 17.4.3.2 In the western and central area of the Port there are 98 discharge consent records within 0 - 250m of the Project. 93 of these (all for Associated British Ports (ABP)) have either been revoked or expired. The remaining discharge consents are for Cemex UK Materials Ltd (site drainage), the Corporation of Trinity House (sewage and trade effluent combined), J W Aquaculture Ltd (trade effluent) and two for ABP, all of which discharge to Kings Dock. There are a further 109 discharge consents within 251 – 1000m of the Project. However the majority of these have either been revoked or expired and do not discharge into Swansea Bay within the area of the Project. There is a single discharge consent for BP Chemicals Ltd at the western end of the rock revetment (NGR 267500 191900) that discharges into the Project area. However, based on the existing building (small workshop/store) this is unlikely to be a significant discharge.
- 17.4.3.3 At the eastern end of the Port there are five discharge consents within 250m of the Project that are still authorised. Three of these are Storm Sewage Overflows or final treated effluent for DCWW into Swansea Bay. The remaining consents are for trade effluent discharged by BP Chemicals into Queens Dock.

- 17.4.3.4 A Dwr Cymru Welsh Water (DCWW) combined sewer serves the port area and waste water is treated at the DCWW Waste Water Treatment Works located to the east of the Project area.

17.4.4 Fisheries

- 17.4.4.1 Swansea Bay has a long history with the commercial shellfish and finfish fishing industry. Queens Dock has recently been classified as Class B for shellfish production. The Bay as a whole is designated under the Shellfish Waters Directive (Council Directive, 1979), with some areas identified as Mussel Production Areas for harvesting mussels. More information regarding commercial and recreational fishing, as well as the effects of the Project on fish and shellfisheries, can be found in Chapter 9: Fish which assesses Recreational and Commercial Fisheries.

17.4.5 Flood risk

- 17.4.5.1 The Project lies within DAM Zone C2 as delineated by the WG. This DAM Zone covers areas that have an Annual Exceedance Probability (AEP) of flooding that is equal to or greater than 0.1% (i.e. prone to flooding during a 1 in 1000 year flood event from tidal and/or fluvial sources). The main risk of flooding to the Project is considered to be from tidal sources. In addition, the CCSC Level 2 Strategic Flood Consequence Assessment (SFCA) also confirms the Project lies within DAM Zone C2, with the majority of the Project also lying within the Environment Agency defined Flood Zone 3.
- 17.4.5.2 Although the onshore part of the Project is not located in an area which benefits from current sea defence, the site visit identified that sea flood defences do exist around the Port area. The sea flood defences observed include a rock revetment which runs along the southern boundary of the Port and this is supplemented by a raised seawall. On the landward side of the seawall are drainage ditches which collect spray overtopping and surface water. These flood defences are not identified on the Environment Agency Flood Map and it is therefore considered that the Standard of Protection afforded by these defences is likely to be less than the 1 in 200 year tidal flood event.
- 17.4.5.3 To assess tidal flood risk, the Environment Agency's report on Coastal Flood Boundary Conditions (Design Sea Levels) (Environment Agency, 2011) and the Defra FCDPAG3 Economic Appraisal Supplementary Note to Operating Authorities – Climate Change Impacts, October 2006, were considered. The Environment Agency's report provides the sea levels for a range of return periods around the UK coastline whilst the Defra report provides the allowances for Net Sea Level Rise. These reports demonstrate that:
- i. the existing 1 in 200 year still water tide level is 6.3 mAOD²;
 - ii. the existing 1 in 1000 year still water tide level is 6.5 mAOD; and
 - iii. the future 1 in 200 year still water tide level is approximately 7.0 mAOD assuming a 75 year development lifetime (NRW comments on the PEIR, June 2013).
- 17.4.5.4 These provide a precautionary allowance for sea level rise and whilst a 'potential' 120 year lifetime of development has been expressed, the design of the lagoon structure provides an allowance for raising the seawall height in the future therefore providing a sustainable solution. A 75 year lifetime of development is considered appropriate based

² metres Above Ordnance Datum. This value is based on the Design Sea Level at Mumbles. This has been adjusted through linear interpolation to account for changes in level between Mumbles and Newport and rounded to one decimal place.

on current recommendations by NRW for non-residential development. It is noted that the hydraulic modelling undertaken to assess the effects on coastal change is currently looking at a time span of 50 years using the UK Climate Projections 2009 (UKCP09). This approach indicates that using the 95 percentile for a medium emissions scenario, sea level rise for a period of 50 years is likely to be approximately 0.32m. However, the proceeding sections demonstrate that the structure provides an informal level of protection for a 75 year development lifetime based on the Defra FCDPAG3.

17.4.5.5 With regard to surface water, the CCSC Level 2 SFCA identifies that there are isolated areas of surface water flooding. However, these do not present a significant constraint to future development. The SFCA indicates also that there has been no recorded historical flooding from sewer flooding or other sources onsite.

17.4.5.6 Artificial flood sources include raised channels such as canals or storage features such as ponds and reservoirs. The Environment Agency Map of Flood Risk from Reservoirs shows that the Cefn Parc Reservoir is located approximately 2km to the north-east of the site. If this reservoir were to fail, the map shows that the site would not be affected, however low lying areas associated with the Crymlyn Bog are likely to be inundated. The same map shows that any flooding that was to occur from the Tennant Canal would not affect the site.

17.4.6 Rainfall

17.4.6.1 According to data collected from the Cwm Level Park station, located just north of Swansea, the annual rainfall since 2008 has ranged from 1139mm to 1515mm (1446mm in 2012). The station at Swansea Bay, which was introduced in May 2011, provides data indicating that during 2012 the annual rainfall was 1175mm (CCSC, 2012).

17.4.7 Geology and hydrogeology - geology

17.4.7.1 Chapter 18: Land Quality and Hydrogeology contains a full review of the geology and the hydrogeology of the area. The section below provides a brief summary to set the context within the remit of water resources and flood risk.

17.4.7.2 Based on a review of British Geological Society (BGS) maps and the Landmark Envirocheck report (January 2013) anticipated geological succession beneath the Project area comprises Made Ground (artificial deposits) which is underlain by Beach Deposits (clay, silt and sand) and then Carboniferous coal measures, sandstones and millstone. Towards the eastern end of the study area towards Crymlyn Burrows and the Neath Estuary there is evidence of recent windblown sand deposits.

17.4.8 Hydrogeological setting

17.4.8.1 New aquifer designations replaced the old system of classifying aquifers as Major, Minor and Non-Aquifer in April 2010. This system is in line with the Groundwater Protection Policy (GPP) and the WFD and is based on BGS mapping.

17.4.8.2 A review of the Environment Agency³ website (January 2014) indicates that the Swansea Port site and the onshore elements of the Project would overlie a Secondary A aquifer.

³Information on WFD and Flood Risk on the Natural Resources Wales website is routed to the Environment Agency website (www.environment-agency.gov.uk).

These are areas considered to have permeable layers capable of supporting water supplies at a local rather than a strategic scale. They typically form an important source to base river flows. However, due to their permeability, Secondary A aquifers are considered to be moderately vulnerable to pollutants.

- 17.4.8.3 According to the Envirocheck report, the majority of the Project does not lie within an area that is susceptible to groundwater flooding (see Figures 17.3a and b). The report leads to the conclusion that it is unlikely that groundwater flooding will affect the site and therefore risk is considered negligible. Further work in relation to groundwater flow due to future subsurface structures is presented in Chapter 18: Land Quality and Hydrogeology.

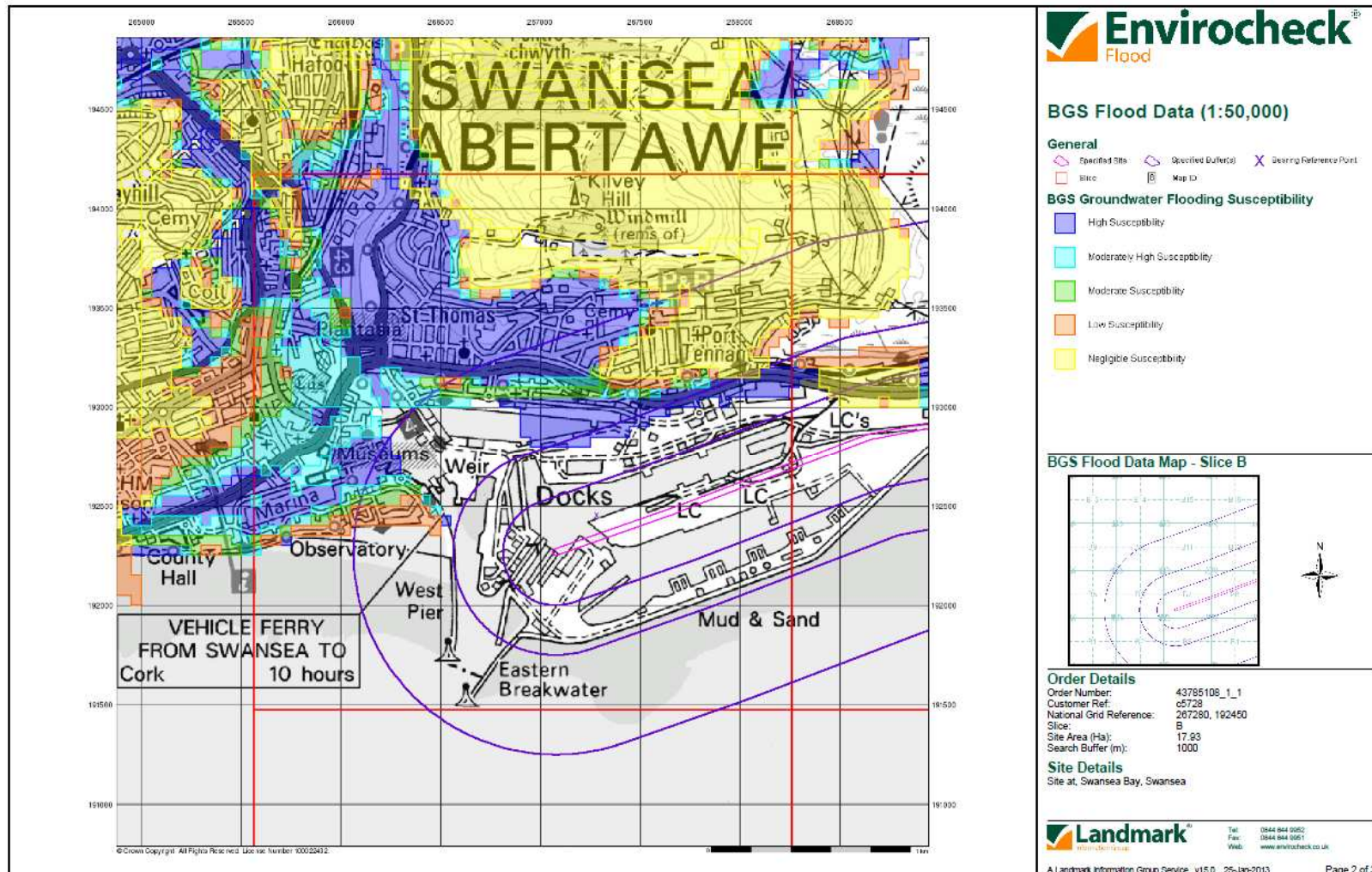


Figure 17.3a Groundwater flooding susceptibility (west)

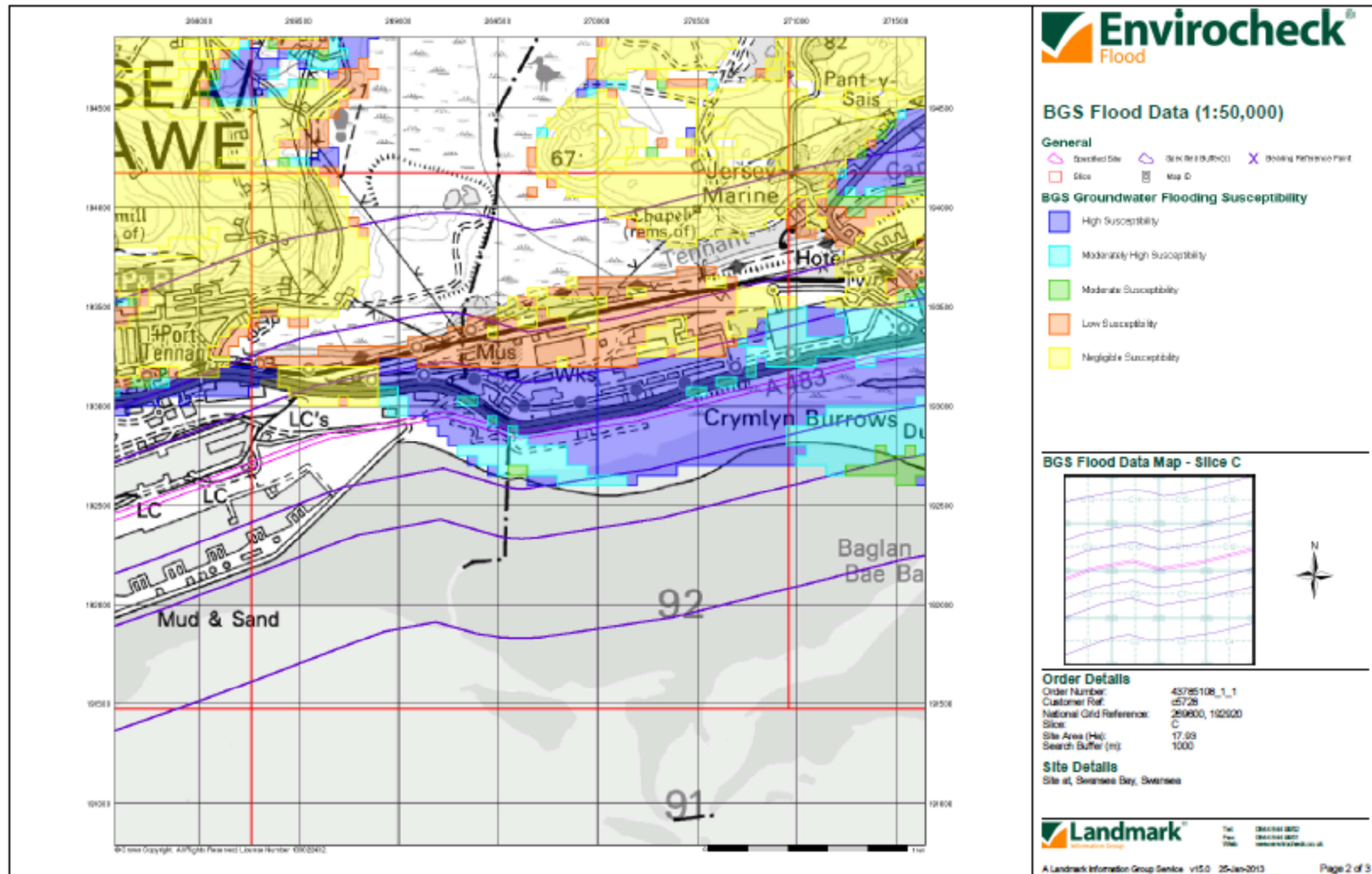


Figure 17.3b Groundwater flooding susceptibility (east)

17.4.9 Groundwater quality

- 17.4.9.1 Source Protection Zones (SPZ) provided by the Environment Agency for groundwater sources have been defined to protect public water drinking supplies from pollution. These SPZs show the risk of contamination from any activities that might cause pollution in a specific location. According to the Environment Agency website (www.environment-agency.gov.uk, January 2014) the onshore elements of the Project do not fall within any SPZ.
- 17.4.9.2 As the groundwater is likely to be in hydraulic continuity with the sea, it is likely that there has been some saline intrusion and that groundwater is slightly saline beneath the onshore areas of the Project. Due to the extensive legacy of industrial activities in the local area, it is also probable that groundwater quality has been adversely affected during previous land occupations. Within the WFD, the groundwater in the Carboniferous Coal Measures Groundwater Waterbody (Figure 17.4) has been classed as 'Poor' based on its current chemical quality, which is predicted to remain 'Poor' until at least 2027 (www.environment-agency.gov.uk, January 2014).

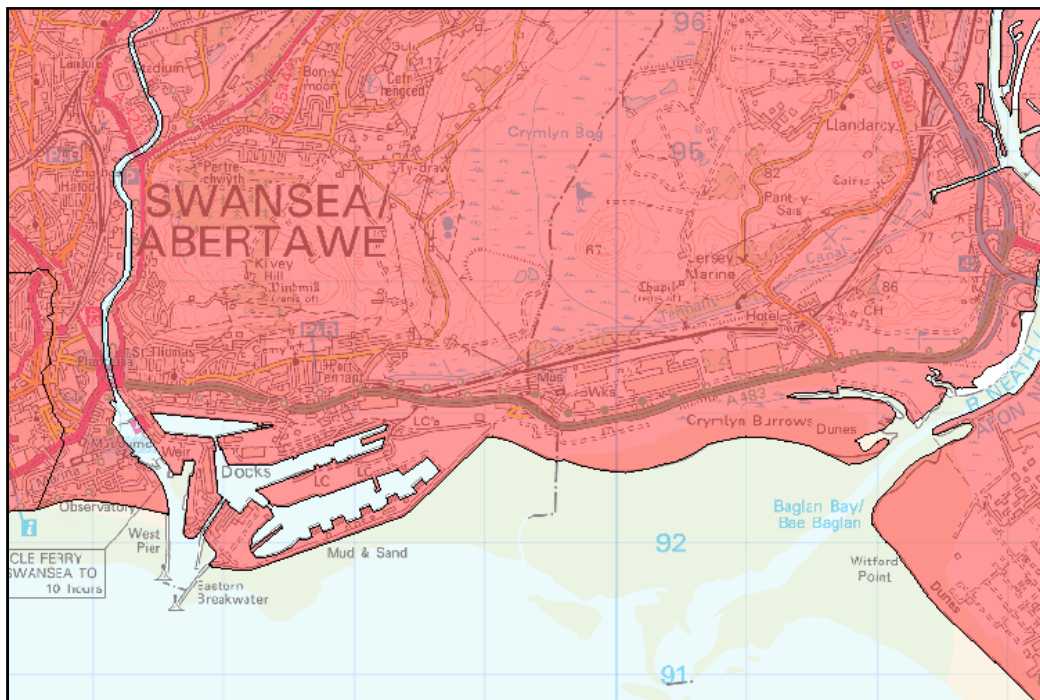


Figure 17.4 WFD Carboniferous coal measures groundwater waterbody. Source: Environment Agency Website (©Environment Agency copyright and database rights 2013 © Ordnance Survey Crown copyright. All rights reserved. Environment Agency, 100026380. Contains Royal Mail data © copyright and database right 2013).

- 17.4.9.3 Previous investigations undertaken by URS in 2005-06 in relation to the BP Transit Site and Eastern pipeline within the area (URS, 2006), established elevated levels of total petroleum hydrocarbons and volatile organic compounds within the groundwater. These are likely to have originated from petroleum-related activities associated with Swansea Port. It should be noted that according to the Shoreline Management Plan (Halcrow, 2012), decontamination of the former BP tank farm site located near the eastern landfall of the Project, is in progress due to the development of the Bay Science and Innovation Campus development adjacent to the Swansea Port. Further information on potential

contamination in this area is presented within Chapter 18: Land Quality and Hydrogeology.

17.4.10 Potable water supply

- 17.4.10.1 The water supply in the local area is provided by DCWW. Examination of DCWW's asset location plans (A1 maps, DCWW supplied February 2013) show that an existing water main runs adjacent to the Queens Dock, and serves the area around the Project.

17.4.11 Foul and surface water drainage

- 17.4.11.1 Sewer flooding can occur as a result of collapsed and/or blocked sewers or failed pumping stations. Asset location plans indicate that there are no foul and surface water sewers managed and maintained by DCWW within the vicinity of the Onshore Works. A pumped main runs along the northern part of the Port (west to east) but is not affected by the proposed onshore development. Storm Sewer Overflows do exist in the eastern extent of the Port in the vicinity of DCWW's Waste Water Treatment Works (WWTW) based on discharge consents and the effluent discharge from the WWTW discharges within the area of the proposed Lagoon. However, the location of onshore works are not considered to affect this infrastructure. Due to the presence of existing buildings within the Swansea Port area, it is likely that a private sewer network exists. Based on the proximity of buildings within the Port, it is considered likely that roof water and surface water generated from hard surfaces is discharged directly into the various docks.
- 17.4.11.2 Overland or surface water flow results from rain that falls on the ground but fails to infiltrate the land and therefore flows over the ground surface. This is exacerbated where the permeability of the ground is low due to the type of soil and geology (such as clayey soils) or hardstanding surfaces. Surface water runoff is also increased in areas of steep topography which can rapidly convey water that has failed to penetrate the surface.
- 17.4.11.3 Runoff from development can result in flooding at other locations if not properly managed. TAN 15 states that development should not increase the risk of surface water flooding elsewhere. As such the aim for all new development is to not create additional runoff compared to the existing situation. Where possible, redevelopment should aim to reduce runoff and improve the existing situation.
- 17.4.11.4 The existing site, which will accommodate the onshore elements of the Project is almost entirely classified as previously developed land with large areas of impermeable hardstanding. The CCSC Level 2 SFCA indicates that there are isolated areas of surface water ponding based on the Environment Agency Flood Map from Surface Water (FMfSW).
- 17.4.11.5 No formal surface water drainage system was observed during the site walkover in December 2012. As a result, small areas of surface water ponding were observed with runoff ponding at road edges. A large open concrete channel is located adjacent to the raised sea wall on the landward side. It is assumed that this collects both spray overtopping and surface water runoff. However, no outfalls were noted therefore it is assumed that water is lost through seepage and evaporation. It is considered that the likelihood of flooding from surface waters is low based on existing land use.
- 17.4.11.6 The proposed highway drainage system of Fabian Way is located to the East of the Swansea University Bay Campus (SUBC) and will discharge into Swansea Bay. The location

of the outfall is located to the East of the proposed land fall of the Lagoon Structure and therefore will be outside of the Lagoon. The performance of this system should therefore not be impeded by the Lagoon.

17.4.12 Summary of resource classification

- 17.4.12.1 The GOMMMS methodology for determining importance of water features in Table 17.1 does not provide guidance for tidal environments. Therefore, the importance of the tidal features in the study area has been determined based on a number of attributes and professional judgement.
- 17.4.12.2 Table 17.4 summarises the importance assigned to the various water resources discussed above, using the GOMMMS methodology where applicable.

Table 17.4 Importance of water resources

Water Resources/Attribute	Importance
Swansea Bay – water quality	High
Swansea Bay – water supply	Low
Kings/Queens Dock – water quality	High
Kings/Queens Dock – water supply	Low
Groundwater – water quality	Low
Groundwater – water supply	Low

17.5 Potential impacts and mitigation measures

- 17.5.0.1 This section outlines the potential impacts of the Project on hydrology and flood risk during the construction, operation and decommissioning phases. Mitigation measures are discussed for any significant impacts and residual effects after mitigation are presented. A Construction Environmental Management Plan (CEMP) (Chapter 4: Project Description) will include all the mitigation measures identified within this Chapter and will be implemented during the construction phase of the Project. To the extent necessary, longer term measures will be secured by requirements attached to the DCO.

17.5.1 Construction phase

Site preparation and construction phase – onshore works

- 17.5.1.1 The potential sources, pathways and receptors in the context of hydrology and water resources for the site preparation and the construction phase of the Project are presented in Table 17.5.

Table 17.5 Potential sources, pathways and receptors for consideration during the site preparation and construction phase

Sources
General construction activities/site preparation materials
Localised soil and groundwater contamination in Made Ground and underlying strata
Off-site soil and groundwater contamination migrating on-site
Increase in water supply and waste water discharge
Pathways
Groundwater dewatering activities
Creation of new direct contact pathways to ground and surface water
Existing buried obstructions, foundations and party walls
Legacy drainage infrastructure
Migration of groundwater
Receptors
Swansea Bay
Queens/Kings Dock
Groundwater
Upstream water supplies, downstream WWTW

17.5.1.2 Pollution sources arising from onshore construction works that could impact surface and groundwater, include the following:

- i. suspended sediments;
- ii. oils and hydrocarbons;
- iii. concrete, cement products and waterproofing chemicals;
- iv. disturbance of contaminated land;
- v. disturbance of the existing drainage system;
- vi. disturbance to groundwater; and
- vii. preferential pathways (as described further below).

Suspended sediments

17.5.1.3 Potential sources of suspended sediments on construction sites include excavations, exposed ground and stockpiles, plant and wheel washing, dust and mud on site access roads and de-watering. The major pathway for suspended sediments to reach controlled water bodies is through runoff during rainfall events or when areas are being washed down.

17.5.1.4 In watercourses, excessive levels of sediment can result in the suffocation of fish, smothering of aquatic plants, reduction in light levels and deterioration in quality of surface water abstractions. Any organic matter contained within the sediment will increase the Biological Oxygen Demand (BOD) of the water and result in a lowering of dissolved oxygen (DO). If the area of the Project is contaminated, sediments may also

contain toxic particles such as heavy metals, which may also impact directly on flora and fauna.

- 17.5.1.5 There are no construction works proposed within the areas immediately adjacent to Queens or Kings Dock, although there is a potential for construction compounds to be located within the central peninsula. Construction of the onshore works and cable connection lie to the west, south and east of Queens Dock. There will be construction compounds, including a batching plant and rock storage areas, located near to Kings Dock as shown on Figure 4.56. Best practice construction measures will be employed during any construction works within the Port area (see 17.5.1.6 below). With appropriate mitigation, it is considered that the release of potentially polluted suspended sediments associated with the onshore works, will have a minor adverse impact on water quality both within the docks and in the wider Swansea Bay.
- 17.5.1.6 As discussed above, a number construction site management measures will be employed to prevent or minimise the release of suspended sediments. A CEMP has been prepared (Chapter 4: Project Description), which sets out measures which will be implemented as appropriate for the nature of the construction works being undertaken. These include:
- i. cut-off ditches and/or geotextile silt-fences installed around excavations or exposed ground and stockpiles to prevent the uncontrolled release of sediments, where appropriate;
 - ii. site access points regularly cleaned to prevent build-up of dust and mud;
 - iii. earth movement controlled to reduce the risk of construction silt combining with runoff;
 - iv. pollution prevention plan within the CEMP;
 - v. properly contained wheel wash facilities where required, to minimise mud on the roads and the potential for sediment rich runoff; and
 - vi. management of surface water runoff, ground water seepage and any de-watering during construction. Silty water abstracted during excavations will be discharged to settlement tanks. Cleaned runoff can then be discharged to an appropriate location (Queens Dock or Lower Tawe) via temporary soakaways or pipes. Discharge arrangements will be agreed with ABP (as landowner, along with any other such parties), NRW and, where there are implications for the foul drainage network, DCWW prior to commencement of works.
- 17.5.1.7 Adoption of these measures will minimise the potential for uncontrolled release of sediment into active drainage systems / tidal areas and will therefore result in a minimal impact on drainage systems and surface waters, and therefore the impact significance is considered to be **insignificant** (refer to 17.3.2.3 for methodology).

Oils and hydrocarbons

- 17.5.1.8 Sources of oils and hydrocarbons on demolition and construction sites include storage tanks, plant and machinery, spillage and leakage at refuelling areas and vandalism.
- 17.5.1.9 Oils and hydrocarbons can have a long-term effect on the water quality of controlled waters and can result in the poisoning of fish, the creation of oily surface films on water and a reduction in the quality of industrial and potable abstractions. Oils also bind to sediments, strata and organisms and can form emulsions that float on the water surface.

Upon breakdown, the action of microbes can lower the DO content of the water. Oils can also cause localised reductions in groundwater quality.

- 17.5.1.10 Measures that will be implemented as appropriate to protect controlled waters from the release of oils and hydrocarbons from the Project comprise the following:
- i. oils and hydrocarbons to be stored in designated locations with specific measures to prevent leakage and release of their contents, including the siting of storage areas away from surface water drains and on an impermeable base with an impermeable bund that has no outflow and is of adequate capacity to contain 110% of the contents.
 - ii. valves and trigger guns to be protected from vandalism and kept locked when not in use;
 - iii. wherever possible, plant and machinery to be kept away from the drainage system and will have drip trays beneath oil tanks / engines / gearboxes / hydraulics which will be checked and emptied regularly via a licensed waste disposal operator;
 - iv. following the discharge of surface runoff and de-watering effluents to settling tanks the drainage will be routed to oil interceptors prior to discharge to sewers; and
 - v. an Emergency Spill Response Plan (ESRP) has been produced as part of the CEMP, which site staff must have read and understood. On-site provision will be made to contain a serious spill or leak through the use of bunding and absorbent material.
- 17.5.1.11 If surface water runoff is required to enter the sewer / drainage system, DCWW and NRW will be consulted on the potential requirement for oil interceptors and sediment traps.
- 17.5.1.12 With these control measures, potential impacts associated with the release of oil and fuel during construction works will be minimal and therefore the impact significance is considered to be **insignificant**.
- 17.5.1.13 Implementation of the above measures does not, however, exclude the possibility of an accidental spillage of oils and fuels, the impact of which is dependent upon the volume lost to ground or surface waters. Although an ESRP is included within the CEMP and will be implemented through the construction programme to minimise the impact of such an event, accidental spillages still have the potential to result in a moderate adverse impact, which could be of **moderate adverse** significance at a local scale.

Concrete and cement products

- 17.5.1.14 Concrete and cement products are highly alkaline and their release into controlled waters, particularly Swansea Bay, could have an adverse impact on fauna in controlled waters and on water quality in general.
- 17.5.1.15 On site concrete and mortar mixing and the washing down of mixing areas can result in large volumes of contaminated wastewater, which can end up in the surface waters and drainage systems (where present). A number of precautions will be implemented on site as appropriate, to reduce effects as a significant volume of concrete will be required for the Project. These precautions include:

- i. locating a batching plant within the Port environs either between Kings and Queens Docks or on development land to the east of the Port. The final locations are to be agreed with landowners.
- ii. wherever possible, mixing and handling of wet concrete onsite will be undertaken in designated impermeable areas, away from any drainage channels, surface water or tidal waters; and
- iii. a designated impermeable area which will be used for any washing down or equipment cleaning associated with concrete or cementing processes and wastewater will be discharged to an agreed point.

17.5.1.16 With these control measures, the impacts associated with concrete and cement products are considered to be minimal and therefore the impact significance is considered to be **insignificant**.

Disturbance of land affected by contamination

- 17.5.1.17 A review of the potential for historic land contamination has been undertaken in Chapter 18: Land Quality and Hydrogeology, including recommendations of suitable mitigation / remediation measures. It is understood that areas of contaminated land exist within the area of the Project, although the land formerly occupied by BP in particular is currently undergoing remediation before the lease ends and the land is handed back to ABP. Notwithstanding this, there is the potential that some contamination could become mobilised during the construction phase in the absence of remediation. Mitigation measures which will be implemented as appropriate, to minimise the potential effects of contamination on surface and groundwater are discussed below.
- 17.5.1.18 A ground investigation will be undertaken prior to construction of the Project. The results will be evaluated and where possible, areas of contaminated land will be avoided or contained. If any areas of contamination will be affected, a scheme of remediation works will be developed and agreed with NRW.
- 17.5.1.19 Stockpiling of possibly contaminated excavated materials and appropriate management, such as positioning away from any drainage systems and subsequent covering to prevent runoff or infiltration of contaminants into the ground, will minimise the risk of pollution of water bodies.
- 17.5.1.20 The use of driven piles, rather than cast-in-place or bored piles, provides little potential for the pollution of water. If using the latter methods, the potential risk of contamination posed to underlying aquifers can be mitigated through measures such as the use of pile casing and isolating and sealing features from surface water. Further information regarding construction methods are provided in Chapter 4. However, use of any of these methods should result in a minimal magnitude of change and an **insignificant** impact.
- 17.5.1.21 As discussed above, depending on the results of the risk assessment process discussed in the Land Quality and Hydrogeology chapter (Chapter 18) and the pre-construction ground investigation, contaminated hotspots present within the made ground underneath the area of the Project will be avoided where possible or removed, treated or isolated prior to construction commencing.

- 17.5.1.22 It is considered that the above measures will reduce the risk of soil or groundwater pollution of controlled waters. However, due to likely ground contamination from previous site uses, it is considered there is a **minor adverse** impact significance.

Disturbance of existing drainage network

- 17.5.1.23 Damage or disturbance to unidentified drainage networks during construction activities could result in the uncontrolled discharge of surface water and/or foul water. Uncontrolled discharge of foul water may result in a temporary localised major adverse impact to both groundwater and surface water resources.
- 17.5.1.24 A number of measures will be implemented on site to minimise the risk of any uncontrolled release of surface and foul waters. These comprise:
- i. all existing utilities will be identified and marked prior to works commencing;
 - ii. exposed disused drainage piping (such as abandoned overflows) will be isolated from surface water runoff and decommissioned;
 - iii. any damages to the drainage network (if present) will be immediately repaired; and
 - iv. the Emergency Action Plan, produced within the CEMP, will be implemented to ensure spillages and leakages are immediately contained.
- 17.5.1.25 The measures described above are intended to reduce the number of situations whereby pollutants may arise, and to restrict their passage to controlled waters. With these control measures, potential impacts to this network are considered minimal and therefore the impact significance will be **insignificant**.

Disturbance to groundwater

- 17.5.1.26 There is potential for encountering shallow groundwater during construction works, particularly those relating to excavations for foundations, albeit these are very limited in scope for this Project. Exposure of groundwater can provide a direct pathway for surface contaminants, such as oils and fuels, to enter controlled waters and excavations can also temporarily alter groundwater levels.
- 17.5.1.27 The following measures will be implemented as appropriate, for controlling groundwater during excavations:
- i. where complete cut-off is provided, then groundwater can be controlled on excavation using normal pumping equipment;
 - ii. if partial cut-off is considered, dewatering systems using sump trenches or well points directing groundwater from the excavation can be used instead;
 - iii. measures such as cut-off trenches will be put in place to prevent potentially polluted runoff from the Project entering the excavation;
 - iv. uncontaminated water arising from excavations will need to be disposed of to an appropriate location (e.g. Queens Dock or Lower Tawe);
 - v. silt will be removed via settlement ponds or alternative measures; and

- vi. prior to any disposal, appropriate consents will be gained from NRW or approval from ABP.

17.5.1.28 Incorporation of these measures during construction will result in an impact significance of **insignificant**.

Water supply

17.5.1.29 It is likely that water requirement for the Project during the construction phase will be met through water supply from the local potable water system. There will be a need for water supply for construction staff welfare facilities, and for construction activities such as concrete mixing and dust suppression.

17.5.1.30 Water supply to the Project during the construction phase will be provided by DCWW and will require a Building Water Supply licence. For offshore elements, water supply is likely to be held within tanked storage.

17.5.1.31 The area identified for the onshore works associated with the Project is currently occupied by a limited number of buildings. No details are available of previous water uses or volumes, however, there is likely to be a temporary, minor increase in the demand for water as a result of the construction phase of the Project. The use of water efficient fixtures and fittings in temporary office facilities and the re-use of water during the construction phase will help to minimise water consumption, as will the use of ready mixed concrete.

17.5.1.32 The usage of water will result in a temporary impact significance of **minor adverse** on the supply network.

Wastewater generation

17.5.1.33 The presence of construction and site facilities will result in the generation of foul and sewage waste from construction activities and offices, which will be kept separate from surface water runoff. The volume of wastewater produced is expected to be similar to water requirements during construction. This will be reduced by the use of water-efficient fixtures and fittings and the re-use of water in construction activities where applicable. Foul water will be drained to the private sewer network (where existing); subject to agreement with DCWW for subsequent connection to the DCWW network. Offshore elements will either be supported by a tanked system requiring periodic emptying by tanker to WWTW or via a piped connection.

17.5.1.34 The available capacity within the local sewers changes daily. However, based on the above considerations it is anticipated that there will be an impact significance of **minor adverse** on the sewer network.

Preferential pathways

17.5.1.35 As discussed above, piling associated with the construction of building foundations may potentially create a pathway for contaminants found in the made ground to reach deeper groundwater. There are no significant groundwater abstractions or potable water supply abstractions within the vicinity of the Project, therefore the impact significance is **insignificant**.

- 17.5.1.36 Old boreholes may be present within the Project environs which may not have been sealed off adequately. These could also provide a preferential pathway for contaminated runoff to enter underground strata. In addition, there may be disused drainage networks from earlier developments or part demolished sections of existing site drainage, which could also provide a preferential pathway for surface waters to the underlying strata. Further details will be sought from ABP or site occupants and investigations such as trial pits will be undertaken, to help minimise the potential risks from these pathways.
- 17.5.1.37 In order to reduce the potential movement of contamination via these pathways, a number of measures will be implemented as appropriate. These include:
- the use of geotextile bunding to isolate and minimise the ingress of surface water runoff to non-decommissioned boreholes or exposed surface water drainage pipes;
 - decommissioning of surface water drainage networks and exposed boreholes to the satisfaction of NRW; and
 - pile casing during piling and isolation of the area around the piling from surface water until piling is complete.
- 17.5.1.38 The adoption of these measures will reduce the potential impact from preferential pathways to minimal and **insignificant** in terms of impact significance.

17.5.2 Operational phase

- 17.5.2.1 The completion and commissioning of the Project also has the potential to affect water resource features and associated attributes. The potential sources, pathways and receptors for the completed and operational Project are presented in Table 17.6 with associated discussion below.

Table 17.6 Potential sources, pathways and receptors during operational phase

Sources
Residual localised soil and groundwater contamination in made ground and underlying strata
Possible storage of fuels and plant for maintenance
Off-site soil and groundwater contamination migrating on-site
Increased demand for water utilities (potable water and sewerage infrastructure)
Pathways
Creation of direct contact pathways to ground and surface water
New site layout and topography (hardstanding, surface water drains)
Existing drainage/service runs
Structure, foundations and piles in building walls
DCWW sewage infrastructure
Receptors
Swansea Bay
Queens/Kings Dock
Groundwater
Buildings and property, including foundations and underground services
Future users of the Project

17.5.2.2 The operational phase of the Project poses less risk of impacts to the environment compared to the onshore works site preparation and construction phases. Impacts on water resources from the built environment relate to the following areas:

- i. impacts on flood risk and drainage;
- ii. water supply and wastewater generation;
- iii. physical disturbance of aquifers;
- iv. contamination of the water environment from in-situ materials; and
- v. pollution.

Flood risk and drainage

17.5.2.3 In order to open up the views to the lagoon the majority of the existing 2m Port seawall (see 17.4.5.2) will be removed (although sections containing archaeological features will be retained). A new road will be constructed on the ABP verge with the public realm/footpath on the seaward side. However, the presence of the Lagoon seawall will provide coastal protection and additional studies have been undertaken to assess the effects of the Project on extreme tide levels and extreme waves on the Port area, summarised below. Other potential sources of flooding include fluvial flooding and surface water/overland flooding. As identified in Section 17.4.5, flooding from fluvial, surface waters, sewers, groundwater and artificial sources is not considered to present a significant risk to the proposed onshore development comprised in the Project and has not been considered further.

17.5.2.4 The effects of the seawall on water levels within the Lagoon area and associated coast have been undertaken by ABPmer (Chapter 6: Coastal Processes, Sediment Transport and Contamination). These have assessed the 1 in 200 year water levels with the Lagoon seawall in place for current (2013) and future (75 years of climate change) water levels (see paragraph 17.4.5.3). Figure 17.5 indicates the 1 in 200 year water levels inside and outside the Lagoon for present day and climate change peak tidal cycle (2nd tidal cycle of three) including the effects of tidal surge.

Tidal Lagoon Swansea Bay plc

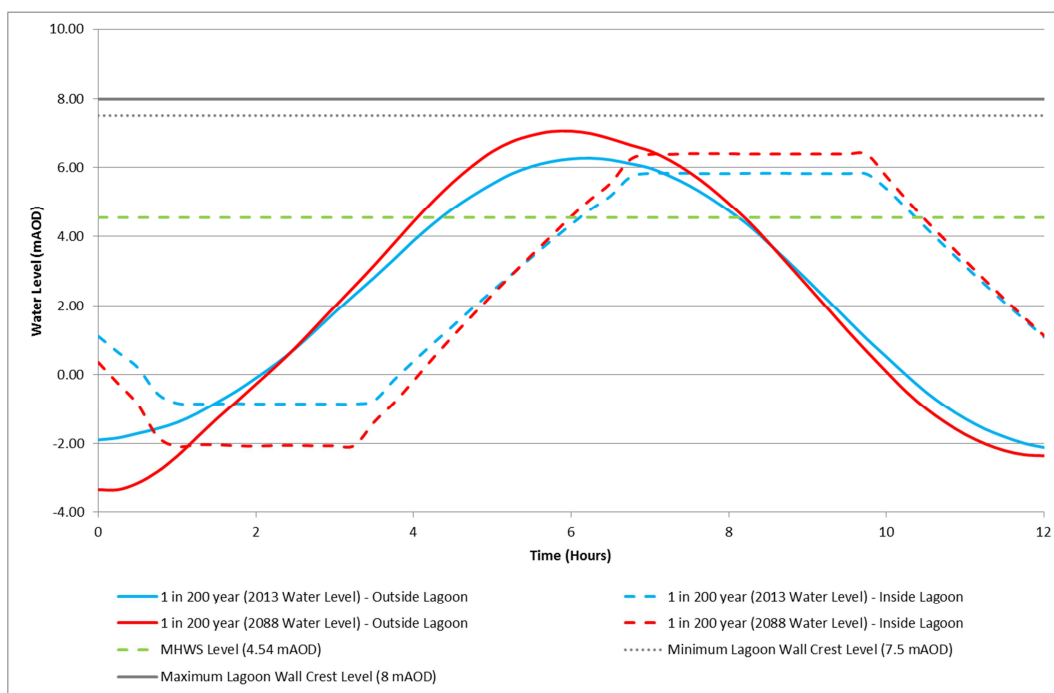


Figure 17.5 Illustration of extreme tide levels inside and outside of the Lagoon wall for 1 in 200 year current (2013) and climate change water levels (m Above Ordnance Datum (mAOD)).

- 17.5.2.5 The operational regime for the turbines comprised in the Project will limit the quantity of water entering the Lagoon during the ebb and flood tides. Figure 17.5 shows that water levels within the Lagoon are considerably lower than those outside during extreme water level conditions. Table 17.7 provides an overview of the modelled levels.
- 17.5.2.6 With regard to sensitivity allowances provided in the Environment Agency's report on Coastal Flood Boundary Conditions (Design Sea Levels) (Environment Agency, 2011), the following provides a summary of the position in relation to the Project:
- I. the current (2013) 1 in 200 year and 1 in 1000 year water levels incorporating a sensitivity allowance of +0.3 m and +0.5 m respectively are within the same range as the 1 in 200 year event inclusive of climate change (i.e. 75 years). It is therefore considered that beneficial effects will remain inclusive of an allowance for sensitivity for these events;
 - II. the incorporation of a sensitivity allowance for the 1 in 200 year water level inclusive of climate change is not considered pragmatic. As described, the operational rules for the turbines limit the quantity of water entering the Lagoon and therefore water levels are expected to be less than those experienced outside of the Lagoon. In addition, Figure 17.5 indicates that the proposed minimum (7.5 mAOD) and maximum (8 mAOD) crest levels of the Lagoon seawall are greater than the 1 in 200 year climate change tide level +0.3 m (for sensitivity). Therefore, it is considered reasonable to expect water levels within the Lagoon at the end of the flood tide to remain less than those outside.

Table 17.7 Summary of modelled water levels (mAOD)

Water Level Return Period Event	Water Level	Modelled Water Level		Difference in Water Level
		Outside Lagoon	Inside Lagoon	
1 in 200 (2013)	6.3	6.27	5.83	-0.44 m
1 in 200 + Climate Change (2088)	7.0	7.05	6.40	-0.65 m

17.5.2.7 Modelling of extreme significant wave heights at five locations around the outside of the seawall of the Lagoon and a Joint Probability Analysis (JPA) of the occurrence of extreme water levels and extreme wave heights at a single location along the outer wall, were undertaken by ABPmer (2014). The findings indicate that:

- i. extreme wave heights for the 1 in 200 year return period (2013) range from 2.09 m to 4.99 m;
- ii. extreme wave heights near to landfall locations of the Lagoon seawall exhibit the smallest predicted wave heights due to the sheltered location;
- iii. extreme wave heights are greatest on the outside of the Lagoon near to the location of the turbine house (southwest area), due to its more exposed position; and
- iv. JPA was undertaken for a single point at the location with the largest extreme wave height. The correlation coefficient of the JPA suggests that there is a low level of correlation between extreme wave heights and extreme water levels. This means that the combination of extremes in water levels and wave heights are mostly unrelated and predominantly random.

17.5.2.8 The findings of the hydraulic modelling of water levels inside the Lagoon and the findings of the extreme wave heights (including JPA), indicate that the Lagoon seawall will afford a level of protection from these variables. It is therefore considered that removal of the existing seawall is feasible due to the reduction in water levels provided by the Lagoon seawall and the effect of sheltering on wave heights. In addition, the JPA suggests that the coincidence of extreme wave height is mostly unrelated to the extreme water level at the southwest area of the Lagoon seawall. To account for uncertainty in tide levels and wave heights, a freeboard allowance of +0.5 m has been provided for finished floor levels of permanent buildings both onshore and offshore.

17.5.2.9 NRW provides a Flood Warning Service (FWS) that covers the area of the Project and aims to provide a minimum of two hours warning prior to the onset of a flood event. To minimise any potential risks of flooding, suitable site specific warning notices will be erected to inform people entering the site of the flood risk associated with the Project and its various occupied elements as well as the surrounding area. Warning notices will include the following information:

- I. the likelihood of flooding to the site and surrounding area;
- II. NRW FWS information and Floodline contact number;
- III. routes for safe access egress in the event of a flood; and
- IV. the notices should ensure that every person who uses the site is aware of the degree of risk associated with the site and surrounding area and actions to be taken in the event of a flood (e.g. safe access and egress routes).

- 17.5.2.10 To ensure that evacuation from the buildings comprised in the Project and other areas within its area is coordinated, and appropriate procedural steps are in place, a Flood Warning Plan will be produced.
- 17.5.2.11 The onshore works associated with the Project are not anticipated to increase the amount of impermeable areas due to the existing extent of hard standings. As such, there should be no notable increase in surface water runoff compared with the existing situation. Due to the industrial nature of Swansea Port, a swale based drainage system that is lined (to stop infiltration into potentially contaminated ground) will be incorporated into the design, where appropriate, to improve the management of surface water onsite and following the principles of SUDS. Discharge of surface water to the DCWW sewer water network is not considered feasible due to lack of infrastructure within the Project area. As such any collected water will be discharged to the docks or Lagoon at an appropriate rate.
- 17.5.2.12 The Project will use a combination of the existing road network and a new road within the Port to provide access. During the site walkover no formal drainage was observed associated with the existing road network and surface water runoff generally falls towards verges at the road side. TLSB has undertaken discussions with ABP, the owner of Swansea Port, and additional drainage measures will be put in place if required. This may include SUDS features such as swales (lined) which would be placed adjacent to the existing access road which would be designed to attenuate any excess surface water. A schematic cross section is provided in Figure 17.6.

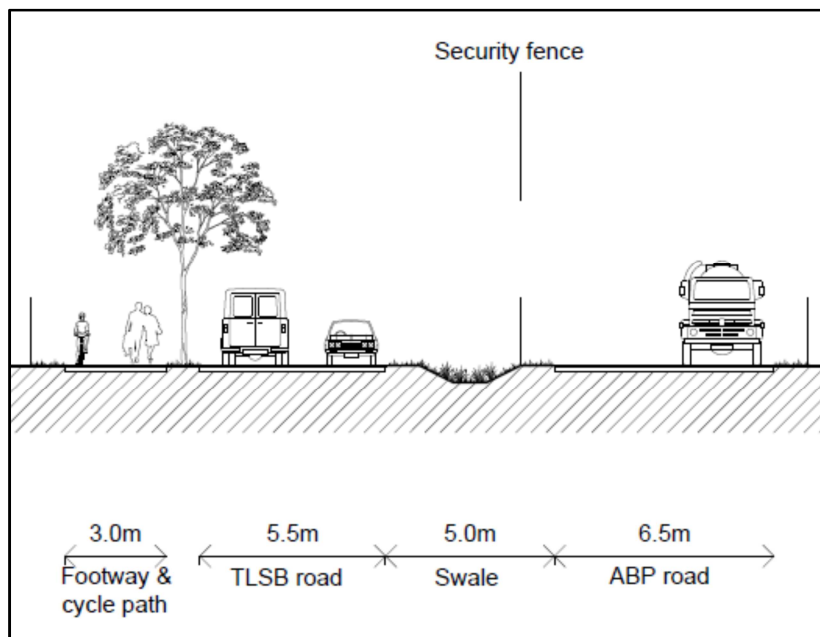


Figure 17.6 Schematic cross section indicating the swale feature.

- 17.5.2.13 Rainwater harvesting techniques and water butts will be used where possible for proposed buildings.
- 17.5.2.14 Based on the mitigation suggested, the Project will have a minimal impact on the flood risk and drainage and is classed as being **insignificant** in terms of impact significance.

Water supply and wastewater generation

- 17.5.2.15 The facilities proposed for the Project will require a supply of mains water and the disposal of wastewater. Thus, the Project may contribute to a small increase in the demand for potable water in comparison with the usage. An increase in water supply demand may result in a small magnitude of impact on mains water resources in the area, which is considered to be of **minor adverse** significance.
- 17.5.2.16 As identified in Chapter 4: Project Description, the Project will be capable of being used for major water sports events and this will have a short-term demand increase on the DCWW infrastructure. DCWW's Draft Water Resource Management Plan (DCWW 2008) states that the Tywi Gower water resource zone, which supplies raw water to the area, has a supply surplus to the year 2035 (a maximum of 35.7 Ml/d to 2035). This suggests that there is sufficient water to supply the Project and associated events.
- 17.5.2.17 Rainwater from roofs and other suitable hard surfaces will be harvested, stored onsite and used for irrigation of landscaped areas, where appropriate. This will reduce the volume of water required from the public water supply network. The installation of water meters and water-efficient appliances and fittings will also reduce water usage.
- 17.5.2.18 The provision of clean water for the Project will also potentially cause an increase in the levels of foul water discharged. This is anticipated to result in a small magnitude of impact on the drainage network and WWTW, considered to be of **minor adverse** significance.

Physical disturbance of aquifers

- 17.5.2.19 The Project involves the construction of structures that have the potential to induce minor ground settlement. This may have an impact of minor magnitude on shallow groundwater flow and may result in a minor local rise of groundwater levels within the deposits. However, this is unlikely to be sufficient to impact any surface structures, particularly if the latter are waterproofed, such that the impact is assessed as being minimal, and **insignificant**. Further details on site hydrogeology are presented within Chapter 18: Land Quality and Hydrogeology.

Contamination from in-situ materials

- 17.5.2.20 Where the Project involves the construction of foundations, suitable damp-proof protection, e.g. membranes, will be incorporated. Such construction will therefore lie within damp-proof membranes and will not be exposed to underground strata or groundwater.
- 17.5.2.21 All the proposed drainage / service runs will be surrounded by appropriate granular bedding materials and located above the static level of any shallow groundwater. Some confirmatory tests of the new systems will be carried out to prove integrity. The drainage networks installed on site will be constructed to meet with the required Building Regulations. The potential effect in terms of contamination is assessed as being **insignificant**.

Pollution

- 17.5.2.22 In order to reduce the impact on the environment and DCWW infrastructure, oil interceptors will be used to drain high-risk areas as defined by the EA's Pollution Prevention Guidelines 3 (EA PPG3). These typically include car park areas that are larger than 800m² or which have more than 50 car parking spaces; or areas where goods vehicles are parked or manoeuvred.
- 17.5.2.23 When the Project is operational, there remains a residual risk of a spillage of contaminating material, for example fuels and oils, which could potentially be released to ground and surface waters. The risk of this occurring can be managed by operational measures such as speed limits and road markings, and implementing procedures during delivery or movement of materials. The drainage system should also have cut-off measures that would allow a spill to be contained, so that any spillage can be effectively controlled and managed without leading to off-site impacts. The ESRP, contained within the CEMP, will be implemented as necessary. Education and information on waste treatment, emergency events, and spills will be provided to staff.
- 17.5.2.24 Commercial activities and landscaping maintenance on the Project will be required to adhere to statutory and best practice waste regulations, and would have to adhere to safety protocols, plans and procedures in relation to the storage and use of all fuels, chemicals and waste. Storage of any chemicals required for use within the Project, such for landscaping and general site maintenance will be in designated areas within buildings. There will be no direct pathway to the sewer system or water courses. With appropriate mitigation implemented, the potential effect of pollution is assessed to be **insignificant** in terms of impact significance.

17.5.3 Electrical grid connection

- 17.5.3.1 The grid connection will be to the National Grid substation within Baglan Energy Park, to the east of the Project across the River Neath. The proposed trench for the cable will be about 0.70m wide and approximately 1.0m deep. There are currently two main route options for the cable route and these discussed Chapter 4: Project Description. The crossing of the Neath estuary will be via directional drilling or the use of existing pipes which pass under the river. As the cable is buried at minimal depth it is likely there will be no affect when considering fluvial, tidal and surface water flood risk. The underground cable is also unlikely to have a significant effect on groundwater.

Flood risk resulting from the Project

- 17.5.3.2 TAN 15 requires that flood sources that could affect other development be considered. The effect of the Project on tidal water levels and coastal process within the wider area (Swansea Bay) has also been investigated within the ES (Chapter 6, Coastal Processes, Sediment Transport and Contamination) by ABPmer.
- 17.5.3.3 As part of this study ABPmer have assessed the extreme wave heights for a number of locations (see Environmental Statement Chapter 6, Figure 6.47, Volume 2 – extract provided below) within the wider Swansea Bay. In particular, Location 8 – the foreshore adjacent to Mumbles has been identified as an existing area at risk (located within DAM Zone C2) and therefore the consequences of the Lagoon on extreme wave heights has been assessed in this location.

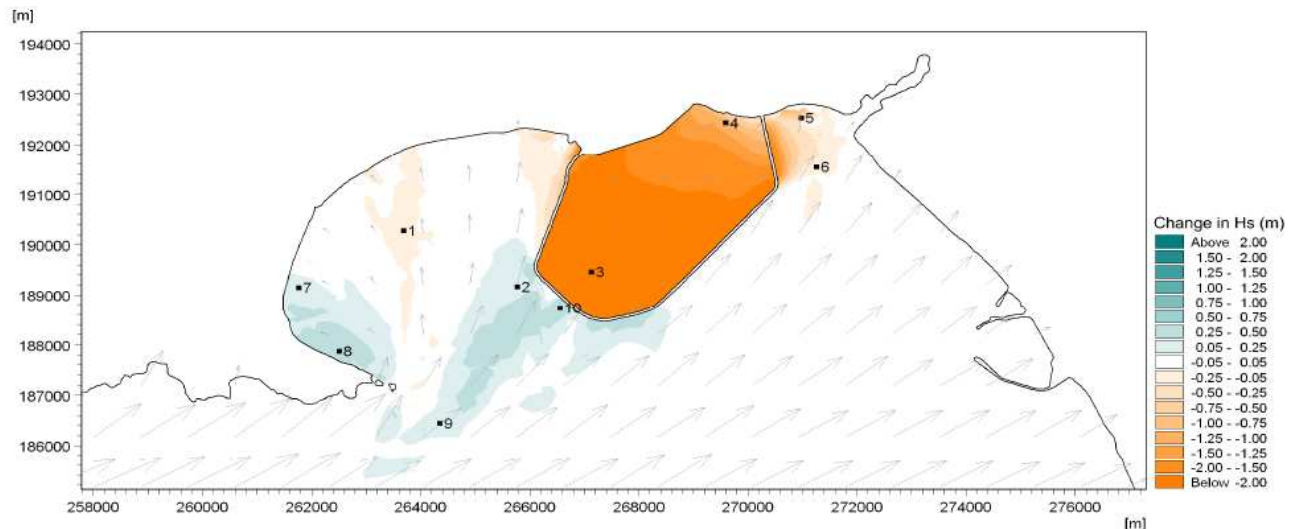


Figure 17.7 Location of extreme wave sites⁴

17.5.3.4 A summary of the key findings are provided for the 1 in 20 year return period wave:

- i. The omnidirectional extreme wave height (i.e. regardless of prevailing conditions) at Location 8 is predicted to be 1.34 m for the 1 in 20 year return period.
- ii. Existing extreme wave heights (with no Lagoon) at Location 8 (foreshore adjacent to Mumbles) for South West prevailing wind and wave conditions are lower than the omnidirectional case due to the sheltering effects of Mumbles Head. Under these conditions, an extreme wave height of 0.93m is predicted at this location for the 1 in 20 year return period.
- iii. With the Project present, wave heights at Location 8 are predicted to increase slightly under South West prevailing wind and wave conditions, due to reflection off the lagoon wall. As a result, the extreme wave height for the 1 in 20 year return period at Location 8 is predicted to increase by up to 0.23m (from 0.93m under baseline conditions to 1.16m with the Lagoon in place).
- iv. Comparison with the omnidirectional extreme wave height at Location 8 shows that the predicted increase under prevailing South West wind and wave conditions results in a wave that remains lower (by 0.18m) than the omnidirectional case at the 1 in 20 year return period. It is therefore considered that the predicted increase in wave heights under prevailing South West wind and wave conditions does not result in an increase in flooding consequence at Location 8.
- v. At Location 8, the biggest waves occur under prevailing South East wind and wave conditions. However, under these conditions the presence of the Lagoon is not predicted to result in increased wave heights at Location 8. In fact, under these conditions the presence of the lagoon will act to shelter part of the bay resulting in a predicted reduction in wave height at locations along Swansea seafront, thus likely reducing the potential for coastal flooding.

⁴ Extract from Figure 6.47, TLSB Environmental Statement Volume 2 - Predicted changes to wave parameters - 1 in 20yr SW wave.

- vi. The findings presented in Chapter 6 of the Environmental statement and summarised above with reference to extreme wave heights and associated flood consequence illustrate that the predicted increase in wave heights at Location 8, as a result of the presence of the Lagoon, will not result in waves that are higher than the baseline omnidirectional extreme wave heights.

17.5.3.5 Results from the numerical modelling undertaken by ABPmer identify that operation of the Project will cause some marginal changes to water levels within Swansea Bay (outside the Lagoon). It is considered that these minor effects on peak tidal water levels will not increase flood risk from tidal sources. Further to this, the tidal flood extent for Flood Zone 3 (1 in 200 year) and DAM Zone C2 will remain in those areas currently at risk, and therefore flood risk in planning terms will remain unchanged (including the effects of wave height). In addition, flood risk from rivers discharging into Swansea Bay will also not be affected due to the minor changes in peak tidal water-level. Overall this is assessed as having an **insignificant** effect.

17.5.4 Decommissioning phase

17.5.4.1 In terms of decommissioning, as identified in Chapter 4: Project Description, there are two potential options under consideration:

- i. at the end of the working life of the Project, the turbines and sluice gates could be removed, and the tide allowed to flow through the resultant gaps in the seawalls;
- ii. by the nominal end of the working life of this facility, power generation by tidal lagoons will have further developed, and the Project will have been progressively updated so that the Project could be kept in use as a generating station.

17.5.4.2 In terms of hydrology, as there are no onshore works proposed in the decommissioning phase, there will be no additional potential effects on hydrology in terms of water quality and creation of new pathways.

17.5.4.3 With option (a), the free movement of water in and out of the Lagoon (through removal of turbines and sluice gates) would not change the tidal height in the Lagoon compared to the baseline state. As such there should not be an increased tidal flood risk.

17.5.5 Residual impact assessment and conclusions

17.5.5.1 The assessment of potential impacts of the Project on water resources has been determined through the identification of baseline environmental quality conditions, and the determination of potential sources, magnitudes and significance of any impacts. The assessment has been based on reviews of data and relevant literature, policies and legislation and professional judgement.

17.5.5.2 It is considered that no significant impacts on water resources will occur throughout the construction, operation and decommissioning phases of the onshore works associated with the Project, provided that standard mitigation measures are applied as discussed above. Table 17.8 summarises the residual impacts on water resources.

Table 17.8 Summary of residual impacts (post-mitigation)

Description	Geographic Scale	Residual Impact Significance
Demolition, Construction & Refurbishment		
Release of suspended sediment	Local	Insignificant
Use and storage of hydrocarbon fuels and oils	Local	Insignificant
Use of concrete and cement products	Local	Insignificant
Disturbance of contaminated land	Local	Minor Adverse
Disturbance of the existing drainage network	Local	Insignificant
Disturbance to Groundwater	Local	Insignificant
Water Demand	District	Minor Adverse
Additional wastewater generation	District	Minor Adverse
Preferential pathways	Local	Insignificant
Completed Operational Development		
Flood Risk	Local	Insignificant
Water Demand and Wastewater Generation	District	Minor Adverse
Disturbance of Groundwater	Local	Insignificant
Physical Disturbance of Aquifers	Local	Insignificant
Contamination from In-situ Materials	Local	Insignificant
Oils and Hydrocarbons	Local	Insignificant

17.6 Cumulative impact and in-combination assessment

17.6.1 Overview

- 17.6.1.1 As identified in Chapter 2 EIA Process and Assessment of Significance, a number of projects have been identified which potentially require assessment in terms of cumulative and in-combination effects. Cumulative and in-combination effects arise from multiple actions on receptors and resources over time and are usually additive or interactive (synergist) in nature. They can also be viewed as effects arising from incremental changes caused by past, present or reasonably foreseeable actions together with those of the Project. For those projects identified in Chapter 2 (EIA Process and Assessment of Significance), Table 17.9 shows those projects for which a cumulative and in combination assessment has been undertaken in relation to water resources.

Table 17.9 Screening of cumulative developments

Project and Location	Current Status	Preliminary Screening
Swansea University Bay Campus, adjacent to Crymlyn Burrows.	Construction Feb 2013 – Sept 2015.	Potential positive effects in terms of flood risk by Lagoon encompassing the shoreline.
St Modwens land development - east of Swansea Docks to west of Neath estuary.	Remediation of land, and potential future developments – no details available.	No cumulative/in-combination impact anticipated.

Project and Location	Current Status	Preliminary Screening
Mumbles pier, foreshore and coastal strip redevelopment	Due to be completed by the end of 2013.	Works distant and anticipated to be complete – no cumulative/in-combination effect anticipated.
Construction of new RNLI Lifeboat Station, Mumbles	Expected completion 2014.	Works distant and anticipated to be complete – no cumulative/in-combination effect anticipated.
SA1 development, Swansea, SA1	Development currently taking place. Completion date unknown.	Works remote – no cumulative/in-combination effect anticipated.
Construction of southern access road to Coed Darcy Urban Village, crossing nearby Crymlyn Bog	Yet to commence.	Works distant – no cumulative/in-combination effect anticipated.
Swansea Boulevard project – work between Princess Way and The Strand, and the River Tawe bridges and The Strand.	Phase to be complete in Nov 2013. Phase 2 to start 2014.	No cumulative/in-combination effect anticipated.
Wind turbine – on Welsh Water site on Fabian Way.	Application – Unsuccessful 25/10/2013.	Not considered.
Five wind turbines- at Mynydd Marchywel between Rhos and Cilfrew Neath	Submitted Jan 2012. Consultation finished Jan 2013. Still in planning.	Works distant – no cumulative/in-combination effect anticipated.
Sixteen wind turbines- at Mynydd Y Gwair, Swansea	Approved – unknown construction timetable.	Works distant – no cumulative/in-combination effect anticipated.
Five wind turbines- on land at Mynydd Brombil Farm, Margam Port Talbot	Submitted June 2012, still in planning. Consultation finishes April 2013.	Works distant – no cumulative/in-combination effect anticipated.
Atlantic Array Wind Farm – off North Devon Coast approx. 35km distant	DCO application submitted but withdrawn in November 2013.	No further assessment.
Seventy six turbine Pen y Cymoedd windfarm near Neath.	Planning approved – construction 2014.	Works distant – no cumulative/in-combination effect anticipated.
Llynfi Afan Renewable Energy Park - fifteen turbine windfarm - on land 500m southwest of Cynnonville Port Talbot	Planning permission refused. Application was allowed on appeal on 27/08/2013.	Works distant – no cumulative/in-combination effect anticipated.
Mynydd y Betws – fifteen turbine windfarm located on land to the east of Ammanford in Camarthenshire	Granted planning consent 2009. Started operating April 2013.	Works distant – no cumulative/in-combination effect anticipated.
Mynydd y Gwrhyd – windfarm in the Upper Amman and Swansea valleys	Approved on appeal 07/05/2009	Works distant – no cumulative/in-combination effect anticipated.
Newlands Farm, single wind turbine – Margam	Application submitted January 2013.	Works distant – no cumulative/in-combination effect anticipated.
Kenfig Industrial Estate single wind turbine	Application submitted. Expected decision by Feb 2014.	Works distant – no cumulative/in-combination effect anticipated.
Port Talbot Harbour Redevelopment.	Potential future activities/development. Status unknown.	Works distant – no cumulative/in-combination effect anticipated..
Upgrading of the existing coastal defence of Aberavon West Promenade, Sandfields, Port Talbot	Completed August 2013.	Works distant – no cumulative/in-combination effect anticipated..
Porthcawl regeneration scheme includes Porthcawl Marina project and 19 th century lighthouse restoration.	Approved by BCBC. Timescale unknown.	Works distant – no cumulative/in-combination effect anticipated.
Tata Steel works – Internal power generation enhancement for Port Talbot steel works – Installation of two new boilers and two new turbines housed in new power station building.	Application expected to be submitted 2014.	No cumulative/in-combination impact anticipated.
Underground coal gasification under Swansea Bay.	License issued.	No cumulative/in-combination impact anticipated.
Underground coal gasification under Llanelli	Conditional Licence issued	Works distant – no cumulative/in-combination effect anticipated.

Project and Location	Current Status	Preliminary Screening
Navigational dredging along the (Swansea) Tawe, Neath and Port Talbot Channels.	On-going.	No in-combination effect on water resources or flooding anticipated.
Marina dredging - Monkston cruising and sailing club and Swansea Marina.	On-going maintenance dredging.	No in-combination effect on water resources or flooding anticipated.
Mumbles Oyster project: Plan to put 10,000 oysters on seabed off the village of Oystermouth	Permission granted September 2013.	No cumulative/in-combination impact anticipated.
Severn Barrage	Not within foreseeable future.	Not considered. See note in Chapter 2.
Swansea Barrage	Operational.	Currently operational – no additional cumulative/in-combination effects anticipated.
Cardiff Barrage	Operational.	No in-combination effect on water resources or flooding anticipated.
Baglan Power station	Operational.	No in-combination effect on water resources or flooding anticipated.
Prenergy Biomass Power station, Port Talbot – 350 MW wood chip fuelled thermal generating station	Granted condition approval by BERR on the 20 November 2007. While large scale construction has not been begun, a lawful start of development has occurred and as such the planning permission remains extant.	No cumulative/in-combination impact anticipated.
Abernedd Power Station was granted conditional approval by DECC on the 23 February 2011 for construction of a 870MW gas fired combined cycle gas turbine power plant	No lawful start has yet been made to this development.	No cumulative/in-combination impact anticipated.
Nobel banks aggregate extraction site	Ongoing	Works distant – no cumulative/in-combination effect anticipated.
The Swansea Bay (Thomas Shellfish Limited) Mussel Fishery Order	Ongoing	No in-combination effect on water resources or flooding anticipated.
Ro-Ro Ferry	Currently not operational	Not considered.
Rhiannon Offshore Windfarm	Pre-application stage	Works distant – no cumulative/in-combination effect anticipated.
Burbo Bank Offshore Windfarm extension	Existing and extension sought 2013	Works distant – no cumulative/in-combination effect anticipated.
Tidal Energy Ltd Deltastream Installation Ramsey Sound	Consent secured. Installation 2014	Works distant – no cumulative/in-combination effect anticipated.
Seagen Skerries Tidal Stream Array	Consent secured. Installation 2014	Works distant – no cumulative/in-combination effect anticipated.
Tidal Stream Energy Demonstration Array St David's Head, Pembrokeshire	Construction is planned to commence in 2017	Works distant – no cumulative/in-combination effect anticipated.

17.6.2 Construction impacts

- 17.6.2.1 Cumulative impacts on water resources during construction and demolition processes are associated with the release of sediments into the combined sewer drainage network; spillage and leakage of oils and fuels; leakage of wet concrete and cement; and disturbance of contaminated land and foul drainage.
- 17.6.2.2 As outlined above, measures will be undertaken to manage and control these impacts (as detailed within the CEMP and reduce the magnitude and significance of any impacts to a minimum for the Project.

- 17.6.2.3 These control measures in combination with the timing of other developments (see Table 17.9) indicate that the cumulative impact is anticipated to be minimal and therefore **insignificant**.

17.6.3 Operational impacts

- 17.6.3.1 The Project is assessed to have an impact significance of insignificant on surface water runoff generated at the Project. Surface water management from proposed developments should be managed in line with TAN15 and not increase risk to others. The cumulative impact from surface water for developments in Table 17.9 is therefore considered to be **insignificant** in terms of impact significance.
- 17.6.3.2 Cumulative impacts from the Swansea University Bay Campus are not considered to pose a cumulative impact on DCWW WWTW capacity because that development has received planning permission. The Port Talbot Harbour Redevelopment is served by a separate DCWW WWTW and the dredging operations do not utilise the WWTW, therefore cumulative impacts of WWTW capacity are considered to be **insignificant**.
- 17.6.3.3 The DCWW Draft Water Resource Management Plan (DCWW, 2008) states that the Tywi Gower water resource zone, which supplies raw water to the area, has a supply surplus to the year 2035 (a maximum of 35.7 Ml/d to 2035). This indicates that there is sufficient water to supply future development and therefore the cumulative impact is considered to be **insignificant**.

17.7 Conclusion

- 17.7.0.1 This Chapter presents the assessment of the hydrological (movement of surface water) and flood consequences resulting from the construction, operation and decommissioning phases of the Project. An FCA has been prepared as a standalone document required as part of the consenting process for the Project.
- 17.7.0.2 During the construction phase, the construction practices identified in this Chapter will be used to control and minimise the effect on surface waters. This will include reducing potential contamination caused by the construction process, such as release of sediments into the sewers, spillage and leakage of oils and fuels, leakage of wet cement and concrete, and the disturbance of existing contamination and drainage. The overall likely impact of the Project during construction will be minor and temporary in nature with the implementation of the CEMP.
- 17.7.0.3 During the operational phase, possible surface water impacts are considerably less than during construction. Possible impacts have been identified as increased surface water runoff, increased foul water volume, and increased drinking water supply demands. Surface water can be managed through the use of lined swales where appropriate. Use of water efficient devices and rainwater harvesting for onshore development will minimise impacts on potable water demands and associated foul water discharges. All of these have been assessed as being insignificant, even with the cumulative effect of current and proposed developments.
- 17.7.0.4 In terms of potential flooding impact, hydraulic modelling results indicate that the Port area and onshore development will benefit from the presence of the Lagoon seawall. Due to the engineering requirements governing the operation of the turbines, the

quantity of water able to enter the Lagoon during the ebb tide means that water levels inside the Lagoon will be lower than those experienced outside of the Lagoon. In addition, there is a low correlation between extreme wave heights and extreme water levels indicating that wave overtopping is unlikely to be associated with extreme water levels. Notwithstanding this, a freeboard allowance of +0.5 m has been added to finished floor levels for all permanent buildings within the Project area. The existing Port sea wall will be removed to open up views and allow access to the Lagoon area. The potential for flooding from tidal sources as a result of this is considered to be low and therefore this option is considered acceptable. When considering the wider Swansea Bay, the effects of the Lagoon on both water level and wave height have been assessed as insignificant.

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