DINAS A SIR ABERTAWE

HYSBYSIAD O GYFARFOD

Fe'ch gwahoddir i gyfarfod

PWYLLGOR RHEOLI A RHEOLAETH DATBLYGU

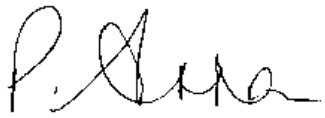
Lleoliad: **Siambr y Cyngor, Canolfan Ddinesig, Abertawe**

Dyddiad: **Dydd Iau, 3 Gorffennaf 2014**

Amser: **5.00 pm**

AGENDA

		Rhif y Dudalen .
1	**Ymddiheuriadau am absenoldeb.**	
2	**Datgeliadau o fuddiannau personol a rhagfarnol.**	**1 - 2**
3	**Morlyn Llanw Bae Abertawe - Adroddiad Effaith Leol a Chynrychioliadau ysgrifenedig.**	**3 - 421**



Patrick Arran
Pennaeth Gwasanaethau Cyfreithiol, Democrataidd a Chaffael
Dydd Gwener, 27 Mehefin 2014

Cyswllt: Democratic Services - 636824

Disclosures of Interest

To receive Disclosures of Interest from Councillors and Officers

Councillors

Councillors Interests are made in accordance with the provisions of the Code of Conduct adopted by the City and County of Swansea. You must disclose orally to the meeting the existence and nature of that interest.

NOTE: You are requested to identify the Agenda Item / Minute No. / Planning Application No. and Subject Matter to which that interest relates and to enter all declared interests on the sheet provided for that purpose at the meeting.

1. If you have a **Personal Interest** as set out in **Paragraph 10** of the Code, you **MAY STAY, SPEAK AND VOTE** unless it is also a Prejudicial Interest.

2. If you have a Personal Interest which is also a **Prejudicial Interest** as set out in **Paragraph 12** of the Code, then subject to point 3 below, you **MUST WITHDRAW** from the meeting (unless you have obtained a dispensation from the Authority's Standards Committee)

3. Where you have a Prejudicial Interest you may attend the meeting but only for the purpose of making representations, answering questions or giving evidence relating to the business, **provided** that the public are also allowed to attend the meeting for the same purpose, whether under a statutory right or otherwise. In such a case, you **must withdraw from the meeting immediately after the period for making representations, answering questions, or giving evidence relating to the business has ended**, and in any event before further consideration of the business begins, whether or not the public are allowed to remain in attendance for such consideration (**Paragraph 14** of the Code).

4. Where you have agreement from the Monitoring Officer that the information relating to your Personal Interest is **sensitive information**, as set out in **Paragraph 16** of the Code of Conduct, your obligation to disclose such information is replaced with an obligation to disclose the existence of a personal interest and to confirm that the Monitoring Officer has agreed that the nature of such personal interest is sensitive information.

5. If you are relying on a **grant of a dispensation** by the Standards Committee, you must, before the matter is under consideration:

   i) Disclose orally both the interest concerned and the existence of the dispensation; and
   ii) Before or immediately after the close of the meeting give written notification to the Authority containing:

a) Details of the prejudicial interest;
b) Details of the business to which the prejudicial interest relates;
c) Details of, and the date on which, the dispensation was granted; and
d) Your signature

Officers

Financial Interests

1. If an Officer has a financial interest in any matter which arises for decision at any meeting to which the Officer is reporting or at which the Officer is in attendance involving any member of the Council and /or any third party the Officer shall declare an interest in that matter and take no part in the consideration or determination of the matter and shall withdraw from the meeting while that matter is considered. Any such declaration made in a meeting of a constitutional body shall be recorded in the minutes of that meeting. No Officer shall make a report to a meeting for a decision to be made on any matter in which s/he has a financial interest.

2. A “financial interest” is defined as any interest affecting the financial position of the Officer, either to his/her benefit or to his/her detriment. It also includes an interest on the same basis for any member of the Officers family or a close friend and any company firm or business from which an Officer or a member of his/her family receives any remuneration. There is no financial interest for an Officer where a decision on a report affects all of the Officers of the Council or all of the officers in a Department or Service.

Report of the Head of Economic Regeneration & Planning

To Development Management and Control Committee

3rd July 2014

SWANSEA BAY TIDAL LAGOON LOCAL IMPACT REPORT AND WRITTEN REPRESENTATION

Purpose:	To appraise the impact of the tidal lagoon proposals on the City and County of Swansea and to recommend a Local Impact Report and Written Representations to the Planning Inspectorate Examining Authority on behalf of this Council along with other recommendations to deal with the procedural aspects of the examination process, including dealing with matters within a Statement of Common Ground and responses to Inspectors questions.
Policy Framework:	National Policy Statements, Planning Policy Wales and the adopted City & County of Swansea Unitary Development Plan.
Reason for Decision:	To provide a response to the Planning Inspectorate Examining Authority on the impacts of the proposed tidal lagoon on the City & County of Swansea and to allow full engagement within the examination process.
Consultation:	Legal Services, Finance, Equalities, Technical Services, Pollution Control, Sustainable Development, Culture, Tourism, Sport and Leisure, Economic Regeneration, Economic Development, Nature and Conservation, Marina Manager and Glamorgan Gwent Archaeological Trust.
Recommendation(s):	It is recommended: 1. That the Local Impact Report be accepted as the Local Impact Report for the City & County of Swansea and be submitted to the Examining Authority of the Planning Inspectorate in accordance with the timetable for the examination process. 2. That delegated powers be granted to the Head of Economic Regeneration and Planning to make minor amendments to the Local Impact Report to rectify such matters as typing or grammatical errors.

	3. That the findings of Kenneth Pye Associates and White Consultant's be accepted and presented to the Examining Authority of the Planning Inspectorate as representing the views of the City & County of Swansea and formally form part of the Council's Local Impact Report. 4. That the Written Representation be accepted as the Written Representation for the City & County of Swansea and be submitted to the Examining Authority of the Planning Inspectorate in accordance with the timetable for the examination process along with a summary version. 5. Delegated powers be given to the Head of Economic Regeneration and Planning to formally contribute to a Statement of Common Ground to be submitted to the Examining Authority of the Planning Inspectorate in accordance with the timetable for the examination process and within the terms of Council's Local Impact Report and Written Representations. 6. Delegated powers be given to the Head of Economic Regeneration and Planning to formally respond to the Examining Authority's Inspector questions in accordance with the timetable for the examination process during the course of the examination and also to make comment on the submissions of other parties, including the applicant. 7. Delegated powers be given to the Head of Economic Regeneration and Planning to formally represent the views of the City & County of Swansea in any topic specific hearing and subsequent requirements in accordance with the timetable for the examination process during the course of the examination, within the terms of the Council's Local Impact Report and Written Representation
Report Author:	Richard Jones

1.0 Introduction

1.1 Members will recall that a report was presented to this Committee on the 29th August 2013 to firstly inform Committee of the formal Section 42 pre-application consultation by Tidal Lagoon Swansea Bay Ltd in respect of their proposals to design, construct and operate a tidal lagoon for the purpose of generating renewable energy in Swansea Bay. The second main purpose of the report was to appraise the supporting Preliminary Environmental Information Report (PEIR), highlight any deficiencies, areas of concern, points of clarification and suggestions for improvements to the proposed scheme in order to inform a recommendation to members for a response to Tidal Lagoon Swansea Bay Ltd to their formal pre-application consultation. It was resolved that:

- Tidal Lagoon Swansea Bay Ltd be forwarded a copy of the report and take note of the concerns set out and request continued liaison with the City & County of Swansea on the design evolution of the scheme and associated Environmental Impact Assessment.

- Tidal Lagoon Swansea Bay Ltd be provided with a copy of the "Review of Preliminary Environmental Report: Seascape, Landscape and Visual" prepared by White Consultants on behalf of the City & County of Swansea and that Tidal Lagoon Swansea Bay Ltd be requested to note and address the findings of the report.

- Tidal Lagoon Swansea Bay Ltd be provided with copies of the unsolicited representation received.

- Members delegate the response on technical matters relating to the forthcoming informal consultation on the draft Environmental Statement to Officers.

- That the Planning Inspectorate be advised in due course that the City and County of Swansea considers that Tidal Lagoon Swansea Bay Ltd has adequately consulted with the Local Planning Authority and provided adequate supporting information to comply with its duties to consult under Section 42 of the Planning Act 2008.

1.2 The project is an offshore generating station, which would have a nominal rated capacity of 240 MW. Consequently, the project is a nationally significant infrastructure project (NSIP) as defined in the Planning Act 2008 with a generating capacity above a threshold of 100MW

1.3 Accordingly, an application for a development consent order (DCO) has been made to the Secretary of State for Energy and Climate Change (the Secretary of State), via the Planning Inspectorate, to authorise construction and operation of the generating station and its component parts. These include both offshore and onshore elements of the project and the electrical grid connection works and recreational amenities which form part of the seawalls and/or the onshore operation and maintenance facilities.

1.4 The application has been formally accepted for examination and an 'Examining Authority' has been appointed by the Secretary of State for Communities and Local Government to examine the application. The Examining Authority is from the Planning Inspectorate, and comprises, in this instance, a panel of five Inspectors.

1.5 The Examining Authority (ExA) subsequently held a Preliminary Meeting (PM) on the 10th June 2014, the purpose of which was to set out the procedure for examining the application, including, setting the timetable for making more detailed written representations.

1.6 Following on from the PM, the formal examination stage of the application commenced on the 11th June 2014. The ExA has six months to carry out the examination and a further 3 months to prepare a report on the application to the Secretary of State, including a recommendation. The Secretary of State then has a further 3 months to make the decision on whether to grant or refuse development consent. Once a decision has been issued by the Secretary of State, there is a six week period in which the decision may be challenged in the High Court. This process of legal challenge is known as Judicial Review.

1.7 As the project lies within Welsh waters, an application for a Marine Licence has also been made to the Marine Licensing Team within Natural Resources Wales.

1.8 In order to construct and operate the project the applicant will undertake two licensable activities: construction of marine energy works; and dredging and disposal of dredged material. The requirement for a Marine Licence is broadly defined by works taking place in the offshore environment that affect the seabed or the movement of materials related to it. In determining an application for a Marine Licence the licensing authority must have regard to: (a) the need to protect the environment; (b) the need to protect human health, (c) the need to prevent interference with legitimate uses of the sea.

2.0 The Site and its Surroundings

2.1 The red line boundary of the project, encompassing all the elements proposed and the maximum extent of land over which powers are sought, is shown below.

2.2 The main focus of the application site essentially comprises the southern edge of Swansea Docks and formerly associated industrial land from the eastern side of the River Tawe to the eastern edge of the new Swansea University Bay Campus and the foreshore and seabed of part of Swansea Bay between the dredged channels of the Rivers Tawe and Neath.

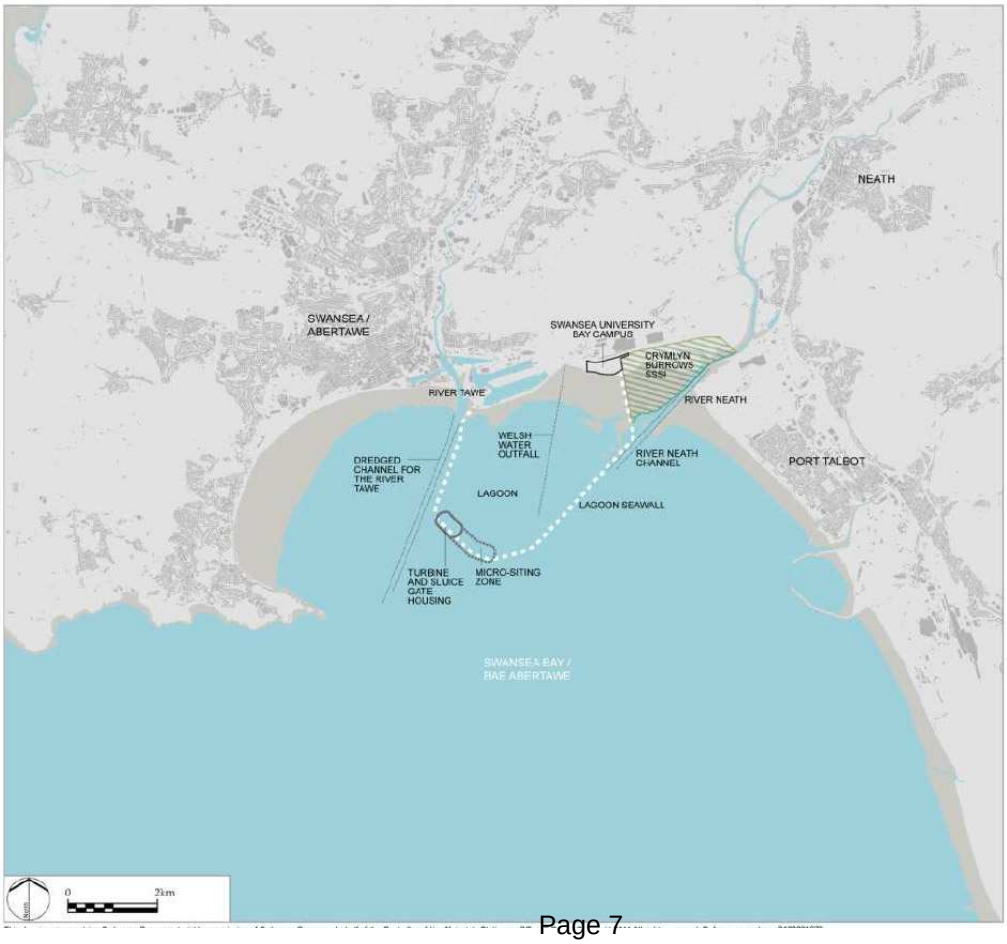
2.3 The site is primarily focused within the administrative area of the City & County of Swansea and Welsh Territorial Waters other than the eastern landfall of the lagoon and grid connections, which fall within Neath Port Talbot County Borough Council (NPT).

2.4 The applicant does not currently own any part of the application site, but is negotiating for its acquisition and is also applying for powers of compulsory acquisition.

3.0 Summary of the Proposed Scheme

3.1 Tidal Lagoon Swansea Bay Ltd proposes to design, construct and operate a tidal lagoon for the purpose of generating renewable energy. This will be achieved by harnessing the power of the high tidal range in Swansea Bay.

3.2 As illustrated below, the lagoon created as part of the project would enclose an area of approximately 11.5km2 of seabed and foreshore of Swansea Bay to create the lagoon. The associated seawalls would be approximately 9.5km in length and extend in a distorted U-shape from the eastern side of the River Tawe to the eastern edge of the new Swansea University Bay Campus, in Neath Port Talbot County Borough Council (NPT).



3.3 The seawall would be a maximum of 107m wide at the base of the deepest section, adjacent to the turbine and sluice gate housing and would narrow as it extends towards the landfalls to a minimum width of 40m. The visible height of the seawalls above the water level measured at the highest point would be approximately 4m at high tide and 12.5m at low tide.

3.4 The seawall would have a sediment core held in place by a casing of sediment-filled geotextile tubes, known as Geotubes® or dredged or imported gravels. The outside of the structure would be covered in rock armour of various sizes, depending on its level of exposure. The sand used to form the walls would be taken from within the lagoon footprint whilst the rock armour would be brought in by sea to provide the outer protection. The crest of the seawall would include provision of an access road which will be used for the operation and maintenance of the Lagoon as well as for visitors.

3.5 The hydro turbines located within the turbine and sluice gate housing would be bi-directional, meaning they are able to generate power with flows of water in both directions. There would be up to 16 turbines, each one around 7m in diameter, and all located permanently underwater. There would also be up to ten sluice gates; these are large gates which will be underwater and able to let seawater in and out of the Lagoon, and so controlling the water passing through the turbines, as required.

3.6 To generate electricity, as the sea starts to rise (flood tide) from low tide level, water is prevented from entering the Lagoon for an average of 2.5 hours, which creates a difference in water levels known as ‘head’. Once sufficient head has been reached, the water is allowed to flow into the Lagoon through the turbines, turning the runner and generating electricity. This process is repeated on the ebb tide, where the water is prevented from leaving the Lagoon until there is sufficient head to start the process again. The project would generate electricity four times per day (on each of two ebb and flood tides) totalling, on average, 14 hours of generation every day.

3.7 Towards the end of the ebb or flood tide the sluice gates would be opened. This is to empty or fill the Lagoon as quickly as possible before low or high tide level. By doing this, it ensures that the Lagoon water level is as close to the outside sea level as possible, before the tide starts to rise or fall again. This is to maximise electricity generation and to keep the intertidal area as close as possible to that occurring naturally outside the Lagoon. An option to pump the seawater at the end of the tide is also being investigated to further equalise seawater levels.

3.8 The electricity generated would be fed into the National Electricity Transmission System (NETS) via National Grid's substation in Baglan by way of an underground cable connection from the generating station. The Lagoon would have a nominal rated capacity of 240 Megawatts (MW), generating 400GWh net of electricity on an annual basis, which is enough to power around 121,000 homes.

3.9 In addition to generating electricity, the project aims to provide visitor facilities and other amenities including art, education, mariculture and sporting/ recreational facilities. The seawall is expected to be open to the public during daylight hours for walking, running, cycling, fishing etc, though access would be controlled in extreme weather.

3.10 The needs of the project have been encompassed in an overarching Masterplan designed around three core areas, namely: the Offshore Building; the western landfall; and the eastern landfall. The Masterplan aims to link these three areas and the seawalls of the Lagoon to the land. It is stated that the public realm of the project has been designed as a 'marine park' with four offshore and onshore character areas reflecting their context and use. These are: the Broad Seaward Park, Narrow Seaward Park, Landward Urban Park and Landward Ecological Park. A circular route around the four parks would be provided for visitors to the lagoon as well as O&M access.

3.11 It is proposed to construct an offshore building as part of the turbine housing structure to accommodate the main operational and maintenance (O&M) with integral visitor centre, leisure facilities and public realm. The building would be a maximum of three storeys high.

3.12 The western landfall will also include a three storey building providing functional space for the O&M requirements of the project. The building will also allow controlled access to the western seawall and water sports facilities and a visitor orientation and public information space. Externally there would be 300 car parking spaces, coach parking, a slip way access to the lagoon, boat storage, a play area, soft and hard landscaping including a beach.

3.13 The main vehicular access routes would be from Fabian Way via a new project access road with combined footpath and cycleway constructed from Langdon Road. A shuttle bus is proposed linking the existing Park & Ride facility on Fabian Way, the western landfall, and the Offshore Building, subject to investigation of its viability. Facilities are also proposed on the western seawall to support a potential water shuttle service linking the existing pontoon on the west bank of the Tawe to the Lagoon facilities.

3.14 At the end of the operational lifetime of the Project (anticipated to be some 120 years), two potential options for decommissioning are being put forward:

1. Replace, upgrade and extend the life of the power generating station; or
2. Remove the turbines and sluice gates leaving the seawalls and housing structure in place and allowing continued leisure use of the impounded area.

3.15 A detailed description of the proposal is provided as Appendix 1.

4.0 Planning Policy

4.1 *National Policy Statements*

4.1.1 On 18th July 2011 the House of Commons debated and approved the six National Policy Statements for Energy (NPS). On 19th July 2011, the Secretary of State for Energy and Climate Change designated the NPSs under the Planning Act 2008.

4.1.2 The energy NPSs set out national policy against which proposals for major energy projects will be assessed and decided on by the Planning Inspectorate. The Planning Inspectorate will use NPSs in its examination of applications for development consent, and Ministers will use them when making decisions. (Under the Planning Act 2008 the Secretary of State must also have regard to any local impact report submitted by a relevant local authority.)

4.1.3 The NPSs of relevance to this application are:

- Overarching Energy National Policy Statement (EN-1);
- Renewable Energy Infrastructure National Policy Statement (EN-3); and
- Electricity Networks Infrastructure National Policy Statement (EN-5).

4.1.4 NPS EN-1 sets out:

- The high level objectives, policy and regulatory framework for new nationally significant infrastructure projects;
- The need and urgency for new energy infrastructure to be consented and built with the objective of contributing to a secure, diverse and affordable energy supply and supporting Government's policies on sustainable development, in particular by mitigating and adapting to climate change;
- Key principles to be followed in the examination and determination of applications;
- Policy on the assessment of impacts which are common across a range of the technologies (generic impacts).

4.1.5 Given the urgency of need for renewable energy infrastructure, it is stated that the Secretary of State should start with a presumption in favour of granting consent to applications for energy NSIPs.

4.1.6 It is stated that this presumption applies unless any more specific and relevant policies set out in the relevant NPSs clearly indicate that consent should be refused or if the proposal will result in adverse impacts from the development outweighing the benefits. In considering any proposed development, and in particular when weighing its adverse impacts against its benefits, the Secretary of State should take into account:

- Its potential benefits including its contribution to meeting the need for energy infrastructure, job creation and any long-term or wider benefits; and

- Its potential adverse impacts, including any long-term and cumulative adverse impacts, as well as any measures to avoid, reduce or compensate for any adverse impacts.

4.1.7 In this context, NPS EN-1 states that the Secretary of State should take into account environmental, social and economic benefits and adverse impacts, at national, regional and local levels. These may be identified in this NPS, the relevant technology-specific NPS, in the application or elsewhere (including in local impact reports).

4.1.8 NPS EN-3 contains policy specifically relating to renewable energy infrastructure and is designed to be read in conjunction with EN-1. The infrastructure covered by this NPS comprises energy from biomass and/or waste, offshore wind and onshore wind. The NPS does not cover other types of renewable energy generation that at the time of publication were not technically viable, such as schemes that generate electricity from tidal stream or wave power. It was expected that tidal range schemes may be the subject of applications within the near future and government is, therefore considering the need for either a revision to this NPS or a separate NPS to provide the primary basis for decision-making under the Planning Act on such schemes.

4.1.9 Although Tidal Lagoon Swansea Bay Ltd now submit that tidal power is now economically and technically viable, Government has not yet indicated when it intends to address the situation on directly applicable NPSs.

4.1.10 NPS EN-3 clarifies that the Secretary of State should have regard to Planning Policy Wales and advice issued by Welsh Government relevant to renewables and expect applicants to have taken them into account when working up their proposals.

4.1.11 NPS EN-5 is concerned with impacts and other matters which are specific to electricity networks infrastructure or where, although the impact or issue is generic and covered in EN-1, there are further specific considerations arising from this technology. The policies set out in this NPS are additional to those on generic impacts set out in EN-1.

4.2 *Planning Policy Wales*

4.2.1 Planning Policy Wales (Edition 6) (PPW) states that in determining applications for renewable and low carbon energy development and associated infrastructure local planning authorities should take into account:

- The contribution a proposal will play in meeting identified national, UK and European targets and potential for renewable energy, including the contribution to cutting greenhouse gas emissions;
- The wider environmental, social and economic benefits and opportunities from renewable and low carbon energy development;
- The impact on the natural heritage, the Coast and the Historic Environment;
- The need to minimise impacts on local communities to safeguard quality of life for existing and future generations;
- Ways to avoid, mitigate or compensate identified adverse impacts;
- The impacts of climate change on the location, design, build and operation of renewable and low carbon energy development. In doing so consider whether measures to adapt to climate change impacts give rise to additional impacts;
- Grid connection issues where renewable (electricity) energy developments are proposed; and
- The capacity of and effects on the transportation network relating to the construction and operation of the proposal.

4.2.2 Planning Policy Wales Technical Advice Note 8: Planning for Renewable Energy sets out the land use planning considerations of renewable energy and advises that in order to meet WG renewable energy targets that 800MW of additional installed capacity is required from onshore wind sources and a further 200MW of installed capacity is required from offshore wind and other renewable technologies.

4.2.3 It is advised that although generally supported, there could be occasions where some hydro schemes are unacceptable because of potential ecological damage. It states that all of the parties involved should work constructively to find acceptable solutions.

4.3 *City & County of Swansea Unitary Development Plan*

4.3.1 The preamble to City & County of Swansea Unitary Development Plan (UDP), Policy R11 sets out the Council's support for Welsh Government's policy for strengthening renewable energy production, and recognises the long-term benefits to be derived from the development of renewable energy sources. It is recognised that renewable energy technologies can have a positive impact on local communities and the local economy in terms of monetary savings and in generating and underpinning economic development within the County. There are however concerns about the impacts that some renewable energy technologies can have on the landscape, local communities, natural heritage and historic environment, nearby land uses and activities. The Council therefore seeks to achieve a balance between supporting renewable energy proposals whilst avoiding significant damage to the environment and its key assets. It is explained that favourable consideration will be given to developments that produce or use renewable energy where such proposals conform with UDP policies and are in scale and character with their surroundings.

4.3.2 To this end Policy R11 states that proposals for the provision of renewable energy resources, including ancillary infrastructure and buildings, will be permitted provided:

i. The social, economic or environmental benefits of the scheme in meeting local, and national energy targets outweigh any adverse impacts,
ii. The scale, form, design, appearance and cumulative impacts of proposals can be satisfactorily incorporated into the landscape, seascape or built environment and would not significantly adversely affect the visual amenity, local environment or recreational/tourist use of these areas,
iii. There would be no significant adverse effect on local amenity, highways, aircraft operations or telecommunications,
iv. There would be no significant adverse effect on natural heritage and the historic environment,
v. The development would preserve or enhance any conservation areas and not adversely affect listed buildings or their settings,
vi. The development is accompanied by adequate information to indicate the extent of possible environmental effects and how they can be satisfactorily contained and/or mitigated,
vii. The development includes measures to secure the satisfactory removal of structures/related infrastructure and an acceptable after use which brings about a net gain where practically feasible for biodiversity following cessation of operation of the installation.

4.3.3 The above sets out the main national and local planning policy principles that apply to this proposal. A significant amount of other relevant planning policy is considered as part of the Local Impact Report.

5.0 The process and involvement of the City & County of Swansea

5.1 Under the provisions of the Planning Act 2008, the City & County of Swansea has the status of 'relevant local authority' for the purpose of this application, on the basis that part of the application proposals are located within the administrative boundary of the County, and, adjacent to it.

5.2 As a relevant local authority, the City & County of Swansea has been invited to submit a local impact report (LIR) to the ExA, giving details of the likely impact of the proposed development on this Authority's area.

5.3 In coming to a decision, the ExA and Secretary of State must have regard to any LIRs that are submitted by the deadline. The Planning Inspectorate strongly encourage local authorities to produce LIRs when invited to do so.

5.4 The sole definition of an LIR is given in s60(3) of the Act as '*a report in writing giving details of the likely impact of the proposed development on the authority's area (or any part of that area)*'. The Planning Inspectorate's Advice Note 1: Local Impact Reports (April 2012) advises that the LIR should be used by local authorities as the means by which their existing body of local knowledge and evidence on local issues can be fully and robustly reported to the ExA.

5.5 The report should consist of a statement of positive, neutral and negative local impacts, and their relative importance together with an assessment of the development's compliance with planning policy and the Authority's view on the DCO.

5.6 The LIR does not need to contain a balancing exercise between positives and negatives as this will be carried out by the ExA, nor should the LIR state opinions on the development itself. Moreover, there is no need for the LIR to replicate the EIA. Nor is it necessary to replicate any assessment already produced in respect of the site such as those included in National Policy Statements. Rather, the advice is that LIR's should draw on existing local knowledge and experience and therefore cover any topics considered relevant to the impact of the proposed development on their area.

5.7 As an LIR does not include the Local Planning Authority's position on the proposed development, it open to relevant authorities to submit a separate Written Representation (WR) if it wishes to express a particular view on any aspect of the development or whether the application should be granted.

5.8 The Local Authority is also required to agree to a Statement of Common Ground (SoCG), which is a written statement prepared jointly by the applicant and other parties, setting out any matters on which they agree and identifying matters where agreement has not been reached. This will be an iterative document that will evolve during the course of the examination.

5.9 Also during the course of the examination, the Local Planning Authority will be required to respond to specific questions raised by the ExA. The first round of questions were posed by the ExA on the 16th June 2014. The Local Authority will also have opportunity to comment on representation and responses to questions made by other interested parties and the applicant during the course of the examination.

5.10 Following the PM, the ExA has now made its procedural decisions about the way in which the application is to be examined and the timetable for the submission of the aforementioned documents. The timetable is provided as Appendix 2.

5.11 The examination of the application will primarily be a consideration of written representations about the application, along with any oral representations made at the open floor and topic specific hearings. Issue specific hearings are held only if the ExA considers they are necessary to ensure adequate examination of an issue or that an interested party has a fair chance to put forward their case.

5.12 An open floor hearing can be requested by anyone who has registered and made a relevant representation or by other interested parties. The dates for the hearings are set out in the examination timetable provided at Appendix 2.

5.13 The first significant deadline for this Authority is Deadline II (8th July) by which time it must submit its LIR, WR, contribution to the SoCG and response to the Inspector's first round of questions.

(The Local Planning Authority has already confirmed, in accordance with Deadline I on the 24th June 2014 that it reserves the right to attend and participate in all of the hearings arranged as well as providing requests for specific locations to be included in the formal site visits by the ExA.)

5.14 Under the terms of the draft DCO, the role of CCS would fundamentally change should consent be granted for the tidal lagoon scheme. In this respect, CCS would become the single Local Planning Authority (and Pollution Control Authority) for matters such as discharge of conditions (known as requirements in this process), obligations and enforcement. For this, the DCO proposes that seaward of the high water springs and that part of the application site located within Neath Port Talbot County Borough Council (NPT) be effectively annexed to CCS.

5.15 In this respect it is normal practice for the Authority with the greatest share of the application site to be the determining Authority. The benefits to CCS is that it will have control over significant matters affecting the County but will have significant resource issues at a time when such resources are already stretched. In this respect the draft DCO also sets out the expected procedures for CCS in discharging the requirements of the scheme. It is considered that a number of these procedures are unreasonable, onerous and resource intensive. Accordingly, submissions to this effect are contained with the LIR along with a suggested requirement for the applicant to fund one full time senior planning officer and one full time supporting technical officer in order to meet any finally agreed procedures. This would be resolved by way of a Planning Performance Agreement.

6.0 Submissions

6.1 A LIR has been prepared on behalf of the City & County of Swansea in consultation with all relevant Service Areas of the Council and its archaeological advisors. A copy of the LIR, which has been produced in accordance with the Planning Inspectorate's Advice Note 1: Local Impact Reports (April 2012) and best practice examples, is provided as Appendix 3. Copies of the internal responses received, which have helped inform the LIR, are reproduced in full as Appendix 4. (No external consultation has taken place with statutory consultees such as Natural Resources Wales, who is a registered interested party in its own right and will make submissions directly to the ExA.)

6.2 The main material considerations with regard to the proposal are set out below and are considered within the appended LIR.

- Principle of development
- Seascape, landscape and visual impact
- Design and public realm
- Cultural heritage and terrestrial and marine archaeology
- Coastal processes, sediment transport and contamination
- Intertidal and subtidal benthic ecology
- Fish, including recreational and commercial fisheries
- Marine mammals and turtles
- Coastal birds
- Terrestrial ecology
- Marine water quality assessment
- Land quality and hydrogeology
- Onshore transport assessment/highways, traffic, car parking, access and pedestrian movements
- Navigation and marine transport assessment
- Air quality
- Hydrology and flood risk
- Residential amenity
- Economy, Tourism and Recreation
- Sustainability

6.3 Given the nature of the proposed development and that the specialism is not available within the Council, White Consultants have been commissioned by the City and County of Swansea to review the seascape and landscape visual impact assessment (SLVIA). A copy of the final report from White Consultants is provided is Appended to the LIR.

6.4 Again, for specialism reasons, the City & County of Swansea has also commissioned Kenneth Pye Associates Ltd Research, Consultancy and Investigations to consider the potential impacts of the lagoon on coastal processes, sediment transport and rates of sediment accretion and erosion along the CCS bay frontage. A copy of the report by Kenneth Pye Associates Ltd is also appended to the LIR.

6.5 As set out above, it is recommended that the findings of Kenneth Pye Associates and White Consultant's be accepted and presented to the ExA as representing the views of the City & County of Swansea and formally form part of the Council's Local Impact Report.

6.6 In accordance with the issues raised in the LIR, Written Representation has been prepared which sets out the recommended position for the City & County of Swansea. This is provided as Appendix 5.

6.7 As set out above, CCS is required to formally agree to a SoCG. This work is currently ongoing and will be an iterative process. It is recommended therefore that delegated powers be given to the Head of Economic Regeneration and Planning to formally contribute to a SoCG in accordance with the timetable for the examination process and within the terms of Council's Local Impact Report and Written Representations.

6.8 The Council is also now in receipt of the Inspectors first round of questions. These are set out in Appendix 6. The appended LIR addresses many of these questions whilst responses to the residual matters are currently being prepared.

6.9 There will be further rounds of questions through the duration of the examination and the advice given by the Planning Inspectorate is that local authorities should ensure any necessary internal authorisation processes are in place to meet the timetable. It is stressed that such are the timescales for responses to Inspector's questions etc that it will not be possible to seek authorisation from Committee.

6.10 It is recommended therefore that delegated powers be granted to the Head of Economic Regeneration and Planning to formally respond to the Examining Authority's Inspector questions in accordance with the timetable for the examination process during the course of the examination and also to make comment on the submissions of other parties, including the applicant.

6.11 Similarly, additional delegated powers are sought to be granted to the Head of Economic Regeneration and Planning to formally represent the views of the Council in any topic specific hearing and subsequent requirements in accordance with the timetable for the examination process during the course of the examination, within the terms of the Council's Local Impact Report and Written Representation.

7.0 Financial Implications

7.1 CCS does not receive a fee for the application which has been made to the Planning Inspectorate. The cost of Officer time therefore falls to the Council. The applicant has however advised that it is willing to pay the costs for the Council's external consultants.

7.2 Should the DCO be granted for the proposed development, CCS will be required to discharge and enforce the requirements of the Order for geographical areas in addition to its own administrative area. The appended LIR addresses the resource implications of this work and suggests that dedicated officer posts are funded by the applicant and that fees are paid to the Local Planning Authority to discharge the requirements of the Order that are proportional to the submission.

8.0 Legal Implications

8.1 The submission is subject to a detailed legal regime under the Planning Act 2008 and the associated Regulations.

8.2 The application includes a draft DCO and Heads of Terms for a Section 106 Obligation. Comments on the same are provided within appended LIR.

9.0 Equalities and Engagement Implications

9.1 A high profile initiative such as this will require a full Equalities and Engagement Implications report. Although the planned work is not thought to affect all protected groups, factors such as access and social inclusion (already covered in some detail in the LIR) will need to be considered as work progresses.

Background Papers:

The Planning Act 2008 (as amended), National Policy Statements, Planning Policy Wales, adopted City & County of Swansea Unitary Development Plan and the Tidal Lagoon Swansea Bay Ltd application documents including Environmental Impact Assessment.

Appendices:

Appendix 1 – Detailed project description
Appendix 2 – Examination timetable
Appendix 3 – City & County of Swansea Local Impact Report
Appendix 4 - Internal consultation responses
Appendix 5 - City & County of Swansea Written Representations
Appendix 6– Inspectors first round of questions

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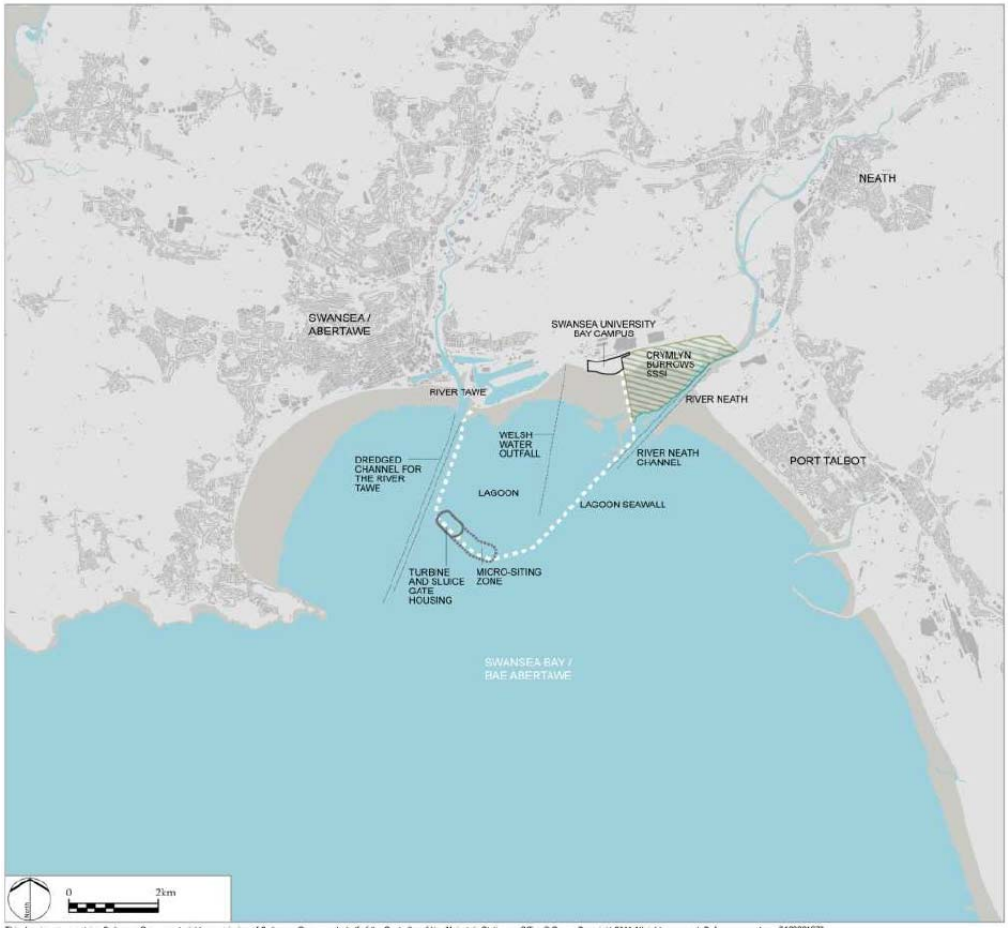
APPENDIX 1

1.0 Detailed Description of the Proposed Scheme

1.1 Tidal Lagoon Swansea Bay Ltd proposes to design, construct and operate a tidal lagoon for the purpose of generating renewable energy. This will be achieved by harnessing the power of the high tidal range in Swansea Bay (where the maximum Spring tidal range reaches over 10m).

1.2 As illustrated below, the lagoon created as part of the project would enclose part of the seabed and the foreshore of Swansea Bay. The associated seawalls would be approximately 9.5km in length and extend in a distorted U-shape from the eastern side of the River Tawe to the eastern edge of the new Swansea University Bay Campus.



1.3 The new seawalls of the lagoon would extend approximately 1.5km directly offshore from the eastern landfall at the Bay Campus (the eastern landfall), adjacent to Crymlyn Burrows SSSI. The seawalls would then extend in a south-westerly direction for approximately 4.3km. A turbine and sluice gate housing structure would be located in the south west of the lagoon, at an oblique angle to the dredged channel of the River Tawe. The seawall would then extend towards Swansea Port for approximately 2.5km, close to the mouth of the River Tawe parallel to the dredged channel for the River Tawe to rejoin the land (the western landfall).

1.4 The seawalls would enclose an area of approximately 11.5km2 of seabed and foreshore to create the lagoon. The hydro turbines used for the project would be bi-directional, meaning they are able to generate power with flows of water in both directions (i.e. on both incoming and outgoing tides). At high water a “head” of water (a difference in water level between the inside and outside of the Lagoon) would be held within the Lagoon using sluice gates located within the turbine and sluice gate housing. About 2.5 hours after high water, the water held within the Lagoon would be released, and power would be generated when the resulting flow is channelled through the turbines on the outgoing tide. This process would be repeated on the flood tide for bi-directional generation. The project would therefore generate electricity four times per day (on each of two ebb and flood tides) totalling, on average, 14 hours of generation every day.

1.5 The electricity generated would be fed into the National Electricity Transmission System (NETS) via National Grid's substation in Baglan by way of an underground cable connection from the generating station. It is anticipated that the Project will produce some 400 GWh net of electricity on an annual basis, which is enough to power around 121,000 homes.

1.6 It is stated that the project will also offer additional benefits to the Swansea Bay area and the wider population, promoting educational, sport, recreational art and cultural activities for public use.

1.7 The offshore works during the construction and operation phases would comprise the following:

- Turbines and sluice gates, their housing structure, gantry crane and other facilities, such as generators and switchgear;
- Temporary cofferdam to facilitate the construction of the turbine and sluice gate housing structure;
- Temporary rock storage areas; seawalls and associated dredging works;
- Dredging to create boating area; access road on the seawalls including public realm works, lighting structures and shelters;
- Offshore Building incorporating operation and maintenance (O&M) facilities, with integral visitor centre, leisure facilities and public realm;
- Emergency facilities; works to Swansea Port Channel; demolition of existing eastern breakwater wall at the entrance to the Port of Swansea;
- Works to Neath Harbour Channel including the widening of the entrance to the channel and replacement of its training wall; water quality enhancement works (if required or implemented);
- Navigation facilities including lighting; reef habitat creation works, provision of oyster spatting ponds, herring mitigation and Sabellaria habitat works.

1.8 The onshore works would comprise:

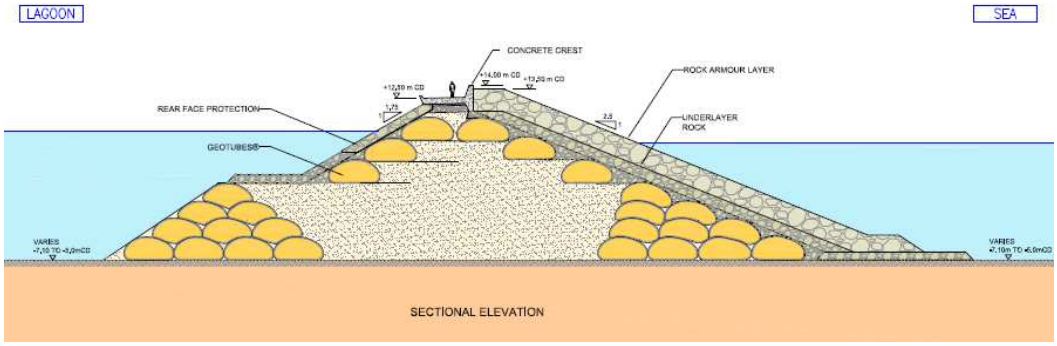
- Provision of construction support sites including access routes for construction traffic and permanent access routes to the project, decontamination/land remediation works, installation of drainage and services, material handling facilities for deliveries by sea or rail, land creation works, including lay-down areas and temporary rock stockpile areas;
- Western Landfall Building incorporating O&M facilities including visitor orientation, recreational boating facilities, laboratory/hatchery building at the western landfall with slipways; vehicle parking; manoeuvring areas, public realm and lagoon side public open space;
- Site of Special Scientific Interest (SSSI) information facility at the eastern landfall;
- Water quality enhancement works;
- Habitat creation works/mitigation, including beach/dune and saltmarsh creation within the lagoon;
- Access works to the lagoon, including new highway access via the controlled junction on Fabian Way with associated alterations to the Swansea Port road network;
- Necessary services; improvements and additions to River Tawe water shuttle pontoon;
- Pedestrian and cycle routes.

1.9 The cable connecting the turbines to the NETS would run along the western seawall to the western landfall and then follow a route through Swansea Port, past the Bay Campus, extending through the Crymlyn Burrows SSSI, and across the River Neath by use of existing ducts or by constructing new ducts.

Seawalls

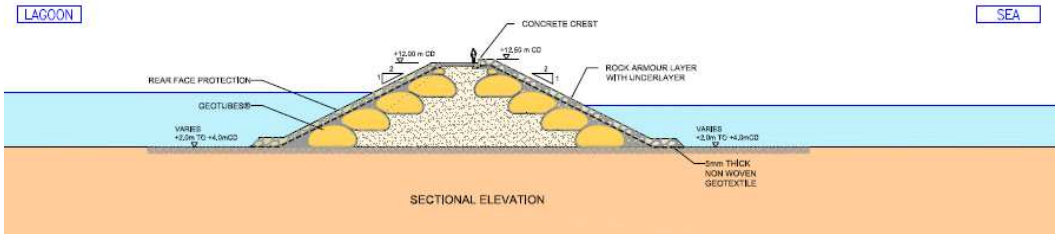
1.10 The seawalls will form the enclosure of the lagoon, controlling the water to allow a difference in water level to be created between the lagoon and the sea outside. It is proposed to construct the seawalls with a sediment core held in position with either sediment filled geotextile tubes, known as Geotubes® or by more conventional methods, where the sediment core is encased in gravel/quarry run. Layers of rock and rock armour would then be placed on the outside of the structure for protection; the thickness and quantity of these layers will vary depending on location.

1.11 At the most exposed locations, typically furthest offshore, adjacent to the turbine and sluice gate housing structure, the construction of the seawall would be as illustrated below.



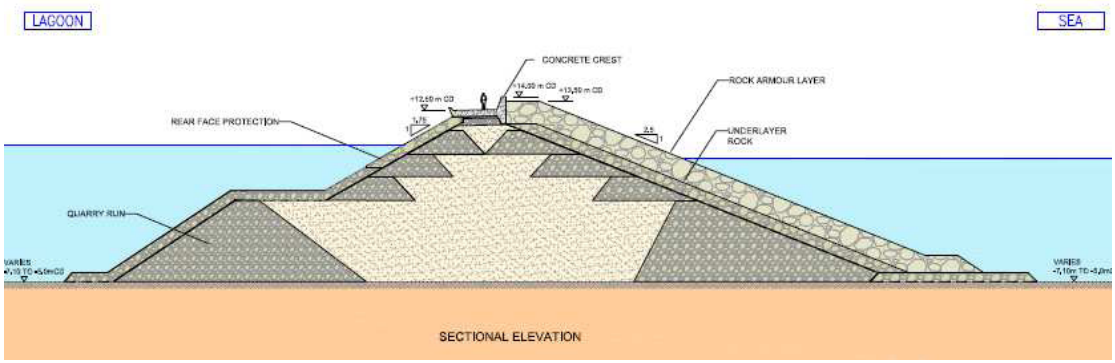
1.12 The Geotubes® on the more exposed seaward side of the seawall would be covered with a 1 to 1.5m thick layer of under-layer rock. A 2 to 2.5m thick layer of armour rock, varying in weight between 3 and 10t, will be placed over the top to create a slope of approximately 1 in 2.5. The lagoon side of the seawall is subject to smaller, locally-generated waves, and therefore less protection is required. This would be in the form of a 0.5 to 1m layer of rear face armour. A 10m-wide level berm is required on the Lagoon side to provide geotechnical stability to the seawall due to the steeper 1 in 1.5 and 1 in 1.75 slopes.

1.13 In less exposed locations, closer to the existing shore, the structure required to achieve the necessary stability, has a less complex construction, as shown below.



1.14 The Geotubes®/sediment will be covered, on both the sea and Lagoon side of the seawall, in a of rocks up to 1.5m thick. Both sides would have a finished slope angle of 1 in 2 or 1 in 2.5 depending on the position of the wall within the overall lagoon.

1.15 An alternative more conventional construction design of the seawall is also being considered. This method does not incorporate Geotubes® and is shown below.



1.16 As with the Geotubes® technique, the seawall has a sediment core, but in this case it would be held in position by large piles of gravel. This gravel would either comprise dredged material from within the Lagoon footprint or quarry run imported by sea. Quarry run is stone material typically between 0 to 0.5t in weight which is left over after the blasting for rock armour. The footprint and angle of the slopes would remain largely unchanged from the design incorporating Geotubes®. The angle of the rock armour that forms the slope of seawalls gives stability to the structure and also reduces reflection of waves.

1.17 The seawall would be a maximum of 107m wide at the base of the deepest section, adjacent to the turbine and sluice gate housing and would narrow as it extends towards the landfalls to a minimum width of 40m.

1.18 The crest of the seawall will generally be 13m across, with the exception of the location of the Offshore Building where the seawall would be widened to accommodate the building and/or create additional recreational space. The seawall would also include local widened sections to accommodate sculptural elements. At the western landfall, in the south west corner of Queens Dock, the seawall crest extends to approximately 152m in width and is proposed to accommodate recreational areas including a beach and spectators areas.

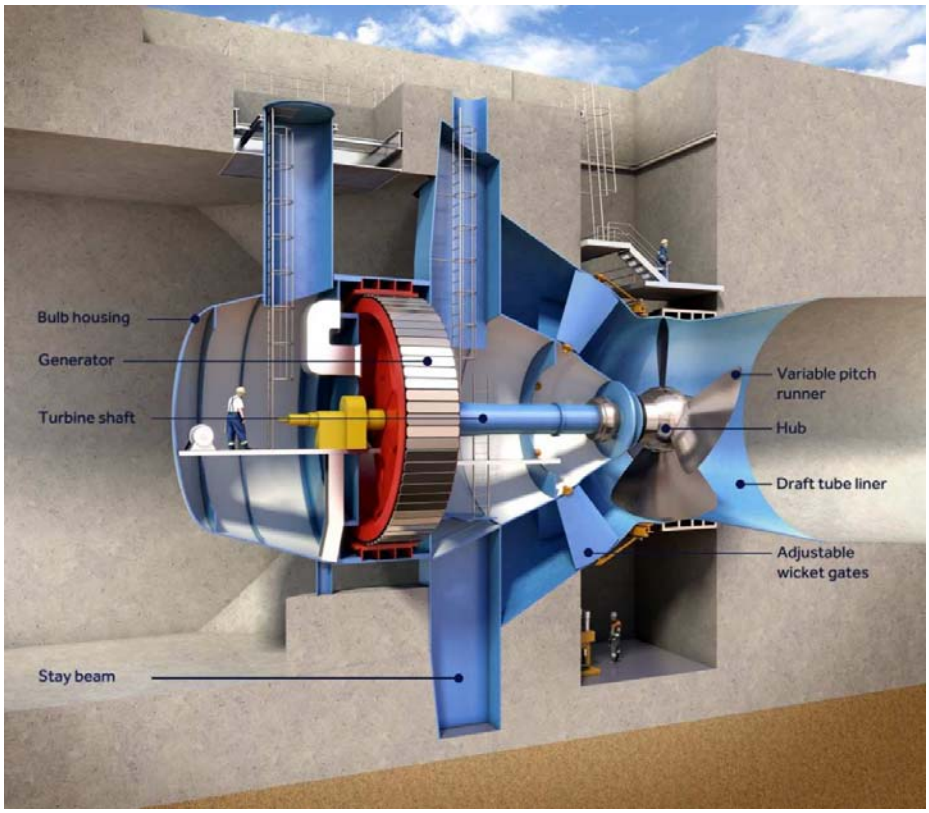
1.19 The visible height of the seawalls above the water level measured at the highest point would be approximately 4m at high tide (MHWS) and 12.5m at low tide (MLWS).

1.20 In order to allow access along the seawall, a road would to be constructed along its entire length. The road would be 0.5 to 1.5m below the crest of the outer rock armour, to provide protection for the road and those using it. The road would generally be 4.5m wide.

1.21 The western seawall would incorporate an additional 3.1m wide cycle track/passing place. The road would form the access route along the seawall to the turbine and sluice gate housing structure for operational staff, emergency access and the public. The public would be permitted to access the road on foot and by bicycle, which forms part of a circular route around the perimeter of the lagoon. The road would be closed in extreme weather conditions and during hours of darkness, except for key O&M access.

1.22 It is proposed that the sediment used within the core of the seawall and the Geotubes® would be taken from the seabed within the footprint of the lagoon. It has been calculated that approximately 8.1 million cubic metres (Mm3) of sediment will be dredged for the project as a whole. A licence to dredge is currently being sought from Natural Resources Wales (NRW), Marine Licensing Team (MLT).

1.23 It is proposed to install between 13 and 16 bi-directional turbines of 7m diameter in the turbine and sluice gate housing structure. Because the turbines are bi-directional, they are able to generate power with water flow entering the lagoon on the flood tide and leaving the lagoon on the ebb tide.



1.24 Between six and ten vertical lift metal sluice gates would be located in the turbine and sluice gate housing structure. The sluice gates are an additional mechanism (as well as the turbines) to control the water entering and leaving the lagoon. The gates remain closed until towards the end of each cycle when they are then opened to allow the water levels in and outside the lagoon to be equalised as much and as quickly as possible.

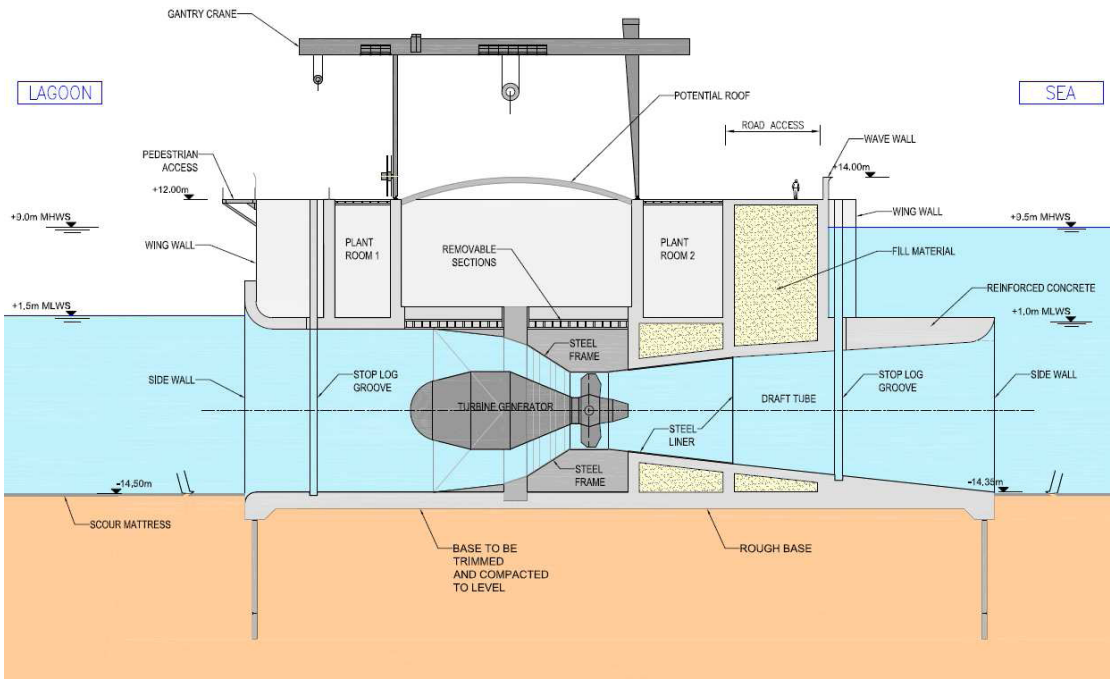
1.25 As indicated, the exact configuration of the sluice gates and turbines is also yet to be resolved, however, a layout shown in the Environmental Statement of 16 turbines, 7m in diameter, 8 sluice gates and a dividing structure incorporating a maintenance area, would give an overall structure of approximately 410m in length. It would be 67.5m wide in the vicinity of the turbines, 45.5m wide in the vicinity of the sluice gates and 137m wide at the widest point of the dividing structure. At seabed level, -14.35m CD, a scour protection mattress would be constructed, which will extend in the order of 50m on either side of the housing structure.

1.26 The dividing structure would be a large concrete structure which assures efficient hydraulic flows into the turbines and sluice gates and would extend to the depth of the housing structure. It would be a platform from which large items can be accessed using on gantry crane for maintenance or repair. This would be located on top of the turbine and sluice gate and would have an overall height of 18.65m above the top of the turbine housing. It would be permanent feature on top of the turbine and sluice gate structure and would traverse the same as required and have a normal ‘home’ position where it will be placed when not in use.

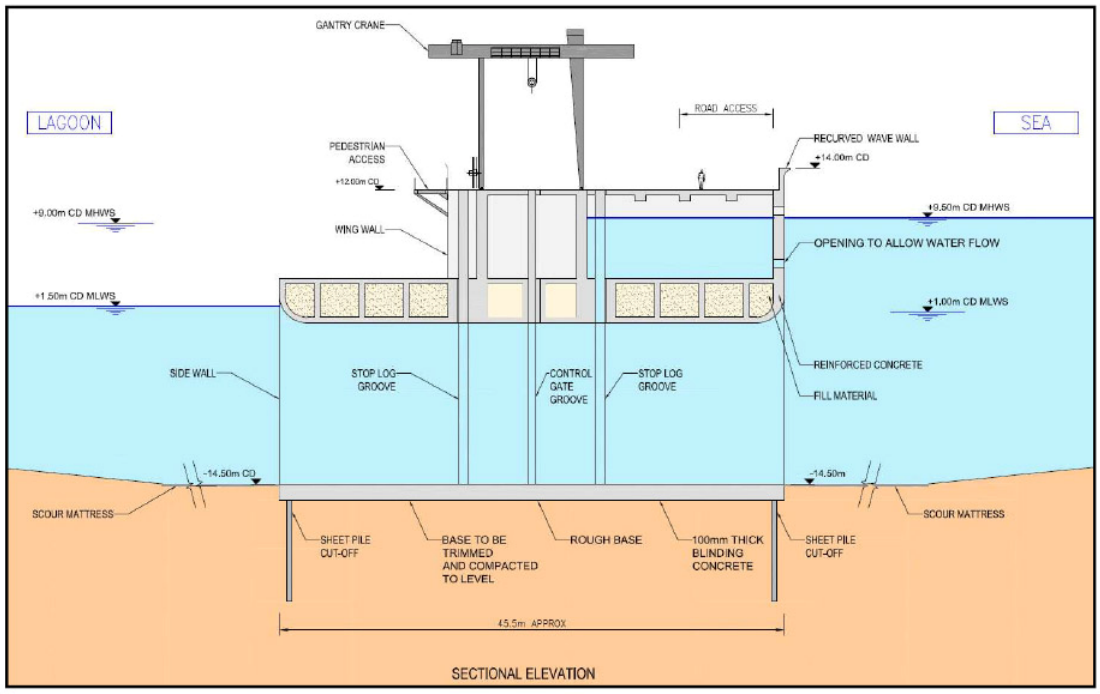
1.27 In order to function efficiently, the turbines and sluice gates have to be submerged at all states of the tide. To achieve this, the seabed would be gradually deepened, at a 1 in 10 slope on either side of the turbine and sluice gate structure, to create a gently-sloping bowl up to 165m wide across the base where it meets the scour protection mattress (50m either side of the turbine housings). It is stated that the angle of the slope will ensure that it remains stable and will minimise scour and erosion.

1.28 The housing unit for each 7m-diameter fixed speed turbine would be approximately 15m wide, 67.5m long and a total of 26.5m in height from deepened seabed level to the apron level. A small wave wall, 1.5m in height, would sit on top of the apron.

1.29 An indicative cross-section of a 7m diameter, fixed speed turbine housing unit with turbine is shown below. (The final design of the gantry crane is subject to review.)



1.30 Each individual sluice gate housing unit would be approximately 16m wide, 45.5m long and will be a total of 26.5m in height from the deepened seabed to the top of the concrete apron. A cross-section of an individual sluice gate housing unit is shown below.



1.31 Each of the turbines would be capable of generating up to 20MW of electricity at 9kV, which would be stepped up to 33kV by a transformer adjacent to, and linked to, pairs of turbines. The electricity would be stepped up again to 275kV by a larger transformer at the power house, located in, or adjacent to, the turbine and sluice gate structure.

1.32 The combined electrical output from all turbines will then be transferred to the nearest National Grid substation. This has been identified as Baglan Bay substation to the east of the River Neath. The electricity would be transferred via cables laid underground, commencing at the turbine and sluice gate housing structure and then extending within the western seawall through a single trench from the lagoon and onwards running to the south of Fabian Way and underneath the River Neath. The precise connection at Baglan Bay substation would in due course be promoted separately by National Grid.

1.33 It is stated that whilst the principal function of the project is as an electricity generating station, it would however provide enhanced recreation and educational facilities to the benefit the local and wider community.

1.34 It is anticipated that the Project would attract some 70,000-100,000 visitors a year. Sporting events are anticipated to range from sailing competitions and training for a variety of classes of boat, to triathlon, swimming or running events once or twice a year, with between 2,000 and 8,000 visitors attending individual events.

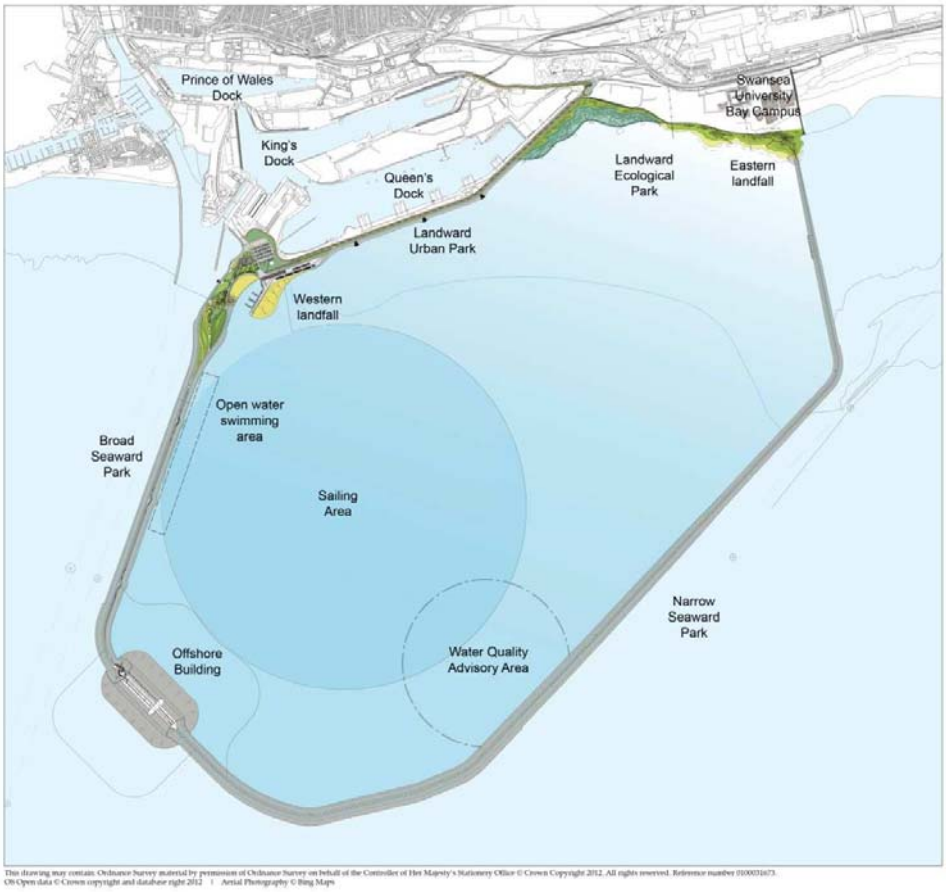
1.35 As highlighted below, three focal areas are proposed to support the operation of the project.

1.36 These and comprise:

i. Offshore Building;
ii. Western landfall; and
iii. Eastern landfall.

1.37 A supporting masterplan aims to link the these three focal areas and the seawalls of the Lagoon to the land while capturing the existing waterside environments associated with Swansea Port, the Bay Campus and existing brownfield land. It is stated that the public realm of the Project has been designed as a “marine park” with four offshore and onshore character areas, namely, the Broad Seaward Park, Narrow Seaward Park, Landward Urban Park and Landward Ecological Park.

1.38 Overall the masterplan encompasses O&M requirements associated with the operation of the energy generation facility and related recreational opportunities, as illustrated below.



1.39 The offshore building would be located on the north west side of the turbine and sluice gate housing structure and would comprise a three-storey structure, with a maximum envelope of 57m by 51m by 25.5m high, and with a ground floor area of approximately 35m by 47m. The design of the building is shown below along with an illustrated cross section.

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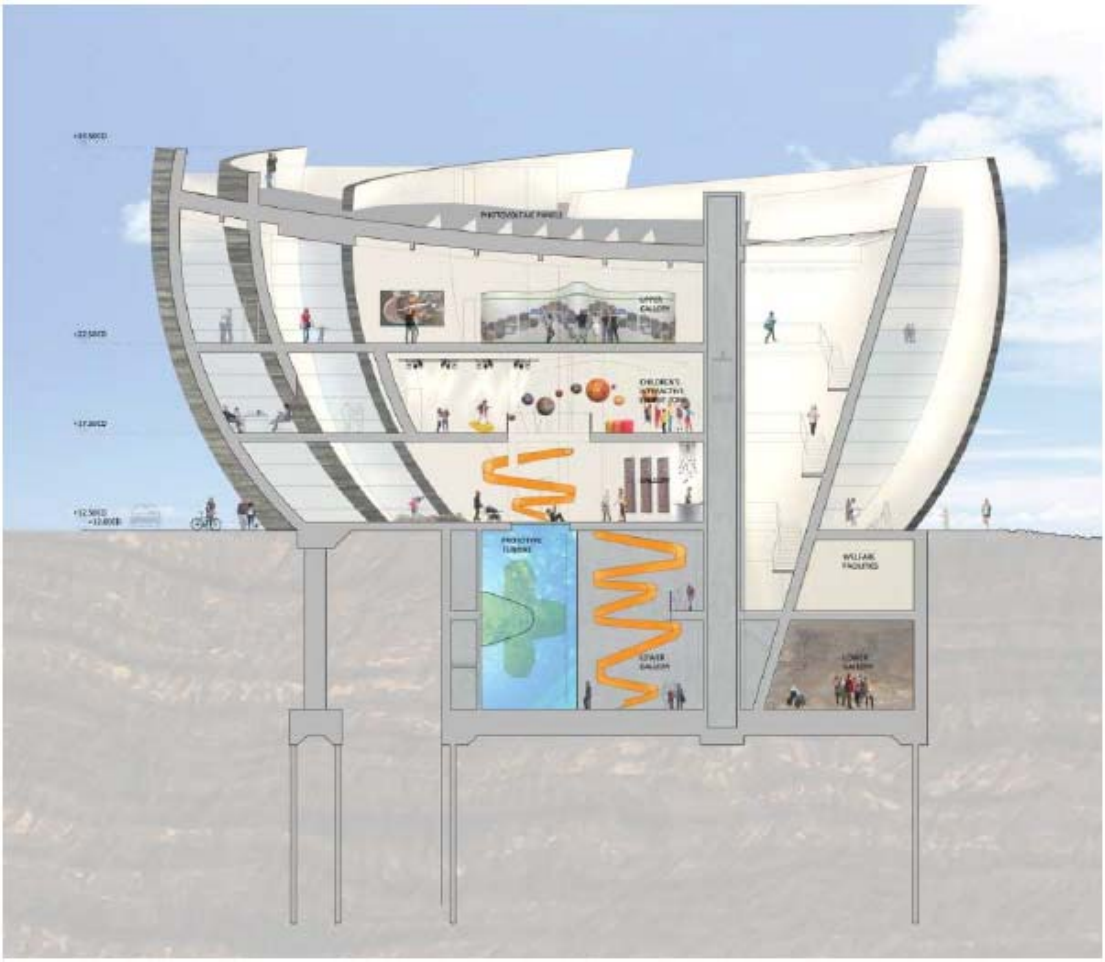


1.40 The building would be up-lit and lighting of the immediate external area would be provided. Amenity lighting of the public realm would extend along the western seawall to the western landfall and at a lower intensity towards the eastern landfall.

1.41 The offshore building will provide O&M facilities associated with the turbines and sluices, and recreational facilities for visitors, including galleries and multi-functional exhibition space; turbine viewing gallery and viewing terraces; education facilities; restaurant/café/ kitchens; and visitor facilities, including composting toilets.

1.42 The western landfall area is intended to form a destination location and gateway to the western seawall, which, it is stated extends as an attractive public realm towards the offshore building. It is anticipated that there will be an electric bus that can transport those visitors not wishing or able to walk between the western landfall and the Offshore Building.

1.43 The western landfall would also include access control measures that permit the seawall to be closed during the hours of darkness and during extreme weather conditions.

1.44 It is stated that the water of the lagoon provides opportunities for a water sports venue capable of providing a permanent body of water for local, regional and national events, with spectator areas along the lagoon seawall.

1.45 The Western Landfall Building would comprise a three-storey structure with a ground floor area approximately 120m by 18m with a total height of 13.5m. The design of the building, which would be up-lit during hours of darkness, is illustrated below, whilst its location is shown above.

1.46 The building would provide functional space associated with the O&M requirements of the project, including controlled access to the western end of the lagoon seawall and provision of space for recreational uses, including:

- Gateway facilities such as visitor orientation, exhibition space, visitor shop and offices;
- Boating/water sports centre including entrance area, changing facilities, dry training/wet briefing areas, workshops/storage, cafe/bar/social space and viewing terrace, classrooms and staff facilities and medical room; and
- Public toilet facilities.

1.47 External facilities would include:

- Access control to lagoon seawall;
- Up to 300 car parking spaces and associated overspill space;
- Six coach parking spaces;
- Bus and heavy vehicle turning facilities;
- Electric bus turning and set down area;
- Slipway access to the lagoon;
- Boat storage area;
- Hard standing areas, soft landscaping, public realm and recreational space; and
- Lighting of external areas and amenity way-finding lighting to the public realm.

1.48 The design of the eastern landfall facility comprises an information wall and viewing platform stepped into the proposed dune and coastal grassland area. The final design is anticipated to be coordinated with the University as a combined facility providing information on the project as well as Crymlyn Burrows SSSI.

1.49 The eastern landfall area including the adjacent Landward Ecological Park, would secured with a locked gate thereby limiting unauthorised vehicular access and controlling public access.

1.50 As shown on the above Masterplan the three focal areas are proposed to be interconnected with four character areas or Parks, namely:

1. The Broad Seaward Park;
2. Narrow Seaward Park;
3. Landward Urban Park and
4. Landward Ecological Park.

1.51 At the Western Landfall, the Broad Seaward Park is intended to invite visitors offshore to the Offshore Building. At its landward and widest extent it would comprise a beach area with recreational space overlooking the Western Landfall Building and associated facilities. An intertwining network of paths would lead visitors across a wide sweeping walkway offshore and onto the main lagoon wall. Positioned along this section would be stopping off places such as viewing areas and sculptures.

1.52 It is envisaged that the new rock armour of the lagoon seawall would provide good opportunities for habitat creation at and below water level. In addition, formal fishing locations, and informal opportunities for walkers, runners and cyclists would be provided.

1.53 A shuttle bus is proposed linking the existing Park & Ride facility on Fabian Way, the western landfall, and the Offshore Building, subject to investigation of its viability. Facilities are also proposed on the western seawall to support a potential 'lagoon water shuttle' service linking the existing pontoon on the west bank of the Tawe to the Lagoon facilities. These proposals are intended to support access to the Project from Fabian Way and Swansea Maritime Quarter respectively.

1.54 Beyond the Offshore Building the Narrow Marine Park would lead visitors back onshore to the Eastern Landfall. Again, this would incorporate stopping off places, fishing platforms and sculptures dotted along the route.

1.55 The Landward Ecological Park and the Landward Urban Park would connect the Eastern Landfall to the Western Landfall are. The landward Ecological Park, shown below aims to provide a buffer between the Project users and the Crymlyn Burrows SSSI.

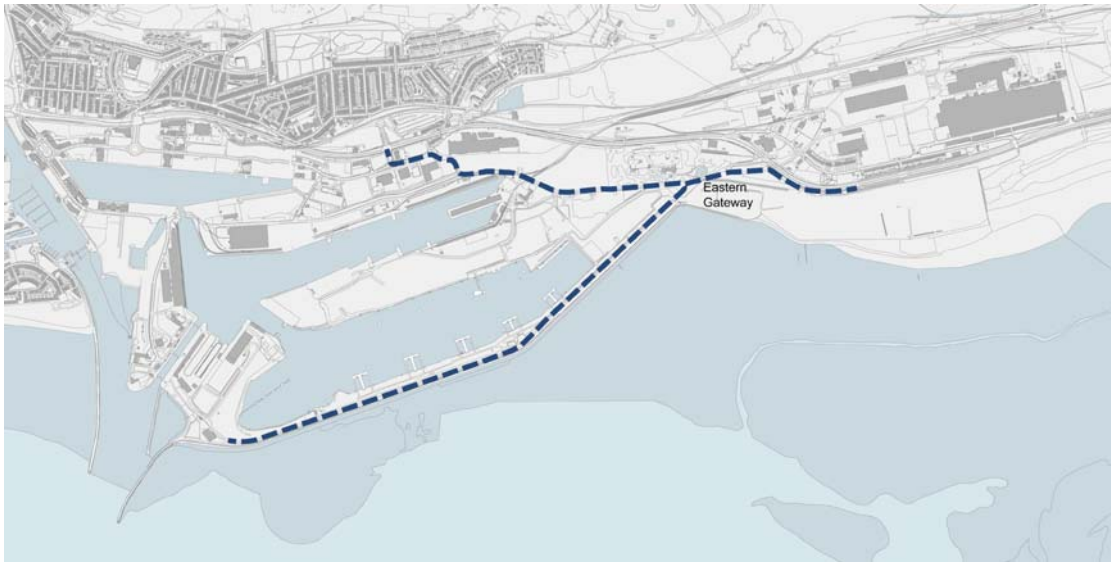
1.56 The Landward Ecological Park would comprise areas of saltmarsh (5ha), coastal maritime grassland (3ha) and dunes (5.5ha). These areas would be formed part in mitigation for lost habitat but also as enhancement proposals thereby adding ecological connectivity and value to the area.

1.57 The Landward Ecological Park would lead into the Urban Park. This area extends along the existing Queen's Dock waterfront as an enhanced public realm and access road environment benefiting from the removal of the existing concrete seawall (where possible) opening up views across the lagoon. The proposal establishes a new waterfront road, lagoon-side public realm and recreation areas at a level above the high tides with limited lagoon-side parking and pedestrian access to intertidal areas at low tide. Public realm, landscape and habitat creation proposals at either end of this route are intended to integrate the western and eastern landfall points of the seawall into its environment before extending into the Bay.

1.58 Overall the circular route around the lagoon is provided for O&M and recreational purposes but the masterplan also makes provision for sculptural elements of various heights, which form a trail around the length of the seawall. This trail would also include large, lit pearls.

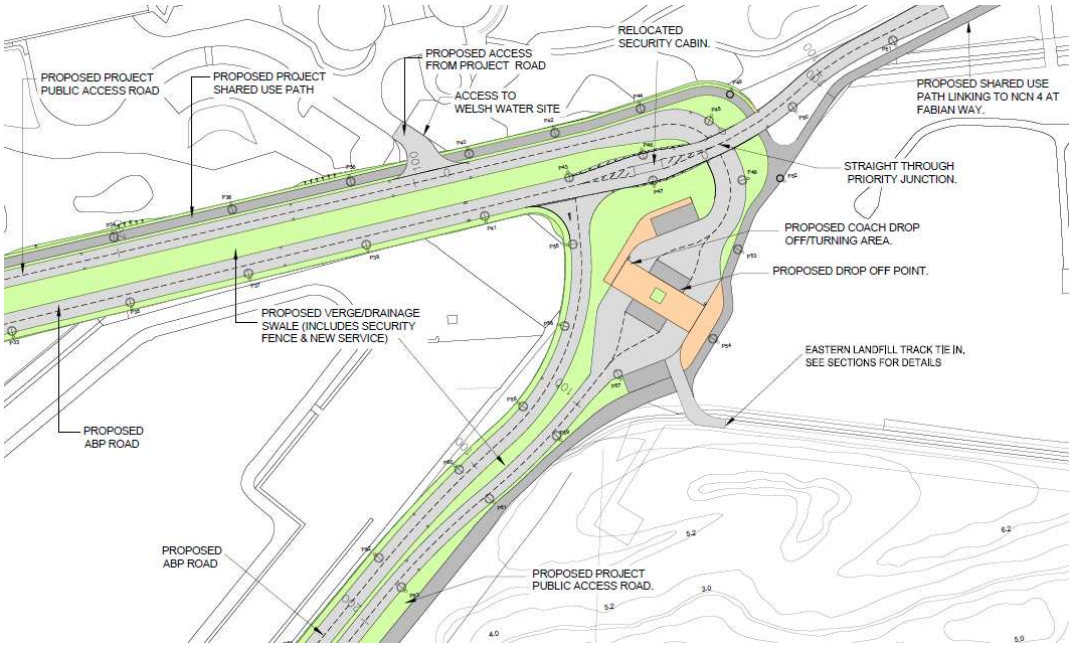
Access infrastructure

1.59 Access to the project would be provided via a new access road with combined footpath and Cycleway starting from Langdon Road, as shown, with vehicles leaving Fabian Way at the existing traffic signal controlled junction by McDonald's restaurant, turning left at the existing roundabout (which extends to link with the SA1 development) and then turning right to join the new road, close to Bevan's Row.



1.60 A new footpath/cycleway would be created south of Langdon Road to link the existing footpath from SA1 to the start of the Project access road.

1.61 The new access road would run along the north side of the existing Port Road, separated by a verge and swale (potentially lined), up to the boundary of the Welsh Water Treatment Works (WWTW), as shown below.



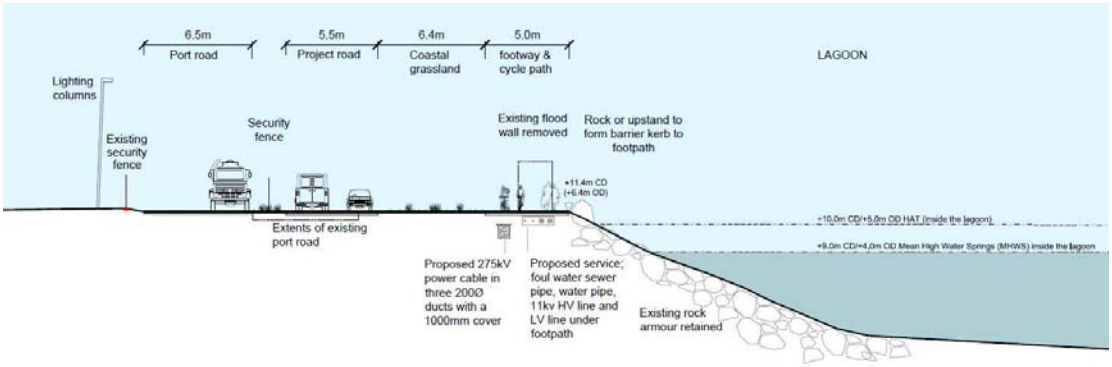
1.62 Here the Port Road would be moved south and the proposed Project access road would continue past the entrance to the WWTW. At approximately 50m past the entrance of the WWTW, the proposed access road would turn, cross the Port Road, and extend west along the south of Queen's Dock. A new Port security entrance would be created with the existing security gatehouse relocated to the west of the proposed Lagoon access road. Access to the Port would remain from Baldwin's Bridge junction.

1.63 There would be a new combined footpath/cycleway that will run along the length of the new access road, it will be 3m wide from Langdon Road to where the road turns to head west along in front of the WWTW. At this point the combined footpath/cycleway would join the route that runs around the perimeter of the Lagoon and widens to 5m as it follows the route to the western landfall.

1.64 Once the Project road has crossed the Port Road there would be a drop off point and turning area allowing pedestrians and cyclists to join the footpath and cycleway to the eastern landfall.

1.65 The Queen's Dock waterfront currently comprises an existing port road with wide grass and stoned verges. On the seaward side is rock armour seawall protection surmounted by a 2m high concrete wall with some gaps. The area is currently privately controlled with access for Port operations only.

1.66 The proposed project road would extend along the south side of the Queen's Dock and utilise the alignment of the existing Port road. The majority of the existing 2m high concrete flood wall would be removed to open up views to the lagoon, as shown below.



1.67 Where there are existing World War II features, such as pill boxes, these structures would be retained, along with a 3m section of wall either side. A new Port road would be constructed immediately north of the Project road, separated by a secure fence line. The Project road would be in the order of 5.5m wide with an adjacent 5m wide footpath and cycleway.

1.68 It is explained that a potential link from the project to the west bank of the River Tawe and central Swansea would be facilitated by the provision of a new pontoon and landing point at the western landfall to support a water shuttle service that will run between the western landfall and the existing pontoon on the western bank of the River Tawe. It is stated that the existing eastern breakwater of the Port of Swansea would be removed as part of the project and that this would create a suitable access point.

Water quality enhancement works

1.69 The long sea outfall from WWTW, owned by DCWW, terminates within the proposed lagoon area. The outfall discharges a high quality tertiary treated UV disinfected final effluent.

1.70 In order to maintain an appropriate standard of water quality all year round for water contact sports within the lagoon, it is proposed to extend the existing long sea outfall beyond the seawall of the lagoon.

Other works to support the Project

1.71 There are additional permanent works that need to be carried out to support the construction of the project. These comprise the demolition of the Eastern Breakwater at the entrance to the River Tawe and the realignment of the eastern training wall at the entrance to the River Neath estuary.

Sequence of Construction

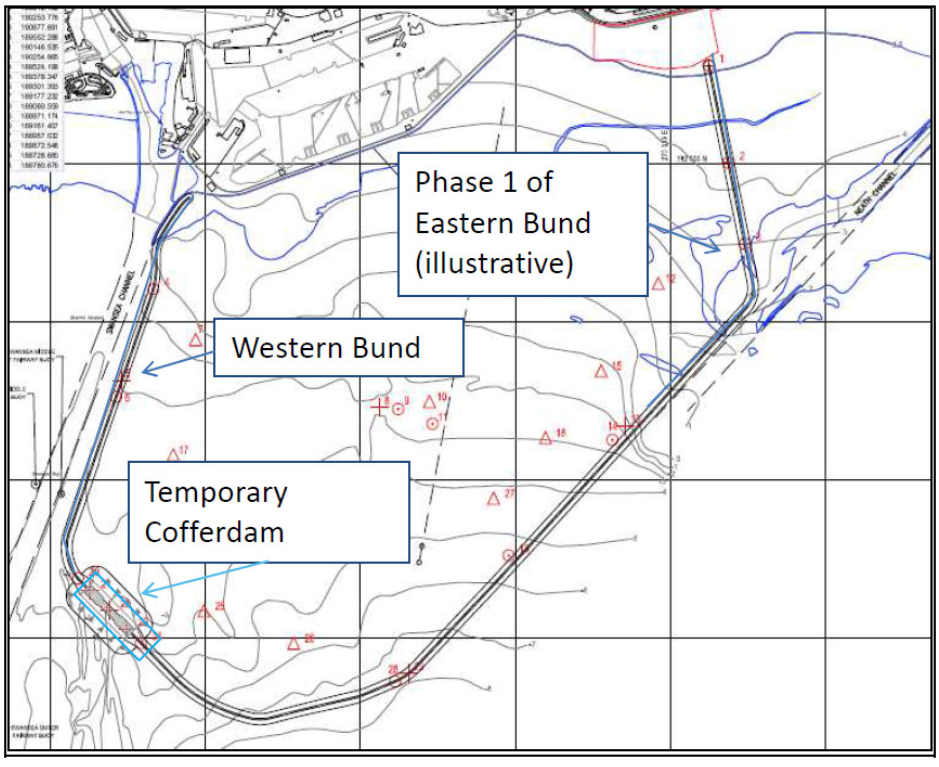
1.72 The construction of the project would commence following the grant of development consent and the Marine Licence and discharge of any relevant requirements or conditions precedent to construction. This is envisaged to be in 2015.

1.73 The construction period would be split into four main phases. (The phases and extent of work will be subject to review and alteration where necessary and as such is indicative only.) The key elements of the four phases are described below.

Phase 1: Mobilisation, western seawall and start of eastern seawall

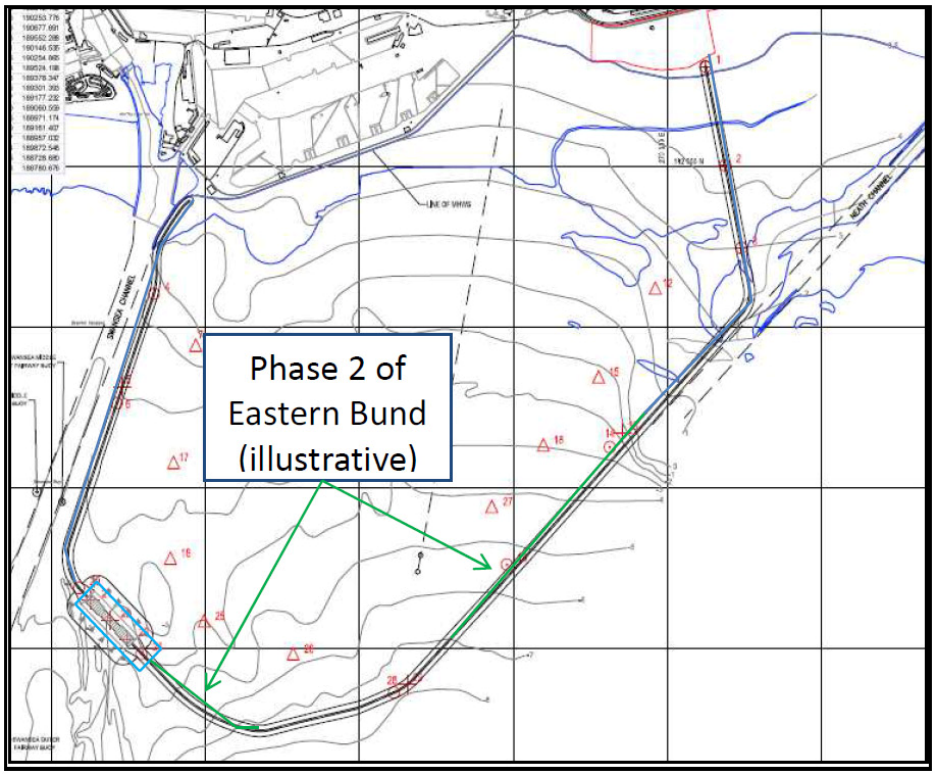
1.74 The landside set up of the construction support site.

1. Construction access routes.
2. Seawall – western arm.
3. Temporary cofferdam around construction area for the turbine and sluice gate housing structure.
4. Lagoon seawall – eastern arm phase 1 (see Figure 4.41 below for explanation of phasing).
5. Water quality enhancement works option 3 - outfall extension.
6. Connection to power supply and utilities for construction phase.
7. Demolition of structures within construction compound areas, removal of Swansea Port eastern breakwater and removal of existing wall along the length of Queens Dock.



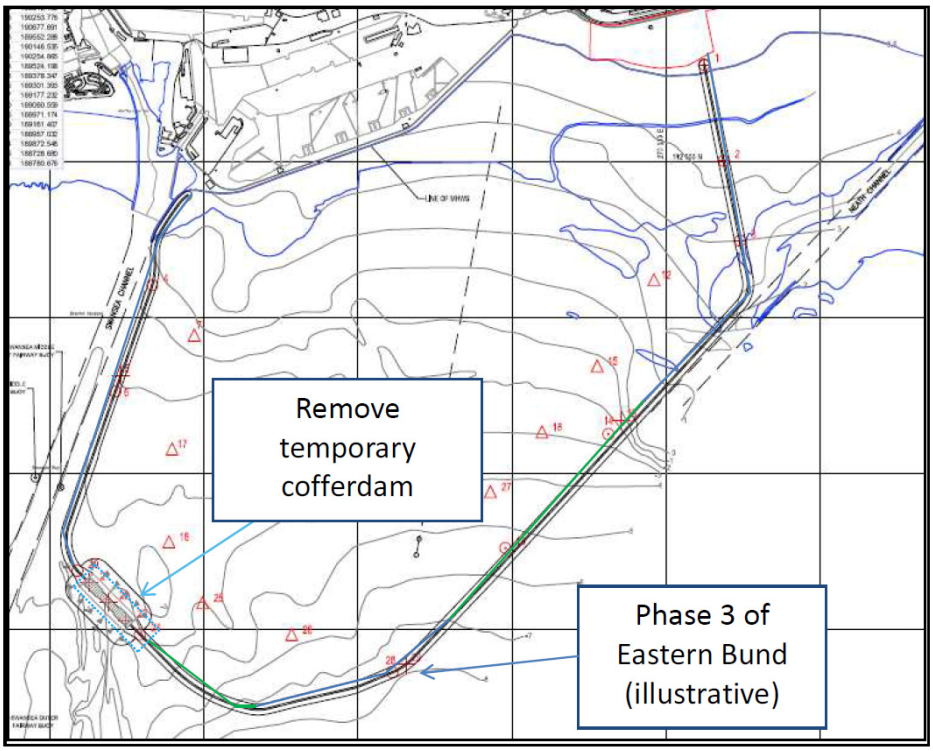
1.75 Phase 2: Turbine and sluice gate structure construction, continue eastern seawall.

1. Construction of the turbine and sluice gate housing structure.
2. Water quality enhancement works (option 2 - UV disinfection of storm water).
3. The installation of the turbines and sluice gates.
4. Dry commissioning of the turbines and sluice gates.
5. Connection to NETS.
6. O&M facilities.
7. Seawall - eastern arm phase 2.



1.76 Phase 3: Lagoon Closure and Commissioning

1. Removal of the temporary cofferdam wall.
2. Seawall - eastern arm (closure) (see Figure 4.43 below for explanation of phasing).
3. Wet commissioning of the turbines and sluice gates.
4. Commencement of finishings and offshore building works.



1.77 Phase 4: Finishing's

1. Seawall finishing.
2. Completion of construction of the Offshore Building.
3. Removal of the construction support sites.
4. Emergency facilities and slipways.

Other Works

1.78 There are also other works that sit outside the four main phases that continue throughout the duration of construction.

1. Construction of onshore building and sporting public realm.
2. Road and pedestrian infrastructure.
3. Visitor facilities, public realm including access and parking.
4. Pedestrian and cycle route links.

Programme

1.79 The construction phase of the project is planned to commence in spring 2015. It is stated that in general, dredging should usually take place in the period from April to October, such that there is less potential chance of delay as a result of bad weather and fewer/smaller environmental impacts. As such, it is intended that the seawalls will be constructed during the summers of 2015, 2016 and 2017, the closure of the eastern arm of the seawall is expected to take place in early 2018. The temporary cofferdam for the turbine and sluice gate structure is planned to be installed in 2015, with the construction of the turbine and sluice gate structure programmed for between Spring 2016 and Autumn 2017.

1.80 Following commencement of generation during the summer of 2018, the supporting infrastructure elements of the project are planned to be completed during 2018 and the beginning of 2019.

1.81 It is stated that the project would be entirely privately funded. The development phase is funded by private individuals and green entrepreneurs, as well as a public share offer held in June 2013. The construction phase will be funded by major institutional investors and a further public share offer.

Decommissioning

1.82 At the end of the operational lifetime of the Project (anticipated to be some 120 years), it is the view of the applicant that the total removal of the Lagoon would cause significant detrimental effects to the rocky reef and sand ecosystems which will by then be well-established and would also result in complete loss of the recreational tourism facilities forming part of the project. For these reasons two potential options for decommissioning are being considered, which are:

1. Replace, upgrade and extend life of the generating station; and
2. Remove turbines, sluice gates and M&E equipment and continue leisure use of the Lagoon water area.

CITY & COUNTY OF SWANSEA

LOCAL IMPACT REPORT

Tidal Lagoon Swansea Bay Project

PINS REFERENCE: EN010049
CCS REFERENCE: 2013/1017

Economic Regeneration & Planning
Civic Centre
Oystermouth Road
Swansea
SA1 3SN

City & County of Swansea

Local Impact Report

Proposed Swansea Bay Tidal Lagoon

1. Terms of Reference

Introduction

1.1. This report comprises the Local Impact Report (LIR) of the City & County of Swansea and has been prepared in accordance with s60(3) of the Planning Act 2008 (as amended) and the Planning Inspectorate's Advice Note One, Local Impact Reports(April 2012).

2.0 Purpose and Structure of the LIR

2.1 The purpose of the LIR is to provide details of the likely impact of the proposed development on the administrative area of the City & County of Swansea (CCS) and Swansea Bay.

2.2 The LIR in the first instance considers the principle of the development before working through the topic issues identified in the Environmental Statement and an additional topic area relating to residential amenity by:

1. Identifying relevant development plan policy and supplementary guidance;
2. Identifying relevant local issues where appropriate;
3. Providing a commentary on the adequacy of the application.

2.3 The LIR also includes commentary on the adequacy of the draft Development Consent Order (DCO), including the draft Heads of Terms for a Section 106 Obligation and the requirements/conditions. Where it has been logical to do so, these comments have been made under the relevant topic area. In other cases it has been specifically addressed under the DCO section of the report.

2.4 The LIR addresses some of the Examining Authority's (ExA's) first written questions, but where it does so that is made clear in the local authorities' separate response to those questions.

3.0 The Site and its Surroundings

3.1 The red line boundary of the project, encompassing all the elements proposed and the maximum extent of land over which powers are sought, is shown below.

3.2 The main focus of the application site essentially comprises the southern edge of Swansea Docks and formerly associated industrial land from the eastern side of the River Tawe to the eastern edge of the new Swansea University Bay Campus and the foreshore and seabed of part of Swansea Bay between the dredged channels of the Rivers Tawe and Neath.

3.3 The site is primarily focused within the administrative area of the City & County of Swansea and Welsh Territorial Waters other than the eastern landfall of the lagoon and grid connections, which fall within Neath Port Talbot County Borough Council (NPT).

3.4 The applicant does not currently own any part of the application site, but is negotiating for its acquisition and is also applying for powers of compulsory acquisition.

4.0 Description of Development

4.1 A summary of the description of development is included within the covering Committee Report for this LIR, along with an appended detailed description. The descriptions are based entirely on the information provide within Chapter 4 of Volume 6.2 of the Environmental Statement. The description contained within Chapter 4 is therefore accepted for this LIR and the SoCG, except where any additional commentary or promotional aspect is provided.

5.0 Relevant Planning History

5.1 Outline planning permission was granted to the former Welsh Development Agency (now Welsh Government) on the 19th August 2003 for a mixed use development of SA1 Swansea Waterfront (SA1) comprising employment (Use Class B1, B2) residential (C3), retail (A1), commercial leisure (D2), food and drink (A3), hotel (C1), and educational (D1/C3) uses, car parking, associated infrastructure (including new highway access and pedestrian overbridge), hard and soft landscaping. (Planning application 2002/1000 refers). The site area extends to just over 40 hectares of land surrounding 10 hectares of water body (the Prince of Wales Dock) along with significant frontage to the basin and tidal area of the River Tawe, located to the north and west of the application site.

5.2 A variation of conditions relating to this permission was approved on the 11th October 2010 to allow a review of the phasing, masterplan, land use allocation and development capacities. (Planning permission 2008/0996 refers.) A copy of the current approved Masterplan is provided as **Appendix A.**

5.3 In pursuance to the mixed use outline planning permission, a number of detailed planning permissions have been granted for significant infrastructure development in and around SA1. Those planning permissions implemented include:

- The provision of two pedestrian/cycle bridges comprising the iconic Swansea Sail Bridge and the Lock Bridge (now known as Trafalgar Bridge), linking SA1 to the City Centre;
- A riverside walkway/cycleway linking to the aforementioned bridges and the walkway/cycle path along the northern part of the site (Fabian Way). The site therefore links the City Centre and Waterfront and the communities to the north via National Cycle Network Route 43. National Cycle Network Route 4 runs through SA1 from the east to the City Centre.
- A continuous dockside walkway/cycleway;
- Areas of public open space;
- Roads and footways;

5.4 Planning permission has also been granted for:

- The construction of channel and channel feature with holding basin and sea lock linking the Prince of Wales Dock and the River Tawe/Swansea Bay. The design incorporates a significant amount of public access and footpaths to create a critical mass of activity in this area. This planning permission has technically been implemented.

- The change of use of water area of Prince of Wales Dock from operational dock to commercial marina (550 berths), craft based water sports, floating commercial outlets (food and drink and retail), boat hire and repair.

5.5 Subsequent to the outline planning permission for SA1, a number of full and reserved matters applications have been approved and implemented. It is evident now that SA1 represents a successful and sustainable waterfront renewal development where people want to live, work and visit. To date, SA1 has achieved planning permission for in excess of 1,000 dwellings and significant commercial development including, circa 30,000 square metres of business floorspace occupied, Class A3 food and drink units and two operational hotels.

5.6 SA1 has a hugely beneficial impact on the eastern gateway to the City Centre, endorsing the City's credentials as a Waterfront City. It is equally visually beneficial when seen in its context from the west, as it completes the waterfront aspirations of the Maritime Quarter and the Tawe Basin. What sets SA1 apart from many other waterfront renewal projects, which are peripherally located, is that SA1 is centrally located and forms part of the comprehensive waterfront/city centre regeneration initiative. Its integration with the City Centre and the Maritime Quarter has underpinned its success and vice versa.

5.7 The Maritime Quarter located to the north west of the lagoon, is an award winning waterfront regeneration development. Other than development at sites known as Meridian Quay and Swansea Point, the majority of the development here took place in during the 1980's and early 1990's and is focused around Swansea Marina located within the South Dock, which provides approximately 550 berths.. The Marina connects into the Tawe River Basin, which was created through the construction of the River Barrage in 1992. This provides an attractive waterfront environment in its own right and accommodates in excess of 200 berths as part of the Swansea Yacht Club. The Tawe River Basin also provides a strong waterfront link between the renewal areas of the Maritime Quarter and SA1 and a strong focus for the development of these areas. SA1 in particular enjoys approximately 800m river frontage at its western extent. The Maritime Quarter benefits from approximately 700m of river frontage.

5.8 The Meridian Quay development within the Maritime Quarter has recently been completed and includes a twenty nine storey tower with retail/leisure use at ground floor, restaurant and bars on the top two floors (Class A3) and 124 residential uses throughout the interim levels. Other smaller blocks within this mixed use development combined provides 291 residential units. Many of the apartments within the 29 storey tower, as well as the restaurants and bars on the top two floors enjoy uninterrupted views of Swansea and its waterfront, including the application site.

5.9 The former 'Spontex' site, now renamed 'Swansea Point', is a transition between the existing Maritime Quarter, Swansea Bay, the Tawe and SA1. Outline planning permission was granted in April 2004 for a mixed use development of this site for housing, employment, commercial (leisure, restaurant/public house, hotel) and maritime uses, public open spaces (including a park, play area and promenade) and car parking. (Planning application 2003/0808 refers). The residential element of this scheme is now complete with approximately 600 units, including a 14 storey residential block (known as Aurora) located in the south east corner of the site, at the junction of the Bay and River Tawe. This also has clear and elevated views of the Bay.

5.10 The Section 106 Obligation forming part of the outline planning permission for Swansea Point has delivered significant waterfront infrastructure to this area. It has completed the promenade along the Bay, which previously terminated at the end of the 1980's and 1990's Maritime Quarter development, adding approximately 500m to the 9.5km (approximate) promenade running from this area to Mumbles in the west along with a north – south riverside extension.

5.11 A Certificate of Lawfulness of Proposed Use or Development was granted at appeal on the 6th April 2010 for Class B2 Use (general industrial) purposes (to repair, recycle and break up marine units, including ships) within the dry docks and adjoining land, located immediately to the north of the application site, within the Kings Dock. (Application 2009/1684 refers.) A subsequent Certificate for the repair, recycling and breaking up of marine units, including ships (Class B2) was granted for Phoenix Wharf on the 14th December 2011 under reference 2011/0503. (Phoenix Wharf is located at the western extent of the Queens Dock.)

5.12 An appeal against the refusal of planning permission for the erection of a biomass fired combined heat and power plant with ancillary offices, workshops, heat rejection building, car parking, landscaping and infrastructure requirements was dismissed on the 6th April 2009. (Planning application 2007/2694 refers.) The application site comprised land between Kings Dock and Queens known as Graigola Wharf. This land is also included within the current application site.

5.13 The existing 43m high wind turbine at the western end of Queens Dock was granted planning permission on the 8th April 2004, whilst an application for a second 77m wind turbine approximately 300m to the east on the proposed access road of the lagoon is currently with the Local Planning Authority for consideration. (Applications 2002/1838 and 2014/0260 refer.)

5.14 The new Swansea Bay Campus at the eastern end of the proposed lagoon is described within NPT's LIR.

5.15 Planning permission for a 104m wind turbine on land at Welsh Water Treatment Works on Fabian Way was refused on the 20th July 2012 and a second application for a 79m wind turbine in the same location was refused on the 25th October 2013. (Planning applications 2011/1658 and 2013/1033 refer.) The second application is currently the subject of an appeal to Welsh Ministers.

6.0 Statutory Development Plan

6.1 The City and County of Swansea Local Development Plan (LDP) Preferred Strategy will be published in August 2014. A Pre-Deposit LDP will be published in late 2014 as an additional stage to the LDP process. It is anticipated that the Deposit Plan will be published in mid 2015 and the LDP will replace the Unitary Development Plan in late 2016.

6.2 The current adopted development plan for the City & County of Swansea is the therefore its Unitary Development Plan (UDP), which was adopted in November 2009.

ASSESSMENT OF IMPACTS AND ADEQUACY OF RESPONSE

7.0 Principle of Development

7.1 The Plan's Spatial Strategy, set out in Part 1 of the Plan, is firmly based on sustainable planning principles. Its primary focus is the reinvigoration of the City Centre and waterfront.

7.2 The core element of the Spatial Strategy is therefore to develop a modern, attractive and vibrant waterfront area integrated with a revitalised City Centre.

7.3 The spatial strategy is summarised in the Spatial Strategy Map provided and amplified with site specific detail in the Proposals Map. It effectively determines the sustainable settlement strategy for the UDP, which includes capitalising on the redevelopment opportunities afforded by brownfield land and the Waterfront area. The application falls within the area identified as "Urban Waterfront", of existing and new housing development, Employment Centre, Sport/Leisure and Regeneration initiatives.

7.4 The spatial strategy reflects the WAG's vision for the regeneration of Swansea Waterfront, which emanates from the Wales Spatial Plan. It is stated that the extensive area of brownfield land on the eastern approach to the city, south of Fabian Way and east of SA1, offers considerable regeneration opportunities. It is recognised that SA1 lies adjacent to the commercial docks, which make an important contribution to the economic infrastructure of the County. It is recognised that land within, and adjacent to, the existing Queens Dock may become surplus to operational requirements during the lifetime of the Plan. Redevelopment of these areas has the potential to create a major mixed use destination, in order to:

- Enhance linkages between a number of sites and locations along the Fabian Way corridor,
- Build upon the success of SA1 Swansea Waterfront,
- Provide opportunities for potential new tourism, leisure, and commercial developments in a range of settings, and
- Contribute to the creation of a strong sustainable transport corridor.

7.5 In line with the recommendations of the WSP, any future proposals for the redevelopment of such a significant brownfield waterfront and coastal area will be considered with the benefit of the waterfront regeneration masterplan for the wider Swansea Bay area. This will be prepared on a joint basis between adjoining Authorities and relevant partners to provide an overarching development framework for the area.

7.6 The overall vision for the Council's UDP is to adopt a sustainable approach to the development of a prosperous region focused on a cosmopolitan and multi-cultural City and County, which capitalises on its waterfront location. The strategy is based on the conservation of the best the County has, whilst making effective provision for the promotion of employment, good housing, shopping, leisure, tourism, community and education facilities in a safe, accessible, innovatively designed, healthy, ecologically rich and visually attractive environment.

7.7 This vision is seen to demonstrate the Council's commitment to the promotion of sustainable development which is to be pursued through goals based on sustainable principles of environmental protection, economic growth, social progress, safeguarding of resources and improved accessibility, each of which forms the basis for the topic policies in the second part of the Plan.

7.8 Within this context, Goal 1 seeks to sustain a healthy, visually attractive, ecologically and historically rich environment. Objectives of Goal 1 include:

- To upgrade the visual environment and image of the area;
- To promote locally distinct, innovative design, sensitive to the location and setting;
- To avoid significant adverse environmental impacts from new development;
- To promote resource efficient buildings and layouts in all new development.

7.9 Goal 2 is to help promote the sustainable growth of the local and regional economy. The objectives of Goal 2 include:

- To develop Swansea as a major Waterfront City capitalising on the opportunities provided by SA1;
- To improve and revitalise existing industrial and commercial areas;
- To reinforce and improve the City Centre as a vibrant regional focus for business and administration, shopping, culture and leisure;
- To improve, expand and diversify tourism infrastructure.

7.10 Goal 4 is to make more efficient and sustainable use of the area's resources. The objectives for Goal 4 include the support of renewable energy projects which would make a positive contribution.

7.11 Arising from the Vision and Goals, the UDP sets out 15 Strategic Policies. The following Strategic Policies are relevant to this application:

7.12 Policy SP1 and SP3 are concerned with creating a quality environment with Policy SP1 stating that sustainable development will be pursued as an integral principle of the planning and development process and that development proposals designed to a high quality and standard, which enhance townscape, landscape, sense of place, and strengthen Swansea's Waterfront identity, will be favoured. Policy SP3 states that the natural, built and cultural heritage of the County will be protected and enhanced to protect from materially harmful development.

7.13 Policy SP4 provides support for proposals to develop or improve the variety and quality of tourism facilities where they contribute to the growth of the local economy, and where they do not have a significant impact on natural heritage and the historic environment or the amenity of local communities.

7.14 Policy SP8 seeks to improve the range of sports and leisure facilities and the tourism portfolio by establishing a network of urban destinations, enhancing sustainable countryside recreation opportunities and further developing a hierarchy of sports facilities.

7.15 Policy SP11 relates to the efficient use of resources and that the upgrading of infrastructure provision and the generation of energy from renewable resources to meet the needs of existing and new development will be favoured, provided the environmental impact is kept to a minimum.

7.16 Policy SP12 states that development that makes efficient use of resources and energy will be encouraged.

7.17 It is the Strategic Policies which provide the link to the topic specific policies contained within the second part of the UDP.

7.18 Part 2 UDP Policy R11 relates to renewable energy and is a key policy for CCS for an application of this nature. The preamble to this policy sets out the Council's support for Welsh Government's (WG) policy for strengthening renewable energy production, and recognises the long-term benefits to be derived from the development of renewable energy sources. It is recognised that renewable energy technologies can have a positive impact on local communities and the local economy in terms of monetary savings and in generating and underpinning economic development within the County. There are however concerns about the impacts that some renewable energy technologies can have on the landscape, local communities, natural heritage and historic environment, nearby land uses and activities. The Council therefore seeks to achieve a balance between supporting renewable energy proposals whilst avoiding significant damage to the environment and its key assets. Favourable consideration will be given to developments that produce or use renewable energy where such proposals conform with UDP policies and are in scale and character with their surroundings.

7.19 The policy itself therefore states that proposals for the provision of renewable energy resources, including ancillary infrastructure and buildings, will be permitted provided:

i. The social, economic or environmental benefits of the scheme in meeting local, and national energy targets outweigh any adverse impacts,
ii. The scale, form, design, appearance and cumulative impacts of proposals can be satisfactorily incorporated into the landscape, seascape or built environment and would not significantly adversely affect the visual amenity, local environment or recreational/tourist use of these areas,

iii. There would be no significant adverse effect on local amenity, highways, aircraft operations or telecommunications,
iv. There would be no significant adverse effect on natural heritage and the historic environment,
v. The development would preserve or enhance any conservation areas and not adversely affect listed buildings or their settings,
vi. The development is accompanied by adequate information to indicate the extent of possible environmental effects and how they can be satisfactorily contained and/or mitigated,
vii. The development includes measures to secure the satisfactory removal of structures/related infrastructure and an acceptable after use which brings about a net gain where practically feasible for biodiversity following cessation of operation of the installation.

7.20 Policy EC1(5) allocates land to meet the growth needs of the local economy and the proposed Landward Ecological Park adjoins this designation. The amplification to the policy recognises that the docks make an important contribution to the industrial infrastructure of the City. It is stated that the remaining operational docks and general industrial side of the port provides opportunities, primarily around the Kings Dock and Queens Dock, for B1, B2 and B8 uses. The amplification to the policy advises that development that would compromise the potential redevelopment of adjoining areas will not be supported.

7.21 Development within the area is technically constrained by a notified hazard safeguarding zone around the BP sphere. This installation is in the process of being removed and the Council is negotiating with BP to rescind the hazardous substance licence, until which time the zone must remain on the Proposals Map. In the meantime, UDP Policy EV41 is relevant and states that development of land in the vicinity of existing hazardous installations will not be permitted if there would be significant risk to life or health.

7.22 It also recognises that there is potential for further releases of land within the Queens Dock for development other than port related activities and that the Wales Spatial Plan emphasises that the revitalisation of significant brownfield sites in this coastal location should be delivered with the benefit of a waterfront regeneration masterplan for the wider Swansea Bay area.

7.23 Policy EC1(2) also allocates land at SA1 as a prestigious mixed use development, which includes elements of housing, commercial, cultural and high grade employment in Use Classes B1 and B2. (Policy EC2 is referenced within the Policy amplification). In this respect, Policy EC2 allocates a major redevelopment area at SA1 Swansea Waterfront for mixed employment and residential development together with supporting leisure, tourism, community uses and ancillary services.

7.24 The amplification to this policy states that a robust and comprehensive policy context for considering proposals within SA1 is set out in the Port Tawe and Swansea Docks Supplementary Planning Guidance and that this guidance has been augmented by an outline planning consent for the site and a Design and Development Framework prepared by the former Welsh Development Agency (now Welsh Government). Together these make clear the broad characteristics and objectives that development within the site must adhere to, emphasising the importance of high quality design and principles of sustainable development.

7.25 The amplification to the policy highlights the importance of the redevelopment of SA1 being suitably integrated with adjoining areas, particularly the existing Maritime Quarter and retained commercial docks. Development within these areas must be compatible with existing land uses and not inhibit redevelopment proposals and strategies.

7.26 It is explained that a programme of infrastructure work is planned with a view to bringing the dock into use as a major marina facility. The SPG and Development Framework provide detail on the use of water areas within the Prince of Wales Dock basin, including the type of uses and activities that are envisaged.

7.27 Policy EC15 seeks to consolidate the urban tourism resource in locations including the, Maritime Quarter, Tawe Riverside Basin, and Mumbles and specific destinations around Swansea Bay. The amplification to the policy explains that the City Centre is intended to be a major attraction for visitors and business tourism. It is envisaged that this attraction will be strengthened when the planned integration with the foreshore to create a “Waterfront City” is more fully realised. The City Centre shopping, leisure, food and drink, and cultural facilities combined with SA1, the Maritime Quarter, the new National Waterfront Museum and the Tawe Basin near to the barrage are intended to create a mixed use destination area with a very strong character.

7.28 Policy EC16 states that new or improved recreational and tourism facilities at specific destinations around Swansea Bay are proposed which capitalise on the seafront aspect and contribute towards the regeneration of the Bay. Between these areas of appropriate development, the emphasis is on safeguarding and enhancing the environment of the Bay and other waterfront areas.

7.29 The entire interface of the Queens Dock to the proposed lagoon falls under the Policy AS12, which relates to the port and docks and states that development proposals that enhance the viability of the port, extend the use of the ferry terminal facilities and increase employment and business opportunities will be permitted provided that such proposals are compatible with adjacent development areas, communities, environmental enhancement schemes, and safeguard the potential canal route corridor.

7.30 The policy amplification recognises that the operational port and docks is an important commercial asset, providing jobs and business opportunities that contribute towards economic regeneration. Proposals for enhancing facilities and operations at the Ferryport and increasing commercial docks activity will be supported where development has suitable regard to issues of amenity, land use compatibility and environmental impact.

7.31 It is stated that the future development of the port and docks will be an important consideration in the proposed waterfront regeneration masterplan for the wider Swansea Bay region. The Council will contribute to the formation of this plan on a joint basis with other relevant authorities and partner organisations, in line with the recommendations of the Wales Spatial Plan.

7.32 Policy HC31 of the UDP supports opportunities for the development of water based recreation facilities and provides protection for the proposed link from the Tennant Canal to Swansea and for the linkage of the Swansea Canal with the navigable section of the River Tawe. Development that would prejudice the restoration of the canals or damage their fabric or infrastructure will not be permitted. The amplification to the policy states that the potential of the local canal system to provide an important tourist and recreation facility has been highlighted by a recent Feasibility Study which investigated the restoration and reopening of the Neath, Tennant and Swansea Canals to create a 32 mile integrated waterway system centred on Swansea Docks, which could serve a national tourism market. The preferred route of this network is safeguarded on the UDP Proposals Map and runs through land to the north of Kings Dock, which is proposed as part of the lagoon access arrangements.

7.33 As referred to above and in the amplification to Policy EC2, a comprehensive policy context for considering proposals within the area is set out in the Port Tawe and Swansea Docks Supplementary Planning Guidance (SPG). The SPG relates also to all of the area between the River Tawe and the eastern boundary of Swansea, south of Fabian Way. A copy of the SPG is provided as **Appendix B.**

7.34 The SPG derives from the premise that Port Tawe (now re-branded as SA1 Swansea Waterfront) is a key element in the next era of the City's development and to the establishment of Swansea's identity as a major "Waterfront City". Part of the purpose of the SPG is to:

- Define the concept of Port Tawe;
- Relate it to the wider docks area and the City Centre/Maritime Quarter;
- Provide an overall strategic framework to assist more detailed master planning;
- Promote sustainable development of the area for the economic, social and environmental benefit of Swansea.

7.35 Swansea City Centre Strategic Framework was adopted as Council Policy in January 2007 and endorsed as SPG to the adopted UDP in January 2009.

7.36 The Study Area was defined to encompass all of the main retail and commercial areas of the City Centre. The City Centre includes the "Maritime Quarter" extending down to the seafront, developed around the old South Dock. Whilst the Civic Centre and SA1 Swansea Waterfront are located outside but adjacent to the Study Area, the Strategic Framework clearly acknowledges their importance, and the need to improve connections between them and the City Centre.

7.37 The Framework is being implemented jointly by the Council and Welsh Assembly Government.

7.38 The Vision for the City Centre is of Swansea City Centre as:

"A vibrant, exciting, attractive, sustainable, cultured European Waterfront City Centre, attracting businesses and visitors, driving the economy and enhancing the quality of life of residents of Swansea and South West Wales."

7.39 A number of Strategic Objectives are set out if Swansea City Centre is to achieve its vision. On such objective is to make a Waterfront City. To do this Swansea needs to:

- Provide good access throughout attractive waterfront areas;
- Developing mixed-uses on the waterfront (including supporting water-related leisure activities);
- Create much better links from the waterfront to the rest of the City.

7.40 In defining the Vision for the City Centre, four priority themes have been identified, including connecting the City to the Waterfront.

7.41 It is envisaged that connecting the City to the Waterfront will ensure that the river and the seafront play a far more active part in the life of the City Centre truly establishing Swansea as a distinctive Waterfront City. Its potential will be realised by fully utilising waterfront locations, so as to create new destinations and attractions which allow people to enjoy both City Centre and waterfront activities. Proximity within walking distance, vibrant spaces, high quality buildings and public realm will contribute to the success of this aspiration.

Commentary

7.42 In principle UDP Policy is supportive of proposals for the provision of renewable energy resources, including ancillary infrastructure and buildings, subject to compliance with the criteria of Policy R11, which are considered below under the relevant topic headings, and other relevant UDP Policy.

7.43 It is however evident from the above synopsis of relevant development plan policy and adopted SPG, the focus for CCS is to make Swansea a vibrant, exciting, attractive, sustainable, cultured Waterfront City and proposals which would compromise these objectives will not be supported. In this respect, the proposal will provide significant new waterfront facilities and attractions but these have to weighed against the significant adverse impacts on the City's existing tourist and recreational assets within the bay.

7.44 Within this context, the positive, negative and neutral impacts of the proposal are considered below.

8.0 Seascape, Landscape and Visual Impact Assessment

City & County of Swansea Unitary Development Plan

8.1 Policy EV1 sets out the Council's commitment to achieving high standards of design and layout in all new developments. To achieve this, the policy requires proposals to meet a number of criteria, which include:

- Being appropriate to its local context in terms of scale, height, massing, elevational treatment, materials and detailing, layout, form, mix and density;
- Not resulting in a significant detrimental impact on local amenity in terms of visual impact, loss of light or privacy, disturbance and traffic movements.
- Sensitively relate to existing development patterns
- Promote resource efficient and adaptable buildings and layouts using sustainable design and construction techniques, including the re-use and recycling of construction and demolition waste on site, and energy and water efficiency measures.

8.2 Policy EV2 deals with siting and location of new development and gives preference to the use of previously developed land over greenfield sites, having regard to the physical character and topography of the site and its surroundings by meeting criteria, which include the following:

- Avoiding locations that would have a significant adverse impact on prominent buildings, landscapes, open spaces and the general locality, including loss of visual amenity;
- Effectively integrating with the landscape, seascape or coastline by utilising topography to integrate into the contours of the site and avoiding conspicuous locations on *prominent skylines* and ridges;
- Retaining important views into and out of the site;
- Having due regard to the implications of the development for infrastructure and services;
- Integrating with existing community facilities;
- Utilising landscape and topography to maximise energy efficiency;
- Having full regard to existing adjacent developments and the possible impact of environmental pollution from those developments, as well as the creation of any environmental pollution to the detriment of neighbouring occupiers (including light, air and noise).

8.3 Criteria (ii) of Policy R11 requires the scale, form, design, appearance and cumulative impacts of proposals to be satisfactorily incorporated into the landscape, seascape or built environment and not significantly adversely affect visual amenity, the local environment or recreational/tourist use of these areas.

Background

8.4 White Consultants have been commissioned by CCS to review the seascape and landscape visual impact assessment (SLVIA).

8.5 Whilst part of the site is located within NPT, the analysis of potential impacts set out below are confined to those on CCS.

8.6 For the purposes of this LIR and the Council's Written Representations, the advice provided by White Consultant's represents the formal position of CCS.

8.7 A copy of the final report from White Consultants is provided as **Appendix C**.

8.8 The LIR and White Consultant's report makes reference to Regional and Local Seascape Units, Landscape Character Areas and to Viewpoint Locations; for reference, these are provided as **Appendix D**.

Adequacy of the application

8.9 The structure of the section covers policy context, assessment method, baseline conditions including the assessment of the value of seascape and landscape character areas, and potential individual and cumulative impacts of the project during construction and operation. This is logical and clear. The text is generally well written and considered comprehensively with a few omissions or inconsistencies which are mentioned below.

8.10 The study area of 15km radius is reasonable.

Method and guidance used

8.11 The SLVIA sets out an assessment method which is generally understandable. Guidance references are noted and are generally helpful. Following comments on the PEIR, the guidance cited by the SLVIA has been updated. However, this excludes the approach taken for seascape assessment at a district scale which has been piloted in Pembrokeshire by White Consultants for the National Park and NRW. This includes a method for taking on board NECR105 as well as CCW guidance and is the most up to date method and relevant to the scale of this project Instead a more limited approach has been taken, based primarily on coastal and Admiralty chart information.

8.12 In terms of the use of LANDMAP, the assessment takes the approach of using the five LANDMAP aspects to inform the derivation of landscape character areas. This is permitted as an option in Guidance Note 3 and appears to be a sensible approach in this case.

8.13 The main effect of this proposal is on the seascape rather than landscape and following PEIR comments the development is assessed in terms of effects on established regional seascape and derived local seascape units which is welcomed. The extent of the local seascape units (LSUs) appear justifiable.

8.14 The overall emphasis of the descriptions is centred primarily on the coastal character, probably due to the limited information collected for the marine element (Admiralty chart). Whilst the descriptions are long and thoughtful, there is limited depth in the marine element of the area including seabed, degree of exposure/wave climate and the patterns of use of the water in various cases. The views across to England also appear to be underplayed.

8.15 The effects of coastal processes are now addressed in respect of the effect of the potentially changed balance and proportions of sand, mud and gravel in Swansea Bay. This is predicated on the conclusions of Chapter 6 of the Environmental Statement (Coastal Process).

8.16 In respect of the calibration of effects, Table 13.10 (Magnitude of visual effects) indicates that medium impact is defined as the development being visually prominent. This seems to be a low calibration. It would have been expected that term 'prominent' would have been more associated with a high/medium impact.

8.17 The SLVIA separates out the significance of change from the nature of that change ie whether it is beneficial, neutral or adverse. This is in line with good practice guidance. Only adverse significant changes are important in the decision-making process.

8.18 In terms of the significance of visual effects, the calibration of these are defined in both the SLVIA Table 13.11 but also in overarching terms, in the Environmental Statement section 2.5.4.4. - The difference between the definitions of level of impact between major and moderate in the SLVIA is large and justifies an intermediate category. This is dealt with to an extent by stating that some effects are major/moderate or moderate/low but there is no definition of these terms either in the SLVIA or the ES in general. This is an omission as many of the assessed effects in the SLVIA are major/moderate. The ES makes it clear that major and moderate effects are significant so it is assumed that major/moderate effects are also significant. Section 2.5.4.4 states that moderate significance of impacts are defined as:

'Where these changes are adverse they may require mitigation'.

8.19 Major significance of impacts are defined as:

'Effects are highest in magnitude and reflect the high vulnerability and importance of receptor (e.g. to nature conservation, noise). Where these changes are adverse they will require mitigation.'

8.20 Neither the SLVIA or ES fully explain what the levels of significance mean in terms of decision making. Suggested definitions are located in this report in Appendix C. This issue is addressed in the discussion at the end of this section considering the SLVIA as a whole.

8.21 A number of other recent and proposed developments are included for consideration in conjunction with the proposal as requested by various consultees [Table 13.12]. The concern of the consultees appears to be the potential combined cumulative effect of the proposal with these other developments- possibly resulting in an over intensification of use of the area. This appears to be reflected in both Tables 13.13 and 13.14 considering the magnitude and significance of combined cumulative effects respectively which is helpful. However, the method appears to only consider the additional rather than the combined change caused by the proposed development over and above the cumulative baseline [13.3.7.7]. It is assumed that this is just carried over from a previous draft but introduces a small degree of uncertainty/inconsistency as to what is considered.

8.22 The viewpoints have been agreed and the photomontages are generally of good quality. The 450mm viewing distance visualisations are particularly helpful.

8.23 The photos were taken on a day with a slight haze so that distant objects are either in distinct or not visible. For instance, from viewpoints 4, 9 and 11 the coastline of England and the landform of Exmoor is not fully apparent although on clear days this is the case and enhances the views. On the other hand, in the visualisation for viewpoint 8 the built form at Port Talbot is not apparent. Whilst it is not expected that new photos will be taken, the assessment should take views of more distant objects into consideration, and not rely on the visualisations to provide this information.

8.24 The Offshore Building is shown as a rectangular block with straight sides in the photomontages. This is assumed to be the maximum visual 'envelope' of the building with the detailed /final design of the building to be resolved. However, this is problematic as the 'envelope' appears as a detractive new focal feature in a very sensitive location. In other words, the visualisations do not do the likely final design justice but the assessment has to be carried out on what is shown rather than indicative designs. The final design of the building must be excellent to achieve a positive landmark which enhances/ complements the horizontal emphasis of the seawall and turbine structure and does not detract from Mumbles as the main focus of Swansea Bay. It should achieve this in nearby views but also more importantly in distant views which is how most people will view it, most of the time. It is possible that the indicative design shown in Figure 4.25 may be appropriate but the evidence is not presented to demonstrate this in the photomontages.

8.25 Some visualisations show the Project at low water and high water. This is helpful. They show the water level inside and outside the Lagoon at the same level. From the reading of the description of the development it is clear, however, that the water level will be different on the inside and outside of the Lagoon for a period of time every six hours to form a head of water so the turbines can optimise their power output. This may be perceptible when viewed from elevated viewpoints.

It would have been helpful if a couple of viewpoint visualisations illustrated the maximum difference likely to occur to understand the degree that this might affect the perception of the development e.g. from Mumbles Hill Nature Reserve and Kilvey Hill.

8.26 The columns supporting the floating boom demarcating and protecting the exclusion zone around the turbines outside the Lagoon are shown as black columns and are indistinct in some visualisations such from Viewpoint 5. It is likely that they will be yellow to a certain height as per Trinity House rules so they would be more noticeable than indicated.

Coastal processes issues

8.27 Chapter 6 coastal processes explores the potential effects on coastal processes, sediment transport and contamination. Of most interest to the seascape and visual effects assessment are the effects on sedimentation pattern to the west of the Lagoon.

8.28 As discussed below, Kenneth Pye Associates Ltd (KPAL) has been engaged to review the coastal processes chapter for NRW and subsequently asked to comment on specific issues for CCS including sediment transport and the potential effects on Swansea Bay beach. KPAL found that the level of the assessment by ABPMer was limited with few detailed studies or sampling. Whilst this was appropriate for a regional scale study the data did not provide full confidence for assessing the likelihood of local impacts. KPAL has recommended that further baseline studies are carried out and monitoring is carried out during construction and operation with trigger points for action/remedial works as necessary.

8.29 The KPAL report for CCS arrives at the following conclusions:

- There has been no specific modelling of littoral sediment transport in the ES or construction of a sediment budget for the north western part of the bay.
- There is little evidence to support the ES's statement that sand transported east from Crymlyn Burrows to the north west of Swansea Bay is significant.
- The main source of sand is provided by sources external to the Bay including south westerly waves and storm tides transporting sand from south of Mumbles Head to the northern and eastern parts of the Bay. The dominant (net) direction of littoral sand transport in the Bay is eastwards.
- The beach varies dependent on wind and wave conditions as illustrated by the period 2000 to 2014.
- Overall, on the basis of evidence, it appears unlikely that the supply of sand to the recreational beaches would be significantly reduced. The net effect is more likely to increase the retention of sand and reduce the severity of upper beach erosion during storms.
- The above could increase wind blown sand on the promenade but this not a seascape issue.

- Increased intertidal mud deposition in sub-tidal areas adjacent to Blackpill SSSI and the mid foreshore seaward of beaches between St Helen's and West Pier could lead to the development of saltmarsh [5.0]. This would change the visual appearance of the shore and would need increased management to prevent Spartina marsh establishing.
- It is assumed that the sandy beaches would be unaffected by the marsh but this needs clarification.

8.30 For the purposes of this topic area, the above conclusions are taken to mean that the predominantly sandy beaches from the Tawe to the Mumbles will remain as an important visual component of the sweep of Swansea Bay, with their essential character unchanged. Therefore, the findings of the ES and KPAL reports combined appear sufficient to arrive at conclusions on this issue in this review.

Review of seascape, landscape and visual impact assessment

Baseline: Local seascape units (LSUs)

8.31 The seascape units descriptions focus on the coastal character with limited comment in some cases of the intertidal characteristics eg sediment movement and marine characteristics eg wave and tidal patterns, use of the water, exposure, openness. It is difficult to fully appreciate the text without the Admiralty chart as a figure in the SLVIA. The distinctive long distance views to Exmoor and the English coast are not mentioned eg in LSU4. It is appreciated that these are most apparent on clear days and in certain lights and may not have been so evident on the assessment site visit days.

Effects on seascape and landscape character- Key Local Issues

8.32 The comments on the individual effects of the Project on the key seascape and landscape character areas are set out in Appendix A of White Consultant's Report.

8.33 In terms of the impacts on seascape and landscape character, the levels of significance are agreed. It is not agreed that the effects are generally either beneficial or neutral.

Significant effects

8.34 In terms of the regional seascape unit of Swansea Bay as a whole [RSU1], it is agreed that the significance of impact is major and significant. It is considered that the development would be adverse to the overall character and sweep of the bay and its mainly sandy foreshore. This sweep would be disrupted by the length and height of the breakwater bund, ancillary structures and, potentially, the difference in levels of the water between the Lagoon and the sea at several times of day. The effects extend beyond the immediate environs of the lagoon. The beneficial effect is in the likely improvement to the coastal edge within the Lagoon and the activity within the Lagoon which is likely to add interest.

8.35 In terms of local seascape unit (LSU) 4, Swansea Port and Crymlyn Burrows, a major significance of effect is agreed but it is considered that the effects are a mixture of adverse, neutral and beneficial.

8.36 It is considered that the development would be adverse to the open sweeping character of the sea/marine element of the seascape character area with a large breakwater bund and ancillary structures projecting into this part of the bay and, potentially, the difference in levels of the water between the Lagoon and the sea at several times of day. The effects would be adverse on the area exterior to the lagoon with the walls and turbine structure dominating the seascape character. However, within the Lagoon the adverse effects would be mitigated to an extent by sporting activity on the water which would give vitality and interest to the seascape, and by some designed elements on the breakwater bund. The effects on this marine element would, on balance be neutral. The effects on the coastal element of the seascape unit would be beneficial where it abuts the interior of the Lagoon. The effects would be adverse on the Crymlyn Burrows to the east as stated in SLVIA.

8.37 For LSU 5, Swansea Bay, a major/moderate significance is agreed but it is considered the development would be adverse to the character and sweep of the bay and its mainly sandy foreshore as views of the continuation of the sandy strand to the east are disrupted and screened by the breakwater bunds at sea/beach level. The turbine structure would stand out from the breakwater bunds as a lighter rectangular object, breaking up the horizontal emphasis of the structure. The offshore building would be a new focus for the bay competing with Mumbles to an extent. The effects extend beyond the immediate environs of the Lagoon.

8.38 For LCA G1 Swansea, a major/moderate significance is agreed but the beneficial/neutral effect is not agreed. The Swansea Bay frontage of the area enjoys unimpeded views out across the bay towards the Bristol Channel and Exmoor. This open unimpeded scenic view is a contrast to the built form of the city. The proposed breakwater bund and ancillary structures would disrupt this view as a feature in the middle ground with no benefits of increased water use etc apparent from the outside of the structure. The effect would therefore be adverse. A neutral effect on much of the built form area character back from the coastal strip is agreed.

Not significant effects

8.39 For LCA G6 Mumbles, a moderate level of significance is agreed but the predicted neutral effect is not agreed. The development is considered to be adverse as the area focuses and relies on the wild open character of the marine element of the bay as a foil for its own complex topography, vegetation and built form character. The Lagoon structures extend far out into the bay, disrupting this simple setting.

8.40 For LSU 6, Gower Coast, a minor significance is agreed but it is considered that the development is adverse for the reasons set out for LSU5.

8.41 For LCA D1 Clyne Valley Country Park, a moderate/minor significance is agreed but it is considered that the development is adverse as the Lagoon structures extend far out into the bay, disrupting the parks focussed views and simple setting.

8.42 For LCA E1 Gower farmlands, a negligible significance of effects is agreed.

8.43 It is broadly agreed with the assessment of neutral or beneficial effects to landscape character areas G9 SA1, H1 Swansea Port and H2 Swansea Gate Business Park.

Visual effects

8.44 The comments on the individual effects of the Project on the representative viewpoints are set out in Appendix B of White Consultant's Report.

8.45 Generally, the significance of effect set out in the SLVIA viewpoint assessment is agreed, with one minor exception.

8.46 The nature of the effect is not agreed in views from outside the Lagoon. The effects are considered to be adverse, or at best, neutral in some cases, such as Meridian Tower, whereas, the SLVIA indicates that effects are generally either neutral or beneficial (with the exception of Viewpoints 5 and 17 discussed below).

Significant effects

8.47 The SLVIA states that there is one major adverse ie significant effect from Crymlyn Burrows [Viewpoint 17]. This is agreed. It states that there is one major neutral i.e. significant effect from Swansea Bay promenade near the Lido at low water [Viewpoint 7] and near the Civic centre [Viewpoint 11]. In the view of CCS the effect is adverse in both cases. The SLVIA states there is one major beneficial and significant effect from Meridian Tower [Viewpoint 10] but in CCS's view, this is neutral.

8.48 The SLVIA states there is a major/moderate adverse i.e. significant effect- from The Knab [Viewpoint 5]. This is agreed.

8.49 The SLVIA identifies five viewpoints undergoing major/moderate significant but neutral effects. These are at Headland Road, St Thomas [4], Mumbles Hill Nature Reserve [6], Kilvey Hill [13], Swansea Bay [19] and Pant y Celyn Road, Townhill [21]. In the view of White Consultant's the effects are adverse.

8.50 There is one viewpoint undergoing major/moderate significant but neutral/beneficial effects - the new Swansea University campus abutting the interior of the Lagoon [16]. This is agreed.

Not significant effects

8.51 The SLVIA states that there are moderate neutral effects from Clyne golf course [8], Nicander Parade, Townhill, [9] and Clyne Gardens [22]. The significance is agreed but the effects are considered adverse.

8.52 The effect on the views from the bridge in SA1 and Pant Street, St Thomas are of minor significance.

8.53 The above findings mean that those most adversely affected are users of the Swansea Bay promenade and beaches, visitors to Mumbles Head and environs and leisure users of Swansea Bay itself. Those most benefiting are new users of the Lagoon as a leisure or sporting experience, and users of the new Swansea University campus.

8.54 Lighting is mentioned in the SLVIA in respect of uplighting of the Onshore and Offshore Buildings, sculptures and on the inside of the Lagoon wall at a low level. It is noted that public access is not allowed after dark so it is assumed that lighting will be limited. Without specific night time views, and an explicit lighting Project it is difficult to verify the findings on night time effects. The 3D model can only be regarded as indicative and appears to be more of a promotional and public consultation tool rather than an assessment tool.

8.55 It is accepted that there is lighting along existing roads and within the built form along the coastline, some of it intense and industrial in nature. However, the existing, flat reflective water surface of the bay itself acts as a positive foil and setting to this, and the Lagoon seawall will interrupt views of this from the promenade and beach level viewpoints.

8.56 There is therefore a balance to be achieved. If it is assumed that the lighting is imaginatively but sensitively designed, particularly taking into account minimising the effects or enhancing the views, especially from the west of the development, then the level of effects are likely to be no more than for daytime views. Lighting is clearly an opportunity to transform and enhance the development and should be utilised in close liaison with CCS and NPT.

Cumulative Effects

8.57 The level of the SLVIA's cumulative significance of effects for viewpoints are the same as for the effects of the development on its own with one exception (see below). This is an indication that the Project is the largest contributor to effects. The largest combined effect is likely to be with the University Campus which affects the Crymlyn Burrows adversely outside Swansea [Viewpoint 17] but is neutral/beneficial within the Lagoon along the coast [Viewpoint 16]. Overall, Swansea Bay will become more defined by development than at present.

8.58 The one exception in the consistency of the assessment appears to be from Swansea Promenade near the Civic Centre [Viewpoint 11] where the effects are stated as less. Here the cumulative magnitude of effects are stated as moderate, compared to high, with major/moderate significance compared to major. This is not logical as it is stated that the view will become more defined by development [13.8.4.170].

Effects on receptors

8.59 The SLVIA states that views from the Gower AONB will be restricted to the north eastern fringe and that the Project will not erode the character of the AONB or contradict management plan policies [13.8.5.2]. It is not considered that there will be significant adverse effects on the qualities or purposes of the designation. This is agreed.

8.60 The SLVIA states that no Registered Parks and Gardens of special historic interest will be significantly adversely affected, including Victoria Park, Clyne Gardens and Cwmdonkin Park. This is agreed.

8.61 The Wales Coast Path will be significantly adversely affected along its route along the Swansea promenade from the Mumbles expressed as a series of virtually uninterrupted views between Viewpoints 5, 7 and 11. The SLVIA predicts the effects on the high sensitivity users are moderate and the significance of effects major/moderate. This is considered fair overall although the effects closer to the Project are likely to be higher. The cumulative effects are stated as high/moderate and the significance of effects major/moderate. This is agreed.

8.62 The effects on the Gower Way are stated as not significant which is agreed.

8.63 The effects on the National Cycle Route (NCN) 4 is stated as similar to the Wales Coast Path which is agreed.

8.64 Users of the A4067 parallel to the Swansea promenade from Oystermouth Castle to Swansea are stated as having intermittently screened views apart from 750m relatively unobstructed views from Victoria Gardens through to the Civic Centre. The users are stated as moderate/low sensitivity with moderate/low magnitude of effect with moderate/minor significance ie not significant and neutral. Whilst the level of effects are probably correct, the effects are likely to be adverse, but they are agreed as not being significant.

8.65 The effects on the visual amenity of the settlement of Swansea is stated as represented by a series of viewpoints (already discussed above and in Appendix B) and are stated as significant but neutral. The effects on the Mumbles are stated as limited by the tight urban grain. In line with the comments on the viewpoints it is considered that the effect is adverse on the settlements for the reasons previously stated.

8.66 The decommissioning process is stated as only including removal of turbines and sluice gates with all other elements remaining. It is also stated that ongoing maintenance is necessary during operation to maintain the integrity of the walls and other features, as well as dredging. White Consultant's has therefore highlighted that this Council will need to take into account responsibilities for maintenance, the future intended use and associated costs in perpetuity and it is strongly advised that this is fully resolved before approval is given to the project.

Discussion

8.67 The key issues are similar to those stated in the PEIR and draft SLVIA reviews although some issues appear now to have been resolved.

8.68 Swansea relies on the character of the bay, in particular west of the Tawe, as a major asset essential to its positive image and quality of life. In this respect, it is helpful that the character of the sandy beaches of north western part of the Bay will be retained.

8.69 The development itself is very large scale protruding 3.5km into Swansea Bay and effectively dividing it into two. The water level regime and character of the water inside the Lagoon will be different inside to outside the Lagoon. The effects are minimised where the water level is high both inside and outside Lagoon.

8.70 The proposed Lagoon seawall forms a strong dark horizontal line extending a long distance into the bay, closing down its apparent width and restricting views. The offshore building is highly noticeable and forms a built focus in the middle of the bay which, with the sea wall, competes with the Mumbles as a visual focus.

8.71 The seawall structure, as one might expect, appears to be dictated almost entirely by engineering and cost considerations, with design finesse and intervention primarily having effect at a very local level along the inside edge of the structure, in associated buildings and on the coastal edge of the Lagoon. These elements are generally positive based on the indicative designs but have limited mitigating effects on the overall character of the structure when viewed from outside the Lagoon. The design of the offshore building, however, is very important. Whilst the line of the seawall is simple and the development generally uncluttered, the overall effect is somewhat utilitarian.

8.72 The rock armour seawall is higher than the existing promenade and will be of dark colour forming a strong line in the Bay. The concrete turbine structure will contrast with the dark rock breaking up its horizontal line in views around Mumbles.

8.73 The overall sweep of the Bay will be disrupted with views of the almost continuous strong sandy strip around the bay being hidden by the seawall from the beach. However, the photomontages appear to indicate that the upper parts of the Aberavon beach would be visible above the seawall from some viewpoints on the promenade as well as from higher viewpoints which is helpful.

8.74 It is crucial to resolve outstanding design elements, in particular the Seaward building but also the gantry cranes, as these will help define the quality of the project in many sensitive views.

8.75 The long term future of the structure post-operation needs to be resolved.

8.76 Overall, it is considered that the effects on seascape and visual receptors are generally adverse outside the Lagoon rather than neutral stated in the SLVIA. This is important to the consideration of the project as neutral effects, even if involving significant change, are not important considerations in the decision-making process compared to adverse effects.

8.77 The ES and SLVIA do not give definitions as to how the various levels of significance of effect should be weighed in the decision-making process. Appendix C of the White Consultants' report sets out a representative calibration used in similar assessments. In order to inform this report definitions are stated after a summary of each significant set of effects set out below.

Major adverse significant effects are expected on:

- Regional Seascape Unit1: Mumbles Head (Swansea Bay) to Sker Point-
- The Crymlyn Burrows part of Local Seascape Unit LSU4: Swansea Port and Crymlyn Burrows.

- Representative viewpoints at Swansea Bay promenade near the Lido at low water [Viewpoint 7], near the Civic Centre [Viewpoint 11] and at Crymlyn Burrows [Viewpoint 17].

8.78 Major adverse significant effects are taken to represent key factors in the decision making process or at least important considerations. At the higher end of the scale these effects are (although not exclusively) associated with sites or features of national importance and resources or features that are unique and which, if lost, cannot be replaced or relocated. This also relates to landscapes/seascapes where the effect of development would overwhelm and/or substantially change their character or where mitigation will not remove the effects on a receptor.

Major/moderate adverse significant effects are expected on:

- Local Seascape Unit 5: Swansea Bay
- Landscape character area G1: Swansea
- Representative viewpoints at Headland Road, St Thomas [Viewpoint 4], The Knab [Viewpoint 5], Mumbles Hill Nature Reserve [6], Kilvey Hill [13], Swansea Bay [19] and Pant y Celyn Road, Townhill [21]
- Wales Coast Path
- National Cycle Route (NCN) 4

8.79 Major/moderate adverse significant effects are taken to represent important considerations at a regional or district scale and, if adverse, are potential concerns to the project depending upon the relative importance attached to the issue during the decision making process. Mitigation measures and detailed design work are unlikely to remove all the effects upon the surrounding landscape/seascape or receptors.

- *A major neutral significant effect is expected on:*Meridian Tower [Viewpoint 10]

A major/moderate neutral or beneficial significant effect is expected on:

- Swansea University Science and Innovation Campus [Viewpoint 16]

8.80 There are no significant effects expected on Gower AONB or on Historic Parks and Gardens.

8.81 There are a number of moderate adverse effects which are taken to represent effects which, while important at a local scale if adverse, may not be key decision making issues. Whilst sometimes a particular combination of such effects may increase in the overall effects on a particular area or set of receptors and therefore may be significant, this is not considered to be the case in relation to this project.

8.82 Having regard to the foregoing, taken in isolation, the proposal would conflict with UDP Policies EV1, EV2 and R11(ii). However, the adverse impacts identified need to be considered in the planning balance with the positive benefits of the development.

9.0 Design and Public Realm

City & County of Swansea Unitary Development Plan

9.1 Design and siting and location Policies EV1 and EV2 are set out above.

9.2 Policies EV4 and EV5 are also relevant to this topic area.

9.3 UDP Policy EV4 states that where development and ancillary features impact on the public realm designs should ensure that schemes integrate with areas to produce spaces and sequences that result in quality townscape and building frontages that actively engage with the public, are of human scale and provide effective surveillance resulting in spaces that are “people friendly” in terms of perceived and actual safety levels, and provide attractive detail through the use of high-quality, durable materials.

9.4 Policy EV5 states that the provision of public works of art, craft or decorative features to enhance the identity and interest of major new developments or refurbishment schemes will be supported.

Adequacy of the Application/DCO

9.5 In addition to energy generation, the stated benefits of the tidal lagoon include an accessible 'world class' public realm, leisure and recreation water sports, visitor and education attractions and mariculture.

9.6 As stated in the supporting information, the lagoon wall would be approximately 4m above the average high tide and up to 12.5m above the average low tide. The structure will be visible as a distinct horizontal band extending out into Swansea Bay and the wider visual impacts of the lagoon structure (especially at low tide) are considered above.

9.7 The proposed lagoon structure has two basic forms; between the western landfall and the off shore building it has a split level arrangement with a service road along the crest and a shared pedestrian/ cycle route alongside. This is supplemented by a pedestrian path at the lower level on the lagoon side. This arrangement is welcomed to encourage the multi functional use of the area including the proposed shuttle bus to the offshore building,

9.8 To the east of the offshore building looping back to the eastern landfall, the lagoon has a more basic structure with a single shared path that is 5m wide. This is because there is no shuttle bus proposed and the main users would be occasional operation vehicles and pedestrians/ cyclists. This arrangement is supported as it reflects the lower levels of use that are expected in this area.

9.9 In both types of lagoon structure it should be noted that there are no extensive areas of hand rails or barriers and this is welcomed to minimise visual clutter and to avoid an overly functional appearance. Furthermore, various low structures are proposed as informal sitting/ resting points. The slopes of the lagoon structure would be protected by rock armour and the size of the boulders would depend on the exposure and wave actions. The lagoon walls would have a hard and functional character which is supplemented by focal buildings and areas of public realm.

9.10 The supporting information indicates that the public realm is conceived as a number of connecting areas:

- Landward Urban Park
- Broad Seaward Park
- Narrow Seaward Park
- Landward Ecological park

9.11 The supporting information proposes to create a 'world class public realm'. However as discussed in detail below there are considered to be fundamental concerns about the pedestrian/ cycle access and wider connectivity, especially to the west with the failure to improve strategic linkages between the City Centre and the new Swansea Bay Campus of Swansea University.

9.12 The proposed inshore facilities would lie to the south and west of the existing wind turbine that is to be retained. This area would be the heart of the 'Landward Urban Park' and would include a multi functional public realm, landscape areas, car park, boat park, play area, wheeled sports park (skate park), inshore building/ facilities as well as access to the lagoon waters. This area has potential to become a significant city park in a maritime location, but the long and convoluted access may deter many users from Swansea. The main focal area around the inshore building would be supplemented by focal points alongside the access road at the retained WWII pill boxes where localised stepped access to the beach would be provided.

9.13 At the eastern landfall along the frontage of the Swansea University Bay Campus that is currently under construction a 'salt marsh' environment is proposed as the 'landward Ecological Park'. As well as creating a new habitat this would also create a softer and more attractive interface between the university/ coastal public realm and the lagoon waters. Within the salt marsh environment a timber boardwalk with bridges over water areas is proposed to provide public access to this new area.

9.14 The 'Broad Seaward Park and Narrow Seaward Park are both exposed areas projecting out into Swansea Bay. These 'parks' are effectively the functional lagoon structures and the main focal point would be around the offshore building and turbine area. This focal area would comprise a tidal sculpture within the lagoon, a rocky and rugged character, plus functional elements such as shuttle bus turning circle (21m) and operational car parking.

9.15 Overall the public proposals are welcomed and supported, but the detail including any public art features would need to be agreed by condition.

9.16 The concept for focal points around the lagoon is based on what is described as a 'string of pearls'. This is a number of distinct points as follows:

- Western landfall building (see below)
- Off shore building (see below)
- Spectator area overlooking the water activity part of the lagoon on the western part of the lagoon wall. This is proposed as a spherical structure (reference to a pearl) to provide shelter with terraced steps as informal seating.
- On the eastern part of the lagoon wall, the 'long walk' to the eastern landfall is split by a 'half way' focal point in the form of another spherical structure that is cantilevered over the lagoon.
- An exhibition centre is proposed at the eastern landfall to address the Burrows SSSI. This is a simple and small land based elevated viewing platform of corten steel which is considered appropriate to this location.

9.17 The proposed western landfall building to the south of the existing wind turbine would be on new made up ground, but it would be perceived as part of the docks. It is a simple linear form with a pitched roof. The stated dimensions are 19m wide 6m to eaves and 13.5m to ridge. It is actually four separate buildings which are 14.5m, 86m, 14.5m and 24m long respectively that share a common form and materials such as engineered timber cladding. The close spacing means that they will be generally read as a single form which is some 153m long overall. Whilst the applicant makes reference to oyster sheds, it is considered that the simple linear form with pitched roof and scale of the building is reflective of the various dock buildings including the listed J Shed and the warehouse that now forms part of the National Waterfront Museum. Furthermore the siting and orientation of the building integrates with the wider character of the docks. Externally boat hoists are proposed which is in keeping with the functional character of the docks. It would be visible from the city across the River Tawe as part of the docks and is considered appropriate to the dock location and the function as a focal public building.

9.18 The offshore building would be some 3km from the current sea wall within the open expanse of Swansea Bay. The building is proposed to be 21.5m tall above the proposed barrage surface level which approximately 4m above the average high tide and up to 12.5m above the average low tide. The proposed footprint is 35m by 47m and the walls flare outwards. The volume is proposed to accommodate 3 levels with café, viewing areas and flexible exhibition. Given the exposed location a texture concrete finish is proposed along with areas of glazing.

9.19 Whilst this offshore building would be highly visible around Swansea Bay, unfortunately the visual testing has included a 'grey box' that reflects the stated parameters from Part 1 of the DCO Schedule – Part 2: Building Heights in place of the proposed architectural design, plus it does not show the adjacent 8m high lifting structure necessary to maintain the barrage and generating machinery. This makes it difficult to comment on the appropriateness of this significant building which would be located in a prominent and unique location. Therefore it is suggested that further visualisations be prepared to show the architectural proposals from the agreed view points.

9.20 As described above, this issue has also been highlighted as part of White Consultants review of the SLIVA on behalf of CCS who has advised that it is possible that the indicative design may be appropriate but the evidence is not presented to demonstrate this in the photomontages.

9.21 Whilst therefore the public realm proposals are supported as are the majority of the buildings/ structures including the main Western Landfall building. The main concerns for CCS focus on:

- The lack of a pedestrian/cycle access westwards to Swansea City Centre;
- The conflict of the proposed access road with the wider regeneration of the western part of the docks as well as the protected route of the canal; and

- Detailed aspects of the public realm design such as the retention of the WWII pill boxes.

9.22 It is also suggested that a full representation of the offshore building is needed to assess the visual appropriateness of this large structure some 3 km out into Swansea Bay.

9.23 As evidenced above, in overall terms the visual impact of the, lagoon and associated structures, will be considerable. As such there would be conflict with UDP Policies EV1, EV2 and R11(ii) but in many respects this is considered inevitable with a development of this nature. There are significant positive aspects to the newly created public realm which would accord with Policy EV4 but the omission of a western link to SA1 and the city centre is significant and would be in conflict with the provisions of this policy. Policy EV5 is supportive of the public art elements of the proposal.

9.24 Additional requirements are considered necessary in respect of:

- Further discussions and/ or future provision for the western end to city pedestrian and cycle connection;
- Realignment of the vehicular access to avoid the protected canal route and provision of servicing of development plots; and
- The design of buildings and public realm within the agreed parameters.
- Delivery of a landmark off shore building as envisaged. It is crucial to resolve outstanding design elements, in particular the Seaward building but also the gantry cranes, as these will help define the quality of the project in many sensitive views.
- The existing navigation structure at the end of the eastern short pier at the mouth of the River Tawe being retained and relocated as a public realm feature.

10.0 Cultural Heritage and Terrestrial and Marine Archaeology

City and County of Swansea Adopted Unitary Development Plan

10.1 UDP Policy EV1(xi) requires new development to have regard to the desirability of preserving the setting of any listed building.

10.2 UDP Policy EV6 seeks to protect, preserve and enhance Scheduled Ancient Monuments and their settings, and also unscheduled archaeological sites and monuments. Where proposals affect sites and areas of archaeological potential, applicants will be required to provide the following information with planning applications:

- An assessment or evaluation of the archaeological or historic importance of the site or structure,
- The likely impact of development on the archaeological site, and
- The measures proposed to preserve, enhance and record features of archaeological interest.

10.3 Policy EV9 states that development within or adjacent to a conservation area will only be permitted if it would preserve or enhance the character or appearance of the conservation area or its setting.

10.4 Policy R11 support for renewable energy schemes is subject to meeting specified criteria including criteria (iv) and (v) which state that the scheme should not have a significant adverse effect on the historic environment and should preserve or enhance any conservation areas and not adversely affect listed buildings or their settings.

Impacts and Adequacy of Application/DCO

10.5 Glamorgan Gwent Archaeological Trust, in its role as the professionally retained archaeological advisors to CCS has confirmed that information on the marine and terrestrial historic and archaeological resource in the development area contained within the Environmental Statement has been prepared to the Standards and Guidance of the Institute for Archaeologists Standard for Historic Environment Desk-based Assessment (2012) as agreed at the scoping stage for the work.

10.6 The work has looked at all of the relevant existing information on the historic and archaeological resource in the development area and included analysis of information provided by marine geophysical data and walkover surveys. The results of this work have shown that Swansea Bay (including the proposed development area) was subject to periodic marine inundations during the prehistoric period, but there is a possibility that occupation and activity sites of most prehistoric periods could be located in the area although Late Upper Palaeolithic, Mesolithic, Neolithic, Late Bronze Age and Iron Age are the most likely. The current maritime location makes it likely that if such sites are found they will be well preserved and be associated with important palaeo-environmental information. Unfortunately the nature of the marine deposits in Swansea Bay mean that archaeological sites are normally covered by sediment and may only be exposed, if at all, in rare short periods. Consequently the short period of investigation allowed for the preparation of the environmental statement, especially for walk over surveys, means that the presence of potentially vary important prehistoric archaeological sites in the development area cannot be discounted and the construction of the proposed lagoon could reveal and destroy these sites.

10.7 The model for sea-level change in Swansea Bay given in Appendix 20.2 confirms with current predictions. It appears that by the Roman period the Bay had been flooded to its current shores, it is therefore unlikely that any Roman and later settlement sites will be found in the area. However, the Bay was heavily used for fishing, not only by boat but particularly using traps and nets with associated features. The walkover survey did find evidence for fish traps in the intertidal part of the development area, but given the variable nature of the sediment cover, the presence of further sites inside the development area cannot be discounted. The discovery of fishing sites could provide considerable information on the development of this important aspect of the historic economy of the Bay.

10.8 The maritime nature of the Bay in historic periods removes the possibility of settlement sites being found but makes it likely that evidence of shipping could be located in the development area. The historic record identify a number of vessels that are known to have been wrecked in, or close to the development area; however, it is often difficult to precisely identify the location of even well documented wrecks, and in many cases there are no documentary references to wrecks. The use of geophysics has been able of identify a number of potential sites inside the development area but analysis of the data suggest that they are unlikely to be wrecks and therefore have been discounted. However, given that the majority of historic boats and ships were constructed in wood with, in some case, no metalwork it is unlikely that geophysical survey at the resolution used for most of the existing surveys would have located them. As such there must remain a possibility that the wrecks of historic vessels could be located in the development area and be revealed by the proposed development.

10.9 As noted above, the marine sediments of Swansea Bay and the nature of the site, part intertidal and partly sea, restricts archaeological investigation of the development area prior to construction commencing. The assessments so far have been carried out to the appropriate levels but cannot discount that important archaeological sites, both terrestrial and marine, may be located in the development area. However, so far, apart from the presence of some features associated with fishing no archaeological sites have been located in the development area. Section 20.9.1.12 provides suggested mitigation of the marine sites, including the continuing analysis by archaeologists of new information produced to assist in the construction process and the need for a watching brief to be maintained during the dredging operations. The Trust suggest that there is also a need for the identified fish traps to be fully investigated and recorded and that contingency arrangements are in place, including the provision of appropriate time and finance, to ensure that that any archaeological features that are revealed during the construction programme are fully investigated and recorded. The developer will also need to ensure that any significant archaeological artefacts that are recovered are appropriately recorded and conserved.

10.10 Chapter 21 of the environmental statement provides little information on appropriate mitigation measures to protect the terrestrial archaeological resource. It is noted that it is proposed to ensure the preservation of at least one of the pillboxes that constitute part of the WWII defences of Swansea and to ensure that any other associated features are fully recorded. Whilst the authors of the assessment suggest that there are only a few possible areas where archaeological sites may be encountered during the construction of the connection to the National Grid there remains a possibility that evidence for human activity could be found. Therefore the Trust would expect an appropriate watching brief to be maintained during these construction works and that contingency arrangements are in place, including the provision of appropriate time and finance, to ensure that that any archaeological features that are revealed during the construction programme are fully investigated and recorded.

10.11 In order to ensure that the measures outlined above are implemented the Trust recommend that appropriate conditions are attached to any DCO granted for this development. The Trust suggest a condition could be worded in accordance with the model given in section 54 of Circular 11/95:-

"No development shall take place until the applicant, or their agents or successors in title, has secured the implementation of a programme of archaeological work in accordance with a written scheme of investigation which has been submitted by the applicant and approved in writing by the local planning authority."

Reason: To identify and record any features of archaeological interest discovered during the works, in order to mitigate the impact of the works on the archaeological resource.

10.12 However, given the complexity of the proposed scheme, the Trust note that preference may be given to the condition set out below, which would provide the developer with a clearer route for meeting their responsibilities.

A) No development shall take place/commence until a programme of archaeological work including a Written Scheme of Investigation has been submitted to and approved by the local planning authority in writing. The scheme shall include an assessment of significance and research questions; and:

1. *The programme and methodology of site investigation and recording*
2. *The programme for post investigation assessment*
3. *Provision to be made for analysis of the site investigation and recording*
4. *Provision to be made for publication and dissemination of the analysis and records of the site investigation*
5. *Provision to be made for archive deposition of the analysis and records of the site investigation*
6. *Nomination of a competent person or persons/organisation to undertake the works set out within the Written Scheme of Investigation.*

B) No development shall take place other than in accordance with the Written Scheme of Investigation approved under condition (A).

C) The development shall not be operational until the site investigation and post investigation assessment has been completed in accordance with the programme set out in the Written Scheme of Investigation approved under condition (A) and the provision made for analysis, publication and dissemination of results and archive deposition has been secured.

10.13 As is the case with NPT, CCS would not object to an alternative time restriction to section C of the above condition, so that energy generation is not unnecessarily delayed, on the proviso that post investigation works are effectively secured.

10.14 There are no listed buildings or conservation areas directly impacted by the tidal lagoon proposals and any indirect impacts are not considered to be significant. However there are a number of heritage features of local interest as outlined below:

10.15 The proposed retention of the WWII pill boxes is welcomed as is the use of these as focal points in the proposed public realm where stepped access to the water/ sand is proposed. Furthermore the proposed removal of the 2m high concrete sea wall is supported in terms of public realm to open up views. However it should be noted that these WWII defence features are integral to the concrete sea wall which is proposed to be removed. Therefore the 3m sections either side of the pill boxes as indicated should be secured.

10.16 The supporting information indicates that these pill boxes have been discussed with Cadw and that they are considering listing them as features of national importance. No formal correspondence has however been received from Cadw on this matter. This matter should be resolved prior to any work affecting them.

10.17 The supporting information also indicates that the existing navigation structure at the end of the eastern short pier at the mouth of the River Tawe could be retained and relocated as a public realm feature. This is supported and is requested as a condition.

11.0 Coastal Processes, Sediment Transport and Contamination

City and County of Swansea Unitary Development Plan

11.1 Policy EV25 states that development, alone or in combination with other plans or projects, which is likely to adversely affect the integrity of a European protected site (SAC, Marine SAC, SPA and Ramsar Sites) and is not directly connected with or necessary to the management of the site, will not be permitted unless:

I. There are imperative reasons of over-riding public interest, including those of a social or economic nature, which are sufficient to override the reasons for designation, and
II. There is no alternative solution.

11.2 Where such development is permitted, planning conditions and/or obligations will be used to secure all compensatory measures necessary to ensure that the overall coherence of the European Site is protected.

11.3 Policy EV27 states that development that significantly adversely affects the special interests of sites designated as SSSIs and NNRs will not be permitted unless the need for the development is of such significance that it outweighs the national importance of the designation. Where development is permitted, planning conditions and/or obligations will be used to protect and enhance those interests and where necessary provide effective mitigation and compensatory measures.

11.4 Policy EV28 states that within locally designated areas the natural heritage will be preserved and enhanced wherever possible. Development that would significantly adversely affect the special interest of Local Nature Reserves will not be permitted unless the need for the development is of such significance that it outweighs the importance of the designation. Development that would significantly adversely affect SINCs or RIGs, or which would not provide for appropriate compensatory or mitigation measures will not be permitted, unless it can be demonstrated to meet appropriate social or economic needs where the benefits in such terms would outweigh the harm to the feature concerned. Where development is permitted which would damage the nature conservation value of the site, such damage will be kept to a minimum, and appropriate mitigation or compensatory measures sought.

Local Issues

11.5 The ecologically important habitats at Blackpill SSSI, Crymlyn Burrows SSSI, and the Section 42 habitats and species (Natural Environment and Rural Communities Act 2006) e.g. sand dunes and *Sabellaria* reefs) within the bay are all dependent on the movement and deposition of sediment. Relatively small changes in the flow of currents, wave structure and sediment deposition can lead to large changes in the quality and distribution of these habitats. Changes in sediment deposition also have potential to significantly alter the visual, recreational, and amenity value of the bay as well as its role in providing sea defences. These changes could result in additional management requirements and costs.

Adequacy of the Application/DCO

11.6 Kenneth Pye Associates Ltd has been instructed by CCS to provide comments relating to the potential impacts of the proposed tidal lagoon development in northern Swansea Bay. Particular attention is given to the potential impacts of the Lagoon on coastal processes, sediment transport and rates of sediment accretion and erosion along the CCS frontage. A copy of the report is provided as **Appendix E** (Comments and Advice relating to the proposed Swansea Bay Tidal Lagoon, with particular reference to changes in coastal processes and potential impacts June 2014) (KPAL Report No: 160995).

11.7 The comments and advice are based on an appraisal of chapters contained within the Environmental Statement, information contained in a number of supplementary reports which have been made publically available by the applicant during the consultation process, and a review of previous scientific investigations, publications and environmental monitoring data relating to Swansea Bay.

11.8 Issues relating to coastal processes which have been identified as being of concern to CCS include:

- The potential of the tidal Lagoon to interrupt the supply of sediment to the sandy beaches to the west of the River Tawe; the compositional condition and visual appearance of these beaches are of vital recreational and amenity importance to the local population and contribute significantly to the overall attractiveness of Swansea as a destination for leisure and business visitors, longer stay tourists and University students. Many of the objectives and actions identified within the Swansea Bay Strategy (CCS, 2008) and the Environment Management Plan Pre-consultation draft document depend on maintenance of the quality of the existing beach features and overall seascape (Commons Vision 2012; Trawscoed Ltd & Commons Vision, 2012).

- The effect of a possible reduction in sand supply on long-term beach levels and the ability of the sand dune systems in northwest Swansea Bay to recover following storm events; this could have implications for coastal flood risk as well as net loss of sand dune habitat and recreational beach area.

- The likely effect of the Lagoon development on the wind-blown sand problem which currently affects the promenade and coastal road between the Civic Centre and Bryn Mill Lane. This is likely to become worse which could potentially lead to increased maintenance costs.

- The potential impact of the Lagoon to cause greater mud deposition / accumulation in the shallow sub-tidal and intertidal areas, possibly leading to more extensive salt-marsh development in the medium term, which would have potentially negative implications for the existing habitats and biota, visual landscape and recreational use of the area.

- The possibility that construction of the Lagoon will lead to increased sediment dredging requirements upstream of the Tawe barrage, as well downstream in the main Tawe navigation channel. (CCS has a Parliamentary obligation to dredge the impoundment).

- The magnitude of changes in flood risk arising from greater wave heights around parts of the Bay (the Environmental Statement suggests increases in wave heights, notably in the Mumbles – Oystermouth area, mainly from wave reflection off the Lagoon structure).

- The effect of possible changes in wave height / energy on recreational navigation in the approach to Swansea Marina, and on the potential for local sediment erosion adjacent to the western wall of the lagoon.

- The potential risk of remobilization of contaminated sediments during, and following, lagoon construction, and possible implications for sediment and water quality on the recreational beaches.

- The adequacy of the Coastal Processes Baseline Assessment undertaken for the Environmental Impact Assessment.

- The adequacy of the modelling undertaken as part of the EIA relevant to the above questions.

- Requirements for monitoring and mitigation measures which might be paid for by the Developer if the development is consented, including requirements for the specification of change thresholds for action.

Sediment Supply to Recreational Beaches

11.9 As stated in the Coastal Processes chapter (Chapter 6) of the ES, construction of the lagoon would effectively divide northern Swansea Bay into two separate hydrodynamic and sediment transport cells, one to the east and one to the west of the lagoon structure. This is anticipated by ABPmer to have two main effects: (1) it would interfere with the anticlockwise residual current in northwest Swansea Bay which is capable of transporting suspended mud, and (2) it would prevent episodic storm-generated littoral transport of sand from north-eastern Swansea Bay towards the west, potentially cutting off the supply of sand to the recreationally important beaches between West Pier and Singleton Park.

11.10 No results of sand transport modelling are presented in the Environmental Statement to support this conclusion. Figure 6.15 of the Environmental Statement shows postulated sand transport pathways in Swansea Bay based largely on previous work summarised in Collins *et al*. (1979). It shows (probably episodic) tidal current transport from the nearshore area off Crymlyn Burrows, across the proposed Lagoon footprint area, towards the anticlockwise tidal eddy in northwest Swansea Bay. However, there is very little empirical evidence to suggest that this pathway is significant for the transport of sand; as reported by Collins *et al*. (1979) and Collins & Banner (1980), tidal current velocities in northern Swansea Bay are too low to entrain sediment from the bed and can only transport fine grained sediment (mud and very fine sand) in suspension. Waves and wave-induced currents are more important for the entrainment and transport of sand across the Bay. The main source of sand is provided by sources external to the Bay, and south-westerly storm waves, combined with the flood tide, play an important role in transporting sand south of Mumbles Head towards the northern and eastern parts of the Bay. The geomorphological evidence from shoreline features demonstrates that the dominant (net) direction of littoral sand transport along the entire shore of northern Swansea Bay, from Oystermouth to the Neath estuary, is easterly. No specific modelling of littoral sediment transport has been undertaken in the Environmental Statement.

11.11 There is no reason to expect that the construction of the Lagoon will change the rate of sand supply from the southwest into Swansea Bay, although this has not been demonstrated in the Environmental Statement by modelling using the Mike 21 Sand Transport module. However, retention (accumulation) of sand in north-western Swansea Bay may be made more likely due to a predicted reduction in both significant wave height (and hence wave energy) (Figures 6.45, 6.46, 6.47, 6.48, 6.49) and tidal current speeds (e.g. Figure 6.34).

11.12 Sediment transport in the shallow sub-tidal and intertidal areas of northwest Swansea Bay is complex. Aerial photographs taken since 1945 show a complex pattern of sand-waves which experiences significant change on annual to decadal timescales (Figure 1 of KPAL Report No: 160995). No analysis of the importance of these features in onshore - offshore alongshore sand transport has been undertaken as part of the Environmental Statement. No attempt has been made to construct a sediment budget for northwestern Swansea Bay, or to document net gains or losses of sediment using historical beach profile data or aerial photogrammetry. However, it is clear from a qualitative comparison of the aerial photographs and beach survey data that there have been periods when there has been a more or less continuous cover of mainly sandy sediment across the north-western part of the Bay, and others when the sand has been concentrated into discrete sand wave features separated by exposures of early to mid Holocene-age muds and peat. The width and elevation of the upper sandy beach between Black Pill and the Civic Centre has also varied in response to variations in wind and wave conditions. The period between 2000 and 2013 was one of relatively few storms and during this period there was a net movement of sand from the shallow sub-tidal areas and mid intertidal zone towards the higher intertidal zone. By 2005 / 6 a very large quantity of sand had accumulated on the upper beaches, giving rise to significant problems of windblown sand incursion onto the promenade and Oystermouth Road (see below). The problem has continued until the winter of 2013/ 14, when a series of severe storms caused significant upper beach and frontal dune erosion and transfer of sand back to the mid / lower intertidal zone (Pye & Blott, 2012, 2014a,b). However, since the 1970s there has been significant net accretion of littoral sand in northwest Swansea Bay between the south side of Black Pill and West Pier (with the exception of the Civic Centre frontage which lies seaward of the general shoreline alignment).

11.13 On the basis of the available evidence, the KPAL Report No: 160995 concludes that it appears unlikely that the supply of sand to the recreational beaches between the west pier and Blackpill lido would be significantly reduced as a result of construction of the Lagoon. The net effect is more likely to increase the retention of sand brought into this part of the Bay (mainly by wave processes) and to reduce the severity of upper beach erosion during storms between St. Helen's and West Pier due to the shelter provided by the Lagoon (especially from southeasterly waves). However the western part of the bay from Blackpill lido to Mumbles is unlikely to see any increase in sand deposition.

Resilience of Sand Dunes and Implications for Coast Protection and Flood Risk Management

11.14 Events during the stormy winter of 2013-14 demonstrated the importance of dunes as a reservoir of sand which is available to release sand to the beaches during storms, and in preventing direct wave attack on the sea wall behind (Pye & Blott, 2014b). Any increase in the frequency / magnitude of dune erosion would potentially diminish this role and increase the risk of storm damage to the sea wall and infrastructure behind. However, as noted above, a consideration of the evidence suggests that the effect of Lagoon construction would be to reduce wave heights, encourage sandy sediment retention on the beach, and reduce the risk of serious dune erosion between St Helen's and West Pier. The 'protective' effect of the Lagoon would decrease westward, especially for south easterly waves, with probably no net change in the vicinity of Black Pill.

Wind-Blown Sand Hazard

11.15 If, as anticipated, there is a medium to longer term increase in total sand volume in the intertidal and supra-tidal areas between St Helen's and the Civic Centre, the existing problem of wind-blown sand incursion onto the promenade, Oystermouth Road and into the Civic Centre west car park is likely to become worse (Pye & Blott, 2012, 2014a,b). This would potentially result in increased maintenance costs associated with removal and disposal of sand from the promenade, road and car park, and increase the safety risk to pedestrians, cyclists and motorists.

11.16 Near Swansea Point, adjacent to the West Pier, the existence of a fairly wide belt of sand dunes should prevent any additional sand blowing on to the promenade and into properties, provided that the recent improvements to sand fencing and visitor management are maintained (Phillips, 2014).

Intertidal Mud-Deposition and Possible Saltmarsh Development

11.17 The coastal processes modelling with the lagoon in place has suggested increased mud deposition in parts of northwestern Swansea Bay, predominantly within shallow sub-tidal area adjacent to Blackpill SSSI, and to a lesser extent across the adjoining intertidal zone including the mid foreshore seaward of the recreational beaches between St. Helen's and West Pier (ES Figure 6.50 , 6.52). The predicted reductions in high tide levels (e.g. ES Figure 6.42), current speeds (e.g. 6.34) and wave heights (e.g. Figure 6.45) suggest that there is a significant risk of increased mud deposition and accumulation across a much wider area, especially within the sheltered areas leeward of the higher intertidal sand bars.

11.18 The effect of increased mud deposition would be to restrict the mobility of the sand bars if mud drapes are formed on the bars and/ or the movement of sand across the surfaces between the bars is reduced as exposures of 'hard' peat and consolidated mid Holocene muds become progressively buried by new mud deposits. Such changes could have implications for the in-fauna and birds as well as affecting the exchange of sand between the upper beach and the lower sub-tidal areas.

11.19 The increased deposition of both sand and mud, together with slight reduction in high tidal levels, indicated by the Environmental Statement modelling, implies a progressive reduction in average water depths and reduction in wave and current energy which will increase sediment accretion by positive feedback. If upper foreshore levels rise sufficiently and wave action is reduced, saltmarsh vegetation will become established, leading to a further acceleration in mud accretion rates. This would change the visual appearance of the shore and potential affect recreational usage. The extent of the existing saltmarsh elevation 'window' is shown in Figure 2 of KPAL Report No: 160995. This could increase significantly in the medium term following Lagoon construction.

11.20 Considerable time and effort has been spent in the past to prevent the development of *Spartina* marsh in the western part of the Bay, involving spraying, pulling and bull-dozing of pioneer vegetation, and such measures could be required again in the future. These historical problems have not been considered in the Coastal Processes Baseline Assessment and the possibility that similar action in the future may be required following construction of the lagoon have not been recognized.

Dredging Requirement in the River Tawe Impoundment

11.21 The ES modelling with the Lagoon in place has indicated higher rates of mud deposition within the approach channel to Swansea Docks during 1 in 10 year and 1 in 20 year storm events, and it is estimated that there will be a mean increase in dredging requirement of 52 x 10^3 m^3, or 27%, annually). Mud accretion along parts of the eastern wall of the Lagoon where tidal energy would be reduced is also indicated by the modelling.

11.22 Figures 6.50 – 6.52 of the Environmental Statement show no increase in mud deposition in the innermost part of the Tawe channel immediately downstream of the Tawe Barrage. However, the Environmental Statement model domain does not extend upstream to include the areas on both sides of the barrage, and contains no specific assessment of potential changes in sedimentation within the impoundment.

11.23 The barrage structure, completed in 1992, includes a boat lock, spillway, fish pass and generator turbine and is designed to allow overflow at the approximate level of mean high water in Swansea Bay (c. 3.4 m OD). Tidal overtopping of the barrage therefore occurs on spring tides, allowing ingress of marine sediment carried in suspension. The majority of sediment transported into the impoundment is likely to settle out and require periodic removal by dredging. The magnitude of the sediment carried into the impoundment, and of any likely change in dredging requirement following lagoon construction, has not be quantified in the Environmental Statement coastal process modelling. However, there is a significant possibility that some of the fine sand and mud released into the water column during the construction phase could be transported over the Tawe barrage on spring tides and become trapped within the impoundment. Longer-term increases in sediment accumulation are also possible and should be monitored.

Adequacy of the Baseline Assessment

11.24 The report presented by Kenneth Pye Associates Ltd highlights that the Coastal Processes, Sediment Transport and Contamination Baseline Assessment displays the following limitations:

- Limited scope of literature review – no detailed consideration given to outputs of previous research projects such as those carried out by the Institute of Oceanographic Sciences (e.g. Heathershaw *et al*., 1980) and Swansea University (e.g. Collins, *et al*., 1979, 1980; Collins & Banner 1980; and more recently by SEACAMS).

- No detailed quantitative analysis undertaken of historical maps, charts or aerial photographs; no attempt made to quantify historical sediment volume or sea bed level changes in different parts of the Bay.

- Very limited analysis and use made of existing environmental monitoring data – e.g:

  - Tide gauge data for Mumbles held by NTSLF and PSMSL
  - Wind data for Mumbles available from Met Office
  - LiDAR data available from EA Geomatics
  - Recent dredging data relating to Ports of Swansea, Port Talbot and Neath
  - Swansea Bay and Carmarthen Bay Coastal Engineering Groups intertidal profile monitoring data 1998-2013

- No detailed field studies have been undertaken from a geomorphological or sedimentological perspective.

- No intertidal sediment samples have been collected or analysed for particle size or levels of contaminants.

- No measurements made of sediment thickness / lithostratigraphy (e.g. from shallow geophysics or boreholes).

- Only a limited number of sub-tidal sediment samples has been collected and analysed; the number and spatial distribution are inadequate to allow sediment trend analysis (STA) or detailed mapping of sedimentary facies.

- Metocean data (water levels, currents, limited suspended sediment concentrations) were collected by Titan Environmental Surveys (2012a) from only two locations (both within the approximate lagoon footprint) and for a short time period (3 months between 16 February and 16 May, 2012). While the data are adequate for model calibration and validation purposes (as reported by ABPMer 2013a), they do not give a full picture of the range of conditions experienced in Swansea Bay. The measurement period included a significant period of time when conditions were dominated by high pressure and northeasterly winds. No long-term wave buoy deployment was used to provide data about wave conditions within the northern part of the Bay.

Adequacy of the Coastal Processes Modelling

11.25 Kenneth Pye Associates Ltd also highlight that the coastal processes, sediment transport and contamination modelling also has a number of limitations:

- Modelling has been restricted to use of a single suite of 2D modelling tools, mainly DHI Mike 21 -FM -HD (flexible mesh hydrodynamic model) and Mike 21 FM-SW (flexible mesh spectral wind-wave model; these are widely used and highly respected models but are applicable only to modelling of change over relatively short time periods. They do not include process – sediment transport - bedform feedbacks and the FM-HD model provides only depth-averaged current velocities and suspended sediment concentrations

- The discussions of the hydrodynamic and wave models provided in Appendix 6.1 of the ES are brief and lack detail. Some further information relating to the hydrodynamic and wave modelling is provided in a report by ABPmer (2013a), but there is no discussion of the DHI Mike 21 mud transport module, sand transport module or particle tracking module in any of the presented documents.

- No validation of the mud transport, sand transport or particle tracking modules has been undertaken using observational data.

- No results for sand transport modelling are presented in the ES, even though much of Swansea Bay is sand-dominated.

- The modelling has considered changes mainly at a regional scale; the models do not capture the details of processes, sediment transport and morphological changes in shallow sub-tidal and intertidal areas.

- Although the short-term hydrodynamic, wave and sediment modelling, undertaken is adequate for the assessment of regional scale changes in water levels, depth-averaged currents and broad scale patterns of likely sediment erosion and accretion, it cannot resolve the detailed patterns of wave - current interaction and sediment movement in the intertidal and shallow sub-tidal areas which are critical for the understanding of likely impacts on the morphology and sedimentary character of receptors.

- The Environmental Statement contains no specific consideration of surface zone processes and littoral sediment transport.

- Appendix 6.4 provides a convenient summary, in tabular form, of all the model runs undertaken as part of the Coastal Processes assessment. Nine model runs were performed using the Mike 21 FM-HD (hydrodynamic) model (including three sensitivity test runs using modified intertidal bathymetry), six runs using the Mike 21 SW (Spectral Wave) model, three using the Mike 21 PT (Particle Tracking) module, two using the Mike 21 MT (Mud Transport) module, and two using the Mike 21 ST (Sand Transport) Module).

- The data used to construct the bathymetric grid used in the short-term modelling originate from several different sources and are of varying age and resolution (this is described in Appendix 6.2 of the ES (Model Bathymetry Review) and in reports by ABPmer 2013b,c). It would have led to increased confidence in the results if the baseline assessment for the project had included collection a comprehensive new bathymetric data set using specially commissioned, synoptic, multi-beam swath bathymetry and airborne LIDAR surveys.

- Most of the hydrodynamic and particle tracking model runs undertaken relate to the construction phase of the proposed development, specifically in relation to the effect of dredging of sediment within the lagoon area and the filling of Geotubes to construct the framework of the lagoon, and to a lesser extent the disposal of surplus dredged material at the Swansea Outer Grounds licensed disposal site. By their very nature, the modelling tools are unsuited to assessment of medium to long term (> 30 days) effects on sediment erosion and deposition patterns / rates during the lagoon operation and decommissioning phases.

- It is evident from Environmental Statement Chapters 1 and 4 that considerable uncertainty remains regarding the methods which might actually be used to construct the Lagoon. It is presently unclear whether Geotubes or more conventional construction methods using imported rock / concrete / fill will be used for parts or all of the construction. No modelling of possible alternatives to Geotubes has been undertaken in Environmental Statement Chapter 6.

- It is also mentioned in Environmental Statement Chapter 4 that the western training wall of the River Neath may be re-built; this has not been included in the modelling. The possible requirement to extend the existing treated sewage / storm-water discharge outfall beyond the limits of the Lagoon walls also has not been modelled.

- The wave modelling undertaken using Mike 21 FM-SW considered two wave approach directions, the prevailing southwesterly approach direction, and a southeasterly direction. The analysis focused mainly on changes in average wave height around the Bay. Patterns of wave refraction with changing pre- and post-construction bathymetries have not specifically been considered even though this aspect is likely to be important for nearshore and intertidal sediment transport.

- Waves from a south-south-west to southerly approach direction have not been considered although these could be important in terms of wave penetration into the mouth of the River Tawe (with implications for small craft navigation), wave interaction along the western walls of the proposed lagoon and the West Pier, and the transfer of sediment over the Tawe barrier.

- Longer-term changes have been considered only using expert geomorphological assessment (EGA) based on the outputs of the short-term numerical modelling and the baseline understanding; no quantitative numerical modelling has been undertaken for alternative future scenarios, using modified bathymetries. The fact that only a limited number of scenarios have been assessed by the short-term modelling, and the baseline assessment is of limited scope, restricts confidence in the EGA.

- No detailed modelling of the Decommissioning phase has been undertaken and only a very brief qualitative assessment based on EGA provided. The option of total removal of the lagoon structure on decommissioning has not been considered. The consequences of allowing the Lagoon structure to degrade through lack of maintenance in the long term also have not been considered.

Requirements for Monitoring, Mitigation and Possible Remediation

11.26 Two potential methods of monitoring are identified in the Environmental Statement as potential contributors to an Operational Environmental Management Plan (OEMP):

- Beach profile monitoring to the west of the lagoon extending into the Blackpill SSSI and to the east in front of Crymlyn Burrows.

- Monitoring of sedimentation within the navigation channel to Swansea Docks.

11.27 In view of potential concerns about the potential impacts of the development on the beaches, intertidal flats and adjacent sub-tidal areas of northwestern Swansea Bay, including possible impacts on windblown sand hazard, mud accretion / saltmarsh development and dredging requirements in the Tawe barrage impoundment, it is suggested by Kenneth Pye Associates that a more extensive programme of pre-construction baseline data acquisition and subsequent monitoring should be agreed with the applicant, and other bodies including Natural Resources Wales, if a DCO is granted. Specific thresholds of change should be agreed which trigger further action in terms of mitigation / compensation / remediation.

11.28 From the viewpoint of physical processes and sediments, the following should be undertaken:

- A baseline LiDAR and comprehensive swath bathymetric survey of the whole of Swansea Bay before any construction activities commence.
- Repeat LiDAR / swath bathymetry surveys at 5 yearly intervals to allow quantitative assessment of changes in beach sediment volume.
- RTK GPS surveys of additional beach profiles to be established between the existing Swansea Bay and Carmarthen Bay profiles line shown in Figures 2 to 5.
- Bathymetric surveys to monitor sediment accumulation in the impoundment above the Tawe barrage
- Aerial photography surveys at 5 yearly intervals to monitor changes in morphological features and vegetation extent (e.g. saltmarsh).

- A comprehensive sediment characterization study of Swansea Bay, involving a minimum of 200 sampling points across the whole of the sub-tidal and intertidal area; samples should be taken from the surface and from specified depth intervals below the sea bed.
- Repeat sediment sampling at 5 yearly intervals in a reduced number of targeted locations.
- Continuous water level, wave and tidal current monitoring in at least two locations within northern Swansea Bay (e.g. using smart buoys).
- Installation of a weather station (including anemometer) at the control centre on the lagoon wall.

11.29 Kenneth Pye Associates Ltd advise that agreement should be reached regarding responsibility for any actions which may be required to tackle potentially adverse impacts such as increased windblown sand hazard, increased dredging requirement, improved coast protection / flood defence, and control of invasive saltmarsh vegetation. Additional agreements should be made in relation to habitat and species monitoring / mitigation.

11.30 With regards to the formal amendments to the application, as submitted by DLA Piper on 3rd June 2014, the following advice has been provided by Ken Pye Associates on behalf of CCS:

11.31 Annexe 9 – Submission re: UV water treatment facility, for option reduction - the decision to abandon the option of the UV water treatment plant and to go for the option of extending the storm water / treated effluent outfall beyond the Lagoon footprint.

"This in itself constitutes a potentially significant engineering scheme which has not been subject to any kind of assessment in terms of its impact on coastal processes, sediments and potential contamination. The potential impacts are likely to depend on the design and method of construction – e.g. whether by open cut trenching followed by burial of the pipe, or construction of an exposed pipe on piers across the sea bed. More details should be required from the Developer and a full coastal processes / ecology / navigation risk assessment undertaken. An extended, exposed outfall could potentially have major effects on hydrodynamics and sediment transport during both construction and operation."

11.32 Annexe 10 – Submission re: temporary cofferdam, for option reduction.

11.33 Location 'A' has now been identified as the preferred location for the sluices and turbine housings. The implications of building a temporary sediment berm / Geotube cofferdam at this location need detailed consideration. The potential impacts during the construction and removal phases have not been modelled or been subject to any other kind of physical processes / sediment assessment. It is advised that this would appear to be a substantial task which would take some time to complete; the effects of sediment dredging, filling of Geotubes and rock emplacement, followed by at least partial removal, need to be fully assessed by further modelling and possibly by geotechnical investigation and sediment testing.

12.0 Intertidal and Subtidal Benthic Ecology

City and County of Swansea Unitary Development Plan

12.1 Policies EV25 (sites of international importance), EV27 (SSSI's and National Nature Reserves) and EV28 (sites of local importance) are set out above.

Adequacy of Application/DCO

12.2 The bay contains a number of intertidal and subtidal habitats including *Sabellaria* reefs and peat and mud exposures which are sensitive to changes in sediment movement. Relatively small changes in the flow of currents, wave structure and sediment deposition can lead to large changes in the quality and distribution of these habitats.

12.3 The current modelling of the coastal processes is not detailed enough to come to a precise conclusion as to the possible effects of the construction of the lagoon on the intertidal and subtidal habitats. and species.

12.4 The KPA:L 2014 report states that "The predicted reductions in high tide levels (e.g. ES Figure 6.42), current speeds (e.g. 6.34) and wave heights (e.g. Figure 6.45) suggest that there is a significant risk of increased mud deposition and accumulation across a much wider area, especially within the sheltered areas leeward of the higher intertidal sand bars. This needs to be discussed and possible effect indicated in detail.

12.5 Kenneth Associates Ltd has also stated that "The effect of increased mud deposition would be to restrict the mobility of the sand bars if mud drapes are formed on the bars and/ or the movement of sand across the surfaces between the bars is reduced as exposures of 'hard' peat and consolidated mid Holocene muds become progressively buried by new mud deposits. Such changes could have implications for the in-fauna and birds as well as affecting the exchange of sand between the upper beach and the lower sub-tidal areas" and that "If upper foreshore levels rise sufficiently and wave action is reduced, saltmarsh vegetation will become established, leading to a further acceleration in mud accretion rates." (Section 5, KPAL Report No: 160995).

12.6 Peat and clay exposures with piddocks are a UK Biodiversity Action Plan priority habitat and a Section 42 Habitat. This biotope is considered to be scarce in the UK. There are sections of this habitat across Swansea Bay, for example, just to the south of the end of Mumbles Pier where clay with piddocks occurs just below spring low tides. This important habitat which is vulnerable to changes in sediment distribution is not mentioned.

12.7 The data on the distribution and species of plankton and macro algae is largely based on desk top studies some of which are now several years old. If these habitats and species are to be protected it is considered essential that an accurate base line is established against which to measure any change.

12.8 The existing data needs to be checked in order to allow an up-to-date base line to be established. There is no reference to the Mumbles Pier Lifeboat Station Subtidal Survey report (Moore, J.J. (2003) Mumbles Lifeboat station Subtidal Survey, May 2003). A report to Posford Haskoning Ltd from Coastal Assessment, Liaison and Monitoring. Cosheston, Pembs.

12.9 There is no description or listing of the Section 42 intertidal and marine habitats and species (Natural Environment and Rural Communities Act 2006) (other than *Sabellaria alveolata* and *Ostrea edulis*). The only distribution maps are of Biotopes but these do not describe Section 42 habitats and species. It is the view of CCS that this needs to be addressed to allow a full assessment of potential effects of the proposed development.

12.10 The information contained in paragraph 8.5.6.5 of the Environmental Statement is not up to date as there are a number of marine non native species in Wales. There is no mention of the Pacific oyster *Crassostrea gigas*, which is present in Swansea Bay whilst paragraph 8.5.6.15 of the Environmental Statement states that it is not recorded.

12.11 The Environmental Statement implies that the probability of the introduction and spread of non-native species from the Lagoon development is considered to be low. It is questioned on what evidence this is based, as there is the potential, without strict bio-security measures in place, for construction materials and vessels to act as vectors of transfer of invasive marine non native species within the lagoon footprint and outside of it.

12.12 Kenneth Pye Associates has pointed out that “Considerable time and effort has been spent in the past to prevent the development of *Spartina* marsh in the western part of the Bay, involving spraying, pulling and bull-dozing of pioneer vegetation, and such measures could be required again in the future. These historical problems have not been considered in the Coastal Processes Baseline Assessment and the possibility that similar action in the future may be required following construction of the Lagoon have not been recognized.” (Section 5, KPAL Report No: 160995.)

12.13 ‘A comprehensive baseline survey of sedimentary facies and contaminant levels in the surface and sub-surface sediments across northern Swansea Bay has not been undertaken, and uncertainty therefore remains regarding the potential for release and redistribution of contaminants outside the sampled areas.’ (KPAL Report No: 160995.) CCS identifies that this could have a negative impact on marine life.

Carmarthen Bay and Estuaries European Marine Site (Burry Inlet SPA and Ramsar site; Carmarthen Bay and Estuaries SAC)

12.14 There are risks of far-field effects which require particular attention. The eastern boundary of CBEEMS is only approximately 11 nautical miles from the proposed Tidal Lagoon site and yet has been overlooked, other than for bird species within the SPA. Each of the features of the EMS must be looked at systematically and considered

in terms of potential damaging effects during construction and operation particularly, in the context of sediment transport and the SAC Sandbanks feature.

13.0 Fish Including Recreational and Commercial Fisheries

Adequacy of Application/DCO

13.1 Some of the fish species e.g. herring are sensitive to increased sediment loads and noise both of which will increase during construction and may increase in the running phase of the lagoon. Disturbed sediments have the potential for smothering feeding and nursery areas for important species of fish. Again uncertainty in the sediment transport modelling makes it difficult to predict effects on sensitive species. herring spawn in Swansea Bay primarily within the bounds of the lagoon footprint and once built they will be excluded from this preferred area. There is no information that can with any certainty explain what will happen to spawning Herring in the Bay. No evidence has been provided to show that any alternative sites will be suitable. With uncertainty as to the levels of sediment movement particularly over time it is not possible to understand potential impacts on the other fish and shell fish species present in the Bay

13.2 It is stated in paragraph 11.6.1.1 of the Environmental Statement that herring spawning media on the outer Lagoon wall will safeguard fish stocks. CCS questions what evidence there is for this as none has been outlined?

13.3 Herring are an important food source for harbour porpoise (e.g. Santos2003, Bjorge et al 2008this was confirmed for the Swansea area during a 2.5 year research project at UWTSD Swansea Metropolitan(Oakley pers comm). Stomach content analysis of locally stranded harbour porpoise provided evidence of the importance of particular fish species. These included whiting, poor cod, herring and smelt. If herring are excluded from the Bay during piling, then the consequential effect on harbour porpoise and sea birds must be fully considered.

13.4 ‘A comprehensive baseline survey of sedimentary facies and contaminant levels in the surface and sub-surface sediments across northern Swansea Bay has not been undertaken, and uncertainty therefore remains regarding the potential for release and redistribution of contaminants outside the sampled areas.’ This could have a negative impact on marine life.

13.5 The Council is also aware that fishing interests on the River Tawe have expressed concern about the possible effects of the development on salmon and sea trout (sewin) fisheries.

13.6 As juveniles going to sea and as adults returning to spawn in the river of their birth, salmon and sea trout have to migrate through Swansea Bay, past the lagoon and its turbine array. Fishing interests and Natural Resources Wales have indicated in their representations to the ExA that in their opinion the applicant’s Environmental Statement is flawed and inadequate.

13.7 Salmon and sea trout fishing rights on the River Tawe, including those owned by the Council itself, are mainly managed by not-for profit clubs which make the fishing readily available at modest cost to the local community and the general public. In some areas the clubs have purchased the fishing rights, whilst in others they pay landowners (including the Council) for the rights. For example, Pontardawe and Swansea Angling Society manages the fishing on about 8 miles of the lower River Tawe (some owned, some leased) and has 300 members of all ages. Younger members pay £5 or £10 a year, disabled and senior members pay £20 a year and other adults pay £60 a year for the right to fish the club's waters. Other clubs have similar arrangements.

13.8 Fishing interests state that over the 10 years 2003-2012 the Tawe was ranked 7th in Wales for salmon catches and 18th in Wales for sea trout catches.

13.9 Salmon and sea trout are important species and the Council recognises the value of these fisheries, not just to their owners but to the community in general (as described, for example, in "Fishing For Answers – The Final Report of the Social and Community Benefits of Angling Project, 2012"[1]).

13.10 The Council requests the Examining Authority to:

- Attach importance to the representations of River Tawe fishing interests and Natural Resources Wales;
- Ensure that the applicant's environmental statement as to fisheries is examined critically;

- Ensure that robust mitigation and monitoring arrangements are put in place, so that harm can be minimised but detected if it occurs; and

- Ensure that adequate mitigation arrangements for fishing interests are secured in the DCO in case the fisheries are harmed.

14.0 Marine Mammals and Turtles

Local Issues and Adequacy of Application/DCO

Grey Seals

14.1 Grey seals (Chapter 10 paragraph 10.4.7) travel large distances and are present on the Gower and Swansea coasts. They are features of the Pembrokeshire Marine SAC, the Cardigan Bay SAC and the Pen Llyn a'r Sarnau SAC. No reference has been made to Carmarthen Bay and Estuaries European Marine Site (Carmarthen Bay and Estuaries SAC). Although grey seals are not listed as a feature of the site, they are present and there may be possible links to grey seal populations on the Pembrokeshire islands or North Devon and Cornwall coasts. The possible effects of the construction of the lagoon on these should be considered in the HRA. There is no evidence in reports to show that there will be no significant effect.

14.2 CCS remains concerned that this document reflects a lack of consideration about:

- Seals in this area possibly being part of a genetically distinct sub population of grey seals and so requiring regional rather than national or international risk assessment.
- The fact that there are a relatively small number of seals in the Swansea Bay area, which increases the significance of potentially negative impacts upon them. Even if a small number of seals are affected relative to the world population, the regional effects will be proportionally huge.
- That monitoring (of live and dead animals) which need to be extremely spatially and temporally comprehensive and very frequent to ensure that it will be statistically robust, with enough power to detect effects in the light of apparently small numbers of seals over apparently temporary time scales.
- The model of ADDs to be used.

Harbour Porpoises

14.3 It is known from scientific research (eg. Jenkins & Oakley, 2013) that harbour porpoise use Swansea Bay on a regular basis, and that calves have been observed on a seasonal basis. Harbour porpoise are a European Protected Species and are listed in Section 2 of the Conservation of Habitats and Species Regulations (2010) and are afforded legal protection, under section 41 of the regulations. Because of the lack of specific land-based surveys in the central part of the bay or dedicated vessel transects within the bay as a whole, the data presented does not explain porpoise habitat use or the location of critical habitats within the Bay.

14.4 The data also does not explain what likely impact the destruction of the herring spawning ground might have, herring being an important prey item for porpoises. The Environmental Statement fails to indicate that the lagoon construction will not be detrimental to the maintenance of porpoises in favourable conservation status (section 9b CHSR 2010).

14.5 With reference to paragraph 10.4.2.10 of the Environmental Statement and the reference to the Jenkins and Oakley (2013) report, raw data was analysed and a summary report provided specifically for the Swansea Bay area (a wider study area was investigated from Port Talbot Docks to Carmarthen Bay/North Gower). The raw data are not included but neither is it for most other reports, none of which have needed to be validated. It is confusing as to what exactly the statement ‘the supporting data would need to be reviewed’ means. The study has been reviewed and analysed by professional Researchers at the University of Wales Trinity St. David.

14.6 With reference to paragraph 10.7.0.4 of the Environmental Statement, the C-POD surveys began in 2014, as a long-term acoustic monitoring programme but it is not stated how long this will continue. This will only provide presence/absence data and not any behavioural data. Acoustic monitoring should accompany dedicated long-term land-based and vessel surveys (specifically within coastal Swansea Bay

rather than offshore where some data is available). It is stated that the results of acoustic monitoring will inform the subsequent monitoring strategies. This data cannot be included after the EIA/ES have been written and submitted. CCS would suggest that these surveys should have already been undertaken and form part of Chapter 10. Also, if, as stated, monitoring is to continue during construction and operation – it is unclear how this could be assured for 120 years.

14.7 With reference to paragraph 10.7.0.6 of the Environmental Statement, an appropriate package of adaptive mitigation and monitoring to reduce collision impacts will be developed as outlined in Chapter 23. This 'package' should be outlined and included in full as part of Chapter 10 of the Environmental Statement.

14.8 The proposal for acoustic deterrent is not outlined in sufficient detail for either fish or marine mammals. It is important that marine mammals do not become habituated to these deterrents. Other than acoustic monitoring, there is no mention of any visual surveys from land or vessels to monitor habitat usage and critical areas.

14.9 No provision is made for recording and monitoring any collision events .There is no strategy included to describe measures to be taken to deal with carcasses nor are there any details of what measures can be put in place to prevent collisions or near misses from happening again.

14.10 For the capture and release of trapped marine mammals, only seal pups are mentioned. There are no procedures identified for harbour porpoise entrapments? As described in Table 10.12 of the Environmental Statement, there is low confidence in collision risk with turbines and noise disturbance during the construction phase therefore the full mitigation measures must be described.

14.11 Strandings data does not appear to have been considered. Evidence for this is available from Marine Environmental Monitoring/CSIP.

14.12 With reference to section 8.2.1.2 of the Environmental statement, surveys undertaken by Researchers at UWTSD Swansea from 2010-2013 indicate that the location with the highest level of harbour porpoise calf sightings was Port Talbot harbour with 22% of all sightings (Oakley & Jenkins, 2014 in press). In view of this and the conclusions from Jenkins and Oakley (2013) report regarding the importance of inshore habitat for porpoise off Tutt Head, Mumbles and Port Talbot docks, it is not clear why only Mumbles in the west is a designated control site for C-POD deployment monitoring and there is no C-POD across the east of the Bay near Port Talbot to monitor this important habitat.

14.13 In the view of CCS, due consideration must be given to timings of construction, particularly in terms of piling and underwater noise pollution, based on seasonal distribution of particularly harbour porpoise mothers and calves. Oakley and Jenkins (2014, in press) note that 38% of all calves sighted across the study area of Port Talbot Docks to Burry Holms, Gower were during the April to September calving period. Other research using TPODS/CPODS has indicated high levels of night-time presence of harbour porpoise. Therefore, if

night-time piling operations are undertaken, monitoring for marine mammals must be considered together with mitigation measures.

14.14 There have been a number of potential impacts on cetaceans from wind wave and tidal developments (Dolman and Simmonds 2010) (Ensuring adequate consideration of cetaceans in Scotland's ambitious marine renewable energy plans Report SC/64/E3. WDCS, Chippenham, Wiltshire). These include increased noise, physical interactions, habitat changes, increased contamination and effects on prey. These authors have suggested that in order to assess impact, plan mitigation and protect the affected species, the following advice should be followed:

- Two years' data collection must be considered as a minimum baseline requirement. This data must help the implementation of the plans through an adaptive management process. It is essential that thorough impact monitoring that is appropriate and adequate for harbour porpoise, grey seal and other marine mammal species found in the area is carried out. Little attention has been paid to understanding potential impacts. Before any development site is determined and construction commences, it is very important to fill data gaps with information from detailed local baseline studies, particularly how cetaceans are distributed and how they utilise their habitats within Swansea Bay.
- To identify whether or not changes in abundance or distribution are the result of adverse impacts from development, data is required that allows for identification of such trends. Considerations should include direct effects on cetaceans as well as indirect effects on prey species.
- A strategic approach to understanding and filling the data gaps of marine species is required. Development of broader monitoring programmes then the development site itself will help to ensure cumulative and in-combination impacts are accounted for and monitored.
- Mitigation alone cannot be guaranteed to overcome biodiversity issues, especially where those mitigation measures are not tested and so may not be effective.
- European Protected Species licenses for any pile-driving or other licensable activities should not be provided until all disturbance requirements resulting from the EU Habitats Directive have been adequately satisfied.
- Acoustic Deterrent Devices (ADDs) introduce additional noise pollution to important cetacean habitats. The use of ADDs to minimise injury from pile driving has yet to be tested so remains unproven as a mitigation measure. ADDs should therefore not be widely advocated.
- The zone of behavioural disturbance may extend considerably beyond 20km for harbour porpoise (Tougaard et al, 2009). As a result, monitoring of behavioural impacts should be conducted to adequate distances.
- Little information exists about how marine mammals will interact with new structures being placed in the water column. With monitoring, particularly if strandings occur as a result, other significant impacts may still come to light.

14.15 It is the view of CCS that the results of monitoring and mitigation studies should be fed back into the decision making process to further develop mitigation and management decisions. CCS does not consider that the application fully addresses the above issues, in order to allow for considered judgement of the affect of the lagoon on cetaceans.

14.16 It is stated in paragraph 8.5.2.4 of the Environmental Statement that an appropriate reporting mechanism will be set up to report collision events and near misses. If this is to be included as monitoring then in the view of CCS the process must be developed prior to inclusion in this appendix and stated in full within this section.

15.0 Coastal Birds

Local Issues and Adequacy of Application/DCO

15.1 The Blackpill SSSI is designated for its nationally important overwintering wildfowl (particularly sanderling and ringed plover) and consists mainly of fine intertidal sediments. The uncertainty therefore in the coastal process analysis makes an assessment of possible effects difficult. Small changes in sediment movement particularly over a long time span could have a significant negative effect.

15.2 The effect of increased mud deposition would be to restrict the mobility of the sand bars if mud drapes are formed on the bars and/ or the movement of sand across the surfaces between the bars are reduced as exposures of 'hard' peat and consolidated mid Holocene muds become progressively buried by new mud deposits. Such changes could have implications for the in-fauna and birds as well as affecting the exchange of sand between the upper beach and the lower sub-tidal areas. (KPAL Report No: 160995.)

15.3 There is no certainty that the pairs of lapwing and little ringed plover will simply relocate. They are a significant population in local terms and would suffer disturbance for the length of the construction phase. Suitable mitigation should therefore be provided.

15.4 The bay is also used by a nationally significant population of great crested grebe which could be adversely affected by a loss of feeding opportunities through destruction of herring spawning ground and through displacement. 'The predicted reductions in high tide levels (e.g. Environmental Statement Figure 6.42), current speeds (e.g. 6.34) and wave heights (e.g. Figure 6.45) suggest that there is a significant risk of increased mud deposition and accumulation across a much wider area, especially within the sheltered areas leeward of the higher intertidal sand bars.This could have significant impacts on coastal birds,their prey and the intertidal habitat these species depend on.

15.5 There may be a transfer of birds in particular oystercatcher, dunlin and curlew between Blackpill SSSI and the Burry Inlet SPA. These birds are features of the Burry Inlet SPA. If the Blackpill SSSI undergoes geomorphological changes due to the lagoon construction there may be a significant effect on the features of the SPA and this should be assessed.

16.0 Terrestrial Ecology

Local Issues and Adequacy of Application/DCO

16.1 There is no mention of the Swansea Bay Site of Importance for Nature Conservation (SINC) and no map of the SINC boundary included as a local designation. The map and citation is therefore provided here as **Appendix F.** SINC habitats and species are not mentioned.

16.2 The Swansea Bay SINC supports a number of section 42 (NERC Act 2006) habitats and species including seastock and small-flowered catchfly which is regarded as "vulnerable to extinction" in Wales. This is probably the last remaining population of small flowered catchfly in the Vice County of Glamorgan. listed as Endangered (IUCN, 2001) and Nationally Scarce.

16.3 There is no mention of invertebrate surveys, nor reference to the presence of Section 42 invertebrates including sand dart moth and robber-fly in the Black Pill SSSI and the SINC in Swansea Bay. It is considered that the Environmental Statement should include a discussion of the strandline habitat across Swansea beach within the chapter on terrestrial ecology (section 12.4.5.28). Only the strandline at Crymlyn Burrows SSSI has been outlined.

16.4 In order to assess the impact of the proposal terrestrial ecology, it would be useful to have a quantitative estimate of losses and gains of Section 42 habitats and species.

16.5 There is likely to be an increase in tidal flooding risk as a result of the Lagoon construction and even if relatively small, this could have a negative affect on section 42 habitats and species.

16.6 There is also considered to be a need for an Invasive non native species strategy referring to terrestrial species.

16.7 A reptile mitigation scheme needs to be agreed. There may be significant numbers of animals involved.

16.8 Whilst the Environmental Statement considers the effect on the westerly sand dunes and the sediment in the Black Pill SSSI to be minimal, there is however, still uncertainty attached to the sediment modelling and accordingly this conclusion may not be valid.

Crymlyn Bog SAC

16.9 Airborne pollution produced as a result of construction may reach Crymlyn Bog. The bog is very sensitive to changes in nutrient status brought about by fall out of airborne nitrogen compounds; an assessment of this should form part of the Habitats Regulations Assessment.

Swansea Bay

16.10 There is no mention of the draft Swansea Bay Environmental Management Plan (Commons Vision 2014) which is available from CCS. The predicted increase in visitor numbers is likely to put increased pressure on the fragile habitats within the bay, and will require additional management resources to prevent additional adverse environmental impacts.

17.0 Mitigation and Monitoring in Respect of Coastal Processes, Sediment Transport and Contamination; Intertidal and Subtidal Benthic Ecology; Fish; Marine Mammals; Coastal Birds and Terrestrial Ecology

17.1 With compensatory measures there are many gaps and uncertainties in the reporting. Further investigation and study is required which would possibly reduce the associated risk. Assessment of possible compensation measures depends on the accuracy and robustness of all the preceding assessment processes with the potential for uncertainties to become magnified. The findings should therefore be treated as indicative and would require further development in light of more detailed understanding.

17.2 Like for like compensation requires proportions of habitats to at least reflect the areas lost and to ensure the same degree of ecosystem structure, function and quality. Provision needs to be made for monitoring to ensure that it is achieved and if it is not, for further supplementary compensation measures to be adopted.

17.3 It is difficult to support claims of assessment of effects and provide adequate mitigation with the level of uncertainty in the coastal processes report. Therefore, it is the view of CCS that the precautionary principle should apply.

17.4 There is a significant risk from invasive non native marine and terrestrial species .There is a need for a full assessment of the risks involved and a strategy to deal with them.

17.5 'In view of potential concerns regarding the potential impacts of the development on the beaches, intertidal flats and adjacent sub-tidal areas of north western Swansea Bay, including possible impacts on windblown sand hazard, mud accretion / saltmarsh development and dredging requirements in the Tawe barrage impoundment, it is suggested that a more extensive programme of pre-construction baseline data acquisition and subsequent monitoring should be agreed with the applicant, and other bodies including Natural Resources Wales, if a DCO is granted. Specific thresholds of change should be agreed which trigger further action in terms of mitigation / compensation / remediation.

17.6 From the viewpoint of physical processes and sediments, the following should be undertaken:

- A baseline LiDAR and comprehensive swath bathymetric survey of the whole of Swansea Bay before any construction activities commence.

- Repeat LiDAR / swath bathymetry surveys at 5 yearly intervals to allow quantitative assessment of changes in beach sediment volume.
- RTK GPS surveys of additional beach profiles to be established between the existing Swansea Bay and Carmarthen Bay profiles line shown in Figures 2 to 5.
- Bathymetric surveys to monitor sediment accumulation in the impoundment above the Tawe barrage.
- Aerial photography surveys at 5 yearly intervals to monitor changes in morphological features and vegetation extent (e.g. saltmarsh).
- A comprehensive sediment characterization study of Swansea Bay, involving a minimum of 200 sampling points across the whole of the sub-tidal and intertidal area; samples should be taken from the surface and from specified depth intervals below the sea bed.
- Repeat sediment sampling at 5 yearly intervals in a reduced number of targeted locations.
- Continuous water level, wave and tidal current monitoring in at least two locations within northern Swansea Bay (e.g. using smart buoys).
- Installation of a weather station (including anemometer) at the control centre on the lagoon wall.

17.7 Agreement should also be reached regarding responsibility for any actions which may be required to tackle potentially adverse impacts such as increased windblown sand hazard, increased dredging requirement, improved coast protection / flood defence, and control of invasive saltmarsh vegetation (eg cord grass). Additional agreements should be made in relation to habitat and species monitoring / mitigation.'

17.8 A comprehensive baseline habitat and species survey should be undertaken prior to any work starting on site and a programme of ongoing monitoring agreed with CCS.

17.9 The possibility of translocating *Sabellaria* successfully is uncertain and there is no published literature on such an attempt. This needs more consideration, particularly because of the high proportion of this section 42 habitat that will be affected and because of its association with the herring spawning ground.

17.10 The selection of receptor sites within Swansea Bay has not been fully considered and there have been no actual trials undertaken on a local level. A full feasibility study and extensive research is therefore required. The statement therefore that "the potential for the successful rehabilitation of this reef habitat exists although approaches are experimental" – is not acceptable to CCS. With regards to Table 8.10 it is questioned how can the confidence level be 'High' when there have been no successful *Sabellaria alveolata* translocation projects in the UK? To be considered as a mitigation method the process should be known to be successful.

17.11 Public access to areas of mitigation e.g. salt marsh and new sand dunes will significantly reduce their ecological value. This issue needs to be addressed to ensure disturbance is minimised.

17.12 Some habitats are very difficult to mitigate or compensate for e.g. mud flats that are used by overwintering wildfowl. There have been historic losses of intertidal habitats in Swansea Bay and Cardiff bay, any further loss is unacceptable. It is the view of CCS that there needs to be a clear statement of how these losses can be compensated.

17.13 There is a need for a detailed long term monitoring particularly as there are uncertainties with the sediment transport modelling. There also needs to be an adequate plan to compensate for any adverse changes that are identified.

17.14 The assumptions within the report are wide-ranging and there is considered to be insufficient linkage between the findings for each section, for example fish with marine mammals

17.15 If, as anticipated, there is a medium to longer term increase in total sand volume in the intertidal and supra-tidal areas between St Helen's and the Civic Centre, the existing problem of wind-blown sand incursion onto the promenade, Oystermouth Road and into the Civic Centre west car park (Pye & Blott, 2012, 2014a,b) is likely to become worse. This would potentially result in increased maintenance costs associated with removal and disposal of sand from the promenade, road and car park, and increase the safety risk to pedestrians, cyclists and motorists. This should be addressed by way of financial contribution in the Section 106 Obligation.

17.16 The applicant's response to the ExA's Section 51 Advice outlines a number of potentially significant decisions with regard to the environmental impact assessment. However, as detailed submissions are not available at the time of writing this report, it is not possible to make a detailed assessment. The most significant points identified by Kenneth Pye Associates on behalf of CCS are:

I. Notwithstanding the comments below regarding water quality, the decision to abandon the option of the UV water treatment plant in favour of the option of extending the storm water / treated effluent outfall beyond the Lagoon footprint is in itself a potentially significant engineering scheme which has not been subject to any kind of assessment in terms of its impact on coastal processes, sediments and potential contamination. The potential impacts are likely to depend on the design and method of construction – e.g. whether by open cut trenching followed by burial of the pipe, or construction of an exposed pipe on piers across the sea bed. More details should be required from the applicant and a full coastal processes / ecology / navigation risk assessment undertaken. An extended, exposed outfall could potentially have major effects on hydrodynamics and sediment transport during both construction and operation.

II. The potential impacts during the construction and removal phases of the decision to build a cofferdam around the turbine housing construction area using 'sediment berm, Geotubes and rock armour' technology, rather than sheet piling option have not been modelled or subject to any other kind of physical processes / sediment assessment. This would appear to be a substantial task which would take some time to complete; the effects of sediment dredging, filling of Geotubes and rock emplacement, followed by at least partial removal, needs to be fully assessed by further modelling and possibly by geotechnical investigation and sediment testing.

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18.0 Marine Water Quality Assessment

City & County of Swansea Unitary Development Plan

18.1 Policy HC31 states that opportunities for the development of water based recreation facilities will be supported, subject to their compatibility with environment and nature conservation interests, water supply, commercial shipping and flood defence at locations including:

- Inland waterways – rivers, dock system and canals;
- Coast and estuary – including Swansea Bay, Oxwich, Port Eynon.

18.2 Policy EV34 states that development proposals that may impact upon the water environment will only be permitted where it can be demonstrated that they would not pose a significant risk to the quality and or quantity of controlled waters. Initiatives that lead to improvements in the quality of surface water will be approved subject to satisfactory ecological and visual safeguards.

Key Issues

18.3 N.B. These comments are made in respect of the amended application which removes the option of ultraviolet ("UV") disinfection of the storm water intermittently discharged through the existing long sea outfall in favour of extending the existing outfall from Welsh Water Treatement Works by 1.5km such that it is located, and therefore discharges, outside the perimeter of the lagoon. The concerns of the Council in respect of the UV treatment option within the lagoon do not therefore form part of this LIR.

18.4 The Council's Pollution Control & Public Health Division has identified the effect of the tidal lagoon on bathing water quality and in particular, the potential loss of the current prediction method, which is used to protect public health on an otherwise failing beach as the most important issue affecting the Division.

18.5 CCS regards the compliance of Swansea Bay as a very important issue. This is for economic regeneration reasons, for legal reasons, for socio-political reasons as well as the fundamental reason behind the revised bathing water Directive (2006/7/EC) – that is to protect public health. For a period of years the council was seeking help to fund the necessary fieldwork to create a successful predict and protect model which could be used in this context, in line with World Health Organization (WHO) Guidelines for Safe Recreational Waters 2003 (WHO Guidelines 2003) and to comply with the revised Directive. Eventually, through a Interreg ('Inter-regional') bid (the Ireland Wales Territorial Co-operation Programme 2007 – 2013), CCS was able to access over €4 million of public money to investigate this issue and successfully deliver a predict and protect model capable of coping with an extremely complex bay. This approach has been successfully used for Swansea Bay and is successfully using the 'discounting rules' in the Directive to change its current status from 'Poor' to 'Sufficient'. This is of major significance to the Council as it is promoted as the 'waterfront city' and much of the regeneration efforts over the last 20 years have been to refocus on the Bay and the Maritime quarter. Without this approach to the revised Directive, the Council would have to publicly sign Swansea Bay as a failing beach with very obvious swimming prohibition signs and similar information on the Internet by 2016. Apart from these important concerns, there would also be the potential for infraction proceedings for the continued failure of Swansea Bay as a designated bathing water under the Directive.

18.6 Critically, this approach is very much in line with the fundamental ideas behind the WHO Guidelines 2003, which led to the revision of the bathing water Directive. It was considered likely by WHO, in preparing the 2003 Guidelines, that in many bathing waters, there would be various sources of faecal indicator organisms (FIOs) and it would not always be possible to eliminate all sources of pollution, through remedial engineering of sewerage infrastructure alone, thus, to guarantee compliance at all times. For some years in Scotland, the Scottish Environment Protection Agency (SEPA) has used predictive models, based on local river flow and rainfall data, to predict when a nearby bathing beach may fail and sign it accordingly.

18.7 This type of 'black box' model approach has been promoted by the WHO and the EC principally in recognition of its potential to protect bathers from poor water quality during storm events. This is not a process based hydrodynamic model which can take many hours to days to complete a full complex simulation. The 'black box' approach examines statistical relationships between environmental predictor variables, based on real 'empirical' field data, allowing a sound prediction to be made quickly to give the public an informed choice of whether to swim at that time or not. There have been some attempts to produce statistical models based on weekly compliance data and predictors such as, rainfall, river flow, wind and tide etc. These models generally produced low predictive power and early trials in Swansea confirmed this. Hence, it was felt by CCS and its partners that this approach required a better scientific foundation provided by a high quality dataset of both the FIOs in the bathing water and the various natural predictors.

18.8 The Interreg funded 'Smart Coasts' project in Swansea Bay delivered exactly what had been hoped for. From 2010 until this year, CCS and its partners have managed to develop a model that accurately predicts the excess risk of gastrointestinal illness (GI) from bathing in Swansea Bay. This uses the well-established epidemiology that underpins the Directive and WHO Guidelines 2003 and uses as its threshold a 10% risk of GI, which is the same as the threshold for dropping into the Poor classification. This brings together the science behind the revised standards and the epidemiological research that underpins that work so that public health is protected and the regulator can apply the discounting rules to compliance samples taken at times when the beach is signed accordingly. CCS partners included Dŵr Cymru/Welsh Water, Natural Resources Wales, Aberystwyth University, University College Dublin and Cardiff University.

This project has been presented in detail to Welsh Government, Defra, Public Health Wales, Examining Authority, Scottish Environment Protection Agency (SEPA) and others and can be supported by fully documented reports (Statistical modelling of faecal indicator organisms at a marine bathing water site: results of an intensive study at Swansea Bay, UK – A report from the Interrag 4a Smart Coasts – Sustainable Communities Project August 2013) (Interrag Report). The selected model, which explained almost 80% of the variance in water quality, uses real-time environmental data, from meteorological and river gauging stations to drive the beach signage outcome. A copy of the Interrag Report is provided as **Appendix G.**

18.9 The black box model used in Swansea Bay since the start of the bathing season 2013 has performed successfully and is principally driven by ultraviolet (UV) solar radiation and tidal height. The other parameters necessary to run the model, currently using an Excel workbook, include flows in the Clyne River, extraterrestrial radiation, two other river flows into the bay and wind speed. This model predicts intestinal enterococci (IE), which was selected rather than *E. coli*, as IE allows prediction of a GI risk outcome. Some observers may be surprised that rainfall was not a strong predictor of water quality. However, the detailed IE data collected for the modeling exercise did exhibit a strong diurnal pattern throughout the bathing season, consistent with solar radiation input (and observations at other sites world-wide which have been so intensively sampled). This pattern was also present regardless of other conditions (e.g. rainfall), producing a considerable variation in water quality within each day. It was clear that for discounting to work in a Bay as complex as Swansea, a rapid application black box type approach was essential. It is the intention of CCS to move from running the model manually three times a day, to an automatic system operating an electronic sign on an hourly basis, which will have two standard messages - one for good water quality and one advising against bathing. CCS intends the system to operate from 09.00 to 20:00 BST in the same way as SEPA.

Adequacy of Application/DCO

18.10 It was always accepted by the Council that if the lagoon was consented there would be a period during construction when the black box model may become less accurate and would require re-calibration as soon as the lagoon construction was completed. Initially, the applicant indicated their willingness to fund that work, but, on the basis of an estimate of the fieldwork costs of circa £400k at 2017 prices for re-calibrating only the black box model was unacceptable.

18.11 The above referenced Interreg project reports suggest that the application cannot claim that it is simply a question of removing more sewer misconnections or carrying out more capital improvements and Swansea Bay will be compliant solely via the corresponding AMP programs as stated in paragraphs 7.4.2.6 and 7.4.2.18 of Chapter 7 of the Environmental Statement. Indeed, at a meeting of the project partners and the water company's consultants it was agreed that using the predict and protect model approach to discounting was essential to achieve Directive compliance. It must be borne in mind that the Revised Directive 'Sufficient' classification is temporary and using the 'Black Box' approach to 'discounting' will be even more important as achieving 'Good' status in Swansea Bay will be a huge challenge.

18.12 Chapter 7 of the Environmental Statement describes the black box model as a statistical correlation although it incorrectly states it is not a predictive model. It is specifically developed to provide real-time prediction of faecal indicator concentrations and thereby, the excess risk of GI. It clearly cannot define causality as it is a statistical model, however the predictors in the model do demonstrate plausibility (e.g. solar radiation variables are inversely related to IE concentration).

This does mean that it cannot attribute effects to sources (which it was not designed to do), but also that means that one should not assume that it will over predict after certain improvements or that it is more sensitive to these changes than to the construction of the lagoon (paragraph 7.4.2.24 of the Environmental Statement). It should also be noted that connectivity from riverine sources to the DSP suggested by the black-box prediction model has been confirmed by dedicated microbial tracer studies.

18.13 It is considered likely that a project as large as the tidal lagoon may change the offshore processes sufficiently to require a different set of predictors to run a black box model after construction. However, given the explanation of how it works, it is not considered sensible to try and second-guess how accurate it may be in the future after such a major change, or how many decades of natural change would require revalidation. What does seem probable is that it is not that sensitive to the infrastructure network improvements, given that the main predictors are fundamental natural processes affecting the survival of FIOs.

18.14 It is therefore the Council's position that unless there is a paradigm shift in the science around this subject, CCS would expect any consent for the tidal lagoon to require sufficient fieldwork (i.e. comparable to the presently available model calibration resource) to be undertaken at the applicant's expense so that a high quality predictive statistical model can be maintained with the same degree of explained variance as the current model.

18.15 With reference to the issue raised in the application on the future use of hydrodynamic models around the lagoon, given the variability of microbial concentrations on any given day in the bathing season and given the strong relationship with UV, it is respectfully considered as misleading to suggest, as the applicant does in Chapter 7 of the Environmental Statement, that somehow after construction some version of a storm impact model can be modified to continue this function. This model uses multiple runs of a hydrodynamic model to provide a library of scenarios which can be used to simulate a given future state of weather and tides quickly, thus to drive water quality prediction at a site. However, it should be appreciated that the hydrodynamic model predictions are only as good as the calibration and validation data on which they are based. In the case of Swansea Bay, the previous hydrodynamic models have been very significantly improved by access to the uniquely rich model calibration data afforded by the Smart Coast Interreg project which were shared with Dwr Cymru/Welsh Water and its modelling contractor at an early stage. The costs of this data acquisition exceeded £1.5m. However, even the best hydrodynamic models still have, as yet, not proven competent to simulate the diurnal variability in microbial concentrations observed at Swansea Bay's bathing water compliance site – although this is actively being investigated as part of the Interreg project.

18.16 It is considered likely and highly probable, that the proposed lagoon would significantly change the hydrodynamic behaviour of water flows within Swansea bay. This would compromise the utility of any hydrodynamic model calibration data collected to date.

Thus any future hydrodynamic model build needed to drive a Storm Impact modelling approach would need to replicate the extensive calibration data acquisition, paralleling the Smart Coast programme scope and costs to ensure that the hydrodynamic model produced was equivalent to the present models produced for Dwr Cymru/Welsh Water. If this was not done, and most importantly, appropriate funds not committed (i.e. it is likely that similar to the Smart Coasts £1.5m plus inflation would be needed), any hydrodynamic modelling used to underpin the storm impact approach would prove insufficiently precise in predicting faecal indicator organism concentrations at the Swansea Bay designated sampling point (DSP). Even then, there are significant difficulties in delivering any hydrodynamic model which could approach the 80% explained variance achieved by the existing black box model. However, CCS is open minded and happy to use the best predictive system, post construction, but would need the decision to be based on a 'back to back' trial with a fully transparent analysis of the comparative statistical power of any future approach, undertaken by an independent expert. It should also be noted that the current approach was publicly funded and is 'open – source' whereas the 'storm impact model' would be a commercial product and may not be freely available on a daily basis to the Council or Natural Resources Wales.

18.17 A further point raised by the Council's Pollution Control & Public Health Division is that the existing emergency short outfalls from Welsh Water's Sewage Treatment Works are not really taken into account. These would discharge into the lagoon directly, should there be a major problem. It is considered that this should be taken into account in a management plan for the lagoon users and will need Natural Resources Wales involvement to resolve at the same time as they deal with the existing old Queens Dock outfall, which discharges small amounts of untreated sewage into the lagoon area.

18.18 The final comment from the Council's Pollution Control and Public Health Division is in relation to the Water Framework Directive Assessment (Doc. 8.5). It is noted that the map used (section 3.2.0.4) to show the boundaries of the transitional water body for the Tawe Estuary does not appear to include the correct upper limit. The Tawe is tidally influenced as far upstream as Beaufort Weir at least. Also the impoundment itself is made up of 70% direct from Swansea Bay. Hence consequences of any dredging activity downstream could have implications within the impoundment and a significant distance up the Tawe.

19.0 Land Quality and Hydrogeology

City & County of Swansea Unitary Development Plan

19.1 Policy EV34 states that development proposals that may impact upon the water environment will only be permitted where it can be demonstrated that they would not pose a significant risk to the quality and or quantity of controlled waters. Initiatives that lead to improvements in the quality of surface water will be approved subject to satisfactory ecological and visual safeguards.

19.2 Policy EV38 states that development proposals on land where there is a risk from contamination or landfill gas will not be permitted unless it can be demonstrated to the satisfaction of the Council, that measures can be taken to satisfactorily overcome any danger to life, health, property, controlled waters, or the natural and historic environment.

Local Issues

19.3 Swansea Bay has operated as the main sink, for over 300 years, of very significant contamination by almost all the heavy metals. Swansea was the metallurgical world centre for the nonferrous metal smelting industries throughout the 17 and 1800s. A huge amount of contamination ended up in the River Tawe or the local canal systems. Much of this eventually ends up in Swansea Bay sediments.

Adequacy of Application/DCO

19.4 It is acknowledged as very difficult to come up with a sampling strategy that adequately describes the current situation at a reasonable cost. It is however a reasonable assumption that particularly during construction, it is possible that the production of shellfish for human consumption may need to be prohibited by the Food Standards Agency. It is accepted that this could be regarded as a temporary problem, which could be inevitable given the scale of construction, but CCS Pollution Control & Public Health Division has limited confidence in the approach that the various hotspots will be suitably diluted and will not accumulate in local filter feeders. In these circumstances it is considered reasonable to suggest a further risk assessment of the various pathways for the toxic or ecotoxic metals prior to agreeing a detailed dredging and construction plan. The application implies an iterative process but it needs to be clearer that the aim is not just 'geotechnical' but is also designed to avoid mobilizing metals where ever possible.

19.5 A similar lack of confidence exists around the discussion of contaminated land, particularly on land previously occupied by BP in and around the Queens Dock. A very limited remediation project is underway dealing with fairly serious and obvious contamination which has actually released free hydrocarbons into the intertidal zone. It is likely that there is much more widespread contamination around the Queens Dock area which would need to be properly assessed. This needs the usual type of conditions, agreed by ourselves and NRW, which can be properly enforced (not as outlined in the schedule of draft conditions).

Remobilization of Contaminates Sediments

19.6 On this subject area, the KPAL Report No: 160995 refers to the Environmental Statement, which concludes that there will be no significant risk of contaminant remobilization associated with dredging of sediment for construction of the Lagoon since none of the samples analyzed exceeds Cefas action level 2 for any specific contaminant (paragraph 6.4.4.5 of Chapter 6).

However, this conclusion is based on the collection and analysis of a very limited number of sediment samples, most from the surface or shallow depth and largely excluding the intertidal areas of the Bay (see Figure 6.16 of the Coastal Processes Chapter, Figure 4.7b of the Marine Ecology chapter and the summary Figure 6 in this report). As noted in paragraph 6.4.4.1 of the Environmental Statement Chapter 6, "Across the wider Swansea Bay region, and specifically within the footprint of the proposed Lagoon, there is a general paucity of historic sediment quality data".

19.7 Environmental Statement Appendix 6.3 provides a summary of the particle size analysis and contaminant analysis performed on sediment samples collected during the sub-tidal benthic survey and the geotechnical investigation (Atkins, 2013; Titan 2012b, 2013a,b; EGS, 2013). The total number of samples analysed for particle size and composition is very small for a project of this scale and does not give a comprehensive picture of the surface or sub-surface sediment character in the northern part of Swansea Bay. No sampling or analysis has been undertaken in the intertidal and supratidal beach areas of northwest Swansea Bay. No investigation has been carried out of the thickness of superficial sediment in these areas, or the sedimentary characteristics and chemical composition of older sediments which underlie them. A comprehensive baseline survey of sedimentary facies and contaminant levels in the surface and sub-surface sediments across northern Swansea Bay has not been undertaken, and uncertainty therefore remains regarding the potential for release and redistribution of contaminants outside the sampled areas.

20.0 Onshore Transport Assessment/ Highways, traffic, car parking, access and pedestrian movements

City and County of Swansea Adopted Unitary Development Plan

20.1 UDP Policy AS1 requires new development associated with housing, employment, shopping, leisure and service provision to be located in areas that are currently highly accessible by a range of transport modes, in particular, public transport, walking or cycling, on in areas where a good level of such provision can realistically be achieved.

20.2 Policy AS2 states that new developments should be designed to:

I. Promote the use of public transport and facilitate sustainable travel choices,
II. Provide suitable facilities and an attractive environment for pedestrians, cyclists and other non-motorised modes of transport,
III. Allow for the safe, efficient and non intrusive movement of vehicles, and
IV. Comply with the principles of accessibility for all.

20.3 The means of access to new developments should be designed to ensure that vehicle speeds are minimised, extraneous traffic is not attracted and impacts on the natural, historic and built environment and local communities are minimised.

20.4 Policy AS4 seeks to encourage the creation or improvement of public access routes whilst Policy AS5 states that development proposals will be required to consider the access requirements for pedestrians and cyclists and, where necessary, provide appropriate facilities and/or infrastructure to encourage their use.

20.5 Policy AS6 states that parking provision to serve development will be assessed against adopted maximum parking standards to ensure that proposed schemes provide appropriate levels of parking, including motorcycles and cycles.

20.6 Policy AS10 states that new developments will be required to incorporate appropriate traffic management measures to mitigate against significant adverse impacts that would otherwise be caused by traffic movements.

20.7 Policy EV3 of the UDP requires new development proposals to provide access and facilities for all; provide satisfactory parking in accordance with Council adopted design standards; contribute to a high quality public realm by improving pedestrian linkages with adjoining spaces and attractions and be accessible to pedestrians, cyclists and users of public transport.

20.8 Policy HC31 supports the development of water based recreation facilities subject to their compatibility with environment and nature conservation interests, water supply, commercial shipping and flood defence. The policy also sets out a line to be protected for the proposed link from the Tennant Canal to Swansea and for the linkage of the Swansea Canal with the navigable section of the River Tawe. It is stated that development that would prejudice the restoration of the canals or damage their fabric or infrastructure will not be permitted.

Local Issues

20.9 Highway Network: Fabian Way is an arterial road which forms part of the A483, connecting Swansea city centre with the M4 motorway at Junction 42. It is the main route into Swansea from the surrounding area and for traffic from further afield, and forms the principal object of study within the study area.

20.10 Fabian Way is a dual carriageway for its whole length in the study area. The speed limit is 30 mph between Swansea city centre and the junction with Port Tennant/SA1 Swansea Waterfront, after which the speed limit rises to 50 mph until the junction with Ffordd Amazon (Jersey Marine roundabout). The road is a standard, national speed limit, dual carriageway between Jersey Marine and the junction with the M4.

20.11 An extensive study has been undertaken on Fabian Way in order to prepare it for future traffic flows. A scheme has been prepared with a budget estimate of £25 million and all developments both in CCS and NPT that generate any traffic directly to Fabian Way are expected to contribute towards this sum of money on a pro-rata basis.

20.12 Bus services operate regularly in the vicinity of the site, with 11 services operating along Fabian Way, Elba Crescent or Baldwin's Crescent. All of these services start from Swansea Bus Station and travel between Swansea and various towns and villages to the east. Service 7 runs between Swansea Bus Station and Swansea Marina. The site can be accessed from bus stops at two locations. The first is on Fabian Way near the junction with Wern Terrace. These stops are approximately 3.7km from the western landfall, via Bevans Row and the new Lagoon access road. There is a pedestrian overbridge crossing Fabian Way providing access to the eastbound stop. The second location is near the Bay Campus, and is approximately 950m from the perimeter cycle and footpath that will run around the Project, approximately 3.3km from the western landfall, and is presently accessed from Fabian Way via Baldwin's Bridge.

20.13 There is a cycle path running along the southern side of Fabian Way between Kings Road and the junction with Port Tennant Road, which forms a section of both National Cycle Network route 4 (NCN 4) and the Swansea to Glyncorrwg Loop. NCN 4 provides links between Swansea, Neath, Briton Ferry, Port Talbot and several local villages. To the east of the Port Tennant junction the cycle path continues running adjacent to the southern side of Fabian Way and then crosses to the north via the pedestrian/cycle and bus bridge linking to the Park and Ride facility. The cycle path runs to the north of the Park & Ride site to Wern Terrace. It is then signed along a short section on Wern Terrace to the north side of Fabian Way, where is continues east to Baldwin's Crescent. NCN 4 is signed along Baldwin's Crescent and Elba Crescent until re-joining the north side of Fabian Way. It continues east to the Jersey Marine roundabout where it turns north to join Ffordd Amazon.

20.14 The existing rail sidings to the north of Fabian Way are still in use. Where the rail passes underneath Fabian Way it changes possession from Network Rail to ABP. The railway through the docks has not been in use for approximately eight years and would require refurbishment to be in a serviceable state. The railway lines within the docks also have some tight corners which may need upgrading to be usable by more modern rolling stock. The feasibility of using the rail sidings for import of construction materials has been considered and upgrade works would be required.

Adequacy of the Application/DCO

20.15 The Project is expected to employ approximately 72 staff during its operational phase, comprising 21 O&M staff and 51 staff at the Visitor Centre. Key O&M staff will work a rota ensuring coverage at all times to support the operation and security of the project. Visitor and staff car and cycle parking is included within the project area.

20.16 The project also makes provision for a shuttle bus service from the Park & Ride facility on Fabian Way, subject to investigation of its viability. No details have been provided as to the mechanism of how this may work, nor whether there is capacity in the existing Park and Ride to supplement parking for the Tidal Lagoon.

20.17 The application also refers to the provision of a water shuttle service between the western bank of the River Tawe and the lagoon but no further details have been included. (Please refer to the comments included within the Navigation and Marine Transport Assessment section of this report below.)

20.18 In terms of visitor numbers, it is anticipated that the project will attract some 70,000- 100,000 visitors a year, with national triathlon, swimming, sailing or running events occurring once or twice a year. These would be likely to attract between 2,000 and 8,000 visitors each. In preliminary discussions that have been held much larger visitor numbers were discussed and these relatively conservative figures would have a bearing on the level of the project contribution to the Fabian Way Corridor works that are proposed as joint venture between CCS and NPT and not considered to be sufficiently robust to give an idea on the level of traffic generated nor impact on the affected junctions.

20.19 In order to construct and operate the project, different types of access will be needed at different times, namely:

- Construction phase - for staff, HGV deliveries and abnormal loads (if required); and
- Operational phase - access at all times for O&M staff and emergency vehicles; local pedestrian, cycle and vehicular visitor access; visitor access from the wider area; and visitor access for major sporting events.

Access impacts during the construction phase

20.20 Much of the construction phase transport movement will be marine-based, including delivery of rock and the construction of the Geotubes®, which will use locally derived sediment from the seabed or a combination of dredge gravels and imported quarry run. This will limit construction phase impacts on the local road network.

20.21 However, some raw materials for concrete production, steel reinforcement, turbine components and other elements of the project will have to be imported by road. It has been assumed that sand required for concrete production will be obtained via Swansea Port, and that concrete will be produced at an on-site batching plant, which means that these activities will not generate any HGV movements on the external road network.

20.22 Based on these assumptions the maximum number of HGV deliveries using the local road network is expected to be 1,975/month. Based on a five and a half day working week, or 24 days in each month, this equates to an average of 82 deliveries per day. Assuming that deliveries are made between 08:00-18:00 this gives an average of 8 deliveries per hour, or 16 two-way trips. Even if the deliveries are restricted to outside of the peak hours (to minimise congestion on Fabian Way) of 08.00 to 09.00 and 17.00 to 18.00 then the resulting movements per hour would increase by 2 to 10 per hour, or by 4 to 20 two way flows.

20.23 Overall Construction phase traffic will result in an increase of 2.6% on Fabian way east and 0.7% west. In terms of HGV's there will be an increase of 12% on Fabian Way. Whilst there is anticipated to be minimal impact during the traditional peak hours there will be increase both before the morning peak and after the evening peak. The overall impact is said to be a short term minor adverse impact on the local highway network and CCS concurs with this statement.

20.24 Working hours during the construction phase have not yet been finalised. However, it is likely that there will be continuous working during some phases of construction. In terms of impact on the local highway network, the key busiest periods are the AM and PM commuter peaks, typically 08:00-09:00 and 17:00-18:00. When work is carried out in shifts, the start and finish times generally do not coincide with the regular commuter peaks. To ensure that the assessment of the impact of construction traffic is conservative it has been assumed that construction staff will operate typical daytime hours. Working hours for construction projects are typically 08:00-18:00 on weekdays and 08:00-13:00 on Saturdays. However, for safety reasons, it is expected that staff will not be permitted to drive their own vehicles close to the Lagoon seawall. Instead, transport will be provided between the site compound and the work area. Therefore, it is expected that construction staff will be required to arrive at the site compound by 07:30 in the morning, which will allow 30 minutes for transport within the site.

20.25 The implementation of the Construction Phase Travel Plan will include an access strategy for the project which will help minimize the impact of construction on all modes of transport. HGV movements will be timed to avoid peak hours and CCS request that a suitably worded condition to this effect should form part of any DCO granted. Furthermore, all HGVs will be required to travel to and from the site via the M4 and Fabian Way to avoid routing such traffic through Swansea city centre.

Impacts during operational phase.

20.26 A total of 21 staff will be associated with the operation and maintenance side (working 24 hours over shifts) whereas a total of 52 staff are to be employed to service the visitor and recreational facilities.

20.27 The project will form a new focal point as a tourist attraction within the bay and therefore an assessment of the impact on leisure related traffic has been made. In this respect, the Environmental Statement states that 'the normal weekday operation of the project will not have an unacceptable impact on local transport network. Leisure use at the site will be a greatest at weekends and therefore does not coincide with the weekday peak flows experienced on the highway network. Impact at weekends and in holiday periods is not expected to be significant.'

20.28 This statement is disputed and is of concern to CCS's Telematics Team as traffic flows in the summer holidays at weekends and lunchtimes can be in excess of the a.m. and p.m. peaks of a normal working week and hence severe congestion may arise. As some of the junctions are approaching capacity already this could result in unacceptable congestion and delays being experienced.

20.29 A suggested solution could be to install an Automatic Traffic Counter (ATC) at a location to be agreed which would provide daily vehicular movements to the site. A cycle ATC could also be included for completeness and in order to measure cycle daily flows adjacent to the vehicular access.

20.30 If the car flows measured are in excess of those expected than a financial penalty could be imposed, firstly to resolve any arising issues with the signals/junctions to improve flows and secondly to increase the contribution made towards the Fabian Way Corridor Study proposed series of works, over and above those already identified as being required due to the expected traffic flows predicted. In this respect, NPT has arrived at a sum of £535,000 as a financial contribution required for the Fabian Way Corridor Study works based on visitor numbers to Pembrey Country Park. This figure is agreed by CCS and will be used jointly between the two Authorities to fund the more pressing elements of the proposed upgrade.

20.31 The precise penalty levels should be identified and form part of the Section 106 Obligation.

20.32 Similarly patronage on the bus network will also occur when the background levels are not at their highest so impact on public transport is expected to be acceptable.

20.33 The lagoon will be capable of holding major sailing events and these may attract up to 8000 spectators per day. They would be one off events occurring several times per year.

20.34 Special measures would be put in place to manage vehicle and spectator movements. It is stated that there will be no spectator parking at site and that all visitors will park off site and be bussed in. A framework major events travel plan will be supplied prior to any event taking place in joint consultation with CCS and NPT. The major Events Travel Plan will attempt to minimise impact on all modes of transport and should be planned in advance with both local Authorities. Through the suggested measures it is hoped that impacts on the local highway network can be minimised.

20.35 No highway objections are therefore raised to the proposal subject to additional requirements in respect of:

1. No deliveries to be received on site (via on shore methods) between 0800 and 0900, and 1700 and 1800 in the interests of the free-flow of traffic along Fabian way.
2. The installation of an ATC (Automatic Traffic counter) at a site, the exact location to be agreed with the LPA in order to monitor ongoing traffic flows within the site.
3. The development of a financial penalty scale dependent on the levels of vehicular traffic over and above that predicted. The monies to be used to fund traffic signals alterations (if required), and to contribute and appropriate sum to the Fabian Way Corridor Study scheme already identified. Details to be agreed at a later date.

4. The nomination of a Travel Plan Co-ordinator within three months of the date of this consent.
5. The Construction Phase Travel Plan/Operational Travel Plan/Major Event Travel Plan to be developed in conjunction with the relevant affected bodies.
6. The payment of a sum to be agreed towards the Fabian Way Corridor study works, as per NPTBC committee report circa £535,000 towards improvement works on Fabian Way.
7. All the infrastructure works, vehicular access, shared use pedestrian/cycle path will need to be undertaken to Local Authority Standards and Specification.
8. Any off site car parks/park and rides will be the subject of separate planning applications.
9. Adequate cycle parking to be provided in accordance with details to be submitted for approval.
10. Adequate car parking layout to be laid out in accordance with details to be submitted for approval.

20.36 The lack of a pedestrian and cycle linkage to the west to connect to the city centre via the SA1 regeneration area is a significant issue. It is noted that this option was discussed at length with ABP but has been discounted for security reasons due to the route having to cross the lock to Kings Dock which is the sole sea access to the operating docks. Whilst an accessible ferry shuttle has been proposed to access Tidal Lagoon from the west bank (city side) of the River Tawe, this is only a minor compensation for the lack of a permanent physical path connection towards the city centre.

20.37 Whilst the reasons for this omission are understood, this is considered to be a fundamental missed opportunity to provide a direct and car free link from the City Centre and SA1, along the dock edge to the emerging Swansea University Bay Campus and onward links to the Wales Coastal Path and Sustrans cycle routes, in accordance with the Council's wider ongoing waterfront regeneration objectives.

20.38 In doing so, it is a missed opportunity to improve strategic linkages and to retrofit the Bay Campus within NPT in a sustainable manner to Swansea City Centre. This amounts to an integral component to delivering 'world class' public realm. Its forced omission from the scheme has severe implications in terms of sustainable connectivity, resulting in the essentially becoming a destination rather than part of the City.

20.39 Given the level of concern on this matter, it is respectfully requested that further investigation should take place as part of the formal examination to explore other options to secure a pedestrian and cycle connection westwards to Swansea City Centre, perhaps as part of a walkway integrated into the Kings Dock locks. If this is not successful, it is further requested that provision should be made for any DCO that is granted, to allow this option to be revisited at some point in the future.

20.40 Whilst a ferry shuttle may be novel, it will not accommodate high levels of visitors. There are also significant operational concerns, as set out in the Navigation and Marine Transport section of this report.

20.41 The proposed vehicular access road, with pedestrian and cyclist provision, leaves Fabian Way at what is referred to as 'McDonalds Junction' then passes eastward through vacant industrial sites to run alongside the existing port road as a separate carriageway. The proposed public road would be separated from the port road with a security fence. This parallel arrangement would run east to the existing port security point and then would turn westwards to run alongside the existing sea wall to the proposed inshore facilities. This route measures 3km from the existing eastern end of Langdon Road to the proposed western landfall building and would pass through what is currently a range of vacant sites with no activity or natural policing. Therefore given the significant distance; the convoluted route; the vacant sites and the perceived safety issues it is considered that this will discourage pedestrians and cyclists and it is likely that the Tidal Lagoon would primarily be access by car users and this may limit the potential number of users.

20.42 To make sense of the significant distance involved with regard to walking and cycling, the proposed access route along Langdon Road and then westwards into the docks measures 4.9km from Ice House Square to the proposed western landfall, whereas the direct route to the south from the same start and end points over the lock to the docks measures 1.35km.

20.43 There is also a fundamental conflict with the alignment of the proposed tidal lagoon access road and the protected route for the Tennant Canal as protected by UDP Policy HC31. Whilst the application references this policy it does not address the protected canal route. Therefore CCS requests mechanisms be put in place to allow a different road alignment that avoids the protected canal route to be agreed between Langdon Road and the existing port road (in the vicinity of the Welsh Water site).

20.44 Given also that the proposed vehicular access to the Tidal Lagoon passes through vacant sites that are no longer required for the operation of the docks, it is considered that the access road should facilitate/make provision for access to the potential development sites in this area in order to stimulate wider regeneration of the area. The Council is currently exploring this strategic issue with the relevant landowners as part of the Local Development Plan process via a concept master planning exercise.

21.0 Navigation and Marine Transport Assessment

City & County of Swansea Unitary Development Plan

21.1 Policy HC31 states that opportunities for the development of water based recreation facilities will be supported, subject to their compatibility with environment and nature conservation interests, water supply, commercial shipping and flood defence at locations including:

- Inland waterways – rivers, dock system and canals;
- Coast and estuary – including Swansea Bay, Oxwich, Port Eynon.

Local Issues and Adequacy of the Application/DCO

21.2 Much of the attention in the Navigational Risk chapters of the Environmental Statement appears to be on larger vessels. This is important, as CCS would not wish to see any increased risk of oil spills etc. However the Council must also be concerned about the risk to smaller craft, including sailing vessels, using the Council Marina or the local sailing clubs. This is particularly significant for Swansea as it is seen as a safe haven during storms. There are very few safe entrances under all conditions in the Bristol Channel and certainly no safe alternatives close to Swansea.

21.3 The lagoon wall will be a rocky lee shore for any small vessel approaching the Marina. This is particularly difficult for sailing vessels that also have to take account of some of the potential jet currents around the turbine area. Some of the figures for tidal flows, particularly in the area that vessels would need to pass through to enter the river, are concerning to CCS and in this respect the Marina Manager has commented that the proposed 50m exclusion zone around the turbine outfalls seems very small given the volume of water that would be passing through them. Due to flow rates it is a concern that smaller craft may struggle to negotiate the waters adjacent to the exclusion zone during operation.

21.4 Sailing vessels will not be able to deviate inshore to avoid this as they will run the risk of going aground at certain times. Given the variety of wind directions, the position of Mumbles Head, the shallow inner bay areas and the physical restrictions around the lagoon, this could make Swansea a far less attractive destination for Marina clients on the perception that it is a difficult place to enter or exit. This in turn may have knock on effects for local marine businesses.

21.5 This Environmental Statement comments on problems with increased wave heights particularly due to reflections from the lagoon wall, but considers them an insignificant risk. Also chapter 6 comments that vessels will be unaffected when manoeuvring in the channels (6.5.2.42). However chapter 6 claims that wave heights could increase by approximately 30 cm in exactly the area that small vessels will need to pass through to reach Swansea. In addition it should be noted, that small vessels will particularly struggle where the prevailing wind is against the strong jet currents ebbing from the turbine area. This will cause an additional wave height and can lead to a very unpleasant chop that smaller vessels can find difficult given the proximity to Mumbles Head and shallow waters.

21.6 Furthermore, vessels entering or exiting Swansea will be faced with a dredged approach channel, shared with commercial shipping, bordered on one side by the rocks of the lagoon and the shallows of Swansea Bay on the other during certain tidal conditions. It seems that the development will cause an increased risk to all users of the approach channel, as a potential escape route will be taken away by the scheme. These risks range from little or no time to react in the event of a vessel breakdown to avoid collision with the rocks of the lagoon, to an increased likelihood of collision between pleasure and commercial traffic.

21.7 The presence of a safety boat during the construction phase is welcomed, but given the rocky nature of the lagoon structure and the flows from the turbines, it may be wise to retain a safety boat post-construction in order to deal with events such as vessel breakdowns on a rapid response basis.

21.8 Increased siltation in the impounded waters, the estuary channel and Swansea Bay in general is of concern to CCS. In this respect, the Environmental Statement states a likelihood of increased dredging being required around the Tawe dredged channel. In paragraph number 14.6.2.31 and also in 6.5.2.74, table 6.18 as well as chapter 4, an increase of between 20 to 34% is suggested.

21.9 Any significant changes in siltation as a result of the scheme, particularly with the impounded waters or the estuary channel leading to the Barrage, could lead to a general perception that Swansea is a difficult place to get in to and out of. (Some visitors already claim that the River Tawe lock entrance is a little difficult as it is not dredged regularly or marked between the river entrance and the River Tawe barrage lock.) If this perception were to occur, it could result in a loss of Marina custom and could affect the viability of Swansea Marina, Swansea Yacht and Sub Aqua Club and the proposed SA1 Swansea Waterfront Marina development. In turn it could also affect the viability of local marine businesses whose trade relies on boat owners keeping the boats in Swansea. This is not just an issue that would affect local boat owners, as approximately 40% of the Swansea Marina customer base come from outside of the Swansea area and this percentage does not include the circa 500 visiting vessels received per annum.

21.10 Furthermore, given that the Council already struggles to fund its dredging liability in relation to the Barrage and most of the material dredged has entered from the bay, the lines of responsibility for monitoring and dredging post construction should be agreed. The existing limited dredging already costs £100k per annum and it is considered reasonable therefore that any additional dredging requirements arising from the development should be addressed by way of financial payment through an appropriate planning agreement.

21.11 The loading / unloading pontoon immediately below the Tawe Barrage was fully grant funded with the intention of it being used for local water sport activities, including loading / unloading for charter vessels and sea schools, and general use by marina users. Acquisition of this piece of infrastructure by the scheme could lead to CCS being required to repay the grant that funded it.

21.12 The water space and land immediately below the Tawe Barrage provide the only entry / exit point to Swansea Marina and the Marina Manager has advised that acquisition for the proposed scheme or losing control of this area could mean enforced closures of the Marina, leading to possible breach of contract with Marina customers, who would not be able to enter or leave the impounded waters.

21.13 Even if the pontoon is not acquired, there is a strong likelihood that barrage lock operations would be impeded by a shuttle ferry, particularly during certain tidal conditions.

21.14 During peak times, in excess of 50 pleasure and commercial craft may be waiting below the Tawe Barrage to lock in. The navigable channel leading up to the Tawe Lock is narrow and negotiating the waiting craft could be problematic in both directions for the proposed shuttle ferry service, particularly during certain tidal conditions. This would almost certainly lead to delays for Swansea Marina customers who are paying to berth their boat in Swansea and use the Tawe Lock.

21.15 Furthermore, there are sometimes significant flows from the lock and penstock systems during certain tidal conditions, which could lead to Swansea Marina being asked to suspend operations during times when the shuttle ferry is manoeuvring. If this were to happen, it would impact negatively on customer waiting times.

21.16 KPAL Report No: 160995 has advised that Environmental Statement Tables 6.15 and 6.16 summarise the changes in significant wave height and wave period for 10 in 1 year, 1 in 1 year, 1 in 10 year and 1 in 20 year waves approaching from the southwest at ten locations in Swansea Bay. Point location 2 relates to the seaward end of the Tawe navigation channel close to the southwestern corner of the lagoon (position shown on Environmental Statement Figure 6.44). These Tables show an increase in significant wave height at Point 2 of between 8 and 12 cm. The predicted increases in wave period range from 0.11 to 0.15 seconds.

21.17 Environmental Statement Table 6.17 presents values for changes in significant wave height and period at the same locations for 10 in 1 year and 1 in 10 year waves approaching from the southeast. A reduction in significant wave height of between 3 and 7 cm, and an associated increase in wave period of 0.07 to 0.16 seconds, is predicted at Point 2 due to the sheltering effect of the Lagoon.

21.18 No modelling results are presented for locations further up the navigation channel, and no modelling of waves approaching from a south-southwesterly direction, parallel to the axis of the navigation channel, has been undertaken. The possibility of complex wave interaction, arising from reflection, deflection and refraction of waves off the western wall of the Lagoon and/or the West Pier, has not been considered. However, from the results presented it is likely that small recreational vessels will encounter larger head-waves when navigating the Tawe entrance channel towards the open sea.

22.0 Air Quality

City & County of Swansea Unitary Development Plan

22.1 Policy EV40 states that development proposals will not be permitted that would cause or result in significant harm to health, local amenity, natural heritage, the historic environment or landscape character because of significant levels of air, noise or light pollution.

Local Issues

22.2 The main pollutant of concern for CCS is nitrogen dioxide (NO_2). There are two standards/objectives set within the Air Quality (Amendment) (Wales) Regulations 2002 (the EU Limit Values mirror these standards):

- The hourly NO_2 concentration shall not exceed 200ug/m^3 on more than 18 occasions in any one calendar year;
- The NO_2 annual mean shall not exceed 40$ug/m^{3.}$

22.3 CCS is monitoring for NO2 along Fabian Way to make an assessment against the annual mean objective. Results for the last two years indicate a failure to meet this objective along Vale of Neath / Wern Terrace (outbound towards M4). An Air Quality Management Area has not yet been declared whilst results are being verified and properly understood.

22.4 Monitoring on the inbound section of Fabian Way at Bevans Row indicate compliance. Current thinking is that the new docks entrance signal controlled junction has an influence on concentrations along the Vale of Neath/Wern Terrace. Despite traffic being free flowing at this location it is likely that the acceleration past these properties is resulting in the concentrations being recorded as well as exhaust plumes from any queuing traffic on the inbound lanes drifting over to the facades on prevailing winds.

22.5 CCS is unable to assess compliance with the 1-hour objective due to funding issues procuring real-time equipment. However, research published into the relationship of the 1-hour objective with the annual mean concentrations indicate that as the annual mean at this location does not exceed 60ug/m3 then no exceedences of the 1-hour objective are likely to have occurred.

22.6 Defra and Welsh Government have this week further amended the Local Air Quality Management Technical Guidance (LAQM.TG(09) to reflect the projections of future roadside NO2 concentrations into future years. This guidance builds on work to understand vehicle emissions given the probability that newer EURO class diesel vehicles emit direct from the exhaust system primary NO2. The guidance indicates cases where all future projections require an assessment of the HDV content of the flow. Where the HDV content is less than 10% one set of adjustment factors are to be used. Where the HDV content is greater than 10% a different set of factors apply to the future year projections.

22.7 CCS's traffic counter along Fabian Way shows the HDV content for 2013 is 5.3%. However, the ATC is along Fabian Way by Sebastopol Street and does not reflect the HGV flows into/out of the docks entrance which is suspected would increase the overall HDV component of the flow. Funding issues again presently prevent resolving this issue by replacing/upgrading an old manual traffic counting site outside Four Counties Office Furniture buildings in Crymlyn Burrows. (Manual in the fact that it has to be dialled up (by Highways staff) to collect data whereas the traffic counters operated as part of the air quality network are automatic in that they send the data to CCS servers every 5 minutes.

Also, these counters have been configured to produce a vehicle by vehicle EUR6 classification scheme whereas Highways counters are configured in general for volumetric counts and not always classified.)

22.8 The current issue regarding EU infraction proceedings against CCS are complicated but it remains a possibility that fines may cascade down to the local level.

Adequacy of Application/DCO

22.9 The application does not recognise the fact that some dwellings around Fabian Way are currently failing air quality objectives already. It is hoped that some adjustments to local traffic management systems may improve this situation. However it should be recognised that the Swansea University Bay Campus and this application both put extra pressure on this part of the road network. Clearly the Council has a statutory obligation to ensure that residents are not overexposed to air pollutants specified in the relevant Directives and Regulations.

22.10 Should the scheme be able to fund a real-time chemiluminescent analyser along Vale of Neath/Wern Terrace, this would address air quality issues/concerns as real-time measurements would be possible.

22.11 Furthermore, as noted above, an additional requirement has been requested to provide an ATC to monitor on site vehicle movements; if funding can be justifiably be sought to "upgrade" the 4 Counties site to an automatic, classified counter, this would provide valuable data to Highways and the Council's Pollution Control & Public Health Division, as ve*hicle access for both the construction and operational phases will be via the Fabian Way/Langdon Road/Park & Ride junction*.

22.12 Statutory background for LAQM is as follows:

- Part IV of the Environment Act 1995 – required production of a National Air Quality Strategy (NAQS)
- Environment Act 1995 places duty on local authorities to carry out periodic reviews (LAQM cycle of reporting)
- NAQS first published in 1997 with the Air Quality Regulations 1997 which set the legal footing for the objectives set out in NAQS
- NAQS uses health based standards to control seven designated pollutants
- NAQS has evolved over time with the latest revision - the Air Quality Strategy 2007 being published in July 2007
- The air quality objectives now applicable to LAQM in Wales are set out in the Air Quality (Wales) Regulations 2000, No. 1940 (Wales 138), Air Quality (Amendment) (Wales) Regulations 2002, No 3182 (Wales 298),

22.13 Statutory background for EU (and therefore WG) Limit Values are:

- The EU Ambient Air Quality Directive (2008/50/EC) and the 4th Air Quality Daughter Directive (2004/107/EC) set the air quality standards against which national and local ambient air quality policies are formulated.

- The directives set limit values and target values for various pollutants in ambient air including nitrogen dioxide (NO2) and require EU member states to assess and report compliance and take action to rectify any exceedences of those values
- The 2008 directive consolidated the requirements of the Air Quality Framework Directive (1996/62/EC) and its daughter directives (1999/30/EC, 2000/69/EC, 2002/3/EC) which are now largely repealed. The 2008 directive was transposed into national legislation in Wales by the June 2010 deadline.
- The Air Quality Standards (Wales) Regulations 2010 incorporate the CAFÉ Directive and the Fourth Daughter Directive into Welsh law, and replace the Air Quality Standards (Wales) Regulations 2007. The Regulations come into force on 11 June 2010 and require that Welsh Ministers divide Wales into two air quality zones: North Wales and South Wales

23.0 Hydrology and Flood Risk

City and County of Swansea Adopted Unitary Development Plan

23.1 Policy EV2 states that new development must have regard to the physical character and topography of the site and its surroundings by meeting a range of criteria including, determining whether the proposal would be at risk from flooding, increase flood risk off-site, or create additional water run-off, development for infrastructure and services. (Criteria (ix).)

23.2 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 the Council that its location is justified and the consequences associated with flooding are acceptable.

23.3 Policy EV37 states that the integrity and continuity of tidal and river defences will be maintained and improved where necessary. Access to existing and future tidal and river defences for maintenance and emergency purposes will be protected and where appropriate, improved subject to satisfactory ecological and visual safeguards. Where development relating to tidal and river defences is permitted the stability and continuity of the defences must be maintained.

Key Local Issues

23.4 The low lying areas of Swansea Bay are at tidal flood risk as identified by the Technical Advice Note 15 (Development and Flood Risk) Development Advice Maps; there are areas around the bay where flooding issues are more high profile than others and which require careful consideration and assessment to avoid increasing flood risk to surrounding third parties, infrastructure and the public as a result of the development.

23.5 Swansea Bay is fronted by a promenade and sea wall that is made up of a variety of structures ranging from concrete revetments to old stone walls to soft ground which offer the low lying areas of the city protection from coastal flooding events.

23.6 The application has indicated that water levels and wave heights to the west of the lagoon will increase, this may have the effect of eroding the standard of the current defences that protect the public. There are also areas where flooding occurs more regularly due to the interactions between fluvial and coastal processes, the submitted reports have identified that Blackpill and Mumbles could be particularly affected by any changes in the coastal regime. In Blackpill there are two watercourses (R. Clyne & Cwm Stream) both of which are tidally influenced and have caused flooding to the public, businesses and infrastructure.

23.7 There are a number of locations where there are openings in the sea walls from the Civic Centre to Mumbles where the City and County of Swansea install stop logs to prevent flooding, the changes in coastal regime as a result of the tidal lagoon may mean that the Authority's current operational regime in relation to the stop logs may need to become more active and greater in extent due to increased flood risk.

Adequacy of the application

23.8 CCS consider that the flood risk aspects of the application have not been adequately considered in Swansea Bay in general or for the various locations identified as suffering detriment as a direct consequence of the proposals and therefore the application does not meet the requirements of TAN15: Development and Flood Risk and UDP Policies EV2(ix) and EV36.

23.9 Paragraph 6.5.2.27 of the Environmental Statement states that increases in wave height are shown to occur across the intertidal area within the western region of the bay between Mumbles Head and West Cross, where the reflected waves are refracted across the shallow foreshore. For a 1 in 20 year wave event, the model predicts that wave heights will generally be increased within this area by 0.1 to 0.2m, with a peak increase at the shoreline fronting Oystermouth. There does not appear to be any assessment included regarding whether this increase will overtop the sea wall or the defences that have be installed prior to high tide/storm events. This has the potential to be detrimental to flood risk management assets and third parties and must be investigated further and if necessary mitigation measures must be proposed and incorporated as part of the development.

23.10 Section 17.5.2.3 states that in order to open up the views to the lagoon the majority of the existing 2m port sea wall will be removed and that the presence of the lagoon seawall will provide coastal protection, however there does not appear to be any studies included on the standard of protection the existing sea wall provides and whether the new lagoon wall will provide comparable protection. Furthermore when the lagoon is decommissioned it is questioned who will become responsible for the upkeep of the remaining lagoon walls, details of this must be submitted and how the walls will be maintained in perpetuity.

23.11 Section 17.5.3.4 part iii states that extreme wave heights for location 8 (Mumbles/West Cross Area) is predicated to increase by up to 0.23m or 230mm with the lagoon in place. However, again no assessment has been made with respect to the possible impacts regarding the onset of any possible flooding. CCS would expect the FCA to have looked at the standard of protection of the sea wall/defences as the point of comparison with the new wave heights as this may affect the onset of flooding i.e. defences may be overtopped sooner than at present or they may need to be deployed sooner as a direct result of the lagoon thus in certain circumstances increasing the risk/potential for coastal flooding to third parties.

23.12 Whilst the application has identified that the Oystermouth/Mumbles promenade is affected by the changes in coastal regime, there is no comparison with the existing situation. As such, it is not possible to assess the full impact of the proposals apart from indications that the promenade may suffer greater flooding on a far more frequent basis.

23.13 Section 17.5.3.5 identifies that the operation of the project will cause some marginal changes to water levels within Swansea Bay and that these 'minor' effects on peak tidal water levels will not increase flood risk from tidal sources. It is questioned how has this statement has been substantiated as no assessment against the existing situation has been provided. Furthermore there does not seem to have been any deeper investigation on increased wave heights and levels on the watercourses that discharge directly to the bay. These watercourses are tidally influenced and controlled and do cause localised flood risk to adjacent property. CCS would therefore expect this issue to be assessed as part of the FCA as the most sensitive watercourses affected by these issues are around West Cross/Blackpill where the application has identified higher water levels and wave heights.

23.14 West Cross may also suffer greater effects of erosion and flood risk due to the deeper water and high waves, again the effects are not fully known as a like for like comparison has not been undertaken.

23.15 The effects of climate change over the lifetime of the development have not been incorporated. The operational lifetime of the project is anticipated to be 120 years but only 75 years is considered as part of this application. This should be considered as part of the assessment.

23.16 Accordingly it is considered that the application has not adequately considered the effects of the development on flood risk within the bay in accordance with the requirements of TAN15 and UDP Policies EV2 and EV36. Any revised assessment must therefore consider these issues including but not limited to the following on a like for like basis for the pre and post development situations:

- Effect of increased wave height and number on Swansea Bay flood risk management features including outfalls, contributing watercourses and tidal inundation routes.
- Effect of increased flood risk on third parties and critical infrastructure.

- Effect of reflected waves in general on the bay and including the areas identified as being put at greater risk over the lifetime of the development including climate change on a like for like basis.
- Effect of deeper water and larger waves on erosion/deposition in relation to flood risk management infrastructure as well other interest features already looked at.

23.17 On the issue of wave heights, tide – river flow interaction and flood risk, the KPAL Report No: 160995 commissioned on behalf of CCS also highlights that the analysis of the potential impact of the lagoon on wave heights undertaken by ABPMer indicates a potential increase in water levels with the Lagoon present of 0.1 to 0.23 m on the western side of Swansea Bay, with the largest increases between Mumbles and Oystermouth (Hydrology and Flood Risk, Chapter 17, p36 of the ES; also ABPmer, 2013d). This will lead to an increased risk of overtopping and flooding in this area, which is backed by areas of low-lying land (Figures 3 & 4 of KPAL Report No: 160995).

23.18 It was concluded from the analysis that, since the biggest waves on the Swansea Bay waterfront originate from a southeasterly direction, construction of the Lagoon will provide a measure of shelter and lead to no increased flood risk along this frontage. However, Figure 17.7 of the Environmental Statement shows that the Lagoon structure only provides shelter from waves from an easterly direction; there is effectively unbroken fetch from southeasterly to south-southwesterly directions. No modelling of waves from the SSW to SSE has been undertaken.

23.19 Paragraph 6.5.2.32 reports that consideration has been given to extreme waves under conditions of a 1.5 m surge on top of a MHWS tide. It is reported that for Point 8 on the Mumbles frontage there is an increase in significant wave height of 0.19 m compared with an increase of 0.17 m for the without-surge case. A consideration of the effects of sea level rise based on the UKCP09 medium emissions scenario 95th % model output value indicated an increase of 0.18 m compared with 0.17 m for the without sea-level rise case. The additional water depth associated with surges and sea level rise is therefore predicted by the modelling to have a relatively minor effect.

23.20 The overall conclusion to be drawn from this assessment is that there is likely to be an increase in tidal flooding risk as a result of the Lagoon construction, albeit relatively small.

23.21 Any increase in wave heights along parts of the shore of western Swansea Bay where there is no high tide beach or dunes is also likely to increase the risk of wave reflection from the sea defences and to create increased risk of beach lowering by toe scour.

23.22 No specific assessment is provided in the Environmental Statement of potential interactions between high tides, surges, waves and high flows from the River Tawe. The Tawe barrage is overtopped by tides which reach above mean high water level (c. 3.4 m OD).

Potential increases in the still water levels or wave heights in the Tawe Channel, adjacent to the western arm of the lagoon, could potentially increase the frequency and/ or duration of overtopping of the barrage, or could impede the discharge of Tawe floodwater to the sea. Potential implications for the Lower Swansea Valley Flood Risk Management Scheme have not been explored by the Environmental Statement hydrodynamic and wave modelling.

23.23 The Environmental Statement Baseline Assessment contains no detailed analysis of severe historical floods of the Tawe, or modelling of the likely behaviour of water levels arising from interaction of tides, waves and river floods of magnitudes similar to those in 1929 and 1979 (e.g. Walsh, 1982).

24.0 Residential Amenity

City and County of Swansea Unitary Development Plan

24.1 As stated above, Policy EV1 of the UDP requires new development to accord with 11 specified objectives of good design. Criteria (iii) is that the development should not result in a significant detrimental impact on local amenity in terms of visual impact, loss of light or privacy, disturbance and traffic movements. Furthermore, UDP Policy EV40 states that development proposals will not be permitted that would cause or result in significant harm to health, local amenity, natural heritage, the historic environment or landscape character because of significant levels of air, noise or light pollution.

24.2 The support for renewable projects in Policy R11 is subject to criteria including criteria (iii) which states that there should be no significant impact on local amenity.

Adequacy of the Application

24.3 Issues relating to impacts relating to visual amenity and air quality have been addressed above.

24.4 A residual area of concern for CCS is that the proposed access arrangements to the proposed lagoon will significantly result in traffic movements and general disturbance in close proximity to the rear of these residential properties. This would run contrary to UDP Policy EV1(iii) and Policy R11(iii).

25.0 Economy, Tourism and Recreation

City and County of Swansea Adopted Unitary Development Plan

25.1 Policy EC1 allocates land to meet the growth needs of the local economy.

25.2 Policy EC2 allocates a major redevelopment area at SA1 Swansea Waterfront for mixed employment and residential development together with supporting leisure, tourism, community uses and ancillary services.

25.3 Policy EC3 seeks to encourage the improvement and enhancement of the established industrial and commercial areas, through building enhancement, environmental improvement, infrastructure works, development opportunities and targeted business support. Development at established industrial and commercial areas for non-business uses will not be permitted where proposals unacceptably limit the range and quality of sites available for employment development.

25.4 Policy EC15 supports proposals that consolidate the urban tourism resource, by improving the quality and range of attractions, destinations, accommodation and services, at locations including the City Centre, Maritime Quarter, Tawe Riverside Basin, and Mumbles and specific destinations around Swansea Bay.

25.5 Policy EC16 states that new or improved recreational and tourism facilities at specific destinations around Swansea Bay are proposed which capitalise on the seafront aspect and contribute towards the regeneration of the Bay. Between these areas of appropriate development, the emphasis is on safeguarding and enhancing the environment of the Bay and other waterfront areas.

25.6 Policy HC31 states that opportunities for the development of water based recreation facilities will be supported, subject to their compatibility with environment and nature conservation interests, water supply, commercial shipping and flood defence at the following locations:

1. Lakes and reservoirs,
2. Inland waterways – rivers, dock system and canals,
3. Coast and estuary – including Swansea Bay.

25.7 As set out above, the support of Policy R11 for renewable energy schemes is subject to satisfying a number of criteria. Criteria (i) is that the social and economic benefits of the scheme in meeting local, and national energy targets outweigh any adverse impacts.

Adequacy of the Application/DCO

25.8 The Cardiff Business School assessment (Appendix 22.1 of the Environmental Statement) estimates the value of the three year construction phase from 2015 to Wales at: -

- £454 million of additional output;
- £173 million Gross Value Added (GVA); and
- 5,540 person years of employment (or 1,847 full time equivalent jobs per annum).

25.9 The value of the operational phase per annum is estimated to be: -

- £5.2 million of additional output;
- £2.2 million GVA; and
- 60 full time equivalent jobs.

25.10 The equivalent estimates for Swansea Bay (the geographical assessment area) are not provided.

25.11 During the construction phase, the following employment profile across Wales is envisaged: -

Sector	**Average Annual Employment (person years)**
Manufacturing and Production	387
Construction	1,150
Distribution, Retail and Hospitality	97
Transport and Communications	33
Financial and Professional Services	157
Other	23
Total	**1,847**

25.12 Construction phase occupational/professional profiles are not specified so it is not possible to assess the value profile of these jobs.

25.13 Together with leakage, displacement, multiplier effects and deadweight, the total net employment from the operation phase is estimated to 57 jobs, which corresponds to the overview of operational employment proposed by the Welsh Economy Research Unit of 60 full-time equivalent jobs referred to above.

25.14 A procurement strategy is under development with a commitment to focus on maximising local procurement in partnership with Welsh Government, CCS, NPT and others, encompassing employment, supply and manufacture, training and up-skilling the workforce and creating opportunities for the long-term unemployed.

25.15 Environmental Statement Appendix 22.1 Economic Significance study states that "Historically renewables projects in Wales (at commercial scale, particularly on shore and off shore wind) have fairly limited local economic effects during development because the highest value components, and elements of specialist professional services tend to be sourced outside of the UK…

25.16 (However)…In this respect Tidal Lagoon Swansea Bay could offer the opportunity for a more sustained economic impact with the innovative project placed in a more industrial part of Wales and with a supply side background in metal goods and structures, and construction engineering which could feed into the project…"

25.17 An art & science study project is ongoing in collaboration with Swansea University, University of Wales Trinity St David (specifically Swansea Metropolitan University) and The Low Carbon Research Institute to consider the potential impacts the proposed tidal lagoon development will have on the local community and beyond. In addition, the project would support the development and production of high quality public art projects and the applicant has established three programmes to progress the public art research and development phase in respect of the project.

25.18 The applicant has created an education programme 'TLSB Education Programme and Resource' to help young people develop their skills, knowledge and understanding of global climate change and renewable energy.

25.19 As part of the development of the Project, links with the local educational community will be developed to progress plans for how the Project can best benefit Swansea Bay and the surrounding areas. The key themes the applicant is working on are: -

- Science, Engineering, Energy and Enterprise;
- Arts, Culture and Heritage; and
- Skills, Training and Employability.

25.20 Links are also being established with organisations/initiatives: Regional Learning Partnership; NSA Afan Community Regeneration; Jobs Growth Wales Internships; undergraduate/Post Graduate research; EU Leonardo or Erasmus placements, alongside year-in-industry placements; and future opportunities with Beyond Bricks and Mortar, Workways and the Sector Skills Councils

25.21 Environmental Statement Appendix 22.1 states that "The project also offers an element of community ownership through a share offer which will seek to give preference to those living in the immediate vicinity of the project", although this is not detailed in Chapter 22.

25.22 A variety of opportunities are described in the Statement to enhance recreation and tourism (such as the visitor centre, fishing, walking, cycling and watersports). Initial estimates suggest that between approximately 70,000 to 100,000 people could visit the lagoon each year, generating visitor spend to support between 65 and 90 full time equivalent jobs per annum.

25.23 The Environmental Statement assesses the project will be beneficial to employment (construction "major, short term"; operation "minor, long-term), mariculture ("moderate, long term"), tourism ("minor long term"), recreation ("moderate, long term") and education/arts ("minor, long term").

25.24 The Environmental Statement's analysis of the Policy Context and its methodology for assessing impacts are relevant and appropriate. It identifies the key socio-economic impacts and its evaluation is reasonable, although some of the estimated economic impacts are for Wales and not specifically Swansea Bay. It is evident that the project will have a significant socio-economic impact during the construction phase with wider, more modest impacts secured for the long term.

25.25 Further information would however be welcomed in respect of:

- The estimated employment impact in Swansea Bay (the geographical assessment area), and what the occupational/ professional employment profile is likely to be; and

- The share offer and any other economic (e.g. a Community Fund, cheaper electricity tariffs) and community benefits TLSB plc and its on-going art and science study are examining.

25.26 From a tourism perspective, it is important that the project links to 'Destination Swansea Bay 2013-2016', the official Destination Management Plan for Swansea Bay (DMP). This strategic document, provided here as **Appendix H**, and states clear development and marketing priorities for the next three years. Planned projects are done so in the knowledge that they link to the overall development of the destination to help achieve its aspirations to be a world class visitor destination by 2020.

25.27 Projects, like the Tidal lagoon, not identified in the plan but which come forward during its implementation, are done so on the basis that they have the potential to make significant contributions to the stated aims. In particular the Tidal Lagoon appears to be able to;

- Provide Swansea Bay and Wales with a unique 'maritime-themed' visitor attraction – this might help provide Swansea with a real sense of distinctiveness over other coastal locations. In effect, this project could attract a new type of visitor, a major stated aim of the DMP.

- Contribute towards a more visually appealing gateway to the city from the sea and the highway.

- Provide a visitor centre in a seascape setting which can be enjoyed in all weather conditions.

- Create a new 'Unique Selling Point' to include in destination marketing activity for the area.

- Meet the needs of our current visitor demographic – mainly interested in scenery/landscape, walking and watersports.

- Complement the existing Swansea Bay watersports projects including the 'Watersports Centre of Excellence' capital projects achieved in the Marina, St Helen's and at Knab Rock and build on this even further with more actual reasons to visit.

- Provide the infrastructure to potentially stage major events in the area at international and national levels regardless of any tidal restrictions that currently exist due to the difference between very high and low water levels.

- Have the potential to act as a catalyst to either encourage further tourism investment – e.g. accommodation, additional attractions, etc. or fill some of the spare capacity of bedspaces during shoulder season.
- Generate employment opportunities both at construction stage and post completion (linking with Beyond Bricks and Mortar scheme).

- Combat seasonality challenges by relieving pressure from Gower in busy summer period for water based recreational activities.

- Improve the offer within the destination for water sports related training and recreational activities (sailing, rowing etc.)

- Encourage sustainability by rejuvenating bio-diversity / marine eco-systems, therefore promoting local produce (oysters, lobsters, samphire) and Welsh heritage. This in turn could help support the increased demand for and expectation of locally sourced seafood products as part of the important food product for visitors.

25.28 However, the proposals raise a number of significant concerns in relation to:

- Water quality - Poor water quality within the Bay and/or the lagoon would build a negative reputation as a major tourist attraction and fail to attract watersports events – as well as being detrimental to the marine eco-systems.

- The size of the Lagoon and the fact that it is taking up such a large portion of Swansea Bay – the bay may lose its appeal for activities such as sailing and windsurfing as an area of 'calm' bay water would be greatly reduced.

- The adverse seascape, landscape and visual impact to existing recreational/tourism resource and receptors, such as the seafront promenade, Mumbles, Maritime Quarter and the Bay itself.

- Impact on the make up and appearance of Swansea Bay beach.

- There is the potential for displacement of business from other Watersports facilities recently in receipt of public funding.

- Adverse impacts on the operation of Swansea Marina as set out in the Navigation and Marine Transport section of this report.

- The 'bottleneck effect' at entrance of Port/Marina – access would be limited during construction and may lead to drop in Marina occupancy level. Access to port would also be affected during construction and may have an effect on potential cruise ship visits. Once complete the Lagoon would represent an attraction but could also be seen as making access to port and Marina more difficult and more risky.

- Access to Lagoon – no direct link with City and SA1 other than via a proposed water ferry service. Visitors would have to drive through port to access Lagoon and this is considered to be a missed opportunity to link the Lagoon to Swansea as a 'Waterfront City'.

25.29 Some aspects where further information / clarification would be helpful:

- Impact on any other tourism sectors e.g. cruise market and port access and what impact this might have on the potential of Swansea to encourage cruise ships.
- Business plan measures of success, including marketing strategy and targets for visitor numbers and expenditure.
- The role and management of the visitor centre - experience from other alternative energy projects which have included visitor centres as community gain haven't been sustainable.
- Parking provision at peak times and during major events.
- Pricing structure and policy.

26. Sustainability

City and County of Swansea Adopted Unitary Development Plan

26.1 The Plan's Spatial Strategy of the UDP, contained in Part 1 of the Plan, is firmly based on sustainable planning principles. The overall vision for the UDP is to adopt a sustainable approach to the development of a prosperous region focused on a cosmopolitan and multi-cultural City and County, which capitalises on its waterfront location.

26.2 This vision is seen to demonstrate the Council's commitment to the promotion of sustainable development which is to be pursued through goals based on sustainable principles of environmental protection, economic growth, social progress, safeguarding of resources and improved accessibility, each of which forms the basis for the topic policies in the second part of the Plan.

26.3 UDP Policy R11 states that proposals for the provision of renewable energy resources, including ancillary infrastructure and buildings, will be permitted provided:

i. The social, economic or environmental benefits of the scheme in meeting local, and national energy targets outweigh any adverse impacts,
ii. The scale, form, design, appearance and cumulative impacts of proposals can be satisfactorily incorporated into the landscape, seascape or built environment and would not significantly adversely affect the visual amenity, local environment or recreational/tourist use of these areas,
iii. There would be no significant adverse effect on local amenity, highways, aircraft operations or telecommunications,
iv. There would be no significant adverse effect on natural heritage and the historic environment,
v. The development would preserve or enhance any conservation areas and not adversely affect listed buildings or their settings,
vi. The development is accompanied by adequate information to indicate the extent of possible environmental effects and how they can be satisfactorily contained and/or mitigated,

Local Issues

26.4 The City and County of Swansea defines sustainable development as:

26.5 "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" and has an adopted Sustainable Development Policy (Sustainable Development Policy - City and County of Swansea).

26.6 The Policy contains a Vision for a sustainable Swansea that is "inclusive and safe and provides an excellent start to life. A county that supports a prosperous and resilient economy, recognises and benefits fully from its exceptional environment and promotes good health" and identifies seven priority areas:

I. Sustainable use of natural resources
II. Climate change/decarbonisation
III. Economic resilience
IV. Procurement
V. Social inclusion
VI. Natural Environment
VII. Governance

Adequacy of the Application/DCO

26.7 The following comments are based upon the impact the proposal on the aims and priority areas within the above policy, other than for issues relating to natural environment, which have been considered above.

Sustainable Use of Natural Resources

26.8 If built as per the project description, the proposal will make a significant contribution to renewable electricity generation, using a natural resource in a sustainable way.

26.9 Renewable energy installations, by their nature, are likely to have a lower installed capacity as compared to large scale power generation stations using thermal energy from fossil or nuclear fuels to produce electricity. Whilst it is unlikely that this scheme in itself will result in a reduction in electrical output from fossil fuelled power stations, it will help the UK build resilience into its aging energy infrastructure, which is facing a significant reduction in the number of operating fossil fuel and nuclear power stations in the foreseeable future. The scheme will also have the potential to help the UK to reduce its reliance on imported energy which currently stands at 43%[2] and is on an upward trend.

26.10 The development of power generation infrastructure locally that is able to supply intergenerational production of electricity has the potential to provide long term energy resilience into the region.

Climate change/decarbonisation

26.11 At this present time, the proposal will make some but limited impact in terms of climate change mitigation at a local level as the electricity will be distributed via the National Grid for distribution.

Whilst there will be no direct local benefit there will be indirect benefits to the de-carbonising the supply of electricity and supporting the UK and Welsh Governments meet their renewable energy targets.

26.12 At a national level the impact on climate change mitigation is less significant as compared to other renewable energy technologies at this time, for example solar photovoltaic. However if this scheme proves the concept, then the Tidal Lagoon Swansea Bay could be the gateway to larger tidal lagoon projects which would have a much greater national impact.

26.13 The Environmental Statement however is still unclear about what contribution the development of a tidal lagoon in Swansea Bay will have in building or undermining resilience to climate change in the future. The Environmental Statement considers a UKCP09 medium emissions scenario when looking at the impact of climate change on coastal processes. The Council's report on the changes to coastal process suggests that the changes will increase the risk of tidal flooding, albeit small, under these conditions. However evidence from the IPCC and other sources suggests that a high emissions scenario is also a likely outcome at this point in time, due to the uncertainty about the path of global economic development and the global response to climate change mitigation. When considering the worse case scenario CCS would have expected the Environmental Statement to look at the impact of a high emissions scenario (SRES A1FI) as well and the cumulative impact on wave height and other coastal processes.

26.14 The lack of a direct access for pedestrians and bicycles over the river from Swansea City Centre is disappointing and reduces the options for visitors to lagoon to use sustainable forms of transport.

Economic Resilience & Procurement

26.15 As is the nature of large scale energy projects, the financial value of the project comes from the selling and export of energy to National Grid. It is usual that the income generated from the energy sales will primarily go to pay off loans to investors and dividends to the shareholders. The applicant ran a local share offer and subsequent share offers will help build local ownership, but the impact of this is going to be limited and only to those who can afford to buy shares. It should also be noted that such investment comes with significant risk and the long term benefits of such investments may not be realised.

26.16 The Department for Energy and Climate Change (DECC) recognises the value of owning or co-owning renewable energy developments, that communities can have a real stake in, and share in the profits of the energy generation in their local area. This encourages joint venture/partnership working between developers and communities.

26.17 There are other models of community ownership schemes, where the developer provides a shareholding in the renewable enterprise as a community benefit, which can be supplemented by local communities investing further as a community energy enterprise.

If the level of confidence in the scheme is such that it will successful, then this approach could offer a more reliable and sustainable form of income to support economic development in the area.

26.18 Since however it is unlikely that there will be significant local ownership, to build resilience locally, the short term economic value to the Swansea Bay Region will be in the supply chain for the development of the lagoon. In the long term it will be in the potential to supply goods and services for future lagoons, as the direct employment by the lagoon for operation and maintenance is limited. The commitment to a local employment scheme in the draft DCO and a strategy to support local procurement of goods and services is welcome as this helps local businesses and people take advantage of the opportunity presented by the development, especially if these strategies include training and business development support in the pipeline stages to address the issue of paucity of supply identified in Appendix 22.1.

26.19 In addition to direct economic benefits through employment and supply, the applicant has outlined potential indirect benefits for the tourism and recreation sector, through the creation of new infrastructure and a destination. This has focused on the construction of new public realm, water shuttle jetty, on shore and off shore visitor facilities that may include a hatchery, laboratory facilities and a sailing/boating centre. Appendix 22.1 also identifies the potential to attract additional visitors to eight national sporting events a year, although the Environmental Statement does not provide evidence about how this figure was determined.

26.20 Furthermore, the application does not provide information about how these facilities will be managed and run once they have been constructed and there is no evidence provided regarding the viability of such facilities and business opportunities. Appendix 22.1 identifies a list of visitor attractions to demonstrate the potential for increased visitor numbers. However all these examples require significant public sector subsidy, without which they are financially unsustainable. Without this supporting evidence, that there is a sustainable business case for the new facilities, there is a risk that this infrastructure will be redundant, or need substantial public monies to remain viable.

Social Inclusion

26.21 "Social Inclusion" is a broad term describing the kind of "wealth" which comes from being able to play a full and active part in society – such as having access to good work, training or educational opportunities, as well as other factors such as sound health, a secure home and finances, and having a fulfilling social life. Poverty and poor health, symptoms of social exclusion, are significant sustainability issues for Swansea. There is a strong correlation between the two, so developments that are able to maximise access to opportunities that improve health and well-being to those who face disadvantage will have a positive impact on social inclusion.

26.22 In this respect, the lack of access via a bridge from the west side of the river Tawe is a significant barrier to those who do not have access to a car. There is no guarantee at this stage that either the water taxi across the river or the shuttle bus will be viable, and any charge will be an additional barrier to those with low incomes. In addition, those wanting to visit the lagoon using public transport are currently not able to catch a bus directly to the park and ride from the City Centre due to the way the park and ride buses are currently operated.

26.23 The concept of community benefits stems from the renewable wind power industry, focusing on how communities can have more of a say over, and receive greater economic and wider social benefits from on-shore wind power. The UK Government[3] is proposing to introduce legislation making it compulsory for developers to consult local communities before submitting planning applications for more significant onshore wind applications in England with expectations of the wind power industry to enhance community benefits, improve local economic impacts and increase community ownership. Similar actions are proposed for nuclear power and gas-fracking industries. No such guidance currently exists for tidal range power due to the immaturity of the industry in the UK and the lack of any comparator developments.

26.24 Contained within the Preliminary Environmental Information Report (PEIR) were proposals for a local energy tariff, a community fund and a local share offer. These have been removed from the Environmental Statement. The applicant's document titled 'Notes on the rationale for draft s106' clarifies the applicant's position on these two proposals. In this respect, Tidal Lagoon Swansea Bay Ltd are still committed to a local energy tariff but have limited this to 20,000 households in the Swansea and Neath Port Talbot area. There is currently no detail on how the tariff will be allocated to households. Targeting household that are fuel poor or households that are most disadvantaged would support the Council's objectives to address poverty. However the document suggests that the fund will be limited to a specific period of time that is relatively short in comparison to the time that the development will be operational. If this is the case then the benefit from this offer will be limited. There are no comparisons to how similar savings might be achieved in other more sustainable ways that have a longer term benefit, such as investment in energy efficiency initiatives or through collective purchasing of energy - where householders procure energy through bulk purchase, gaining savings through economies of scale.

26.25 Tidal Lagoon Swansea Bay Ltd are no longer proposing to provide a community fund arguing that the proposed on-site facilities (public realm, on-shore visitors facilities, hatchery etc) along with a range of 'off-site' benefits accords with the consultees' ambitions for the project. However it is not clear from the evidence presented in Volume 5 of the Environmental Statement why some benefits are deemed to outweigh the benefits of a community fund. No direct question has been asked of the local community about a community fund, only about the value to them of "Benefits to the community (e.g. grants to community projects)".

26.26 In the applicant's analysis of this element of the consultation responses, it is stated that in "simple terms, this indicates that all of the potential benefits of the proposed lagoon were regarded as important by all respondents, with little to choose between them" (Pages 1-16 Chapter 9, Volume 5 of the Environmental Statement).

26.27 Much of the detail of the project was not available at that time and there have been some significant changes to the project such the inability to secure a pedestrian and cycle link to the western sea wall to allow greater access to the project. There was no detail at the time of consultation regarding the scale of the community fund and what it could be used for. In comparison, the on-shore wind power industry is now proposing community funds based on a figure of £5,000 per MW per annum. The UK Government is consulting on a fund of £1,000 per MW per annum for new nuclear, where the energy outputs are that much greater.

26.28 The applicant also states that another reason why a community benefit fund was discounted was due to budgetary constraints, a fund could only be considered after approximately 30 years. This position is different from other energy developments where it is expected that community funds are payable for the operational lifetime of the development. It is also anticipated that after the operational lifetime of such energy developments the infrastructure is then removed. This is not the case with the tidal lagoon proposal where local people will be impacted by the project in perpetuity.

26.29 It is the view of CCS that a Community Benefits Fund, running the lifetime of the project, has the potential to support social inclusion initiatives, support the development of social enterprises through seed funding and provide an element of local control on how that benefit is allocated to meet local needs. Of all the community benefits proposed it is the one with least risk associated for local communities and it is the view of CCS that the applicant has not provided enough evidence to show why it has been discounted and why other benefits are seen to have greater value for local people.

26.30 The provision of a local employment scheme has the potential to support social inclusion. This will be limited to the availability of appropriate skills and expertise. Appendix 22.1 suggests that there is paucity in the locality. It would be beneficial therefore if there was a pro-active training strategy for local people in advance of the build to maximise this benefit, especially if this targets those people facing the most disadvantage. This impact is limited by the construction timescale of the lagoon but will help local people develop skills that could be used elsewhere in the construction industry or in the building of future lagoons.

Governance

26.31 The scheme will have little impact on governance in the region.

Additional comments

26.32 The applicant suggests that the development will provide benefit through the creation of freely accessible public realm. The benefit to local people will be limited due to the inaccessibility of the project from the western landfall of the sea wall and controls put in regarding the sea wall and the compounded water. These limitations will be exacerbated in the winter months due to the short day length.

26.33 Whilst the provision of walking and cycling provision along the sea wall is positive, it must be considered in conjunction with the visual impact on the promenade and the cycle route, which is considered by the Council to be adverse, and the potential for increase of blown sand on the promenade creating difficulties of access to cyclists and pedestrians.

26.34 Elements of the project do support the long term resilience for Swansea, however there are aspects of the project that do not fully mitigate some of the adverse impacts. The high uncertainty of the long term impacts on coastal processes and the wider potential social, economic and environmental negative impacts is still cause for concern.

27.0 Development Consent Order, Obligations and Requirements

27.1 The comments below refer to the Draft Development Consent Order (DCO) February 2014 (Document Reference: 3.1). The comments are made in the order in which the DCO is set out and do not repeat those comments given above where the adequacy of the DCO is considered under the relevant topic heading.

27.2 Article 4 applies section 96A of the Town and Country Planning Act 1990, which applies only in England at present, to the development. The section allows a Local Planning Authority to make changes to planning permissions in its area subject to the terms of the section. Nothing is said in this clause about section 96A(5), which states that the form and manner of an application under section 96A must be as prescribed in a development order. The development order which is relevant is the Town and Country Planning (Development Management) England Order 2010 which does not apply in Wales.

27.3 The council does not believe Article 4 of the DCO is appropriate in view of the procedure provided for Changes to and Revocation of Orders under the Planning Act 2008 Section 153 and Schedule 6.

27.4 In principle however, mechanisms to agree changes to the scheme, which do not extend beyond the parameters tested within the Environmental Statement, is considered reasonable and justified for a scheme of this scale and complexity.

27.5 Article 5 of the DCO allows a large amount of what would normally constitute development to be carried out without planning control once the Order has been made. The heading of the Article is “Maintenance of the authorised development”, but the matters set out under sub paragraph (2) –which states the power is to “carry out” as well as to maintain - is much wider than a power to maintain that which is allowed. The Clause goes well beyond the model clause, which only consists of sub paragraph 5(1) of the Order. This is of significant concern to CCS given the sensitivity of the location and the potential adverse impacts arising to the City’s main asset.

27.6 Similarly, given the nature and location of the development and significant issues arising from decommissioning and demolition works, such issues should not, in the view of CCS be contained within this Article. Furthermore, Article 3 (2) of the DCO already gives a meaning to the authorised development which allows alteration, removal, clearance, refurbishment, reconstruction, decommissioning and demolition of any building or other structure within the Order limits to the extent that they relate to or are required by or incidental to the carrying out of the authorised development. Therefore Article 5 (2) as drafted is not required as it duplicates the Article 3 rights.

27.7 For these reasons CCS objects to Article 5 as drafted and would wish this clause to be revised to restrict its provisions to maintenance and small scale ancillary works only.

27.8 CCS would also wish to Article 7 amended to ensure it its notified of any change in development and operator, given the responsibilities of the Authority under Article 48.

27.9 With regards to Article 8 (defence to proceedings in respect of statutory nuisance), the Council’s Pollution Control & Public Health Division is of the view that whilst a CEMP can be advantageous for some construction or engineering works, CCS has a statutory duty to ensure that it takes an enforceable position on the control of this type of noise. It cannot be backed up by statutory nuisance powers, as there is considerable doubt over whether temporary works can be a legal nuisance. This is why the parallel powers were introduced in the 1974 Act. On some major schemes contractors will still weigh up the penalties they may pay for contract delays against the potential penalties of a Section 60 notice. This matter has been tested in the courts and has been successfully dealt with using Section 60 alongside CCS’s power to seek an injunction with unlimited fines.

27.8 It is always hoped however, that draconian actions are not necessary, but CCS has a duty to protect residents from this type of noise and to follow the extensive guidance specifically on this subject in BS 5228. The system is designed (and reinforced by recent case law) to specifically tailor controls to the scheme on its merits. The City and County of Swansea automatically serves Section 60 notices on any development sites where construction is starting unless it is involving certain statutory undertakers who require their contractor to use a section 61 agreement with this authority. Anything less than that leaves the authority vulnerable to ombudsman complaints.

Whilst alternatives may sound attractive they have no statutory backing and are not clearly enforceable on a timescale required by the nature of this business.

27.9 Article 9 (street works) should include a requirement to reinstate/make good any work undertaken.

27.10 Article 10 (temporary stopping up of streets) is considered reasonable but the requirement for adequate diversions to be advertised and implemented for both pedestrians and vehicles.

27.11 Article 11 (access to the works) should include reinstatement in accordance with details to be agreed with the relevant Local Planning Authority following the cessation of the use.

27.12 CCS would again request that Article 12 (agreements with street authority) that the reinstatement of any works should be carried out within a specified timescale to be agreed.

27.13 The applicant will need to be registered on the NSG website as a stand alone utility and will require a DTI licence and subsequently a unique organisation reference number to send notices via EToN (Electronic Noticing System).

27.14 The applicant can been granted Code Powers which would entitle them to place apparatus in public and private land.

27.15 Code Powers allow the applicant to benefit from certain exemptions under Town and Country Planning legislation and also entitles them to carry out street works under the New Roads and Streetworks Act 1991 (NRSWA) without the need to apply for a licence to do so.

27.16 Code Powers enables an organisation to plan effective delivery of large infrastructure builds with an emphasis on close liaison with the Local Authority Roads departments. The legislation has an inspection regime that is monitored locally, regionally and nationally to ensure that all operators work to certain standards. In broad terms, this applies to the opening and closing of streetworks notices, the placement of apparatus in roads and footways including final re-instatement which needs to be guaranteed ensuring quality is maintained throughout the build.

27.17 Article 13(1), which relates to the discharge of water, is of significant concern to CCS as there may be watercourses in the area that it would not wish any further water to be connected to due to flood risk issues. It is requested that the wording is changed to more accurately reflect flood risk. There is also no statement regarding when the relevant drainage body will be consulted about any physical alterations and how this will be recorded and agreed i.e. in the case of ordinary watercourses the normal route is via the Land Drainage Act. CCS suggests re-drafting as follows:

13(1) Prior to utilising any watercourse or public sewer or drain for the drainage of water in connection with the carrying out, operation or maintenance of the authorised development the undertaker shall obtain the written agreement of the relevant drainage authority and for that purpose may not lay down, take up and alter pipes and may, on any land within the Order limits, make openings into, and connections with, the watercourse, public sewer or drain without the express consent of the relevant drainage body, which shall not be unreasonable withheld.

27.18 Article 13(2) makes no reference to any disputes regarding connections to watercourses be it a culvert or open watercourse. Allowance should be made for procedures regarding this to avoid any possible issues arising in the future.

27.19 For Article 13(3), CCS would question whether private people's riparian rights and responsibilities been considered here? Under common law a riparian owner would be within their rights to refuse a connection for no reason. It is also questioned what process will be followed with respect to agreeing discharge rates? CCS would expect any discharge to an ordinary watercourse to be based on the appropriate greenfield rate. If to a culvert the rate will need to be agreed based possible capacity which may not reflect greenfield rates.

27.20 Article 13(5) does not include ordinary watercourse and it is suggested therefore that the clause be amended as set out below to take account of all eventualities.

27.21 13(5) The undertaker shall not, in carrying out or maintaining works pursuant to this article, damage or interfere with the bed or banks of any watercourse forming part of a main river or ordinary watercourse in such a way as to affect the flow or flood risk management.

27.22 It is the view of CCS that the definition of an ordinary watercourse should be added for clarity as Article 13(8)(c) as follows:

(c) The term ordinary watercourse, as defined in the Land Drainage Act 1991 is a watercourse that does not form part of a statutory main river, and includes all rivers, streams and all ditches, drains, cuts, culverts, sluices, sewers (other than public sewers within the meaning of the Water Industry Act 1991) and passages through which water flows.

27.23 CCS is supportive of the provisions of Articles 17(3)(b), 18 and 19 which:

- If it appears to the Welsh Government urgently necessary to do so, the Welsh Government may remove the tidal work, or part of it, and restore the site to its former condition; and
- Provides for the relevant enforcing authority to require the undertaker to repair or restore at its own expense any tidal works abandoned or suffered to fall into decay.

27.24 Article 42 allows a Section 106 Obligation to be entered into even though the applicant may have no land interest at the time of the Obligation. This will be significant for the Section 106 provisions.

27.25 CCS is agreeable to Article 48(1) which provides that for the period beginning with the date when the Order comes into effect and ending on the accretion date, the area east of the administrative boundary of the County within the Order limits that falls within NPT and seaward of mean high water springs shall, for the purposes of the Control of Pollution Act 1974 and the 1990 Act be annexed to and incorporated with CCS. This agreement is subject to satisfactory resolution of the resources issue considered below under Schedule 6 and a fair and reasonable procedure for the discharge of requirements.

27.26 CCS however, agrees with the position of NPT that the annexation of Article 48(2) should not be a permanent change in jurisdiction for the purpose of this development, once completed.

27.27 A major part of the Draft DCO is concerned with compulsory acquisition of rights and land by the applicant. So long as CCS are assured that all compensation payable under these provisions is not to paid by CCS but is payable by TLSB, then no further concerns are raised here.

Schedule 1 Part 2 - Buildings Heights

27.28 Schedule 1 Part 2 details building heights and upward deviations that would be permitted; CCS raises no issue with this if the upward deviation is included within the parameters tested as part of the SLIVA.

Schedule 1 Part 3 - Requirements

27.29 Additional developer requirements are set out throughout this report under the relevant topic headings.

Schedule 6 – Procedure for Discharge of Requirements

27.30 The requirements essentially placed on CCS by the draft procedures for the discharge of requirements set out in Schedule 6 are considered to be unreasonable, unrealistic and onerous.

27.31 CCS will make every effort to deal with each submission as promptly as possible, however, given the size, nature, complexity, significant uncertainties and sensitivity of the location, as well as the requirement to involve other relevant parties, including statutory consultees, it will not be possible to deal with each requirement within 5 weeks. Many aspects of the scheme will also require significant pre-submission discussion with CCS prior to submission. The Statutory time period for the determination of condition applications is 8 weeks.

27.32 For the same reasons, the requirement to request additional information within 7 working days is unreasonable and onerous and also relies on responses to the submissions being made to the relevant case officer which will be outside of his or her control.

27.33 The requirement to send out all consultations in regards to requirements and to forward all response within 1 working day is again considered unreasonable and onerous and does not reflect the multiple responsibilities that local Authority officers have. Nor does it allow for instances of annual leave or sickness.

27.34 Given the budgetary constraints faced by local authorities and the issue of ongoing associated resource issues, to meet reasonable expectations, it will be necessary for the applicant to enter into a Planning Performance Agreement with CCS that funds one full time senior planning officer and one full time technical support officer.

27.35 Furthermore, the suggested fee for discharging requirements is disproportionally small and would not cover the costs for dealing with such matters.

27.36 Finally, the provision that if the application is rejected or not determined within the specified time period that the fee should be returned is unacceptable. This implies payment for approvals only rather than the process of consideration.

Section 106 Draft Heads of Terms

27.37 In the "Note on rationale for draft S106" the Applicant describes the document entitled "Heads of Terms" as a draft section 106. This is not the case as the draft document is in fact a document, which seeks only to list the obligations which the Applicant will covenant to provide. It could be a cause of confusion if the Heads of Terms (HOT) document continues to be referred to as a draft section 106.

27.38 Paragraph 5 of the HOT refers to the obligations to be given by the Applicant to cover Traffic and Transport. The obligations should include:

(a) The payment of a sum towards the Fabian Way Corridor Study Works in the sum of circa £535,000.
(b) The installation of an Automatic Traffic Counter at the site in a location to be agreed at the Applicant's expense in order to monitor ongoing traffic flows within the site.
(c) A mechanism requiring the Developer to make payments to the Council if the monitoring referred to in (b) above shows traffic flows over and above that predicted for the development. The payments to be used to fund traffic signal alterations, any other traffic orders as required by the flows of traffic and additional Fabian Way Corridor Study Works.
(d) The appointment of a Travel Plan Coordinator within 3 months of the date of the Consent Order, at the expense of the Applicant. This post to be maintained throughout the life of the project.
(e) That the three Plans referred to in Paragraph 5.4 are to be developed in conjunction with the Councils.

27.39 In addition to the extra obligations referred to above the applicant will have to provide the traffic and transport obligations to the standards and requirements of the Council. The caveat "subject to investigation of its viability" should be removed from Paragraph 5.2.2.

27.40 Paragraph 6 of the HOT refers to obligations to be given by the Applicant to cover Environmental matters. Paragraph 6.4.2.2 refers to a "financial or in kind contribution". The manner of the contribution must be at the discretion of the Council. The HOT should also cover the monitoring and mitigation issues raised above under the sections of this report relating to coastal processes, sediment transport and contamination; intertidal and subtidal benthic ecology; fish; marine mammals; coastal birds and terrestrial ecology.

27.41 The provision or upgrading of any necessary air quality equipment should form part of the Section 106 Obligation.

27.42 Further obligations in respect of the following environmental issues are also considered necessary and relevant:

a) The applicant to fund the re-calibration/validation of a water quality model capable of continuing to provide the level of prediction and discounting necessary for the designated sampling point in Swansea Bay. This should include funding the appointment of an independent expert, agreed by CCS and NRW, to assess the available approaches that could be trialled as soon as the construction of the lagoon is completed and the sluices are operational. This will include the existing statistical approach and any other suitable technique, including the use of hydrodynamic models.

b) Funding the collection of the necessary environmental data, including local met data, hydrodynamic data, detailed faecal indicator data, with the assistance of CCS and NRW. This must include certainty that any microbial data is of sufficient standard to satisfy the relevant European Directives.

c) Funding the independent expert to analyse and interpret these data, in such a way that a back-to-back trial can take place between the existing approach being used by CCS and other partners, and any other selected technique. The independent expert will report publicly on the findings of any such trial so that CCS and NRW can select the best performing system for prediction, protection, public information and discounting for Directive purposes.

d) Funding of detailed riverbed and River channel surveys by a reputable Marine surveyor. This will need to take place from the Sail Bridge to at least the middle fairway buoys. It should commence as early as possible, so that any change in sediment deposits in the navigable channels can be detected throughout the construction phase and beyond, probably for a period of five years from operational completion. It may be that ABP will need to be party to this agreement as they currently accept responsibility for dredging the shipping channel and the Council have responsibility for dredging upstream of the Kings Dock lock entrance. CCS currently undertakes a survey of its area of responsibility on an annual basis with Longden and Browning, but clearly this could be negotiable if the three parties could agree on one surveyor undertaking this project.

In terms of dredging liability, should the survey identify a significant additional burden to certain parts of the navigable channel, the applicant should be accepting that part of the dredging cost. These can be considerable, particularly for the outer channel currently dredged by ABP.

27.43 As detailed above, given the rocky nature of the lagoon structure and the flows from the turbines, consideration should be given to retain a safety boat post construction in order to deal with events such as vessel breakdowns on a rapid response basis.

27.44 The obligation should also set out matters for a suitably detailed decommissioning strategy and appropriate funding arrangements along with a clear position of responsibility for maintenance or any future intended use and associated costs for the same.

27.45 Paragraph 7 of the HOT refers to the Applicant's obligations to provide Community Provisions. Paragraph 7 is vague and would not commit the applicant to the provision of benefits of the scheme which are significant to the planning 'balance' of acceptability for the proposal as a whole.

27.46 In Paragraph 7.4 the requirement to fund the University Post does not have a date and this should be specified.

27.47 Paragraph 8 of the HOT refers to the Applicant's obligations to provide Public Art. The obligation as stated in the HOT refers only to the Applicant funding three competitions. The obligation should also be to pay for the items of public art which emerge from the competitions and to maintain those items once they are constructed.

27.48 Generally, all the obligations must be to provide the matters described to the Council's specifications and to meet all relevant standards. Trigger dates for all the obligations must be identified and the Applicant's commitment in terms of maintenance must be specified.

Other matters

27.49 CCS shares the concerns highlighted by NPT in its LIR regarding the "potential risks associated with the failure of the project to complete construction and the unpredicted impacts that partial completion could have upon biodiversity, coastal processes, navigable waters, tourism and commercial economies, and the visual amenity of the wider area. As the project will be one of the first of its type, together with the dynamic and complexity of the environment in which it is to be located, and in combination with the potential interrelationship between many of the potential impacts identified above, the financial failure of the project is possibly greater than that which would be associated with other large scale infrastructure projects of this type." CCS also agrees with the suggested response of NPT and invite the Examining Authority to "fully consider the relevant merits of the provision of a suitably constructed bond or insurance to ensure the possibility of appropriate measures being available to deal with any resultant impacts or where necessary to provide suitable mitigation measures should the project, or a significant contractor, or funding source fail." (Paragraph 10.1.1 of NPT LIR).

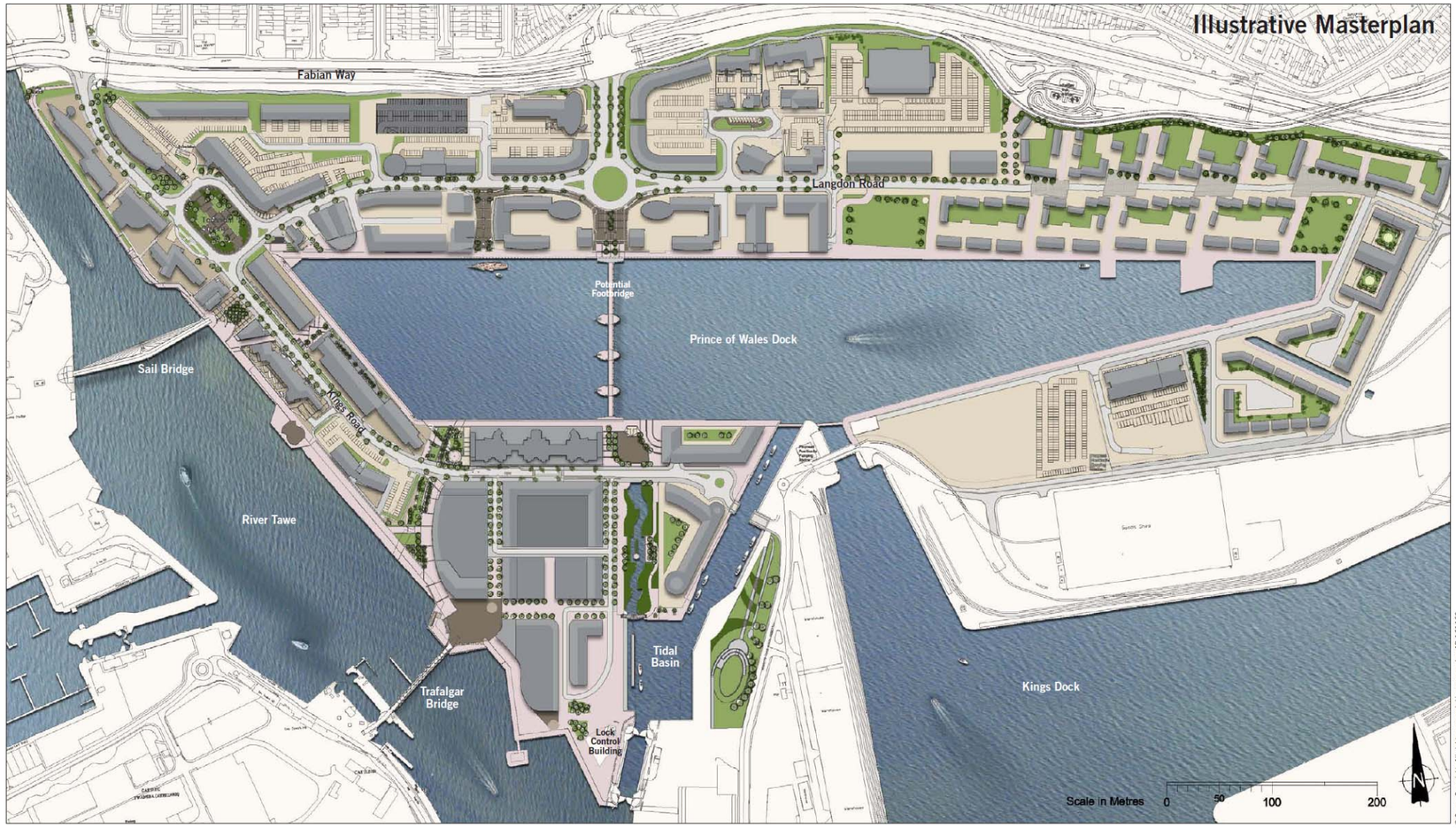
27.50 It is the view of CCS that further investigation should take place as part of the formal examination to explore other options to secure a pedestrian and cycle connection westwards to Swansea City Centre, perhaps as part of a walkway integrated into the Kings Dock locks. If this is not successful, it is further requested that provision should be made for in any DCO that is granted, to allow this option to be revisited at some point in the future.

Appendices

Appendix A	SA1 Swansea Waterfront Masterplan
Appendix B	Port Tawe and Swansea Docks adopted Supplementary Planning Guidance
Appendix C	White Consultants Report – Swansea Bay Tidal Lagoon Review of Environmental Statement: Seascape, Landscape and Visual, Final Report for the City & County of Swansea June 2014**.**
Appendix D	Seascape Landscape and Visual Impact Assessment Regional and Local Seascape Units, Landscape Character Areas and to Viewpoint Locations.
Appendix E	Kenneth Pye Associates Ltd Report - Comments and Advice relating to the proposed Swansea Bay Tidal Lagoon, with particular reference to changes in coastal processes and potential impacts (April 2014) (KPAL Report No: 160995).
Appendix F	Swansea Bay Sinc Map
Appendix G	Statistical modelling of faecal indicator organisms at a marine bathing water site: results of an intensive study at Swansea Bay, UK – A report from the Interrag 4a Smart Coasts – Sustainable Communities Project August 2013
Appendix H	Destination Swansea Bay 2013-2016', the official Destination Management Plan

SA1 SWANSEA WATERFRONT

Llywodraeth Cynulliad Cymru
Welsh Assembly Government



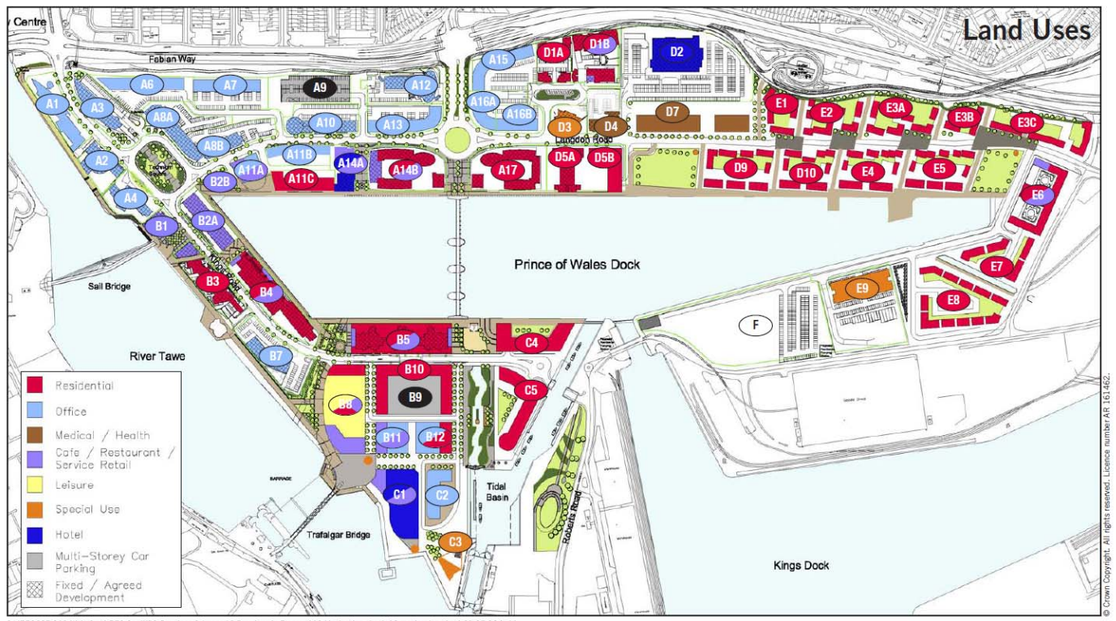

Aerial view of SA1 Swansea Waterfront

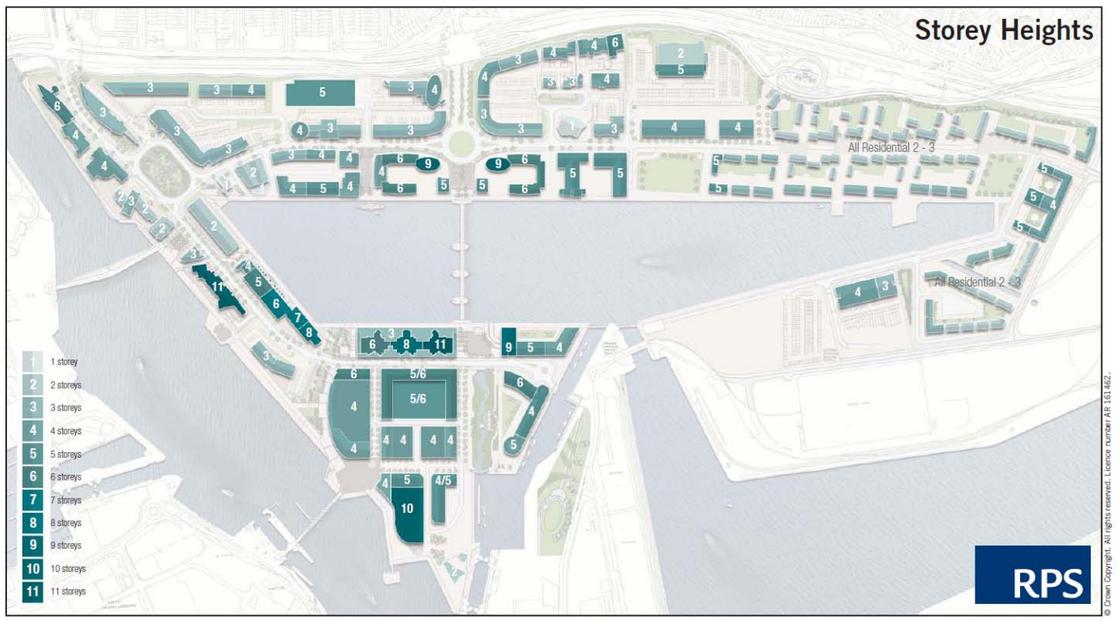

Sail Bridge


Bellway residential buildings *(Plot B4)*


Technium 1 *(Plot A4)*


The J-Shed *(Plot B2A)*





S:\UBR1235.SA1 Waterfront.RPS Cardiff\3 Drawings & Images\2 Drawings in Progress\A2 Masterplan sheet *A2 masterplan sheet 01.05.10.indd*

Do not scale from these drawings as they are for indicative purposes only. All information contained in these drawings should be verified through a proper survey.

Port Tawe and Swansea Docks

Supplementary Planning Guidance

Adopted 12th September 2002
Craig Anderson, Director of Development

City and County of Swansea – Dinas A Sir Abertawe

Contents

Plans

1. Introduction

1.1 This Supplementary Planning Guidance (SPG) relates to all the area between the River Tawe and the eastern boundary of Swansea, south of Fabian Way. See Plan 1. It is complemented by separate SPG for the St Thomas Station / New Cut area . Together this will provide comprehensive proposals for the eastbank waterfront.

1.2 The SPG derives from the premise that Port Tawe is a key element of the next era of the City's development and to the establishment of Swansea's identity as a major "Waterfront City".

1.3 The purpose of this SPG is to:

- define the concept of Port Tawe
- relate it to the wider docks area and the City Centre / Maritime Quarter
- provide an overall strategic framework to assist more detailed master planning
- promote sustainable development of the area for the economic, social and environmental benefit of Swansea
- ensure a comprehensive, integrated and inclusive form of development that is accessible for all
- promote a widely shared vision of Port Tawe and a plan for its delivery.

1.4 These overarching aims are expanded on in Section 5. This SPG will be amplified where appropriate by briefs for specific sites. It does not set out fine detail, rather it concentrates on the broad characteristics and objectives that the area's development should achieve.

1.5 This SPG replaces the earlier Port Tawe Strategy (Sept 1991). Circumstances and opportunities have changed significantly since that document was prepared. Evolving economic development strategy, in particular the Swansea Bay Economic Development Strategy (1999), has highlighted the significance of the waterfront to the development portfolio. The inner city housing market is rapidly developing. A number of large retail schemes have progressed, or are specifically planned, elsewhere in the city. The Welsh Development Agency crucially have assembled a large scale land holding to facilitate comprehensive development and make delivery of the Port Tawe concept realistic.

1.6 The longer term future proposals for the oil tank farm areas and the Queens Dock area have yet to be resolved. It is not therefore appropriate to consider revised land uses at this stage. It is assumed for the purposes of this Guidance that operational port activity will continue in that area for the immediate future. If this situation changes then the SPG can be updated.

2. Port Tawe Overview

2.1 Port Tawe is proposed to be a **mixed use development** comprising of business, housing and ancillary recreation and services. It will be developed simultaneously with adjacent ongoing commercial docks operations and related industrial activity.

2.2 To realise its potential Port Tawe needs to be **developed comprehensively** in both land use and design terms. It should **complement the City Centre**, which is the Council's primary development priority in terms of urban design, uses, balanced economy and transport movements. Together with the Maritime Quarter it should extend and reinforce Swansea's **waterfront focus** to the point that it is of national significance. The scheme should be an **image builder**, contributing to the creation of a new progressive identity for the city. To achieve this an urban design framework will be an essential tool to integrate design proposals prepared in consultation with the Local planning authority.

2.3 By capitalising on the exceptional length of water frontage Port Tawe will provide highly attractive sites for the **knowledge based economic development** that will be essential to Swansea's future prosperity, whilst at the same time providing opportunities for high quality and **imaginative living environments** which include a mixture of compatable land uses, and further establishing the mouth of the Tawe as a **multi-purpose visitor destination.**

2.4 It is also a **"gateway"** location and has the potential to assist in changing perceptions of the east of the city particularly by opening up the immediate and more distant waterfront to view from the eastern approaches. In this context the form of development between Fabian Way and Prince of Wales Dock is critical. An early commencement of the planned development here would aid the sense of arrival.

2.5 In terms of the **commercial docks** the aim is to support initiatives to maximise new trade and which may realise the important potential for Swansea to act as a land bridge between southern Eire and continental Europe.

2.6 The rate of development will depend on market conditions, sequential testing and transport capacity in the central area network. The initial focus for development is expected to be in the Technium and river front area.

2.7 The **strategic aims** for the area are set out in section 5.2.

3. Policy Context

National Policies

3.1 Development of surplus land in Swansea's dockland is very much in line with the national aim to place priority on developing previously used land and to locate development in accessible locations close to centres.

Local Policy

3.2 ***The Local Plan Review (1999)*** recognises the opportunity presented by surplus land in the docks area, but the proposals were set out in advance of the ongoing land assembly by the WDA. It covers the immediate riverside area with the same policy as for the Maritime Quarter and includes a separate more business orientated allocation for the Fabian Way sites. It also stresses the importance of promoting ongoing docks activity.

3.3 ***The Unitary Development Plan (UDP)*** is currently in preparation, and will make provision for a comprehensive employment and housing scheme at Port Tawe and for the ongoing development of docks related activity and other industrial development elsewhere in the area.

3.4 The significance of the Port Tawe area as a flagship location for the establishment of a knowledge based "cluster" that complements the City centre was highlighted in the ***Swansea Bay Economic Development Strategy.*** The Council endorsed the document in 1999 and resolved that it should inform the Council's Economic Development Statement and preparation of the UDP.

4. Background Information

Location

4.1 See Plan 1.

4.2 The development opportunity is exceptionally well located being immediately adjacent to the City Centre and the Maritime Quarter. Technium Phase 1 is 500m from Wind Street. The area north of the Ferryport is 230m from the Spontex site. These distances though have to be made "real" by new linkages over the River Tawe. If they are not then the objective for integration cannot be satisfactorily achieved. The river would be a barrier in the south and the area would be separated from the City Centre by a pedestrian-hostile environment.

4.3 The area is very accessible being situated on Fabian Way, the eastern approach road and public transport corridor and close to the main northern approach route at New Cut. Rail access is available in the eastern section of the study area.

4.4 The Port Tawe element of the SPG area extends to 38Ha gross.

Land ownership

4.5 The principal landowners as at June 2001 are Associated British Ports and the WDA. City and County of Swansea. The area contains a number of tenancies.

Existing land uses

4.6 See Plan 3

4.7 A large proportion of the Port Tawe area is now either vacant, being redeveloped or the subject of site preparation. Remaining uses inconsistent with the Port Tawe scheme are being progressively relocated to more suitable locations.

Listed buildings

4.8 These are indicated on Plan 6.

4.9 They are:

Norwegian Church – Small landmark building at the docks entrance.

The Flag Ship Building – Built 1880. Redbrick former ice factory with one of the few remaining chimneys in the Swansea Valley.

J Shed (built first half of 19thC) a large redbrick warehouse overlooking Prince of Wales Dock.

4.10 Development of these premises would require Listed Building Consent and be subject to the views of Cadw.

Environmental issues

Ground conditions / contamination

4.11 In view of previous uses there is a liklihood of contamination to varying degrees throughout the area. Site Investigations will be necessary in association with all development proposals. It is recommended that prospective developers discuss proposals with the Director of Environment and Health.

Hazards, consultation zones

4.12 There are a number of areas within which the Health and Safety Executive require to be consulted on development proposals. The boundaries relating to the liquid gas storage sphere located to the east of Kings Dock are set out in Plan 7. The sphere and adjacent infrastructure serve the isopropanol plant at Baglan Bay. Consequently it is envisaged that it will remain for the forseeable future. A general interpretation of the zone, which has three bands, is set out in the table below. There are a number of caviats and qualifications to this general guidance, and if further general information is required the Development Dept should be contacted. Detailed information should be sought from the Health and Safety Executive direct. It should be noted that the greater part of Port Tawe is located outside of the consultation zone relating to the spheres.

See table below.

Development Sensitivity Level (SL)	Inner Zone 625m	Middle Zone 825m	Outer Zone 1100m
SL1 Normal working Population	Acceptable	Acceptable	Acceptable
SL2 General public at home and involved in normal activities	Not acceptable	Acceptable	Acceptable
SL3 Vulnerable Members of the public	Not acceptable	Not acceptable	Acceptable
SL4 Large examples of SL3 and large outdoor examples of SL2	Not acceptable	Not acceptable	Not acceptable
NB Detailed definitions of the Sensitivity Levels are currently being finalised by the Health and Safety Executive.			

4.13 Additionally there are some licensed explosives sites that carry consultation zones. The WDA have negotiated agreements in relation to these so that they can be terminated subject to notice. The WDA should be consulted in relation to these.

4.14 As licensed operations / uses and consequent consultation zones are a dynamic situation it would be prudent to consult with the Local Planning Authority regarding up to date Health and Safety Executive consultation requirements.

Flood risk

4.15 The Environment Agency have indicated that in considering tidal defence structures they would normally set a level near the 7.2m AOD mark. In this particular area however the up-river location will serve to dampen any wave effect and any overtopping of water may be intercepted by the open dock areas. accordingly it is suggested that ground levels of above 6.2 metres AOD would be safe from all but extreme circumstances.

Engineering issues

Levels

4.16 The main issues requiring resolution are:

- the future of the tidal basin near to the barrage
- the mixed levels and retaining walls between Fabian Way and Langdon Road.

4.17 Otherwise existing ground levels are not anticipated as being a significant constraint on development.

Main trunk sewer

4.18 The main trunk sewer which connects to the main Wastewater Treatment Works follows the general line of Langdon Road. For much of this length it serves as a combined sewer storage tunnel. It does not represent a major obstacle to development although wherever possible it would be preferable to avoid building directly over it. In the event that development over the sewer is required then approval will be required from Dwr Cymru Welsh Water (DCWW). Network Development Consultants, Hyder Consulting Ltd, P.O.Box 10, Pentwyn Road, Nelson, Mid Glam, CF46 6XZ should be contacted in the first instance as Network Controller for DCWW, so that guidance can be sought. It is critically important to ensure that access shafts to the sewer are kept clear of development. Manholes C and A adjacent to Shafts 1 and 4 (see Plan 3) provide the easiest and preferred connection points, for new sewer lines introduced to serve development areas. Prior consent from the Network Development Consultants for Dwr Cymru is required for such works (Address as above).

Surface Water

4.19 Surface water generated by the development will not be permitted to be discharged to the public sewer system. Alternative methods of disposal will need to be implemented. This may require consent from the appropriate authority.

Canal protection corridor

4.20 The Local Plan requires a 20m reservation to accommodate any future construction of a canal link between the Tennant Basin and Price of Wales Dock, and between that dock and the Tawe Barrage basin a 14m reservation is required. (See Plan 5 and paragraph 5.33).

4.21 Whilst a specific route is identified, the essential requirement is to retain the opportunity for a link. It may be possible therefore to vary the exact alignment of the reservation to facilitate the most effective layout of development in the vicinity. Details relating to this issue will be the subject of further evaluation through the consultation process.

Misc issues

4.22 The City and County of Swansea has control of the River Tawe basin with the exception of a narrow strip of water extending approximately 6 – 10m from the eastern bank and for a length of approximately 400m north of the barrage. Ownership of this limited area is vested in WDA and carries with it only very limited mooring rights.

5. DEVELOPMENT PROPOSALS

OVERALL STRATEGY

5.1 The broad strategy for the area is set out in Section 2. It is about creating a modern, diverse high quality new sector of the City. Port Tawe is intended to integrate with the City Centre and Maritime Quarter to create a primary waterfront development focus that is unique, and can lead Swansea into a new era of its development. It forms an important element of the "Swansea Bay Arc of Opportunity". The specific aims which serve this are as follows.

5.2 **Strategic Aims**

Port Tawe should:

i. Provide a major extension of Swansea's waterfront development zone / destination.
ii. Contribute to the development of Swansea's image as a "Waterfront City".
iii. Complement, and not compete with, the City Centre.
iv. Increase the range of housing choice in Swansea.
v. Add a quality new element to the employment location / sites portfolio.
vi. Integrate with the Maritime Quarter and the Old Town Quarter of the City Centre.
vii. Provide positive benefits for St. Thomas and Port Tennant.
viii. Achieve a high standard of design with an integrated identity and sense of place.
ix. Contribute to a modern, innovative, high quality image of Swansea.
x. Achieve a comprehensively developed form rather than disjointed plots.
xi. Provide an integrated approach to the provision of safe and effective access for all groups in the community.
xii. Positively promote development of the commercial docks function and schemes to enhance linkages with the Irish Republic and other locations.

5.3 Proposals for delivering these aims are set out below in terms of land use, access, engineering issues, character and design.

LAND USE PROPOSALS

5.4 **Land use objectives**

i. Encourage growth of commercial docks activity and other employment development in the docks area.
ii. Docks development activity and operations should not be prejudicial to nearby redevelopment.
iii. Land uses in Port Tawe should be complementary to the City Centre.
iv. Port Tawe should be a mixed use development the principal elements of which are high quality employment and residential development together with ancillary leisure and service uses.
v. Employment development schemes should provide significant opportunities for growth and clustering of knowledge based enterprises.
vi. Residential development should achieve sufficient critical mass to reinforce the waterfront area as a residential location.
vii. Provision of hotels will be encouraged.

viii. Retail development should be limited to meeting local needs and should not prejudice the City Centre or other planned retail and trade locations, or the overall employment and residential role of Port Tawe.

ix. Leisure, tourism and catering uses as well as being complementary to the City Centre and the Maritime Quarter should reinforce the waterfront as a visitor destination, and provide facilities for residents and employees in the area.

x. Leisure, tourism and small scale specialist retailing should contribute to the creation of an attractive mixed use riverside environment.

xi. A "finer grain" of land use deriving from smaller units, high densities and a greater deal of mixed use should be achieved in the riverside areas.

xii. Opportunity should be retained for a strategic leisure facility eg arena.

Land use overview

5.5 The proposed general distribution of land uses is set out in the Development Proposals Plan (Plan 4). In summary this consists of:

- An **"innovation" area** at the Kings Road entrance, based on the Technium concept.
- A **mixed use area** between the Barrage Basin and Prince of Wales Dock. This should include leisure uses to reinforce a destination centred on the Barrage Basin.
- A **dense residential cluster** with employment and leisure uses intermixed across the barrage from Spontex, reinforcing the rivermouth as an intensive residential area.
- A **mixed use residential and B1 area** along the northside of Prince of Wales Dock.
- **High quality business park** between Langdon Road and Fabian Way, east of the innovation cluster.
- A **prestige site** is earmarked at the east end of Prince of Wales Dock for longer term development of a landmark scheme.
- Opportunities for **B2 General Industry and B8 Storage / Distribution** are identified on vacant land adjacent to the commercial docks area.
- A **cluster of service uses** adjacent the recently constructed Docks entrance.

NB Mixed use will promote sustainability by supporting integrated transport and reducing the need to travel by providing opportunities to live and work in proximity.

Employment Development

5.7 ***Technium innovation cluster***. This is targeted on knowledge based operations including start up and R and D type activity sometimes with linkage to the University. Technium 1 is complete. Further Technium development is anticipated. No eastern limit to this area is proposed and a flexible boundary with the adjacent campus business park is identified. It is anticipated that this area will be developed within the 5 year period.

5.8 ***Business Park***. As indicated above the western boundary is not fixed at this stage. It is intended that the Business Park integrates with Technium. It will provide opportunities for "grow – on" from Technium and also for separate initiatives including locally developed and inward investment The area should be primarily for B1 uses and could accommodate a range of accommodation types. A relatively high density of employment is envisaged. No rigid design, size or height requirements are proposed but buildings should be of good quality appropriate to such a prime location and incorporate quality landscaping which cumulatively creates an integrated setting. It is not anticipated that a significant proportion of this area will be developed within the 5 year period. The speed of growth beyond the initial phase will be determined by transport infrastructure capacity for the wider central araea. This will be an important consideration in Transport Assessments for specific schemes.

5.9 Further B1 opportunities could also be available interspersed with residential development along the ***north side of Prince of Wales Dock***. It is not currently envisaged that such schemes will be commenced within the 5 year period.

5.10 In the longer term there is potential for **further quality business park** development on the *south east edge of Prince of Wales Dock*. A degree of flexibility needs to be retained in this area until the requirements of longer term use of the "prestige" site adjacent are known. The "prestige" site could ultimately be a B1 opportunity for an HQ type scheme, but this is not anticipated before the medium term. There could also be more general industrial requirements arising from the land's proximity to the operational dock area.

5.11 Land is allocated for ***B2 (General Industry) and B8 (Distribution / Storage)*** in the area north and east of Kings Dock. This could be used in association with operational docks activity or independently. It would also be suited to accommodating employment uses displaced from the Port Tawe area that wish to remain in the general area. Immediately adjacent his area a recycling operation is to be implemented. This will be strictly controlled to ensure compatability with other uses in the area.

5.12 ***Ongoing commercial docks activity*** outside of the area identified as Port Tawe is expected to continue. This will focus on the Kings and Queens Docks. In addition to the general trade in Kings Dock the potential exists to create a sea / rail / road freight interchange facility between Kings and Queens Docks. Resource bids have been submitted. If successful not only would there be considerable additional trade potential environmental conditions would be radically improved. There may also be possibilities for a Freeport in the future, with value adding potential that could bring. Proposals are also being brought forward to improve screening of the coal quays.

5.13 Rail access to the north side of Kings Dock could also be rationalised. This could facilitate a more efficient layout of development plots in the industrial allocation to the north of the dock access road.

5.14 In addition to ongoing activities at Queens Dock there is a specific opportunity at the west end, south of the dry dock area to provide yacht moorings and repair / maintenance facilities, together with facilities for trawlers.
5.15 Within the commercial docks area hazardous uses and substances should not be located where they would inhibit the wider redevelopment proposals. It should be noted that whilst extensive Permitted Development (PD) rights exist for docks related development, where developments are subject of Environmental Impact Assessments Regulations the PD rights do not apply.
5.16 The opportunity for increasing services from the Ferryport are being explored. Considerable potential exists for Swansea Docks to act as a landfall connection between southern Eire and continental Europe.

Residential Development

5.17 Three main locations are envisaged:

i. Within the proposed ***mixed use area*** between Prince of Wales Dock and the Barrage Basin. Schemes could include river edge new build and conversion of the J Shed possibly in association with other complementary uses. It is anticipated that this development could take place within 5 years. Dwelling numbers will be dependent on the land use mix and design solutions.

ii. A main residential cluster to the ***north of the Ferryport***. The existing tidal basin could be filled to extend the developable area. This could in total provide 9.45 Ha. High density is anticipated. This would be likely to provide in the range of 800 - 1200 homes. To achieve higher densities it is anticipated that the designs will include elements of medium and high rise. A fixed approach to design is not stipulated but should complement the Spontex scheme across the river to the west. Within this main residential cluster compatable employment and leisure opportunities including a commercial leisure anchor use, and other uses will be acceptable as they will contibute to diversity of activity and create life and interest and help establish a vibrant mixed use area. The balance of the land use mix though should orientate towards residential. It is proposed that development in this area should commence in the 5 – 10 year period.

iii. ***North edge of Prince of Wales Dock***. A density similar to the Maritime Quarter is envisaged in this area. On that basis in the order of 350 homes could be accommodated in a mixed use scheme. An integration of elements of B1 and ancillary use with the housing would be expected. Except in the westernmost area it is not anticipated that significant development will commence in the 10 year period.

Social Housing

5.18 Due to the scale and location of the residential development opportunities an element of social housing is likely to be required in accordance with Development Plan policy. As each phase of development is planned the Director of Housing will assess current need and what specific requirement, if any, is to be sought and what the mechanism for delivery is to be. Whilst primarily a Buiding Regulations issue, the building of homes to a "lifetime standard" is encouraged.

Hotel development
5.19 Opportunities exist for both higher and budget market hotels. Appropriate locations include:

- Adjacent main access points.
- On the waterside near to the barrage.
- Other locations may also be acceptable.

Leisure and Tourism development
5.20 To help facilitate the establishment of ***the "rivermouth and Old Town destination area"*** the location of a commercial leisure use would be appropriate in the area between the tidal basin and the River Tawe provided that (a) the two proposed footbridges over the Tawe are constructed, and (b) the use is not diverted from the City Centre where it would preferably be located in terms of a sequential test and where it could reasonably be expected to be implemented in the short term. A3 uses (bars, restaurants) would be appropriate within the riverside mixed use area and have the potential to help establish a "leisure circuit" around the barrage basin. There is a particular opportunity adjacent to the barrage. Secondary opportunities also exist near to the area's "entry points", possibly in association with hotel development.

5.21 ***Tourism attractions*** will be considered on their merits. They have the potential to reinforce the riverside area and west end of Prince of Wales Dock as a component of a wider waterfront tourism destination.

5.22 Other leisure uses geared to serving the area and which comply with the objective of complementarity with the City Centre may also be acceptable.

5.23 The above opportunities could be implemented in the early years of the project.

5.24 The concept plan also identifies a particularly important site at the eastern head of the Prince of Wales dock as having potential for a larger scale attraction, or facility (eg Arena), should the opportunity arise in the market. It is not anticipated that this would be likely in the short term. All such proposals will need to accord with Health and Safety Executive advice.

Shopping development
5.25 Large scale retailing is not proposed to be located in the area, in accordance with Development Plan policy. ***Small scale retail*** (as defined in the Local Plan) to serve the localised needs of the area will be appropriate however and should be properly integrated into area design solutions. Also small scale speciality retailing serving tourism activity will be appropriate within the mixed use area to reinforce its destination character.

Community Facilities
5.26 Support services such as medical surgeries and creches should be integrated into residential development areas. No specific allocations are therefore made.

5.27 No school site is allocated in the area. *School provision* will be made by existing schools in the wider area. Some improvements will be needed to these facilities to accommodate the increased demand. Contributions towards upgrading existing facilities to a standard that can properly serve the increased needs resulting from the new developments will be sought from developers by means of S106 planning obligations. The specific contributions required will be assessed at the time individual planning applications are determined.

Landscaping and open space

5.28 The character of Port Tawe will be primarily built urban, capitalising on water edge (see Character section). Appropriate landscape (hard and soft) for individual sites will be identified in briefs and will be determined in the total design context of specific planning applications.

5.29 In this context the main use of land for landscaping will consist of:

i. A continuous landscape belt along the ***Fabian Way frontage***. This belt should accommodate:
   (a) a 3m wide joint use footpath / cycleway which could replace the existing roadside footpath and
   (b) a 3.65m wide reservation for a possible future bus lane. This could incorporate the space occupied by the existing roadside path and the balance could simply be grassed in the short term.

   The joint use path should be separated from the bus lane reservation by a planted area of minimum 3m width with some variations to create interest, and be flanked on the south side by a minimum of 3m of further landscaping. This area should integrate with the landscaping to be provided as part of future frontage development schemes. There will be no rigid building line for the frontage and in places the total landscape depth will be substantial. At other locations high quality built elevations could closely relate to the landscape belt. It is important that these works are implemented in the short term as it is anticipated that full build- out of the eastern part of the Business Park will not be completed for several years.

ii. A high level ***"green cycleway corridor" into Port Tennant*** via the disused railway bridge over Fabian Way. This will effectively form a linear park and should link with the Fabian Way landscaping.

iii. The ***canal route protection corridor*** (see 5.33 below) provides an opportunity to contribute to a landscaped link to the Sewage Treatment Plant landscaped area. This opportunity should be retained for future implementation. There may also be further opportunity in the future to link this corridor to the seafront in association with redevelopment of the tank farm area.

5.30 Where areas of public realm (both hard and soft) are intended to be adopted by the Council commuted sums for their ongoing maintenance will be required. These will be agreed with the Culture and Recreation Department as schemes are progressed. If such areas are not to be adopted then suitable measures for their ongoing satisfactory maintenance will need to be agreed.

5.31 Whether there is need for play provision within housing phases will be assessed in terms of the specific housing types and anticipated residents. The approach towards maintenance of such areas will be as set out above.

Use of water areas

5.32 Once commercial use of the ***Prince of Wales Dock Basin*** ceases there will be need to create interest and make positive use of what could otherwise be an extensive, uninteresting water area. Options to be explored include: further marina use (although it will be important not to prejudice existing marina operations that have underpinned the establishment of the Maritime Quarter and the concept of the Swansea waterfront regeneration area), sports activities including rowing and sailing training, arts and water sports events, and water features. Proposals to extend development sites and public access areas on to / over the water areas could be effective and will be assessed on their merits. Floating restaurants and even house boats could also be considered on their merits. The possibility of use of the commercial docks lock for pleasure craft is a possibility subject to suitable management arrangements. There is also potential for a role as a base for sailing holidays, and if the canal scheme proceeds, as a base for canal cruising. Boat taxis also have potential as the development proceeds. These could also link with the Maritime Quarter and the Yorkshire Imperial and Morfa locations upstream.

5.33 A ***Canal route protection and landscape development corridor*** 20m wide should be retained to link the Tennant Basin with Prince of Wales Dock, and a 14m wide link from the Dock into the River Tawe. As noted earlier the precise location of the link is subject of some flexibility to minimise disruption to development opportunities. The option also exists for an alternative link to the River Tawe via the tidal basin. The Development Plan protected corridor is shown on Plan 5. An optional route is shown on Maps 4 and 5. Construction of the canal is not a requirement of the development. The link to the River Tawe barrage basin could however be beneficial in achieving positive use of the Dock water space should it not prove acceptable to use the main docks lock. Alternatively a separate link between Prince of Wales Dock and the tidal area downstream of the barrage to serve marina – type activity would also be acceptable.

5.34 Limited opportunities only exist for the provision of boat moorings along the east bank of the barrage basin as an access corridor along the river needs to be maintained. Allowance should be made for providing access points for passenger boats (eg water taxis) on the river frontage of the mixed use area.

ACCESS PROPOSALS

5.35 **Access Objectives**

i. Improve pedestrian, vehicular and public transport access into the area for all groups in the community.

ii. Minimise conflict between inappropriate docks and ferryport traffic and Port Tawe.

iii. Minimise adverse impacts of vehicles on the environmental quality and safety of Port Tawe.

iv. Accommodate a high quality bus link to the City centre.
v. Rail links to efficiently serve Kings and Queens Docks should be retained.
vi. Provide a section of the National Cycle Route between the River Tawe and Port Tennant.
vii. Provide new pedestrian links to\the Maritime Quarter and Old Town Quarter.
viii. Provide safe and convenient pedestrian links with St Thomas / Danygraig / Port Tennant.
ix. Car parking provision should take into account both the needs of the development and the availability of alternative transport means.
x. Provide public car parking at destination locations where appropriate.

5.36 Vehicle Access

i. The broad pattern of access and separation of routes to Port Tawe from the Docks routes is set out in Plan 5.

ii. Port Tawe should be accessed by a ***new all-directional junction*** at the location indicated on the concept plan. The design for this junction and its link to Langdon Road should be subject of detailed discussion with the Director of Technical Services. It should incorporate an at-grade pedestrian crossing of Fabian way. Once this new connection is completed the Kings Road / Fabian Way junction should be downgraded to left in – left out. Until such time as the new access and link to Langdon Road are provided development will be limited to the area hatched on Plan 5 subject to there being no unusual intensity of development.

iii. The area to be primarily served by the new Port Tawe access (as indicated on Plan 5) should be designed as a ***20mph traffic zone***. Heavy vehicles will be discouraged from this area other than for servicing purposes.

iv. Other specific access requirements / issues are summarised on Plan 5.

5.37 Bus Routes

The Park and Ride facility for the eastern approach to the City Centre is to the north of Fabian Way. The route for buses from this site has finally to be determined, and the opportunity to provide a dedicated route should be protected. Options for this include: at-grade crossing of Fabian Way, a route over the disused Fabian Way railway bridge and ramp down to either Langdon Road or Fabian Way. See Plan 5.

Options for the ***Park and Ride bus route*** to the City Centre include use of Langdon Road, use of Fabian Way with bus priority measures at junctions and provision of a dedicated bus lane within the landscaping corridor. Whichever route is selected it is proposed that the bus route should be separated from general traffic on the Quay Parade river bridge by constructing a new bus bridge on the existing piers in the river.

It will also be important to ensure that the access pattern within Port Tawe facilitates convenient local bus services and connection to the ferryport.
The layout of new development areas should accommodate a high degree of bus permeability.

5.38 Pedestrian and Cycle routes
An extensive network of pedestrian routes is proposed. These are summarised on Plan 5. Most of the quaysides are proposed for public access and these should be interconnected by a series of strategic links. Outside of these routes and defined areas of public space the emphasis will be on providing secure private access and space.

5.39 The ***National Cycleway*** route is defined on Plan 5. It is proposed to run through the landscape corridors identified earlier.
Additional cycle routes may also be developed including along the south edge of the Business Park. These routes should also be available to pedestrians.
Public pedestrian routes should be provided along all the quaysides and to make the linkages indicated on Plan 5.

5.40 Pedestrian / Cycle linkage to the Maritime Quarter
Two new ***footbridges*** are proposed:
i. Over, or if necessary in the vicinity of, the barrage.
ii. Between Technium 1 and Maritime Quarter Site 3 as indicated on Plan 4.

5.41 These links are essential for the integration of Port Tawe with the westbank and Old Town and reinforcement of the rivermouth as a destination, and to properly link Port Tawe with the City Centre via a safe, convenient and attractive route. The bridges are a requirement and consequently planning conditions will be applied requiring their provision, and a S 106 obligation regarding their construction will be sought.

Car Parking
5.42 Standing Conference standards will apply to developments in the area. Copies of these standards can be obtained from the Council's Technical Services Department. The standards will generally be applied as upper limits, and specific requirements of individual projects will be the subject of on merits considerations including the provisions of Travel Plans where relevant.
It should be noted that an addendum to Standing Conference standards is expected to be adopted shortly. Car parking provision should be made through a combination of "on-plot" and shared destination car parks at appropriate locations. "Blue Badge" parking should be provided in accord with the Council's Access Guide.
The Authority will also welcome innovative proposals which would reduce car dependence eg the establishment of "car share" clubs. Adequate provision should be made for cycle parking.
Railway
5.43 Rail linkage to the north side of Kings Dock and the area between Kings and Queens Docks should be retained. This would not preclude rationalisation of track routes to facilitate more effective patterns of development. The potential for a sea / rail / road freight interchange is noted earlier.

Development Control Considerations - Transport

5.44 To ensure comprehensive appraisal a full ***Transport Assessment*** (TA) will be required for Port Tawe as a whole (as defined on Plan 1). This can most effectively be provided in relation to an overall outline planning application (see section 7). Within the context of an overall TA individual major proposals, or phases of the wider development, will be the subject of detailed specific assessments as they are brought forward. These TA's will identify works required as part of the development scheme within the site and that are required beyond the site, within the network, as a consequence of the traffic generated by the development. It is also anticipated that ***Travel Plans*** will be required for major developments at that stage.

ENGINEERING PROPOSALS

Landform

5.45 Site preparation requirements for different development parcels will vary with specific Site Investigation findings as schemes are brought forward. At this overview stage only two major proposals are identified:

- Infill of the tidal basin north west of the Ferryport. Whilst this is not a requirement and alternatives such as repairs to the banks could be acceptable, it is anticipated that infill will be the most cost effective solution and will maximise the potential development area.
- Levelling of the ground between Fabian Way and Langdon Road by means of a balanced cut and fill operation to create a largely single level development platform. This will increase visibility of the wider development area from Fabian Way which will reinforce the "city by the sea character" and facilitate a comprehensive layout of the proposed business park development.

Infrastructure

Sewerage

5.46 The main sewerage connection points are most cost effective at the locations indicated on Plan 3. To accommodate links to these connection points either a new sewer be incorporated in a services reservation retained alongside the main distributor road routes (anticipated to be based on Langdon Road and Kings Road) or shafts 2 and 3 are improved to allow additional connections to be made at these locations. Individual schemes could then link to the "spine" sewer or via any of four shafts suitably spaced along Langdon Road.

Other Utilities

5.47 No unusual difficulties in supplying gas , electricity, water and telecommunications are anticipated.

5.48 It is proposed that a 2m services reservation be retained alongside Langdon Road.

6. CHARACTER AND DESIGN PROPOSALS

6.1 This SPG does not intend to be prescriptive about specific design solutions. The key test will be whether the objectives below and characteristics set out in Plan 6 are being delivered.

6.2 It is proposed that an Urban Design Framework be prepared by the developer (WDA). This should indicate how the objectives of the SPG are proposed to be met. It could serve as supporting information showing how individual development schemes contribute to the overall design and character aspirations.

6.3 The WDA may wish to consider how it can be ensured that the funding mechanisms and tendering processes deliver quality design.

6.4 **Character and design objectives**

i. Create an individual identity and image that sets it apart from competing cities, towns and developments in the region.
ii. The form of development should contribute to the overall development of Swansea's image as a "Waterfront City".
iii. Create a place that is a destination and which is enjoyable for residents, tourists/visitors and incorporates the principles of inclusive design for all groups.
iv. A comprehensive master planned approach to ensure a cohesive and integrated, organic development form.
v. Maximise benefit from the waterfront location and capitalise on vistas and water based activity.
vi. Designs should reinforce an image of Swansea as an innovative city progressing into a new era.
vii. The layout and design should complement schemes on the west bank, and create a high quality setting around the barrage basin.
viii. Provide attractive new public realm with a network of water edge routes, links and focal points at key locations which also promote functional linkage with the west bank.
ix. Contribute to enhancement of Swansea's eastern gateway.
x. Increase visibility of the waterfront from Fabian Way.
xi. Overall development form should incorporate variety in terms of scale, density, height and massing.
xii. Prestigeous, landmark buildings and spaces should be located at key locations.
xiii. High quality gateway treatment of the main entry points.
xiv. Provide interest through the detailing of buildings and spaces.
xv. Treatment of the adjacent New Cut and St Thomas Station areas should continue this approach into the Tawe river corridor north of Quay Parade bridge.
xvi. Developments which demonstrate best practice in terms of sustainable development principles will be encouraged.

Design Proposals

6.5 In pursuit of the design objectives Plan 6 sets out a number of key characteristics that should be taken into account when more detailed design proposals are developed and serve as a design "bottom line". In particular the following are highlighted:

- High quality elevations, in a themed landscape corridor along Fabian Way.
- A strong sense of "arrival" at Port Tawe.
- Landmark architecture at main entry points with views to the water areas created.
- Make the new development and water areas more visible from Fabian Way.
- Enclose the Prince of Wales Dock with high quality cohesive elevations along all dock edges.
- Encourage "colonisation" of the water area with development, particularly along the north edge of the dock.
- In the longer term landmark architecture at the east end of Prince of Wales Dock.
- Visual enclosure of the River Tawe barrage basin to create a strong sense of place that itself becomes a destination. There is considerable potential for the imaginative use of light in this context.
- Create an "icon" feature that will strongly identify Port Tawe in views from the Fabian Way bridge. The proposed footbridge provides an exceptional opportunity for this.
- Create focal points / spaces adjacent the barrage and footbridge.
- Landmark feature / building and viewing opportunities from the tidal basin area.
- Visual linkage between the tidal basin and Prince of Wales Dock.
- Use of the remaining historic buildings as features.
- Public access in attractive public realm along all water edges. The public realm should be of human scale through specific townscape treatments.
- Use of art features in the public realm, in particular at focal points.
- Measures to deal with dull, overlong views along Langdon Road.
- Landscape corridor linkage with Port Tennant.
- Green corridor linkage to the burrows to the east.

% for Art

6.6 The % for Art policy applies to this area. The opportunity should be taken to introduce a themed approach to its delivery in the area. More detailed consideration of ideas and concepts will be the subject of further, separate discussion, but could pick up on strands such as maritime history and technological advance.

Development Control - Design

6.7 Site specific ***planning briefs*** may be prepared for particular development parcels where necessary. ***Design Statements*** will be required for all schemes. These should set out the design principles of the proposal and show how it

meets the brief, complies with this SPG and the "urban design framework", enhances the area and relates to the "evolving place".

7. IMPLEMENTATION

General

7.1 The key to the successful development of Port Tawe will be comprehensive development, socially inclusive design, integrated advance infrastructure works and ongoing maintenance of a cohesive and attractive environment.

7.2 To ensure this occurs adherance to broad land use and design / character parameters will be essential. This SPG forms part of the framework by setting out an overview of appropriate land uses and their distribution together with a number of bottom line design and character objectives. It is intended that this should be underpinned by a clear design statement for the overall development prepared by the principal developer. It should be noted that the Council's Access Design Guide applies to the area in association with the BS8300 Code of Practice.

7.3 Whilst the area has great potential, considerable pump priming investment not the least in terms of infrastructure and the public realm, will be required. A large part of such investment will need to take place in the early years but will need to be offset from development returns over the full life of the project. In this context it will be essential not only to adhere to agreed land use and design frameworks but to avoid piecemeal "cherry picking" developments that capitalise on short term market opportunities but do not contribute to the total infrastructure and public realm provision for the area. Comprehensive development and unified ownership will be significantly beneficial in this respect.

Development Control

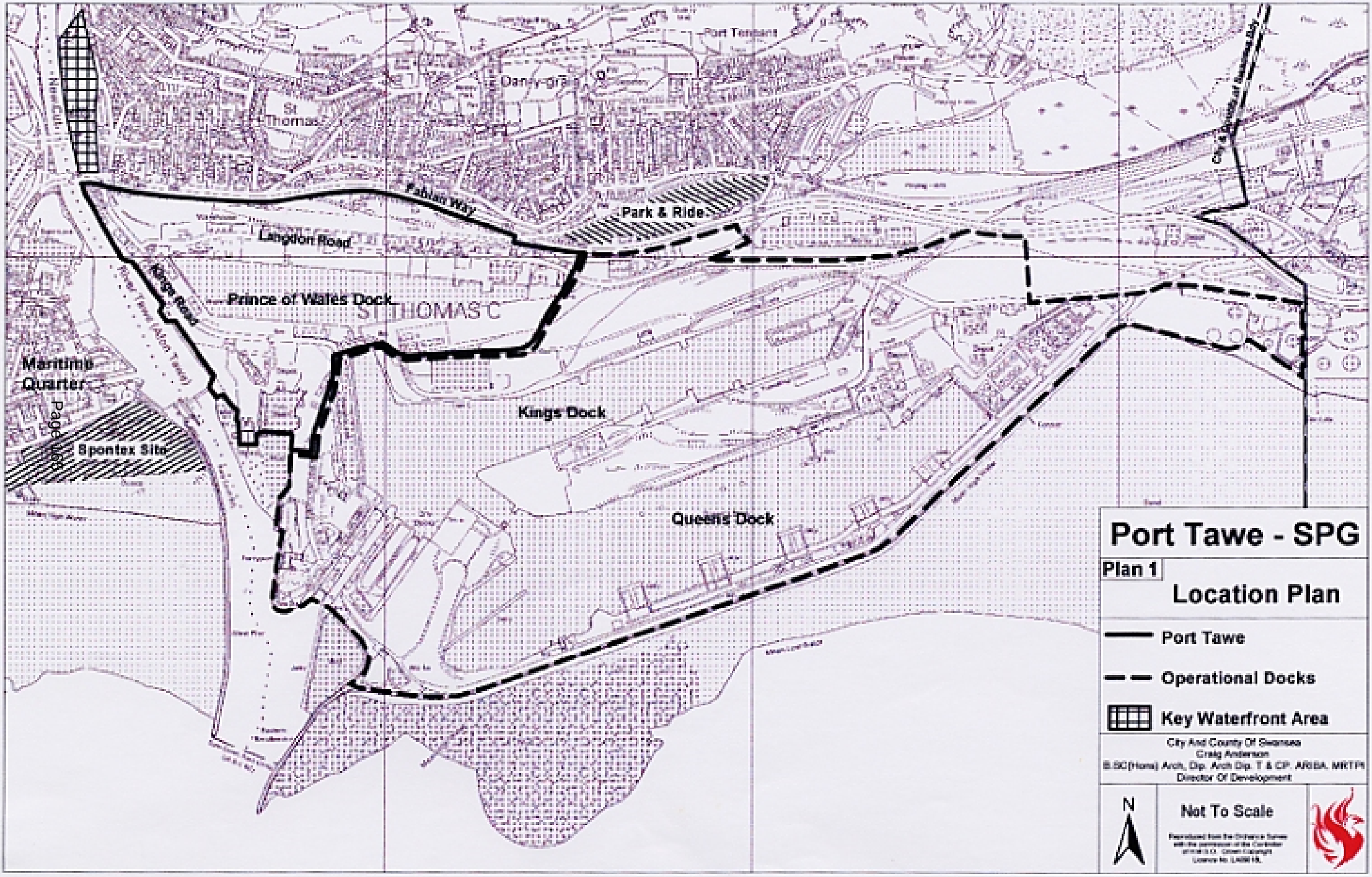
7.4 In addition to basic statutory requirements the development control approach to the project will be to ensure that the comprehensive, long term approach outlined above takes place. An outline planning application for Port Tawe as a whole supported by an Environmental Impact Assessment and a Transport Assessment, and preferably with supporting information in terms of an urban design framework will be sought. Conditions linking to the SPG will be incorporated and where appropriate S106 obligations will be sought. It should be noted that new guidelines for developer contributions are being prepared at the national government level.

7.5 See also paragraphs 5.44 and 6.7

Phasing of Development

7.6 Phasing of the development and associated access infrastructure requirements will need to reflect the adopted recommendations that derive from the ongoing Joint CCS / WDA Development and Transportation Study.

7.7 In promoting developments in Port Tawe in the short term, The Council request the WDA to pay particular attention to the need to use grant aid in a way which promotes a strong City Centre and which does not undermine the principles of the sequential test.


Port Tawe
St Thomas
Danygraig
Fabian Way
Park & Ride
Langdon Road
Kings Road
Prince of Wales Dock
ST THOMAS C
Maritime Quarter
Spontex Site
Kings Dock
Queens Dock
Port Tawe - SPG
Plan 1
Location Plan
Port Tawe
Operational Docks
Key Waterfront Area
City And County Of Swansea
Craig Anderson
B.SC(Hons) Arch, Dip. Arch Dip. T & CP. ARIBA. MRTPI
Director Of Development
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Not To Scale

Port Tawe - SPG

Plan 2

Aerial Photograph

City And County Of Swansea
Craig Anderson
B.SC(Hons) Arch, Dip. Arch Dip. T & CP, ARIBA, MRTPI
Director Of Development

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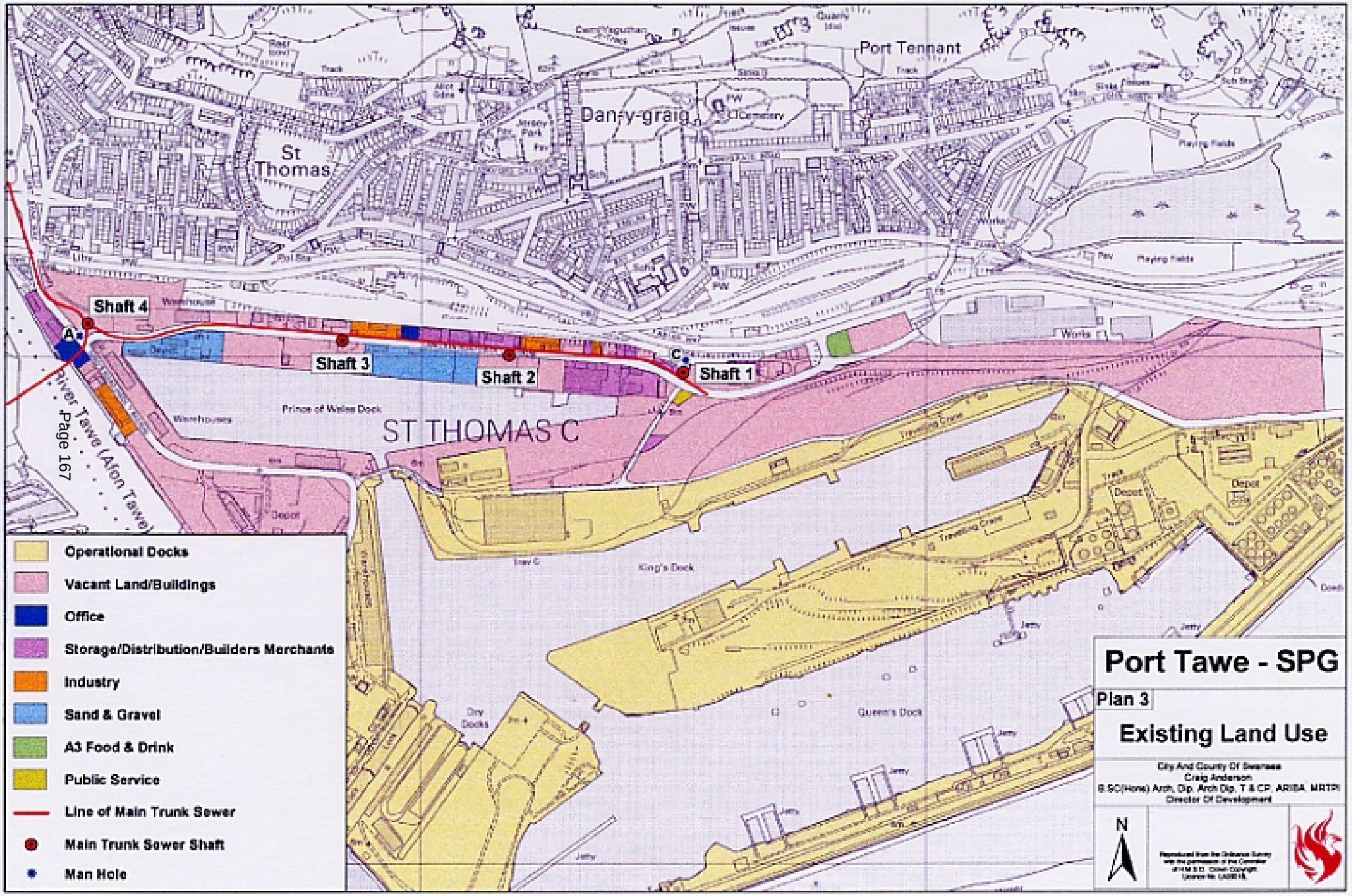
Port Tennant
Danygraig
St Thomas
Shaft 4
Shaft 3
Shaft 2
Shaft 1
A
C
River Tawe (Afon Tawe)
Prince of Wales Dock
ST THOMAS C
King's Dock
Queen's Dock
Dry Docks
Operational Docks
Vacant Land/Buildings
Office
Storage/Distribution/Builders Merchants
Industry
Sand & Gravel
A3 Food & Drink
Public Service
Line of Main Trunk Sewer
Main Trunk Sewer Shaft
Man Hole
Port Tawe - SPG
Plan 3
Existing Land Use
City And County Of Swansea
Craig Anderson
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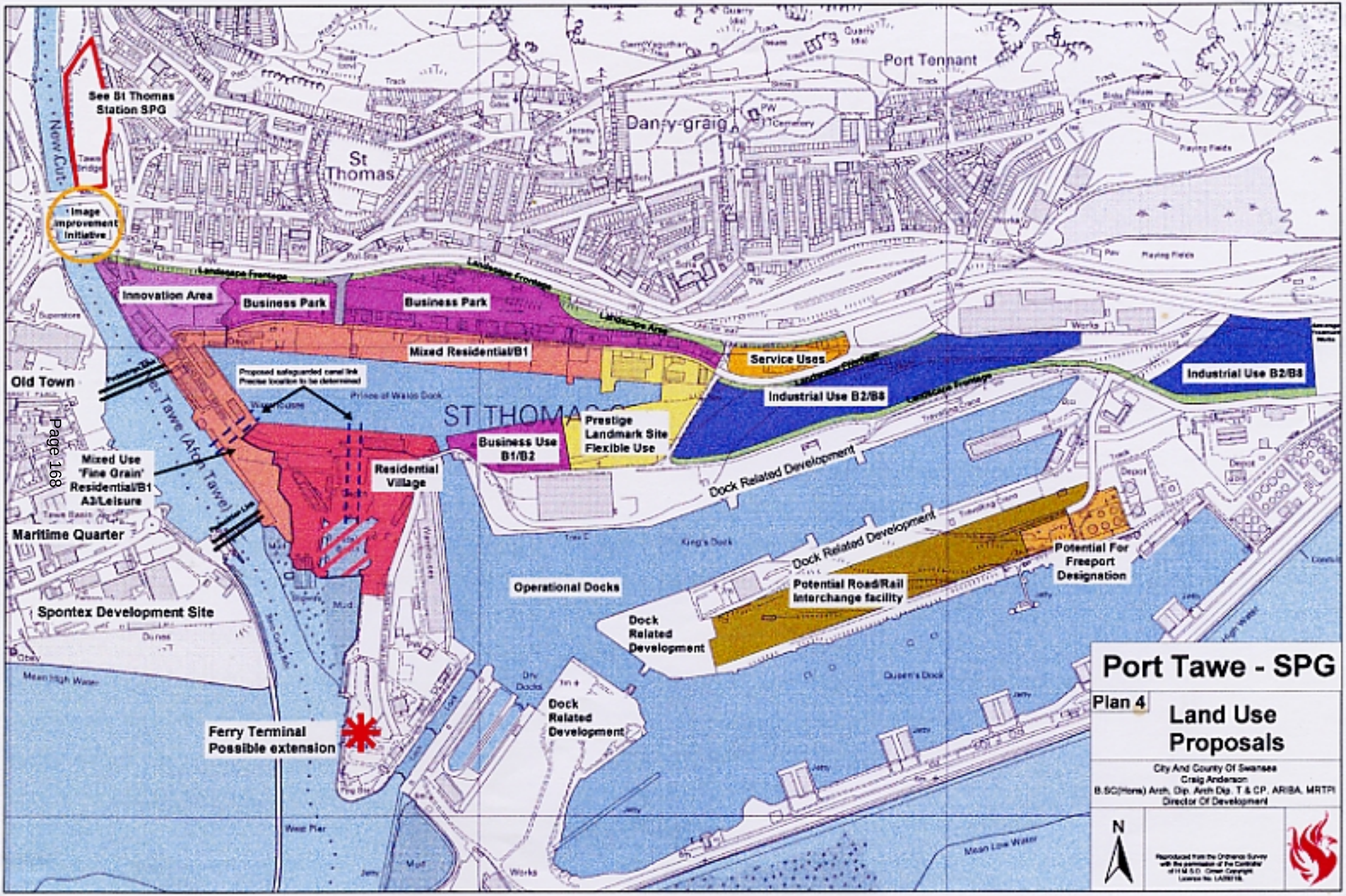
N


See St Thomas Station SPG
New Cut
Image Improvement Initiative
St Thomas
Port Tennant
Dan-y-graig
Landscape Frontage
Innovation Area
Business Park
Business Park
Landscape Area
Mixed Residential/B1
Service Uses
Industrial Use B2/B8
Industrial Use B2/B8
Old Town
Proposed safeguarded canal link
Prince of Wales Dock
ST THOMAS
Prestige Landmark Site Flexible Use
Business Use B1/B2
Residential Village
Mixed Use 'Fine Grain' Residential/B1 A3/Leisure
Dock Related Development
Maritime Quarter
Dock Related Development
Potential For Freeport Designation
Operational Docks
Potential Road/Rail Interchange facility
Spontex Development Site
Dock Related Development
Dock Related Development
Ferry Terminal Possible extension
Mean High Water
Mean Low Water
Port Tawe - SPG
Plan 4
Land Use Proposals
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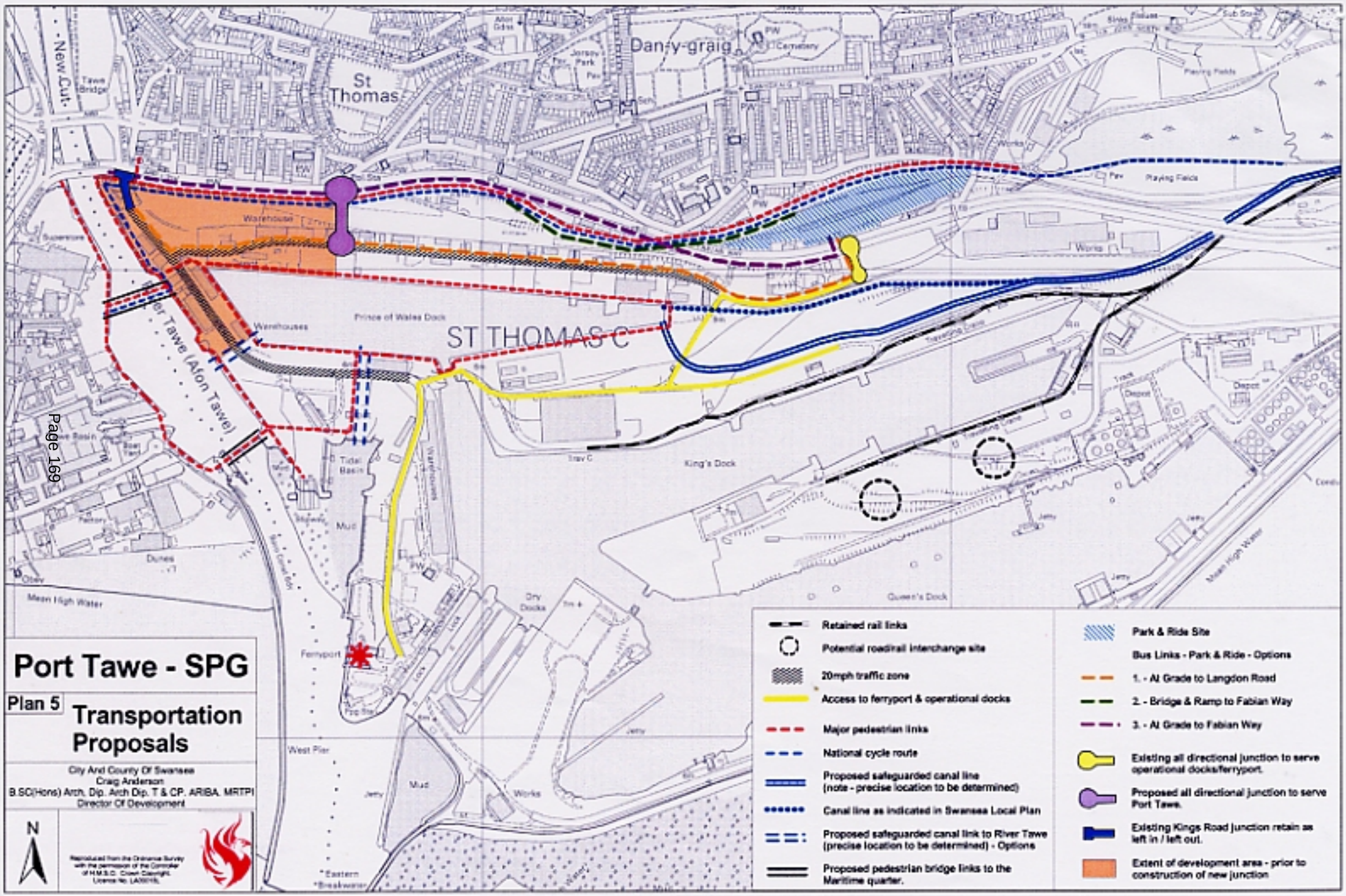
Port Tawe - SPG
Plan 5
Transportation Proposals
City And County Of Swansea
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Director Of Development
N
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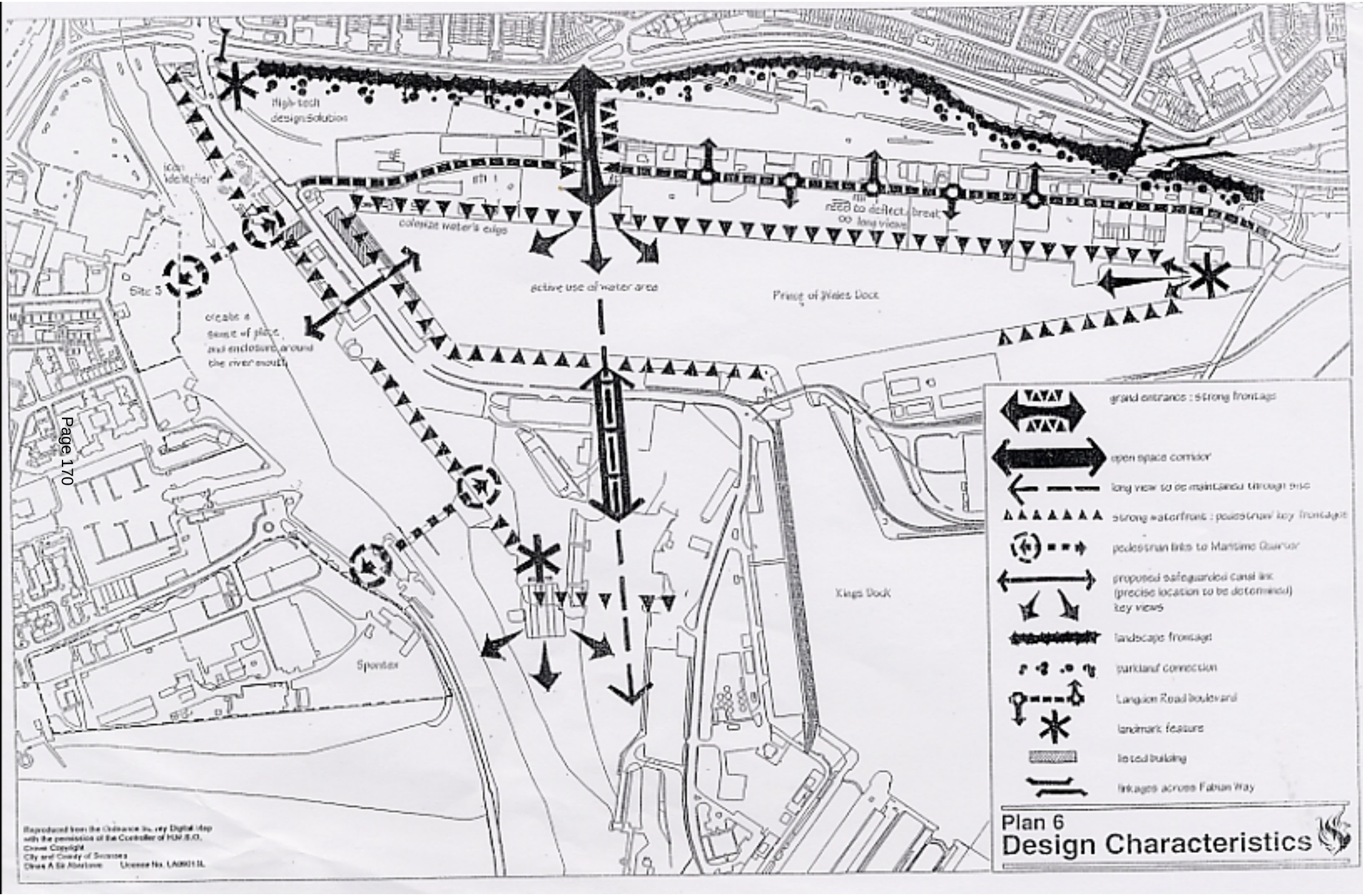
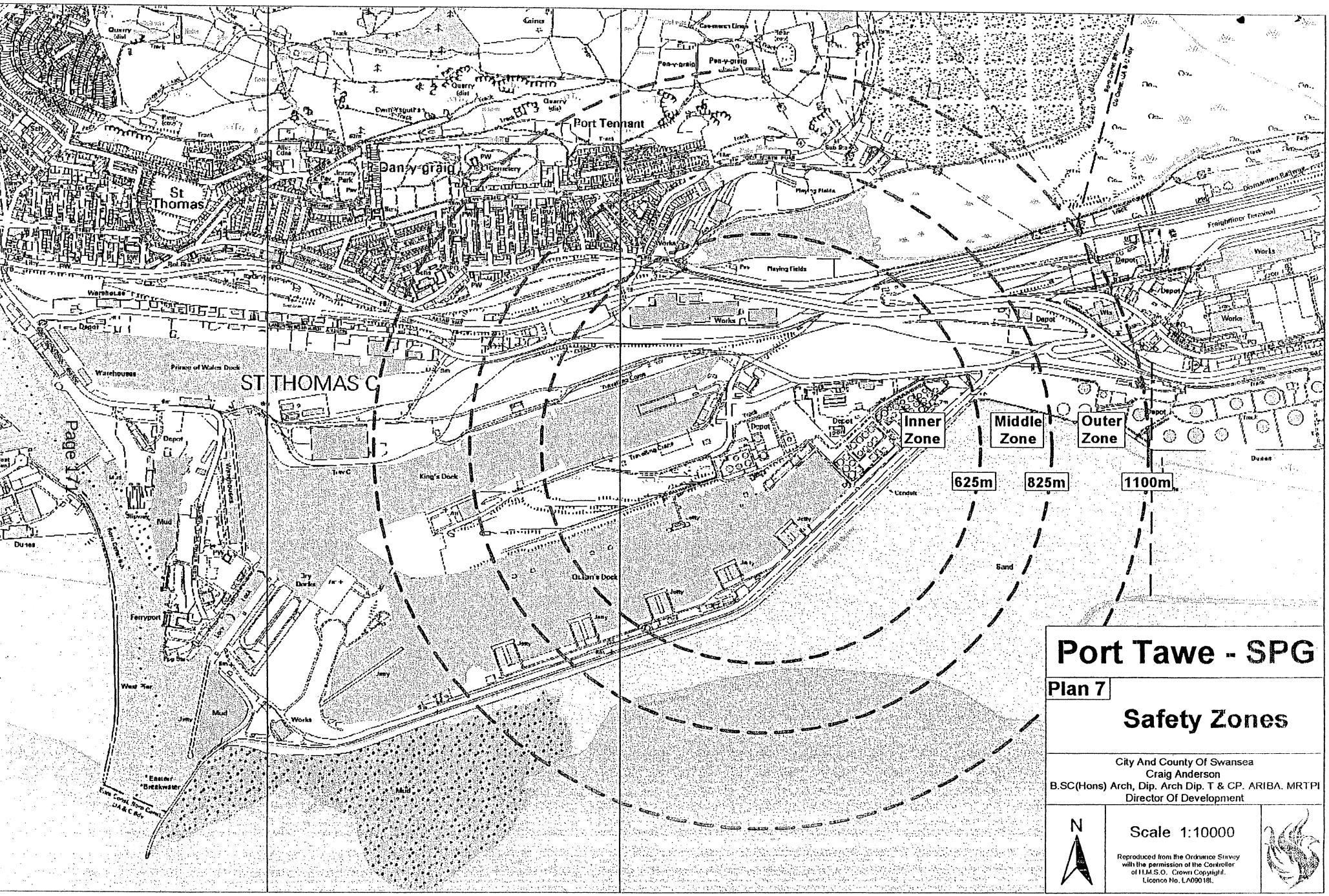
Retained rail links
Potential road/rail interchange site
20mph traffic zone
Access to ferryport & operational docks
Major pedestrian links
National cycle route
Proposed safeguarded canal line (note - precise location to be determined)
Canal line as indicated in Swansea Local Plan
Proposed safeguarded canal link to River Tawe (precise location to be determined) - Options
Proposed pedestrian bridge links to the Maritime quarter.
Park & Ride Site
Bus Links - Park & Ride - Options
1. - At Grade to Langdon Road
2. - Bridge & Ramp to Fabian Way
3. - At Grade to Fabian Way
Existing all directional junction to serve operational docks/ferryport.
Proposed all directional junction to serve Port Tawe.
Existing Kings Road junction retain as left in / left out.
Extent of development area - prior to construction of new junction
St Thomas
Dan-y-graig
ST THOMAS C
Prince of Wales Dock
King's Dock
Queen's Dock
Tidal Basin
Ferryport
West Pier
Eastern Breakwater
River Tawe (Afon Tawe)
New Cut
Mean High Water




Port Tennant
Dan-y-graig
St Thomas
ST THOMAS C
Inner Zone
Middle Zone
Outer Zone
625m
825m
1100m
Port Tawe - SPG
Plan 7
Safety Zones
City And County Of Swansea
Craig Anderson
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Director Of Development
N
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SWANSEA BAY TIDAL LAGOON

REVIEW OF ENVIRONMENTAL STATEMENT: SEASCAPE, LANDSCAPE AND VISUAL

Final Report

for

City and County of Swansea

June 2014

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white CONSULTANTS

CONTENTS

1. Introduction

1.1. White Consultants were initially commissioned by the City and County of Swansea (CCS) on 4 July 2013 to review a scheme for tidal Lagoon in Swansea Bay. A Preliminary Environmental Information Report [PEIR] was assessed and comments were made in a report and followed up with liaison and a meeting with the developer's EIA coordinator and relevant team members.

1.2. A second report reviewed the scheme design and the seascape, landscape and visual impact (SLVIA) element of the draft Environmental Statement [ES].

1.3. This report reviews the final proposed scheme and SLVIA.

1.4. The project is an offshore electricity generating station of more than 100 megawatts, and so is considered to be a Nationally Significant Infrastructure Project (NSIP) under the Planning Act 2008. It requires a DCO via an application to the Planning Inspectorate (PINS). As it is located in Welsh coastal waters it also requires a marine licence to be granted by an application to Natural Resources Wales (NRW) and possibly additional consents for areas outside the NSIP and DCO.

1.5. A chartered landscape architect with 30 years experience has carried out this review. The ES was studied with accompanying drawings and information. The site and its environs have been visited on 9 July 2013 including key viewpoints of relevance to CCS's consideration of the scheme, on 10 December 2013 and again on 15 April 2014. The submitted documents considered include:

- Environmental Statement (ES) March 2014 and draft ES November 2013:
    - Chapter 4: Project description
    - Chapter 6: Coastal Processes, Sediment Transport and Contamination
    - Chapter 13: Seascape, Landscape and Visual Impact Assessment

1.6. In addition the PEIR documents (July 2013) reviewed have included:

- Chapter 1: Introduction
- Chapter 2: Project context and consenting process
- Chapter 3: Site selection and option appraisal
- Chapter 4: Project description
- Chapter 4: The Preliminary Scheme
- Chapter 6: Coastal Processes
- Chapter 13: Seascape, Landscape and Visual Impact Assessment

- PEIR Non- Technical Summary July 2013

1.7. The site lies predominantly in the CCS but also partly to the east in Neath Port Talbot. However, the analysis of the potential effects are confined to those on CCS.

1.8. It is important to note that in assessing the project, the reviewer separates the degree of change which is reflected in the magnitude of effect and thus the significance, and the nature of change ie neutral, beneficial or adverse. ie an effect of major significance and beneficial does not necessarily mean that the change is extremely beneficial or if adverse, extremely adverse.

1.9. The structure of the report includes the following:

- Review of overall structure, clarity and comprehensiveness of the landscape and visual resources section of the ES.
- Review of proposed method and references in relation to best practice guidance- eg Guidelines for Landscape and Visual Impact Assessment [GLVIA] 2013, LANDMAP guidelines and seascape guidance.
- Review of:
    - baseline data
    - seascape and landscape character effects
    - visual effects
    - effects on designations
- Discussion

1.10. The views in this report represent those of the assessor, not CCS.

2. The site, current Project and site selection process

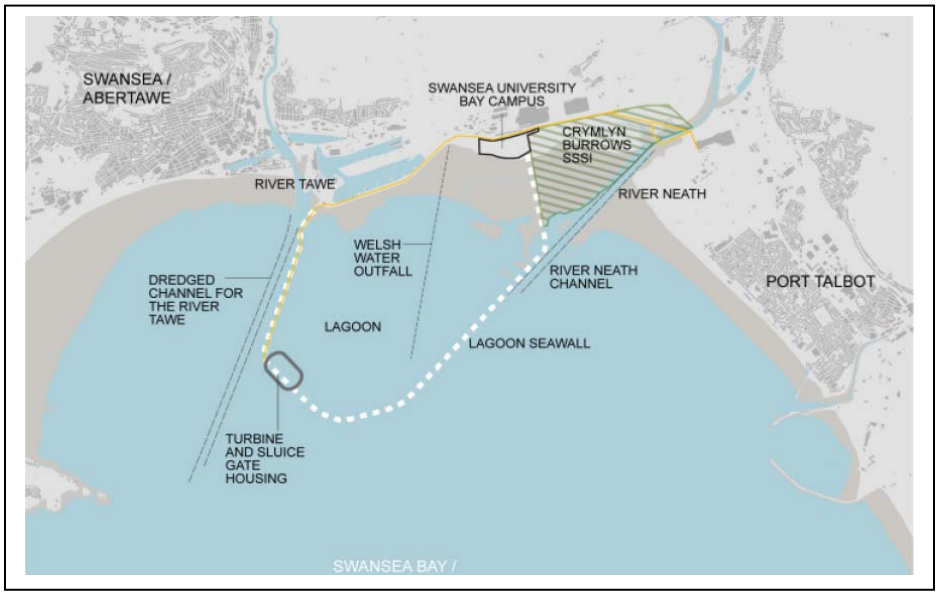
Site selection and alternatives

2.1. The process followed in identifying a suitable site and layout is explained in Chapter 3 of the PEIR. The key factors for location in Swansea Bay were appropriate beach profile and depth of water, avoidance of beaches of recreational quality, suitable landfall, avoidance of navigation channels and sufficient turbine depth.

2.2. Fourteen Lagoon shape options and multiple turbine configurations have been explored to balance commercially viable options with navigation, water quality, coastal processes, nature conservation and visual considerations.

Site and the development

2.3. The site lies in Swansea Bay between the mouths of the Tawe and Neath rivers. The landfall of the Lagoon seawall is at Swansea Docks to the east and the Swansea Science and Innovation campus under construction to the west [see Masterplan extract from Figure 1.3 below].



2.4. The proposal is for a tidal Lagoon generating 400GWh of electricity, enough to

power 121,000 homes. The development comprises:

- Lagoon enclosing 11.5km^2 of seabed and foreshore extending around 3.25km offshore from Swansea Docks.
- Breakwater bund seawall 9.5km in length, 40-107m wide at the base and generally 13m wide at the top with a top wall level of 14mAOD, and access road at around 12.5mAOD. . Its visible height of the breakwater above the water level measured at the deepest point will be approximately 4 m high at high tide and 12.5 m high at low tide.
- Road 4.5m around the top of the bund to accommodate operational staff , emergency vehicles and the public. A further 3.1m wide cycle path/passing place will run on the western arm of the seawall. Access will be allowed around the whole perimeter of the Lagoon but will be closed after dark and in extreme weather.
- 13-16 hydro turbines nominally 7m in diameter and sluice gates within a concrete housing structure 410m long and 67.5m wide. There are two options for location of the structure- Options A and B. Option A , closer to the western arm of the seawall is illustrated in the masterplan and SVIA photomontages. A semi-goliath gantry crane is located on the structure for maintenance.
- Electricity connection to the grid via an underground conduit beneath the River Neath to Baglan Bay substation.
- Operational and management facilities including slipways
- Visitor facilities including one main visitor centre offshore by the sluices upto 25.5m high, 57m by 50m. A further lower key reception building onshore upto 13.5m high and 120m by 18m will be located at the Western landfall. These buildings will include operational and visitor facilities. The Eastern landfall building will be very small and provide shelter and SSSI information. Vertical structures with a floating boom demarcating and protecting the exclusion zone around the turbines outside the Lagoon. A boom located inside the Lagoon.
- Vehicle access with combined footpath/cycleway from Fabian Way (via SA1 Langdon Road and parking
- Seafront public realm including a circular route, pedestrian and cycle links and beaches, onshore saltmarsh, coastal maritime grassland and dune creation including an ecological park.
- Water shuttle slipway and link to Swansea city centre as pedestrian and cycle access crossing Associated British Ports (ABP) land has not been successfully negotiated.
- Sporting public realm including sailing, swimming
- Mariculture facilities
- Lighting- assumed to be carefully designed to enhance the structure and buildings and low level and inward facing on the western Lagoon edge
- Sculptural elements such as a 'halfway point pearl'.
- Outfall either within or outside the Lagoon.

2.5. The project as a whole uses 7.3 million cu.m of sediment abstracted from the Lagoon seabed as a fill for the geotube or traditional construction and core and other locations. Cement for concrete would be sourced from Aberthaw, Ireland

and/or Europe.

2.6. The stone for the natural stone rock armour facing will be sourced from Dean Quarry in Cornwall. This produces Gabbro- a hard igneous rock. Pictures of this quarry on the web appear to indicate that the rock appears as an even mid-grey colour and texture when viewed from any distance. Samples of the stone available on the web show a fine grain flecking when observed at close quarters. It is noted that the ES cover illustration appears to have used this attractive fine grain flecking and enlarged it to produce a very coarse flecking for the rock armour. It would not be expected to look as attractive as this in reality. The mid-grey rock would also be likely to darken where in the intertidal zone.

2.7. Construction support sites would be located in and around Swansea docks. The construction period is intended to start from the beginning of 2015 and be completed in 2019.

2.8. The life expectancy of the project would be expected to last 120 years but with a design life of 50 years. It is assumed that it would remain in perpetuity from this time, whether operational or not. There is no apparent provision for maintenance during this period.

3. Review of SLVIA structure and method

Review of overall structure, clarity and comprehensiveness of the assessment and adequacy of information provided.

3.1. The structure of the section covers policy context, assessment method, baseline conditions including the assessment of the value of seascape and landscape character areas, and potential individual and cumulative impacts of the Project during construction and operation. This is logical and clear. The text is generally well written and considered comprehensively with a few omissions or inconsistencies which are mentioned below.

3.2. The study area of 15km radius is reasonable.

3.3. Following comments at PEIR and draft report stage a number of amendments have been made in the method which are welcomed eg inclusion of local seascape units and consideration of coastal processes/sediment transport. A brief commentary on the method and remaining issues arising are considered below.

Method- guidance used

3.4. The SLVIA sets out an assessment method which is generally understandable. Guidance references are noted and are generally helpful. Following comments on the PEIR, the guidance cited by the SLVIA has been updated. However, this excludes the approach taken for seascape assessment at a district scale which has been piloted in Pembrokeshire by White Consultants for the National Park and NRW. This includes a method for taking on board NECR105 as well as CCW guidance and is the most up to date method and relevant to the scale of this project Instead a more limited approach has been taken, based primarily on coastal and Admiralty chart information.

Method- LANDMAP

3.5. In terms of the use of LANDMAP, the assessment takes the approach of using the five LANDMAP aspects to inform the derivation of landscape character areas. This is permitted as an option in Guidance Note 3 and appears to be a sensible approach in this case.

Method-Seascape

3.6. The main effect of this proposal is on the seascape rather than landscape and following PEIR comments the development is assessed in terms of effects on established regional seascape and derived local seascape units which is welcomed.

3.7. The extent of the local seascape units (LSUs) appear justifiable.

3.8. The overall emphasis of the descriptions is centred primarily on the coastal character, probably due to the limited information collected for the marine element (Admiralty chart). Whilst the descriptions are long and thoughtful, there is limited depth in the marine element of the area including seabed, degree of exposure/wave climate and the patterns of use of the water in various cases. The views across to England also appear to be underplayed.

3.9. The effects of coastal processes are now addressed in respect of the effect of the potentially changed balance and proportions of sand, mud and gravel in Swansea Bay. This is predicated on the conclusions of Chapter 6 Coastal Process.

Method- Individual development effects

3.10. In respect of the calibration of effects, Table 13.10 (Magnitude of visual effects) indicates that medium impact is defined as the development being visually prominent. This seems to be a low calibration. It would have been expected that term 'prominent' would have been more associated with a high/medium impact.The SLVIA separates out the significance of change from the nature of that change ie whether it is beneficial, neutral or adverse. This is in line with good practice guidance. Only adverse significant changes are important in the decision-making process.

3.11. In terms of the significance of visual effects, the calibration of these are defined in both the SLVIA Table 13.11 but also in overarching terms, in the Environmental Statement section 2.5.4.4. The difference between the definitions of level of impact between major and moderate in the SLVIA is large and justifies an intermediate category. This is dealt with to an extent by stating that some effects are major/moderate or moderate/low but there is no definition of these terms either in the SLVIA or the ES in general. This is an omission as many of the assessed effects in the SLVIA are major/moderate. The ES makes it clear that major and moderate effects are significant so it is assumed that major/moderate effects are also significant.

3.12. ES Section 2.5.4.4 defines major significance of impacts as:

'Effects are highest in magnitude and reflect the high vulnerability and importance of receptor (e.g. to nature conservation, noise). Where these changes are adverse they will require mitigation.'

3.13. Moderate significance of impacts are defined as:

'Where these changes are adverse they may require mitigation'.

3.14. Neither the SLVIA or ES fully explain what the levels of significance mean in terms of decision making. Suggested definitions are located in this report in Appendix C. This issue is addressed in the discussion at the end of this section considering the SLVIA as a whole.

3.15. The ES defines neutral as *'no impact'* whereas the SLVIA uses the term neutral to qualify the nature of the level of change (as in beneficial, *neutral* or adverse). This is inconsistent. The definition used in the SLVIA is that which is accepted and used in this review.

Method- Cumulative effects

3.16. A number of other recent and proposed developments are included for consideration in conjunction with the proposal as requested by various consultees [Table 13.12]. The concern of the consultees appears to be the potential combined cumulative effect of the proposal with these other developments- possibly resulting in an over intensification of use of the area. This appears to be reflected in both Tables 13.13 and 13.14 considering the magnitude and significance of combined cumulative effects respectively which is helpful. However, the method appears to only consider the additional rather than the combined change caused by the proposed development over and above the cumulative baseline [13.3.7.7]. It is assumed that this is just carried over from a previous draft but introduces a small degree of uncertainty/inconsistency as to what is considered.

Viewpoints and visualisations

3.17. The viewpoints have been agreed and the photomontages are generally of good quality. The 450mm viewing distance visualisations are particularly helpful.

3.18. The photos were taken on a day with a slight haze so that distant objects are either in distinct or not visible. For instance, from viewpoints 4, 9 and 11 the coastline of England and the landform of Exmoor is not fully apparent although on clear days this is the case and enhances the views. On the other hand, in the visualisation for viewpoint 8 the built form at Port Talbot is not apparent. Whilst it is not expected that new photos will be taken, the assessment should take views of more distant objects into consideration, and not rely on the visualisations to provide this information.

3.19. The Offshore Building is shown as a rectangular block with straight sides in the photomontages. This is assumed to be the maximum visual 'envelope' of the building with the detailed /final design of the building to be resolved. However, this is problematic as the 'envelope' appears as a detractive new focal feature in a very sensitive location. In other words, the visualisations do not do the likely final design justice but the assessment has to be carried out on what they show rather than indicative designs. The final design of the building must be excellent to achieve a positive landmark which enhances/ complements the horizontal emphasis of the seawall and turbine structure and does not detract from the Mumbles as the main focus of Swansea Bay. It should achieve this in nearby views but also more importantly in distant views which is how most people will view it, most of the time. It is possible that the indicative design shown in Figure 4.25 may be appropriate but the evidence is not presented to demonstrate this in the photomontages.

3.20. Some visualisations show the Project at low water and high water. This is helpful. They show the water level inside and outside the Lagoon at the same level. From the reading of the description of the development it is clear, however, that the water level will be different on the inside and outside of the Lagoon for a period of time every six hours to form a head of water so the turbines can optimise their power output. Visualisations have not been previously requested to illustrate this difference but it may be perceptible when viewed from elevated viewpoints. It would have been helpful if a couple of viewpoint visualisations illustrated the maximum difference likely to occur to understand the degree that this might affect the perception of the development e.g. from Mumbles Hill Nature Reserve and Kilvey Hill.

3.21. The columns supporting the floating boom demarcating and protecting the exclusion zone around the turbines outside the Lagoon are shown as black columns and are indistinct in some visualisations such from Viewpoint 5. It is

likely that they will be yellow to a certain height as per Trinity House rules so they would be more noticeable than indicated.

4. Coastal processes issues

4.1. Chapter 6 Coastal Processes explores the potential effects on coastal processes, sediment transport and contamination. Of most interest to the seascape and visual effects assessment are the effects on sedimentation pattern to the west of the Lagoon.

Sediment transport- Method

4.2. Kenneth Pye Associates Ltd (KPAL) were engaged to review the coastal processes chapter for NRW and subsequently asked to comment on specific issues for CCS including sediment transport and the potential effects on Swansea Bay beach. KPAL found that the level of the assessment by ABPMer was limited with few detailed studies or sampling. Whilst this was appropriate for a regional scale study the data did not provide full confidence for assessing the likelihood of local impacts. KPAL has recommended that further baseline studies are carried out and monitoring is carried out during construction and operation with trigger points for action/remedial works as necessary.

4.3. The KPAL report for CCS arrives at the following conclusions:

- There has been no specific modelling of littoral sediment transport in the ES or construction of a sediment budget for the north western part of the bay.
- There is little evidence to support the ES's statement that sand transported east from Cymlyn Burrows to the north west of Swansea Bay is significant.
- The main source of sand is provided by sources external to the Bay including south westerly waves and storm tides transporting sand from south of Mumbles Head to the northern and eastern parts of the Bay. The dominant (net) direction of littoral sand transport in the Bay is eastwards.
- The beach varies dependent on wind and wave conditions as illustrated by the period 2000 to 2014.
- Overall, on the basis of evidence, it appears unlikely that the supply of sand to the recreational beaches would be significantly reduced. The net effect is more likely to increase the retention of sand and reduce the severity of upper beach erosion during storms.
- The above could increase wind blown sand on the promenade but this not a seascape issue [4.0].
- Increased intertidal mud deposition in sub-tidal areas adjacent to Blackpill SSSI and the mid foreshore seaward of beaches between St helen's and West Pier could lead to the development of saltmarsh [5.0]. This would change the visual appearance of the shore and would need increased management to prevent Spartina marsh establishing.

4.4. It is assumed that the sandy beaches would be unaffected by the marsh but this needs clarification.

4.5. The above conclusions are taken to mean that the predominantly sandy beaches from the Tawe to the Mumbles will remain as an important visual component of

the sweep of Swansea Bay, with their essential character unchanged. Therefore, the findings of the ES and KPAL reports combined appear sufficient to arrive at conclusions on this issue in this review.

5. Review of seascape, landscape and visual impact assessment

Baseline: Local seascape units (LSUs)

5.1. The seascape units descriptions focus on the coastal character with limited comment in some cases of the intertidal characteristics eg sediment movement and marine characteristics eg wave and tidal patterns, use of the water, exposure, openness. It is difficult to fully appreciate the text without the Admiralty chart as a figure in the SLVIA. The distinctive long distance views to Exmoor and the English coast are not mentioned eg in LSU4. It is appreciated that these are most apparent on clear days and in certain lights and may not have been so evident on the assessment site visit days.

Effects on seascape and landscape character

5.2. The comments on the individual effects of the Project on the key seascape and landscape character areas are set out in **Appendix A**.

5.3. In terms of the impacts on seascape and landscape character, the levels of significance are agreed. It is not agreed that the effects are generally either beneficial or neutral.

Significant effects

5.4. In terms of the regional seascape unit of Swansea Bay as a whole [RSU1], it is agreed that the significance of impact is major and significant. It is considered that the development would be adverse to the overall character and sweep of the bay and its mainly sandy foreshore. This sweep would be disrupted by the length and height of the breakwater bund, ancillary structures and, potentially, the difference in levels of the water between the Lagoon and the sea at several times of day. The effects extend beyond the immediate environs of the lagoon. The beneficial effect is in the likely improvement to the coastal edge within the Lagoon and the activity within the Lagoon which is likely to add interest.

5.5. In terms of local seascape unit (LSU) 4, Swansea Port and Crymlyn Burrows, I agree with the major significance of effect but consider that the effects are a mixture of adverse, neutral and beneficial. I consider the development to be adverse to the open sweeping character of the sea/marine element of the seascape character area with a large breakwater bund and ancillary structures projecting into this part of the bay and, potentially, the difference in levels of the water between the Lagoon and the sea at several times of day. The effects would be adverse on the area exterior to the Lagoon with the walls and turbine structure dominating the seascape character. However, within the Lagoon the adverse effects would be mitigated to an extent by sporting activity on the water which would give vitality and interest to the seascape, and by some designed elements on the breakwater bund. The effects on this marine element would, on balance be neutral. The effects on the coastal element of the seascape unit would be beneficial where it abuts the interior of the Lagoon. The effects would be adverse on the Crymlyn Burrows to the east as stated in SLVIA.

5.6. For LSU 5, Swansea Bay, a major/moderate significance is agreed but it is considered the development would be adverse to the character and sweep of

the bay and its mainly sandy foreshore as views of the continuation of the sandy strand to the east are disrupted and screened by the breakwater bunds at sea/beach level. The turbine structure would stand out from the breakwater bunds as a lighter rectangular object, breaking up the horizontal emphasis of the structure. The offshore building would be a new focus for the bay competing with the Mumbles to an extent. The effects extend beyond the immediate environs of the Lagoon.

5.7. For LCA G1 Swansea, a major/moderate significance is agreed but the beneficial/neutral effect is not agreed. The Swansea Bay frontage of the area enjoys unimpeded views out across the bay towards the Bristol Channel and Exmoor. This open unimpeded scenic view is a contrast to the built form of the city. The proposed breakwater bund and ancillary structures would disrupt this view as a feature in the middle ground with no benefits of increased water use etc apparent from the outside of the structure. The effect would therefore be adverse. A neutral effect on much of the built form area character back from the coastal strip is agreed.

Not significant effects

5.8. For LCA G6 The Mumbles, a moderate level of significance is agreed but the predicted neutral effect is not agreed. The development is considered to be adverse as the area focuses and relies on the wild open character of the marine element of the bay as a foil for its own complex topography, vegetation and built form character. The Lagoon structures extend far out into the bay, disrupting this simple setting.

5.9. For LSU 6, Gower Coast, I agree with the minor significance but consider development to be adverse for the reasons set out above.

5.10. For LCA D1 Clyne Valley Country Park, I agree with the moderate/minor significance but consider the development to be adverse as the Lagoon structures extend far out into the bay, disrupting the parks focussed views and simple setting.

5.11. For LCA E1 Gower Farmlands, I agree with the negligible significance of effects.

5.12. It is broadly agreed with the assessment of neutral or beneficial effects to landscape character areas G9 SA1, H1 Swansea Port and H2 Swansea Gate Business Park.

Visual effects

5.13. The comments on the individual effects of the Project on the representative viewpoints are set out in **Appendix B**.

5.14. Generally, the significance of effect set out in the SLVIA viewpoint assessment is agreed, with one minor exception.

5.15. The nature of the effect is not agreed in views from outside the Lagoon. I consider the effects to be adverse, or at best, neutral in some cases, such as Meridian Tower, whereas, the SLVIA indicates that effects are generally either neutral or beneficial (with the exception of Viewpoints 5 and 17 discussed below).

Significant effects

5.16. The SLVIA states that there is one major adverse ie significant effect from Crymlyn Burrows [Viewpoint 17]. This is agreed. It states that there is one major neutral ie significant effect from Swansea Bay promenade near the Lido at low water [Viewpoint 7] and near the Civic centre [Viewpoint 11]. In my view the effect is adverse in both cases. The SLVIA states there is one major

beneficial and significant effect from Meridian Tower [Viewpoint 10] but in my view this is neutral.

5.17. The SLVIA states there is a major/moderate adverse ie significant effect- from The Knab [Viewpoint 5]. This is agreed.

5.18. The SLVIA identifies five viewpoints undergoing major/moderate significant but neutral effects. These are at Headland Road, St Thomas [4], Mumbles Hill Nature Reserve [6], Kilvey Hill [13], Swansea Bay [19] and Pant y Celyn Road, Townhill [21]. In my view the effects are adverse. There is one viewpoint undergoing major/moderate significant but neutral/beneficial effects- the new Swansea University campus abutting the interior of the Lagoon [16]. This is agreed.Lagoon

Not significant effects

5.19. The SLVIA states that there are moderate neutral effects from Clyne golf course [8], Nicander Parade, Townhill, [9] and Clyne Gardens [22]. The significance is agreed but the effects are considered adverse.

5.20. The effect on the views from the bridge in SA1 and Pant Street, St Thomas are of minor significance.

5.21. The above findings mean that those most adversely affected are users of the Swansea Bay promenade and beaches, visitors to Mumbles Head and environs and leisure users of Swansea Bay itself. Those most benefiting are new users of the Lagoon as a leisure or sporting experience, and users of the new Swansea University campus.

5.22. Lighting is mentioned in the SLVIA in respect of uplighting of the Onshore and Offshore Buildings, sculptures and on the inside of the Lagoon wall at a low level. It is noted that public access is not allowed after dark so it is assumed that lighting will be limited. Without specific night time views, and explicit lighting Project it is difficult to verify the findings on night time effects. The 3D model can only be regarded as indicative and appears to be more of a promotional and public consultation tool rather than an assessment tool.

5.23. It is accepted that there is lighting along existing roads and within the built form along the coastline, some of it intense and industrial in nature. However, the existing, flat reflective water surface of the bay itself acts as a positive foil and setting to this, and the Lagoon seawallwill interrupt views of this from the promenade and beach level viewpoints.

5.24. There is therefore a balance to be achieved. If it is assumed that the lighting is imaginatively but sensitively designed, particularly taking into account minimising the effects or enhancing the views, especially from the west of the development, then the level of effects are likely to be no more than for daytime views. Lighting is clearly an opportunity to transform and enhance the development and should be utilised in close liaison with the planning authority.

Cumulative Effects

5.25. The level of the SLVIA's cumulative significance of effects for viewpoints are the same as for the effects of the development on its own with one exception (see below). This is an indication that the Project is the largest contributor to effects. In my view, the largest combined effect is likely to be with the University Campus which affects the Crymlyn Burrows adversely outside Swansea [Viewpoint 17] but is neutral/beneficial within the Lagoon along the coast [Viewpoint 16]. Overall, Swansea Bay will become more defined by development than at present.

5.26. The one exception in the consistency of the assessment appears to be from

Swansea Promenade near the Civic Centre [Viewpoint 11] where the effects are stated as less. Here the cumulative magnitude of effects are stated as moderate, compared to high, with major/moderate significance compared to major. This is not logical as it is stated that the view will become more defined by development [13.8.4.170].

Effects on receptors

5.27. The SLVIA states that views from the Gower AONB will be restricted to the north eastern fringe and that the Project will not erode the character of the AONB or contradict management plan policies [13.8.5.2]. In my view there will not be significant adverse effects on the qualities or purposes of designation. This is agreed.

5.28. The SLVIA states that no Registered Parks and Gardens of special historic interest will be significantly adversely affected, including Victoria Park, Clyne Gardens and Cwmdonkin Park. This is agreed.

5.29. The Wales Coast Path will be significantly adversely affected along its route along the Swansea promenade from the Mumbles expressed as a series of virtually uninterrupted views between Viewpoints 5, 7 and 11.The SLVIA predicts the effects on the high sensitivity users are moderate and the significance of effects major/moderate. This is fair overall although the effects closer to the Project are likely to be higher. The cumulative effects are stated as high/moderate and the significance of effects major/moderate. This is agreed.

5.30. The effects on the Gower Way are stated as not significant which is agreed.

5.31. The effects on the National Cycle Route (NCN) 4 is stated as similar to the Wales Coast Path which is agreed.

5.32. Users of the A4067 parallel to the Swansea promenade from Oystermouth Castle to Swansea are stated as having intermittently screened views apart from 750m relatively unobstructed views from Victoria Gardens through to the Civic Centre. The users are stated as moderate/low sensitivity with moderate/low magnitude of effect with moderate/minor significance ie not significant and neutral. Whilst the level of effects are probably correct, the effects are likely to be adverse, but they are agreed as not being significant.

5.33. The effects on the visual amenity of the settlement of Swansea is stated as represented by a series of viewpoints (already discussed above and in Appendix B) and are stated as significant but neutral. The effects on the Mumbles are stated as limited by the tight urban grain. In line with the comments on the viewpoints my view is the effect is adverse on the settlements for the reasons previously stated.

5.34. The decommissioning process is stated as only including removal of turbines and sluice gates with all other elements remaining. It is also stated that ongoing maintenance is necessary during operation to maintain the integrity of the walls and other features, as well as dredging. The Council will therefore need to take into account responsibilities for maintenance, the future intended use and associated costs in perpetuity. It is strongly advised that this is fully resolved before approval is given to the project.

6. Discussion

6.1. The key issues are similar to those stated in the PEIR and draft SLVIA reviews although some issues appear now to have been resolved.

6.2. Swansea relies on the character of the bay, in particular west of the Tawe, as a

major asset essential to its positive image and quality of life. In this respect, it is helpful that the character of the sandy beaches of north western part of the Bay will be retained.

6.3. The development itself is very large scale protruding 3.5km into Swansea Bay and effectively dividing it into two. The water level regime and character of the water inside the Lagoon will be different inside to outside the Lagoon. The effects are minimised where the water level is high both inside and outside Lagoon.

6.4. The proposed Lagoon seawall forms a strong dark horizontal line extending a long distance into the bay, closing down its apparent width and restricting views. The offshore building is highly noticeable and forms a built focus in the middle of the bay which, with the sea wall, competes with the Mumbles as a visual focus.

6.5. The seawall structure, as one might expect, appears to be dictated almost entirely by engineering and cost considerations, with design finesse and intervention primarily having effect at a very local level along the inside edge of the structure, in associated buildings and on the coastal edge of the Lagoon. These elements are generally positive based on the indicative designs but have limited mitigating effects on the overall character of the structure when viewed from outside the Lagoon. The design of the offshore building, however, is very important. Whilst the line of the seawall is simple and the development generally uncluttered, the overall effect is somewhat utilitarian.

6.6. It is important to note the positive benefits that the Lagoon will bring such as leisure use along the seawall and visitor centres, the use of the water for sport and mariculture and major improvements to an underused and degraded coastal fringe. It is unfortunate that the development cannot now be directly accessed by land from the city centre due to intervening ABP ownership or control. The site is primarily accessible a long way to the east, from Fabian Way. The alternative access by water taxi will only allow limited access through the size of boat and pricing. The recreational/tourism benefits of the Project will be reduced in this respect and efforts to rectify this should continue to be pursued.

6.7. The rock armour seawall is higher than the existing promenade and will be of dark colour forming a strong line in the Bay. The concrete turbine structure will contrast with the dark rock breaking up its horizontal line in views around Mumbles.

6.8. The overall sweep of the Bay will be disrupted with views of the almost continuous strong sandy strip around the bay being hidden by the seawall from the beach. However, the photomontages appear to indicate that the upper parts of the Aberavon beach would be visible above the seawall from some viewpoints on the promenade as well as from higher viewpoints which is helpful.

6.9. It is crucial to resolve outstanding design elements, in particular the Seaward building but also the gantry cranes, as these will help define the quality of the project in many sensitive views.

6.10. The long term future of the structure post-operation needs to be resolved.

6.11. Overall, it is considered that the effects on seascape and visual receptors are generally adverse outside the Lagoon rather than neutral stated in the SLVIA. This is important to the consideration of the project as neutral effects, even if involving significant change, are not important considerations in the decision-making process compared to adverse effects.

6.12. The ES and SLVIA do not give definitions as to how the various levels of

significance of effect should be weighed in the decision-making process. Appendix C of the White Consultants' report sets out a representative calibration used in similar assessments. In order to inform members, definitions are stated after a summary of each significant set of effects set out below.

6.13. Major adverse significant effects are expected on:

- Regional Seascape Unit1: Mumbles Head (Swansea Bay) to Sker Point
- The Crymlyn Burrows part of Local Seascape Unit LSU4: Swansea Port and Crymlyn Burrows.
- Representative viewpoints at Swansea Bay promenade near the Lido at low water [Viewpoint 7], near the Civic Centre [Viewpoint 11] and at Crymlyn Burrows [Viewpoint 17].

6.14. Major adverse significant effects are taken to represent key factors in the decision making process or at least important considerations. At the higher end of the scale these effects are (although not exclusively) associated with sites or features of national importance and resources or features that are unique and which, if lost, cannot be replaced or relocated. This also relates to landscapes/seascapes where the effect of development would overwhelm and/or substantially change their character or where mitigation will not remove the effects on a receptor.

6.15. Major/moderate adverse significant effects are expected on:

- Local Seascape Unit 5: Swansea Bay
- Landscape character area G1: Swansea
- Representative viewpoints at Headland Road, St Thomas [Viewpoint 4], The Knab [Viewpoint 5], Mumbles Hill Nature Reserve [6], Kilvey Hill [13], Swansea Bay [19] and Pant y Celyn Road, Townhill [21]
- Wales Coast Path
- National Cycle Route (NCN) 4

6.16. Major/moderate adverse significant effects are taken to represent important considerations at a regional or district scale and, if adverse, are potential concerns to the project depending upon the relative importance attached to the issue during the decision making process. Mitigation measures and detailed design work are unlikely to remove all the effects upon the surrounding landscape/seascape or receptors.

6.17. A major neutral significant effect is expected on Meridian Tower [Viewpoint 10].

6.18. A major/moderate neutral or beneficial significant effect is expected on Swansea University Science and Innovation Campus [Viewpoint 16].

6.19. There are no significant effects expected on Gower AONB or on Historic Parks and Gardens.

6.20. There are a number of moderate adverse effects which are taken to represent effects which, while important at a local scale if adverse, may not be key decision making issues. Whilst sometimes a particular combination of such effects may increase in the overall effects on a particular area or set of receptors and therefore may be significant, this is not considered to be the case in relation to this project.

6.21. Overall, the adverse effects will need to be considered in the planning balance with the positive benefits of the development in terms of renewable energy generation and leisure, sport and environmental improvements to the coastal

edge within the Lagoon.

APPENDIX A

SEASCAPE AND LANDSCAPE CHARACTER EFFECTS ASSESSMENT EVALUATION

APPENDIX A: SEASCAPE AND LANDSCAPE CHARACTER OPERATIONAL EFFECTS ASSESSMENT: EVALUATION

SEASCAPE CHARACTER

SLVIA							***REVIEW***
Seascape Unit	**Value**	**Susceptibility to Change**	**Sensitivity**	**Magnitude of Impacts**	**Significance of Impacts**	**Beneficial/ Neutral / Adverse**	***Assessment reasonable?***
Regional Seascape Units							
RSU1: Mumbles Head (Swansea Bay) to Sker Point	High/ Moderate	Moderate	High-Moderate	High	Major Significant	Beneficial/ Neutral/ Adverse	Agree with significance. Disagree with Beneficial/Neutral/ Adverse. Consider development to be adverse to the overall character and sweep of the bay and its mainly sandy foreshore This sweep is disrupted by the length and height of the seawall, ancillary structures and the difference in levels of the water between the lagoon and the sea at several times of day. The offshore building would be a new focus for the bay competing with the Mumbles to an extent. Much would depend on its shape, colour and overall design perceived at a distance where most people will view it most of the time. The effects extend beyond the immediate environs of the lagoon. The beneficial effect is in the likely improvement to the coast within the lagoon.
RSU2: Three Cliffs Bay to Mumbles Head	Outstanding	High	High	Moderate/ Low	Moderate/ Minor Not Significant	Neutral	Agree with significance. Effect is adverse, however for reasons above.
Local Seascape Units							
LSU4: Swansea Port and Crymlyn Burrows	High/ Moderate	High/ Moderate	High-Moderate	High	Major Significant	Beneficial/ Adverse	Agree with significance. Disagree with beneficial/adverse as set out in the text. Consider development to be adverse to the open sweeping character of the sea/marine element of the seascape character area with a large seawall and ancillary structures projecting into this part of the bay and the difference in levels of the water between the lagoon and the sea at several times of day. The effects would be adverse on the area exterior to the lagoon with the seawalls, turbine structure and offshore building dominating the seascape character. However, within the lagoon the adverse effects would be mitigated to an extent by sporting activity on the water which would give vitality and interest to the seascape, and by some designed elements on the seawall. This would be partially offset by restrictions of view beyond the lagoon seawalls in places at water level. The effects on this marine element would, on balance be neutral. The effects on the coastal element of the seascape unit would be beneficial where it abuts

							the interior of the lagoon with the coastal (Landward) park. The effects would be adverse on the Crymlyn Burrows to the east as stated in SVIA.
	Value	**Susceptibility to Change**	**Sensitivity**	**Magnitude of Impacts**	**Significance of Impacts**	**Beneficial/ Neutral / Adverse**	***Assessment reasonable?***
LSU5: Swansea Bay	Outstanding/ High	High/ Moderate	High-Moderate	High/ Moderate	Major/ Moderate Significant	Adverse/Neutral	Agree with significance. Disagree with adverse/neutral as set out in the text. Consider development to be adverse to the character and sweep of the bay and its mainly sandy foreshore as views of the continuation of the sandy strand to the east are disrupted and screened by the seawall/sea wall when viewed from beach level. The turbine structure would stand out from the seawalls/sea wall as a lighter rectangular object, breaking up the horizontal emphasis of the structure. The offshore building would be a new focus for the bay competing with the Mumbles to an extent. Much would depend on its perceived shape, colour and overall design at a distance. The effects extend beyond the immediate environs of the lagoon.
LSU6: Gower Coast	Outstanding	High	High	Low/Negligible	Minor Not Significant	Neutral	Agree with significance. Disagree with neutral. Consider development to be adverse for the reasons set out above.

LANDSCAPE CHARACTER

DRAFT SLVIA							***REVIEW***
Landscape character area	**Value**	**Susceptibility to Change**	**Sensitivity**	**Magnitude of Impacts**	**Significance of Impacts**	**Beneficial/ Neutral / Adverse**	***Assessment reasonable?***
D1 Clyne Valley Country Park	High	Moderate	High – moderate	Moderate/low	Moderate/minor not significant	Neutral	Agree with significance. Disagree with neutral. Consider the development to be adverse as the lagoon structures extend far out into the bay, disrupting the parks focussed views and simple setting.
E1 Gower farmlands	Outstanding	Low	High – moderate	Negligible	negligible not significant	Neutral	Agree
G1 Swansea	High moderate	High/ moderate	Moderate	High/ moderate low	Major/ moderate Minor	Beneficial/ neutral	Agree with significance relating to different parts of the city. Disagree with beneficial/neutral as set out in the text. The Swansea Bay frontage of the area enjoys unimpeded views out across the bay towards the Bristol Channel and Exmoor. This open unimpeded scenic view is a contrast to the built form of the city. The proposed seawall, offshore building and ancillary structures would disrupt this view as a feature in the middle ground with no benefits of increased water recreation use etc apparent from the outside of the structure at coast level. Agree with minor/neutral effect on much of the built form area character back from the coastal strip.
G6 The Mumbles	Outstanding/ high	High	High	Moderate/ negligible	Moderate/ negligible not significant	Neutral	Agree with significance. Disagree with neutral. Consider the development to be adverse as the area focuses and relies on the wild open character of the marine element of the bay as a foil for its own complex topography, vegetation and built form character. The lagoon structures extend far out into the bay, disrupting this simple setting.
G9 SA1	Moderate/ low	Low	Moderate to low	Negligible	Minor not significant	Neutral	Agree
H1 Swansea Port	Low	Low	Low	High/ moderate	Major/moderate significant	Beneficial	Agree
H2 Swansea Gate Business Park	Low	Low	Low	High negligible	Major significant negligible not significant	Beneficial	Agree

APPENDIX B

VIEWPOINTS OPERATIONAL VISUAL EFFECTS ASSESSMENT EVALUATION

APPENDIX B: VIEWPOINTS OPERATIONAL VISUAL EFFECTS ASSESSMENT EVALUATION

SLVIA									***REVIEW/EVALUATION***
SLVIA View-point refer-ence	*Viewpoint Location*	*Distance to centre of lagoon [km]*	*Receptors at or near viewpoint*	*Susceptibility to change*	*Sensitivity of receptors*	*Magnitude of visual impacts*	*Significance*	*Beneficial/ neutral/ adverse *()*	*Assessment reasonable?*
4	Headland Road, St. Thomas, Swansea	3.6	Walkers, residents	high	Moderate	High/ moderate	Major/ moderate significant	Neutral *(Beneficial)*	Agree with significance. The seawall extends a significant distance out to sea with the offshore building and gantries apparent. The enclosed lagoon will be at differing levels to the sea outside at various times of the day which will reinforce its separation, and with the ancillary structures, its differing character from the surrounding sea. The position of the lagoon appears to have some logic extending out from the docks. From this angle the line of the embankment looks simple and uncluttered. Activity within the lagoon will be of interest. However, the sweep of the bay and sea which is a positive contrast and setting to the built up area would be disrupted by the intervention of the lagoon. On balance the effect is adverse and at best neutral.
5	The Knab, Adjacent to Mumbles Pier	6.2 [irrelevant]	Visitors, boat users	high	High	High (low tide) moderate (high tide)	Major/ moderate significant	Adverse *(Neutral)*	Agree with significance. The effects at high tide would remain major/moderate. The seawall comes out into the centre of the Bay. The turbine structure would stand out from the seawalls as a lighter rectangular object, breaking up the dark line and horizontal emphasis of the structure. The offshore building is noticeable and forms a built focus in the middle of the bay. The nearby gantries are apparent and industrial in character, and with the exclusion zone vertical structures further emphasise the utilitarian nature of the structure. The seawall structure appears to screen the lower part of beach at Crymlyn Burrows and Aberavon but the top of the beach is apparent so there appears to be some continuity of the light sandy strand around the Bay. This view looks across to the settled and partly industrialised coast around Aberavon and Port Talbot so the structure is not entirely out of keeping with the coastal development. However, overall, it erodes the open unspoilt natural qualities of the bay itself and therefore is adverse.
6	Mumbles Hill Nature Reserve		Walkers	high	High	High – moderate	Major/ moderate significant	Neutral	Agree with significance. Disagree with neutral effect. The lagoon extends a significant distance into the centre of the Bay. The enclosed lagoon will be at differing levels to the sea outside at various times of the day which will reinforce its separation, and with the ancillary structures, its differing character from the surrounding sea. The turbine structure would stand out from the seawalls as a lighter rectangular object, breaking up the dark line of the structure. The offshore building is highly noticeable and forms a built focus in the middle of the bay, seen against the water of the lagoon. The nearby gantries would be just apparent and industrial in character, and with the exclusion zone vertical structures would emphasise the utilitarian nature of the structure. This view looks across to the settled and partly industrialised coast around Aberavon and Port Talbot and there are the structures of the lifeboat station in the middle ground so the structure is not entirely out of keeping with the coastal development. However, it erodes the uninterrupted sweeping curve and open unspoilt natural qualities of the bay itself with a new built focus and therefore is adverse.
7	Swansea promenade , near Lido	6.4	Walkers, cyclists, beach users, visitors	high	High	High (low tide) moderate (high tide)	Major (low tide) major/moder ate (high tide) significant	Neutral *(Beneficial)*	Agree with significance. Disagree with neutral effect. The seawall comes out into the centre of the Bay. The offshore building is noticeable and forms a built focus in the middle of the bay which competes with the Mumbles (as a focus). The nearby gantries are just apparent and industrial in character, and with the exclusion zone vertical structures emphasise the utilitarian nature of the structure. The turbine structure would stand out from the seawalls as a lighter rectangular object, breaking up the dark line and horizontal emphasis of the structure. The structure appears to partially screen the beach at Aberavon thus breaking up the continuity of the light sandy strand around the Bay although the beach in the foreground is

									much more important at this point. The view looks across to the settled and partly industrialised coast around Aberavon and Port Talbot so the structure is not entirely out of keeping with the coastal development. However, it impinges upon the open unspoilt qualities of the bay itself and therefore is adverse.
LVIA View-point refer-ence	*Viewpoint Location*	*Distance to centre of lagoon [km]*	*Receptors at or near viewpoint*	*Susceptibility to change*	*Sensitivity of receptors*	*Magnitude of visual impacts*	*Significance*	*Beneficial/ neutral/adve rse*	*Assessment reasonable?*
8	Clyne Golf Course, Swansea	8.3	Walkers, Golfers	Moderate	High-moderate	Moderate	Moderate not significant	Neutral	Agree with significance. Disagree with neutral effect. The receptor should be high as the viewpoint is near a bridleway. The seawall comes out into the centre of the Bay. The offshore building is apparent and forms a built focus in the middle of the bay. The view looks across to the settled and partly industrialised coast around Aberavon and Port Talbot so the structure is not entirely out of keeping with the coastal development in the far distance. However, it impinges upon the open unspoilt qualities of the bay itself and therefore is adverse.
9	Nicander Parade, Townhill, Swansea	4.8	Residents, road users	high	Moderate	Moderate	Moderate not significant	Neutral *(Beneficial)*	Agree with significance. Disagree with neutral effect. The seawall extends a significant distance out into the bay as a new element. The offshore building is noticeable and forms a built focus in the middle of the bay which competes with the Mumbles (as a focus). The gantries are just apparent and industrial in character and emphasise the utilitarian nature of the structure. The enclosed lagoon will be at differing levels to the sea outside at various times of the day which will reinforce its separation, and with the ancillary structures, its differing character from the surrounding sea. The position of the lagoon appears to have some logic extending out from the Tawe/docks sea walls. From this point the line of the embankment looks simple although somewhat angular at its apex due to the sharp change in direction. The building location here (Option A) appears to make sense of this change in direction. Activity within the lagoon will be of interest. However, the sweep of the bay and sea which is a positive contrast and setting to the built up area would be disrupted by the intervention of the lagoon.
10	Meridian Quay, Swansea	3.3	Visitors to building, restaurant	high	Moderate	High	Major significant	Beneficial	Not visited. The significance looks fair. The beneficial effect appears optimistic. The extent of the seawall enclosing part of the bay is very clear. The offshore building is highly noticeable and forms a built focus in the middle of the bay. The gantries are noticeable and industrial in character and emphasise the utilitarian nature of the structure. Marine sporting activities within the lagoon would be apparent from this ‘’bird’s eye’ viewpoint adding interest. The presence and function of the lagoon may also be an attraction to some visitors. The location appears to have logic extending the seawall. However, the intervention of the structure into the open sweep of the bay is detractive. On balance, the effect is considered neutral based on the desk study of the visualisation only.
11	Swansea promen-ade		Walkers, cyclists, beach users, visitors	High	High	High (low tide) High/ moderate (high tide)	Major significant	Neutral	Agree with significance. Disagree with neutral effect. The embankment bund is higher than the existing seawall and forms a strong dark horizontal line extending a long distance into the bay, closing down its apparent width. The offshore building is highly noticeable and forms a built focus in the middle of the bay which, with the sea wall, competes with the Mumbles (as a focus). The gantries are apparent and, with the exclusion zone vertical structures, are industrial in character and emphasise the utilitarian nature of the structure. The proposal detracts from the existing open views to Exmoor across the Bristol Channel although does not screen the English coast/landform. Overall the effect of the development as shown in the photomontage is considered adverse due to the scale of the intervention, change in the bay’s open natural character and change in focus of the bay.

LVIA View-point refer-ence	*Viewpoint Location*	*Distance to centre of lagoon [km]*	*Receptors at or near viewpoint*	*Susceptibility to change*	*Sensitivity of receptors*	*Magnitude of visual impacts*	*Significance*	*Beneficial/ neutral/ adverse*	*Assessment reasonable?*
12	SA1 Swansea Waterfront		Visitors, office users	Moderate	Low	Low	Minor not significant	Neutral	The sensitivity of receptors are moderate but the effect is not significant as the embankment bund continues the line of the seawall and the context is highly engineered and utilitarian.
13	Kilvey Hill, Swansea		Walkers	High	High/ moderate	Moderate	Major / moderate significant	Neutral	Agree with significance. The seawall extends a significant distance out to sea. The enclosed lagoon will be at differing levels to the sea outside at various times of the day which will reinforce its separation, and with the ancillary structures, its differing character from the surrounding sea. The position of the lagoon appears to have some logic extending out from the docks. From this angle the line of the embankment looks simple and uncluttered and the offshore building and gantries relate to the onshore buildings and docks infrastructure. Activity within the lagoon will be of interest. However, the sweep of the bay and sea which is a positive contrast and setting to the built up area would be disrupted by the intervention of the lagoon. On balance the effect is adverse and at best neutral.
16	Swansea University, Science and Innovation Campus			Moderate	Moderate	High/ moderate	Major / moderate significant	Neutral/ beneficial	Not visited (in Neath Port Talbot). The likely effect is major as the lagoon will be enclosed and the coastal edge significantly modified. The effect is likely to be neutral or beneficial.
17	Crymlyn Burrows, Swansea			Moderate	Moderate	High	Major significant	Adverse	Agree with significance and adverse effect. The seawall is close to and high and extends a significant distance out to sea blocking views across the open bay to the Mumbles. If the balance of sand and mud changes with an increase in the mud to the extent that this predominates visually and affects the intertidal area's use as a beach the effect would be more severe at low tide. The effects at high tide would remain the same.
19	Swansea Bay		Boat users	High/ moderate	Moderate	High/ moderate	Major / moderate significant	Neutral	Not visited. The likely effect would be of major significance and adverse as the openness and natural character of the bay contrasting with the urban coastal edge would be significantly changed by the nearby structure. The number of receptors would be limited.
20	Pant Street, St. Thomas, Swansea		Residents	Moderate	Low	Low	Minor not significant	Neutral	The viewpoint is highly urban with a restricted framed view of part of the lagoon and seawall only. The sensitivity of receptors are moderate so the significance could be moderate/minor but the effect is not considered significant and the effect is neutral in this location.
21	Pant y Celyn Road, Townhill, Swansea		Residents, green space users, road users	high	High	Moderate	High/ moderate significant	Neutral *(Beneficial)*	Agree with significance. The seawall extends a significant distance out into the bay as a new element. The offshore building is noticeable and forms a built focus in the middle of the bay which competes with the Mumbles to an extent (as a focus). The gantries are just apparent and industrial in character and emphasise the utilitarian nature of the structure. The enclosed lagoon will be at differing levels to the sea outside at various times of the day which will reinforce its separation, and with the ancillary structures, its differing character from the surrounding sea. The position of the lagoon appears to have some logic extending out from the Tawe/docks sea walls. From this point the line of the embankment looks simple and uncluttered. Activity within the lagoon will be of interest. However, the sweep of the bay and sea which is a positive contrast and setting to the built up area would be disrupted by the intervention of the lagoon. On balance the effect of the development as shown on the photomontage is adverse.

LVIA View-point refer-ence	*Viewpoint Location*	*Distance to centre of lagoon [km]*	*Receptors at or near viewpoint*	*Susceptibility to change*	*Sensitivity of receptors*	*Magnitude of visual impacts*	*Significance*	*Beneficial/ neutral/ adverse*	*Assessment reasonable?*
22	Clyne Gardens, Swansea		Visitors	high	High–moderate	Moderate/ low	Moderate not significant	Neutral *(Beneficial)*	Agree with significance. Disagree with neutral effect. The embankment bunds/sea walls extend the width of the focused vista of the Bay with the offshore building at the furthest edge. This view looks across to the settled and partly industrialised coast around Aberavon and Port Talbot so the structure is not entirely out of keeping with the coastal development. However, it breaks up and divides the uninterrupted open unspoilt expanse of the bay itself and therefore is adverse.

Note:

* brackets indicate *draft* SLVIA evaluation of whether effects are beneficial, neutral or adverse.

APPENDIX C
DEFINITIONS OF SIGNIFICANCE

APPENDIX C: DEFINITIONS OF SIGNIFICANCE

White Consultants definitions		**Assumed equivalent levels of significance in ES/SLVIA**
Significance	**Criteria**	
Severe	Adverse effects which represent key factors in the decision making process. These effects are generally (although not exclusively) associated with sites or features of national importance and resources or features that are unique and which, if lost, cannot be replaced or relocated. This also relates to landscapes/seascapes where the effect of development would overwhelm and/or substantially change their character or where mitigation will not remove the effects on a receptor.	Major
Major	Effects which are important considerations at a regional or district scale and, if adverse, are potential concerns to the project depending upon the relative importance attached to the issue during the decision making process. Mitigation measures and detailed design work are unlikely to remove all the effects upon the surrounding landscape/seascape or receptors	Major or Major/moderate
Major/ moderate	Effects which are important considerations at a district/local scale and, if adverse, are potentially of some concern to the project depending upon the relative importance attached to the issue during the decision making process. Mitigation measures and detailed design work are unlikely to remove all the effects upon the surrounding landscape/seascape or receptors	Major/moderate
Moderate	Effects which, while important at a local scale if adverse, may not be key decision making issues. Nevertheless, a particular combination of such effects may lead to an increase in the overall effects on a particular area, receptors or resource and therefore may be significant. They represent issues where effects will be experienced but mitigation measures and detailed design work may ameliorate/enhance some of the consequences upon affected landscapes/seascapes or receptors. Some residual effects will still arise.	Moderate
Moderate/ minor	Effects at a local scale which are of limited importance in the decision making process. They represent issues where some minor residual effects will be experienced. They are of relevance in the detailed design of the project and in the consideration of mitigation or compensation measures.	Moderate/minor
Minor	Effects raised as local issues but are unlikely to be of importance in the decision making process. Nevertheless, they are of relevance in the detailed design of the project and in the consideration of mitigation or compensation measures.	Minor
Negligible	Effects which are so slight that there is no need to take them into consideration in the design or mitigation of the development.	Insignificant/ negligible

GLOSSARY

ES- Environmental Statement

LCA- Landscape character assessment/area

GLVIA3- Guidelines for Landscape and Visual Impact Assessment, LI IEMA 2013.

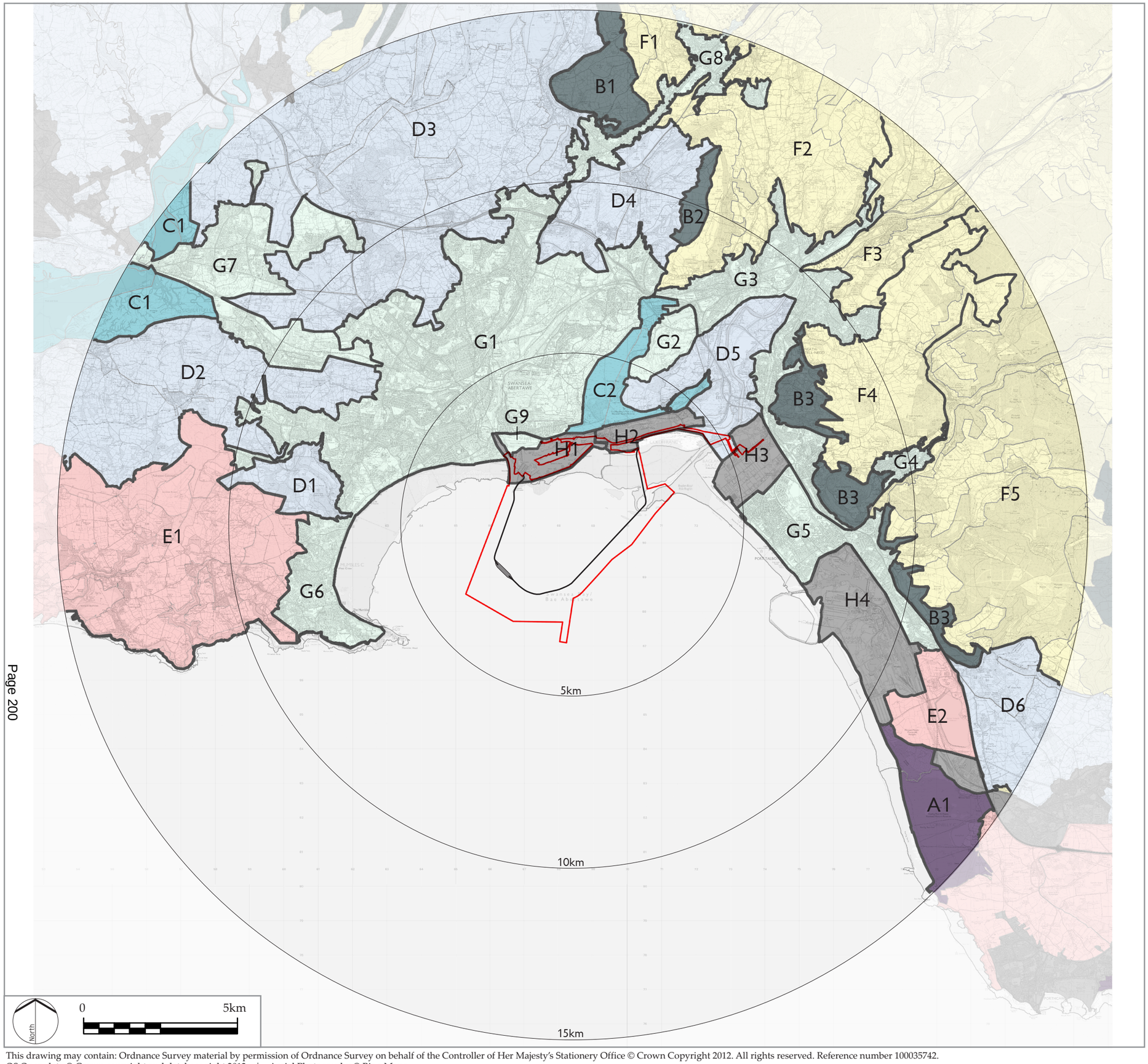
SLVIA- Seascape, Landscape and Visual Impact Assessment in Environmental Statement

NTS- Non Technical Summary

PEIR- Preliminary Environmental Information Report

ZTV- Zone of Theoretical Visibility

APPENDIX D



Page 200

LEGEND

- Application Site
- 15km — Study Area
- Indicative Lagoon seawall
- Dunes:
  - A1 Margam and Kenfig Burrows
- Hillside and Scarp Slopes:
  - B1 North of Clydach
  - B2 Mynydd Drumau
  - B3 Margam and Mynydd Dinas
- Intertidal Wetlands:
  - C1 Llanrhidian Marsh
  - C2 Crymlyn Bog
- Mosaic Lowlands:
  - D1 Clyne Valley Country Park
  - D2 Three Crosses
  - D3 Rhyd-y-Pandy
  - D4 Afon Tawe
  - D5 Gelli-Bwch
  - D6 Coed Hirwaun
- Open Lowlands:
  - E1 Gower Farmlands
  - E2 Margam Moor and Eglwys Nunydd Reservoir
- Uplands:
  - F1 Upland Clydach River Valley
  - F2 Clydach Valley
  - F3 Vale of Neath
  - F4 Mynydd y Gaer
  - F5 Mynydd Margam, Mynydd Emroch and Mynydd Penhydd
- Urban:
  - G1 Swansea
  - G2 Coed Darcey
  - G3 Neath
  - G4 Cwmafan
  - G5 Port Talbot and Margam
  - G6 The Mumbles
  - G7 Gorseinon and Gowerton
  - G8 Pontardawe
  - G9 SA1 Swansea Waterfront
- Industrial:
  - H1 Swansea Docks
  - H2 Swansea Gate Business Park
  - H3 Baglan Bay
  - H4 Port Talbot Steel Works

TIDAL LAGOON SWANSEA BAY

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PROJECT TITLE

SWANSEA BAY TIDAL LAGOON

DRAWING TITLE

Figure 13.01
Landscape Character

ISSUED BY	Soltys Brewster Consulting	T: 020 2040 8476	
DATE	Oct 2013	DRAWN	ES
SCALE@A3	Refer to Scale Bar	CHECKED	RC
STATUS	Final	APPROVED	GS

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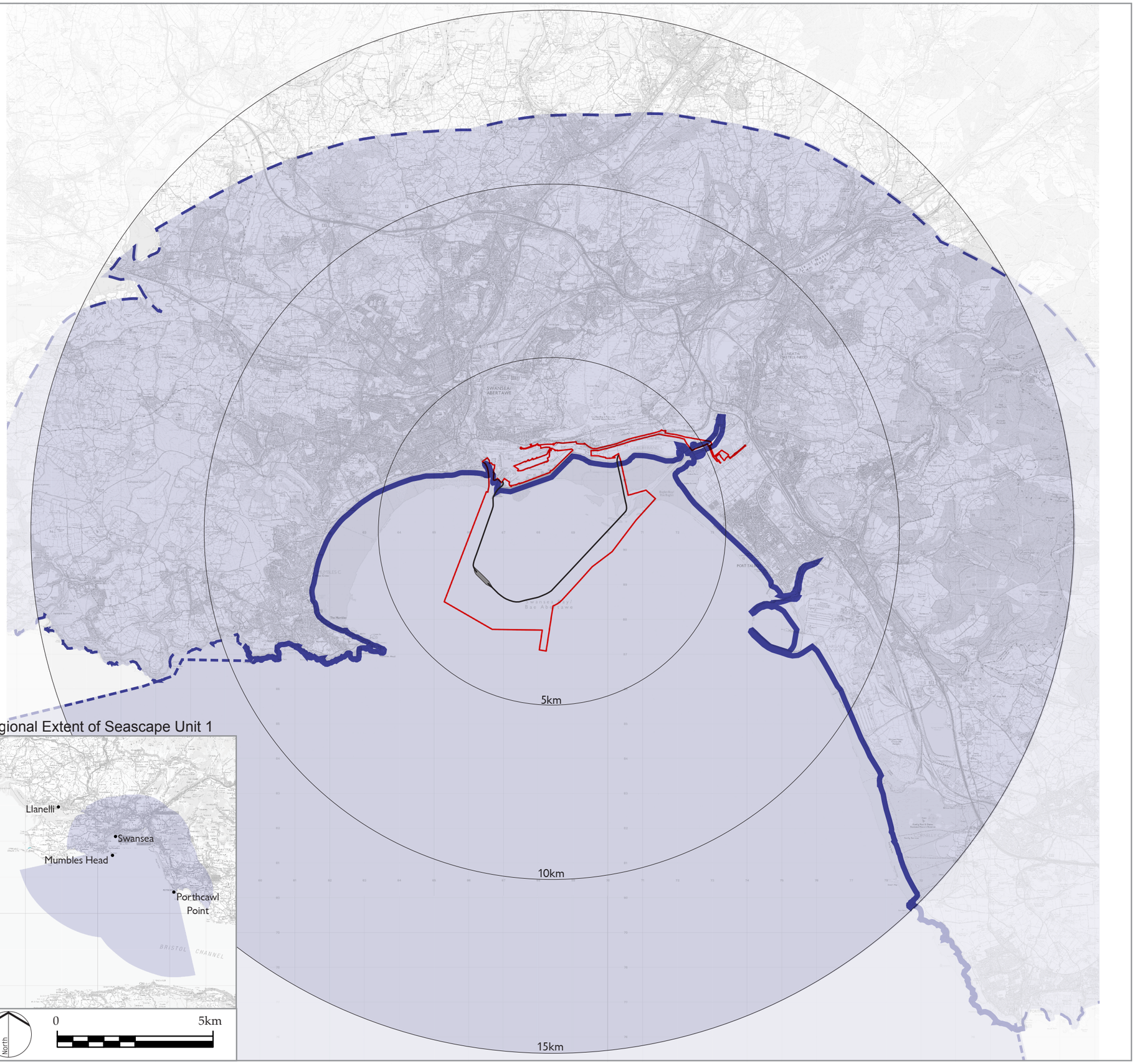
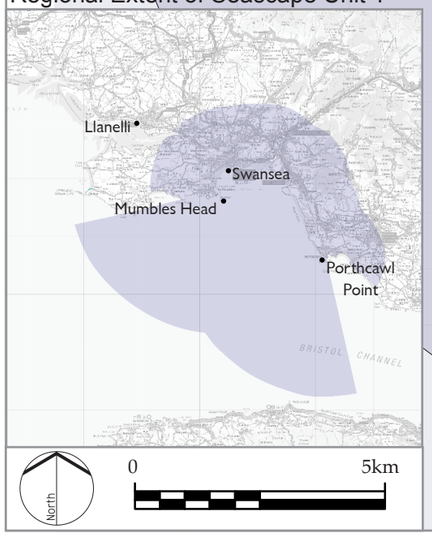
Area measurements for indicative purposes only.

Sources: Ordnance Survey.



Regional Extent of Seascape Unit 1



LEGEND

- Application Site
- Study Area (15km)
- Indicative Lagoon seawall
- Sker Point to Mumbles Head
- Coastline within Seascape Unit
- Landward Limit
- Seaward Limit

TIDAL LAGOON SWANSEA BAY

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Figure 13.02
Regional Seascape Unit 1
Sker Point to Mumbles Head

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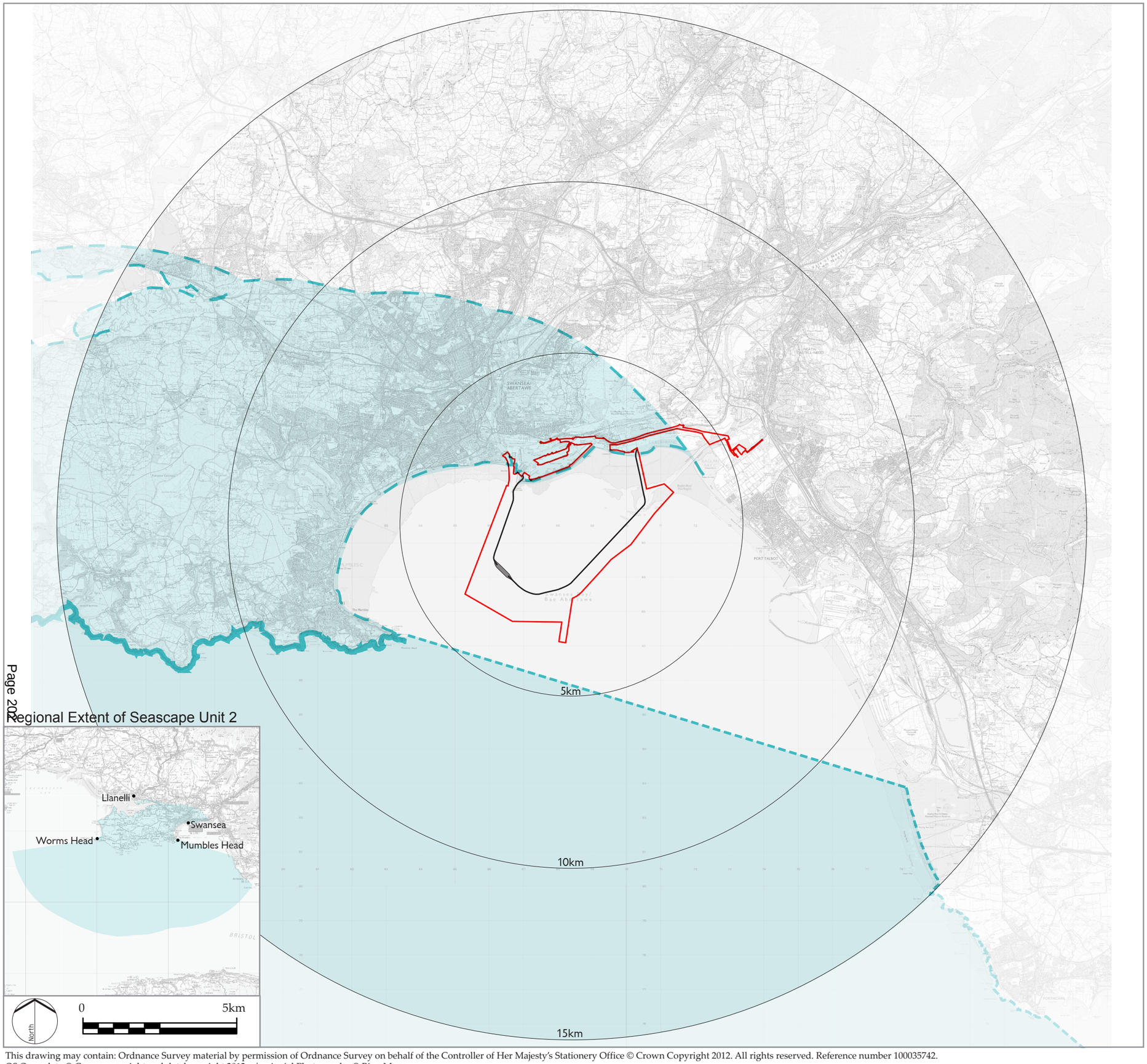

LEGEND

- Application Site
- Study Area (15km)
- Indicative Lagoon seawall
- Sker Point to Mumbles Head
- Coastline within Seascape Unit
- Landward Limit
- Seaward Limit

TIDAL LAGOON SWANSEA BAY

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SWANSEA BAY TIDAL LAGOON

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Figure 13.03
Regional Seascape Unit 2
Mumbles Head to Three Cliffs Bay

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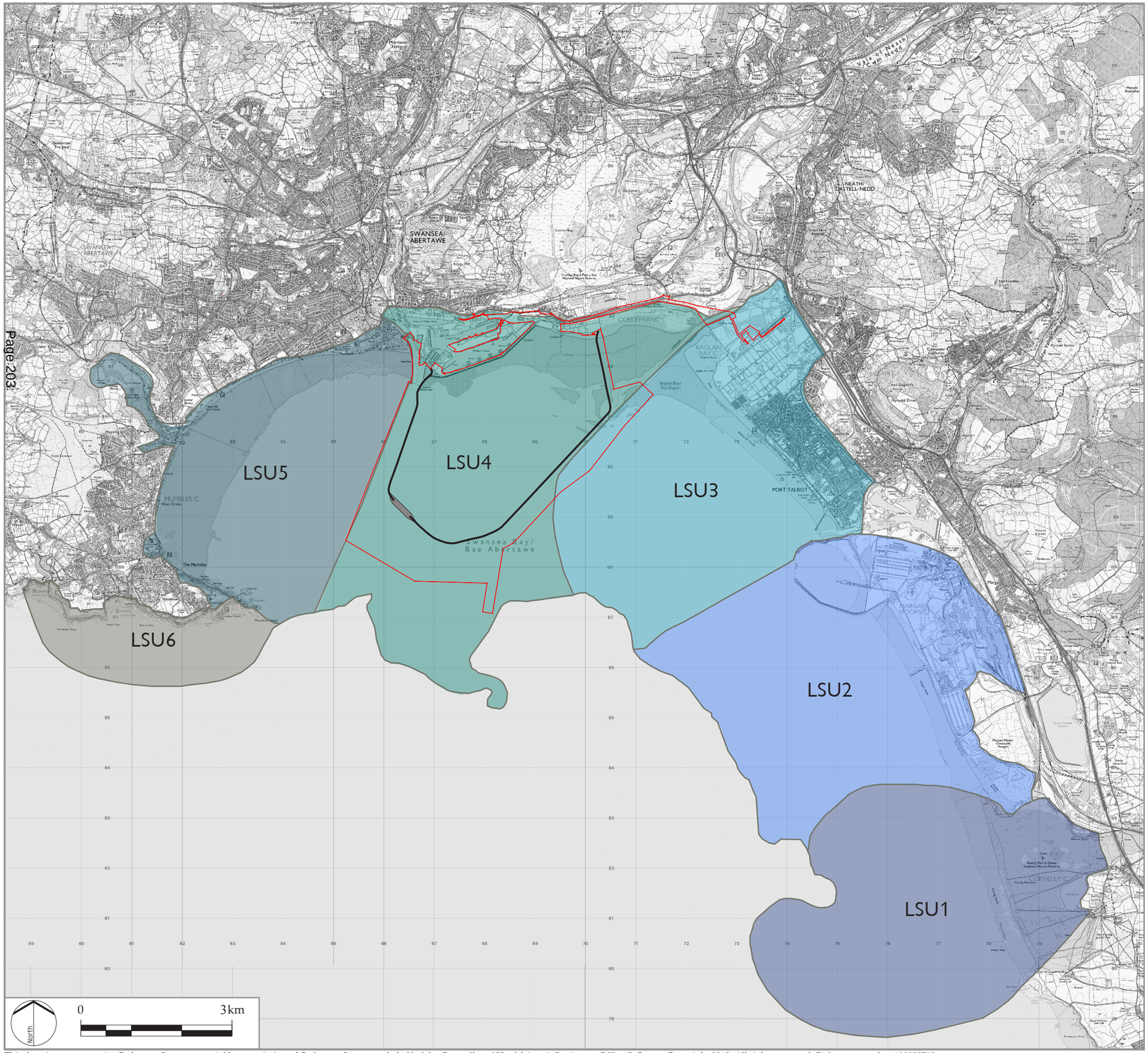
Sources: Ordnance Survey.



LEGEND

- Application Site
- 15km — Study Area
- Indicative Lagoon seawall
- LSU1 Kenfig Sands
- LSU2 Port Talbot Steel Works
- LSU3 Aberavon Sands
- LSU4 Swansea Port & Crymlyn Burrows
- LSU5 Swansea Bay
- LSU6 Gower Coast

TIDAL LAGOON SWANSEA BAY

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PROJECT TITLE
SWANSEA BAY TIDAL LAGOON

DRAWING TITLE
Figure 13.04
Local Seascape Units

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Sources: Ordnance Survey.

LEGEND

- Application Site
- 15km — Study Area
- Indicative Lagoon seawall
- Authority Boundaries
- Viewpoint Location

No.	Name	Grid Reference	
1	Aberavon Sands, south	274633	189343
2	Aberavon Sands, north	273089	190995
3	Maes Ty Canol, Baglan	275530	192793
4	Headland Road, St. Thomas, Swansea	266560	193626
5	The Knab, Adjacent to Mumbles Pier	262458	187751
6	Mumbles Hill Nature Reserve	262778	187437
7	Swansea promenade, near Lido	261990	190586
8	Clyne Golf Course, Swansea	260174	190610
9	Nicander Parade, Townhill, Swansea	264797	193582
10	Meridian Quay, Swansea	265574	192356
11	Swansea promenade	265255	192265
12	SA1 Swansea Waterfront	266596	192508
13	Kilvey Hill, Swansea	266849	193658
14	Memorial Stone, Margam Country Park	281380	186380
15	Sker Point	278883	179959
16	Swansea University, Science & Innovation Campus	269973	192603
17	Crymlyn Burrows, Swansea	271378	192598
18	PRoW on Mynydd Brombil	278528	188352
19	Swansea Bay	264808	189089
20	Pant Street, St. Thomas, Swansea	267623	193392
21	Pant y Celyn Road, Townhill, Swansea	264039	193384
22	Clyne Gardens, Swansea	261253	190505

TIDAL LAGOON SWANSEA BAY

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PROJECT TITLE

SWANSEA BAY TIDAL LAGOON

DRAWING TITLE

Figure 13.07
Viewpoint Locations

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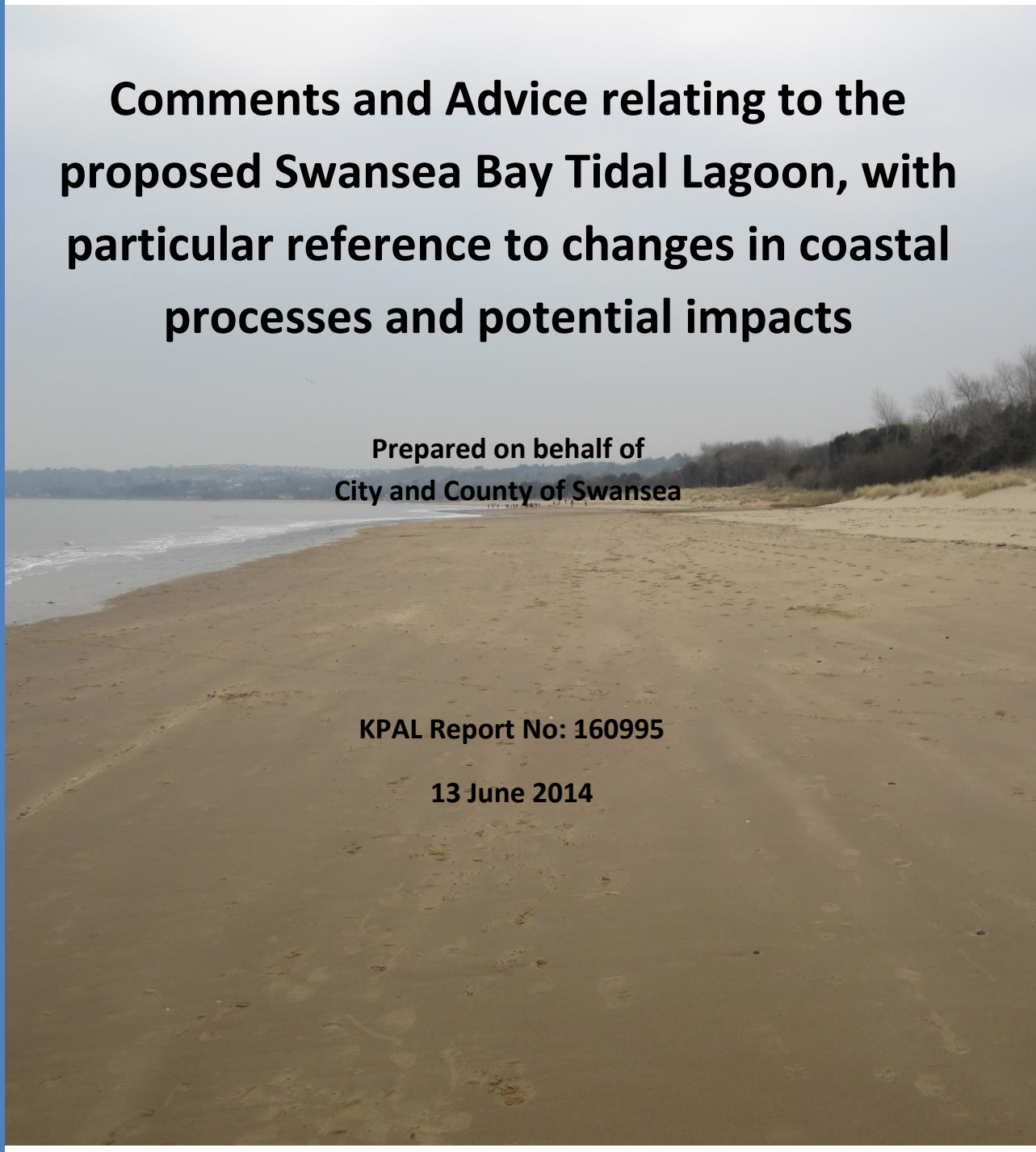

Comments and Advice relating to the proposed Swansea Bay Tidal Lagoon, with particular reference to changes in coastal processes and potential impacts

Prepared on behalf of
City and County of Swansea

KPAL Report No: 160995

13 June 2014

Kenneth Pye Associates Ltd.
Scientific Research, Consultancy and Investigations

Comments and Advice relating to the proposed Swansea Bay Tidal lagoon, with particular reference to changes in coastal processes and potential impacts

Professor Kenneth Pye ScD PhD MA CGeol FGS

13 June 2014

Report history	
Draft:	25 April 2014
Final:	13 June 2014

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Contents

SUMMARY

This report contains comments and advice to the City and County of Swansea (CCS) relating to the potential impacts of the proposed tidal lagoon development in northern Swansea Bay. Attention is given to the potential impacts of the Lagoon on coastal processes, sediment transport and rates of sediment accretion and erosion along the CCS frontage. A number of issues relating to coastal processes have been identified as being of concern to CCS, including: (a) the potential of the Lagoon to interrupt sediment supply to the recreational sandy beaches between Black Pill and West Pier; (b) the possible effect on the wind-blown sand problem which affects the promenade and Oystermouth Road; (c) possible greater mud accumulation in the shallow sub-tidal and intertidal areas of northwestern Swansea Bay which could encourage salt-marsh development, have negative impacts on the designated wildlife features of Blackpill SSSI, and adversely affect recreational use of the area; (d) possible increased dredging requirement upstream of the Tawe barrage and in the main Tawe navigation channel; (e) possible increased coastal flood risk in the Mumbles - Oystermouth area; (f) possible changes in wave conditions in the approach to Swansea Marina; (g) possible remobilization of contaminated sediments.

Confidence in the Coastal Processes, Sediment Transport and Contamination Baseline Assessment is limited by the following: (i) the background literature and data review is limited in scope, (ii) no quantitative analysis of historical maps, charts or aerial photographs has been undertaken, (iii) very limited analysis has been undertaken of existing environmental monitoring data, (iv) no geomorphological or sedimentological field studies have been reported; (v) only a limited number of intertidal and sub-tidal sediment samples has been collected and analysed for particle size and contaminants; (vi) water level, current, and suspended sediment data were collected from only two locations within the approximate lagoon footprint and only over a three month period. Confidence in the coastal processes modelling is also limited because (i) only a single suite of 2D modelling tools was used, (ii) no validation of the mud transport, sand transport or particle tracking modules has been demonstrated using observational data, (iii) the modelling has considered changes mainly at a regional scale and does not capture the details of processes and morphological changes on the beaches and in shallow intertidal areas; (iv) the wave modelling has concentrated almost exclusively on possible changes in wave height around the Bay, (v) the details of wave breaking, refraction and wave-generated sediment transport have not been modelled in detail, and (vi) only a very limited number of present and possible future scenarios have been modelled.

In order to minimise risks associated with uncertainties arising from the EIA it is recommended that a detailed monitoring, mitigation and remediation programme should be developed if a DCO is granted. This should include further detailed baseline studies as a precursor for further monitoring and the definition of ‘trigger’ thresholds for mitigation / remedial action.

1.0 REPORT SCOPE AND PURPOSE

1.1 This report contains comments and advice to the City and County of Swansea (CCS) relating to the potential impacts of the proposed tidal lagoon development in northern Swansea Bay (Figure 1). Particular attention is given to the potential impacts of the Lagoon on coastal processes, sediment transport and rates of sediment accretion and erosion along the CCS frontage.

1.2 The comments and advice presented below are based on an appraisal of chapters contained within the Tidal Lagoon Swansea Bay (TLSB) Environmental Statement (ES) which forms part of the Development Consent Order (DCO) application, information contained in a number of supplementary reports which have been made publically available by the Developer during the consultation process, and a review of previous scientific investigations, publications and environmental monitoring data relating to Swansea Bay.

1.3 Key components of the ES which are relevant to this appraisal are:

- TLSB ES Chapter 6. Coastal Processes, Sediment Transport and Contamination (prepared by ABPMer)
- Appendix 6.1: Swansea Bay Tidal Lagoon Coastal Processes: Model Setup, Calibration and Validation, ABPMer Report R.2108TN, December 2013
- Appendix 6.2 Model Bathymetry Review, ABPMer Report R2220TN, February 2014
- Appendix 6.3 Summary of results from contamination and PSA analyses (data supplied by Titan Environmental Surveys Ltd)
- Appendix 6.4 Summary of model run scenarios for Coastal Processes EIA (prepared by ABPmer)

1.4 Issues relating to coastal processes which have been identified as being of concern to CCS include:

- The potential of the tidal Lagoon to interrupt the supply of sediment to the sandy beaches to the west of the River Tawe; the compositional condition and visual appearance of these beaches are of vital recreational and amenity importance to the local population and contribute significantly to the overall attractiveness of Swansea as a destination for leisure and business visitors, longer stay tourists and University students. Many of the objectives and actions identified within the Swansea Bay Strategy (CCS, 2008) and the Environment Management Plan Pre-consultation draft

document depend on maintaining the quality of the existing beach features and overall seascape (Commons Vision 2012; Trawscoed Ltd & Commons Vision, 2012).

- The effect of a possible reduction in sand supply on long-term beach levels and the ability of the sand dune systems in northwest Swansea Bay to recover following storm events; this could have implications for coastal flood risk as well as net loss of sand dune habitat and recreational beach area.

- The likely effect of the Lagoon development on the wind-blown sand problem which currently affects the promenade and coastal road between the Civic Centre and Bryn Mill Lane (Figure 1).

- The potential impact of the Lagoon to cause greater mud deposition / accumulation in the shallow sub-tidal and intertidal areas, possibly leading to more extensive salt-marsh development in the medium term, which would have potentially negative implications for the existing habitats and biota, visual landscape and recreational use of the area.

- The possibility that construction of the Lagoon will lead to increased sediment dredging requirements upstream of the Tawe barrage, as well downstream in the main Tawe navigation channel (CCS has a Parliamentary obligation to dredge the impoundment).

- The magnitude of changes in flood risk arising from greater wave heights around some parts of the Bay (the ES suggests increases in wave heights, notably in the Mumbles - Oystermouth area, mainly from wave reflection off the Lagoon walls).

- The effect of possible changes in wave height / energy on recreational navigation in the approach to Swansea Marina, and on the potential for local sediment erosion adjacent to the western wall of the Lagoon.

- The potential risk of remobilization of contaminated sediments during, and following, Lagoon construction, and possible implications for sediment and water quality on the recreational beaches.

- The adequacy of the Coastal Processes Baseline Assessment undertaken for the EIA.

- The adequacy of the modelling undertaken as part of the EIA relevant to the above questions.

- Requirements for monitoring and mitigation measures which might be paid for by the Developer if the development is consented, including requirements for the specification of change thresholds for action.

2.0 SEDIMENT SUPPLY TO RECREATIONAL BEACHES

2.1 As stated in the Coastal Processes chapter (Chapter 6) of the ES, construction of the lagoon would effectively divide northern Swansea Bay into two separate hydrodynamic and sediment transport cells, one to east and one to the west of the lagoon structure. This is anticipated by ABPmer to have two main effects: (1) it would interfere with the anticlockwise residual current in northwest Swansea Bay which is capable of transporting suspended mud, and (2) it would prevent episodic storm-generated littoral transport of sand from north-eastern Swansea Bay towards the west, potentially cutting off the supply of sand to the recreationally important beaches between the West Pier and Singleton Park.

2.2 No results of sand transport modelling are presented in the ES to support this conclusion. Figure 6.15 of the ES shows postulated sand transport pathways in Swansea Bay based largely on previous work summarised in Collins *et al*. (1979). It shows (probably episodic) tidal current transport from the nearshore area off Crymlyn Burrows, across the proposed Lagoon footprint area, towards the anticlockwise tidal eddy in northwest Swansea Bay. However, there is very little empirical evidence to suggest that this pathway is significant for the transport of sand; as reported by Collins *et al*. (1979) and Collins & Banner (1980), tidal current velocities in northern Swansea Bay are too low to entrain sediment from the bed and can only transport fine grained sediment (mud and very fine sand) in suspension. Waves and wave-induced currents are more important for the entrainment and transport of sand across the Bay.

2.3 The main source of sand is provided by sources external to the Bay, and south-westerly storm waves, combined with the flood tide, play an important role in transporting sand south of Mumbles Head towards the northern and eastern parts of the Bay. The geomorphological evidence from shoreline features demonstrates that the dominant (net) direction of littoral sand transport along the entire shore of Swansea Bay between Oystermouth and the Neath estuary is easterly. No specific modelling of littoral sediment transport has been undertaken in the ES.

2.4 There is no reason to expect that the construction of the Lagoon will change the rate of sand supply from the southwest into Swansea Bay, although this has not been demonstrated in the ES by modelling using the Mike 21 Sand Transport module. However, retention (accumulation) of sand in northwestern Swansea Bay may be made more likely due to a predicted reduction in both significant wave height (and hence wave energy) (Figures 6.45, 6.46, 6.47, 6.48, 6.49) and tidal current speeds (e.g. Figure 6.34).

2.5 Sediment transport in the shallow sub-tidal and intertidal areas of northwestern Swansea Bay is complex. Aerial photographs taken since 1945 show indicate a

complex pattern of sand-waves which experiences significant change on annual to decadal timescales (Figure 2). No analysis of the importance of these features in onshore - offshore alongshore sand transport has been undertaken as part of the ES. No attempt has been made to construct a sediment budget for northwestern Swansea Bay, or to document net gains or losses of sediment using historical beach profile data or aerial photogrammetry. However, it is clear from a qualitative comparison of the aerial photographs and beach survey data that there have been periods when there has been a more or less continuous cover of mainly sandy sediment across the north-western part of the Bay, and others when the sand has been concentrated into discrete sand wave features separated by exposures of early to mid Holocene-age muds and peat. The width and elevation of the upper sandy beach between Black Pill and the Civic Centre has also varied in response to variations in wind and wave conditions. The period between 2000 and 2013 was one of relatively few storms and during this period there was a net movement of sand from the shallow sub-tidal areas and mid intertidal zone towards the higher intertidal zone. By 2005/6 a very large quantity of sand had accumulated on the upper beaches, giving rise to significant problems of windblown sand incursion onto the promenade and Oystermouth Road (see below). The problem has continued until the winter of 2013/14, when a series of severe storms caused significant upper beach and frontal dune erosion and transfer of sand back to the mid / lower intertidal zone (Pye & Blott, 2012, 2014a,b). However, since the 1970s there has been significant net accretion of littoral sand in northwestern Swansea Bay between the south side of Black Pill and West Pier with the exception of the Civic Centre frontage which lies seaward of the general shoreline alignment (see comparison of beach profiles in Figure 6).

2.6 On the basis of the available evidence, it appears unlikely that the supply of sand to the recreational beaches would be significantly reduced as a result of construction of the Lagoon. The net effect is more likely to increase the retention of sand brought into this part of the Bay (mainly by wave processes) and to reduce the severity of upper beach erosion during storms between St. Helens and West Pier due to the shelter provided by the Lagoon (especially from southeasterly waves).

3.0 RESILIENCE OF SAND DUNES AND IMPLICATIONS FOR COAST PROTECTION AND FLOOD RISK MANAGEMENT

3.1 Events during the stormy winter of 2013-14 demonstrated the importance of dunes as a reservoir of sand which is available to release sand to the beaches during storms, and in preventing direct wave attack on the sea wall behind (Pye & Blott, 2014b). Any increase in the frequency / magnitude of dune erosion would potentially diminish this role and increase the risk of storm damage to the sea wall and infrastructure behind. However, as noted in section 2.0, a consideration of the evidence suggests

that the effect of Lagoon construction would be to reduce wave heights, encourage sandy sediment retention on the beach, and reduce the risk of serious dune erosion between St Helens and West Pier. The 'protective' effect of the Lagoon would decrease westward, especially for southeasterly waves, with probably no net change in the vicinity of Black Pill.

4.0 WIND-BLOWN SAND HAZARD

4.1 If, as anticipated, there is a medium to longer term increase in total sand volume in the intertidal and supra-tidal areas between St Helens and the Civic Centre, the existing problem of wind-blown sand incursion onto the promenade, Oystermouth Road and into the Civic Centre west car park (Pye & Blott, 2012, 2014a,b) is likely to become worse. This would potentially result in increased maintenance costs associated with removal and disposal of sand from the promenade, road and car park, and increase the safety risk to pedestrians, cyclists and motorists.

4.2 Near Swansea Point, adjacent to the West Pier, the existence of a fairly wide belt of sand dunes should prevent any additional sand blowing on to the promenade and into properties, provided that the recent improvements to sand fencing and visitor management are maintained (for more detailed information see Phillips, 2014).

5.0 INTERTIDAL MUD-DEPOSITION AND POSSIBLE SALTMARSH DEVELOPMENT

5.1 The coastal processes modelling with the Lagoon in place has suggested increased mud deposition in parts of northwestern Swansea Bay, predominantly within shallow sub-tidal area adjacent to Blackpill SSSI, and to a lesser extent across the adjoining intertidal zone including the mid foreshore seaward of the recreational beaches between St. Helens and West Pier (ES Figure 6.50 , 6.52). The predicted reductions in high tide levels (e.g. ES Figure 6.42), current speeds (e.g. 6.34) and wave heights (e.g. Figure 6.45) suggest that there is a significant risk of increased mud deposition and accumulation across a much wider area, especially within the sheltered areas leeward of the higher intertidal sand bars.

5.2 The effect of increased mud deposition would be to restrict the mobility of the sand bars if mud drapes are formed on the bars and/ or the movement of sand across the surfaces between the bars is reduced a exposures of 'hard' peat and consolidated mid Holocene muds become progressively buried by new mud deposits. Such changes could have implications for the in-fauna and birds as well as affecting the exchange of sand between the upper beach and the lower sub-tidal areas.

5.3 The increased deposition of both sand and mud, together with slight reduction in high tidal levels, indicated by the ES modelling, implies a progressive reduction in average water depths and reduction in wave and current energy which will increase sediment accretion by positive feedback. If upper foreshore levels rise sufficiently and wave action is reduced, saltmarsh vegetation will become established, leading to a further acceleration in mud accretion rates. This would change the visual appearance of the shore and potential affect recreational usage. The extent of the existing saltmarsh elevation 'window' is shown in Figure 3. This could increase significantly in the medium term following Lagoon construction.

5.4 Considerable time and effort has been spent in the past to prevent the development of *Spartina* marsh in the western part of the Bay, involving spraying, pulling and bull-dozing of pioneer vegetation, and such measures could be required again in the future. These historical problems have not been considered in the Coastal Processes Baseline Assessment and the possibility that similar action in the future may be required following construction of the Lagoon have not been recognized.

6.0 DREDGING REQUIREMENT IN THE TAWE IMPOUNDMENT

6.1 The ES modelling with the Lagoon in place has indicated higher rates of mud deposition within the approach channel to Swansea Docks during 10 in 1 year and 1 in 20 year storm events, and it is estimated that there will be a mean increase in dredging requirement of 52 x 10^3 m^3, or 27%, annually). Mud accretion along parts of the eastern wall of the Lagoon wall where tidal energy would be reduced is also indicated by the modelling.

6.2 Figures 6.50 - 6.52 of the ES show no increase in mud deposition in the innermost part of the Tawe channel immediately downstream of the Tawe Barrage. However, the ES model domain does not extend upstream to include the areas on both sides of the barrage, and contains no specific assessment of potential changes in sedimentation within the impoundment.

6.3 The barrage structure, completed in 1992, includes a boat lock, spillway, fish pass and generator turbine, is designed to allow overflow at the approximate level of mean high water in Swansea Bay (c. 3.4 m OD). Tidal overtopping of the barrage therefore occurs on spring tides, allowing ingress of marine sediment carried in suspension. The majority of sediment transported into the impoundment is likely to settle out and require periodic removal by dredging. The magnitude of the sediment carried into the impoundment, and of any likely change in dredging requirement following Lagoon construction, has not be quantified in the ES coastal process modelling. However,

there is a significant possibility that some of the fine sand and mud released into the water column during the construction phase could be transported over the Tawe barrage on spring tides and become trapped within the impoundment. Longer-term increases in sediment accumulation are also possible and should be monitored.

7.0 WAVE HEIGHTS, TIDE - RIVER FLOW INTERACTION AND FLOOD RISK

7.1 The analysis of the potential impact of the Lagoon on wave heights undertaken by ABPMer indicated a potential increase in water levels with the Lagoon present of 0.1 to 0.23 m on the western side of Swansea Bay, with the largest increases between Mumbles and Oystermouth (Hydrology and Flood Risk, Chapter 17, p36 of the ES; also ABPmer, 2013d). This will lead to an increased risk of overtopping and flooding in this area, which is backed by areas of low-lying land (Figures 4 & 5).

7.2 It was concluded from the analysis that, since the biggest waves on the Swansea Bay waterfront originate from a southeasterly direction, construction of the Lagoon will provide a measure of shelter and lead to no increased flood risk along this frontage. However, Figure 17.7 of the ES shows that the Lagoon structure only provides shelter from waves from an easterly direction; there is effectively unbroken fetch from southeasterly to south-southwesterly directions. No modelling of waves from the SSW to SSE has been undertaken.

7.3 Paragraph 6.5.2.32 reports that consideration has been given to extreme waves under conditions of a 1.5 m surge on top of a MHWS tide. It is reported that for Point 8 on the Mumbles frontage there is an increase in significant wave height of 0.19 m compared with an increase of 0.17 m for the without-surge case. A consideration of the effects of sea level rise based on the UKCP09 medium emissions scenario 95th % model output value indicated an increase of 0.18 m compared with 0.17 m for the without sea-level rise case. The additional water depth associated with surges and sea level rise is therefore predicted by the modelling to have a relatively minor effect.

7.4 The overall conclusion to be drawn from this assessment is that there is likely to be an increase in tidal flooding risk as a result of the Lagoon construction, albeit relatively small.

7.5 Any increase in wave heights along parts of the shore of northwestern Swansea Bay where there is no high tide beach or dunes is also likely to increase the risk of wave reflection from the sea defences and to create increased risk of beach lowering by toe scour.

7.6 No specific assessment is provided in the ES of potential interactions between high tides, surges, waves and high flows from the River Tawe. The Tawe barrage is overtopped by tides which reach above mean high water level (c. 3.4 m OD). Potential increases in the still water levels or wave heights in the Tawe Channel, adjacent to the western arm of the lagoon, could potentially increase the frequency and/ or duration of overtopping of the barrage, or could impede the discharge of Tawe floodwater to the sea. Potential implications for the Lower Swansea Valley Flood Risk Management Scheme have not been explored by the ES hydrodynamic and wave modelling.

7.7 The ES Baseline Assessment contains no detailed analysis of severe historical floods of the Tawe, or modelling of the likely behaviour of water levels arising from interaction of tides, waves and river floods of magnitudes similar to those in 1929 and 1979 (e.g. Walsh, 1982).

8.0 RECREATIONAL NAVIGATION

8.1 ES Tables 6.15 and 6.16 summarise the changes in significant wave height and wave period for 10 in 1 year, 1 in 1 year, 1 in 10 year and 1 in 20 year waves approaching from the southwest at ten locations in Swansea Bay. Point location 2 relates to the seaward end of the Tawe navigation channel close to the southwestern corner of the Lagoon (position shown on ES Figure 6.44). These tables show an increase in significant wave height at Point 2 of between 8 and 12 cm. The predicted increases in wave period range from 0.11 to 0.15 seconds.

8.2 ES Table 6.17 presents values for changes in significant wave height and period at the same locations for 10 in 1 year and 1 in 10 year waves approaching from the southeast. A reduction in significant wave height of between 3 and 7 cm, and an associated increase in wave period of 0.07 to 0.16 seconds, is predicted at Point 2 due to the sheltering effect of the Lagoon.

8.3 No modelling results are presented for locations further up the navigation channel, and no modelling of waves approaching from a south-southwesterly direction, parallel to the axis of the navigation channel, has been undertaken. The possibility of complex wave interaction, arising from reflection, deflection and refraction of waves off the western wall of the Lagoon and/or the West Pier, has not been considered. However, from the results presented it is likely that small recreational vessels will encounter larger head-waves when navigating the Tawe entrance channel towards the open sea.

9.0 REMOBILIZATION OF CONTAMINATED SEDIMENTS

9.1 The ES concludes that there will be no significant risk of contaminant remobilization associated with dredging of sediment for construction of the Lagoon since none of the samples analyzed exceeds Cefas action level 2 for any specific contaminant (paragraph 6.4.4.5 of Chapter 6). However, this conclusion is based on the collection and analysis of a very limited number of sediment samples, most from the surface or shallow depth and largely excluding the intertidal areas of the Bay (see Figure 6.16 of the Coastal Processes Chapter, Figure 4.7b of the Marine Ecology chapter, and Figure 7 of this report). As noted in paragraph 6.4.4.1 of the ES Chapter 6, "Across the wider Swansea Bay region, and specifically within the footprint of the proposed Lagoon, there is a general paucity of historic sediment quality data".

9.2 ES Appendix 6.3 provides a summary of the particle size analysis and contaminant analysis performed on sediment samples collected during the sub-tidal benthic survey and the geotechnical investigation (Atkins, 2013; Titan 2012b, 2013a,b; EGS, 2013). The total number of samples analysed for particle size and composition is very small for a project of this scale and does not give a comprehensive picture of the surface or sub-surface sediment character in the northern part of Swansea Bay. No sampling or analysis has been undertaken in the intertidal and supra-tidal areas of northwestern Swansea Bay and only very limited sampling in the northern part of the Bay which will be directly impacted by the Lagoon construction.

9.3 No investigation has been carried out of the thickness of superficial sediment in these areas, or the sedimentary characteristics and chemical composition of older sediments which underlie them. A comprehensive baseline survey of sedimentary facies and contaminant levels in the surface and sub-surface sediments across northern Swansea Bay has not been undertaken, and uncertainty therefore remains regarding the potential for release and redistribution of contaminants outside the sampled areas.

10.0 ADEQUACY OF THE BASELINE ASSESSMENT

10.1 The Coastal Processes, Sediment Transport and Contamination Baseline Assessment displays the following limitations:

- Limited scope of literature review – no detailed consideration given to previous research projects such as those carried out by the Institute of Oceanographic Sciences Sker Project (e.g. Heathershaw *et al.*, 1980, 1981) and Swansea University (e.g. Collins, *et al*., 1979, 1980; Collins & Banner 1980) and more recently by SEACAMS).

- No detailed quantitative analysis undertaken of historical maps, charts or aerial photographs; no attempt made to quantify historical sediment volume or sea bed level changes in different parts of the Bay.

- Very limited analysis and use made of existing environmental monitoring data - e.g:
  - Tidal and mean sea level data for Mumbles held by the National Tidal and Sea Level Facility (NTSLF) and the Permanent Service for Mean Sea Level (PSMSL)
  - wind data for Mumbles available from Met Office
  - LiDAR data available from the Environment Agency (EA) Geomatics Group
  - Recent dredging data relating to Port of Swansea, Port Talbot, Port of Neath
  - Swansea Bay and Carmarthen Bay Coastal Engineering Groups (SBCBEG) intertidal profile monitoring data for the period 1998-2013.

- No detailed field studies have been undertaken from a geomorphological or sedimentological perspective.

- No intertidal sediment samples have been collected or analysed for particle size or levels of contaminants

- No measurements made of sediment thickness / lithostratigraphy (e.g. from shallow geophysics or boreholes).

- Only a limited number of sub-tidal sediment samples has been collected and analysed; the number and spatial distribution are inadequate to allow Sediment Trend Analysis (STA) or detailed mapping of sedimentary facies.

- Metocean data (water levels, currents, limited suspended sediment concentrations) were collected by Titan Environmental Surveys (2012a) from only two locations (both within the approximate lagoon footprint) and for a short time period (3 months between 16 February and 16 May, 2012); while the data are adequate for model calibration and validation purposes (as reported by ABPMer 2013a), they do not give a full picture of the range of conditions experienced in Swansea Bay. The measurement period included a significant period of time when conditions were dominated by high pressure and northeasterly winds. No long-term wave buoy deployment was used to provide data about wave conditions within the northwestern, northern and northeastern parts of the Bay.

11.0 ADEQUACY OF THE COASTAL PROCESSES MODELLING

11.1 The coastal processes, sediment transport and contamination modelling also has a number of limitations:

- Modelling has been restricted to use of a single suite of 2D modelling tools, mainly DHI Mike 21-FM-HD (Flexible Mesh Hydrodynamic model) and Mike 21 FM-SW (Flexible Mesh Spectral Waves model; these are widely used and highly respected models but are applicable only to modelling of change over relatively short time periods; they do not include process - sediment transport - bedform feedbacks and the Mike 21 FM-HD model only provides depth-averaged current velocities and suspended sediment concentrations.

- The discussions of the hydrodynamic and wave models provided in Appendix 6.1 are brief and lack detail. Some further information relating to the hydrodynamic and wave modelling is provided in a report by ABPmer (2013a), but there is no discussion of the DHI Mike 21 mud module, sand module or particle tracking module in any of the presented documents.

- No validation of mud transport, sand transport or particle tracking modules has been undertaken using observational data.

- No results for sand transport modelling are presented in the ES, even though much of Swansea Bay is sand-dominated.

- The modelling has considered changes mainly at a regional scale; the models do not capture the details of processes, sediment transport and morphological changes in shallow sub-tidal and intertidal areas.

- Although the short-term hydrodynamic, wave and sediment modelling, undertaken is adequate for the assessment of regional scale changes in water levels, depth-averaged currents and broad scale patterns of likely sediment erosion and accretion, it cannot resolve the detailed patterns of wave - current interaction and sediment movement in the intertidal and shallow sub-tidal areas which are critical for the understanding of likely impacts on the morphology and sedimentary character of receptors

- The ES contains no specific consideration of surface zone processes and littoral sediment transport.

- Appendix 6.4 provides a convenient summary, in tabular form, of all the model runs undertaken as part of the Coastal Processes assessment. Nine model runs were performed using the Mike 21 FM-HD (hydrodynamic) model (including three sensitivity test runs using modified intertidal bathymetry), six runs using the Mike 21 SW (Spectral Waves) model, three using the Mike 21 PT (Particle Tracking) module, two using the Mike 21 MT (Mud Transport) module, and two using the Mike 21 ST (Sand Transport) Module).

- The data used to construct the bathymetric grid used in the short-term modelling originate from several different sources and are of varying age and resolution (this is described in Appendix 6.2 of the ES (Model Bathymetry Review) and in reports by ABPmer 2013b,c). It would have led to increased confidence in the results if the baseline assessment for the project had included collection a comprehensive new bathymetric data set using specially commissioned, synoptic, multi-beam swath bathymetry and airborne LIDAR surveys.

- Most of the hydrodynamic and particle tracking model runs undertaken relate to the construction phase of the proposed development, specifically in relation to the effect of dredging of sediment within the lagoon area and the filling of Geotubes to construct the framework of the lagoon, and to a lesser extent the disposal of surplus dredged material at the Swansea Bay Outer disposal site. By their very nature, the modelling tools are unsuited to assessment of medium to long term (>30 days) effects on sediment erosion and deposition patterns / rates during the lagoon operation and decommissioning phases.

- It is evident from ES Chapters 1 and 4 that considerable uncertainty remains regarding the methods which might actually be used to construct the Lagoon. It is presently unclear whether Geotubes or more conventional construction methods using imported rock / concrete / fill will be used for parts or all of the construction. No modelling of possible alternatives to Geotubes has been undertaken in ES Chapter 6.

- It is also mentioned in ES Chapter 4 that the western training wall of the River Neath may be re-built; this has not been included in the modelling. The possible requirement to extend the existing treated sewage / storm-water discharge outfall beyond the limits of the Lagoon walls also has not been modelled.

- The wave modelling undertaken using Mike 21 FM-SW considered two wave approach directions, the prevailing southwesterly approach direction, and a southeasterly direction. The analysis focused mainly on changes in average wave height around the Bay. Patterns of wave refraction with changing pre- and post-construction bathymetries have not specifically been considered even though this aspect is likely to be important for nearshore and intertidal sediment transport.

- Waves from a south-south-west to southerly approach direction have not been considered although these could be important in terms of wave penetration into the mouth of the River Tawe (with implications for small craft navigation), wave interaction along the western walls of the proposed lagoon and the West Pier, and the transfer of sediment over the Tawe barrier.

- Longer-term changes have been considered only using Expert Geomorphological Assessment (EGA), based on the outputs of the short-term numerical modelling and the baseline conceptual understanding; no quantitative numerical modelling has been

undertaken for alternative future scenarios, using modified bathymetries; the fact that only a limited number of scenarios have been assessed by the short-term modelling, and the baseline assessment is of limited scope, results confidence in the EGA.

- No detailed modelling of the Decommissioning phase has been undertaken and only a very brief qualitative assessment based on EGA provided. The option of total removal of the lagoon structure on decommissioning has not been considered. The consequences of allowing the Lagoon structure to degrade through lack of maintenance in the long term also have not been considered.

12.0 REQUIREMENTS FOR MONITORING, MITIGATION AND POSSIBLE REMEDIATION

12.1 Two potential methods of monitoring are identified is the ES as potential contributors to an Operational Environmental Management Plan (OEMP):

- Beach profile monitoring to the west of the lagoon extending into the Blackpill SSSI and to the east in front of Crymlyn Burrows

- Monitoring of sedimentation within the navigation channel to Swansea Docks

12.2 In view of potential concerns about the potential impacts of the development on the beaches, intertidal flats and adjacent sub-tidal areas of northwestern Swansea Bay, including possible impacts on windblown sand hazard, mud accretion / saltmarsh development and dredging requirements in the Tawe barrage impoundment, it is suggested that a more extensive programme of pre-construction baseline data acquisition and subsequent monitoring should be agreed with the Developer, and other bodies including Natural Resources Wales (NRW), if a DCO is granted. Specific thresholds of change should be agreed which trigger further action in terms of mitigation / compensation / remediation.

12.3 From the viewpoint of physical processes and sediments, it is recommended that the following should be undertaken as part of a broader environmental monitoring package:

- A baseline LiDAR and comprehensive swath bathymetric survey of the whole of Swansea Bay before any construction activities commence.

- Repeat LiDAR / swath bathymetry surveys at 5 yearly intervals to allow quantitative assessment of changes in beach sediment volume.

- RTK GPS surveys of additional beach profiles to be established between the existing Swansea Bay and Carmarthen Bay profiles lines.

- Bathymetric surveys to monitor sediment accumulation in the impoundment above the Tawe barrage.

- Aerial photography surveys at 5 yearly intervals to monitor changes in morphological features and vegetation extent (e.g. saltmarsh).

- A comprehensive sediment characterization study of Swansea Bay, involving a minimum of 200 sampling points across the whole of the sub-tidal and intertidal area; samples should be taken from the surface and from specified depth intervals below the sea bed.

- Repeat sediment sampling at 5 yearly intervals in a reduced number of targeted locations.

- Continuous water level, wave and tidal current monitoring in at least two locations within northern Swansea Bay (e.g. using smart buoys).

- Installation of a weather station (including anemometer) at the control centre on the lagoon wall.

Agreement should be reached between TLSB and all interested parties regarding responsibility for any actions which may be required to tackle potentially adverse impacts such as increased windblown sand hazard, increased dredging requirement, improved coast protection / flood defence, and control of invasive saltmarsh vegetation. Additional agreements should be made in relation to habitat and species monitoring / mitigation.

13.0 REFERENCES

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FIGURES

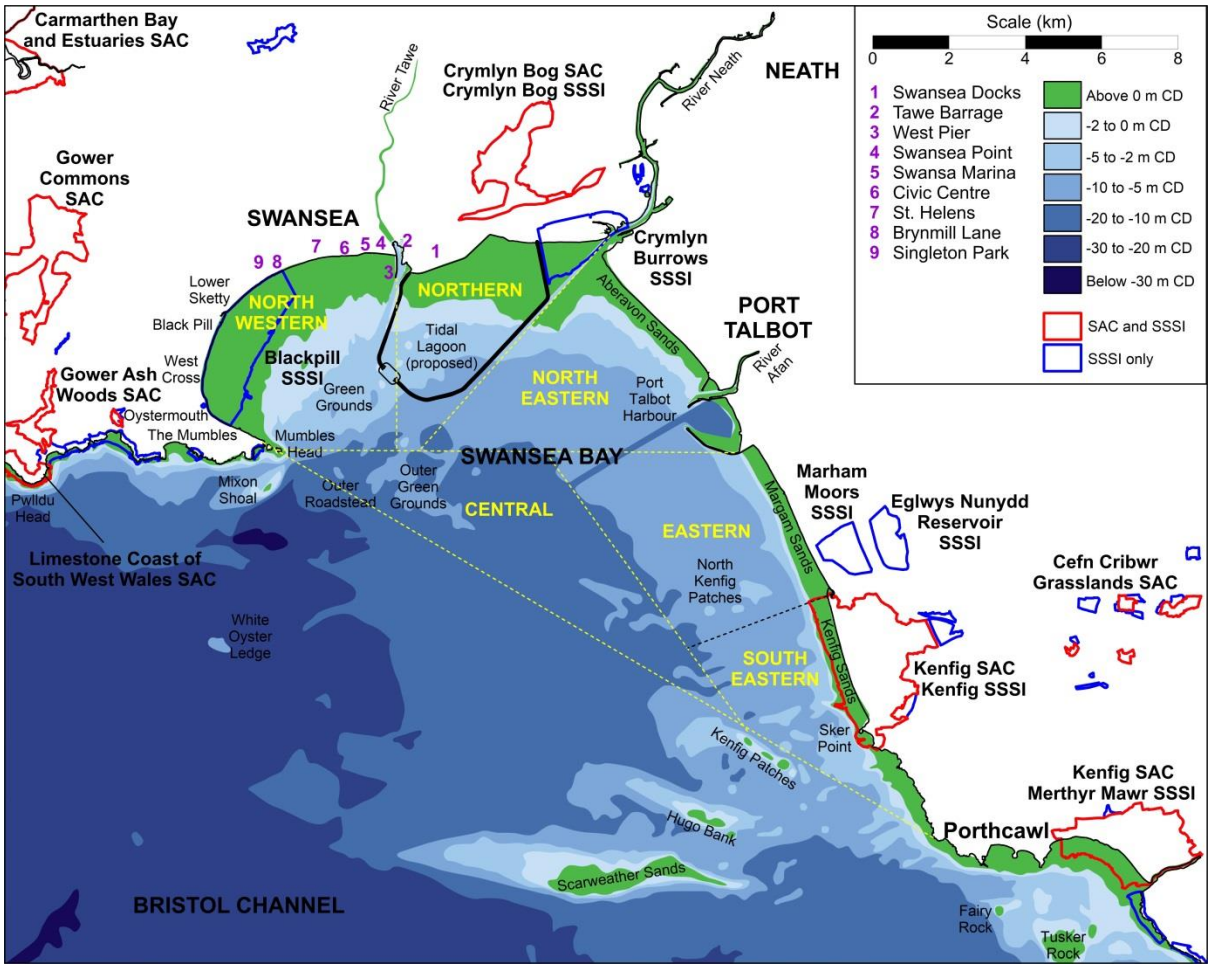


Figure 1. Map showing locations mentioned in the text, with bathymetry taken from the most recent Admiralty Charts (1161 and 1165), surveyed in large part 1980-1993 with minor recent corrections. Yellow lettering shows the main divisions of the Bay.


(a)
BLACK PILL


(b)


(c)

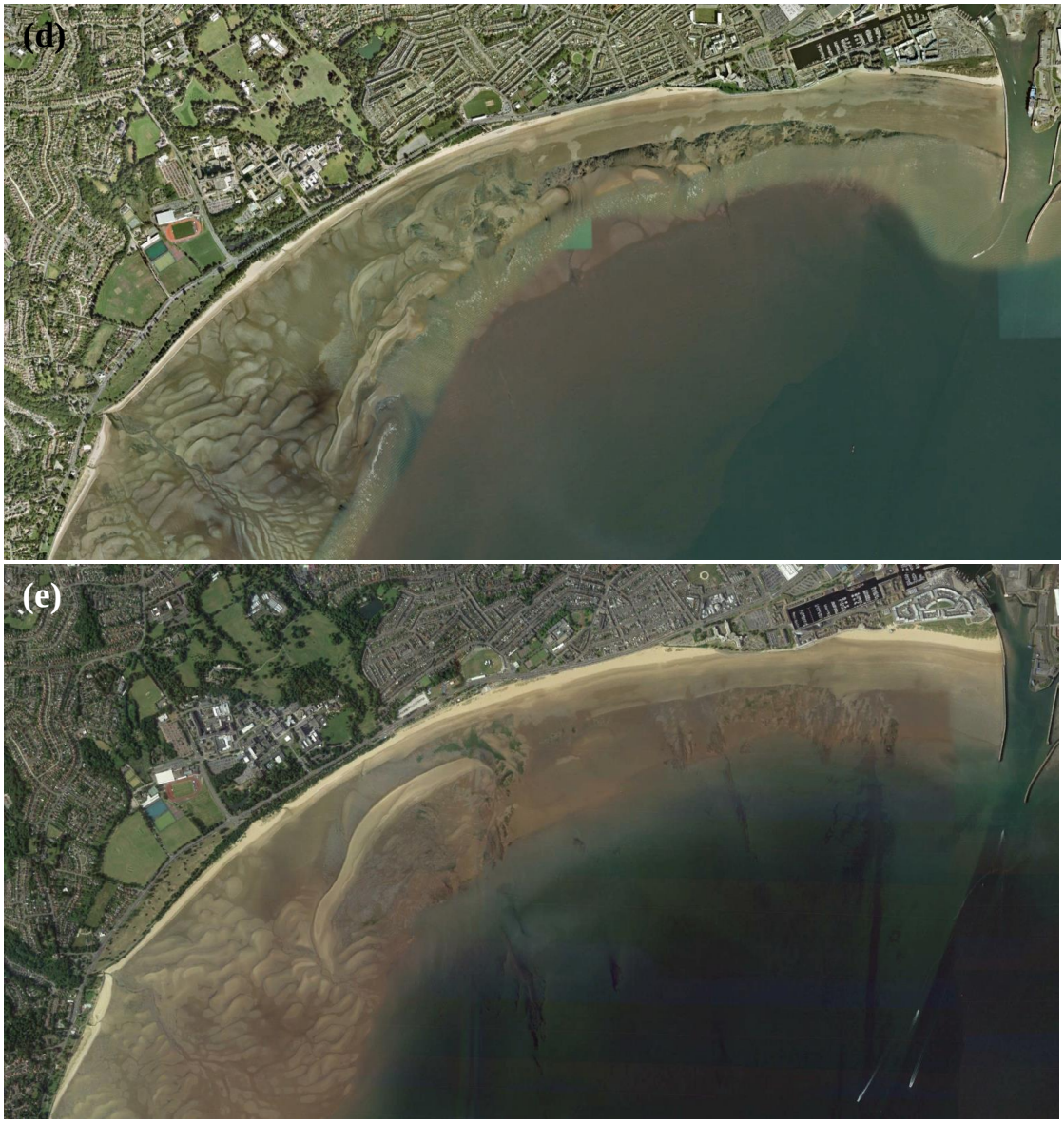


Figure 2. Aerial photographs of the northwestern part of Swansea Bay between Black Pill and West Pier: (a) 1945; (b) 1999: (c) 06/04/2002; (d) 05/09/2006; (e) 12/07/2013. Note variable size and position of intertidal sand bars, exposures of mid Holocene silt / peat platform, and upper dry sand beach / dunes. Data source: Google Earth

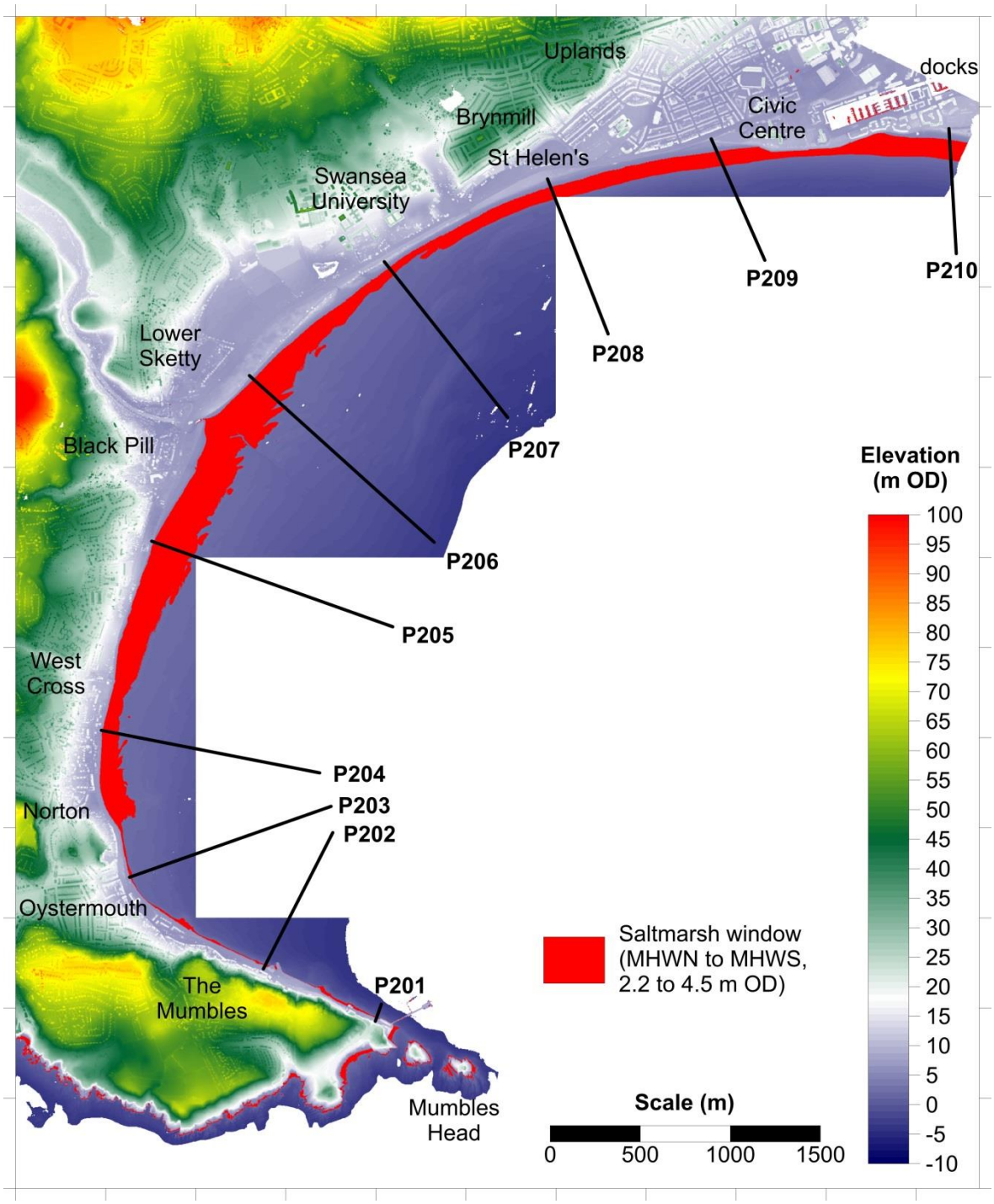


Figure 3. Lateral extent of the potential saltmarsh elevation 'window' (MHWN to MHWS) in western Swansea Bay, determined from LiDAR survey flown 26-27 February 2006. Positions of Swansea Bay and Carmarthen Bay Coastal Engineering Group beach topographic monitoring profiles are also shown

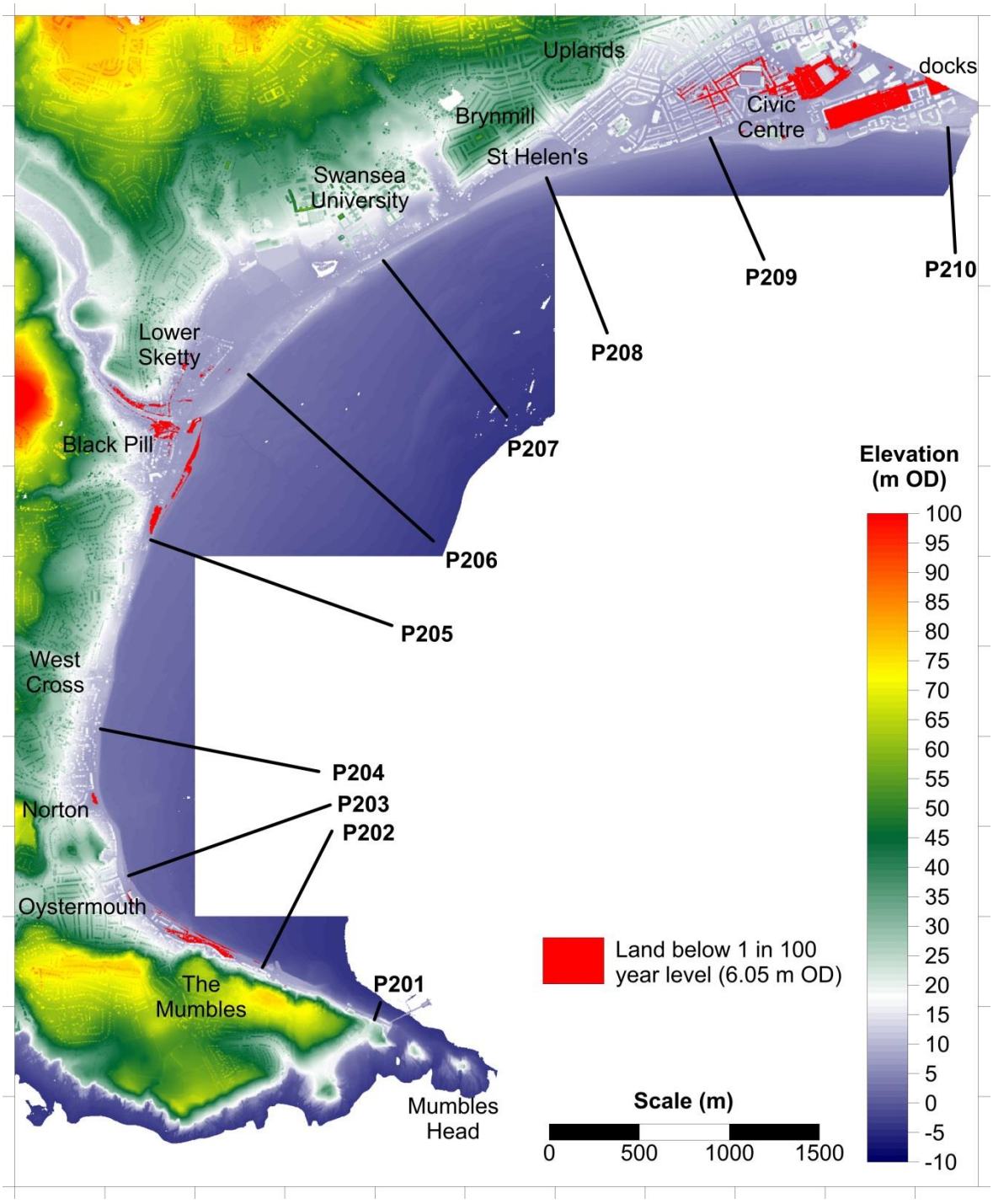


Figure 4. Land below the present 1 in 100 year return high water level (approx..6.05 m OD) in western Swansea Bay, determined from LiDAR survey flown 26-27 February 2006. Positions of Swansea Bay and Carmarthen Bay Coastal Engineering Group beach topographic monitoring profiles are also shown

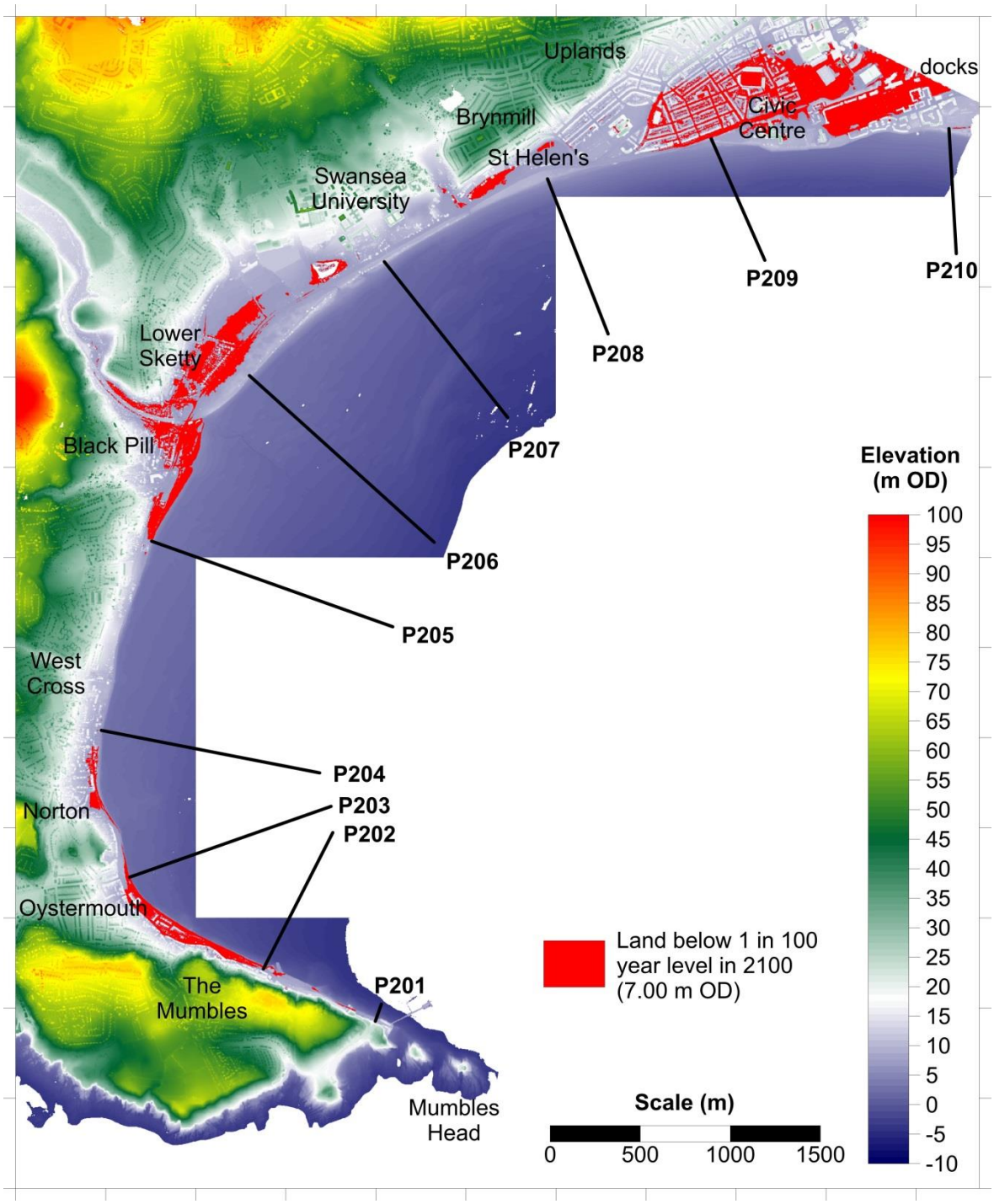


Figure 5. Land below the estimated 1 in 100 year return level in 2100 (approx.7.00 m OD) in western Swansea Bay, determined from LiDAR survey flown 26-27 February 2006. Positions of Swansea Bay and Carmarthen Bay Coastal Engineering Group beach topographic monitoring profiles are also shown

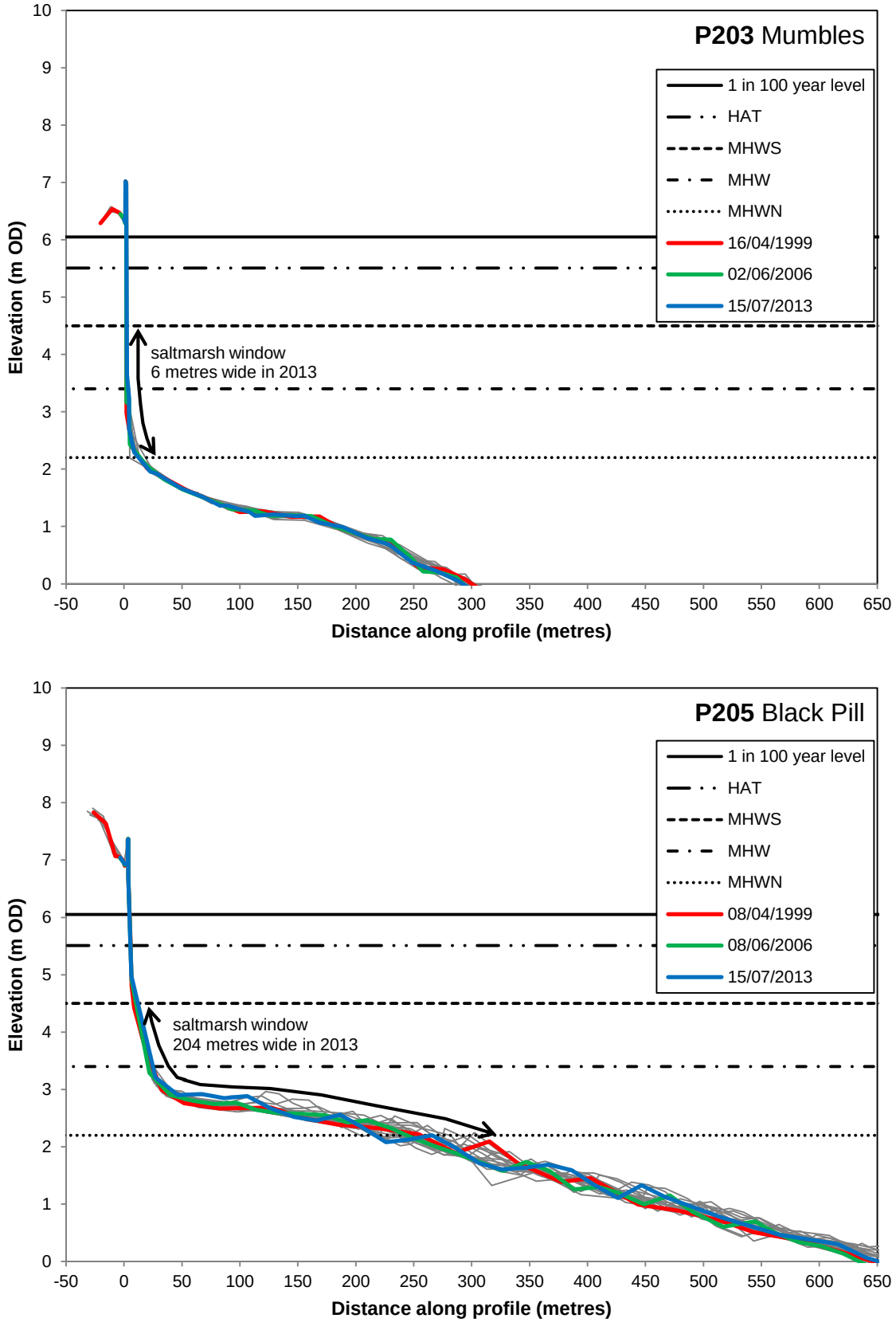


Figure 6. Beach cross-sections P203, P205 and P208 monitored by Swansea Bay Coastal Group between 1999 and 2013. Tidal levels and the extent of the saltmarsh window (MHWN to MHWS) are indicated

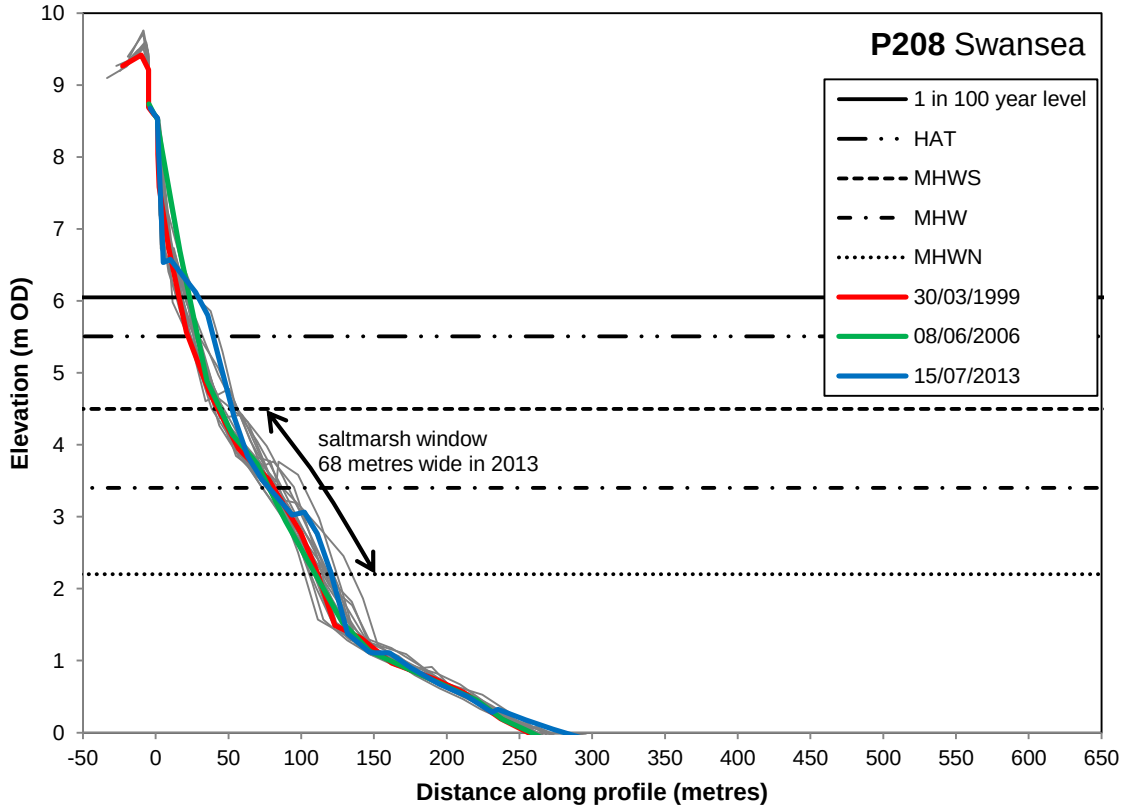


Figure 6. continued

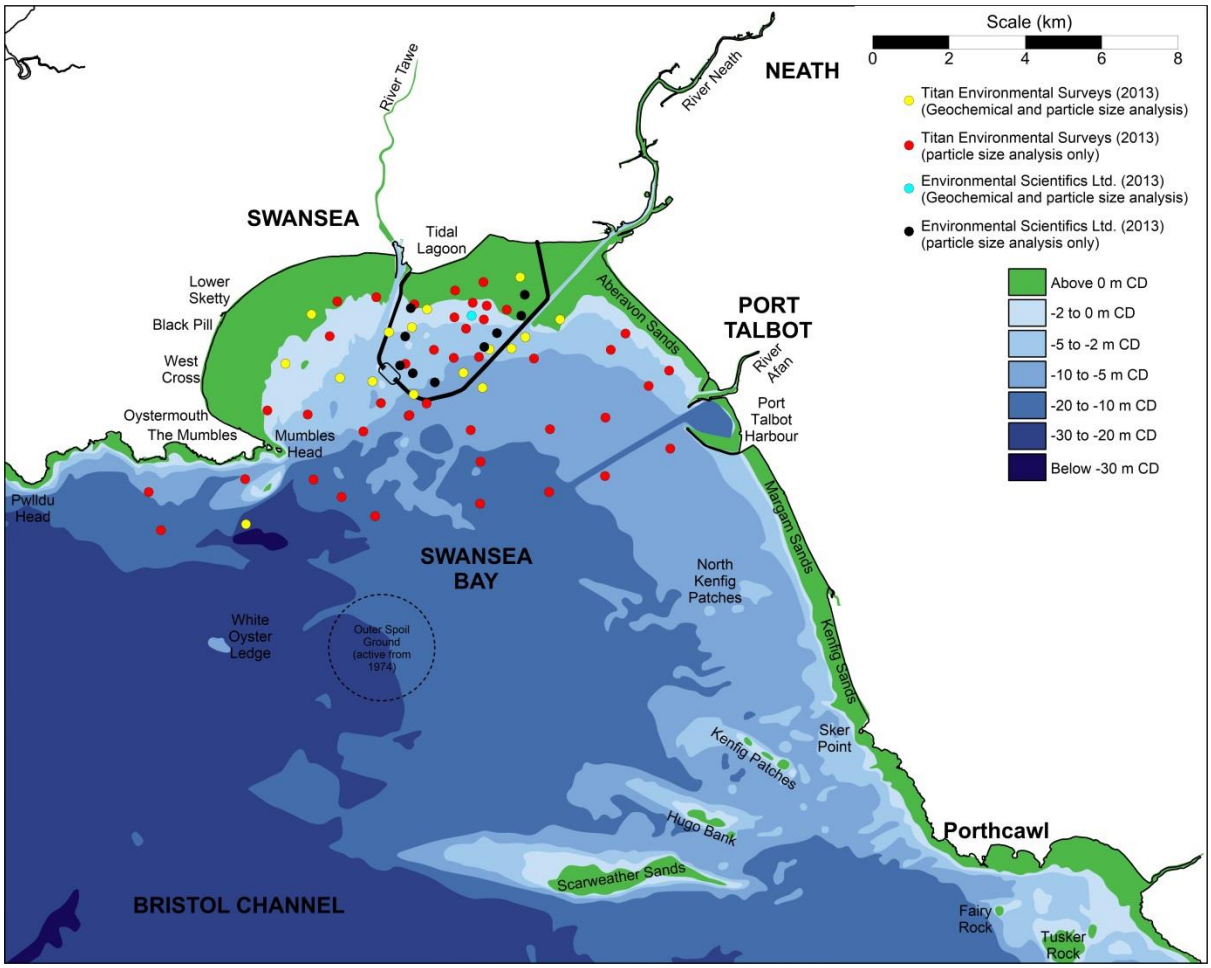
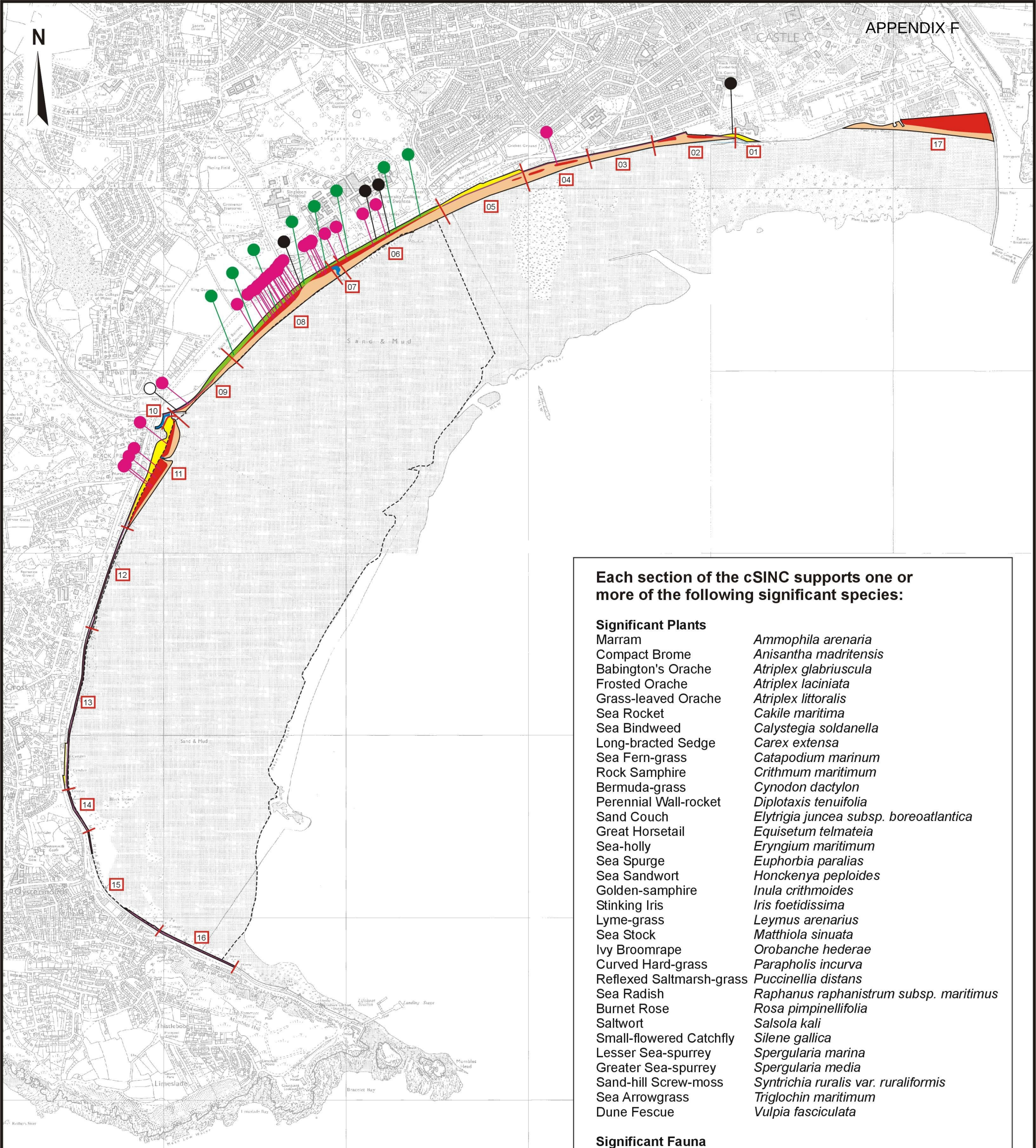


Figure 7. Locations where sediment samples were collected as part of the TLSB EIA for particle size analysis, determination of contaminant levels, and geotechnical testing. Note the absence of samples from the intertidal areas and supra-tidal areas

Blythe Valley Innovation Centre
Central Boulevard
Blythe Valley Park
SOLIHULL
B90 8AJ
United Kingdom
Telephone: 0121 506 9067
E-mail: info@kpal.co.uk
website: www.kpal.co.uk



Each section of the cSINC supports one or more of the following significant species:

Significant Plants

Marram	*Ammophila arenaria*
Compact Brome	*Anisantha madritensis*
Babington's Orache	*Atriplex glabriuscula*
Frosted Orache	*Atriplex laciniata*
Grass-leaved Orache	*Atriplex littoralis*
Sea Rocket	*Cakile maritima*
Sea Bindweed	*Calystegia soldanella*
Long-bracted Sedge	*Carex extensa*
Sea Fern-grass	*Catapodium marinum*
Rock Samphire	*Crithmum maritimum*
Bermuda-grass	*Cynodon dactylon*
Perennial Wall-rocket	*Diplotaxis tenuifolia*
Sand Couch	*Elytrigia juncea subsp. boreoatlantica*
Great Horsetail	*Equisetum telmateia*
Sea-holly	*Eryngium maritimum*
Sea Spurge	*Euphorbia paralias*
Sea Sandwort	*Honckenya peploides*
Golden-samphire	*Inula crithmoides*
Stinking Iris	*Iris foetidissima*
Lyme-grass	*Leymus arenarius*
Sea Stock	*Matthiola sinuata*
Ivy Broomrape	*Orobanche hederae*
Curved Hard-grass	*Parapholis incurva*
Reflexed Saltmarsh-grass	*Puccinellia distans*
Sea Radish	*Raphanus raphanistrum subsp. maritimus*
Burnet Rose	*Rosa pimpinellifolia*
Saltwort	*Salsola kali*
Small-flowered Catchfly	*Silene gallica*
Lesser Sea-spurrey	*Spergularia marina*
Greater Sea-spurrey	*Spergularia media*
Sand-hill Screw-moss	*Syntrichia ruralis var. ruraliformis*
Sea Arrowgrass	*Triglochin maritimum*
Dune Fescue	*Vulpia fasciculata*

Significant Fauna

White or Sandhill Snail	*Theba pisana*
Sand Dart	*Agrotis ripae*
Robber-fly	*Pamponerus germanicus*
Strandline Beetle	*Nebria complanata*

Legend

- Seawall with significant species (non-intervention)
- Marginal vegetation (non-intervention, though Japanese Knotweed present by University stream outlet)
- Lawns with significant species (best maintain as lawns - Bermuda-grass abundant where soils sandy)
- Dune with trees and scrub (mostly degraded dune that would benefit from management)
- Open dune vegetation (most important habitat in SINC supporting several key species)
- Open beach above MHWM (supports key strandline species)
- Blackpill SSSI
- Proposed Swansea Bay SINC boundary
- Sea Stock (Population of National significance)
- Sea-buckthorn (Invasive alien that degrades dunes - clearance work required)
- Poplar hybrid (Invasive alien that has degraded the dunes - some clearance work would be beneficial)
- Small-flowered Catchfly (Last remaining site in Glamorgan - population highly vulnerable)

City and County of Swansea

SWANSEA BAY cSINC
Terrestrial Qualyfing Features

SCALE 0 1km

DRAFT

November 2009

Statistical modelling of faecal indicator organisms at a marine bathing water site: results of an intensive study at Swansea Bay, UK

smart coasts

Volume 1 - Report

Smart Coasts - Sustainable Communities

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IRELAND-WALES 2007 – 2013
Ireland's EU Structural Funds Programmes 2007 - 2013
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EUROPEAN REGIONAL DEVELOPMENT FUND

Statistical modelling of faecal indicator organisms at a marine bathing water site: results of an intensive study at Swansea Bay, UK

A report from the Interreg 4a Smart Coasts – Sustainable Communities Project

Mark D. Wyer[1], David Kay[1], Huw Morgan[2], Sam Naylor[2], Phil Govier[2], Simon Clark[2], John Watkins[1], Cheryl M. Davies[1], Carol Francis[1], Hamish Osborn[3] and Sarah Bennett[3]

August 2013

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Summary

An investigation the feasibility of statistical modelling of faecal indicator organism concentrations (FIOs – *Escherichia coli* and intestinal enterococci (IE) as colony forming units (cfu)/100 ml)) at Swansea Bay, south Wales, UK is reported. Predictive modelling can mitigate bathing prohibition at sites that are unlikely to comply with the revised European bathing waters Directive (rBWD) by 2020. Based on historical data, Swansea Bay is such a site. An intensive seawater sampling programme was implemented at the designated sampling point: 0.5 h samples between 07:00 and 16:00 GMT on 60 days between 16/05/2011 and 28/09/2011, extended to 19:00 on 24 days (total 1303 samples). All FIO analyses were made in triplicate to improve the precision of the dependent variables. A coastal meteorological station was installed 3 km away and five level/discharge stations set up in local rivers and streams to derive potential environmental predictor variables. Further data were acquired from discharge gauges at larger local rivers and sewage works, plus a local tide station.

The FIO concentrations showed pronounced, consistent, within day variation of two or three $\log_{10}$ orders, a pattern not apparent in weekly compliance data. Daily rBWD water quality classification showed IE to drive the classification outcome. Daily probability of gastrointestinal illness (*p*GI) was computed from IE values and the results showed that 10% *p*GI was associated with a daily geometric mean (GM) IE of 37 cfu/100 ml.

Predictor variable matrices were constructed allowing modelling of single sample $\log_{10}$ FIO and daily $\log_{10}$ mean FIO concentrations using stepwise multiple regression. Statistically significant models for single sample results tended to provide relatively low levels of explanation (explained variance (r^2): 33% to 65%). The daily $\log_{10}$ mean FIO models produced higher levels (r^2: 55% to 89%). For both FIOs, the highest level predictors related to: solar radiation, local stream discharge and tidal variables. Turbidity in samples was also relatively important in models including this parameter. The main predictors showed plausibility in terms of slope directions.

Daily mean $\log_{10}$ FIO models were refined to predict for a 9 h time window, applicable to 4.5 h in the immediate past and future. Selected models exhibited relatively high levels of explanation (r^2: *E. coli* 81%, IE 76%), low critical misclassification (*E. coli*: 1.7%, IE 6.8% - not predicting "Poor" water quality when the observed rBWD class was "Poor") and acceptably normal residuals distributions. Solar radiation is a dominant driver and predictions show strong diurnal patterns. Analysis of FIO concentration by time of day showed significant within-day changes, with lowest concentrations in the late morning/early afternoon. This pattern also alters rBWD classification during the day and corroborates the model predictions.

The IE model was selected for signing the site because IE: (i) generally drives the observed daily rBWD compliance outcome and (ii) provides a public health outcome in terms of *p*GI. The 37 cfu/100 ml *p*GI 10% threshold is being used for signing three times per day (twice per day on weekends) in the 2013 bathing season.

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1. Introduction

Compliance monitoring for the revised European bathing water Directive (rBWD) (CEU, 2006) commenced in 2012 with the first official compliance assessment against these standards based on the 2012 to 2015 bathing seasons. Environment Agency (2012) estimates suggest that 10% of designated bathing waters in England and Wales are likely to fail to comply with the rBWD standards. Should these bathing waters consistently fail to comply by 2020, then notices prohibiting their use will be applied under the Directive. This could have potentially disastrous consequences with respect to local tourist economies. In addition, approximately 50% of the UK's current 'Blue Flag' beach awards would be lost if the numerical standards in the rBWD were applied without beach management and sample discounting as outlined by WHO (2003, 2009).

The rBWD includes provisions for this type of discounting of compliance sample results where there is a prediction and communication system in place to inform the public of impending poor water quality. The application of predictive modeling and public information is would prevent the loss of 'Blue Flag' awards and maintain access to UK bathing waters. Efforts to model FIO concentrations in bathing waters statistically have been made in the UK and world-wide using compliance data sets and data describing antecedent environmental conditions, such as rainfall, river flow and other meteorological data from existing monitoring networks (e.g. Crowther *et al.*, 2001; Francy and Darner, 2006). Some of this research has resulted in successful operational prediction systems, such as those currently used in Scotland (McPhail and Stidson, 2009; Stidson *et al*., 2012). This report summarizes a study designed to improve statistical prediction of FIO concentrations at Swansea Bay in Wales, by enhancing the data sources used to build the statistical model beyond the available compliance sample results (typically 20 per bathing season) and existing hydrometric and meteorological networks.

The Swansea Bay location is shown in Figure 1. The beach is close to the large conurbation of Swansea, with a relatively rural hinterland. The bathing water is at risk of non-compliance with the rBWD and potential de-designation, based on the 2009-2012 compliance data. There are further urban areas around the bay, including Neath and Port Talbot, with the total urban population exceeding 250,000.

2. Materials and methods

2.1 Sampling programme

Water samples were collected from the Swansea Bay designated sampling point (DSP) at half-hourly intervals between 07:00 GMT and 16:00 GMT during three days of each week (typically Monday-Wednesday) throughout the 20 week bathing season in 2011 (16/05 2011 to 28/09/2011), following a successful trial run of the sampling and analysis protocol on 10/05/2011. This gave a total of 60 sampling days, each with 19 water quality samples. Thus, nearly as many samples were collected on individual sampling days as are collected for routine compliance monitoring at

Swansea DSP in an entire bathing season (20 weekly samples). The sampling period was extended into the evening to 19:00 GMT for 24 days between 18/07 2011 and 07/09/2011, yielding 25 samples per day.

Since the location is highly tidal, with a maximum tidal range in excess of 9 m, the sampling followed a transect, shown in Figure 1. Due to the distances involved in the intertidal zone an all terrain vehicle was required for the duration of the study. All samples were collected aseptically in sterile 1 l containers (Aurora Scientific) and immediately stored in the dark within cool boxes. Batches of samples (three per day) were then transferred to a refrigerator before dispatch to the laboratory. Samplers recorded the location details (latitude/longitude) of each sample using a hand held global positioning system (Garmin H72) and the seawater temperature using a portable electronic thermistor thermometer (Hanna Instruments 93510N). Suitable spirit-in-glass thermometers (Brannan 0-50 ˚C, 0.5 ˚C division) were provided for the event of an electronic thermometer failure.

Two samples, split from a single sample, were collected on each day. These samples were collected in a clean 5 l bucket and passed through a clean stainless steel funnel into two separate 1 l sterile bottles. The bucket and funnel were cleaned with isopropanol wipes (Vernon Carus Azo wipes) immediately before and after use. Sample numbers were randomly assigned for these samples prior to commencing the sampling programme. One sample was used as an analytical quality control (AQC) positive sample and the other for additional FIO analyses as outlined below. To determine that the procedure involved in splitting the sample was aseptic, a control of autoclaved seawater, from the site, was run through the sample splitting procedure.

2.2 Laboratory analysis

All samples were analyzed for *Escherichia coli* and intestinal enterococci (IE) using standard membrane filtration techniques. *E. coli* were enumerated using membrane lactose glucoronide agar (MLGA, Oxoid/Glycosynth) as outlined in SCA (2009, 2011). Membranes were incubated for 4 h at 30˚C, followed by 14 h at 44˚C (±0.5˚C). All green colonies were counted as *E. coli*.

At the time of the study an official analytical method for *E. coli* in UK rBWD compliance samples had not been determined and a range of methods, based on chromogenic media (e.g. MLGA), were under review. One method, subsequently adopted, uses tryptone bile glucoronide agar (TBX, Merck). A randomly pre-allocated split sample from each day was analyzed using this medium, with membranes incubated for 4 h at 30˚C, followed by 14 h at 44˚C (±0.5˚C) (SCA, 2011).

Enterococci were isolated using membrane enterococcus agar (MEA, Oxoid) by incubation for 4 h at 37˚C, followed by 44 h at 44˚C (±0.5˚C) (SCA, 2012). All maroon colonies were counted as presumptive enterococci. Membranes were then transferred to kanamycin aesculin azide agar (KAAA, Oxoid) and incubated for 6 h at 44˚C (±0.5˚C). All colonies that developed black halos were counted as confirmed IE.

All microbiological analyses were undertaken in triplicate to improve measurement precision (Fleisher and McFadden, 1980) and resulting concentrations expressed as colony forming units per 100 ml (cfu/100 ml). Serial dilutions, based on the trial run, were made using sterile Ringers solution in order to capture the appropriate range of FIO concentrations. The lower limit of detection (LLD) for *E. coli* was 3 cfu/100 ml. The theoretical LLD for IE was 1 cfu/100 ml due to the two-stage incubation. Here, a single membrane with a single presumptive colony could result, which, when incubated on KAAA does not confirm as IE. All samples were analyzed within 24 hours of collection (Mean: 10.77 h, Standard Deviation (SD): 8.12 h).

Following microbiological analysis, the samples were analyzed for turbidity (Hannah Instruments LP2000, NTU) and conductivity (Mettler Toledo SevenGo, mS). Total dissolved solids (TDS, g/l) and salinity (ppt) were also recorded using the conductivity meter.

2.3 Probability of gastrointestinal illness calculations

The World Health Organization guidelines for safe recreational waters (WHO, 2003) define water quality thresholds based on calculations related to the probability of gastrointestinal illness (*p*GI). This is outlined in Kay *et al.* (2004) and uses the relationship between IE and *p*GI from randomized epidemiological studies in the UK (Kay *et al*., 1994) to calculate *p*GI associated with the statistical distribution of $\log_{10}$ IE concentrations described by mean and SD values (Wyer *et al*. 1999). These relationships were used to calculate *p*GI associated with individual IE determinations and for each sampling day, allowing water quality comparisons to be made for defined *p*GI thresholds.

2.4 Meteorological and hydrometric monitoring

A coastal meteorological station was commissioned for the project at Black Pill, approximately 2.9 km west of the DSP (Figure 1), based on a 9 m high mast (Clark Mast ST90) attached to a building by brackets. Solar radiation sensors at the station included: global radiation (GR) (Skye Instruments SKS 1110 Pyranometer), Ultra violet-A (UVA) (315 – 380 nm, Skye Instruments SKA 420) and Ultraviolet-B (UVB) (315 – 280 nm, Skye Instruments SKA 430), all measuring W/m^2. These sensors were all mounted on a suitable bracket at 3.5 m above ground level. A combined air temperature (AT, ˚C) and relative humidity (RH, %) sensor (Rotronic HygroClip2 HC2-S3) was mounted within a radiation shield (Gill multi-plate, Model 41002) at 3.4 m above the ground surface, whilst rainfall (RF, mm) was measured using a tipping bucket rain gauge (Met One Instruments 370C 20.3 cm aperture, 0.2 mm tip) mounted on the roof apex (3.5 m above ground). A Gill Instruments WindSonic, mounted at 8.4 m above ground level, measured wind speed (WS, m/s) and direction (WD, ˚ from N). An atmospheric (barometric) pressure sensor (AP, hPa) (Met One Instruments 092) was housed inside the building alongside the data logging equipment.

The station was set to log data at 1-second intervals, using Opsis EnviLogger software. This was used to derive 15-minute averages to match hydrometric data sequences. With the exception of the GR sensor, the station was fully operational from 14:00 GMT on 16/05/2011 onwards. Data from a meteorological station at Cwm Level (Figure 1) were available as a further data source for GR, rainfall, AT, RH plus WS and WD parameters. Global radiation data from this station were used until the sensor at Black Pill was installed at 11:00 GMT on 21/06/2011. Both stations are operated by the City and County of Swansea (CCS) Environment department. A 15-minute sequence of extraterrestrial radiation (ETR, W/m^2) input (i.e. solar radiation received at the top of the atmosphere) was computed based on the latitude/longitude position of the Black Pill meteorological station. Any short periods of missing data (typically < 1 h) were replaced by linear interpolation (radiation parameters) or mean values calculated using the observations immediately preceding and following the period of missing data (all other meteorological station parameters).

The existing hydrometric monitoring network, operated by Natural Resources Wales (NRW), focuses on monitoring the major river systems in the area. The three largest rivers discharging to Swansea Bay are the Afon Tawe, Afon Nedd and Afon Afan. The closest discharge gauging stations to the outlet of each of these rivers are shown in Figure 1 (stations F to I). There are two gauging stations in the Nedd catchment, station G on the Afon Dulais tributary and station H on the main river channel. The Afon Afan also has two gauges; stations I and J (Figure 1). These stations log level (m) and discharge (m^3/s) at 15-minute intervals. Tide level data (m above chart datum) were obtained for the local NRW tidal monitoring station at Mumbles (Figure 1) as a 15-minute time series.

A further five hydrometric monitoring stations were installed for the project, based in smaller stream inputs that discharge to the bay closer to the DSP (Figure 1, stations A to E). These comprise of A. Ott Orpheus Mini pressure transducer systems set to log stream levels (m) at 5-minute intervals and report 15-minute mean values. Each unit was housed in a secure steel pipe to act as a stilling well. Two units, at stations A and C were equipped with corresponding Intelligent Top Caps (ITCs), enabling remote data logging by short message service (SMS). Standard 1 m staff gauge (stage) boards (Shelley Signs) were installed at each site. Data were processed using corresponding Hydras 3 software

A programme of open channel discharge measurements (m^3/s), across a range of stream levels, was undertaken at these stations using standard procedures (Environment Agency, 2003; Herschy, 1985). Velocities, at 0.6 of the depth from the water surface, were measured using electro-magnetic velocity meters (Sensa RC2) and the average of three measurements was recorded at each point across the channel profile. The resulting discharge measurements were related to stream level readings to generate discharge rating curves for each station.

Fifteen-minute time series from discharge monitoring stations at two sewage treatment works (STWs) were also available (Figure 1, stations K and L). Station K

records the final effluent discharge (l/s) from Swansea STW, whilst station L measures the inlet flow (l/s) at Afan STW. These stations are operated by Dŵr Cymru-Welsh Water. Measurement units for these stations were converted to m^3/s to match the other discharge monitoring stations.

Any short periods of missing flow data (< 4 h) were filled in using linear interpolation. For longer periods, either catchment area scaled data from a neighbouring gauge or regression models, based on nearby gauges, were employed to replace missing values.

2.5 Statistical analysis and data preparation

With the exception of circular (angular) data such as wind direction, statistical analyses were performed using the SPSS statistical software package (version 19, SPSS 2010). The parametricity of distributions was assessed using the Shapiro-Wilk (S-W) normality test and Skewness statistic. General descriptive statistics included the mean, standard deviation (SD), range and the 95% confidence interval for the mean. Student's t-test was used to compare means between two groups. The outcome of the corresponding Levene test for homogeneity of variances was used to determine the appropriate type of t-test; based on either (i) separate or (ii) pooled variance estimates. Wind direction statistics were generated using the R statistical package (R Studio version 0.97.551), which was also used to generate corresponding wind-rose diagrams.

Robust analysis of variance (ANOVA) was employed to examine the significance of differences between more than two mean values. Here, the significance of the ANOVA is judged on (i) the Levene test for homogeneity of group variances and (ii) whether the numbers of observations (*n*) in groups can be considered equal. Where variances can be considered homogenous and *n* values are equal the significance (*p*) of the *F* statistic is used. Where *n* values are equal but variances are not homogenous then the Brown-Forsyth statistic *p* value is used. Finally, when *n* values are unequal and variances not homogeneous the significance of the Welch statistic is employed. The Levene test also drives the selection of an appropriate *post-hoc* test to explore the significance of multiple paired comparisons between means. Where variances are homogenous the Tukey test is used, whilst the Tamhane test is employed when variances cannot be considered homogenous.

Bivariate regression, using the SPSS curve estimation procedure, was used to develop discharge rating curves for stream gauging stations A to E (Figure 1). This allowed examination of linear and power function forms typical of such situations. The resulting functions were used to translate stream level to discharge values. Bivariate regression was also used to examine relationships between results from different FIO methods (e.g. *E. coli* by MLGA vs. *E. coli* by TBX) or, in the case of *p*GI calculation, different calculation methods. In this case, the difference of the resulting regression slope value from 1 was evaluated using Student's t-test, as outlined by Zar (2010). Microsoft Excel was used to fit non-linear curves, such as polynomial curves, with the Solver plugin applied to special non-linear cases as outlined by

Brown (2001). This plugin uses an iterative procedure to maximize the coefficient of determination (r^2) value for the specified non-linear function.

Stepwise multiple linear regression was used to explore relationships between potential environmental predictor variables (i.e. meteorological and hydrometric parameters) and FIO concentrations. For this analysis, calculations were made to generate a sequence of lagged environmental predictor variables in relation to water quality sampling times. These variables, thus, describe the antecedent environmental conditions prior to sampling.

Ten antecedent lag periods were defined for meteorological variables (0.25 h, 0.5 h, 1 h, 2 h, 3 h, 4 h, 6 h, 8 h, 10 h and 12 h before sampling). In the case of solar radiation parameters, total radiation dose received was computed for each period, with ETR, GR and UVB expressed as MJ/m^2 and UVA as kJ/m^2. A total UV dose (MJ/m^2) was computed as the sum of UVA and UVB radiation. GR was also expressed as the proportion (%) of ETR. Remaining meteorological parameters were expressed as the mean for each antecedent period with AP expressed as kPa. Calculations for mean wind direction (radians) employed circular statistical calculations as outlined by Hassan *et al.* 2009. Data for some of the antecedent periods during the first two sampling days could not be calculated for the UV parameters and AP because the relevant sensors were not active until 14:00GMT on the first sampling day (16/05/2011). This also applies to the 60-day matrix described below. Tidal variables included the tide height (m) at the time of sampling, times (h) from the temporally closest high water (HW) or low water (LW) (signed + to denote time after HW or LW and – to denote time before HW or LW) and absolute times from HW and LW. Sixteen lag periods were defined for the hydrometric rainfall and discharge variables, ranging from 0.25 h to 36 h before sampling. Intervals were as per the meteorological variables plus: 15 h, 18 h, 21 h, 24 h, 30 h, and 36 h intervals. In each case the total rainfall received (mm) and total discharge volumes (m^3) were computed for each period. Discharge variables were $\log_{10}$ transformed to reduce the absolute values involved and to reduce skew. Rainfall variables were similarly transformed, but a constant of 1 added prior transformation to account for zero values.

A similar predictor variable data matrix was developed based on data for the 60 sampling days, for which mean FIO concentrations were calculated. Variables included mean values for the seawater temperature, turbidity and salinity measured on each day. Environmental data describing the meteorological and hydrometric conditions on each sampling day were computed in a similar manner (e.g. total UVA radiation received (kJ/m^2) during the sampling day). Tidal variables included maximum and minimum tide heights and tidal range. Four antecedent lag periods were defined for this matrix (12 h, 24 h, 36 h and 48 h), each commencing at the mid-point of the sampling day and applied to all meteorological, hydrometric and tidal variables.

The forward selection stepwise regression procedure was employed to generate statistical models predicting FIO concentration (*Y*) from the environmental predictor variable matrix (X_1 to X_n). The models have the form:

$$Y = a + b_1 \times X_1 + b_2 \times X_2 + \cdots + b_n \times X_n \pm u \quad [1]$$

where:

a = constant (intercept)
b_1 to b_n = slope coefficient for each predictor variable, X_1 to X_n
u = standard error of the estimate (stochastic disturbance term)

Two criteria for variable selection/removal were applied, the significance level (*p*-in) for a variable to enter the model was set to 0.05 and the *p*-out level, for variable removal from the model, set to 0.06 (the procedure requires *p*-out > *p*-in to operate). These settings give a 94-95% confidence window for variables in the model. In some cases, slight adjustments to this window were necessary to allow generation of a model sequence. A third criterion, tolerance, was applied to control for multicollinearity between predictor variables in a model. Tolerance is the inverse of the variance inflation factor, a low value (0.0001) allowing multicollinear variables into an equation and a high value (0.9) only allowing un-related predictors into an equation. Thus, a low tolerance model will typically contain a larger number of predictor variables, the number of which declines as tolerance increases. Model sequences were generated using tolerance values of 0.0001 plus successive 0.1 intervals between 0.1 and 0.9 and, in some cases, 0.95. This allowed analysis of consistency of variables between models and the persistence of variables as multicollinearity is increasingly controlled. The total number of predictors allowed in the models was restricted to 20.

The models were assessed using: (i) the coefficient of determination (r^2, adjusted for degrees of freedom) and (ii) the residuals distribution. r^2 defines the amount of variance in *Y* (i.e. FIO concentration) explained by the predictor variables, X_1 to X_n (i.e. antecedent environmental descriptors), in the model and indicates the overall strength of the relationship. Ideally, the distribution of residuals should be normal; this was assessed by inspection of corresponding normal-probability plots and histograms.

The overall statistical significance of all tests was evaluated at the 95% confidence level.

3. Results and discussion

3.1 Designated sampling point monitoring

A total of 1303 samples were collected and analyzed from the 60 sampling days. Two results, one for each FIO parameter, were not reported due to analytical errors. No *E. coli* were recovered from 48 samples (3.7%) and no IE from 116

samples (8.9%). Detection limit values were assigned to these samples for the purpose of statistical analysis. Descriptive statistics and normality tests showed that the FIO concentration distributions were positively skewed (skewness > 6) and demonstrated statistically significant departures from normality (S-W $p < 0.05$). Log_{10} transformation reduced skewness appreciably (< 0.2), though the distributions still showed statistically significant departure from normality (S-W $p < 0.05$). Given the reduction in skewness, the FIO data were log_{10} transformed prior to further statistical analysis.

The FIO results for individual samples are shown in Figure 2. *E. coli* concentrations ranged from <3 cfu/100 ml to 3100 cfu/100 ml (geometric mean (GM) 51 cfu/100 ml), whilst IE concentrations ranged from < 2 cfu/100 ml to 4300 cfu/100 ml (GM 31 cfu/100 ml). The striking feature of this data set is the variation in FIO concentrations within individual days, which often demonstrates a range of 2 to 3 log_{10} orders; a pattern that was continually repeated throughout the study period. The discharge record from station C (Clyne River) is shown for comparison. There appears to be a general pattern of increased FIO concentrations, and thus a decline in water quality, following hydrograph event conditions, although the daily variance is independent of antecedent rainfall.

Of the 60 samples analyzed for *E. coli* using both MLGA and TBX media, only two analyses, both using TBX, produced no *E. coli* colonies. Thus, 58 pairs were available for comparison. Figure 3 summarizes the comparison regression analysis. Student's t-test indicated that the slope of this regression (0.9476) showed no statistically significant difference from 1. This suggests that the results using both methods were comparable and that the use of MLGA in the current project would be unlikely to produce radically different results for *E. coli* than the analytical method subsequently adopted by the UK authorities (i.e. TBX).

Seawater temperatures ranged from 10.9 to 26.0 ˚C (Mean 17.2˚C, SD 2.2˚C) and were not normally distributed (S-W $p < 0.05$) though skewness (< 0.6) was low. Turbidity (Figure 4-A) ranged from 1 NTU to 3180 NTU and showed reduced skewness (< 0.4) when log_{10} transformed, though statistically significant departure from normality remained (S-W $p < 0.05$). Turbidity data were, thus, log_{10} transformed for further statistical analyses. The GM turbidity was 92 NTU. Turbidity displayed a 1 to 2 log_{10} order variation within sampling days and tended, like FIO concentrations, to be elevated following hydrograph event conditions. Distributions of all conductivity parameters showed statistically significant departure from normality (S-W $p < 0.05$) and negatively skewed distributions (skewness -2.3 to -1.9). Salinity (Figure 4-B) ranged from 23.7 ppt to 35.0 ppt (mean 32.0 ppt, SD 1.3 ppt). Lower salinity values tended to occur following hydrograph event conditions, when greater volumes of freshwater would have been present from river and stream inputs.

3.1.1 Variations in daily water quality and probability of gastrointestinal illness

The mean and SD for $\log_{10}$ FIO concentrations were calculated for each sampling day. The results are shown as GM values in Figure 5, which also shows the corresponding 95% confidence intervals for each mean. The plots show that the daily mean FIO concentrations varied considerably between days, but that the 95% confidence intervals remained relatively similar.

The daily mean and SD of $\log_{10}$ FIO concentrations were used to classify each day in terms of the rBWD standards (Table 1). The results show that daily classification is largely driven by IE concentrations, with *E. coli* driving only 3 of the 23 "Poor" overall outcomes. The results also demonstrate an effective polarization of daily outcomes at Swansea Bay, with virtually equal numbers of days in the "Excellent" (42%) and "Poor" (38%) categories. This is despite the conclusion, from compliance data, that Swansea Bay is at risk of failing to comply with the rBWD standards, with associated provisions for prohibition of bathing activities. It is, thus, critical to understand the factors affecting these observed daily rBWD outcomes.

Daily mean and SD of $\log_{10}$ intestinal concentrations were also used to calculate daily *p*GI values. The richness of the data set also allowed calculation of mean *p*GI values associated with each individual result on each day. The daily *p*GI values were then compared with the thresholds defined in the WHO guidelines for recreational waters, namely 1%, 5% and 10% *p*GI. Figure 6-A illustrates the results. Daily *p*GI values were variable, with 45% of days exceeding the upper *p*GI 0.1 (i.e. 10%) threshold, with a corresponding high risk of water associated GI (Table 2). Figure 6-B compares the *p*GI calculation methods, which show excellent parity. Student's t-test comparing the regression slope to 1 showed no significant difference from this test value. This lends an additional degree of credence to the calculations based on the daily mean and SD of $\log_{10}$ IE values.

Figure 6-C shows the relationship between the mean $\log_{10}$ IE concentration on each day and the calculated daily *p*GI. The Solver plugin for Microsoft Excel was used to fit an asymptotic logistic function, or Richard's curve, shown in the plot. This function has the form:

$$Y = A + ((K - A)/1 + e^{A-((X-M)/B)}) \qquad [2]$$

where:
X = daily mean $\log_{10}$ IE,
Y = daily *p*GI,
A is the lower asymptote (*Y* = 0),
K is the upper asymptote (Y = 0.3855)
and *B* and *M* are coefficients estimated in the procedure.

The value of *K* derives from the *p*GI calculation limits, which use a relationship between $\log_{10}$ IE and *p*GI restricted to the maximum observed IE concentration in

the UK randomized controlled trials (158 cfu/100 ml) as outlined in Kay et al. (1994) and Wyer et al. (1999). The r^2 for this best fit curve was effectively 1.

Based on the corresponding daily GM IE concentrations for the WHO guideline thresholds at the Swansea Bay DSP are:

*p*GI = 0.01 : daily GM IE = 6 cfu/100 ml
*p*GI = 0.05 : daily GM IE = 20 cfu/100 ml
*p*GI = 0.10 : daily GM IE = 37 cfu/100 ml (Figure 6-C)

The daily results were split into two groups based on *p*GI, days with values > 0.1 (*n* = 33) and days with *p*GI ≤ 0.1 (*n* = 27). Using Student's t-tests, the two groups were tested for significant differences between means of daily mean $\log_{10}$ FIO concentrations (expressed as GM values) and means of daily SDs of $\log_{10}$ FIO concentrations. The results are shown in the box and whisker plots in Figure 7. Unsurprisingly, the daily mean FIO concentration associated with days with *p*GI > 10% showed statistically significant elevation compared to the *p*GI ≤10% group (Student's t-tests $p < 0.05$). This is also shown by the discrete 95% confidence intervals in Figure 7-A, which do not overlap for the individual FIOs. In contrast, Figure 7-B shows no statistically significant differences for the mean SD of $\log_{10}$ FIO concentrations in each comparison (Student's t-tests $p > 0.05$). This demonstrates that daily variance in $\log_{10}$ FIO concentrations is similar in the groups, despite the significant difference in GM FIO concentrations between the two types of days. Thus, daily variance in $\log_{10}$ FIO concentrations at the Swansea Bay DSP can effectively be regarded as constant (average daily SDs for all 60 sampling days: $\log_{10}$ *E. coli* = 0.3707, $\log_{10}$ IE = 0.4044). This finding is potentially useful in the classification of water quality using rBWD or WHO guideline criteria, which both require the mean and SD of $\log_{10}$ FIO concentrations in the relevant calculations. For example, the constant SD value for the bathing water could be applied alongside a mean value predicted using a model to determine the water quality classification for signing at the beach.

3.2 Environmental monitoring

3.2.1 Hydrometric monitoring

The level recording instrumentation at stations A to E provided 100% data capture through the study period (*n* = 13248). The results of discharge gauging at stations A to E are summarized in Figure 8. At least 11 discharge measurements were made at each site. Power functions were fitted to the data from four sites (r^2 adj. 0.87 to 0.98):

$$Y = b \times X^a \qquad [3]$$

where:

X = stream level (m)

Y = discharge (m^3/s)
and a and b are constants

A composite rating was fitted for station D, with a power function (r^2 adj. 0.98) fitted at stream levels below 0.36 m and a second order polynomial when level ≥ 0.36 m:

$$Y = a \times X^2 + b \times X + c \quad [4]$$

where:

X = stream level (m)
Y = discharge (m^3/s)
and a, b *and* c are constants

This function was derived from analysis of relationships between: (i) stream level (m) and channel cross sectional area (m^2) and (ii) stream level (m) and average velocity (m/s). This produced a more realistic function in terms of the physical attributes of the station site. In addition, maximum level was limited to 0.81 m, which was the level above which flow would be constrained by a bridge structure at this station. Proportions of the time series exceeding the maximum stream gauging levels ranged from < 1% at station E to 7% at station A, and was < 2% at remaining stations.

The time series for the smaller streams (stations A, B, D and E) are shown in Figure 9-A. These streams were flashy, with short hydrograph responses typical of urban streams. The corresponding record for station C is shown in Figure 2 and demonstrates a less rapid response in this larger river, the contributing catchment having comparatively large proportions of agricultural land in the headwaters (Figure 1). Table 2-A gives a statistical summary of the 15-minute discharge data through the study period. The data were highly skewed (skewness > 10).

The discharge sequences for stations F to I were complete except for 96 sequential observations at station G (09:15 GMT 25/09/2011 to 09:00 GMT 26/09/2011). The missing observations were replaced with modelled values using a lagged (+2 h) second order polynomial regression model (equation 4) predicting the discharge (Y) at station G from that at station F (X) (r^2 = 0.928). Figure 9-B illustrates the discharge at these stations and statistical summaries are given in Table 3-A. Discharges at these stations were relatively large, with maximum values at stations F and H exceeding 100 m^3/s. Hydrograph response was less rapid than observed in the smaller urban streams. The values were again highly skewed (skewness > 4.5).

Discharge at the two STWs showed a similar range (station K: 0-1.81 m^3/s, station L: 0-1.29 m^3/s) (Table 2-A). In contrast with the rivers and streams, the data for both sites exhibited low skewness (< 1). The mean discharge at station L (0.58 m^3/s) was higher than at station K (0.44 m^3/s).

The rainfall record for Black Pill was complete apart from two observations, when the station was having the global radiation sensor installed (10:30-10:45 GMT 21/06/2011). The corresponding gauge at Cwm Level indicated no rainfall at this time, so zero values were substituted in each case. The 15-minute rainfall totals recorded at Black Pill ranged from 0 to 2.2 mm (Table 3-A) and were highly skewed (skewness = 7.99).

3.2.2 Tidal and meteorological monitoring

Table 3-B illustrates the wide tidal range experienced in Swansea Bay during the study period (range: 10.23 m). The tidal data, which were complete, exhibited extremely low skew (skewness < 0.01), with a mean tide height of 5.23 m.

The mean calculated ETR during the study period was 413.35 W/m^2, with a maximum of 1166.15 W/m^2. These data exhibited low skew (skewness < 1). Global radiation data from the Cwm Level meteorological station (Figure 1) were used until the GR sensor was operational at Black Pill (n=3501). The nighttime GR data from Cwm Level were adjusted slightly, such that GR values were zero at the same time as corresponding ETR values. The data from the Black Pill GR sensor (from 11:15 GMT 21/06/2011 onwards, n=9747) were also adjusted using a baseline correction of -0.15 W/m^2, to yield zero GR during nighttime. The combined record from the two stations gave a complete 15-minute GR sequence, summarized in Table 3-B. The data were moderately skewed (skewness < 1.4). Figure 5-B illustrates the daily GR input during the study period.

The UVA and UVB sensors at Black Pill were operational from 14:00 GMT on 16/05/2011. Since no corresponding data were available from the Cwm Level station, these parameters have 56 missing records at the start of the sequence (n = 13192) amounting to < 0.5% of the record. Data from both UV sensors required consistent baseline adjustment, by -0.02 W/m^2 in the case of UVA and +0.01 W/m^2 for UVB, to yield zero nighttime values. Statistical summaries for these parameters are given in Table 3-B, and show that the energy received in the UVA spectrum is an order of magnitude higher than that in the UVB range (maxima: UVA 34.37 W/m^2, UVB 2.38 W/m^2), which are, in turn, more than an order of magnitude less than the GR input. Like GR, the UV radiation parameters exhibited moderate skew (skewness < 1.5)

Table 3-B also summarizes the other meteorological parameters measured. With the exception of AP, the sensor for which was installed along with the UV sensors, all remaining time series were complete. Air temperatures showed a range typical of summer conditions, from 5.01 to 25.93 ˚C, whilst mean RH was 80.54% (34.5% to 99.37%). Values for AP ranged between 991.2 hPa to 1034.68 hPa, typical of the fluctuating conditions between low-pressure cyclonic depressions and summer anticyclones. Wind speeds ranged between 0.22 and 12.49 m/s (mean: 2.89 m/s), with a circular mean direction of 254.15˚ (i.e. west-southwest). A further analysis of WD data is presented in Figure 10, which illustrates the predominance of winds in the westerly sector, particularly between 210˚ and 325˚. The distributions of

AT, RH and AP exhibited low negative skew (skewness < 0.7), whilst WS values demonstrated moderate positive skew (skewness < 1.5).

3.3 Multiple regression models

3.3.1 Models predicting single sample faecal indicator organism concentration

Two sets of regression models were generated for each FIO. Version 1 included measurements made at the time of sampling (position and sea temperature) and other parameters measured in the samples (turbidity and salinity) in the predictor variable matrix. These variables were excluded from the predictor matrix in the second version, since no continuous recording of these parameters could be made for a practical application of a model including them.

Table 4 summarizes the models predicting $\log_{10}$ *E. coli* concentrations based on the first version of the predictor matrix. Statistically significant models ($p < 0.05$) were generated at each tolerance level (0.0001 to 0.95). Residuals in all models all showed either slightly skewed or effectively normal distributions. Table 4 shows that the number of variables in the model progressively decreases as tolerance is increased reducing the allowed multicollinearity between predictors. The amount of explained variance, indicated by the r^2 value, progressively decreases as the tolerance increases, commencing at 0.610 (61.0%) in model 1 and ending at 0.327 (32.7%) in the final model. All eleven models included two consistent variables, entered at the first two steps. These were: (i) $\log_{10}$ discharge at station C in the 18 hours preceding a sample and (ii) global radiation received in the 4 hours prior to sampling. The first variable has a positive slope; the predicted $\log_{10}$ *E. coli* concentration increasing as discharge at station C increases. The second variable shows an inverse relationship, with the $\log_{10}$ *E. coli* concentration declining as the global radiation received increases. Both of these relationships appear plausible since rivers and streams generally exhibit elevated FIO loadings as discharge increases and increased solar radiation input has a bactericidal effect. The consistent inclusion of these variables right up to a tolerance value of 0.95 indicated that these variables were statistically unrelated to each other. Other variables that appear in a majority of the models included turbidity (positive slope, models 1-9) and salinity (negative slope, models 1-10), Tide height (positive slope, models 1-3, 5-8). These variables also appear to have plausible slope directions. For example, increased turbidity could represent increased suspended solids, which could act to shield FIOs from solar radiation and potentially act as adsorption sites for microbes. The overall levels of variance in $\log_{10}$ *E. coli* concentrations explained by the predictor variable sets were relatively low ranging from approximately one third in model 11 (4 variables) to two thirds in model 2 (20 variables). A model including the two consistent variables (i.e. steps 1 and 2) had an r^2 value of 0.300, indicating that the remaining variables entered in the models explain a relatively small amount of additional variance in $\log_{10}$ *E. coli* concentration. For instance, the 18 additional predictor variables in model 1 together account for only a similar level of explained variance (0.310) to the initial two predictors.

Table 5 shows the regression modeling results based on the second version of the predictor matrix. Overall, the levels of explained variance were reduced by excluding variables such as turbidity and salinity (r^2 range: 0.327 to 0.531). The consistent variables entered at the first two steps using the version 1 matrix remained the same in these models, model 11 in Table 5 being identical to that in Table 4.

Eleven models predicting $\log_{10}$ IE concentration in individual sample are summarized in Table 6. All were statistically significant ($p < 0.05$) and exhibited normal or only slightly skewed residuals distributions. As with the corresponding *E. coli* models, two predictors were entered consistently at the first two steps. These were: (i) GR received in the three hours to sample collection (negative slope) and (ii) $\log_{10}$ discharge at station B in the preceding 24 h (positive slope). A model including only these two predictors had an r^2 of 0.332 (Table 7, model 11) and inclusion of both variables in all models indicated that they were statistically unrelated to each other. The additional variables in the models explain comparatively low levels of additional variance. For instance, the addition of salinity to model 11 only adds a further 1.2% to the total explained variance. As with *E. coli*, variables appearing in the majority of models included turbidity (positive slope, models 1 to 9), salinity (negative slope, models 1-2, 4, 6-11) and tide height (positive slope, models 1-8, 10). Again, the relationships appear plausible. For example, the inverse relationship with salinity indicates that $\log_{10}$ IE concentration increases with reduced salinity, which might indicate elevated proportions of freshwater associated with elevated discharge, and FIO flux, from freshwater inputs during hydrograph events. Levels of explained variance (r^2 range: 0.344 to 0.603) were similar to those observed in the corresponding $\log_{10}$ *E. coli* models.

Excluding parameters such as salinity and turbidity reduced levels of explained variance (r^2 range: 0.332 to 0.536) (Table 7). The consistent variables entered at the first two steps remained, with tide height entering at the third step in all models except model 11.

Overall, the regression analysis to predict $\log_{10}$ FIO concentrations in individual samples showed:

(i) predictor variables relating to solar radiation and local stream flow contribute a high proportion of the variance explained, amounting to approximately one third of the variance in $\log_{10}$ FIO concentrations,

(ii) levels of explained variance are low (typically < 0.4), particularly for models with manageable numbers of predictors (≤ 7) for deployment in a practical context.

It is evident that explanation of variance in this FIO data set on an individual sample basis is limited, despite the enhanced precision in FIO enumeration derived from triplicate analyses and the array of data describing antecedent environmental conditions available for modelling. The resulting models, whilst interesting in terms

of potential factors affecting FIO concentrations at Swansea DSP, therefore, have very limited practical utility as regulatory and/or public health protection tools.

3.3.2 Models predicting daily mean faecal indicator organism concentration

Table 8 summarizes eight statistically significant ($p < 0.05$) stepwise multiple regression models predicting daily mean $\log_{10}$ *E. coli* concentrations at Swansea DSP with mean sea temperature, $\log_{10}$ turbidity and salinity variables included in the predictor matrix. The models produced comparatively high levels of explained variance (r^2 range: 0.555 to 0.887), with all models explaining > 50% of the variance in the daily mean $\log_{10}$ *E. coli* concentration. However, the models exhibited either slightly skewed or skewed residuals distributions. All models included UVB radiation on the sampling day (negative slope) as the predictor entered at the first step, with seven models including the mean $\log_{10}$ turbidity (positive slope) at the second step. As a single variable, the UVB radiation received on the sampling day explained 41.4% of the variance in daily mean $\log_{10}$ *E. coli* concentration. Variables relating to local stream gauges, maximum $\log_{10}$ discharge at station E (past 36 h in models 1 -6, past 24 h model 7) and station C (past 48 h, model 8), appeared in all models, whilst variables relating to maximum tide height (on the sampling day in models 1 to 6, past 24 h in model 7) appeared in the first seven models. As with the single sample models, the slope directions for the predictors appear plausible.

Removing the predictors relating to sea temperature, turbidity and salinity resulted in five models (Table 9). Levels of explained variance were comparatively high (r^2 range: 0.624 to 0.787), with models 3 to 5 exhibiting normally distributed residuals. All models were statistically significant ($p < 0.05$). The UVB radiation received in the past 48 h (negative slope) was included at the first step in each model, this individual predictor explaining 42.4% of the variance in the daily mean $\log_{10}$ *E. coli* concentration. However, this variable was removed at step 4 in model 1. Maximum tide height (positive slope) on the sampling day was also included in all five models, whilst mean relative humidity (positive slope) featured in models 1 to 4, entered at step 2. With the exception of model 4, the models also included one variable relating to local stream discharge (positive slope), though the specific station was not consistent.

A summary of statistically significant models ($p < 0.05$) predicting daily mean $\log_{10}$ IE concentrations is given in Table 10. Seven models resulted from this analysis, with UVB on the sampling day (negative slope) entered at step 1. Explained variance exceeded 50% in all cases (r^2 range: 0.573 to 0.824) and residuals distributions were slightly skewed or normal. The individual UVB variable explained 44.0% of the variance in daily mean $\log_{10}$ IE concentration. In all models, the predictor variable entered at step 2 related to local stream discharge (positive slope). For models 1 to 6 this variable was the maximum $\log_{10}$ discharge at station E in the past 24 h (positive slope), whilst in the final model it was the maximum $\log_{10}$ discharge at station D in the past 48 h (positive slope). A tide related variable was entered at step 3 in all models, this being the maximum tide height on the sampling day (positive slope) in models 1 to 6 and the tidal range on the sampling day (positive slope) in the final

model. Unlike the *E. coli* models (Table 8), turbidity was a low ranking variable only entering the first two models at step 9.

Regression models using the version 2 matrix to predict the daily mean $\log_{10}$ enterococci concentration at Swansea Bay DSP are summarized in Table 11. Levels of explained variance in these seven statistically significant models ($p < 0.05$) were, again, comparatively high, consistently exceeding 50% (r^2 range: 0.589 to 0.801). All models had slightly skewed or normally distributed residuals, except model 2. As with the models described above, UVB radiation input during the sampling day (negative slope) was entered at the first step of all models. The second step was also consistent in all models, with the maximum $\log_{10}$ discharge at station E in the past 48 hours (positive slope) entered in each model. This suggests that these two variables are statistically unrelated to each other and that this second variable contributes an additional 14.9% of the total explained variance. The maximum tide height during the sampling day was entered at the third step in models 1 to 6, adding 7.3% explained variance. The fact that the UVB, station E and maximum tide variables remain in each model up to a tolerance of 0.8 suggests that these variables are statistically unrelated to each other (i.e. exhibit low multicollinearity).

The modeling based on predicting daily mean $\log_{10}$ FIO concentrations suggests:

(i) comparatively high levels of explained variance, consistently exceeding 50% and, in some cases, exceeding 80%,

(ii) solar radiation, particularly UVB, and local stream discharge are the most important variables, with tidal variables providing some additional explanation,

(iii) the slope directions for the main predictors appear plausible,

(iii) predictor variables contributing the most to the explained variance tend to be statistically unrelated to each other.

This type of model, with associated high levels of explained variance, offers greater scope for practical deployment as part of a public information system. For example, a predicted daily mean $\log_{10}$ concentration when combined with the consistent daily SD of $\log_{10}$ FIO concentrations (described in Section 3.1.1) can be used to generate water quality classification based on the rBWD or WHO guideline criteria (Wyer *et al*., 1999).

3.3.3 Model refinement for practical application

A problem with the models described in Section 3.3.2 is that the predictor matrix includes variables matched to the sampling day (either 07:00 GMT to 16:00 or 07:00 to 19:00) and these variables appear in all models. Thus, these models would predict a mean $\log_{10}$ FIO concentration for the immediate past (i.e. 9 or 11 h). A further set of models were developed using: (i) consistent FIO data for a 9 h time

window on each sampling day (07:00 to 16:00 GMT) and (ii) a revised set of sampling day variables covering a 5.5 hour time period up to the mid point of the sampling day (11:30 GMT). The sampling day tide variable was retained in the matrix, because tide for the Mumbles station can be calculated reliably. All other lag periods were also fixed to the 11:30 GMT mid-point in the predictor matrix, to reflect the consistent sampling day. These models would, thus, predict a mean $\log_{10}$ FIO concentration for the mid point of a 9 h time window, valid for 4.5 hours in the immediate past and future.

A further test for these models was set in terms of corresponding rBWD water quality misclassifications. The critical misclassification (C. M.) in this context was judged to be cases where the model predicted water quality that was not "Poor" (i.e. it was "Excellent", "Good" or "Sufficient") when the observed classification was actually "Poor". This situation would be regarded as not protective of public health, since a corresponding sign would indicate acceptable water quality. Other outcomes, for example the model predicting "Poor" water quality when the observed classification was "Good", were considered precautionary (i.e. the "Poor" water quality signing would be protective of public health even though the predicted outcome was incorrect). For this analysis the observed and predicted rBWD outcomes were assessed using the average SD of $\log_{10}$ FIO concentrations for all 60 9 h periods (*E. coli*: 0.3657, IE 0.3986) to compute the relevant geometric 90%ile and 95%ile values to compare with the rBWD criteria. The proportion (%) of C. M.s was then computed for each model and are shown in Tables 12 and 13.

Models predicting daily mean $\log_{10}$ *E. coli* concentration for the 9 h time window are summarized in Table 12. All models were statistically significant ($p < 0.05$) and explained over 50% of the variance in 9 h mean $\log_{10}$ *E. coli* concentration (r^2 range: 0.566 to 0.802). Residuals distributions were variable, with models 3 and 6 exhibiting particularly skewed distributions. As with previous models, variables relating to solar radiation (UV, negative slope) and local stream discharge (station E, positive slope) were entered at the first two steps. These variables were subsequently removed at later steps in some models, as indicated in Table 12 (models 1 – 4), along with an RH variable. Replacement solar radiation (GR, negative slope) and local stream discharge (station C, positive slope) variables were included in models 2 – 4, retaining the solar radiation and local stream elements in these models. All models included a tidal variable (positive slope).

Generation of a model sequence predicting 9 h mean $\log_{10}$ IE required adjustment of the regression criteria. The *p*-in value was raised from 0.05 to 0.051, giving a confidence window for variables in the model of 94% to 94.9%. Without this change, the same model resulted for all tolerance values between 0.1 and 0.8. This slight adjustment resulted in eight distinct models, summarized in Table 13. All were statistically significant ($p < 0.05$) and explained more than 50% of the variance in the dependent variable (r^2 range: 0.541 to 0.765). The first two steps in all models involved local stream discharge (station E, positive slope) and solar radiation related variables (UVA, models 1 – 7, GR, model 8, both negative slope), though the local stream variable was removed at a later step in some models (models 2 and 3),

following inclusion of a different local discharge variable associated with station C (positive slope). Models 1 to 7 consistently included a tidal variable (positive slope).

A "best" model for each FIO was selected from Tables 12 and 13. For *E. coli*, model 2 was selected as it exhibited: (i) high explained variance (81.4%), low rBWD C. M. (1.69%) and (iii) a relatively normal residuals distribution (Figure 11-C). A plot of observed and predicted values using this model is shown in Figure 11-B, whilst Figure 11-A displays a temporal plot of the running 9 h GM *E. coli* concentration predicted by the model during summer 2011. This plot also shows the correspondence of the prediction with the observed 9 h GM concentrations from the sample days.

The corresponding IE model selected was model 3 from Table 13, which displayed: (i) the lowest rBWD C.M. (6.78%), (ii) relatively high explained variance (75.9%) and (iii) normally distributed residuals (Figure 12-C). Figure 12-A illustrates the behaviour of this model as a time series of 9 h running GMs through the summer of 2011 along with the observed sample day GMs.

The FIO concentration data from the 24 days on which sampling was extended to 19:00 GMT were used to calculate six successive 9 h mean $\log_{10}$ values for each 0.5 h interval between 07:30 – 16:30 GMT and 10:00 – 19:00 GMT. These 144 observed 9 h mean $\log_{10}$ FIO values were compared with the corresponding model predictions, as a form of validation. The results are shown in Figure 13, which shows distinct groups of points associated with individual days. In some cases these show positive trends, with observed and predicted values increasing. Other cases are static, with the observed values increasing slightly compared to the predicted values (vertical lines of points), whilst in other cases the predicted values decline whilst observed values increase (negative slope). Both models tend to under-predict at the top end of the observed range of values. The IE model also allows assessment of *p*GI outcome, based on the *p*GI 0.1 threshold IE concentration (37 cfu/100 ml) shown in Figure 13-B. Based on the 144 observations shown, 124 (86.11%) showed the correct classification with respect to the threshold. However, 12.5 % of cases have observed values > 37 cfu/100 ml with corresponding predictions below this threshold (shown as red points in Figure 13-B). This represents a critical misclassification, where the model would not result in a "Poor" water quality sign when the observed water quality indicates otherwise. A further 2 cases, just 1.39%, showed "Good" observed water quality but "Poor" predicted water quality. These are regarded as protective of public health.

3.3.4 Within-day variation of faecal indicator organism concentrations

It is evident from Figure 2 that there was considerable within day variation in FIO concentrations at the Swansea bay DSP. The multiple regression modelling has suggested that solar radiation related variables are important predictors of FIO concentration and the model predictions, illustrated in Figures 11 and 12, suggest a strong diurnal pattern in the running GM FIO concentration, driven by the solar

radiation input predictor variables. With this in mind, a temporal analysis of the FIO concentration data was undertaken.

The 07:00 -16:00 GMT data from all 60 days were grouped into two periods: (i) samples collected between 07:00 GMT and 11:00 and (ii) samples collected between 11:30 and 16:00 GMT. The days were further classified according to the calculated *p*GI, based on the same 07:00 – 16:00 GMT data, split into days with *p*GI ≤ 0.1 (34 days) and *p*GI > 0.1 (26 days). This split is slightly different to that based on all available data for each day (i.e. including 16:30 – 19:00 GMT data) shown in Table 2 (*p*GI ≤ 0.1: 33 days, *p*GI > 0.1: 27 days). The results are shown in Figure 14. Using data for all 60 days, the GM FIO concentrations for the late morning-afternoon period were significantly lower than the earlier morning period (Student's t-test $p < 0.05$). ANOVA of the four groups, based on time and *p*GI, revealed statistically significant differences between group GMs for all comparisons (Tamhane multiple comparison test $p < 0.05$). This demonstrates that pattern of late morning-afternoon reduction in GM FIO concentrations, compared to the earlier morning, persists even when water quality has significantly deteriorated (i.e. on days with *p*GI > 0.1).

The data from the 24 days with 07:00 – 19:00 GMT samples were split into three temporal categories: (i) 07:00 and 11:00 GMT samples, (ii) 11:30 – 15:00 GMT samples and (iii) 15:30 – 19:00 GMT. The days were also classified based on calculated daily *p*GI : (i) 11 days with *p*GI ≤ 0.1 and (ii) 13 days with *p*GI > 0.1. The results are shown in Figure 15. Based on all 24 days, the GM *E. coli* concentrations in the late morning-early afternoon period was significantly lower than during the earlier morning (Tamhane multiple comparison test $p < 0.05$, Figure 15-A). No other comparisons were significantly different for *E. coli*. This suggests that, on average, the GM *E. coli* concentration in the late afternoon-early evening recovered to a similar level as the earlier morning samples. The pattern for IE (Figure 15-B) was more distinct, with the late morning-early afternoon GM being significantly lower than both other groups, which were not significantly different from each other.

The ANOVA for the groups split by time period and *p*GI class showed GM FIO concentrations to be significantly elevated in the *p*GI > 0.1 group for all time periods. Comparisons of GM *E. coli* (Figure 15-A) showed no statistically significant differences between the three time periods on days with *p*GI ≤ 0.1 (Tamhane multiple comparison test $p > 0.05$). In contrast, the GM IE concentration in the late morning-early afternoon was significantly lower than the earlier morning in the *p*GI ≤ 0.1 group (Tukey multiple comparison test $p < 0.05$). No other comparisons were significantly different in this *p*GI group. Comparisons of GM *E. coli* concentrations in the *p*GI > 0.1 group showed the only significant difference to be between the morning and late morning-early afternoon groups (Tukey multiple comparison test $p < 0.05$, Figure 15-A). Similar comparisons between GM IE values in the *p*GI > 0.1 group showed the late morning GM to be significantly lower than both the earlier morning and late afternoon-evening groups, which were not significantly different from each other (Figure 15-B). Figure 16 shows the pattern of GM FIO concentrations by time of day for all days and the two *p*GI groupings. The pattern based on all days suggests that, on average, FIO concentrations decline through the

day to early afternoon and increase during the late afternoon and early evening. The patterns for days with *p*GI > 0.1, with corresponding elevated FIO concentrations, appear more exaggerated, whilst the *p*GI ≤ 0.1 days exhibit a more subdued pattern.

These results suggest significant within day changes in FIO concentration that have a diurnal pattern, with the lowest FIO concentrations associated with the late morning-early afternoon period. On average, based on the 60 day 07:00 to 16:00 GMT data, the resulting rBWD *E. coli* classification would shift from "Sufficient" in the earlier morning to "Good" in the late morning-early afternoon, whilst the shift based on IE is from "Poor" to "Sufficient" (Table 14-A). Using the three classes applied to the 24 days with sampling extended to 19:00 GMT, the rBWD *E. coli* classification is, on average, "Good" in the late morning-early afternoon, and "Sufficient" in both the earlier morning and late afternoon-early evening periods (Table 14-B). For IE the change in GM concentrations between the three periods is enough to alter the corresponding rBWD classification from "Poor" in the earlier morning to "sufficient" in the late morning-early afternoon, with a return to the "Poor" classification in the late afternoon-early evening (Table 14-B). Table 14-C shows the diurnal change in rBWD classification based on values for each hour on an average sampling day. This observed, dynamic, within day pattern of FIO concentration change lends credence to the diurnal patterns suggested by the model predictions (Figures 11 and 12). This diurnality has clear implications with respect to compliance sampling regimes, which are often driven by factors such as sample delivery times. It also presents considerable challenges to predictive modelling efforts, which may currently produce an advisory applied to an entire day. The observations from the current study suggest that models should attempt to account for within day variations in FIO concentrations to: (i) provide timely public information on changes in water quality and (ii) sign a site appropriately for as long as required.

3.3.5 Model application

The two selected models had five common variables (and data sources):

(i) maximum tide (m) on sampling day (i.e. 9 h window),
(ii) ETR (MJ/m2) in the past 24 h,
(iii) $\log_{10}$ maximum discharge (m^3) at station C in the past 48 h,
(iv) $\log_{10}$ discharge (m^3) at station I in the past 48 h,
and
(v) mean wind speed (m/s) in the past 24 h.

For the *E. coli* model, three further meteorological variables were involved:

(i) GR (MJ/m^2) in the past 12 h
(ii) mean WD (radians) in the past 12 h
and
(iii) mean AP (kPa) in the past 12 h,

whilst the selected IE model included two further variables:

(i) UVA radiation (kJ/m^2) in the past 12 h and
(ii) $\log_{10}$ maximum discharge (m^3) at station G in the past 5.5 h

Thus, running the two models would require data input streams from 10 separate sources, eight of which would be from continuous logging sensors (gauging stations (3) and meteorological parameters (5)), whilst two (ETR and tide) could be calculated in advance.

The rBWD classifications for the 60 sampling days showed that IE dominated the overall classification outcome (Table 1), with *E. coli* driving the "Poor" water quality classification in 3 of 23 instances. Unlike the *E. coli* model, the IE model could also be related to a public health risk outcome in terms of *p*GI, as discussed in Section 3.1.1 (Figure 6). It was, thus, decided to concentrate operational efforts on a single model, predicting 9 h mean $\log_{10}$ IE concentration (Figure 12) referenced to *p*GI outcome. This reduced the required data input streams to five sensors (3 gauging stations (C, G and I) and 2 meteorological sensors (UVA and WS)) plus the two pre-calculated input parameters (ETR and tide). It was thought that this would have some practical benefits in terms of potential data loss from factors such as instrumentation and data transfer failures.

At the time of writing (summer 2013), the model has been run operationally for 11 weeks using Excel workbooks, the first of which is used to collate the input data, which are then used to populate a second workbook. This workbook transforms the data, in terms of units, and performs the relevant calculations to predict the running mean $\log_{10}$ IE value at a 0.25 h interval using the model. This value is then used to generate corresponding rBWD and WHO guideline classifications. The value is also compared to the 0.10 *p*GI threshold generated using the relationship between mean $\log_{10}$ IE and *p*GI (Figure 6-C). Exceedence of the 0.1 (i.e. 10%) *p*GI threshold (GM IE 37 cfu/100 ml – Figure 6-C) is used as the basis for manual signing at the DSP. Model results for the 2011 bathing season are shown in Figure 12-A in relation to this threshold. Three signs are used: (i) Good water quality is predicted, (ii) Poor water quality is predicted and (iii) prediction unavailable. The latter is used in the event of the model not being able to be run, due, for example, to equipment failure.

Data are received from three gauging stations three times per day (just after 09:00, 12:00 and 15:00 GMT) and relevant data from the meteorological station are retrieved from a file transfer protocol (FTP) data stream at the appropriate time (just after 09:15, 12:15 and 15:15 GMT). The model uses data from station J as surrogate for station I, due to refurbishment work at station I. Station J is 3.2 km upstream of Station I on the same river (Figure 1) and a comparison of past records shows excellent agreement between the stations. The data from the two NRW gauges (stations G and J, Figure 1) are currently received by e-mail, whilst the data from the local river (station C, Figure 1) arrive by SMS and are processed, and extracted, locally using relevant software (A. Ott Hydras 3 and Hydras 3 Rx packages). So far,

data capture has been very good, with few equipment/data transfer failures impacting on the signing programme. Experiments are currently underway to transfer the station C data by FTP, and early results, using a second Orpheus Mini level logger, are encouraging.

The model is currently run three times per day during the working week and the DSP signed accordingly. The resulting sign is also displayed on the CCS website, via a "Twitter" feed (http://www.swansea.gov.uk/index.cfm?articleid=29433). The model is also run twice per day at weekends (12:00 and 15:00 GMT). Figure 17 shows two examples of operational plots showing the behaviour of the predicted gunning GM IE concentration and the predictor variables during two contrasting weeks during the 2013 bathing season. The predicted GM line is compared to the threshold GM 37 cfu/100 ml concentration used for signing; values above the line indicating a "Poor" water quality prediction and values below indicating "Good" predicted water quality. In the first week (Figure 17-A) "Poor" water quality was predicted for approximately 36 hours between 24 h and 60 h. This corresponded to rainfall driven hydrograph events (shown in the traces for the three gauging stations) and corresponding depression of UVA input, associated with cloudy skies. Towards the end of the week the river discharge pattern had settled to lower levels and maximum UVA input had increased, minimizing the time that "Poor" water quality was predicted. The maximum tide level variable also decreased through this week, which also acted to reduce the predicted GM IE levels. The plot for week 9 (Figure 17-B) corresponded with a summer anticyclone, with clear skies. This is shown in the consistent UVA pattern through the whole week. The river discharge variables showed only slight reductions through the week and maximum tide levels were also moderate through out the period. This resulted in a consistent diurnal cycle of running GM IE concentrations through the week, with values exceeding the 37 cfu/100 ml threshold for short periods during the nighttime.

There are future plans to automate the system by incorporation into a 'Nowcast' air quality prediction system linked to electronic signs. This will be used to make running hourly predictions, to account for within day changes in *p*GI. This should: (i) ensure that the DSP is signed appropriately for as long as required and (ii) inform the public of likely "Poor" water quality, with a high associated GI risk, as soon as possible. A programme of confirmation (closure) and replacement sampling has also been instigated alongside the compliance monitoring at the Swansea Bay DSP. This is based on the sign displayed at the time a compliance sample is taken. If "Poor" water quality is predicted then a confirmation sample is taken within 72 h of the compliance sampling time. A replacement compliance sample is then taken within 7 days of the confirmation sample. At Swansea Bay, this should alleviate the impending threat of prohibition should this bathing water fail to comply with rBWD up to 2020.

4. Summary and conclusions

1. An intensive programme of monitoring faecal indicator organism (FIO) concentrations at Swansea Bay designated sampling point (DSP) was successfully implemented during the summer of 2011. Seawater samples were collected at 0.5 h intervals between 07:00 and 16:00 GMT on 60 days through the 20-week bathing season (16/05/2011 and 28/09/2011). Sampling was extended to 19:00 GMT for 24 days between 18/07/2011 and 07/09/2011. A total of 1303 samples were collected.

2. Samples were analyzed for *E. coli* and intestinal enterococci (IE) (colony forming units (cfu)/100 ml) using standard membrane filtration methods and in triplicate. Only two results, one for each FIO, were missing, due to analytical errors. The resulting concentrations were found to exhibit closer approximation to normality when $\log_{10}$ transformed.

3. The FIO concentrations showed pronounced, consistent, variation within individual sampling days, often amounting to two or three $\log_{10}$ orders of magnitude. Patterns also showed elevated FIO concentrations following hydrograph event conditions in the rivers. Daily classification using the criteria of the revised European bathing waters Directive (rBWD) showed IE, rather than *E. coli*, was the principal driver of water quality classification.

4. The IE data were used to calculate the probability of gastrointestinal illness (*p*GI), as used in the derivation of WHO guideline standards for recreational waters (Kay *et al.*, 2004). These results were used to assess of modeling outcomes in terms of public health. For example, a relationship between daily mean $\log_{10}$ IE and *p*GI was developed and used to generate threshold water quality values for relevant *p*GI values (e.g. *p*GI 0.1 – used to define high GI risk – has a corresponding geometric mean (GM) IE concentration of 37 cfu/100 ml).

5. An analysis of within-day variation, measured by the daily standard deviation (SD) of $\log_{10}$ FIO concentrations, demonstrated that the mean daily SD on days with high *p*GI (> 0.1) was not significantly different from that on days with low *p*GI (≤ 0.1). Daily variation in $\log_{10}$ FIO concentrations at Swansea Bay can, thus, be regarded as effectively constant.

6. A meteorological station was installed at a coastal location approximately 3 km west of the DSP. This measured rainfall, solar radiation input (Global, UVA and UVB), air temperature, relative humidity, atmospheric pressure, wind speed and direction. Parallel data were also available from an inland station.

7. A network of five stream level recorders was installed in local rivers and streams. Discharge rating curves were developed for these sites through a programme of discharge measurements. Further data were available from the gauging station network on the larger rivers discharging to the bay and tide level data were also available from a local tide gauge.

8. A virtually complete set of 0.25 h time series were generated for the meteorological, tidal and gauging station data covering the water quality monitoring period. UV radiation data were missing at the start of the period because the sensor was not installed until the first sampling day. Other short periods of missing data were substituted by interpolation or regression modelling, based on data from neighbouring stations.

9. Matrices of antecedent environmental predictor variables were generated from the meteorological, tidal and gauging station data. Separate matrices were developed for statistical modelling of: (i) $\log_{10}$ FIO concentrations in individual samples and (ii) daily mean $\log_{10}$ FIO concentrations using stepwise multiple regression.

10. The individual sample models, though statistically significant, exhibited low levels of explained variance (typically between 33% and 65%). The most important predictors in these models were solar radiation, local river and stream flow and tidal variables. Turbidity was also important, when included in the models.

11. Models predicting daily mean $\log_{10}$ FIO concentrations were more successful, with maximum levels of explained variance approaching 90% and always exceeding 50%. Again, important predictors were related to solar radiation, local stream flow and tide. Turbidity was an important predictor in *E. coli* models when included, but not the IE models.

12. The daily mean $\log_{10}$ FIO models were refined to provide predictions for a 9 h time window, with antecedent lag periods tied to the mid-point. This produced models to predict the mean applicable to 4.5 h in the immediate past and future. These models provided between 54% and 80% explained variance, with main predictors related to solar radiation, local stream flow and tide.

13. Two models, one for each FIO, were selected based on: (i) level of explained variance, (ii) distribution of residuals (normality) and (iii) critical misclassification (predicting “Good” water quality when observed water quality was “Poor”, based on rBWD). Both models exhibited relatively high levels of explained variance (*E. coli*: 81%, IE: 76%), low critical misclassification (*E. coli*: 1.7%, IE 6.8%) and acceptable residuals distributions. Important predictors were again related to solar radiation, local stream flow and tide.

14. Predictions from both models suggested pronounced diurnality in the running GM FIO concentration sequences, related to the solar radiation predictor. Temporal analysis of the FIO data demonstrated statistically significant within day temporal variation in FIO concentrations, with minimum values in the late morning-early afternoon compared to the earlier morning and late afternoon early-evening periods. On average, this variation was enough to produce within day variation in rBWD classification and supports the model results. This within-day variation of FIO concentrations has implications with respect to compliance monitoring and provides challenges for existing FIO modelling strategies, which generally seek to predict a

"bathing-day" water quality. The empirical data acquired in this project suggest that the bathing day does not, in reality, exhibit a uniform water quality. Hence, the existing models world-wide that are based on this assumption may, therefore, provide an inappropriate and potentially dangerous simplification of reality.

15. Given that IE tends to drive the daily rBWD classification and can, unlike *E. coli*, be applied in a public health context, the IE model was adopted for practical application for signing at the Swansea Bay DSP. Signing is based on a threshold GM of 37 cfu/100 ml, above which the *p*GI exceeds 0.1. Applying a model that provides within day prediction ensures that the DSP is appropriately signed for as long as required and informs the public of "Poor" water quality as soon as possible.

16. The selected model has been applied manually during the 2013 bathing season. It is currently run three times each day during the working week and twice per day at weekends. Appropriate signs are then displayed at the DSP. A complementary confirmation/replacement compliance sampling programme has also been put in place, linking the model outcome to compliance monitoring.

17. Overall, this successful modelling exercise has demonstrated that prediction of FIO concentrations at a bathing water is possible given: (i) collection of a sufficiently rich data set describing water quality and (ii) a robust set of predictor variables. This suggests that modeling exercises cannot rely on compliance data sets and existing environmental monitoring networks, especially with the challenge to model within day variations in water quality. For example, the most important predictors in the current project derive from sensors specifically installed for this work, namely solar radiation (UVA) and a local river gauge.

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Swansea Bay
Mumbles and Gower

Bae Abertawe
Y Mwmbwls a Gŵyr

Destination Swansea Bay

2013-2016

Destination Management Plan

City and County of Swansea
Dinas a Sir Abertawe

JOINT FOREWORD

However you wish to label it – Tourism, the Visitor Economy or the Hospitality Industry – the many sectors that impact upon the visitor experience in any destination are vital parts of a vibrant, aspiring economy looking for new markets in which to grow.

Swansea Bay is unlike any other part of Wales with its strong rural, coastal and city centre product offers, which appeal to many different types of visitors. Attracting over 4M visitors, who in turn spend well over £300M* in the local economy, supporting more than 5K jobs, there is little doubt tourism is big business for the area. (**Source - 2012 City and County of Swansea STEAM Results)*

However, the tourism sector locally is not without its own set of challenges. It relies heavily on seasonal business, it constantly needs to change to meet customer expectations and most of all, it has a vast number of stakeholders who all play a different part in delivering the customer experience.

Despite these challenges, Swansea Bay is one of the most attractive parts of the UK, which has seen generation after generation visit. It has a product offer which continues to evolve and the potential to build upon a platform of high visibility as a result of the top quality sport played and the diverse cultural offering enjoyed across the destination.

'Destination Swansea Bay 2013-2016' is the Industry's statement of intent on how it will collectively identify, acknowledge and improve the visitor experience over the next three years. For the first time, the private, public and third sectors involved in tourism have identified the challenges ahead and will work collaboratively to ensure a positive change in perception and performance through the delivery of this agreed Plan, resulting in increased profile and more sustainable business.

We acknowledge the role the City and County of Swansea has to play in bringing together its own departments in partnership with key stakeholders. Only by working together through some very tough economic times, will we stand the chance of looking back and acknowledging that the commitments that we make now, will lead to an economy which does so much more for people, business and places.

We fully endorse the principles of the new destination management plan and its call for closer collaborative working over the next few years and we are confident that this new approach to managing the destination will reap positive economic, environmental, social and health benefits for years to come.

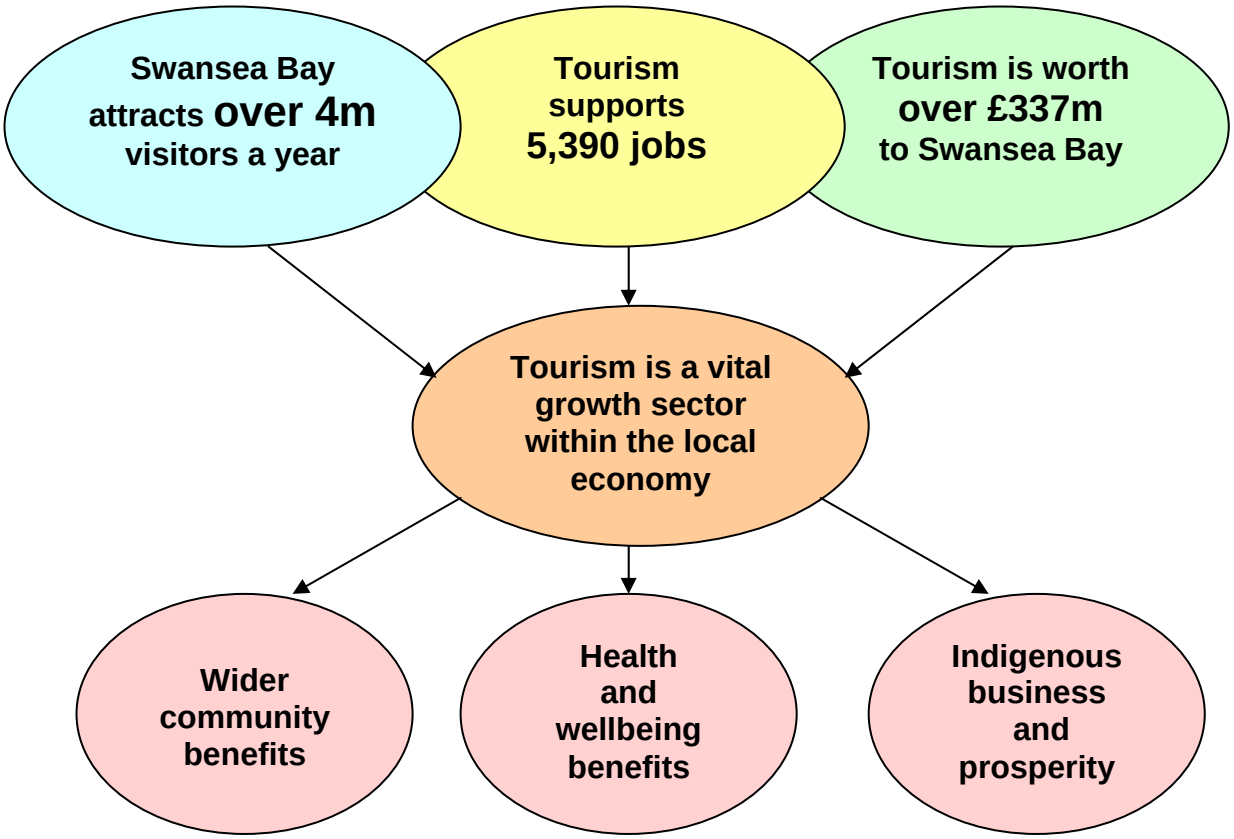
Councillor Nick Bradley
Cabinet Member for Regeneration

Tony McGetrick
Chairman of Tourism Swansea Bay

‘DESTINATION SWANSEA BAY’
2013 – 2016

INDEX

1.0 INTRODUCTION



Tourism has long been recognised as a vital contributor to the Welsh economy and it has now been highlighted as one of the key drivers of the City Region status. Clearly its importance has significant value in a regional as well as national context.

The Welsh Government's priority is to have robust destination management plans in place, developed and implemented at local level by the appropriate stakeholders. Future funding will be directed at priorities highlighted in local plans; therefore Welsh Government recommends that each local authority in Wales develop their own Destination Management Plan (DMP).

The Welsh Government Strategy for Tourism 2013-2020: 'Partnership for Growth' defines **Destination Management** as:

'A simple concept which involves a partnership approach to managing places. Tourism infrastructure such as way-marking, signposting, car parking, beach management, toilets, tourist information and litter collection are often only noticed when they are sub-standard but they can often be the difference between a satisfied and an alienated visitor.'

Swansea Bay as a destination requires a strategic vision and a joint plan bringing stakeholders together to fully exploit opportunities for long-term economic growth with minimum impact on the surrounding environment. This partnership approach is reflected throughout the Destination Management Plan.

'Destination Swansea Bay 2013-2016' addresses the vital role tourism plays in the local economy and sets a strategic direction for Swansea Bay as a visitor destination. This DMP replaces the previous Tourism Strategy 'Grab a Piece of the Action'. It was produced in consultation with, and for all local tourism stakeholders. Therefore it should not be regarded purely as a Council strategy. Instead, it should be seen as a shared statement of intent between the public, private and third sectors on how to manage, develop and promote Swansea Bay over the next three years.

For the DMP to succeed, it is vital that key stakeholders are engaged at all levels and buy into the concept from the outset. In particular, the DMP will need to ensure that two key areas are addressed:

- The City & County of Swansea will need to take the lead role in the process to influence and coordinate the management of all aspects of the destination, taking into account the needs of visitors, residents, businesses and the environment.

- The sharing of responsibility to manage the destination over a period of time, allocating roles and responsibilities, identifying and resourcing clear actions amongst the stakeholders in the public, private and third sectors.

The main focus of the DMP is the **Action Plan**, which identifies clear actions and allocated resources to address strategic issues such as seasonality, quality of the product, funding and sustainable development*. *(*'Development that meets the needs of the present without compromising the ability of future generations to meet their own needs - Bruntland, 1987').*

Why now?

- The focus from Welsh Government and other funding bodies is to base future marketing and investment strategies around robust DMPs.

- The need to ensure greater coordination and collaboration with internal stakeholders and partners.

- The global exposure the destination is receiving on the back of the Swans being in the Premier League is clearly going to have immediate and longer term benefits.

- The creation of a Directorate of Place, responsible for the vast majority of all service areas impacting upon tourism enabling a more coordinated approach to managing the destination.

- The need to now address the challenge of wider engagement with private and public sector partners in a more formalised structured way.

- The issues raised over many years are not showing any significant signs of improvement.

2.0 BACKGROUND & RESEARCH

This DMP is based on sound research and consultation as highlighted below:

2.1 STEAM Figures

Table 1 below illustrates the growth in tourism visitor spend, numbers and employment in Swansea since 2006. With the exception of 2012, it shows that the industry has performed consistently and productively over the last 6 years. The decline in figures for 2012 mirrors results from other marketing areas in Wales and has been attributed to the economic climate and sensitivities towards the climate.

Table 1 – STEAM figures for Swansea (2006-2012)

	2006	2007	2008	2009	2010	2011	2012
Visitor Expenditure – contribution to local economy (£s millions)	N/A	328.4	339.0	335.1	346.4	348.4	337.1
Visitors (millions)	3.9	3.8	4.1	4.1	4.1	4.2	4.2
Employment Supported (full time equivalent)	4,945	5,184	5,341	5,398	5,539	5,602	5,390
Source: Scarborough Tourism Economic Activity Model							

(See Appendix 1 for the full 2012 STEAM Executive Summary)

During this period and over the lifetime of the previous tourism strategy the following key developments took place; many of which can be linked to the growth seen in the STEAM figures:

Visitor amenities:

- Redevelopment of Swansea Bus Station (Quadrant)
- Redevelopment of Swansea Railway Station (High Street)
- Confirmation of multi-million Pound funding for European Boulevard from Welsh Government
- Development of new public footpaths in Cwm Cerdinen, Cwm Clydach
- Opening of the All Wales Coastal Path
- Training of 8 Green Badge Guides to cater for the cruise and group travel markets

Accommodation:

- Opening of Morgans Townhouse
- Opening of Travelodge, Swansea City Centre
- Opening of Premier Inn, Waterfront SA1
- Opening of Oldwalls Leisure, Llanrhidian
- Opening of 5 Cwmdonkin Drive, Birthplace of Dylan Thomas

- Refurbishment of the Marriott Hotel
- Refurbishment of the Ramada Hotel (now Mercure)
- Refurbishment of The Dragon Hotel
- Refurbishment of The Grand Hotel

Attractions & Activities:

- Opening of The LC
- Opening of Dynamic Rock, Clydach
- Confirmation of funding for Watersports Centre of Excellence
- Completion of Oystermouth Castle project
- Opening of The Grape & Olive restaurant on the top of the tallest residential building in Wales
- Enhancement of Cwmdonkin Park as part of £1million HLF bid

Events:

- Airshow major success – 2009, 2011 and 2013
- Tour of Britain in Swansea (only stage in Wales) – September 2010
- Continued success of Waterfront Winterland
- Successful Premier League football season – first Welsh Club ever
- Environmental Events leaflets produced twice a year

Marketing:

- Implementation of successful Premier League Marketing Campaign on the back of Swansea City FC's promotion into the Premier League
- Re-launch of the main destination website visitswanseabay.com resulting in number of unique visits increased by 40%
- New Swansea Bay destination branding and guidelines launched
- Highest number of 'likes' for any Wales Marketing Area Facebook page
- Highest ever conversion rate of 30% for 2011 Swansea Bay Holiday Guide
- Implementation of an RDP Rural Swansea Walking & Cycling Marketing Campaign

2.2. Visitor Survey 2012

A visitor survey was conducted between March and September 2012 which involved 2000 visitors to Swansea Bay being interviewed across a variety of sites including the city centre, Mumbles and Gower.

- **Who are our visitors?**

- Average age of visitor is 45+
- 70% of visitors are upmarket (ABC1)
- 42% are from Wales, 46% from rest of the UK and 12% from overseas
- 79% arrived by car or van
- 86% had visited Swansea Bay before (+11% since 2008)
- 56% were overnight visitors

- 46% stayed in Gower, 41% in the City Centre
- 37% travelled in a family or group; 35% with spouse or partner
- The Internet was the most popular method of obtaining information about Swansea Bay (29%) and 15% of visitors had logged on to the official tourism website www.visitswanseabay.com prior to their visit.
- On average, a day visitor spends £42 and a staying visitor £59 per day.

➢ **Why do they visit?**

- The factors which most influenced visitors' decision to visit were the scenery/landscape (44%), the coast (44%), the beaches (35%) and visiting friends and family (20%)
- 'Walking' is the most popular activity undertaken by visitors during their stay followed by watersports, cycling, golf and fishing.
- 'The quality of the Gower landscape' was the most popular 'key strength' identified by visitors.

➢ **What do they think our strengths are?**

- 'The quality of the Gower landscape' was the most popular 'key strength' identified by visitors (97%). Other strengths included the feeling of safety and security (90%), the feeling of welcome (89%), the quality of attractions and places to visit (82%) and the range and quality of places to eat and drink (80%).
- 94% said their visit was good or better than expected
- 97% said they would recommend a visit to Swansea Bay

➢ **What do they think our weaknesses are?**

Visitors suggested a series of improvements that could make the destination a better place to visit. Below is a summary of the issues raised, which have been incorporated into the DMP action plan where possible:

- 35% said signposting
- 20% said cleanliness of public toilets
- 19% said availability of public toilets
- 18% said cleanliness of streets

Further comments that arose from the visitor survey include:

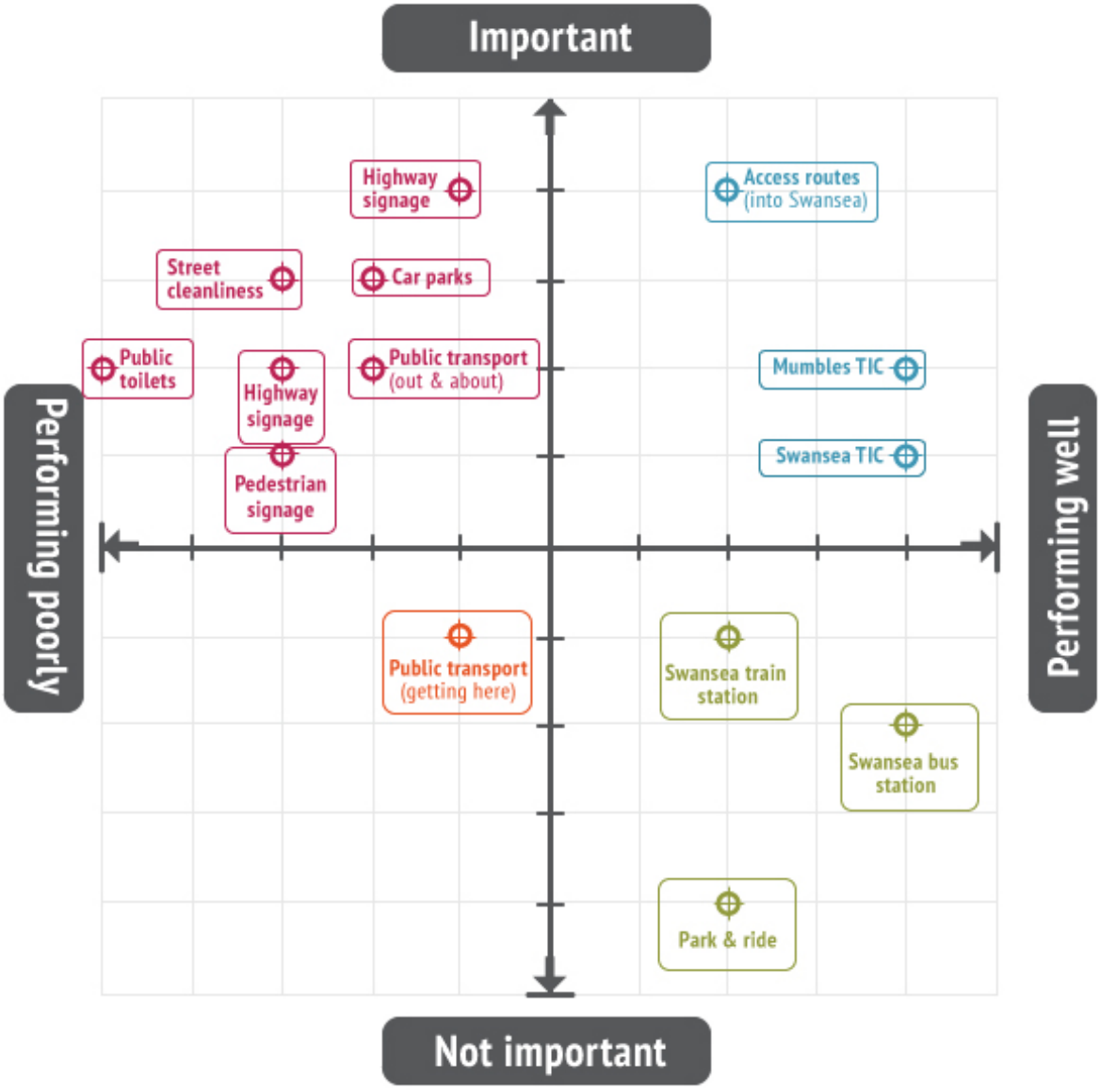
- difficulty in parking and car parking prices
- traffic congestion
- lack of all-weather attractions
- lack of high quality shops in the city centre

Please see Appendix 2 for the Executive Summary of the 2012 Visitor Survey findings and Appendix 3 for the infographic presentation.

2.3. Tourism Trade Survey

An online trade survey was conducted in October 2012 to gauge operators' opinions on the issues facing them as businesses and also how they felt the industry is performing and what improvements can be made. Again, these results have been incorporated into the DMP action plan and a summary of the key findings are demonstrated in Diagram 2 below:

Diagram 2 – 'Importance versus Performance' ratings of tourism-related services by trade operators



Please see Appendix 4 for the Executive Summary of the 2012 Trade Survey findings and Appendix 5 and the infographic presentation.

2.4 Tourism Scrutiny Inquiry Panel

A Council Tourism Scrutiny Inquiry Panel was set up in September 2012 to investigate if Swansea Bay was making the most of its potential as a visitor destination. The panel invited a number of internal and external industry stakeholders to present and discuss some of the key issues surrounding tourism. Findings from the final report are outlined below and generally reflect much of the results generated from the trade and visitor consultation carried out by the Tourism Team:

- Swansea is well placed to address future challenges in developing local tourism and meeting visitor expectations
- Improving the visitor experience depends not only on what Swansea has to 'offer' visitors but services available and the overall environment of the area.
- Getting destination management planning right will be essential to improving what Swansea already has to offer the visitor. The move to develop a Destination Management Plan is a correct one.
- There is more that could be done to work with key stakeholders, including local traders and providers, in improving and developing tourism locally.
- Consultation with users and understanding Swansea's visitor base is important in the creation of a Destination Management Plan and developing a vision for the future.
- Tourism is a key economic sector and demonstrates significant economic benefits for the area. We, therefore, should be recognising its importance and raising the profile of tourism as a priority.
- Creating a pleasant, clean and well maintained environment is a must… making Swansea an outstanding tourist destination is essential.
- Improvements to 'navigation' and signage around Swansea are necessary.
- The Authority has improved marketing Swansea as a tourist destination. Marketing campaigns are excellent but we must not rest on our laurels.
- Swansea must ensure any investment in tourism is environmentally and economically sustainable now and in the future.

Read the full report of the Tourism Scrutiny Inquiry Panel in Appendix 6.

3.0 CURRENT POSITION

3.1 SWOT Analysis

STRENGTHS	WEAKNESSES
• Gower as UK's first 'Area of Outstanding Natural Beauty' • Premier League football team • Natural landscape / scenery and beaches • Uniqueness of city, coast and countryside product in close proximity to other key destinations with good transport links • Association to Dylan Thomas and DT100 celebrations • Established and effective working partnerships with internal departments, external organisations and local tourism operators • Established and effective destination branding • Local welcome and friendliness highly rated • 97% of respondents in the 2012 Visitor Survey said they would visit again	• Weak shopping offer in City Centre • Fragmentation of tourism community and lack of communication and integration between stakeholders • Highway and Gateway signage • Cleanliness – public toilets and streets • Poor impressions created in some key settlements, e.g. Mumbles, Uplands
OPPORTUNITIES	**THREATS**
• Capitalise on opportunities presented by the Premier League • Maximise opportunities resulting from 'City of Culture' Bid 2017 • New, improved destination website and social media activity • City Region Status benefits • Purple Flag Status for City Centre • Expand high profile calendar of events e.g. Airshow, Waterfront Winterland • Exploit the growing 'staycation' trend by developing short break packages • New Swansea University campus • Development of accommodation provision in North Swansea	• Changeable weather making the need to extend the season even more important • Decline of Marketing Partners participating in Tourism Team Destination Marketing • Economic climate – cuts in public sector resources • High street brand shops withdrawing from the City Centre leaving empty, unsightly space • Negative perceptions

3.2 Bedstock Data

Bedstock, also called accommodation stock or supply, identifies the level of tourist accommodation and sleeping capacity of a destination. This can be calculated in terms of establishments, bedrooms or bedspaces.

Table 3 – Number of establishments and bedspaces in Swansea (2013)

	Number of establishments	Number of bedspaces
Serviced	166	5916
Non-serviced	365	4403
Caravan and Camping	53	21355
TOTAL	**584**	**31,674**
		Figures accurate as of Sept 2013

See Appendix 7 for a mapped version of accommodation provision (by type and postcode sector) in the City & County of Swansea.

3.3 Occupancy Data – National and Local

Occupancy data determines the percentage of the total number of occupied bedspaces during any given period. These figures are referenced with caution as the sample size used is minimal.

Table 4 – Occupancy figures for Swansea and Wales (2012)

2012 Figures (%)	SERVICED (%)		SELF CATERING (%)	
	Swansea	Wales	Swansea	Wales
January	17.2	21.2	40.7	33.7
February	30.6	28.5	50.5	42.6
March	47.3	36.0	40.9	45.2
April	50.0	38.7	56.7	55.2
May	51.7	40.3	46.5	48.6
June	53.4	45.5	61.0	66.2
July	56.6	45.4	56.8	68.0
August	70.7	53.6	75.2	80.7
September	63.3	48.2	62.3	64.6
October	44.6	43.5	30.7	50.5
November	30.1	31.0	23.2	36.7
December	18.8	29.6	26.1	38.1
AVERAGE	**41.2**	**38.2**	**47.5**	**52.5**

4.0 VISION AND STRATEGIC THEMES

4.1 Links to Existing Strategies and Initiatives

The DMP is underpinned by various existing policies, strategies and initiatives, which guide the development of tourism at a local, regional and national level, including:

- The Welsh Government Strategy for Tourism 2013-2020: 'Partnership for Growth'
- The South West Wales Tourism Strategy: 'Open All Year'
- Visit Britain Strategy for Inbound Tourism 2012-2020: 'Delivering a Golden Legacy'
- 'Unitary Development Plan' (UDP)
- 'Local Development Plan' (LDP)
- 'Swansea 2020'
- City of Culture Bid 2017
- 'Welsh Coastal Tourism Strategy'
- 'Swansea Rural Development Plan' (RDP)
- 'Sustainable Development Policy'
- 'Swansea Wayfinding Strategy'
- 'Tourism Signing Strategy'
- 'Swansea Cycling Strategy'
- Tourism Topic Paper for 'Local Development Plan'
- Countryside Access Plan 2007 - 2017
- 'Gower AONB Management Plan'
- 'Gower Tourism Sustainability Plan'
- 'Gower Landscape Partnership'
- 'Wales Spatial Plan'
- 'Planning Policy Wales, 2012'
- Swansea Bay City Region Economic Regeneration Strategy
- UK Healthy Cities Network
- 'Green Infrastructure' initiative

See Appendix 8 for more details on some of the above documents.

4.2 Vision – what do we want to achieve?

- **A national vision**

The most recent national publication in relation to tourism is 'Partnership for Growth - The Welsh Government Strategy for Tourism 2013-2020', which proposes the following vision for tourism:

'Wales will provide the warmest of welcomes, outstanding quality, excellent value for money and memorable, authentic experiences to every visitor.'

The goal is for *'tourism to grow in a sustainable way and to make an increasing contribution to the economic, social and environmental well-being of Wales.'*

The ambition is to *'grow tourism earnings in Wales by 10% or more by 2020.'*

- **A Sustainable Development vision**

In 2012, the City and County of Swansea adopted the Sustainable Development Policy, which sets the following vision:

'A sustainable Swansea is a great place to live now and in the future. Somewhere that is inclusive and safe and provides an excellent start to life. A county that supports a prosperous and resilient economy, recognises and benefits fully from its exceptional environment and promotes good health.'

To achieve this, the Policy highlights the need to deliver services which create greener, safer and more prosperous communities and the need for partnership working between the private, public and voluntary sectors.

In line with these visions, 'Destination Swansea Bay 2013-2016' aims to:

"Create a world class tourism destination, which delivers a high-quality visitor experience in a pleasant, clean and well-maintained environment.

This will be achieved by establishing a sustainable working partnership that will, in turn, drive improved tourism provision, effective management and high-quality promotion of Swansea Bay, Mumbles and Gower as a destination".

4.3 Strategic Themes – how do we achieve our vision?

Strategic Theme 1 – Working Together

- Create effective working partnerships with key local tourism stakeholders
- Improve communication between new and existing tourism businesses and local Business Support agencies
- Raise awareness throughout all departments of the City & County of Swansea of the importance of tourism to the local economy
- Improve and sustain communication channels between City & County of Swansea and key tourism stakeholders on a local, regional and national level

Strategic Theme 2 – Driving Quality

- Develop and maintain high quality infrastructure and public realm to satisfy visitor and resident needs
- Build a positive perception of Swansea Bay by reinforcing a distinctive brand for the destination on a national level
- Support the development of high quality tourism provision by encouraging businesses to participate in official accreditation schemes
- Continue to monitor and evaluate destination performance

Strategic Theme 3 – Tackling Seasonality

- Continue to implement an effective marketing campaign for Swansea Bay in the shoulder seasons (Spring, Autumn and Winter)
- Attract and promote new and existing high-profile events in Swansea Bay throughout the year
- Encourage operators to adopt an 'open all year' policy, thereby creating an all year round destination
- Support the development of all-weather attractions & activities, cultural offering as well as luxury, high-end product to create new demand

Strategic Theme 4 – Ensuring Sustainability

- Adopt a balanced approach between economic prosperity, environmental protection and social equity to support sustainable development within the destination
- Support relevant tourism funding applications ensuring they meet the strategic themes of the destination
- Tourism operators to participate in relevant training and staff development opportunities
- Promote tourism as a key sector for Inward Investment
- Economic and environmental good practice amongst stakeholders and social responsibility amongst all stakeholders
- Encourage visitor action on sustainability by providing information on issues such as waste, recycling, countryside code (biodiversity), energy, transport and local produce.

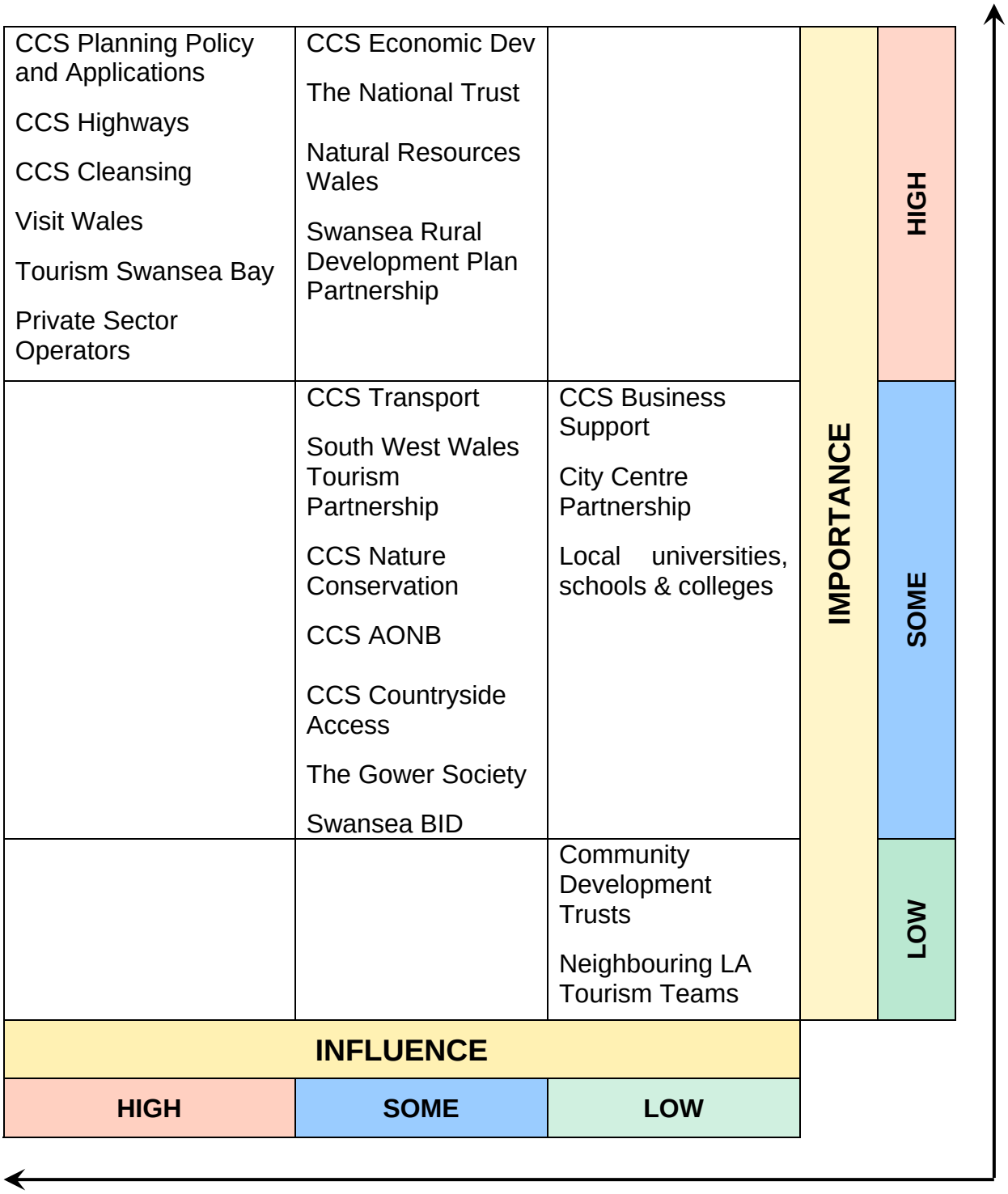
5.0 KEY PARTNERS AND STAKEHOLDERS

Partnership working is the strategic focus and overarching theme of this DMP. Some of the key internal and external partners are highlighted below. Please note this list is not exhaustive as more businesses / organisations may become involved in the DMP delivery as the Action Plan develops over time.

Key internal partners include:	**Key external partners include:**
➢ City and County of Swansea's Departments: • Tourism • Planning – Apps and Policy • Cleansing • Business Support • Highways / Transport • Economic Development • Special Events • Nature Conservation • Countryside Access • AONB Team ➢ City Centre Partnership ➢ Swansea BID	➢ Welsh Government / Visit Wales ➢ South West Wales Tourism Partnership (SWWTP) ➢ Tourism Swansea Bay (TSB) and private sector operators ➢ The National Trust ➢ Natural Resources Wales ➢ Business Support organisations ➢ Local universities, schools and colleges ➢ Community Development Trusts ➢ Swansea Rural Development Plan (RDP) Partnership ➢ Neighbouring Local Authorities' Tourism Teams

Table 5 – Stakeholder Analysis: 'Importance versus Influence'

The aim of this matrix is to capture the degree to which each stakeholder has influence over the project and their level of importance for its success. The objective of this exercise is to provide a clearer understanding of stakeholders and, as a result, provide insights as to how best to engage them.



6.0 DELIVERY STRUCTURE

The City & County of Swansea has undergone a major departmental restructure resulting in three new directorates namely; People, Place and Corporate Services.

See Appendix 9 for the 'Senior Management Team' structure.

Subsequently the vast majority of the services impacting on tourism now fall under the same directorate – Place. We envisage this new structure to work favourably for the delivery of the action plan; improving communication between all departments.

The consultation process highlighted the need for a clear structure to be established to ensure the action plan is delivered on time and with a coordinated approach.

As a result the delivery structure consists of representatives from a cross section of public, private and third sector industry bodies.

See Appendix 10 for a full list of consultees and the make-up of the groups highlighted below.

- **DMP Steering Group**

It is proposed that the group meet twice a year.

This group is responsible for the overall monitoring of the DMP Action Plan and managing its implementation. It is made up of representatives from key internal and external tourism stakeholders namely:

- Cabinet Member for Regeneration
- City & County of Swansea Director of Place
- City & County of Swansea Head of Culture, Tourism, Sport & Leisure
- City & County of Swansea Strategic Manager for Tourism, Marketing Services & Special Events
- Director of South West Wales Tourism Partnership
- Chairman of Tourism Swansea Bay
- A representative from Visit Wales

- **DMP Delivery Groups**

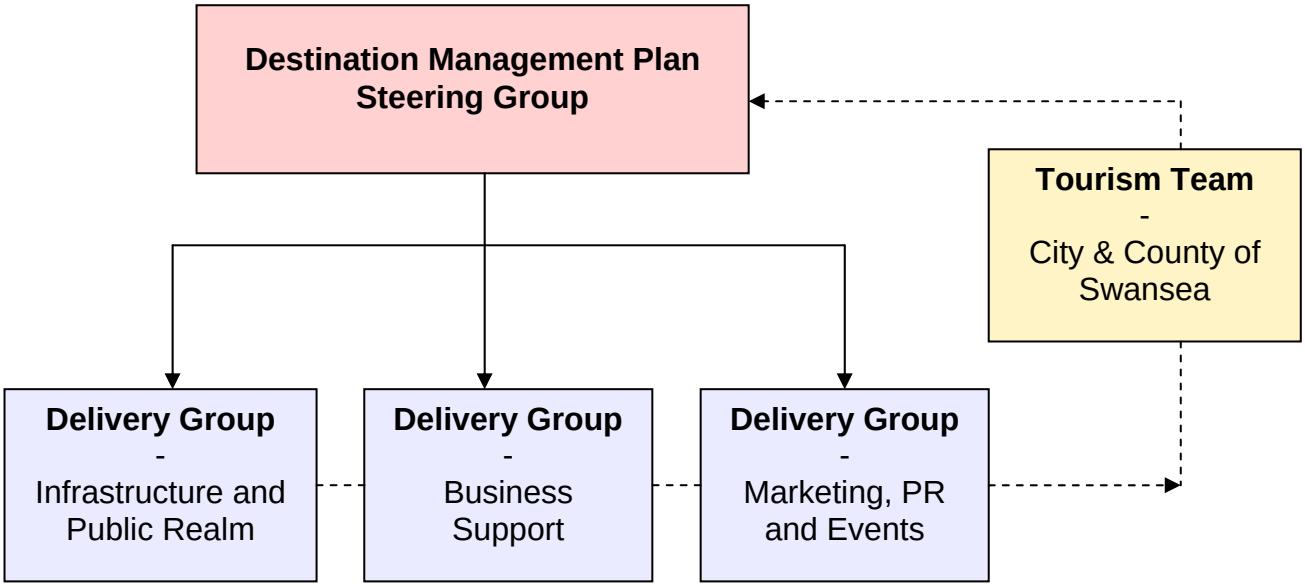
Three Delivery Groups have been established to assist in monitoring, updating and delivering the DMP action plan on the following key aspects of the destination:

- Infrastructure & Public Realm
- Business Support
- Marketing, PR & Events

It is proposed that each group meet two to three times a year to report on the DMP Action Plan, depending on requirements.

- **City & County of Swansea Tourism Team**

The Tourism Team will play a pivotal role in co-ordinating the overall delivery and monitoring of the DMP action plan ensuring that the delivery structure is working effectively and achieving the approved outputs.



7.0 MONITORING AND EVALUATION

'Destination Swansea Bay 2013-2016' benefits from full support from the Council and local tourism trade association. It has been successfully Equality Impact Assessed (EIA) and Integrated Impact Assessed (IIA). Both reports are available on request by emailing dmp@swansea.gov.uk.

'Destination Swansea Bay 2013–2016: The Action Plan' *(Appendix 11)* will continue to be updated as it develops. Tourism is a dynamic industry often responding to the change in market conditions. The plan will acknowledge this particular characteristic by constantly evolving over time. Regular Delivery Group meetings will report on the individual actions included in the Action Plan. It will be the role of the Steering Group and the Tourism Team to monitor and review the overall delivery and implementation of the plan.

In parallel to this, in-depth research will take place amongst visitors and local tourism businesses to evaluate the impact the DMP is having on the destination. Findings will be fed back at the Delivery Group meetings and may translate into future or revised actions for the Action Plan.

Future planned research includes:

- **Trade Survey** – annual consultation with the local tourism trade
- **Visitor Survey** – face-to-face interviews with visitors and holiday makers at the destination (biannual)
- **Conversion Research** – to evaluate the effectiveness of our marketing campaigns in bringing visitors to the destination (annual)
- **Holiday Guide Survey** – to evaluate satisfaction rate with the Swansea Bay Holiday Guide (annual)
- **Web survey** – to evaluate the satisfaction rate of visitswanseabay.com users (annual)
- **Tourist Information Centre (TIC) Survey** – to evaluate the satisfaction rate of TIC users (annual)
- **Occupancy Survey** – monthly reports received from accommodation operators. Annual report produced.
- **Bedstock Survey** – monthly reports produced to maintain accurate accommodation bedstock database and to feed into STEAM data
- **STEAM Report** – annual report produced indicating overall performance of tourism in Swansea

8.0 CONCLUSIONS

… on the importance of having a Destination Management Plan

Destinations that are well managed are more likely to grow their economy, attract investment and be seen as great places to live in and visit. Managing a destination includes planning, developing and marketing as well managing the physical, financial and operational elements.

'Destination Swansea Bay 2013-2016' demonstrates the wide range of stakeholders and services necessary to support a healthy visitor economy and highlights tourism as a core contributor to economic development rather than being treated in a silo. It sets a strategic direction for Swansea Bay as a visitor destination over the next three years.

… on the opportunities for Swansea Bay as a destination

The Tourism Inquiry Scrutiny Panel acknowledges that Swansea Bay is well placed to address future challenges in developing local tourism and meeting visitor expectations. The destination benefits from considerable assets, including the quality of the scenery and beaches, Gower as Britain's first AONB, Dylan Thomas, a Premier League football team in addition to highly-rated local welcome and friendliness. These positive factors have all contributed to building a strong visitor base over the years.

The challenge set by 'Destination Swansea Bay' is to build on these strengths, to explore new markets and opportunities and ultimately to strengthen and further develop Swansea Bay into a 'world class destination' as outlined in the vision.

… on the next steps for 'Destination Swansea Bay 2013-2016'

'Destination Swansea Bay 2013-2016' can only work effectively if its vision, strategic themes and agreed delivery plan are meaningful to all key stakeholders.

The implementation of the Action Plan over the next three years will be crucial to the overall success of the DMP. The Action Plan will be kept relevant and up-to-date at all times following feedback from regular Steering Group and Delivery Group meetings. These groups will be responsible for identifying clear, deliverable actions and defining priorities within the Action Plan. They will also create a framework for on-going reporting and communication, a process for assessing its impact and a programme of review and renewal.

Any queries on 'Destination Swansea Bay 2013-2016' and its associated Action Plan should be directed to dmp@swansea.gov.uk. Alternatively, ring the Tourism Team on tel: 01792 635205.

Latest documents and appendices can be found at www.swansea.gov.uk/dmp

APPENDIX 4

INTERNAL CONSULTATION RESPONSES

Ecological Comments on the Proposed Swansea Bay Tidal Lagoon (Generating Station) Development Consent Order City and County of Swansea

Volume 5 Reports

5.4 Natural Features Report

It is difficult to support claims of assessment of effect in table 2.3 and in section 2.9.0.3 considering the uncertainty with sediment modelling.

5.5 Habitats Regulations Assessment

Grey Seals

Grey seals travel large distances and are present on the Gower and Swansea coasts. They are features of the Pembrokeshire Marine SAC, the Cardigan Bay SAC and the Pen Llyn a'r Sarnau SAC. The possible effects of the construction of the lagoon on these must be considered in the HRA. There is no evidence in reports to show that there will be no significant effect.

Crymlyn Bog SAC

Airborne pollution produced as a result of construction may reach Crymlyn Bog. The bog is very sensitive to changes in nutrient status brought about by fall out of airborne nitrogen compounds; an assessment of this should form part of the Habitats Regulations Assessment

Carmarthen Bay and Estuaries European Marine Site (Carmarthen Bay and Estuaries Special Area of Conservation (SAC), Carmarthen Bay Special Protection Area (SPA) ,Burry inlet SPA. and Ramsar site)

Carmarthen Bay and Estuaries European Marine Site (EMS) is part of a European-wide network of areas – the *Natura 2000* series – designated under the European Union's Habitats and Birds Directives to safeguard habitats and species that are important and threatened on a European scale.

There is no mention of Carmarthen Bay and Estuaries European Marine Site (CBEEMS).There are risks of far-field effects which require particular analysis. The eastern boundary of CBEEMS is only approximately 11 nautical miles from the proposed Tidal Lagoon site and yet has been overlooked, other than for bird species within the two SPAs. Each of the features of the EMS must be looked at systematically and considered in terms of potential damaging effects during construction and operation.

There may be a transfer of birds in particular oystercatcher, dunlin and curlew between Blackpill SSSI and the Burry Inlet SAC. These birds are features of the Burry Inlet SAC. If the Blackpill SSSI undergoes geomorphological changes due to the lagoon construction there may be a significant effect on the features of the SAC, this needs to be assessed

Volume 6 Environmental Statement

Chapter 6 Coastal Processes, Sediment Transport and Contamination

The ecologically important habitats at Black Pill SSSI,and Crymlyn Burrows SSSI, and the Section 42 of the Natural Environment and Rural Communities Act 2006 habitats (sand dunes and *Sabellaria* reefs) within the bay are all dependant on the movement and deposition of sediment. Relatively small changes in the flow of currents and wave structure can lead to large changes in the quality and distribution of these habitats. The current modelling of the coastal processes is not detailed enough detail to give enough confidence to any prediction particularly as time passes. The bay will effectively be cut in two which may affect the . periodic east west movements of sand and the long term effect on the sediments present in the western section of the bay are uncertain.

'The effect of a possible reduction in sand supply on long-term beach levels and the ability of the sand dune systems in northwest Swansea Bay to recover following storm events; could have implications for coastal flood risk as well as net loss of sand dune habitat and recreational beach area.'KPAL report No 160995

There may be possible effects on Helwick Bank from sediment transport changes this needs to be addressed.

The report notes that "The geomorphological evidence from shoreline features demonstrates that the dominant (net) direction of littoral sand transport along the entire shore of northern Swansea Bay, from Oystermouth to the Neath Estuary, is easterly. The recent report by Ken Pye Associates (KPAL Report No 160995 April 14) discusses issues with the coastal processes these comments are summarised as follows. No specific modelling of littoral sediment transport has been undertaken in the ES." Aerial photographs taken since 1945 show a complex pattern of sand-waves which change significantly on annual and decadal timescales. No analysis of the importance of these features in onshore - offshore alongshore sand transport has been undertaken as part of the ES. No attempt has been made to construct a sediment budget for north-eastern Swansea Bay, or to document net gains or losses of sediment using historical beach profile data or aerial photogrammetry" and it was noted that "The problem has continued until the winter of 2013/14, when a series of severe storms caused significant upper beach and frontal dune erosion and transfer of sand back to the mid / lower intertidal zone". These areas need to be covered. The report also states that "The predicted reductions in high tide levels (e.g. ES Figure 6.42), current speeds (e.g. 6.34) and wave heights (e.g. Figure 6.45) suggest

that there is a significant risk of increased mud deposition and accumulation across a much wider area, especially within the sheltered areas leeward of the higher intertidal sand bars. This needs to be discussed and possible effect indicated.

With reference to Section 6.4.4 Contamination of sediment and Section 6.4.3 Sediment Regime of the Lagoon report Ken Pye states that with reference to contamination that “this conclusion is based on the collection and analysis of a very limited number of sediment samples, most from the surface or shallow depth and largely excluding the intertidal areas of the Bay” and that The total number of samples analysed for particle size and composition is very small for a project of this scale and does not give a comprehensive picture of the surface or sub-surface sediment character in the northern part of Swansea Bay. No sampling or analysis has been undertaken in the intertidal and supratidal beach areas of northwest Swansea Bay. No investigation has been carried out of the thickness of superficial sediment in these areas, or the sedimentary characteristics and chemical composition of older sediments which underlie them. A comprehensive baseline survey of sedimentary facies and contaminant levels in the surface and sub-surface sediments across northern Swansea Bay has not been undertaken, and uncertainty therefore remains regarding the potential for release and redistribution of contaminants outside the sampled areas.

In Section 6.7 Mitigation and Monitoring Ken Pye 14 has suggested and we agree that “a more extensive programme of pre-construction baseline data acquisition and subsequent monitoring should be agreed with the Developer, and other bodies including Natural Resources Wales, if a DCO is granted. Specific thresholds of change should be agreed which trigger further action in terms of mitigation / compensation / remediation.” and that “A comprehensive sediment characterization study of Swansea Bay, involving a minimum of 200 sampling points across the whole of the sub-tidal and intertidal area; samples should be taken from the surface and from specified depth intervals below the sea bed”

Chapter 8 Intertidal and Subtidal Benthic Ecology

Because of the uncertain conclusions of the assessment of coastal processes it is difficult to come to a precise conclusion as to the possible effects of the construction of the lagoon on the intertidal and subtidal habitats. The bay contains a number of intertidal and subtidal habitats including *Sabellaria* reefs and peat and mud exposures, these are sensitive to changes in sediment movement. The data on the distribution and species of plankton and macro algae is largely based on desk top studies some of these are now several years old. If these habitats and species are to be protected it is essential that an accurate base line is established against which to measure any change. The existing data needs to be checked in order to allow an up-to-date base line to be established. There is no reference to the Mumbles Pier Lifeboat Station Subtidal Survey report (Moore, J.J. (2003) Mumbles Lifeboat station

Subtidal Survey, May 2003). A report to Posford Haskoning Ltd from Coastal Assessment, Liaison and Monitoring. Cosheston, Pembs. 11pp.

There is no description ,or listing of Section 42 intertidal and marine habitats and species (other than *Sabellaria alveolata* and *Ostrea edulis*). The only distribution maps are of Biotopes but these do not describe Section 42 habitats and species. This needs to be addressed to allow a full assessment of potential effect of the proposed development.
Peat and clay exposures with piddocks are a UK Biodiversity Action Plan priority habitat and a Section 42 Habitat. This biotope is considered to be scarce in the UK; there are sections of this habitat across Swansea Bay e.g. just south of the end of Mumbles Pier where Clay with piddocks occurs just below spring low tides it is vulnerable to changes in sediment distribution. This important habitat is not mentioned

In section 8.5.6.5 the information is not up to date there are a number of marine non native species in Wales. There is no mention of the Pacific oyster *Crassostrea gigas*, which is present in Swansea Bay (section 8.5.6.15 states it is not recorded).

The probability of the introduction and spread of non-native species from the Lagoon development is considered to be low, what evidence is this based on? There is the potential, without strict biosecurity measures in place for construction materials and vessels to act as vectors of transfer of marine non native species within the lagoon footprint and outside of it.

It is stated in section 8.5.2.4 that an appropriate reporting mechanism will be set up to report collision events and near misses. If this is to be included as monitoring then the process must be developed prior to inclusion in this appendix and stated in full within this section.

Ken Pye has stated that “The effect of increased mud deposition would be to restrict the mobility of the sand bars if mud drapes are formed on the bars and/ or the movement of sand across the surfaces between the bars is reduced a exposures of ‘hard’ peat and consolidated mid Holocene muds become progressively buried by new mud deposits. Such changes could have implications for the in-fauna and birds as well as affecting the exchange of sand between the upper beach and the lower sub-tidal areas” and that “If upper foreshore levels rise sufficiently and wave action is reduced, saltmarsh vegetation will become established, leading to a further acceleration in mud accretion rates.”

Ken Pye has pointed out that “Considerable time and effort has been spent in the past to prevent the development of *Spartina* marsh in the western part of the Bay, involving spraying, pulling and bull-dozing of pioneer vegetation, and such measures could be required again in the future. These historical problems have not been considered in the Coastal Processes Baseline Assessment and the possibility that

similar action in the future may be required following construction of the Lagoon have not been recognized. “

Chapter 9 Fish Including Recreational and Commercial Fisheries

Some of the fish species e.g. Herring are sensitive to increased sediment loads and noise both of which will increase during construction and may increase in the running phase of the lagoon. Disturbed sediments have the potential for smothering feeding and nursery areas for important species of fish. Again uncertainty in the sediment transport modelling makes it difficult to predict effects on sensitive species. Herring spawn in Swansea Bay primarily within the bounds of the lagoon footprint, once built they will be excluded from this preferred area. There is no information that can with any certainty explain what will happen to spawning Herring in the Bay. No evidence has been provided to show that any alternative sites will be suitable. With uncertainty as to the levels of sediment movement particularly over time it is not possible to understand potential impacts on the other fish and shell fish species using the Bay

It is stated in section 11.6.1.1 that Herring spawning media on the outer Lagoon wall will safeguard fish stocks. What is the evidence for this?

Herring are an important food source for harbour porpoise (Oakley pers comm.) this was confirmed during a 2.5 year research project at UWTSD Swansea Metropolitan. Stomach content analysis of locally stranded harbour porpoise provided evidence of the importance of particular fish species. These included whiting, poor cod, herring and smelt. If herring are excluded from the Bay during piling, then the knock-on effect on harbour porpoise must be fully considered.

Chapter 10 Marine Mammals and Turtles

Harbour porpoises use Swansea Bay and seasonally bring their calves with them. Harbour porpoises are listed in section 2 of the Conservation of Habitats and Species Regulations 2010 (CHSR 2010) and are afforded the legal protection under section 41 of the regulations. The data does not explain what harbour porpoises are doing in the Bay in particular what they are doing with their calves. The data also does not explain what likely impact the destruction of the herring spawning ground might have, herring being an important prey item for porpoises. The report fails to indicate that the lagoon construction will not be detrimental to the maintenance of porpoises at a favourable conservation status (section 9b CHSR 2010).

There is no data presented that would allow an assessment of the effect of the development on Atlantic grey seals, a feature of the Pembrokeshire Marine SAC, Cardigan Bay SAC and PenLlyn a’r Sarnau SAC

With reference to section 10.4.2.10 (Jenkins and Oakley (2013) report) raw data was analysed and a summary report provided specifically for the Swansea Bay area (a wider study area was investigated from Port Talbot Docks to Carmarthen Bay/North Gower). The raw data is not included but neither is it for most other reports, none of which have needed to be validated. It is confusing as to what exactly the statement ‘the supporting data would need to be reviewed’ means. The study has been

reviewed and analysed by professional Researchers at the University of Wales Trinity St. David.

With reference to section 10.7.0.4, the C-POD surveys began in 2014, as a long-term acoustic monitoring programme, when do they continue until? This will only provide presence/absence data and not any behavioural data. Acoustic monitoring should accompany dedicated long-term land-based and vessel surveys (specifically within coastal Swansea Bay rather than offshore where some data is available). It is stated that the results of acoustic monitoring will inform the subsequent monitoring strategies. How can this data be included after the EIA/ES have been written and submitted? These surveys should have already been undertaken and form part of Chapter 10. Also, if, as stated, monitoring is to continue during construction and operation – how will this be undertaken for 120 years?

With reference to section 10.7.0.6, an appropriate package of adaptive mitigation and monitoring to reduce collision impacts will be developed as outlined in Chapter 23. This 'package' should be outlined and included in full here, as part of Chapter 10 and not in some future document.
The proposal for acoustic deterrent is not outlined in detail for either fish or marine mammals. It is important that marine mammals do not become habituated to these deterrents. Other than acoustic monitoring, there is no mention of any visual surveys from land or vessels to monitor habitat usage and critical areas.
Who will record the collision events reporting these events? There is no strategy included to describe measures to be taken to deal with carcasses nor are there any details of what measures can be put in place to prevent collisions or near misses from happening again.
Capture and release of trapped marine mammals (only seal pups are mentioned). What about procedures for harbour porpoise entrapments?
As described in Table 10.12 there is low confidence in collision risk with turbines and noise disturbance the full mitigation measures must be described.
Strandings data does not seem to have been considered. Evidence is available from Marine Environmental Monitoring.
With reference to section 8.2.1.2, surveys undertaken by Researchers at UWTSD Swansea Metropolitan from 2010-2013 indicate that the location with the highest level of harbour porpoise calf sightings was Port Talbot harbour with 22% of all sightings (Oakley & Jenkins, 2014 in press). In view of this and the conclusions from Jenkins and Oakley (2013) report regarding the importance of inshore habitat for porpoise off Tutt Head, Mumbles and Port Talbot docks, it is not clear why only Mumbles is a designated control site for C-POD monitoring and there is no C-POD across the Bay near Port Talbot to monitor this important habitat.
Due consideration must be given to timings of construction, particularly in terms of piling and underwater noise pollution, based on seasonal distribution of particularly harbour porpoise mothers and calves. Oakley and Jenkins (2014, in press) note that 38% of all calves sighted across the study area of Port Talbot Docks to Burry Holms, Gower were during the April to September calving period.

There have been a number of potential impacts on cetaceans from wind wave a tidal developments proposed by Dolman and Simmonds 2010 (Dolman & Simmonds, Ensuring adequate consideration of cetaceans in Scotland's ambitious marine

renewable energy plans Report SC/64/E3. WDCS, Chippenham, Wiltshire) These include increased noise, physical interactions, habitat changes, increased contamination and effects on prey. They have suggested that in order to assess impact, plan mitigation and protect the affected species the following advice should be followed.

- Two years' data collection must be considered as a minimum baseline requirement. This data must help the implementation of the plans through an adaptive management process. It is essential that thorough impact monitoring that is appropriate and adequate for harbour porpoise, grey seal and other marine mammal species found in the area is carried out. Little attention has been paid to understanding potential impacts. Before any development site is determined and construction commences, it is very important to fill data gaps with information from detailed local baseline studies, particularly how cetaceans are distributed and how they utilise their habitats within Swansea Bay.
- To identify whether or not changes in abundance or distribution are the result of adverse impacts from development, data are needed that allow identification of such trends. Considerations should include direct effects on cetaceans as well as indirect effects on prey species.
- A strategic approach to understanding and filling the data gaps of marine species is required. Development of broader monitoring programmes then the development site itself will help to ensure cumulative and in-combination impacts are accounted for and monitored.
- Mitigation alone cannot be guaranteed to overcome biodiversity issues, especially where those mitigation measures are not tested and so may not be effective.
- European Protected Species licenses for any pile-driving or other licensable activities should not be provided until all disturbance requirements resulting from the EU Habitats Directive have been adequately satisfied.
- Acoustic Deterrent Devices (ADDs) introduce additional noise pollution to important cetacean habitats. The use of ADDs to minimise injury from pile driving has yet to be tested so remains unproven as a mitigation measure. ADDs should therefore not be widely advocated.
- The zone of behavioural disturbance may extend considerably beyond 20km for harbour porpoise (Tougaard et al, 2009). As a result, monitoring of behavioural impacts should be conducted to adequate distances.
- Little information exists about how marine mammals will interact with new structures being placed in the water column. With monitoring, particularly if strandings occur as a result, other significant impacts may still come to light.
- The results of monitoring and mitigation studies be fed back into the decision making process to further develop mitigation and management decisions?

The report does not fully address the issues above, in order to make a considered judgement of the affect of the lagoon on cetaceans the points above need to be covered.

Chapter 11 Coastal Birds

The Blackpill SSSI is designated for its nationally important overwintering wildfowl (particularly sanderling and ringed plover); the SSSI consists mainly of fine intertidal sediments, the uncertainty in the coastal process analysis makes a an assessment of possible effects difficult .A small changes in sediment movement particularly over a long time span could have a significant negative effect. The bay is also used by a nationally significant population of great crested grebes which could be adversely affected by a loss of feeding opportunities through destruction of herring spawning ground and through displacement. 'The predicted reductions in high tide levels (e.g. ES Figure 6.42), current speeds (e.g. 6.34) and wave heights (e.g. Figure 6.45) suggest that there is a significant risk of increased mud deposition and accumulation across a much wider area, especially within the sheltered areas leeward of the higher intertidal sand bars.
The effect of increased mud deposition would be to restrict the mobility of the sand bars if mud drapes are formed on the bars and/ or the movement of sand across the surfaces between the bars is reduced a exposures of 'hard' peat and consolidated mid Holocene muds become progressively buried by new mud deposits. Such changes could have implications for the in-fauna and birds as well as affecting the exchange of sand between the upper beach and the lower sub-tidal areas.'

Chapter 12 Terrestrial Ecology
There is no mention of then Swansea Bay SINC and no map of SINC boundary and habitats/species included as a local designations.(See attached map and citation?)
The SINC supports a number of section 42 habitats and species including seastock and small-flowered catchfly which is regarded as "vulnerable to extinction" in Wales. This is probably the last remaining population of small flowered catchfly in the Vice County of Glamorgan. Listed as Endangered (IUCN, 2001) and Nationally Scarce
There is no mention of invertebrate surveys (e.g. section 42 invertebrates including sand dart moth, robber-fly and the strandline beetle) in the Black Pill SSSI and the SINC in Swansea Bay. This chapter should include a discussion of the strandline which is missing from the chapter on terrestrial ecology (section 12.4.5.28). Only Crymlyn Burrows SSSI has been outlined.

It would be useful to have a quantitative estimate of losses and gains of section 42 habitats and species to be able to help assess the impact of the proposal on the terrestrial ecology
There is likely to be an increase in tidal flooding risk as a result of the Lagoon construction, albeit relatively small.' This could have a negative affect on section 42 habitats and species

There is no mention of the Swansea Bay Management Plan

There is a need for an Invasive non native species strategy.

A reptile mitigation scheme needs to be agreed. There may be significant numbers of animals involved.
Within the document the effect on the westerly sand dunes and the sediment in the Black Pill SSSI are considered to be minimal however there is still uncertainty attached to the sediment modelling and this conclusion may not be valid.
There is no certainty that the pairs of lapwing and little ringed plover will simply relocate. They are a significant population in local terms and would suffer disturbance for the length of the construction phase. Suitable mitigation needs to be provided.

‘

Chapter 23 Mitigation and Monitoring

There is a need for an Invasive non native species strategy to cover both marine and terrestrial species
The possibility of translocating *Sabellaria* successfully is uncertain there is no published literature on such an attempt. This needs more consideration, particularly because of the high proportion of this section 42 habitat that will be affected and because of its association with the herring spawning ground. The selection of receptor sites within Swansea Bay has not been fully considered and there have been no actual trials undertaken on a local level. A full feasibility study and extensive research is required. The statement “Therefore the potential for the successful rehabilitation of this reef habitat exists although approaches are experimental” - is unacceptable In Table 8.10 – how can the confidence level possibly be ‘High’ when there have been no successful *Sabellaria alveolata* translocation projects in the UK? To be considered as a mitigation method the process should be known to be successful, otherwise it cannot be mitigation.

Public access to areas of mitigation e.g. salt marsh and new sand dunes will significantly reduce their ecological value. This issue needs to be addressed.

With compensatory measures there are many gaps and uncertainties in the reporting. Further investigation and study required which would possibly reduce the associated risk. Assessment of possible compensation measures depends on the accuracy and robustness of all the preceding assessment processes with the potential for uncertainties to become magnified. The findings should therefore be treated as indicative and would require further development in light of more detailed understanding.

Like for like compensation requires proportions of habitats to reflect the areas lost.

‘In view of potential concerns about the potential impacts of the development on the beaches, intertidal flats and adjacent sub-tidal areas of northwestern Swansea Bay, including possible impacts on windblown sand hazard, mud accretion / saltmarsh development and dredging requirements in the Tawe barrage impoundment, it is suggested that a more extensive programme of pre-construction baseline data acquisition and subsequent monitoring should be agreed with the Developer, and other bodies including Natural Resources Wales, if a DCO is granted. Specific

thresholds of change should be agreed which trigger further action in terms of mitigation / compensation / remediation.
From the viewpoint of physical processes and sediments, the following should be undertaken:

A baseline LiDAR and comprehensive swath bathymetric survey of the whole of Swansea Bay before any construction activities commence

Repeat LiDAR / swath bathymetry surveys at 5 yearly intervals to allow quantitative assessment of changes in beach sediment volume

RTK GPS surveys of additional beach profiles to be established between the existing Swansea Bay and Carmarthen Bay profiles line shown in Figures 2 to 5

Bathymetric surveys to monitor sediment accumulation in the impoundment above the Tawe barrage

Aerial photography surveys at 5 yearly intervals to monitor changes in morphological features and vegetation extent (e.g. saltmarsh)

A comprehensive sediment characterization study of Swansea Bay, involving a minimum of 200 sampling points across the whole of the sub-tidal and intertidal area; samples should be taken from the surface and from specified depth intervals below the sea bed

Repeat sediment sampling at 5 yearly intervals in a reduced number of targeted locations

Continuous water level, wave and tidal current monitoring in at least two locations within northern Swansea Bay (e.g. using smart buoys)

Installation of a weather station (including anemometer) at the control centre on the lagoon wall

Agreement should be reached regarding responsibility for any actions which may be required to tackle potentially adverse impacts such as increased windblown sand hazard, increased dredging requirement, improved coast protection / flood defence, and control of invasive saltmarsh vegetation. Additional agreements should be made in relation to habitat and species monitoring / mitigation.'

<u>Other Issues</u>

There is a need for a detailed long term monitoring particularly as the outcomes due to there are uncertainties with the sediment transport modelling. There also needs to be an adequate plan to compensate for any adverse changes that are identified.

There is a significant risk from Invasive non native marine and terrestrial species there is a need for a full assessment of the risks involved and a strategy to deal with them.

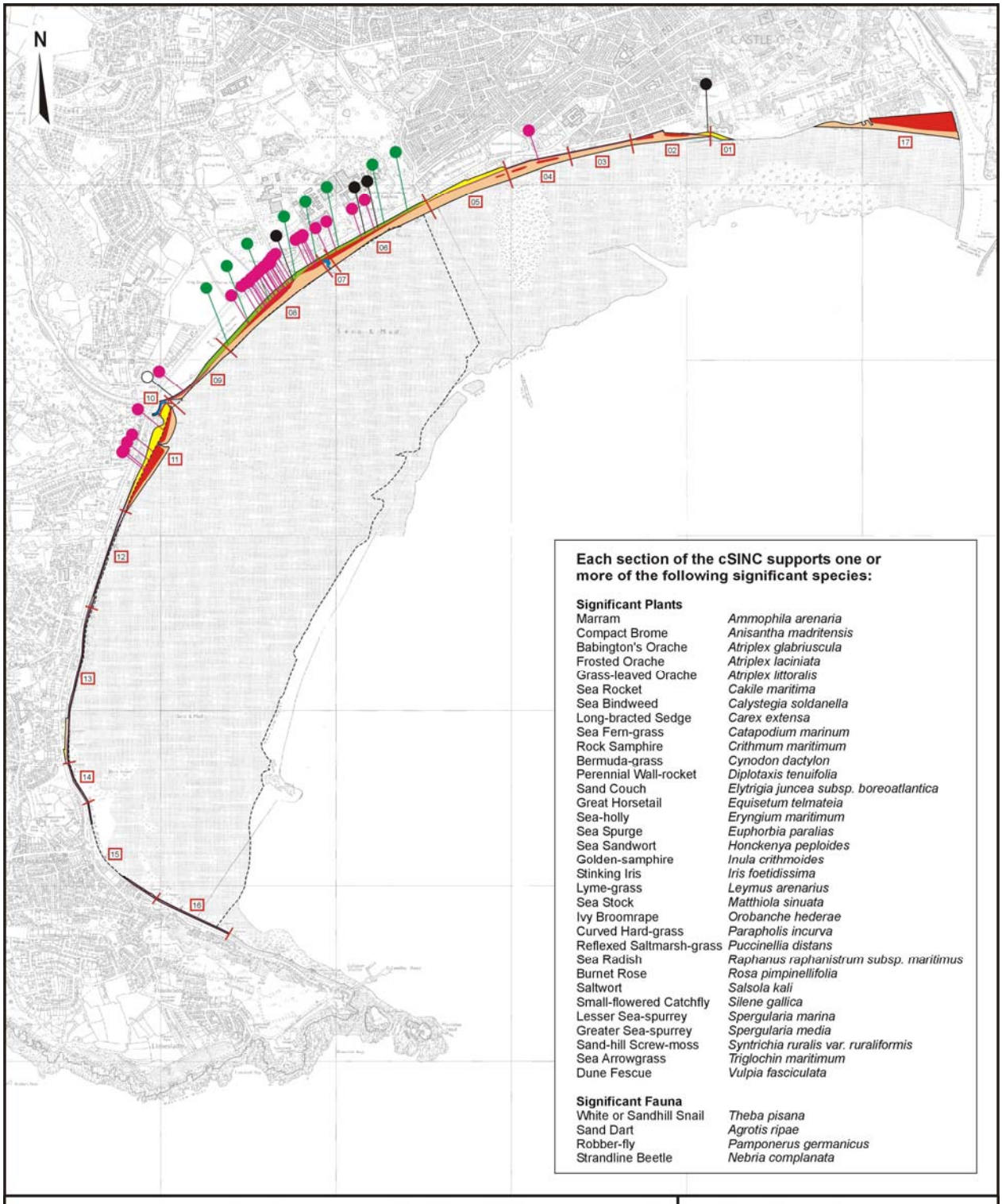
Some habitats are very difficult to mitigate or compensate for e.g. mud flats that are use by overwintering wildfowl there have been historic losses of intertidal habitats in Swansea bay any further loss is unacceptable, how these may be compensated for.

It is difficult to support claims of assessment of effects and provide adequate mitigation with the level of uncertainty in the coastal processes report. The precautionary principal should apply

The assumptions within the report are wide-ranging with no real effort to link sections such as fish with marine mammals
‘As stated in the Coastal Processes chapter (Chapter 6) of the ES, construction of the lagoon would effectively divide northern Swansea Bay into two separate hydrodynamic and sediment transport cells, one to east and one to the west of the lagoon structure. This is anticipated by ABPmer to have two main effects: (1) it would interfere with the anticlockwise residual current in northwest Swansea Bay which is capable of transporting suspended mud, and (2) it would prevent episodic storm-generated littoral transport of sand from north-eastern Swansea Bay towards the west, potentially cutting off the supply of sand to the recreationally important beaches between West Pier and Singleton Park.’

‘If, as anticipated, there is a medium to longer term increase in total sand volume in the intertidal and supra-tidal areas between St Helen’s and the Civic Centre, the existing problem of wind-blown sand incursion onto the promenade, Oystermouth Road and into the Civic Centre west car park (Pye & Blott, 2012, 2014a,b) is likely to become worse. This would potentially result in increased maintenance costs associated with removal and disposal of sand from the promenade, road and car park, and increase the safety risk to pedestrians, cyclists and motorists.’ Who will cover the additional costs for this work ?
‘A comprehensive baseline survey of sedimentary facies and contaminant levels in the surface and sub-surface sediments across northern Swansea Bay has not been undertaken, and uncertainty therefore remains regarding the potential for release and redistribution of contaminants outside the sampled areas.’ This could have a negative impact on marine life.

2nd June 2014



Each section of the cSINC supports one or more of the following significant species:

Significant Plants

Marram	*Ammophila arenaria*
Compact Brome	*Anisantha madritensis*
Babington's Orache	*Atriplex glabriuscula*
Frosted Orache	*Atriplex laciniata*
Grass-leaved Orache	*Atriplex littoralis*
Sea Rocket	*Cakile maritima*
Sea Bindweed	*Calystegia soldanella*
Long-bracted Sedge	*Carex extensa*
Sea Fern-grass	*Catapodium marinum*
Rock Samphire	*Crithmum maritimum*
Bermuda-grass	*Cynodon dactylon*
Perennial Wall-rocket	*Diplotaxis tenuifolia*
Sand Couch	*Elytrigia juncea subsp. boreoatlantica*
Great Horsetail	*Equisetum telmateia*
Sea-holly	*Eryngium maritimum*
Sea Spurge	*Euphorbia paralias*
Sea Sandwort	*Honckenya peploides*
Golden-samphire	*Inula crithmoides*
Stinking Iris	*Iris foetidissima*
Lyme-grass	*Leymus arenarius*
Sea Stock	*Matthiola sinuata*
Ivy Broomrape	*Orobanche hederae*
Curved Hard-grass	*Parapholis incurva*
Reflexed Saltmarsh-grass	*Puccinellia distans*
Sea Radish	*Raphanus raphanistrum subsp. maritimus*
Burnet Rose	*Rosa pimpinellifolia*
Saltwort	*Salsola kali*
Small-flowered Catchfly	*Silene gallica*
Lesser Sea-spurrey	*Spergularia marina*
Greater Sea-spurrey	*Spergularia media*
Sand-hill Screw-moss	*Syntrichia ruralis var. ruraliformis*
Sea Arrowgrass	*Triglochin maritimum*
Dune Fescue	*Vulpia fasciculata*

Significant Fauna

White or Sandhill Snail	*Theba pisana*
Sand Dart	*Agrotis ripae*
Robber-fly	*Pamponerus germanicus*
Strandline Beetle	*Nebria complanata*

Legend

- Seawall with significant species (non-intervention)
- Marginal vegetation (non-intervention, though Japanese Knotweed present by University stream outlet)
- Lawns with significant species (best maintain as lawns - Bermuda-grass abundant where soils sandy)
- Dune with trees and scrub (mostly degraded dune that would benefit from management)
- Open dune vegetation (most important habitat in SINC supporting several key species)
- Open beach above MHWM (supports key strandline species)
- Blackpill SSSI
- Proposed Swansea Bay SINC boundary
- Sea Stock (Population of National significance)
- Sea-buckthorn (Invasive alien that degrades dunes - clearance work required)
- Poplar hybrid (Invasive alien that has degraded the dunes - some clearance work would be beneficial)
- Small-flowered Catchfly (Last remaining site in Glamorgan - population highly vulnerable)

City and County of Swansea

SWANSEA BAY cSINC
Terrestrial Qualyfing Features

SCALE 0 1km

DRAFT

November 2009

Huw Morgan
Pollution Control & Public Health Division
Residual issues for our submission to Inspector
(in addition to water quality evidence)

A remaining minor point of detail would be that the existing emergency short outfalls from the Swansea sewage treatment works are not really taken into account. These would discharge into the lagoon directly should there be a major problem. Clearly this needs to be taken into account in the management plan for the lagoon users. This will need NRW involvement to resolve at the same time as they deal with the existing old Queens dock outfall which discharges small amounts of untreated sewage into the lagoon area.

Much of the attention in the Navigational Risk chapters seems to be on larger vessels. This is important, as we would not wish to see any increased risk of oil spills etc. However the council must also be concerned about the risk to smaller craft, including sailing vessels, using the Council Marina or the local sailing clubs. This is particularly significant for Swansea as it is seen as a safe haven during storms. There are very few safe entrances under all conditions in the Bristol Channel and certainly no safe alternatives close to Swansea. The lagoon wall will be a rocky lee shore for any small vessel approaching the Marina. This is particularly difficult for sailing vessels that also have to take account of some of the potential jet currents around the turbine area. Some of the figures for tidal flows, particularly in the area that vessels would need to pass through to enter the river, seem quite concerning (fig 4.13). Sailing vessels will not be able to deviate inshore to avoid this as they will run the risk of going aground at certain times. Given the variety of wind directions, the position of Mumbles Head, the shallow inner bay areas and the physical restrictions around the lagoon, this could make Swansea a far less attractive destination for Marina clients. This chapter comments on problems with increased wave heights particularly due to reflections from the lagoon wall, but considers them an insignificant risk. Also chapter 6 comments that vessels will be unaffected when maneuvering in the channels (6.5.2.42). However chapter 6 claims that wave heights could increase by approximately 30 cm in exactly the area that small vessels will need to pass through to reach Swansea. In addition it should be noted, that small vessels will particularly struggle where the prevailing wind is against the strong jet currents ebbing from the turbine area. This will cause an additional wave height and can lead to a very unpleasant chop that smaller vessels can find difficult given the proximity to Mumbles Head and shallow waters.

Some visitors already claim that the River Tawe lock entrance is a little difficult as it is not dredged regularly or marked between the river entrance and the River Tawe barrage lock. The lagoon application also mentions the likelihood of increased dredging being required around the Tawe dredged channel. In 14.6.2.31 also in 6.5.2.74 – table 6.18 as well as

chapter 4, an increase of between 20 to 34% is suggested. Given that the Council already struggles to fund its dredging liability in relation to the Barrage and most of the material we dredge has entered from the bay, we should agree the lines of responsibility for monitoring and dredging post construction. Given the possible costs (our limited dredging already costs £100k pa) is this another area for legal agreements through the obligation?

I understand that the Royal Yachting Association has registered an interest and I would hope that they may identify specific risks with regard to the safety of water users within the lagoon. In case no one else raises this issue, I think I should mention some of the significant hazards which will be present some of the time in terms of the velocities of flow and the turbulence of flow patterns which are likely to occur during certain parts of the tidal cycle. Given some of the likely uses, Kayaking, paddle boarding, dinghy sailing, windsurfing and of course open water swimming, some of these risks could be highly significant and require careful attention.

Metal contamination of the sediments is referred to in the application. Whilst the data looks reasonable at first glance, it should be borne in mind that the Bay has operated as the main sink, for over 300 years, of very significant contamination by almost all the heavy metals. Swansea was the metallurgical world centre for the nonferrous metal smelting industries throughout the 17 and 1800s. Huge amounts of contamination ended up in the River Tawe or the local canal systems. Much of this eventually ends up in Bay sediments. It is very difficult to come up with a sampling strategy that adequately describes the current situation at a reasonable cost. It is however a reasonable assumption that particularly during construction, it is possible that the production of shellfish for human consumption may need to be prohibited by the FSA. I accept this could be regarded as a temporary problem, which could be inevitable given the scale of construction, but I have limited confidence in the approach that the various hotspots will be suitably diluted and will not accumulate in local filter feeders. In these circumstances it seems reasonable to suggest a further risk assessment of the various pathways for the toxic or ecotoxic metals prior to agreeing a detailed dredging and construction plan. The application implies an iterative process but it needs to be clearer that the aim is not just ‘geotechnical’ but is also designed to avoid mobilizing metals where ever possible.

A similar lack of confidence exists around the discussion of contaminated land, particularly on land previously occupied by BP. A very limited remediation project is underway dealing with fairly serious and obvious contamination which has actually released free hydrocarbons into the intertidal zone. It is likely that there is much more widespread contamination around the Queens Dock area which would need to be properly assessed. This needs the usual type of conditions, agreed by ourselves and NRW, which can be properly enforced (not as outlined in the schedule of draft conditions).

Air quality management is mentioned by the applicant, but it does not recognise the fact that some dwellings around Fabian way are currently

failing air quality objectives already. It is hoped that some adjustments to local traffic management systems may improve this situation. However it should be recognised that the second campus and this application both put extra pressure on this part of the road network. Clearly the Council has a statutory obligation to ensure that residents are not overexposed to air pollutants specified in the relevant Directives and Regulations.

#

Tidal Lagoon Application
Huw Morgan- Pollution Control & Public Health Division.

The most important issue for my section is the effect of the tidal lagoon on bathing water quality and in particular, the potential loss of the current prediction method, which is used to protect public health on an otherwise failing beach.

1. The City and County of Swansea regards the compliance of Swansea Bay as a very important issue. This is for economic regeneration reasons, for legal reasons, for socio-political reasons as well as the fundamental reason behind the revised bathing water Directive (2006/7/EC) – that is to protect public health. For a period of years the council was seeking help to fund the necessary fieldwork to create a successful predict and protect model which could be used in this context, in line with World Health Organization (WHO) guidelines (WHO, 2003) and to comply with the revised Directive. Eventually, through a Wales-Ireland programme Interreg bid, we were able to access over €4 million of public money to investigate this issue and successfully deliver a predict and protect model capable of coping with an extremely complex bay. This approach has been successfully used for Swansea Bay and is successfully using the 'discounting rules' in the Directive to change its current status from 'Poor' to 'Sufficient'. This is of major significance to the Council as it is promoted as the 'waterfront city' and much of the regeneration efforts over the last 20 years have been to refocus on the Bay and the Maritime quarter. Without this approach to the revised Directive, the Council would have to publicly sign Swansea Bay as a failing beach with very obvious swimming prohibition signs and similar information on the Internet by 2016. Apart from these important concerns, there would also be the potential for infraction proceedings for the continued failure of Swansea Bay as a designated bathing water under the Directive.

2. Critically, this approach is very much in line with the fundamental ideas behind the World Health Organization recreational waters guidelines (WHO, 2003), which led to the revision of the bathing water Directive. It was considered likely by WHO, in preparing the 2003 Guidelines, that in many bathing waters, there would be various sources of faecal indicator organisms (FIOs) and it would not always be possible to eliminate all sources of pollution, through remedial engineering of sewerage infrastructure alone, thus, to guarantee compliance at all times. For some years in Scotland, the Scottish Environment Protection Agency (SEPA) has used predictive models, based on local river flow and rainfall data, to predict when a nearby bathing beach may fail and sign it accordingly. This type of 'black box' model approach has been promoted by the WHO and the EC principally in recognition of its potential to protect bathers from poor water quality during storm events. This is not a process based hydrodynamic model which can take many hours to days to complete a full complex simulation. The 'black box' approach examines statistical relationships between environmental predictor variables, based on real 'empirical' field data, allowing a sound prediction to be made quickly to

give the public an informed choice of whether to swim at that time or not. There have been some attempts to produce statistical models based on weekly compliance data and predictors such as, rainfall, river flow, wind and tide etc. These models generally produced low predictive power and early trials in Swansea confirmed this. Hence, it was felt by the Council and our partners that this approach required a better scientific foundation provided by a high quality dataset of both the FIOs in the bathing water and the various natural predictors.

3. The Interreg funded 'Smart coast' project in Swansea Bay delivered exactly what we had hoped for. From 2010 until this year, we have managed to develop a model that accurately predicts the excess risk of gastrointestinal illness (GI) from bathing in Swansea Bay. This uses the well-established epidemiology that underpins the Directive and WHO guidelines and uses as its threshold a 10% risk of GI, which is the same as the threshold for dropping into the Poor classification. This brings together the science behind the revised standards and the epidemiological research that underpins that work so that public health is protected and the regulator can apply the discounting rules to compliance samples taken at times when the beach is signed accordingly. Our partners included Dŵr Cymru-Welsh Water, Natural Resources Wales, Aberystwyth University, University College Dublin and Cardiff University. This project has been presented in detail to Welsh government, Defra, Public Health Wales, EA, SEPA and others and can be supported by fully documented reports (ref[1]). The selected model, which explained almost 80% of the variance in water quality, uses real-time environmental data, from meteorological and river gauging stations to drive the beach signage outcome.

4. The black box model used in Swansea Bay since the start of the bathing season 2013 has performed successfully and is principally driven by ultraviolet (UV) solar radiation and tidal height. The other parameters necessary to run the model, currently using an Excel workbook, include flow in the Clyne River, extraterrestrial radiation, two other river flows into the bay and wind speed. This model predicts intestinal enterococci (IE), which was selected rather than *E. coli*, as IE allows prediction of a GI risk outcome. Some observers may be surprised that rainfall was not a strong predictor of water quality. However, the detailed IE data collected for the modeling exercise did exhibit a strong diurnal pattern throughout the bathing season, consistent with solar radiation input (and observations at other sites world-wide which have been so intensively sampled). This pattern was also present regardless of other conditions (e.g. rainfall), producing a considerable variation in water quality within each day. It was clear that for discounting to work in a Bay as complex as Swansea, a rapid application black box type approach was essential. It is our intention to move from running the model manually three times a day, to an automatic system operating an electronic sign on an hourly basis, which will have two standard messages - one for good water quality and one advising against bathing. We intend the system to operate from

09.00 to 20:00 BST in the same way as SEPA.

It was always accepted by the Council that if the lagoon was consented there would be a period during construction when the black box model may become less accurate and would require re-calibration as soon as the lagoon construction was completed. Initially, the applicant indicated their willingness to fund that work, but our estimate of the fieldwork costs for re-calibrating only the black box model (probably £400k at 2017 prices) was unacceptable.

5. The Interreg project reports suggest that the application cannot claim that it is simply a question of removing more sewer misconnections or carrying out more capital improvements (7.4.2.6) and Swansea Bay will be compliant solely via the corresponding AMP programs (7.4.2.18). Indeed, at a meeting of the project partners and the water company's consultants it was agreed that using the predict and protect model approach to discounting was essential to achieve Directive compliance. It must be borne in mind that the Revised Directive 'Sufficient' classification is temporary and using the 'Black Box' approach to 'discounting' will be even more important as achieving 'Good' status in Swansea Bay will be a huge challenge. Chapter 7 describes the black box model as a statistical correlation although it incorrectly states it is not a predictive model. It is specifically developed to provide real-time prediction of faecal indicator concentrations and thereby, the excess risk of GI. It clearly cannot define causality as it is a statistical model, however the predictors in the model do demonstrate plausibility (e.g. solar radiation variables are inversely related to IE concentration). This does mean that it cannot attribute effects to sources (which it was not designed to do), but also that means that one should not assume that it will over predict after certain improvements or that it is more sensitive to these changes than to the construction of the lagoon (7.4.2.24). It is also worth noting that connectivity from riverine sources to the DSP suggested by the black-box prediction model has been confirmed by dedicated microbial tracer studies.

6. It is likely that a project as large as the tidal lagoon may change the offshore processes sufficiently to require a different set of predictors to run a black box model after construction. However, given the explanation of how it works, it is not sensible to try and second-guess how accurate it may be in the future after such a major change, or how many decades of natural change would require revalidation. What does seem probable is that it is not that sensitive to the infrastructure network improvements, given that the main predictors are fundamental natural processes affecting the survival of FIOs.

7. **It is the Council's position that unless there is a paradigm shift in the science around this subject, we would expect any consent for**

the tidal lagoon to require sufficient fieldwork (i.e. comparable to the presently available model calibration resource) to be undertaken so that a high quality predictive statistical model can be maintained with the same degree of explained variance as the current model.

8. For the sake of clarity, some further comments are needed on the issue raised in the application on the future use of hydrodynamic models around the lagoon. Clearly, given the variability of microbial concentrations on any given day in the bathing season and given the strong relationship with UV, it is misleading to suggest, as the applicant does in Chapter 7 of the environmental statement, that somehow after construction some version of a storm impact model can be modified to continue this function. This model uses multiple runs of a hydrodynamic model to provide a library of scenarios which can be used to simulate a given future state of weather and tides quickly, thus to drive water quality prediction at a site. However, it should be appreciated that the hydrodynamic model predictions are only as good as the calibration and validation data on which they are based. In the case of Swansea Bay, the previous hydrodynamic models have been very significantly improved by access to the uniquely rich model calibration data afforded by the Smart Coast Interreg project which were shared with Dwr Cymru and its modelling contractor at an early stage. The costs of this data acquisition exceeded £1.5m. However, even the best hydrodynamic models still have, as yet, not proven competent to simulate the diurnal variability in microbial concentrations observed at Swansea Bay's bathing water compliance site – although this is actively being investigated as part of the Interreg project.

9. It is likely and highly probable, that the proposed lagoon would significantly change the hydrodynamic behavior of water flows within Swansea bay. This would compromise the utility of any hydrodynamic model calibration data collected to date. Thus any future hydrodynamic model build needed to drive a Storm Impact modelling approach would need to replicate the extensive calibration data acquisition, paralleling the Smart Coast programme scope
and costs to ensure that the hydrodynamic model produced was equivalent to the present models produced for Dwr Cymru. If this was not done, and most importantly, appropriate funds not committed (i.e. it is likely that similar to the Smart Coasts £1.5m plus inflation would be needed),any hydrodynamic modelling used to underpin the storm impact approach would prove insufficiently precise in predicting faecal indicator organism concentrations at the Swansea Bay designated sampling point (DSP). Even then, there are significant difficulties in delivering any hydrodynamic model which could approach the 80% explained variance achieved by the existing black box model. However the Council are open minded and happy to use the best predictive system, post construction, but would need the decision to be based on a 'back to back' trial with a fully transparent analysis of the comparative statistical power of any future approach, undertaken by an independent expert. It should also be noted that the current approach was publicly funded and is 'open – source' whereas the 'storm impact model' would be a commercial product and may not be freely available on a daily basis to the Council or NRW.

ref 1

Statistical modelling of faecal indicator organisms at a marine bathing water site: results of an intensive study at Swansea Bay, UK

A report from the Interreg 4a Smart Coasts – Sustainable Communities Project

Mark D. Wyer[1], David Kay[1], Huw Morgan[2], Sam Naylor[2], Phil Govier[2], Simon Clark[2], John Watkins[1], Cheryl M. Davies[1], Carol Francis[1], Hamish Osborn[3] and Sarah Bennett[3]

August 2013

HM / SN 18.6.14

Head of Highways and Transportation

Tidal Lagoon, Swansea Bay, Swansea

Proposed application for development consent to construct a tidal lagoon for the purpose of generating renewable energy (consultation under Section 42 of the Planning Act 2008).

Onshore Transport Assessment

1. Introduction

The TA describes the assessment of the impact of the Project on the surrounding highway network, public transport, cycling and pedestrian amenities. It is based on an assessment of the interaction between future development-related movements and existing patterns of vehicular, pedestrian and cycle movements.

The outline construction programme (as discussed in more detail in other parts of the submitted document) anticipates construction starting in 2015 with the main construction phase lasting for about three years.

The first phase of the TA was the identification of sensitive receptors (i.e. locations that may be sensitive to changes in numbers of people or vehicle movements). The following sensitive receptors have been identified:

i. pedestrian and cyclists on the roads and footways leading to the site;
ii. motorised users on the local highway network;
iii. public transport facilities around the site.

The Institute of Environmental Management and Assessment (IEMA) recommends a detailed assessment for highway links where:

i. traffic flows will increase by more than 30% (or the number of heavy goods vehicles (HGVs) will increase by more than 30%); or
ii. specific environmental problems may occur (sensitive areas affected by traffic increases of at least 10%, unless there are significant changes in the composition of traffic).

Based on these guidelines, the geographical extent of the assessment was initially identified as incorporating Fabian Way from the Tawe Bridges junction to the junction with Baldwin's Crescent. Subsequently both CCSC and NPTCBC requested that the assessment should be extended to include all junctions on Fabian Way east to the A48/A483 junction after reviewing the PEIR, and this has accordingly been incorporated into this assessment.

The significance criteria for assessing the traffic and transport effects of the Project have been assessed. These significance criteria have been based on the IEMA guidance and the Department for Transport document ‘Guidance on Transport Assessment’ (2007). However, for a number of effects there are no ready thresholds of significance. In these cases, the thresholds of significance have been assessed through interpretation and professional judgement,

based on knowledge of the Project and study area and/or quantitative data, where available.

Impacts are assessed before and after mitigation, and are identified as either: I. adverse - meaning that they produce disbenefits in terms of transportation and access; II. negligible - meaning that there is no measurable effect; or III. beneficial - meaning that they produce benefits in terms of transportation and access. Where adverse or beneficial impacts have been identified these have been assessed against the following scale: 1) minor - slight, very short or highly localised impact of no significant consequence; 2) moderate - limited impact (by extent, duration or magnitude) which may be considered significant; and 3) major - considerable impact (by extent, duration or magnitude) of more than local significance or in breach of recognised acceptability, legislation, policy or standards.

2. Baseline conditions and study area

Highway Network: Fabian Way is an arterial road which forms part of the A483, connecting Swansea city centre with the M4 motorway at Junction 42. It is the main route into Swansea from the surrounding area and for traffic from further afield, and forms the principal object of study within the study area. The section of Fabian Way under consideration is approximately 7.6 km long and extends though the centre of Crymlyn Burrows and bridges the two unitary authorities of CCSC and NPTCBC. Fabian Way is a dual carriageway for its whole length in the study area. The speed limit is 30 mph between Swansea city centre and the junction with Port Tennant, after which the speed limit rises to 50 mph until the junction with Ffordd Amazon (Jersey Marine roundabout). The road is a standard, national speed limit, dual carriageway between Jersey Marine and the junction with the M4.

An extensive study has been undertaken on Fabian Way in order to prepare it for future traffic flows. A scheme has been prepared with a budget estimate of £25 million and all developments both in CCS and NPTBC that generate any traffic directly to Fabian Way are expected to contribute towards this sum of money on a pro-rata basis. NPTBC have undertaken calculations based on visitor numbers to Pembrey country park and arrived at a contribution of approximately £535,000. I have no reason to dispute this figure which will be used jointly between CCS and NPTBC to fund the more pressing elements of the proposed upgrade.

Public Transport: Bus services operate regularly in the vicinity of the site, with 11 services operating along Fabian Way, Elba Crescent or Baldwin's Crescent. All of these services start from Swansea Bus Station and travel between Swansea and various towns and villages to the east. Service 7 runs between Swansea Bus Station and Swansea Marina. The site can be accessed from bus stops at two locations. The first is on Fabian Way near the junction with Wern Terrace. These stops are approximately 3.7km from the western landfall, via Bevans Row and the new Lagoon access road. There is a pedestrian overbridge crossing Fabian Way providing access to the eastbound stop. The second location is near the SUBC, and is approximately

950m from the perimeter cycle and footpath that will run around the Project, approximately 3.3km from the western landfall, and is presently accessed from Fabian Way via Baldwin's Bridge.

Pedestrians and cyclists: There is a cycle path running along the southern side of Fabian Way between Kings Road and the junction with Port Tennant Road, which forms a section of both National Cycle Network route 4 (NCN 4) and the Swansea to Glyncorrwg Loop. NCN 4 provides links between Swansea, Neath, Briton Ferry, Port Talbot and several local villages. To the east of the Port Tennant junction the cycle path continues running adjacent to the southern side of Fabian Way and then crosses to the north via the pedestrian/cycle and bus bridge linking to the Park and Ride facility. The cycle path runs to the north of the Park & Ride site to Wern Terrace. It is then signed along a short section on Wern Terrace to the north side of Fabian Way, where is continues east to Baldwin's Crescent. NCN 4 is signed along Baldwin's Crescent and Elba Crescent until re-joining the north side of Fabian Way. It continues east to the Jersey Marine roundabout where it turns north to join Ffordd Amazon.

Rail: The existing rail sidings to the north of Fabian Way are still in use. Where the rail passes underneath Fabian Way it changes possession from Network Rail to ABP. The railway through the docks has not been in use for approximately eight years and would require refurbishment to be in a serviceable state. The railway lines within the docks also have some tight corners which may need upgrading to be usable by more modern rolling stock. The feasibility of using the rail sidings for import of construction materials has been considered and upgrade works would be required. For the purpose of the worst case assessment in this it has been assumed that those construction materials required which will not be transported by or sourced from the sea (e.g. sediment/gravel from seabed or rock armour and quarry run from Dean quarry) will reach the Project by road.

3. Baseline traffic flows

Information gathered during site visits has been used to establish baseline conditions in terms of the highway network, accessibility and public transport facilities. This data has been supplemented by information obtained from maps and documents published by various authorities, including NPTCBC and CCSC. 15.4.5.2 Baseline information on existing road traffic movements has been obtained from CCSC, and is based on turning count surveys and Automatic Traffic Counts (ATCs) undertaken in June 2010 and May 2012. Additional traffic counts were requested by CCSC and NPTCBC during a consultation meeting held on 9 October 2013. The purpose of the additional counts was to establish traffic flows at weekends, in order to assess the impact of traffic related to major sporting events that could be held at the Project. These additional counts were carried out in November 2013. In July 2013, ABP altered the location of their main port access from the Port Tennant Junction to the Baldwins Bridge Junction. The surveys undertaken in October 2013 represent conditions after the port access change. ATC (Automatic Traffic Counters) data was obtained from CCSC for a site located

on Fabian Way, close to the Baldwin's Bridge junction. Data for Monday to Friday is from a count undertaken in May 2012, and data for Saturday and Sunday is from a count undertaken in May 2013. Eastbound, westbound and two-way flow profiles were presented and can be summarised as follows:

Am peak (0800-900) Mon-Friday 1,477 (westbound) 791 (eastbound) total 2,268
Lunchtime peak (1100-1200) Saturday 1,207 (w/b) 991 (e/b) total 2,198
Lunchtime peak (1200-1300) Sunday 799 (w/b) 1,042 (e/b) total 1,841
Pm peak (1600-1700) Monday –Friday 1,105 (w/b) 1508 (e/b) total 2,612
Pm peak (1500-1600) Saturday 693 (w/b) 1,144 (e/b) total 1,837
Pm peak (1500-1600) Sunday 594 (w/b) 1,001 (e/b) total 1,595

In summary the peak weekday flow occurs between 16.00 and 17.00 and is 2,612 vehicles, on a Saturday between 11.00 and 12.00 and is 2,198 and finally on a Sunday between 12.00 and 13.00 which is 1,841 vehicles.

4. Assessment of impact.

The Project is intended to be of both functional and recreational benefit to the local and wider community and therefore public use of the Project. The principal purpose and function of the Project is as an electricity generating station. Two buildings are proposed which will be used by visitors: the Offshore Building which will comprise a visitor centre and O&M facilities and will be accessed along the western seawall; and the Western Landfall Building which will comprise a visitor orientation point, boating facilities, O&M facilities and a laboratory hatchery. In addition, extensive facilities for recreation are planned including a perimeter cycle and footpath around the Lagoon. The Project is expected to employ approximately 72 staff during its operational phase, comprising 21 O&M staff and 51 staff at the Visitor Centre. Key O&M staff will work a rota ensuring coverage at all times to support the operation and security of the Project. Visitor and staff car and cycle parking is included within the Project area.

The Project also makes provision for a shuttle bus service from the Park & Ride facility on Fabian Way, subject to investigation of its viability. No details have been provided as to the mechanism of how this may work, nor whether there is capacity in the existing Park and Ride to supplement parking for the Tidal Lagoon. In terms of visitor numbers, it is anticipated that the Project will attract some 70,000- 100,000 visitors a year, with national triathlon, swimming, sailing or running events occurring once or twice a year. These would be likely to attract between 2,000 and 8,000 visitors each. In preliminary discussions that have been held much larger visitor numbers were discussed (upto 1 million). These relatively conservative figures would have a bearing on the level of the project contribution to the Fabian Way Corridor works that are proposed as joint venture between CCS and NPTBC and also are not considered to be robust enough to give an idea on the level of traffic generated nor impact on the affected junctions.

In order to construct and operate the Project, different types of access will be needed at different times, namely:
i. construction phase - for staff, HGV deliveries and abnormal loads (if required); and
ii. operational phase - access at all times for O&M staff and emergency vehicles; local pedestrian, cycle and vehicular visitor access; visitor access from the wider area; and visitor access for major sporting events. 1

Vehicle access for both the construction and operational phases will be via the Fabian Way/Langdon Road/Park & Ride junction. At the roundabout to the south of this junction, traffic will turn east along Langdon Road. From the eastern end of Langdon Road, a new road to link to the south side of the Port and Queens Dock will be provided, as well as a new coastal access road extending to the western landfall of the Lagoon. From Langdon Road, the route will turn south and then east, running parallel to and immediately north of the existing port access road, before running to the boundary of the existing waste water treatment works (WWTW). From here, the existing Port road will be moved south and the Lagoon access road will continue past the entrance to the WWTW. Approximately 50m east of the entrance to the WWTW, the Lagoon access road will turn south, cross the Port access road by a priority junction, and extend west along the south of Queen's Dock. A new port security entrance will be created, and the existing security gate house will be relocated to the west of the Lagoon access road. Access to the Port will continue to be from Baldwin's Bridge junction.

Once the Lagoon access road has crossed the Port road, there will be a drop off point and turning area. This will allow pedestrians and cyclists to join the footpath and cycleway to the eastern landfall. The Lagoon access road will extend along the south side of Queen's Dock and utilise the alignment of the existing Port road. A new road will be constructed immediately to the north of the Lagoon access road, which will be separated by a secure fence this should ensure that existing movement through the Port is not significantly affected by the Project. A shared use path (SUP) of 3m width is also included for shared cycle/ pedestrian access. At its southern end the SUP will link directly to the circular SUP which runs on top of the proposed lagoon wall. Lagoon Traffic will be prevented from direct access to Baldwins Bridge to join Fabian Way.

As was previously mentioned there is the possibility of running a shuttle bus from the Fabian Way Park and Ride but no details or agreements are included to that effect. A jetty will be provided on the western bank of the River Tawe on the lagoon wall to facilitate a water shuttle serving the Project from the west bank of the River Tawe and/or Mumbles. Again no further details have been included.

5. Car/cycle parking

Car parking provision at the western landfall building will be as follows:

i. 304 spaces for visitors, including 33 disabled bays;
ii. 28 spaces for staff, including 5 disabled bays

Since access to the Offshore Building incorporating the visitor centre will be on foot or by a shuttle bus provided by TLSB, car parking provision at the Offshore Building will be as follows:

i. 27 spaces for staff, including 3 disabled bays.

Cycle parking for staff has been based on provision of one space per 10 employees, in line with CCSC parking standards.

There is expected to be a total of 73 staff (including Visitor Centre staff and O&M staff), and therefore 8 staff cycle parking spaces will be provided. For visitors, 100 cycle parking spaces will be provided. Cycle parking will be distributed across the site as follows:

1) Offshore building - 12 spaces;
2) Western arm - 30 spaces;
3) Western landfall - 56 spaces; and
4) Eastern landfall - 10 spaces.

6. Access impacts during the construction phase

Much of the construction phase transport movement will be marine-based, including delivery of rock and the construction of the Geotubes®, which will use locally derived sediment from the seabed or a combination of dredge gravels and imported quarry run. This will limit construction phase impacts on the local road network.

Working hours during the construction phase have not yet been finalised. However, it is likely that there will be continuous working during some phases of construction. In terms of impact on the local highway network, the key busiest periods are the AM and PM commuter peaks, typically 08:00-09:00 and 17:00-18:00. When work is carried out in shifts, the start and finish times generally do not coincide with the regular commuter peaks. To ensure that the assessment of the impact of construction traffic is conservative it has been assumed that construction staff will operate typical daytime hours. Working hours for construction projects are typically 08:00-18:00 on weekdays and 08:00-13:00 on Saturdays. However, for safety reasons, it is expected that staff will not be permitted to drive their own vehicles close to the Lagoon seawall. Instead, transport will be provided between the site compound and the work area. Therefore, it is expected that construction staff will be required to arrive at the site compound by 07:30 in the morning, which will allow 30 minutes for transport within the site. A suitably worded condition can be included to limit site deliveries to out of peak times.

Assumptions have been made regarding on site personnel during the construction phase after consultation with the Cardiff Business School. Annually, it is predicted that there will be 1,150 construction personnel. For the purpose of this assessment it is assumed that during the peak construction period the maximum number of employees on site is 600, comprising 200 contractor’s staff and 400 sub-contractors. In order to

estimate the number of staff cars and vans travelling to site the following assumptions regarding vehicle occupancy have been made:
Contractor's staff 1 person/car = 200 vehicles
Sub-contractors 2 people/car = 200 vehicles
Total = 400 vehicles

Predictions have been made regarding the origin of these construction phase staff and the results are as follows:

Swansea 25%
M4 (east) 25%
M4 (west) 20%
A48 (to Neath/Port Talbot) 10%
B4290 / A465 (via M4 J43) 20%
TOTAL 100%

This seems a reasonable assumption to make and would mean that 75% of staff (equating to 300 vehicles) would originate from the east, and would therefore travel west along Fabian Way into Swansea in the morning. It has been assumed that one third of these (or 100 vehicles) would arrive between 06:30-07:00, and two thirds (or 200 vehicles) would arrive between 07:00-07:30. In the evening the 300 vehicles would travel in the opposite direction between 18:00-19:00. It is planned to have the staff arriving on site outside the traditional morning peak time of 0800 to 0900, and also leaving outside the traditional evening peak of 1700 to 1800. The 0700 to 0800 hour will increase by 19% to 1,255 but will remain below the current am peak of 1,477 vehicles/hour between 0800 to 0900. Similarly the 1800 to 1900 peak will increase by 28% to 1366 but will still remain below the current peak flow of 1508 between 1600 and 1700. The arrangement of moving the staff outside of the peak times will result in a minimal impact on the current traditional peak hour flows.

It is anticipated that the main bulk material for the construction of the Lagoon seawall will be imported by sea as far as possible. The use of a concrete batching plant within the Port has also been proposed. However, some raw materials for concrete production, steel reinforcement, turbine components and other elements of the Project will have to be imported by road. It has been assumed that sand required for concrete production will be obtained via Swansea Port, and that concrete will be produced at an on-site batching plant, which means that these activities will not generate any HGV movements on the external road network. Based on these assumptions the maximum number of HGV deliveries using the local road network is expected to be 1,975/month. Based on a five and a half day working week, or 24 days in each month, this equates to an average of 82 deliveries per day. Assuming that deliveries are made between 08:00-18:00 this gives an average of 8 deliveries per hour, or 16 two-way trips. Even if the deliveries are restricted to outside of the peak hours (to minimise congestion on Fabian Way) of 08.00 to 09.00 and 17.00 to 18.00 then the resulting movements per hour would increase by 2 to 10 per hour, or by 4 to 20 two way flows.

As part of the requirements of the Construction Phase Traffic Management Plan which will be secured by Development Consent Obligation it is expected that all HGVs will be required to travel to and from the site via the M4 and Fabian Way. This is in order to avoid routing HGV traffic through Swansea city centre.

Overall Construction phase traffic will result in an increase of 2.6% on Fabian way east and 0.7% west. In terms of HGV's there will be an increase of 12% on Fabian Way. Whilst there is anticipated to be minimal impact during the traditional peak hours there will be increase both before the morning peak and after the evening peak. The overall impact is said to be a short term minor adverse impact on the local highway network and I concur with this statement.

In terms of the Fabian Way Corridor Study a financial contribution will be required from Tidal Lagoon, based upon average trips generated.

7. Assessment of impacts during operation.

A total of 21 staff will be associated with the operation and maintenance side (working 24 hours over shifts) whereas a total of 52 staff employed to service the visitor and recreational facilities.

The project will form a new focal point as a tourist attraction within the bay and therefore an assessment of the impact on leisure related traffic has been made. It is estimated that the project could attract 110 days of peak time (weekends march to October plus summer and Easter holidays) and 255 days of off peak times.

Using the figure of 100,000 visitors and assuming 50 visitors/day off peak then this equates to 12,750 visitors/year. This leaves a peak day averaging (100,000 – 12,750)/110 which equates to 793 visitors per day. Making the assumption that high season would attract upto 50% more visitors than an average peak day then this takes the figure upto 1,190 visitors per day.

Consulting the National TRICS Database for multi modal spilt it has been assumed that the following figures will apply (basing the figures on a leisure parks category):

Car driver 40%
Car passenger 40%
Walk 10%
Cycle 5%
Public transport 5%

This works out at 476 car driver, 476 car passenger, 119 walk, 60 cycle and 60 by public transport.

Referencing the 'marinas' category of TRICS a distribution chart was produced which included for the arrivals and departures of staff plus visitors. An assumed distribution of operational traffic was also made which included:

33% coming from Swansea,
30% from m4 east,
17% from M4 west,
10% from NPTBC via the a48, and
10% Coming from junction 43 (A465).

In summary approximately 2/3 of the flows will be coming from the east, a total of 661 two way trips/ day.

Given that the peak events are likely to take place on the weekend then the combined flows still equate to less than the traditional weekday peak flows in both the morning and the evening. Major events are catered for separately, see point 8 below.

8. Major events

The lagoon will be capable of holding major sailing events and these may attract upto 8000 spectators per day. They would be one off events occurring several times per year and special measures would be put in place to manage vehicle and spectator movements. A framework major events travel plan will be supplied prior to any event taking place in joint consultation with NPTBC and CCS.

An additional traffic survey was undertaken on a Saturday in November 2013 (between 08.00 and 17.00) to determine traffic flows at 8 key junctions along Fabian Way.

The peak hour was subsequently identified as 12.00 to 13.00.

Major sporting events will require temporary measures to manage traffic movements including the provision of off-site parking and shuttle buses to the site. The location of the off-site parking has not been established as yet but assumptions have been made about distribution of the traffic. The modal spilt for traffic has been assumed along the same lines as that on an operational day but with a higher proportion of public transport and car sharing due to the fact that car parking will not be available at the site.

Assuming 8000 visitors for a major event this equates to
Car driver 2,400
Car passenger 3,600
Walk 400
Cycle 400
Public transport 1200.

A statement has been made that there will be no spectator parking at site and that all visitors will park off site and be bussed in. This will be covered by the Major Events Travel Plan. A number of options are being considered regarding shuttle bus locations but it is likely that 45% of visitor traffic will travel along Fabian Way. The peak hour for car trips is anticipated to be between 15.00 and 16.00 which provides 552 two way movements (based on

2400 cars (4800 two way flows) over the day). As a worst case scenario, and to provide a robust assessment this flow has been added to the current peak flow between 12.00 and 13.00. There will also be a demand from visitors needing transport to the project from Swansea city centre of prom any temporary park and ride site. It is envisaged that 20 shuttle buses per hour will be required to cater for this need.

Construction works are expected to be completed by the beginning of 2019 and the traffic flows have been factored to take into account this time difference.

Junction assessment results were undertaken using Linsig and the traffic signal information was obtained from CCS. A total of eight junctions were tested and the majority were well within the theoretical capacity even up until 2018 with event traffic. Some of the junctions were in excess of 90% of the degree of saturation but still within capacity.

Summary of impacts during operational phase.

‘The normal weekday operation of the project will not have an unacceptable impact on local transport network. Leisure use at the site will be a greatest at weekends and therefore does not coincide with the weekday peak flows experienced on the highway network. Impact at weekends and in holiday periods is not expected to be significant.’

Having consulted with CCS Telematics they are concerned regarding this statement and dispute this claim. Traffic flows in the summer holidays at weekends and lunchtimes can be in excess of the a.m. and p.m. peaks of a normal working week and hence severe congestion may arise. As some of the junctions are approaching capacity already this could result in unacceptable congestion and delays being experienced. A solution could be to install an Automatic Traffic Counter at a location to be agreed which would provide daily vehicular movements to the site. A cycle ATC could also be included for completeness and in order to measure cycle daily flows adjacent to the vehicular access. If the car flows measured are in excess of those expected than a financial penalty could be imposed, firstly to sort out any arising issues with the signals/junctions and secondly to increase the contribution made towards the Fabian Way Corridor Study.

Similarly patronage on the bus network will also occur when the background levels are not at their highest so impact on public transport is expected to be acceptable.

The project will include enhancements to the pedestrian and cycle ways in the port area and will provide new links along the waterfront. A shared use cycle/ pedestrian route is proposed alongside the new vehicular access and this will link to the Swansea University Bay Campus.

Due regard has also been taken of all the relevant committed development in the area of CCS and NPTBC.

9. Mitigation measures.

- A detailed construction Management Plan will be prepared by the contractor and submitted to CCS and NPTBC for approval prior to any works commencing on site.
- All construction traffic will be closely controlled. Vehicles entering/leaving the site will travel via designated routes to be agreed with CCS and NPTBC.
- Deliveries will be phased on a 'just in time' basis to minimize travel and congestion**. I propose to also suggest limiting deliveries to outside the peak hours of 0800 to 0900 and 1700 to 1800 in the interest of the freeflow of traffic in the area.**
- A safe site access strategy will be agreed with the relevant bodies including the access and egress of construction traffic to minimize the impact on the highway.
- Construction staff will be encouraged to travel by sustainable means. Parking within the car park will be managed to prevent overspill parking on the surrounding side roads.
- Pedestrian access to the site will be segregated with clear signage to maintain the safety of the project and the general public.
- A detailed operational phase travel plan will be prepared and submitted to CCS and NPTBC for approval prior to any public visitors going to the site. The travel plan will include initiatives to encourage the use of sustainable modes of transport including the promotion of walking, cycling and public transport.
- A travel plan co-ordinator will be appointed, whose role will be set out in the travel plan.
- A separate major events travel plan will also be proposed and will be submitted to CCS and NPTBC. This will cover:
    - Definition of what constitutes a major event.
    - Expected numbers of competitors and spectators and mode of transport.
    - Management of vehicular and pedestrian access including off-site parking, park and ride, drop off and pick up arrangements.
    - Any temporary road closures or traffic management required.
    - Car and coach parking arrangements.
    - Details of any police liaison.
    - Access signage and advertising strategy.

10. Conclusions

An assessment of the potential impacts to onshore traffic and transport resulting from the project has been undertaken. The baseline environment was examined in relation to the surrounding highway network, public transport, cycling and pedestrian facilities. The assessment then considered the interaction between future development related movements and the baseline environment.

The site is accessible by a number of alternative options. There is no public access to the port of Swansea currently. Public transport runs along Fabian Way as does the National Cycle Network. There is a park and ride also located on Fabian Way but that only runs directly into Swansea City Centre. There is no feasible railway link at present to the site.

The implementation of the Construction Phase Travel Plan will include an access strategy for the project which will help minimize the impact of construction on all modes of transport. HGV movements will be timed to avoid peak hours **but I consider that a condition is put in to this effect**. The impact on the local highway network is predicted to be of minor adverse impact (from the assessment) **however due to concerns regarding traffic in the summer holidays , possibly more in the operational phase but likely in the construction phase also (as mentioned above in point 8 above: Major events) we feel that the development has the potential to place increased demand on the affected junctions and roundabouts, and also on the flow on Fabian Way. Traffic in excess of that predicted will generate financial penalties which can be used to try to alter the traffic signals to improve flows, and also to put additional funds into the Fabian way Corridor Study proposed series of works, over and above those already identified as being required due to the expected traffic flows predicted. A way of monitoring this is to lay down at ATC at a location to be agreed which will pick up all flows. If the results show flows in excess of those predicted then there will be cost implications for the project. The level of costs can be agreed at a later date.**

Whilst the impacts on the local highway network are expected to be negligible during normal day to day use and also during weekends and holiday periods we do have concerns that the flows may be in excess of those previously referred to in general. The major Events Travel Plan will attempt to minimise impact on all modes of transport and will be planned well in advance. Through the suggested measures it is hoped that impacts on the local highway network can be minimised.

11. Recommendations

I recommend that no highway objections are raised to the proposal subject to:
1. No deliveries to be received on site (via on shore methods) between 0800 and 0900, and 1700 and 1800 in the interests of the free-flow of traffic along Fabian way.
2. The installation of an ATC (Automatic Traffic counter) at a site, the exact location to be agreed with the LPA in order to monitor ongoing traffic flows within the site.
3. The development of a financial penalty scale dependent on the levels of vehicular traffic over and above that predicted . The monies to be used to fund traffic signals alterations (if required), and to contribute

and appropriate sum to the Fabian Way Corridor Study scheme already identified. Details to be agreed at a later date.
4. The nomination of a Travel Plan Co-ordinator within three months of the date of this consent.
5. The Construction Phase Travel Plan/Operational Travel Plan/Major Event Travel Plan to be developed in conjunction with the relevant affected bodies.
6. The payment of a sum to be agreed towards the Fabian Way Corridor study works, as per NPTBC committee report circa £535,000 towards improvement works on Fabian Way.
7. All the infrastructure works, vehicular access, shared use pedestrian/cycle path will need to be undertaken to Local Authority Standards and Specification.
8. Any off site car parks/park and rides will be the subject of separate planning applications.
9. Adequate cycle parking to be provided in accordance with details to be submitted for approval.
10. Adequate car parking layout to be laid out in accordance with details to be submitted for approval.

Tidal Lagoon Swansea Bay
Environmental Statement

Economic Development Assessment

Content and Methodology

1. An Economic Development Assessment of Tidal Lagoon Swansea Bay's Preliminary Environmental Information Report in August 2013 concluded that: -
   "…the Project is likely to have an overall positive impact on the study area economy, albeit a minor impact over the long term. Further assessment at the EIA stage is welcome, particularly if it reveals: -
   - The estimated economic impact/value of the Onshore and Offshore Project outputs;
   - Details of the occupational/ professional employment profile at the construction phase;
   - The procurement strategy and how opportunities for local procurement will be maximised;
   - How community benefits will be delivered (e.g. Community Fund, Share Offer, Cheaper Electricity and any other benefits);
   - The impact on tourism, recreational users, the Marinas, surfers and water quality, and details of any mitigation measures to minimise potential negative impacts."

2. This second (updated) Economic Development Assessment focuses on TLSB's Environmental Statement and specifically on Chapter 22 Economy, Tourism and Recreation and Appendix 22.1 Turning Tide etc., which provides an assessment of the Tidal Lagoon Swansea Bay project conducted by Welsh Economy Research Unit at Cardiff Business School. The CBS assessment employs an established input output model for estimating the economic impact of the construction and operation of the Tidal Lagoon.

Impacts

3. Economic Impact/Value

   The Cardiff Business School assessment (Appendix 22.1) estimates the value of the **three year construction phase** from 2015 **to Wales** at: -
   - £454 million of additional output;
   - £173 million Gross Value Added (GVA); and
   - 5,540 person years of employment (or 1,847 full time equivalent jobs per annum).

   The value of the **operational phase per annum** is estimated to be: -
   - £5.2 million of additional output;
   - £2.2 million GVA; and
   - 60 full time equivalent jobs.

The equivalent estimates for Swansea Bay (the geographical assessment area) are not provided.

4. Employment

During the construction phase, the following employment profile **across Wales** is envisaged: -

Sector	Average Annual Employment (person years)
Manufacturing and Production	387
Construction	1,150
Distribution, Retail and Hospitality	97
Transport and Communications	33
Financial and Professional Services	157
Other	23
Total	**1,847**

Construction phase occupational/professional profiles are not specified so it is not possible to assess the value profile of these jobs.

Additional information on operational employment is provided by the TLSB Project Team in Chapter 22 of the Statement. Together with leakage, displacement, multiplier effects and deadweight, the total net employment from the operation phase is estimated to 57 jobs, which corresponds to the overview of operational employment proposed by the Welsh Economy Research Unit of 60 full-time equivalent jobs referred to in paragraph 3 above..

5. Procurement

A procurement strategy is under development with a commitment to focus on maximising local procurement in partnership with Welsh Government, CCS, NPTCBC and others, encompassing employment, supply and manufacture, training and up-skilling the workforce and creating opportunities for the long-term unemployed.

Appendix 22.1 Economic Significance study states that “Historically renewables projects in Wales (at commercial scale, particularly on shore and off shore wind) have fairly limited local economic effects during development because the highest value components, and elements of specialist professional services tend to be sourced outside of the UK…

(However)…In this respect Tidal Lagoon Swansea Bay could offer the opportunity for a more sustained economic impact with the innovative project placed in a more industrial part of Wales and with a supply side background in metal goods and structures, and construction engineering which could feed into the project…”

6. Community benefits

An art & science study project is ongoing in collaboration with Swansea University, University of Wales Trinity St David (specifically Swansea Metropolitan University) and The Low Carbon Research Institute to consider the potential impacts the proposed tidal lagoon development will have on the local community and beyond. In addition, the Project will support the development and production of high quality public art projects and TLSB has established three programmes to progress the public art research and development phase in respect of the project.

TLSB has created an education programme 'TLSB Education Programme and Resource' to help young people develop their skills, knowledge and understanding of global climate change and renewable energy.

As part of the development of the Project, links with the local educational community will be developed to progress plans for how the Project can best benefit Swansea Bay and the surrounding areas. The key themes TLSB is working on are: -

- Science, Engineering, Energy and Enterprise;
- Arts, Culture and Heritage; and
- Skills, Training and Employability.

Links are also being established with organisations/initiatives: Regional Learning Partnership; NSA Afan Community Regeneration; Jobs Growth Wales Internships; undergraduate/Post Graduate research; EU Leonardo or Erasmus placements, alongside year-in-industry placements; and future opportunities with Beyond Bricks and Mortar, Workways and the Sector Skills Councils

Appendix 22.1 states that "The project also offers an element of community ownership through a share offer which will seek to give preference to those living in the immediate vicinity of the project", although this is not detailed in Chapter 22.

7. Tourism and Recreation

A variety of opportunities are described in the Statement to enhance recreation and tourism (such as the visitor centre, fishing, walking, cycling and watersports). Initial TLSB estimates suggest that between approximately 70,000 to 100,000 people could visit the Project each year, generating visitor spend to support between 65 and 90 full time equivalent jobs per annum.

A small improvement in water quality is assessed, and wave conditions are not considered to affect surfing conditions. The project is also considered to have a beneficial effect on fish biodiversity, of benefit to recreational fishing.

Facilities to allow provision of a “water shuttle” are also proposed between the Project and the western bank of the Tawe.

8. Other benefits

A number of other projects are planned in the vicinity where there may be potential positive cumulative or in-combination socio-economic impacts, including: -

- Swansea University Science and Innovation Campus (in terms of education);
- Mumbles Pier etc. redevelopment (tourism);
- SA1 development (not specified);
- Port Talbot Harbour redevelopment (no information currently available);
- Porthcawl regeneration scheme (tourism);
- Mumbles Oyster project (employment diversification);
- Prenergy Biomass Power Station, Port Talbot - 350 MW wood chip fuelled thermal generating station;
- Abernedd Power Station (granted conditional approval by DECC on the 23 February 2011 for construction of a 870MW gas fired combined cycle gas turbine power plant.);
- The Swansea Bay (Thomas Shellfish Limited) Mussel Fishery Order.

Two options for decommissioning are outlined – continuous operation and removal of turbines and sluice gates: -

- Continuous operation would result in operational impacts being sustained;
- If the turbines and sluice gates are removed, options for maintaining the continued use of the lagoon for recreation would be considered, including creating an inter-tidal mudflat and saltmarsh area with potential ecological benefits.

Consideration

9. The Statement assesses the project will be beneficial to employment (construction “major, short term”; operation “minor, long-term), mariculture (“moderate, long term”), tourism (“minor long term”), recreation (“moderate, long term”) and education/arts (“minor, long term”).

The Environmental Statement’s analysis of the Policy Context and its methodology for assessing impacts are relevant and appropriate. It identifies the key socio-economic impacts and its evaluation is reasonable, although some of the estimated economic impacts are for Wales and not specifically Swansea Bay. It is evident that the project will have a significant socio-economic impact during the construction phase with wider, more modest impacts secured for the long term.

Some further information on: -

- The estimated employment impact in Swansea Bay (the geographical assessment area), and what the occupational/ professional employment profile is likely to be; and
- The share offer and any other economic (e.g. a Community Fund, cheaper electricity tariffs) and community benefits TLSB plc and its on-going art and science study are examining

would be welcome.

Comments on the Sustainability Impacts of the Proposed Swansea Bay Tidal Lagoon

The City and County of Swansea defines sustainable development as:

"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" and has an adopted Sustainable Development Policy (Sustainable Development Policy - City and County of Swansea).

The Policy contains a Vision for a sustainable Swansea that is “inclusive and safe and provides an excellent start to life. A county that supports a prosperous and resilient economy, recognises and benefits fully from its exceptional environment and promotes good health” and identifies seven priority areas:

i. Sustainable use of natural resources
ii. Climate change/decarbonisation
iii. Economic resilience
iv. Procurement
v. Social inclusion
vi. Natural Environment
vii. Governance

These comments on the Planning Application and Environmental Statement for the Tidal Lagoon Swansea Bay (TLSB) proposal is based upon the impact the proposal will have on the aims and priority areas within this policy. Any comments made by us at this juncture are purely observational based on the information presented and may vary, should new / additional information be forthcoming at any stage in the future.

Sustainable Use of Natural Resources

If built as per the project description, the TLSB Proposal will make a significant contribution to renewable electricity generation, using a natural resource in a sustainable way.

Renewable energy installations, by their nature, are likely to have a lower installed capacity as compared to large scale power generation stations using thermal energy from fossil or nuclear fuels to produce electricity. Whilst it is unlikely that this scheme in itself will result in a reduction in electrical output from fossil fuelled power stations, it will help the UK build resilience into its aging energy infrastructure, which is facing a significant reduction in the number of operating fossil fuel and nuclear power stations in the foreseeable future. The scheme will also have the potential to help the UK to reduce its reliance on imported energy which currently stands at 43%[1] and is on an upward trend.

[1] DUKES 2013

The development of power generation infrastructure locally that is able to supply intergenerational production of electricity has the potential to provide long term energy resilience into the region.

Climate change/decarbonisation

At this present time, the proposal will make some but limited impact in terms of climate change mitigation at a local level as the electricity will be distributed via the National Grid for distribution. Whilst there will be no direct local benefit but there will be indirect benefit to the de-carbonising the supply of electricity and supporting the UK and Welsh Governments meet their renewable energy targets.

At a national level the impact on climate change mitigation is less significant as compared to other renewable energy technologies at this time, for example solar photovoltaic. However if this scheme proves the concept then the Tidal Lagoon Swansea Bay could be the gateway to larger tidal lagoon projects which would have a much greater national impact.

However the ES is still unclear about what contribution the development of a tidal lagoon in Swansea Bay will have in building or undermining resilience to climate change in the future. The ES considered a UKCP09 medium emissions scenario when looking at the impact of climate change on coastal processes. The Council's report on the changes to coastal process suggests that the changes will increase the risk of tidal flooding, albeit small, under these conditions. However evidence from the IPCC and other sources suggests that a high emissions scenario is also a likely outcome at this point in time, due to the uncertainty about the path of global economic development and the global response to climate change mitigation. When considering the worse case scenario we would have expected the ES to look at the impact of a high emissions scenario (SRES A1FI) as well and the cumulative impact on wave height and other coastal processes.

The lack of a direct access for pedestrians and bicycles over the river from Swansea City Centre is disappointing and reduces the options for visitors to lagoon to use sustainable forms of transport.

Economic Resilience & Procurement

As is the nature of large scale energy projects, the financial value of the project comes from the selling and export of energy to National Grid. It is usual that the income generated from the energy sales will primarily go to pay off loans to investors and dividends to the shareholders. The applicant ran a local share offer and subsequent share offers will help build local ownership, but the impact of this is going to be limited and only to those who can afford to buy shares. It must be remembered that at this point such investment comes with significant risk and the long term benefits of such investments may not be realised.

DECC recognises the value of that owning or co-owning renewable energy developments, communities can have a real stake in, and share in the profits of, energy generation in their local area that encourages joint venture/partnership working between

developers and communities. There are other models of community ownership schemes, where the developer provides a shareholding in the renewable enterprise as a community benefit, which can be supplemented by local communities investing further as a community energy enterprise. If the level of confidence in the scheme is such that it will successful, then this approach could offer a more reliable and sustainable form of income to support economic development in the area.

Since it is unlikely that there will be significant local ownership, to build resilience locally, the short term economic value to the Swansea Bay Region will be in the supply chain for the development of the lagoon in the short term. In the long term will be in the potential to supply goods and services for future lagoons, as the direct employment by the lagoon for operation and maintenance is limited. The commitment to a local employment scheme in the draft Development Consent Order (DCO) and a strategy to support local procurement of goods and services is welcome as this helps local businesses and people take advantage of the opportunity presented by the development, especially if these strategies include training and business development support in the pipeline stages to address the issue of paucity of supply identified in Appendix 22.1.

In addition to direct economic benefits through employment and supply, the applicant has outlined potential indirect benefits for the tourism and recreation sector, through the creation of new infrastructure and a destination. This has focused on the construction of new public realm, water shuttle jetty, on shore and off shore visitor facilities that may include a hatchery, laboratory facilities and a sailing/boating centre. Appendix 22.1 also identifies the potential to attract additional visitors to eight national sporting events a year, although does not provide evidence about how this figure was determined.

However the applicant does not provide information about how these facilities will be managed and run once they have been constructed and there is no evidence provided by the applicant of the viability of such facilities and business opportunities. Appendix 22.1 identifies a list of visitor attractions to demonstrate the potential for increased visitor numbers. However all these examples require significant public sector subsidy, without which they are financially unsustainable. Without this supporting evidence that there is a sustainable business case for the new facilities there is a risk that this infrastructure will be redundant, or need substantial public monies to remain viable.

Social Inclusion

"Social Inclusion" is a broad term describing the kind of "wealth" which comes from being able to play a full and active part in society – such as having access to good work, training or educational opportunities, as well as other factors such as sound health, a secure home and finances, and having a fulfilling social life. Poverty and poor health, symptoms of social exclusion, are significant sustainability issues for Swansea. There is a strong correlation between the two, so developments that are able to maximise access to opportunities that improve health and well-being to those who face disadvantage will have a positive impact on social inclusion.

However the lack of access via a bridge from the west side of the river Tawe is a significant barrier to those who do not have access to a car. There is no guarantee at this stage that either the water taxi across the river or the shuttle bus will be viable, and any charge will be an additional barrier to those with low incomes. In addition, those wanting to visit the lagoon using public transport are currently not able to catch a bus directly to the park and ride from the City Centre due to the way the park and ride buses are currently operated.

Whilst not a planning obligation yet, the concept of community benefits stems from the renewable wind power industry, focusing on how communities can have more of a say over, and receive greater economic and wider social benefits from on-shore wind power. The UK Government[2] is proposing to introduce legislation making it compulsory for developers to consult local communities before submitting planning applications for more significant onshore wind applications in England with expectations of the wind power industry to enhance community benefits, improve local economic impacts and increase community ownership. Similar actions are proposed for nuclear power and gas-fracking industries. No such guidance currently exists for tidal range power due to the immaturity of the industry in the UK and the lack of any comparator developments so it is our position that it is appropriate to use such guidance as a benchmark.

In the PEIR there were proposals for a local energy tariff, a community fund and a local share offer. References to both these have been removed from the Environmental Statement. The Applicant's document titled 'Notes on the rationale for draft s106' clarifies the Applicant's position on these two proposals. TLSB are still committed to a local energy tariff but have limited this to 20,000 households in the Swansea, Neath Port Talbot area. There is currently no detail on how the tariff will be allocated to households. Targeting household that are fuel poor or households that are most disadvantaged would support the Council's objectives to address poverty. However the document suggests that the fund will be limited to a specific period of time that is relatively short in comparison to the time that the development will be operational. If this is the case then the benefit from this offer will be limited. There are no comparisons to how similar savings might be achieved in other more sustainable ways that have a longer term benefit, such as investment in energy efficiency initiatives or through collective purchasing of energy- where householders procure energy through bulk purchase, gaining savings through economies of scale.

TLSB are no longer proposing to provide a community fund arguing that the proposed on-site facilities (public realm, on-shore visitors facilities, hatchery etc) along with a range of 'off-site' benefits accords with the consultees' ambitions for the project. However it is not clear from the evidence presented in Volume 5 of the ES why some benefits are deemed to outweigh the benefits of a community fund. No direct question was asked of the local community about a community fund, only about the value to them of "Benefits to the community (e.g. grants to community projects)".

In their analysis of this element of the consultation responses, TLSB state

[2] "Onshore Wind Call For Evidence – Government Response" DECC June 2013

"In simple terms, this indicates that all of the potential benefits of the proposed lagoon were regarded as important by all respondents, with little to choose between them"[3]

Much of detail of project was not available at that time and there have been some significant changes to the project such the inability to secure a pedestrian and cycle link to the western sea wall to allow greater access to the project. There was no detail at the time of consultation regarding the scale of the community fund and what it could be used for. In comparison, the on-shore wind power industry is now proposing community funds based on a figure of £5,000 per MW per annum. The UK Government is consulting on a fund of £1000 per MW per annum for new nuclear, where the energy outputs are that much greater.

The Applicant has also states that another reason why a community benefit fund was discounted was due to budgetary constraints, a fund could only be considered after approximately 30 years. This position is different from other energy developments where it is expected that community funds are payable for the operational lifetime of the development. It is also anticipated that after the operational lifetime of such energy developments the infrastructure is then removed. This is not the case with the tidal lagoon proposal where local people will be impacted by the project in perpetuity.

A Community Benefits Fund, running the lifetime of the project, has the potential to support social inclusion initiatives, support the development of social enterprises through seed funding and provides an element of local control on how that benefit is allocated to meet local needs. Of all the community benefits proposed it is the one with least risk associated for local communities and it is of my opinion that the Applicant has not provided enough evidence to show why it has been discounted and why other benefits are seen to have greater value for local people.

The provision of a local employment scheme has the potential to support social inclusion in the year. This will be limited to the availability of appropriate skills and expertise. Appendix 22.1 suggests that there is paucity in the locality. It would be beneficial if there was a pro-active training strategy for local people in advance of the build to maximise this benefit, especially if this targets those people facing the most disadvantage. This impact is limited by the construction timescale of the lagoon but will help local people develop skills that could be used elsewhere in the construction industry or in the building of future lagoons.

Of the remaining community provisions, these would appear to benefit the developer as much as or even more so than the community and would have little impact on social inclusion in the area.

[3] (p1-16 Chapter 9, Volume5 of the ES)

Natural Environment

The impact directly on the Natural Environment has been commented on by colleagues in other departments of the Council and NRW.

Governance
The scheme will have little impact on governance in the region.

Additional comments

The Applicant suggests that the development will provide benefit through the creation of freely accessible public realm. The benefit to local people will be limited due to the inaccessibility of the project from the western landfall of the sea wall and controls put in regarding the sea wall and the compounded water. These limitations will be exacerbated in the winter months due to the short day length. Whilst the restriction of access during periods extreme weather it would be useful to understand why access during hours of darkness has to be controlled. There are useful benefits, especially to anglers, for night-time access that cannot be realised under current proposals. Access to the sea wall along side the Tawe Barrage does not have similar constraints.

Whilst the provision of walking and cycling provision along the sea wall is positive, it must be considered in conjunction with the visual impact on the promenade and the cycle route, which is considered by the Council to be adverse, and the potential for increase of blown sand on the promenade creating difficulties of access to cyclists and pedestrians.

Elements of the project do support the long term resilience for Swansea, however there are aspects of the project that do not fully mitigate some of the adverse impacts. The high uncertainty of the long term impacts on coastal processes and the wider potential social, economic and environmental negative impacts is still cause for concern.

Tidal Lagoon Swansea Bay

Tourism comments – submitted 23.04.2014

From a tourism perspective, it is important that the TLSB project links to 'Destination Swansea Bay 2013-2016', the official Destination Management Plan for Swansea Bay. This strategic document states clear development and marketing priorities for the next three years. Planned projects are done so in the knowledge that they link to the overall development of the destination to help achieve its aspirations to be a world class visitor destination by 2020.

Projects, like the Tidal lagoon, not identified in the plan but which come forward during its implementation, are done so on the basis that they have the potential to make significant contributions to the stated aims. In particular the Tidal Lagoon appears to be able to;

- Provide Swansea Bay and Wales with a unique 'maritime-themed' visitor attraction – this might help provide Swansea with a real sense of distinctiveness over other coastal locations. In effect, this project could attract a new type of visitor, a major stated aim of the DMP.
- Contribute towards a more visually appealing gateway to the city from the sea and the highway.
- Provide a visitor centre in a seascape setting which can be enjoyed in all weather conditions.
- Create a new USP (Unique Selling Point) to include in destination marketing activity for the area.
- Meet the needs of our current visitor demographic – mainly interested in scenery/landscape, walking and watersports.
- Complement the existing Swansea Bay watersports projects including the 'Watersports Centre of Excellence' capital projects achieved in the Marina, St Helen's and at Knab Rock and build on this even further with more actual reasons to visit.
- Provide the infrastructure to potentially stage major events in the area at international and national levels regardless of any tidal restrictions that currently exist due to the difference between very high and low water levels.
- Have the potential to act as a catalyst to either encourage further tourism investment – e.g. accommodation, additional attractions, etc. or fill some of the spare capacity of bedspaces during shoulder season
- Generate employment opportunities both at construction stage and post completion (linking with Beyond Bricks and Mortar scheme).
- Combat seasonality challenges by relieving pressure from Gower in busy summer period for water based recreational activities.

- Improve the offer within the destination for watersports related training and recreational activities (sailing, rowing etc.)
- Encourage sustainability by rejuvenating bio-diversity / marine eco-systems, therefore promoting local produce (oysters, lobsters, samphire) and Welsh heritage. This in turn could help support the increased demand for and expectation of locally sourced seafood products as part of the important food product for visitors.

However, we are aware that a number of real concerns have been raised in relation to:

- **Water quality in the Lagoon** if the discharge pipe cannot be moved / extended. Poor water quality would build a negative reputation of the Lagoon as a major tourist attraction and fail to attract watersports events – as well as being detrimental to the marine eco-systems.

- **The size of the Lagoon** and the fact that it is taking up such a large portion of Swansea Bay – the bay may lose its appeal for activities such as sailing and windsurfing as area of 'calm' bay water would be greatly reduced. Potential displacement of business from other Watersports facilities recently in receipt of public funding.

- **'Bottleneck effect'** at entrance of Port/Marina – access would be limited during construction and may lead to drop in Marina occupancy level. Access to port would also be affected during construction and may have an effect on potential cruiseship visits. Once complete the Lagoon would represent an attraction but could also be seen as making access to port and Marina more difficult and more risky, particularly for large ships. Proposed water ferry service from Marina to Lagoon would increase 'bottleneck' effect in this busy area.

- **Access to Lagoon** – no direct link with City and SA1 other than proposed water ferry service. No bridge planned. Visitors would have to drive through port to access Lagoon. Missed opportunity to link the Lagoon to Swansea as a 'Waterfront City'.

Some aspects which we felt needed further information / clarification related to;

- Level of noise affecting existing leisure and recreational businesses on SA1
- Impact of sand levels at other Swansea Bay beaches as a result of the development

- Impact on any other tourism sectors e.g. cruise market and port access and what impact this might have on our potential to encourage cruise ships .
- Business plan measures of success – clearly payback into the local grid system is one, but we would be keen to have more information about the marketing strategy and targets for visitor numbers and expenditure
- The role and management of the visitor centre, experience from other alternative energy projects which have included visitor centres as community payback haven't been sustainable, although there are some good ones on the east coast of England
- Parking provision at peak times and during major events
- Pricing structure and policy

Jenkins, Hayley

From: Jones, Richard (Planning)
Sent: 26 June 2014 21:11
To: Jenkins, Hayley
Subject: FW: Lagoon Concerns - Swansdea Marina

From: Kern, Steve
Sent: 24 April 2014 11:58
To: Jones, Richard (Planning)
Cc: Morgan, Huw
Subject: Lagoon Concerns - Swansdea Marina

Marina Manager Comments

Acquisition of Water Space / Land Below Tawe Barrage, Including Loading / Unloading Pontoon

Current proposals suggest that water space and land immediately below the Tawe Barrage are to be acquired for the scheme. This is the only entry / exit point to Swansea Marina and losing control of this area could mean enforced closures of the Marina, leading to possible breach of contract with our customers.

The loading / unloading pontoon immediately below the Tawe Barrage was fully grant funded with the intention of it being used for local water sport activities, including loading / unloading for charter vessels and sea schools, and general use by marina users. Acquisition of this piece of infrastructure by the scheme could lead to CCS being required to repay the grant that funded it.

Shuttle Ferry Service

During peak times, in excess of 50 pleasure and commercial craft may be waiting below the Tawe Barrage to lock in. The navigable channel leading up to the Tawe Lock is narrow and negotiating the waiting craft could be problematic in both directions, particularly during certain tidal conditions. This would almost certainly lead to delays for customers who are paying a not inconsiderable amount of money to berth their boat in Swansea and use the Tawe Lock.

There are sometimes significant flows from the lock and penstock systems during operation during certain tidal conditions, which could lead to us being asked to suspend operations during times when the Shuttle Ferry is manoeuvring. If this were to happen, it would negatively impact customer waiting times.

Siltation – Impounded Waters, River Tawe Estuary Channel and Swansea Bay

There are concerns that siltation may increase in the impounded waters, the estuary channel and Swansea Bay in general. Any significant changes in siltation as a result of the scheme, particularly with the impounded waters or the estuary channel leading to the Barrage, could lead to a general perception that Swansea is a difficult place to get in and out of. If this perception were to occur, it could result in a loss of Marina custom and could affect the viability of Swansea Marina, Swansea Yacht and Sub Aqua Club, the proposed SA1 Marina development and the local marine businesses whose trade relies on boat owners keeping the boats in Swansea. This is not just an issue that would affect local boat owners, as approximately 40% of our customer base are

from outside of the Swansea area. This percentage does not include the some 500 visiting vessels we receive per annum.

A good example of siltation having a major impact on the viability of a Marina would be Burry Port. Since construction of the tidal gate, the pattern of the approach channel is constantly shifting and they are experiencing issues with significant siltation in their Marina basin. These factors have contributed to occupancy levels of less than 50%.

Navigational Hazards

The proposed 50m exclusion zone around the turbine outfalls seems very small when you consider the volume of water that will be passing through them. Concerns have been raised that smaller craft may struggle to negotiate the waters adjacent to the exclusion zone during operation due to flow rates.

Vessels entering or exiting Swansea will be faced with a dredged approach channel, shared with commercial shipping, bordered on one side by the rocks of the lagoon and the shallows of Swansea Bay on the other during certain tidal conditions. It seems that the development will cause an increased risk to all users of the approach channel, as a potential escape route will be taken away by the scheme. These risks range from little or no time to react in the event of a vessel breakdown to avoid collision with the rocks of the lagoon, to an increased likelihood of collision between pleasure and commercial traffic.

The presence of a safety boat during the construction phase is welcomed, but given the rocky nature of the lagoon structure and the flows from the turbines it may be wise to retain a safety boat post construction in order to deal with events such as vessel breakdowns on a rapid response basis.

Once again, if Swansea is perceived as being a difficult place to enter or exit, it is likely that custom will be affected, leading to knock on effects for all local marine businesses.

Jenkins, Hayley

From: Jones, Richard (Planning)
Sent: 26 June 2014 21:10
To: Jenkins, Hayley
Subject: FW: Tidal Lagoon Comments from Drainage and Coastal Management.

Expires: 14 July 2014 00:00

From: McAulay, Dan
Sent: 15 April 2014 11:49
To: Jones, Richard (Planning)
Cc: Sweeney, Mike; Anthony, Simon
Subject: Tidal Lagoon Comments from Drainage and Coastal Management.

We have reviewed the submitted information and would offer the following comments.

We consider that the flood risk aspects of the application have not been adequately considered in Swansea Bay in general or for the various locations identified as suffering detriment as a direct consequence of the proposals and therefore the application does not meet the requirements of TAN15 and National Planning Policy.

For example section 6.5.2.27 states that increases in wave height are shown to occur across the intertidal within the western region of the bay between Mumbles Head and West Cross, where the reflected waves are refracted across the shallow foreshore. For a 1 in 20 year wave event, the model predicts that wave heights will generally be increased within this area by 0.1 to 0.2m, with a peak increase at the shoreline fronting Oystermouth. There does not appear to be any assessment included regarding whether this increase will overtop the sea wall or the defences that have be installed prior to high tide/storm events. This has the potential to be detrimental to flood risk management assets and third parties and must be investigated further and if necessary mitigation measures must be proposed and incorporated as part of the development.

Section 17.5.2.3 states that in order to open up the views to the lagoon the majority of the existing 2m port sea wall will be removed and that the presence of the lagoon seawall will provide coastal protection, however there does not appear to be any studies included on the standard of protection the existing sea wall provides and whether the new lagoon wall will provide comparable protection. Furthermore when the lagoon is decommissioned who will become responsible for the upkeep of the remaining lagoon walls, details of this must be submitted and how the walls will be maintained in perpetuity.

Section 17.5.3.4 part iii states that extreme wave heights for location 8 (Mumbles/West Cross Area) is predicated to increase by up to 0.23m or 230mm with the lagoon in place. However, again no assessment has been made with respect to the possible impacts regarding the onset of any possible flooding; we would expect the FCA to have looked at the standard of protection of the sea wall/defences as the point of comparison with the new wave heights as this may affect the onset of flooding i.e. our defences may be overtopped sooner than at present or they may need to be deployed sooner as a direct result of the lagoon thus in certain circumstances increasing the risk/potential for coastal flooding to third parties.

Section 17.5.3.5 identifies that the operation of the project will cause some marginal changes to water levels within Swansea Bay and that these ‘minor’ effects on peak tidal water levels will not increase flood risk from tidal sources. How has this statement been substantiated as no

assessment against the existing situation has been provided. Furthermore there does not seem to have been any deeper investigation on increased wave heights and levels on the watercourses that discharge directly to the bay. These watercourses are tidally influenced and controlled and do cause localised flood risk to adjacent property, we would expect this issue to be assessed as part of the FCA as the most sensitive watercourses affected by this issues are around West Cross/Blackpill where the application has identified higher water levels and wave heights.

Furthermore the effects of climate change over the lifetime of the development have not been incorporated, we understand that there are two possible lifetimes for the development and that only 75 years is included as part of this application. However if the turbines are upgraded as envisaged in some aspects of the report the lifetime of the development will be extended this should be looked at as part of the assessment.

In summary we consider that the application has not adequately considered the effects of the development on flood risk within the bay in accordance with the requirements of TAN15 and any revised assessment must consider these issues including but not limited to the following on a like for like basis for the pre and post development situations:

- Effect of increased wave height and number on Swansea Bay flood risk management features including outfalls, contributing watercourses and tidal inundation routes.
- Effect of increased flood risk on third parties and critical infrastructure.
- Effect of reflected waves in general on the bay and including the areas identified as being put at greater risk over the lifetime of the development including climate change on a like for like basis.
- Effect of deeper water and larger waves on erosion/deposition in relation to flood risk management infrastructure as well other interest features already looked at.

Regards,

Dan McAulay
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Drainage and Coastal Management
City and County of Swansea

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CITY & COUNTY OF SWANSEA

WRITTEN REPRESENTATIONS

Tidal Lagoon Swansea Bay Project

PINS REFERENCE: EN010049
CCS REFERENCE: 2013/1017

Economic Regeneration & Planning
Civic Centre
Oystermouth Road
Swansea
SA1 3SN

1.1 In principle, as set out in the City and County of Swansea' adopted Unitary Development Plan (UDP), the Council supports Welsh Government's policy for strengthening renewable energy production, and recognises the long-term benefits to be derived from the development of renewable energy sources. It is recognised that renewable energy technologies can have a positive impact on local communities and the local economy in terms of monetary savings and in generating and underpinning economic development within the County. There are however concerns about the impacts that some renewable energy technologies can have on the landscape, local communities, natural heritage and historic environment, nearby land uses and activities. *The Council therefore seeks to achieve a balance between supporting renewable energy proposals whilst avoiding significant damage to the environment and its key assets.* Favourable consideration will therefore be given to developments that produce or use renewable energy where such proposals conform with UDP policies and are in scale and character with their surroundings.

1.2 It is anticipated that the Project will produce some 400 GWh net of electricity on an annual basis, which is enough to power around 121,000 homes.

1.3 In principle therefore it is considered that the tidal lagoon proposal would make a significant contribution to renewable electricity generation, using a sustainable natural resource.

1.4 In addition to generating electricity, the project also aims to provide visitor facilities and other amenities including art, education, mariculture and sporting/recreational facilities. The seawall is expected to be open to the public during daylight hours for walking, running, cycling etc, though access will be controlled in extreme weather.

1.5 In strategic terms therefore the tidal lagoon has potential to create a significant visitor attraction as well as an important local public realm resource.

1.6 However, Swansea relies on the character of the Bay as a major asset essential to its positive image and quality of life.

1.7 The focus for the Council's regeneration strategies, UDP Policy and adopted Supplementary Guidance is to make the most of this key asset and make Swansea a vibrant, exciting, attractive, sustainable, cultured Waterfront City. Proposals which would compromise these objectives will not be supported.

1.8 The development itself is of a very large scale protruding 3.5km into Swansea Bay and effectively dividing it into two. The lagoon seawall would form a strong dark horizontal strudture extending a long distance into the Bay, closing down its apparent width, restricting views and disrupting the overall iconic sweep of the Bay.

1.9 The seawall structure appears to be dictated almost entirely by engineering and cost considerations, with design finesse and intervention primarily having effect at a very local level along the inside edge of the structure, in associated buildings and on the coastal edge of the lagoon. These elements are generally positive based on the indicative designs, but have limited mitigating effects on the overall character of the structure when viewed from outside the lagoon.

1.10 The offshore building would be highly noticeable and would form a built focus in the middle of the bay which, with the sea wall, would compete with Mumbles as a visual focus. Its final design is therefore very important as it will help define the quality of the project in many sensitive views.

1.11 Within this context, it is the view of CCS (and its landscape consultant) that the proposal will result in major adverse significant effects for Mumbles and from key representative locations along the seafront promenade, as well as Swansea Port, resulting in substantial change to the character of these areas. Such major adverse significant effects are taken to represent key factors in the decision making process or at least important considerations.

1.12 Major/moderate adverse significant effects are also expected on the Swansea Bay seascape unit, the Swansea landscape character area, representative viewpoints at St Thomas, The Knab (Mumbles), Mumbles Hill Nature Reserve, Kilvey Hill, Swansea Bay, Townhill, Wales Coast Path and National Cycle Route (NCN) 4

1.13 Major/moderate adverse significant effects are taken to represent important considerations at a regional or district scale and, if adverse, as is the case in this instance, are potential concerns to the project depending upon the relative importance attached to the issue during the decision making process.

1.14 There are also a number of moderate adverse effects which are taken to represent effects which, while important at a local scale if adverse, may not be key decision making issues.

1.15 It is considered therefore that the proposal will have significantly adverse seascape, landscape and visual impacts on CCS and its key asset and taken in isolation would conflict with UDP Policies EV1, EV2 and R11(ii).

1.16 Given the extent of the impacts and the sensitivities of the receptors, it is considered that significant weight should be afforded to these identified impacts in the decision making process.

1.17 It is recognised however, that for a renewable energy scheme of the nature proposed, adverse seascape, landscape and visual impacts are somewhat inevitable. In this instance, however, it is the highly sensitive location for such a scheme that is considered critical.

1.18 It is also recognised that these impacts need to be considered in the planning balance with the positive benefits of the development in terms of renewable energy generation and leisure, sport and environmental improvements to the coastal edge within the lagoon. It is also evident that the project will have significant socio-economic impacts during the construction phase with wider, more modest impacts secured for the long term.

1.19 On the leisure related points, the proposals for public realm, public art and associated community provisions such as sailing centre and education facilities, if delivered and sustainable, would make a significant contribution to improved recreational and tourism facilities within in Swansea Bay which capitalise on the seafront aspect and contribute towards the regeneration of the Bay, as envisaged by UDP Policies HC31, EC15 and EC16.

1.20 This however should be balanced against the significant adverse impacts on the City's existing tourist and recreational assets within the Bay, not least from the above stated adverse seascape, landscape and visual impacts on the Maritime Quarter, Tawe Riverside Basin, the seafront promenade and Mumbles. In addition there is a significant possibility that the lagoon would result in increased deposition of mud along large parts of the Bay which would also impair its visual and recreational value.

1.21 The lack of a pedestrian and cycle linkage to the west to connect to the City Centre via the SA1 regeneration area is a significant issue to CCS. Whilst the reasons for this omission are understood, this is considered to be a fundamental missed opportunity to provide a sustainable direct and car free link from the City Centre and SA1, along the dock edge to the emerging Swansea University Bay Campus and onward links to the Wales Coastal Path and Sustrans cycle routes, in accordance with the Council's wider ongoing waterfront regeneration objectives.

1.22 This amounts to an integral component in the delivery of 'world class' public realm. Its omission from the scheme has severe implications in terms of sustainable connectivity, resulting in the lagoon essentially becoming a destination rather than part of the City.

1.23 The impact on the operation of the existing Swansea Marina is also a significant material consideration. Problems with potential navigational hazards created by the lagoon and the increased siltation of impounded Waters, the River Tawe Estuary Channel and Swansea Bay could lead to a general perception that Swansea Marina is a difficult place to get in and out of. If this perception were to occur, it could result in a loss of Marina custom and could affect the viability of Swansea Marina, Swansea Yacht and Sub Aqua Club, the proposed SA1 Marina development and the local marine businesses whose trade relies on boat owners keeping the boats in Swansea. These are all integral aspects to the success of Swansea's Waterfront City aspirations.

1.24 Furthermore, whist the lagoon would provide additional water recreation features, it does take away 11.5sq km of bay currently available for such purposes. By taking up such a large area, the Bay may lose its appeal for activities such as sailing, windsurfing, kayaking and paddle boarding etc.

1.25 The Council's Pollution Control & Public Health Division has identified the effect of the tidal lagoon on bathing water quality and in particular, the potential loss of the current prediction method, which is used to protect public health on an otherwise failing beach as the most important issue affecting the Division.

1.26 CCS regards the compliance of Swansea Bay as a very important issue. This is for economic regeneration reasons, for legal reasons, for socio-political reasons as well as the fundamental reason behind the revised bathing water Directive (2006/7/EC) – that is to protect public health.

1.27 CCS has been able to access over €4 million of public money to deliver a predict and protect model which has been successfully used for Swansea Bay and is successfully using the 'discounting rules' in the Directive to change its current status from 'Poor' to 'Sufficient'. This is of major significance to the Council as it is promoted as the 'waterfront city' and much of the regeneration efforts over the last 20 years have been to refocus on the Bay and the Maritime Quarter. Without this approach to the revised Directive, the Council would have to publicly sign Swansea Bay as a failing beach with very obvious swimming prohibition signs and similar information on the Internet by 2016. Apart from these important concerns, there would also be the potential for infraction proceedings for the continued failure of Swansea Bay as a designated bathing water under the Directive.

1.28 Within this context it is considered likely and highly probable, that the proposed lagoon would significantly change the hydrodynamic behaviour of water flows within Swansea Bay. This would compromise the utility of any hydrodynamic model calibration data collected to date. Thus any future hydrodynamic model build needed to drive a Storm Impact modelling approach would need to replicate the extensive calibration data acquisition, paralleling the Smart Coast programme scope and costs to ensure that the hydrodynamic model produced was equivalent to the present models produced for Dwr Cymru/Welsh Water.

1.29 If this was not done, and most importantly, appropriate funds not committed (i.e. it is likely that similar to the Smart Coasts £1.5m plus inflation would be needed), any hydrodynamic modelling used to underpin the storm impact approach would prove insufficiently precise in predicting faecal indicator organism concentrations at the Swansea Bay designated sampling point (DSP).

1.30 It is therefore the Council's position that unless there is a paradigm shift in the science around this subject, CCS would expect any consent for the tidal lagoon to require sufficient fieldwork (i.e. comparable to the presently available model calibration resource) to be undertaken at the applicant's expense so that a high quality predictive statistical model can be maintained with the same degree of explained variance as the current model. This is critical to the application's compliance with UDP Policies EV34 and HC31.

1.31 Furthermore, Swansea Bay is of significant European, national and local importance for its coastal and marine wildlife. This is reflected in its part designation as a Wildlife Corridor, and Site of Importance for Nature Conservation (SINC), whilst over half of Swansea beach is a Site of Special Scientific Interest (SSSI). The Bay supports a wide variety of important habitats and species, including sand dunes, honeycomb worm reefs, harbour porpoise, grey seal, sanderling, ringed plover and small -flowered catchfly. Its rich biodiversity, together with its tranquillity, iconic landscape character, and ecosystem functions make it one of Swansea's most important and distinctive assets.

1.32 From an ecological perspective the key areas of concern regarding the possible impact of the lagoon on biodiversity in the Bay are the inadequacy of the baseline ecological data, and subsequent uncertainty regarding the likely ecological impacts of the lagoon development, and the robustness of the mitigation proposed. This uncertainty is further increased due to lack of confidence in the Coastal Processes Sediment Transport and Contamination Baseline Assessment which is also limited due to the inadequacy of the baseline data.

1.33 Most of the habitats and species in the Bay are sensitive to changes in the flow of currents, wave structure and sediment deposition. Relatively small changes can lead to extensive long term changes in the quality and distribution of these habitats and species. The predicted likely effects of increased sand and mud deposition and increased wave height /storm damage in parts of the Bay could have significant detrimental effects in particular on Blackpill SSSI and the sand dune and honeycomb worm reef habitats and species. Further work/research is required to ensure that all potential adverse impacts on biodiversity are fully considered and mitigation agreed.

1.34 CCS is also concerned about the potential introduction of and increases in invasive non native terrestrial and marine species eg Spartina anglica, and lack of suitable mitigation proposals or a biosecurity strategy.

1.35 It is considered that there is a need for more detailed plans for long term monitoring of changes and impacts on biodiversity and a more robust Habitats Regulations Assessment.

1.36 CCS is further concerned about the likely increase in wind blown sand and increased visitor pressure within the Bay which will create additional management responsibilities and costs. It is considered that a mitigation scheme needs to be agreed to address this.

1.37 CCS consider that the flood risk aspects of the application have not been adequately considered in Swansea Bay in general or for the various locations identified as suffering detriment as a direct consequence of the proposals and therefore the application does not meet the requirements of TAN15: Development and Flood Risk and UDP Policies EV2(ix) and EV36.

1.38 A residual area of concern for CCS is that the proposed access arrangements to the proposed lagoon will significantly increase traffic movements and general disturbance in close proximity to the rear of residential properties in Bevan's Row. This would run contrary to UDP Policy EV1(iii) and Policy R11(iii).

1.39 CCS is satisfied that matters relating to contamination, air quality and highways can be satisfactorily dealt with by way of legal agreement (including financial contributions) and the requirements of the DCO, in the manner set out in its LIR.

1.40 On the basis of the above stated uncertainties and issues, it is not possible for CCS to arrive at a fully informed position as to whether the benefits of the scheme outweigh the negative impacts as the full extent of the negative impacts are unknown as is the potential to mitigate such impacts and the commitment of the applicant to the same.

Annex D

Examining Authority's Questions

These are the Examining Authority's written questions (EAQs) and requests for information. Responses should be received by the Examining Authority (ExA) (also referred to as the Panel) on or before **Wednesday 9 July 2014**.

Questions are asked of interested and/or other parties, where applicable, these have been identified against each question. In addition to any identified party, all interested parties are welcome to respond to any question wherever they have relevant information to offer.

It has been assumed by the Panel that the applicant will have reviewed the section 55 acceptance checklist in relation to this application and will provide responses to all omissions and similar matters by the deadline set. Such responses, where incorporated in any form of written response/submission, should be clearly identified. In relation to information already submitted by the applicant, questions have been set out.

Where questions below can be fully addressed within a Statement of Common Ground (SoCG) then a reference to the relevant SOCG will be sufficient.

No.	Question to:	Question Subject Matter
0.0		**EXAMINATION MANAGEMENT**
		Site inspection in the company of interested parties
0.1	All interested parties	In addition to unaccompanied site inspections the Panel is considering inspecting sites on Wednesday 30 July, in the company of any interested parties who wish to attend, of the following locations: Offshore: To take a boat out of the Tawe dredged channel, around the perimeter of the proposed development and up the dredged channel into the River Neath.

No.	Question to:	Question Subject Matter
		Onshore: To take a minibus to a number of key Landscape and Visual Assessment viewpoints as set out in the Environmental Statement (ES). To visit locations associated with onshore access to the scheme, and with grid connection to the Baglan Bay substation site. Do any interested parties have a view on which of these locations are the priorities for the Panel to inspect and/or do they suggest additional locations for this inspection in the company of interested parties or for other unaccompanied site inspections by the Panel?
1.0		**PRINCIPLE OF DEVELOPMENT: ASSESSMENT APPROACH and POLICY BACKGROUND**
		General and Law and Policy
1.1	Applicant, Welsh Government (WG), Natural Resources Wales (NRW) and Local Authorities (LAs)	Although National Policy Statements (NPSs) EN-1 and EN-3 are referred to in the Planning Statement (application document 8.2); no NPS is designated in relation to tidal projects (as made clear in paragraph 1.4.5 of National Policy Statement EN-1). However, the Panel considers that the policies in the Energy NPSs relating to the way in which Development Consent Orders (DCO) should be set out are potentially important and relevant to this examination. Interested parties are invited to comment upon this and to identify any further or particular policies in NPSs that they consider important and relevant to the examination (as described under s105(2)(c)) of the Planning Act 2008 (PA2008)).
1.2	Applicant	Is it agreed that section 27 of PA2008 relating to dams and reservoirs is not yet in force?
1.3	Applicant, WG and LAs	Given that there is no designated National Policy Statement in relation to the proposed development; given the breadth of information provided in the Planning Statement, which key established policies of government or of local government in Wales/the United Kingdom/internationally, is it considered that the need for the project is set out?

No.	Question to:	Question Subject Matter
1.4	WG and LAs	a) Do the WG and LAs accept that the need case for the project is made, as set out in the Planning Statement? b) In particular, that in principle, the project conforms with Planning Policy Wales (PPW)?
1.5	LAs	The LAs are invited, in answer to this question or in a SOCG or LIR as preferred, to set out: a) The Development Plan Policies they consider relevant; b) Any Development Plan Policies with which the scheme is considered to conflict, c) Whether any identified conflict would amount to a reason to refuse development consent? And; d) Any further mitigation requested.
1.6	LAs, NRW and WG	Table 9.2 of the Planning Statement and the document entitled 'proposed Heads of Terms for a Development Consent Obligation (DCOb)' indicate an Obligation is due to be agreed. The Table of Mitigation sets out a number of mitigation measures to be secured by the DCOb. Which aspects of the DCO, if any, are considered by the LAs, NRW, WG to be essential to enable the scheme to be consented?

No.	Question to:	Question Subject Matter
1.7	Applicant	Table 9.2 of the Planning Statement and the document entitled 'proposed Heads of Terms for a Development Consent Obligation' indicate an Obligation is due to be agreed. a) When does the applicant expect to conclude its proposed DCOb? b) How can the Panel take into account mitigation proposed to be included in an Obligation that has not been agreed and executed? c) If it is not to be concluded during the examination, will the mitigation it provides for, be secured in some other way, and if so how?
1.8	NRW, LAs and WG	Are the proposed mitigation measures and the way they are proposed to be secured by the draft DCO (as listed in the Table of Mitigation) considered to be sufficient?
1.9	LAs	Given the enforcement role of the LAs, are the LAs content that the Requirements in the proposed DCO are all consistent with the tests set out in paragraph 3.6.2 of Planning Policy Wales?
1.10	Applicant	a) Given there is no generation capacity proposed to be stated in the DCO how can the project be said to be a Nationally Significant Infrastructure Project under ss14 and 15 PA2008? b) Does the applicant intend that the DCO will state the generating capacity before it is made?
1.11	Applicant and all interested parties	The applicant includes in its proposed DCO, a range of works that might not normally be considered as principal development in an application for a generating station. However, the Panel recognises that PA2008 does not place a limitation on the scope of principal

No.	Question to:	Question Subject Matter
		development, and that guidance on the subject is not prescriptive or binding. The Panel invites legal submissions from the applicant to support its position that all the proposed development is properly described as principal development, and from any party who wishes to argue against that position.
1.12	NRW and LAs	a) With regard to consents set out in application document 5.6, that would need to be granted by NRW/the LAs if development consent were granted, are the consents listed likely to be ultimately forthcoming? b) Are any of them likely to present insurmountable obstacles to the development becoming operational?
1.13	Applicant	With regard to the Offshore Consents 5, 6, 7, 8 and 9 and Onshore Consents 2 and 4, has the applicant obtained any letters of comfort or similar documents and/or what evidence can be provided that the consents are likely to be obtainable if Development Consent is granted?
1.14	Applicant	In relation to the cable corridor, it is unclear as to whether there may be a need to open up the road to facilitate the burying of the cable. This would need a separate agreement to be entered into by the Welsh Ministers, the applicant and possibly the LA. It is assumed that the form of agreement could be a S50 licence, a Section 184 Agreement or a Section 278 Agreement. The Panel request the applicant to confirm its position in relation to these agreements.

No.	Question to:	Question Subject Matter
1.15	Applicant and NRW	NRW has noted concerns in terms of impacts: • on European Sites under the Habitats Regulations; • in the Water Framework Directive Assessment; • on terrestrial ecology and Sites of Special Scientific Interest (SSSIs); • on intertidal benthic ecology (including loss of Biodiversity Action Plan Annex 1 habitats and degradation of features including in an SSSI, mitigation, offsetting, omission of Blackpill SSSI baseline data) • on sub-tidal ecology (including uncertainty over areas, effects and dredge disposal); • in relation to bio-security; • on fish (including assessment approach, modelling parameters, impacts of sediment levels on fish spawning including interaction with climate change, uncertainty over monitoring and mitigation proposals); • on coastal birds (including Sanderling / Ringed Plover and Great Crested Grebe) and, • on the value of heritage assets. The Panel requests the applicant to provide supplementary information addressing these points, and to identify clearly, the scientific data, evidence and expert opinion on which it is based.
1.16	Applicant	Given the provisions of s135(1) of PA2008, has agreement been reached with the Crown Estate for acquisition of the necessary foreshore and/or other Crown Estate land?
1.17	WG relevant LAs and NRW	Does the Project (Tidal Lagoon Swansea Bay) help deliver against the following:- a) Climate Change Strategy for Wales (Welsh Government, October 2010)

No.	Question to:	Question Subject Matter
		b) Low Carbon Revolution- Welsh Government Energy Policy Statement (2010) c) Energy Wales: A Low Carbon Transition (2010) d) Planning Policy Wales (Ed 5, 2012) e) Marine Renewable Strategy Framework, Approach to Sustainable Development (March 2011) f) Ministerial Policy Statement on Marine Energy in Wales (July 2009) g) Interim Marine Aggregates Dredging Policy, Welsh Government (2004)
1.18	WG relevant LAs and NRW	Do the parties consider that within the Welsh context, are there are any other present or forthcoming future policies, strategies and initiatives that are relevant to the examination and therefore that we should consider during our examination of the Project?
1.19	WG relevant LAs and NRW	In framing of the application for the Project, the applicant states that due notice has been given to the following TAN's: TAN 5 : Nature Conservation and Planning (2009) TAN 8 : Renewable Energy (2005) TAN 12 : Design (adopted 2009) TAN 14 : Coastal Planning (1998) TAN 11: Noise (1997) TAN 15 : Development and Flood Risk (July 2004) TAN 21 : Waste (2001) a) Are there any elements within the application that fail to conform with or contradict the above TANs? b) Are there any other TANs that the applicant should have considered?

No.	Question to:	Question Subject Matter
1.20	CCSC	To what extent does the Project conform with LA's UDP policies on Sustainability and Renewable Energy?
1.21	Applicant and CCSC	Does the Project's lack of clarity on decommissioning cause concern when set against UDP Policy R11, part of which states that new development will be favoured provided, "the development includes measures to secure the satisfactory removal of structures / related infrastructure and acceptable after use which brings about a net gain where practically feasible for biodiversity following cessation of operation of the instillation"?
1.22	WG and CCSC	a) Does the Project conform with the UDP and its key role in delivering Sustainability? b) Does the Project aid the delivery of the Shoreline Management Plan (SMP2), Lavernock Point to St Anne's Head?
2.0		**Renewable Energy Generation and Climate Change**
2.1	Applicant	In the UK Renewable Energy Strategy, presented to Parliament by the Secretary of State for Energy and Climate Change (SSECC) in July 2009, tidal range power is described in the following terms: Although well established, tidal range power remains relatively expensive and there are few applications worldwide. The UK, however, has extensive tidal range resource in the Severn Estuary and there are several other smaller sites along the west coasts of England and Wales. a) Is the first sentence in the statement still accurate? b) If not, in what ways has the situation developed or otherwise altered since 2009 to make tidal range power a more or less attractive financial proposition?

No.	Question to:	Question Subject Matter
2.2	Applicant	What are the assumptions in the mathematical calculation behind the estimated annual 400,000 MWh output from the Project given at Section 2.6 (page 53) of the Design and Access statement (Document 8.1)?
2.3	Applicant	In the context of a national energy policy that seeks to promote a low carbon economy, as well as achieving security and diversity of supply, what particular features of the Project are advanced in its support?
2.4	NRW	In its statement of Environmental Policy, NRW states that: "Our purpose is to ensure that the natural resources of Wales are sustainably maintained, enhanced and used, now and in the future." a) How does the current application for the Project fit with this overall statement of purpose? b) In particular how does the broad design and scale of the Project relate to sustainable use and exploitation of the natural resource of tidal range power latent within Swansea Bay?
3.0		**CONSTRUCTION PROCESS, DREDGING AND PHYSICAL PROCESSES**
		Construction Process
3.1	Applicant	Table 4.1 of the ES is provided to describe the design options under consideration. However by comparing the description of the development in Chapter 4 with this table, not all of the construction options are included in this table. Please could the applicant provide an updated table, which clearly sets out all of the options under consideration, including details identifying which of these options have been assessed in the ES and where applicable, evidence to justify the 'worst case' adopted for

No.	Question to:	Question Subject Matter
		the purposes of the assessment?
3.2	Applicant	A number of methods for constructing the sea-wall are described in the ES (Project Description, paras 4.3.1-4.3.4) and illustrated in Figures 4.4-4.6. It is explained that certain sections of the sea-wall will require certain construction methods, for example the inclusion of a rock-armour crest for health and safety reasons. a) Please could the applicant provide a figure (drawn to scale), which illustrates where each of these sections is proposed to be located? b) Paragraph 4.3.1.7 explains that the seawall will be constructed to absorb 60-70% of wave energy. How will this design requirement be incorporated into the DCO? c) How has this design been incorporated into the coastal processes modelling?
3.3	Applicant	Paragraph 4.3.1.11 of the ES (Project Description) states that rock armour will be placed on the sea-wall, 'at a greater height' to allow for settlement. a) What is the maximum extent of the 'greater height'? b) How much settlement is expected? And; c) Over what timescale is the settlement expected to happen?
3.4	Applicant	Paragraph 4.3.1.8 of the ES (Project Description) refers to an 'engineered toe'. No description of this is provided; it is not known what construction and engineering requirements will be necessary to provide the 'engineered toe'.

No.	Question to:	Question Subject Matter
		Please can the applicant provide a design drawing showing the engineered toe as well as a plan showing where it will be required and details explaining how it will be constructed?
3.5	Applicant	Paragraph 4.3.3.15 (Project Description) confirms that the gantry crane will sit above the turbine housing unit, however, it is anticipated that the roof of the unit will be raised and the crane housed internally. The dimensions of the internal enclosure are not provided in the ES. a) How and where has this part of the construction process been incorporated into the ES in terms of impacts? b) Please could the applicant explain how this design aspect will be secured in the DCO?
3.6	Applicant, MMO and NE	The ES includes a description of temporary work required to facilitate the construction of the development (Section 4.5 (of the Project Description onwards)). The draft DCO does not appear to refer to some of the aspects of the temporary construction works, (for example, lay-down areas, material handling facilities, demolition of sea walls and existing development and concrete crushing etc). a) Please can the applicant provide a list of work processes and areas that will be included in the 'temporary works' and confirm (by cross referencing the work processes and areas to the relevant sections of the ES) that all aspects have been assessed in the ES. b) Does the DCO require amendment to refer to these temporary works?

No.	Question to:	Question Subject Matter
3.7	Applicant	The ES Chapter 4 (Project Description) identifies that piling is likely to take place offshore during the construction of the cofferdam that is required for the turbine and sluice-gate housing, as well as to create the dolphin piles that are proposed to surround the outer edge of the lagoon in the vicinity of the turbine and sluice gates. a) Is piling proposed to take place in any other location? b) If so, please could the location be shown on an OS based plan, together with the provision of details of the likely duration of the piling, the type of piling proposed and whether the piling will be undertaken 24/7?
3.8	Applicant	The ES Chapter 4 (Project Description) identifies that both percussion piling and vibration piling/piling by jack-up barge using a piling rig are likely to be required, with percussive methods necessary when harder base rock materials are encountered. Have the noise and vibration calculations given in ES Chapter 19 assumed that piling would be carried out by vibration piling alone?
3.9	Applicant	Please can the applicant provide an OS based plan (or set of plans), showing both the locational context and the layout of the following construction areas (drawn at a standard scale and with a north point):- a) The concrete batching plant and associated yard and storage bin areas; b) The areas of sea wall and breakwater that are to be demolished; c) Locations for storage of rock armour and other construction aggregate supplies brought to site by sea; and

No.	Question to:	Question Subject Matter
		d) The turbine fabrication yard area including the turbine fabrication building.
3.10	Applicant Part a of the question is aimed at all interested parties including (but not restricted to Dŵr Cymru (Welsh Water) (DCWW) and NRW)	The sediment analysis chart in ES Chapter 4 (Project Description, Table 4.2) gives the results of the analysis for a suite of metals taken from various samples within the proposed lagoon area, at various depths. The analysis results are compared with CEFAS thresholds, which consider their suitability for sea disposal. The contaminants have not been considered against Dutch Standards, which are environmental pollutant reference values used in environmental remediation, investigation and clean up. The 0.7m depth sample from VC206 shows arsenic values of 48.3mg/kg, which is close to the threshold for the Dutch intervention threshold (55mg/kg)[1]. The copper, lead, nickel and zinc levels from this sample are above the Dutch intervention levels. Samples from VC202, 204 and 208 also have metal contents above the Dutch target value[2] but below the intervention value. All of the contaminated samples were located along the western and southern areas within the lagoon footprint. a) Are the Dutch standards relevant to marine sediments? If not, are there any other standards that are commonly used in the UK, which give thresholds relating to metal contamination in sediments, in terms of their potential for ecological harm in the marine environment? b) What additional sampling and analysis of sediment samples within the lagoon area is proposed, in order to identify whether there are any more contaminated areas?

[1] The soil remediation intervention values indicate when the functional properties of soils for humans, plants and animals is seriously impaired or threatened. They are representative of the level of contamination above which a serious case of soil contamination is deemed to exist.
[2] The target value is related to Dutch national background concentrations.

No.	Question to:	Question Subject Matter
		c) What measures will be taken to minimize the risk of mobilizing the metals within these contaminated areas during dredging and avoiding their use in the lagoon walls? d) Para 4.3.1.27 of ES Chapter 4 (Project Description) states that the 'final location of the dredged areas will be dictated by the location of the most suitable material from an engineering property and quality perspective'. e) Does 'quality' include consideration of contamination levels?
3.11	Applicant	Figure 4.35 of ES Chapter 4 shows the location of the proposed access road and the text in Paragraph 4.3.7.6 in this document states that the access track will be constructed in the same method as the seawall, including rock-armour and then the proposed dune-scape built up either side. a) Is it proposed to surface the access track, in order to reduce noise and dust emissions from dump trucks and the lorries moving construction materials including concrete around the site? b) Is there any difference in construction methods/surfacing between the 'Port Road' and the 'Project Road' identified in Para 4.3.7.9 and shown on Figure 4.37 and 4.38? c) Please could the applicant show on a OS based plan the proposed access and egress points into the construction areas for all HGV delivery lorries, as well as details of lorry routing around the construction areas?

No.	Question to:	Question Subject Matter
3.12	Applicant	ES Chapter 4 (Project Description) paragraph 4.5.2.5 describes the working hours for the project. a) Will HGV movements to and from the construction site be restricted to normal working hours (eg 0800-1800 Monday to Friday and 0800-1300 Saturday)? b) Will the concrete batching plant work 24/7?
3.13	Applicant Cornwall Council is requested to respond to part c in particular	Chapter 4, Para 4.6.2.1 and Table 4.6 identify that 1.92mt of rock armour and 0.87mt of rock underlayer will be supplied from Dean Quarry in Cornwall by 10,000 tonne capacity barge. As construction is anticipated to take place over 3 years, a rate of rock supply/importation of circa 930,000 tonnes of rock is assumed necessary. a) Dean Quarry has recently been marketed for sale with the sales particulars identifying that it operated up to 2005 with an annual output of approximately 200,000 tpa. The loading jetty is included in the sale, although the conveyor system installed on the jetty deck has been removed. In view of the dormant nature of the quarry, and the previous output levels of circa 20% of the required output level to supply the TLSB project:-Is there a supply agreement in place between the quarry owners and the applicant to deliver circa 930,000 tpa of rock and rock armour over a 3 year period? b) Will it be possible to re-establish the quarry infrastructure necessary in order to deliver a major increase in rock outputs level within the required timeframe? c) Are there any planning permission restrictions on outputs or schemes required pursuant to conditions that have to be satisfied before rock extraction can re-

No.	Question to:	Question Subject Matter
		commence at Dean Quarry? d) How realistic is it to expect deliveries of rock and rock armour from Dean Quarry to take place at the rate of 3 x 10,000 tonne barges per week, all year round? e) What contingency arrangements would there be for rock supply at times when the transport of the rock by sea cannot be achieved, due to unsuitable sea conditions?
3.14	Applicant and Swansea Port Operator (ABP)	The possibility of bringing the raw materials for concrete by rail is identified in ES Chapter 4, paragraph 4.6.3.2. The site of a potential rail-head for cement/PFA/GGBFS/other is also identified on drawing 4.58 (this shows the Indicative batching plant layout). The quantities of each type of building material required and the number of HGV movements that these would generate are given in Table 4.6. a) In view of the applicant's stated intention to include principles and elements of sustainable development in the project design, if the raw materials for the concrete were imported by rail, it would reduce the number of HGVs visiting the site by an average of 400 HGV movements per week over the construction phase. In order to establish whether these materials can be delivered in a sustainable manner, by rail, it is important to establish whether the adjacent rail head could be adapted for the importation of construction materials:-Please could the applicant describe the technical and financial feasibility (or otherwise) of using the adjacent port rail-head for the importation of construction materials, including cement, cement replacement materials and the construction aggregates necessary to produce 220,000 m3 of concrete over three years? The statement should address matters including (i) the infrastructure improvements necessary to accommodate the types and sizes of freight wagons required for the various types of construction materials; (ii) the

No.	Question to:	Question Subject Matter
		availability of rolling stock for delivering materials by rail; (iii) the availability of time-slots on the rail network to enable a reliable supply to construction aggregates, cement and cement substitutes to be delivered to the project by rail. *These details could be addressed through a Statement of Common Ground.* b) In ES Chapter 4 (Project Description), Table 4.6, the last column is entitled, 'Movements per Week' and the number of HGV movements is given for the various types of construction materials required by the project. In this table, is a HGV movement equivalent to 1 HGV bringing materials to the site (in which case there are also an equivalent number of empty HGVs leaving the site), or do these HGV movements reflect the fact that for every delivery, there is also an empty HGV leaving the site (in which case the number of HGVs delivering material to the site are half of the stated numbers within this table)? c) Are the vehicle movements per week the average number of vehicles per week over the project construction phase, or the maximum number of vehicles per week? If they are average numbers, please could maximum and minimum numbers of HGVs be provided, as well as the average and maximum number of HGV movements on a daily basis during the various stages of construction?
3.15	Applicant	Two options are identified for dealing with the DCWW (DCC) water outfall pipe; they are (i) leave it where it is and provide additional treatment processes to reduce the risk of microbial contamination of the lagoon water or (ii) extend the outfall pipe by 1.5km so that it discharges outside the southern edge of the lagoon. DCC's view is that the only viable option in respect of the current outfall is extension beyond the sea wall. This will provide a consistent solution which is resilient to future

No.	Question to:	Question Subject Matter
		potential population growth and the effects of climate change. DCC stated in their RR that they, "therefore supports the extension of the outfall in accordance with Work no. 3, Part 1, Schedule 1 of the draft DCO and is carrying out detailed design and costings analysis to inform TLSB". The Non –Technical Summary states in the introduction that, 'An integral part of the Project is the provision of an enclosed water sports venue capable of providing a safe body of water for local, regional, national and international events'. In view of this aspiration and DCC's view:- a) Would option (ii) provide a more robust solution for ensuring that the microbial levels within the lagoon are kept at levels which facilitate water sports activities all year round? b) If the outfall is left where it is, what is the risk and likelihood of unexpected heavy rainfall events causing storm water flows to discharge into the lagoon which give rise to elevated microbial levels and thus water sports would not be safe? c) Please could the applicant identify on a plan the location, size (including height) and layout of the proposed UV treatment plant, if it is to be incorporated into the design? d) Is there an agreement in place between the applicant and DCWW for the operation of the UV plant after it has been constructed? e) Is the applicant prepared to agree with DCC that the foul water outlet will need to

No.	Question to:	Question Subject Matter
		be extended outside the lagoon as part of the DCO?
		Physical/Coastal Processes
3.16	Applicant	a) Potential impact on water chemistry from impoundment resulting from sea walls is described on page 51 of the Water Framework Directive (WFD) Report. Is this impact considered acceptable under the terms of the WFD? b) Given the need for there to be certainty over what is to be consented would there be any negative consequences upon the removal of provisions from the DCO to remove the option of retaining the outfall outlet pipe in its current position (thus by default requiring the outfall to be relocated out with the proposed lagoon)?
3.17	Applicant	Para 4.7.7.10 of Chapter 4 (Project Description) states that there may be a need to bring a mobile crushing plant to site at times to re-process temporary slabs and hard-standing as well as crushing of the concrete that is produced from the demolition of the sea wall. It is important to understand whether the concrete derived from the demolition of the sea walls and other concrete structures will be crushed on site or whether these materials will be removed off site for recycling. a) How much concrete will be derived from the sea wall demolition, when will it be produced within the construction phase and over what timescale? b) If it is not crushed on site, where will it go for recycling or disposal? c) What is the likelihood of the concrete being crushed on site? d) What mitigation will be used during the use of the crushing plant in terms of noise

No.	Question to:	Question Subject Matter
		and dust control and how will these measures be incorporated into the DCO?
3.18	Applicant	Paragraph 4.7.7.15 of the Project Description states that rock will be stored in an area of 400m by 400m at the western landfall and 250m by 250m at the eastern landfall. It is unclear whether these areas will be located onshore or offshore. If they are to be located offshore, how will the storage areas be constructed and where in the ES has this operation been considered in terms of impacts on the environment?
3.19	Applicant	In view of the proposed location of the Project walls adjacent to the channels of the River Tawe and River Neath:- a) Will the presence of the lagoon walls adjacent to the river channels give rise to a reduction in velocity of the river water entering the bay? b) Will there be an increase in sediment deposition either side of the lagoon, caused by changes in river velocity and/or turbidity?
	Statement to frame following questions	Chapter 6 of the ES is entitled Coastal Processes, Sediment Transport and Contamination. In paragraph 6.5.1.41, baseline conditions for flood and ebb tidal currents are described as follows: The characteristics of the baseline flood and ebb tidal currents within Swansea Bay lead to a clear tidal residual pattern (see Figure 6.40, Volume 2), which includes: i. an anticlockwise circulation eddy to the west of Swansea Channel, extending from the shoreline to the 10m below CD contour; ii. shoreline parallel residuals across the Swansea Bay intertidal areas in a westerly direction between Mumbles Head and Port Talbot; and iii. north-east tidal residuals in the eastern region of the bay, between 0m CD and the 10m below CD contour, orientated towards Aberafan Sands and Port Talbot.

No.	Question to:	Question Subject Matter
		The long term effect of creation of a lagoon is described in paragraph 6.5.2.59 of Chapter 6 of the ES Coastal Processes in the following terms: It is considered that the completed Project will modify and redefine the existing residual circulation within the western region of Swansea Bay by effectively splitting the bay into two smaller embayment cells whereby the Lagoon structure essentially becomes a headland, thus restricting exchanges between either sides of the Lagoon. And …. the western region of the bay is expected to experience an increased 'trapping' potential of sediments (predominantly mud) in the future compared to existing conditions, particularly across the shallow subtidal areas adjacent to the Blackpill SSSI and within the Swansea Approach Channel.
3.20	NRW and Applicant	Are the dominant forces affecting sediment transportation and coastal morphology in and around Swansea Bay sufficiently understood to enable reliable assessments to be made of the broad consequences for patterns of erosion and deposition in and around the Bay from the introduction of a coastal lagoon between the mouths of the Rivers Tawe and Neath?
3.21	Applicant	Have the consequences of changes in the processes and patterns of erosion and deposition on the shoreline east and west of the proposed lagoon been appropriately examined and assessed for: 1 Features of interest of (a) the Kenfig SAC (b) the Crymlyn Burrows SSSI and (c) the Blackpill SSSI 2 The sandy beaches and amenity value of (a) Swansea Town Beach (b) Aberavon Town Beach (Aberafan Beach)

No.	Question to:	Question Subject Matter
3.22	Applicant	Are there other features of Swansea Bay that are considered particularly sensitive to changes in patterns of erosion and deposition that have not been appropriately examined and assessed?
3.23	Applicant	Would further hydrological modelling significantly assist in predicting the impact on coastal processes of the existence of the proposed lagoon?
4.0		**SPECIES AND HABITATS – EUROPEAN SITES AND OTHER DESIGNATED SITES**
4.1	Applicant	In NRW's relevant representations on the application (letter of 14 April 2014) it is stated that "The development will have a likely significant effect on European designated Special Areas of Conservation (SACs)". The European designated sites that NRW has gone on to identify as subject to likely significant effects are Kenfig SAC, Crymlyn Bog SAC, Pembrokeshire Marine (PM) SAC, Cardigan Bay (CB) SAC and Pen Llyn a'r Sarnau (PLS) SAC. The applicant's conclusion at the screening stage was that "no likely significant effects are predicted on Kenfig SAC" (para 4.7.11 of the Habitat Regulations Updated Screening Report, February 2014, Appendix 2 page 23 to be found in Report 5.5b: Habitat Regulations Assessment Appendices submitted with the Application). a) Do the above diverging views reflect the current position of the two parties in respect of Kenfig SAC? If there has been any modification of one or other of these two party's views, why are the former positions not held to? b) If the difference in views still exists, is there any evidence or argument that either

No.	Question to:	Question Subject Matter
		side wishes to put forward in support of the position taken in respect of "likely significant effect" on Kenfig SAC?
4.2	Applicant	Potential impacts on Crymlyn Bog SAC of NO_2 from construction traffic and of potential saline intrusion of groundwater are covered in Section 3 of the applicant's Updated Screening Report of February 2014 with the conclusion that: "no likely significant effects are predicted on Crymln Bog SAC" (para 3.5.1.1 of the Habitat Regulations Updated Screening Report, February 2014, Appendix 2 in Report 5.5b: Habitat Regulations Assessment Appendices, page 98). a) Does the NRW hold to the position that a small increase in NO_2 for a limited period would have a likely significant effect on the Crymlyn Bog SAC? b) If so in what manner would that significant effect be likely to manifest?
4.3	NRW	The effects of the proposed tidal lagoon on Grey Seals are examined in Section 11 of the Report to inform Habitats Regulation Assessment, Document 5.5 which presents a general conclusion that the Project would have no significant effect on the achievement of conservation objectives for grey seals associated with Pembrokeshire Marine SAC, Cardigan Bay SAC and Lundy SAC. Does the NRW still hold the view that the proposed Project would have a likely significant effect on the Pembrokeshire Marine (PM) SAC, Cardigan Bay (CB) SAC and Pen Llyn a'r Sarnau (PLS) SAC?
4.4	Applicant	A Countryside Council for Wales (CCW) publication 'Your Special Site and its Future' describes the Crymlyn Burrows SSSI as including "fine examples of habitat transitions between Sand dune and Saltmarsh habitats."

No.	Question to:	Question Subject Matter
		To what extent would the proposed lagoon lying immediately to the west of the boundary of the SSSI, affect the balance of forces, including coastal processes that currently operate to maintain the Crymlyn Burrows in a "state of transition"?
4.5	Applicant	The foreshore of the western part of Swansea Bay has elements of bedrock together with shifting superficial deposits of mud, silt and sand. A website on Blackpill SSSI says that "The mud and sand provide the perfect habitat for many marine invertebrates, the rich source of food on which the 150 or so species of birds recorded here depend". (http://www.swansea.gov.uk/blackpillwildlife). On page 48 of the Design and Access Statement a photograph taken from a point north of The Mumbles is included as a representative view of the foreshore of the eastern part of Swansea Bay and shows part of the Blackpill SSSI. The impression is of a foreshore which is largely covered by silty sand. a) Has the character of the superficial deposits on the foreshore been significantly affected by weather conditions earlier in 2014? If so were these the result of an extreme event or part of the natural fluctuation exhibited in the Blackpill SSSI? b) Is a situation where the foreshore at Blackpill contains shifting superficial deposits of mud, silt and sand with elements of exposed bedrock providing perfect habitat for marine invertebrates likely to be altered by changes to coastal processes that would follow from construction of the proposed tidal lagoon? If so are the alterations likely to have positive or negative effects on birds, in particular on the Sanderling, Ringed Plover and Oystercatcher for which the area is particularly important?

No.	Question to:	Question Subject Matter
4.6	Applicant	Benthic Ecology and Protected Features: In Chapter 8 of the ES, the text refers to Sabellaria reef, hydroid rockpools and intertidal mudflat and sandflat as "protected features". In paragraph 8.2.0.5 of Chapter 8 of the ES there is reference to a list of the biodiversity in need of protection in the North-East Atlantic which is being used to guide the setting of priorities for further work on the OSPAR Convention and protection of marine biodiversity. Is the term "protected feature" being used as shorthand for types of marine habitat identified in that list as being in need of protection?
4.7	Applicant	Section 6.3.3 of the Adaptive Environmental Monitoring Plan (page 16 of Appendix 23.1 in Document 6.4) is addressed to the question of translocation of biogenic reefs built by tube-worms in the genus, Sabellaria and states that "the effectiveness of translocation mitigation for Sabellaria is not proven". What is known about the conditions that would be most likely to lead to successful translocation of this species and can any assurances be given that translocation is likely to be successful?
4.8	Applicant	As described in the Chapter 4 of the ES, Project Description, paragraph 4.5.3.8. a) Please can the applicant provide a plan showing the known existing locations of the Sabellaria colonies as well as plan showing the proposed location for its receptor habitat. b) (How will the rocks that host the Sabellaria be moved and when in the construction process will this be carried out?

No.	Question to:	Question Subject Matter
		c) How will the translocation be managed, in terms of ensuring that the receptor habitat is suitable and operations are supervised and then monitored by a competent ecologist?
5.0		**COASTAL BIRDS AND MARINE MAMMALS**
5.1	Applicant, RSPB and NRW	It is recognised that the impacts upon the herring population arising from the Project will impact upon great crested grebes and the Royal Society for the Protection of Birds (RSPB) has raised concerns on the efficacy of mitigation measures proposed. What steps has the applicant taken to work with NRW and RSPB to address these concerns and is there any further work on this issue proposed?
5.2	RSPB	Please could the RSPB clarify what its concerns are regarding a 'lack of analysis of ringed plover and sanderling passage populations'?
5.3	Applicant	Has there been any assessment of the potential effects on bird populations from installing the cable through the Crymlyn Burrows SSSI?
5.4	Applicant	There is an assumption that the construction effects that are likely to impact upon coastal birds will take place primarily in summer and thus will not affect the over-wintering bird interest, particularly the species associated with Blackpill SSSI. However, the only works discussed in the assessment are the construction of the sea walls and dredging. Other construction works are likely to affect coastal birds including the unloading of rock armour into the rock store areas and piling. Please could the applicant provide details of winter/summer/all year round construction activities likely to impact upon coastal birds and provide cross references to the parts of the ES where their impacts upon coastal birds are assessed.

No.	Question to:	Question Subject Matter
5.5	NRW, RSPB	The ES highlights potential collision risks to great crested grebes and cormorants. The ES concludes that collision risk is likely to be low. Please could NRW/RSPB confirm whether they are satisfied with the level of detail provided on this matter and whether they agree with the conclusion?
5.6	Interested Parties (IPs) with an interest in coastal birds, including, but not limited to NRW,LAs and RSPB	a) Has the ES considered all of the projects that should be identified in terms of cumulative impacts upon coastal birds? If there are any projects missing, please explain the link between this Project and the other projects. b) Are the mitigation measures that are proposed for the cumulative impacts from this Project and the Swansea University Bay Campus (SUBC) (in the form of a warden employed during the operational phase and the creation of a beach which would be an alternative focus for visitors) appropriate and adequate?
5.7	Applicant and NRW	How will a programme of monitoring and management be established for marine mammals through a requirement within the DCO in order to ensure minimal impacts occur upon marine mammals during all stages of the TLSB?
5.8	Applicant	Mitigation for the effects of piling upon marine mammals would be secured through the Construction Environmental Management Plan (CEMP). How can the DCO be modified to ensure that these mitigation requirements are secured within the CEMP?
5.9	Applicant	If a marine mammal became trapped in the lagoon, mitigation would be via a capture and release plan. It would involve liaison with the British Divers Marine Life Rescue, Llys Nini RSPCA and RSPCA Cymru. This work would be specified within the Operational

No.	Question to:	Question Subject Matter
		Environmental Management Plan (OEMP). a) Please could the applicant provide evidence to show that these bodies have agreed to participate? b) How can this mitigation be specified within the DCO, so that there is certainty that this matter will indeed be covered within the OEMP?
5.10	Porthcawl Environmental Trust, Rhossili Working Group and NRW	The WWF has identified the Outer Bristol Channel as an A/B site of importance to harbour porpoise (which could lead to the designation of a SAC for harbour porpoise in the vicinity of the Project). Is there any further information on this matter, especially regarding the timescales and locations of the possible SAC designation?
		Inter-tidal and subtidal benthic ecology
5.11	Applicant	a) Has a full bio-security risk assessment been carried, assessing the risk of invasive species being brought into the Project area by ship? b) If so, has it been circulated to relevant IPs for comment? If not, when will it be prepared? c) How will its risk management measures be incorporated into the CEMP and the DCO?
5.12	Applicant and NRW	Has agreement been reached on the matters that NRW raised in its RR regarding sub-tidal benthic ecology and inter-tidal ecology? *This could be addressed by a Statement of Common Ground.*

No.	Question to:	Question Subject Matter
5.13	Applicant	Accidental spillages and discharges arising during the construction phase are to be controlled through good practice, with control measures included in the CEMP. How will spillage control and management within the CEMP be addressed within the DCO?
5.14	Applicant	a) Is the lagoon a suitable potential receptor for new oyster beds, given the potential conflict that may occur with maintenance dredging? b) How will this conflict be minimised?
6.0		**SHIPPING, RECREATIONAL AND NAVIGATIONAL SAFETY**
6.1	Swansea ABP	Please supply the shipping statistics for the last two years including the largest ship to have entered the port during this period by tonnage and maximum draft?
6.2	Swansea ABP	Have discussions taken place with the Applicant regarding the apportioning of costs regarding the extra surveying and maintenance dredging that will be required at Swansea and Port Talbot?(14.6.2.31)
6.3	Swansea ABP	Are any of the tugs stationed in Swansea on a state of instant readiness, if not, how much notice do they need to become available?
6.4	Swansea ABP	Does your Safety Management Plan require any of the ships calling at your port to be met by tug(s) at the entrance to the approach channel?
6.5	Swansea ABP	Do you envisage having to carry extra stocks of oil dispersant to be able to deal with a ship, for whatever reason, colliding with the lagoon wall resulting in an oil spill?
6.6	Swansea ABP	Have you carried out a 'formal risk assessment' with the lagoon wall in place as required under the Port Marine Safety Code yet? If not, when do you anticipate carrying this out?

No.	Question to:	Question Subject Matter
6.7	Swansea ABP	Are there any weather restrictions in place on entering the port at the present time?
6.8	Neath Port Authority	Please supply the shipping statistics for the last two years including the largest ship to have entered the port during this period by tonnage and maximum draft?
6.9	Neath Port Authority	Are there any weather restrictions in place for entering the Port at the present time?
6.10	Neath Port Authority	Have you carried out a 'formal risk assessment' with the lagoon wall in place as required under the Port Marine Safety Code? If not, when do you anticipate carrying this out?
6.11	Neath Port Authority	Are you satisfied with the proposed raising and repositioning of your river training walls (14.6.1.2)?
6.12	Applicant	Have you carried out real time simulation studies of vessels transiting the Swansea and Neath channels under various conditions of wind and tide to validate your predictions?
6.13	Applicant	As suggested by the Maritime Coastguard Agency (MCA), have you discussed with the Pilots the implications for navigating in the Swansea and Neath approach channels with the lagoon walls in place (14.6.4.1-Table 11.1)?
6.14	Applicant	What is the proposed width of the Neath approach channel (14.6.1.2)?
6.15	Applicant	What extra maintenance dredging do you anticipate will be required in the Neath approach channel due to the Project?
6.16	Applicant	What is it you hope to achieve by raising and repositioning of the training walls in the Neath river estuary (14.6.1.2)?
6.17	Applicant	How will vessels adapt to the impact of wave reflection when they have to stay in their respective channels, Swansea or Neath (14.1.12.4.8.6)?

No.	Question to:	Question Subject Matter
6.18	Applicant	Please explain in greater detail how the proposed mitigation measures will help a vessel avoid a collision (14.6.1.15)?
6.19	Applicant	If the proposed mitigation measures fail what is there to stop an unconscious person being sucked into the turbines? Is it intended to fit a mesh over the intakes (14.6.2.26)?
6.20	Applicant	What are the procedures that will be developed for the increased risk caused to shipping by significant adverse weather (14.6.2.12. V111)?
6.21	Applicant	How many tidal cycles will it take for a complete change of water within the lagoon?
6.22	Applicant	Please confirm that CEFAS are satisfied with your survey results regarding contamination and that you can dispose of the arisings not needed in the designated dumping ground?
7.0		**IMPACTS UPON FISH MIGRATION AND FISHING AREAS**
7.1	Applicant	Paragraph 9.7.4.19 concludes that during the operational phase : … the overall predicted long-term impact on the salmon and sea trout fishery is expected to be of Low magnitude with a significance value of Minor, and a confidence of Probable. The basis for the assessment is summarised in paragraph 9.7.4.18, in the following terms: The impact of the operational phase on salmon and sea trout smolt and adult migration, including entrainment and injury in the turbines, has been assessed as being of Minor significance post mitigation. This is due to the low proportion of fish that are predicted to pass through the turbines, the relatively fish-friendly design (small number of blades, slow rotation rate and minimum gap runner) of the turbines and the proposed deployment of fish deterrent systems as a mitigation measure.

No.	Question to:	Question Subject Matter
		a) Does the NRW's "concern over levels of evidence and explanations to support confidence on impacts predicted" expressed in the letter of 11 April 2014 apply to the above assessment? And if so what further analysis is needed to bolster confidence in the assessment made? b) What aspects of this assessment and these conclusions are not accepted by those making representations on behalf of fishing interests?
7.2	Applicant	An attachment setting out a fisheries analysis report is referred to within the Relevant Representations from the Usk Fishing Association and from Fish Legal and several other fishing clubs/angling societies. The Panel has not received this attachment and requests that a copy be submitted into the examination.
7.3	Interested parties	Does the ES address the requirements for on-going monitoring, review and mitigation of the effects of the Project upon fish populations?
7.4	Applicant and Interested Parties including, but not restricted to NRW and the Wildlife Trust of South and West Wales	The ES proposes to use acoustic fish deterrents as mitigation to lower the numbers of fish entrained through the turbines, if this becomes a significant issue. Is there evidence that identifies that acoustic fish deterrents have a significant effect upon other species such as seals and porpoises?
7.5	Applicant and any interested parties who have an interest in this	a) Does the ES sufficiently recognise the importance of the local fishing industry in the Swansea Bay area as a local employer and a supplier of local produce caught sustainably which is supplied into the local markets?

No.	Question to:	Question Subject Matter
	issue	b) Is there sufficient mitigation proposed to address the loss of this economic activity?
7.6	Applicant	How do you intend to address the concerns of NRW, Fish Legal and Angling Clubs that the modeling undertaken for the assessment in Chapter 9 does not contain sufficient information on the parameters and sensitivity testing to have confidence that the models are robust and that worst case scenarios have been assessed (NRW RR, Fish Legal RR, Afan Valley Angling Club RR, 10026555 RR, Phil Jones RR)?
7.7	Applicant	Would you please clarify how the assessment of significance has been determined in respect of fish and shellfish (6.4.9.1Tables 9.28-9.30)?
7.8	Applicant	How do you intend to address the concerns of NRW and Fish Legal regarding fish mortality given in Table 9.5(NRW RR, Fish Legal RR)?
7.9	Applicant	Do you have any evidence to support your conclusion that altering the location of the turbines would have no material effect on fish species (6.4.9.1Table 4.1)?
7.10	Applicant	Do you expect to carry out further fish surveys, if so, do you anticipate the results will affect the baseline, impact modeling or predicted impacts for the project (6.2.23.3.2)?
7.11	Applicant	What are the species referred to, with their value, in the phrase 'other demersal and pelagic species' (6.4.9.1Table 9.4)?
7.12	Applicant	How will you remove the uncertainty on potential sediment levels and construction methods as they feed into the uncertainty over the potential for impacts on fish spawning, foraging and nursery areas (NRW RR)?

No.	Question to:	Question Subject Matter
7.13	Applicant	NRW have concerns over the proposed mitigation measures, in particular, they 'do not consider that sufficient evidence has been provided to demonstrate that measures are fit for purpose, provide suitable alternative habitat or have been adequately assessed for viability'. How will you address these concerns (NRW RR)?
7.14	Applicant	NRW consider that 'further work is needed to create a robust and fit for purpose monitoring programme'. How will you address these concerns (NRW RR)?
7.15	Applicant	Do you intend to compensate the fisherman who will be displaced by the lagoon (Swansea Fisherman's Group RR)?
7.16	Applicant	Several local fishing clubs have stated that no consultations have taken place to date. When will you consult with them (Neath and Dulais Angling Club RR, Pontardawe and Swansea Angling Society RR, Afan Valley Angling Club RR, Mond Angling Club RR)?
7.17	NRW	Do you agree with the valuations assigned to fish and shellfish Valued Ecological Receptors (VERs') (6.4.9.1Table 9.2)?
7.18	NRW	Do you consider the fish and shellfish surveys and proposed further surveys sufficient, if not, what further surveys would you require (6.2.23.3.2)?
7.19	NRW	Do you consider the baseline for fish and shellfish satisfactory (6.4.9.1.4)?
7.20	NRW and EA	Do you consider 'far-field zone' is wide enough when considering the populations of migratory fish passing through the area (6.2.9.7, Appendix 9.1, Usk Fishing Association RR and Fish Legal RR)?
7.21	NRW	What further assessment would you require to be confident that the long term effects have been sufficiently considered over the lifetime of the project (NRW RR)?

No.	Question to:	Question Subject Matter
7.22	NRW	Table 9.41 provides figures for reported salmon catches on the Rivers Afan, Neath and Tawe between 2002 and 2011. This question is primarily for NRW but other parties may wish to comment. a) Are figures for 2012 and 2013 available from NRW and can figures for reported catches on the Neath and Tawe stretching back to 1964 be provided please? b) Can comparable figures be provided for reported catches of sea trout on the Rivers Neath and Tawe? c) If the results are presented graphically as 5 year moving averages, are there any identifiable trends that emerge? d) Are there detectable changes for reported catches on the Tawe as a result of the construction of the barrage in 1992 and modification of the fish pass in 2001?
7.23	Applicant	Application of "IBM fish encounter modelling" is described in paragraphs 9.5.3.30-8 of Chapter 9 of the ES: Fish including Recreational and Commercial Fisheries and output from the model (a still-frame example from the adult salmon model video) is illustrated in Figure 15. Para 9.5.3.38 (Doc 6.2.9) states that: The model shows that olfactory trails from the two rivers remain quite distinct with the Lagoon in place and turbines and sluices operating, allowing adult salmon to home to their natal rivers with minimal distraction. Results demonstrated that there is no significant effect on olfactory trails as a result of water being drawn in to the Lagoon and released again. a) What level of confidence should the panel have in the output from this model?

No.	Question to:	Question Subject Matter
		b) What would be needed to produce an assessment that would be more firmly based?
8.0		**ADAPTIVE MANAGEMENT**
8.1	Applicant and NRW	Chapter 23 of the ES introduces the concept of an Adaptive Environmental Monitoring Plan (AEMP) which is a "document to be updated and refined to give the best possible understanding of the Project's environmental effects such that mitigation can be adjusted" (Para 23.6.0.4). The proposal is presented in more detail in Appendix 23.1 of the ES. Respondents may wish to have regard to the EC Guidance note on the implementation of the EU nature legislation in estuaries and coastal zones (ref http://ec.europa.eu/transport/modes/maritime/doc/guidance_doc.pdf) a) What aspects of the proposal are particularly suited to this approach? b) Are there aspects of the proposal that make such an approach unsuitable or inappropriate? c) What provisions in the draft DCO or the separate application for a Marine Licence would support adaptive management?
8.2	Statement as background to the following questions	Paragraph 4.1.0.2 within a section in Appendix 23.1 addressed to Coastal Processes includes the following: EIA studies …. are able to demonstrate a high level of confidence in relation to baseline conditions as these can be validated against suitable baseline evidence. In contrast, the description of equivalent conditions with the introduction of a scheme can only be proven in a similar way once the scheme has been constructed. And later in paragraph 4.1.0.5 one of the topics proposed for validation is:

No.	Question to:	Question Subject Matter
		v. beach profiles to ascertain any potential changes in erosion and accretion patterns particularly examining Blackpill SSSI and Crymlyn Burrows SSSI.
8.3	Applicant	Has the AEMP identified: a) Appropriate indices for monitoring that reflect not simply whether changes are occurring or have occurred but whether such changes are having significant adverse consequences for example in respect of SSSIs whether the changes would be likely to adversely affect the features of special interest exhibited by that SSSI. b) Effective and achievable management measures designed to secure mitigation of adverse consequences. c) Trigger points for initiating potential mitigating measures.
8.4	Applicant	What is proposed by way of monitoring impact of changes in coastal processes on the Kenfig SAC?
8.5	Applicant	What is proposed by way of monitoring the impact of changes in coastal processes on the Swansea and Aberavon Town Beaches and their value as recreational assets?
8.6	Applicant	What reliance can be placed on monitoring of coastal processes and management actions by the way of mitigation to ensure that creation of the proposed lagoon would not have unacceptable adverse impacts on the features of interest?
9.0		**FLOODING**
9.1	Applicant	In section 6.3 of the Design and Access Statement (Doc 8.1) it is stated that "Whilst the Lagoon will increase waves near the Mumbles area, such increased wave action will not

No.	Question to:	Question Subject Matter
		affect maximum waves at this area or the risk of flooding." What is the basis for this conclusion and what level of confidence can the Panel place on it?
9.2	Applicant and Relevant Interested Parties including (but not limited to) DCWW and NRW	Have the potential impacts from extreme wet weather/high wind and high tide events (as were experienced in early 2014 in many coastal areas) been considered within the ES?
9.3	Applicant and Relevant Interested Parties including (but not limited to) DCWW and NRW	When high tides within the lagoon coincide with extreme wind and rainfall events, what is the likelihood of the lagoon over-topping in the vicinity of the ecological park area on the northern boundary of the lagoon?
9.4	Applicant and Relevant Interested Parties including (but not limited to) DCWW and NRW	Would a high water level in the lagoon, under these extreme weather conditions, cause surface storm water to back up and groundwater levels to increase in nearby areas, thus increasing the risk of flooding of basements in nearby properties?
		WATER FRAMEWORK DIRECTIVE
9.5	Applicant and NRW	The proposed lagoon wall would enclose a body of water and control inflow and outflow. To all intents and purposes these changes would lead to the creation of a highly modified water body that is separated from the remainder of Swansea Bay and with a different tidal regime.

No.	Question to:	Question Subject Matter
		What would be the basis for an assessment of the changes under the Water Framework Directive?
10.0		**SOCIO-ECONOMIC, HEALTH AND TERRESTRIAL TRAFFIC AND NOISE IMPACTS**
		Socio-economic and health
10.1	Applicant	Full consideration of the potential risks associated with the project failing to be completed, do not appear to be included in the ES or in the draft DCO. If the project was not completed, unpredicted impacts could arise from the partially constructed TLSB which could impact upon biodiversity, coastal processes, navigable waters, local fishing, tourism and commercial economies and the visual amenity of the wider area. What is the applicant proposing to incorporate into the DCO in order to provide financial and legal certainties, that in the event of the project failing after construction is commenced, there would be sufficient resources available to return Swansea Bay to its current condition?
10.2	Applicant	Please could the applicant explain why it has not addressed the issue of the potential impacts of electromagnetic fields arising from the project upon human health? This matter was identified in the PHE response to the scoping response in November 2012.
10.3	Applicant	The applicant is requested to provide details regarding the steps that will be taken in the development to ensure that it will not adversely impact on the work that the City and County of Swansea have undertaken in improving the quality of bathing water in the Bay. Please can the applicant also provide assurances that the development will not result in the deterioration of local bathing water quality?

No.	Question to:	Question Subject Matter
		Terrestrial Traffic and Noise Impacts
10.4	Applicant	Paragraph 15.5.2.2 of the Onshore Transport Assessment states that working hours for the construction phase have not yet been finalised. However, it is likely that there will be continuous working during some phases of construction. The last sentence of this paragraph states, "to ensure that the impact of construction traffic is conservative, it has been assumed that construction staff will operate typical daytime hours". a) What aspects of the construction phase operations will take place outside 'normal working hours' (which are stated earlier as being 0800-1800 Monday to Friday and 0800-1300 Saturdays)? b) Does the 'conservative' assumption adopted mean that the potential impact of any HGV vehicles and mobile plant movements delivering materials to the site, leaving the site empty or with waste arisings, or working within the confines of the site outside 'normal working hours' have not been included in the transport and/or noise/air quality assessments?
10.5	Interested Parties including (but not limited to) the City and County of Swansea and Neath Port Talbot County Borough Council	a) In view of the large number of visitors expected at the water based sporting events, is there adequate car parking proposed (circa 300 spaces around the development)? b) Is there capacity at the existing park and ride facility to accommodate the vast majority of visitors during these events?
10.6	Applicant	a) The HGV movement details given in paragraphs 15.5.2.9-12 and Table 15.7 (Construction traffic daily profile –two way trips), give average numbers of HGV

No.	Question to:	Question Subject Matter
		movements broken down into hourly time slots, with the number of HGV movements assumed to be even through-out the working day. Over the 3 year construction phase, there will undoubtedly be peaks and troughs in terms of the delivery of construction materials to the site and peak times for deliveries during the day. What is the maximum daily number of HGV movements anticipated and what is the associated maximum hourly number of HGV movements expected at any one time? b) Table 15.9 shows the impact of construction phase traffic. It shows that in terms of HGV vehicle movements, there will be an increase of 16% on Langdon Road and 12% on Fabian Way. Is this table calculated using the average data given in Table 15.7? c) What would the associated increase in HGV numbers on Fabian Way and Langdon Road be if the worst case scenario (the maximum daily numbers of HGVs) is used to calculate increase in HGVs at these locations?
10.7	Applicant	Paragraph 15.5.2.23 of the Onshore Transport Assessment identifies that "there will be some impact on amenity for existing cyclists due to the increase in traffic on roads leading to the Project area, particularly along the short length of Langdon Road to the east of the Park and Ride junction". When in the construction phase will the segregated pedestrian/cycle land be constructed within the project area and when will the upgrading work on Langdon Road be carried out?
10.8	Interested parties	Table 15.18 of the Onshore Transport Assessment shows a well dispersed spread of car arrivals and departures over the day during major events.

No.	Question to:	Question Subject Matter
		a) Is this a robust and credible way of considering car movements associated with major events? b) Would major sporting events not attract most visitors for the start of the event with the majority leaving after the event is completed, akin to a major sporting event such as a football or rugby match?
10.9	Applicant and LAs	a) Given the assumptions in the Onshore Transport Assessment that all HGV movements will take place in normal working hours, if the Panel decided to recommend to approve the application, would it be reasonable to include within the DCO a provision to limit all HGV movements from and to external supply sources during the construction phase to normal working hours (0800-1800 Monday to Friday and 0800-1300 Saturdays)? b) There is no apparent commitment within the ES to ensure that all loads of construction materials brought to the site are sheeted. How can this matter be addressed in the DCO?
10.10	Applicant and ABP Swansea	a) Paragraph 15.5.2.9 of the Onshore Transport Assessment assumes that the sand deliveries to the concrete plant will be from Swansea Port, so it is considered that this activity would not generate any HGV movements on the external road network. Is there a supply agreement in place between the port and the applicant to facilitate this supply of marine dredged sand? b) Is marine dredged concreting sand currently landed and/or processed at Swansea

No.	Question to:	Question Subject Matter
		Port? c) Table 4.6 of the Project Description gives two scenarios for the supply of the 165,000t of marine dredged sand needed for concrete, with the supply being from the lagoon or from Swansea Port. This table explains that this supply of sand will generate 135 HGVs per week. Whilst supply from the Port would remove the need to move HGVs on the external road network, the deliveries of sand from the Port would generate HGV movements on internal roads. Have these movements been included in the noise assessment calculations?
10.11	Applicant and Swansea University Bay Campus	The Onshore Transport Assessment, paragraph 15.7.1.5 considers cumulative impact with SUBC. It is stated here that, "It has been assumed that in 2018 only Phase 1 (of SBUC) will have been completed, and that SUBC will be operating at approximately 50% of its total capacity, equating to a daily two-way flow of 3,746 trips". a) Is this a realistic assumption to make? b) What if the construction of the TLSB was delayed until a time when the SUBC is completed, how would the doubling of SUBC daily vehicle trips impact upon the cumulative impact chart shown in Table 15.34? c) Table 15.34 is entitled, "Cumulative Scheme Daily Traffic Flows – Summary". Paragraph 15.7.1.6 of the Onshore Transport Assessment states that, "Traffic generated by SUBC has been distributed onto the local network in accordance with the above distribution, and is summarised in Table 15.34. However the locations in Table 15.34 include "SAIC", "SA1" and "Coed Darcy". Where are the SUBC traffic movements shown within Table 15.34?

No.	Question to:	Question Subject Matter
		d) Where are the traffic movements that are likely to be generated from the Project shown within this table? e) Please could the table be expanded or annotated to give clarity on these matters?
10.12	Applicant and LAs	The conclusions of the Onshore Transport Assessment are that the Construction Phase Travel Plan will help to minimise the impact of construction on all modes of transport. HGV movements will be managed so that they avoid the commuter peak periods as far as possible. The impact on the local highway network is predicted to be of minor adverse significance and the impact on public transport during construction is expected to be negligible. Impacts on pedestrian and cycle amenity will be 'minimised through the Construction Phase Travel Plan and the impact is considered to be negligible. a) Are these conclusions founded on a sound and credible evidence base? b) Has sufficient consideration been given to public transport users, cyclists and pedestrians during the construction phase? c) What consideration has there been within the Onshore Transport Assessment of safety of other road users (including cyclists) and pedestrians during the construction phase and also during the operational phase when major events are being held? d) The Onshore Transport Assessment does not appear to give any consideration of historic accident and incident data in the vicinity of the proposed development.

No.	Question to:	Question Subject Matter
		Please could the applicant provide this information?
10.13	Interested Parties including (but not limited to) the LAs	a) Are the LA's and other IPs with an interest in noise and vibration issues satisfied that Chapter 19 of the ES (Noise and Vibration) suitably addresses the requirements of Welsh national, BS requirements within BS5228 and local policy on these matters? b) Are the LA's and other IPs with an interest in noise and vibration issues satisfied that the baseline noise data gathered in 2013 adequately reflects the existing base-line conditions across the area of study and the locations chosen for the baseline noise monitoring reflect suitable nearby noise sensitive property locations? c) Given the applicant's aspiration to use the lagoon for national triathlon, sailing and swimming events which will attract up to 100,000 people per year, with each event attracting up to 8000 visitors, does the noise assessment adequately assess the impacts of these events upon the local community and nearby noise sensitive receptors including the SUBC?
10.14	Applicant	Paragraph 19.3.4.2 of ES Chapter 19 on Noise and Vibration explains that 'it is expected that onshore works, where possible, will only be undertaken during the daytime and hence most assessments have been made against daytime noise levels. It is likely that works at sea will be dictated to some degree by tides and weather, and as such, may be undertaken 24 hours a day". It is also acknowledged that the batching plant will operate 24 hours a day when there are works at sea. It is not clear which other operations have been considered to take place outside normal working hours, such as demolition of the seawall and breakwater, moving aggregates from the Port to the concrete plant by HGV on internal haul roads and the crushing of concrete arising from the breakwater and sea wall.

No.	Question to:	Question Subject Matter
		a) Please could the applicant provide a table showing which construction activities are considered within the noise and vibration assessment to take place only during normal working hours only and those which may take place 24/7? b) Will mobile plant and HGVs visiting the site be fitted with reversing bleepers or will other alarm systems be used to eliminate the noise of vehicle reversing bleepers emanating from the construction site?
10.15	Applicant	Paragraph 19.5.1.5 of ES Chapter 19 on Noise and Vibration does not mention noise emissions from the on-site crushing of concrete, the demolition of onshore structures or the breakwater and seawalls. Nor does it mention HGVs delivering sand from the adjacent Port or other road based deliveries to the construction areas, or the concrete product fabrication area or the steel fabrication yard. a) Please could the applicant provide a list of all of the activities and the associated pieces of mobile plant and HGVs that were included within the noise modelling calculations for both day-time and night time noise levels? b) Does the noise modelling undertaken reflect the 'worst case' scenario for noise emissions from the construction activities?
10.16	Applicant	The ES Chapter 19 on Noise and Vibration, paragraph 19.5.2.15-16 and Table 19.20 shows the assessment of night-time noise levels arising from impact piling activities. It is explained that the comparison of threshold values with the Total Noise Levels predicted at the noise sensitive receivers from impact piling activities indicates that the night-time impact will not be significant, although the margin of compliance is not as great as during the daytime.

No.	Question to:	Question Subject Matter
		a) Please could the applicant explain whether this assessment takes into consideration the effect of clattering, thumps and/or bangs from the piling operations and how they are incorporated into the assessment? b) The ES section on the Project Description identifies that percussive piling may be required in places, if piling is required through hard substrates. Percussive piling is also mentioned in Chapter 19 in paragraph 19.6.0.2. Are noise and vibration impacts from percussive piling assessed within Chapter 19? c) How will the impacts from night-time piling operations be mitigated? For example, could these operations be carried out predominantly when tide conditions are suitable for day-time piling to occur (minimising night time piling activities) and/or could soil screening or rock screening mounds be used to reduce the impacts on the nearest sensitive receptors? d) How could such mitigation measures be incorporated into the DCO?
10.17	Interested Parties including (but not limited to) NRW and The Applicant	a) Are NRW and other interested parties who have an interest in the marine ecosystem satisfied that the details supplied within ES Chapter 19 suitably address the impacts of noise and vibration arising from the development on marine animals including fish? b) Is the conclusion in Paragraph 19.8.0.5 of ES Chapter 19 on noise and vibration that, "overall it can be concluded that the noise and vibration impacts related to all aspects of the development are likely to be negligible" founded on a sound and

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		credible evidence base?
		Air Quality
10.18	The Applicant and Interested parties including LAs	Paragraph 16.3.1.6 of the ES chapter on Air Quality states that the emissions from the batching plant can be reasonably considered to not be significant and therefore have not been considered in this assessment. This is because reliance is being placed upon the Part B permit requirements for the concrete batching process, if a DCO is granted. a) Is this a robust and credible way of assessing emissions from the concrete batching plant area within the construction site, that is leaving it to the permitting process? b) Were dust emissions from the loading/unloading of construction aggregates and from vehicle movements on the fabrication plant yard areas considered elsewhere in the report?
10.19	Applicant (both a and b) and Interested Parties (a)	a) Given the meteorological wind rose for Pembrey Sands (Figure 16.2), which shows that the wind direction is predominantly from the west and south west, has sufficient consideration been given to the potential impacts of wind-blown particulate matter from the construction areas and haul roads upon nearby receptors situated to the east and north east of the on-shore construction areas? b) The ES chapter on Air Quality, paragraph 16.5.2.4 states that "with regard to particulate matter, increases of an imperceptible magnitude are modelled at all receptors. … Imperceptible and small impacts are negligible, which is not significant". What sources of particulate matter were considered in order to arrive

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		at these statements?
10.20	LAs	The ES chapter on air quality, section 16.5.9 states that dust emissions and dust management will be controlled through various mitigation measures, which will be detailed in the Construction Environmental Management Plan. a) In view of the statement in paragraph 16.5.10.1 that wheel washing is not recommended, are the LAs satisfied that dust and mud deposition on the highway network can be controlled by limiting the amount of material transferred onto local roads and by removal of any material from the roads? b) Should the main dust control measures proposed be identified within the DCO?
10.21	Applicant and Local Highway Authority	The project will need to address the issue of funding the new link from Langdon Road and it is now important that there is clarity on how this will be provided. Please could the applicant explain how far this issue has progressed and what steps need to be taken to secure the delivery of this new link?
11.0		**SEASCAPE, LANDSCAPE AND VISUAL ASSESSMENT (SLVIA)**
11.1	NRW and LAs	Were you content with the final viewpoint selection and that your requests for additional or relocates viewpoints as outlined in Table 13.1 were taken into consideration and are reflected in Table 13.7?
11.2	NRW	In your Relevant Rep under Para 17 indent IV, ES Chapter 13, you state that, "The consideration of historic landscape designations appears to lack an assessment of effect on heritage values". Please expand on that statement and explain your concerns and how the applicant can

No.	Question to:	Question Subject Matter
		address those concerns.
11.3	Interested parties	Will the Project have an effect on the visual amenity of the Gower Area of Outstanding Natural Beauty (AONB) or do you agree with applicant that in the Regional Seascape Unit 2, Mumbles Head to Three Cliffs Bay, 13.5.2.17 :- "The Zone of Theoretical Visibility indicates that from the land based areas and areas immediately adjacent to the coastline, the topography of the area, including the headlands and cliffs screen views of the Project"?
11.4	Interested parties	Do you agree with the basis of the applicant's statement outlined in para 13.5.3.7, that an industrial landscape's contrast with a simple form of seascape / landscape creates a visual interest as opposed to a detracting feature?
11.5	NRW and applicant	Of the 8 Landscape Character Areas assessed as outstanding or outstanding/high in Table 13.17, Crymlyn Bog, Clyn Valley Country Park and Coed Hirwaun are screened from the Project by deciduous or mature trees. a) Has an assessment been made / does an assessment need to be made as to how that screening effect changes with the seasons? b) Similarly in the Section, Landscapes, Parks and Gardens of Special Historic Interest, Victoria Park 13.8.5.7, Clyne Garden 13.8.5.11 and Cwmdonkin Park, vegetation and mature trees play a part in the screening process but presumably not to the same extent all the year round?
11.6	Applicant	In Margam Park (13.8.5.21), you state that, "Views from the park's essential setting will be predominately be screened by dense coniferous forestry that covers the majority of the upland area to the north of the park".

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		Given the effect that Phytophthora ramorum is having on larch in South Wales, what is the species mixture of that coniferous forestry? N.B. NRW own the woodland they may be able to assist in answering this question.
11.7	NRW	If Phytophthora ramorum continues to spread at its present rate, what effect will it have on the landscape around the Project Area?
11.8	Applicant	a) Please can confirmation be provided as to the assumptions made in the SLVIA with regards to the height of the Offshore Building, the western landfall building and other buildings proposed within the development? b) Please confirm also whether these are in accordance with the description of the development set out in Chapter 4 of the ES and the draft DCO.
11.9	Applicant	a) Please confirm whether the SLVIA has assessed the potential impacts of all of associated onshore elements of the development, including the cable connection to National Electricity Transmission System (NETS)? b) If these elements have been included already, please confirm what assumptions have been made as to their location and design? c) If the Strategic Landscape Visual Impact Assessment (SLVIA) has not included these elements, please confirm whether the assessment of the seascape, landscape and visual impacts of the proposed development would need to be revised?

No.	Question to:	Question Subject Matter
11.10	LAs	Please confirm whether you are satisfied with the approach taken for the cumulative SLVIA, with regards to; a) The list of other developments at Table 13.12, which have been included for the purposes of cumulative impact assessment; b) The approach taken to the assessment of cumulative SLVI effects; and c) If not, please indicate why.
11.11	Applicant	Please confirm whether the impacts to landscape elements such as trees and vegetation, and any subsequent impacts to landscape character, have been included in the SLVIA. If not, please provide an updated assessment of the overall impact to the proposed development that may result in terms of landscape character from the loss of such features.
11.12	Applicant	Section 13.6.0.2 states that:- '… other than the Masterplan, due to the scale and nature of the Project, mitigation measures to reduce the effects on seascape/landscape character and visual amenity are limited. Notwithstanding this, the lighting design along the Lagoon seawalls and also to the onshore and offshore buildings have been carefully considered and embedded into the design in order to minimise effects at night.' However, draft Requirements 24 and 25 of the draft DCO indicate that the lighting design is yet to be agreed. It is therefore not clear what lighting design has been assumed in the assessment of visual effects in section 13.8. a) Please confirm what lighting design has been assumed for the purposes of the

No.	Question to:	Question Subject Matter
		SLVIA. b) Please also confirm how this will be secured through the DCO?
11.13	Applicant	Is it proposed that the uses of the rooms in the proposed buildings will be as shown on the Planning Drawings and since any change to those uses would constitute development in the meaning of the TCPA1990/PA2008, would any change to those uses require consent through a modification of any Order granted?
11.14	Applicant and LAs	a) Is it considered likely that the onshore and offshore buildings would be used for major events? b) Is it considered that any temporary uses to which the onshore and offshore buildings and open spaces may be used for (incidental to their uses as described on the Planning Drawings) would be adequately controlled?
12.0		**HISTORIC ENVIRONMENT**
12.1	Applicant	a) What is the current status of the gun emplacement, pill boxes and tank cubes mentioned in ES 21.5.1.4 ? b) Has CADW now scheduled them?
12.2	Applicant	It is unclear from Figure 21.1 Vol2 Port of Swansea context map, as to the location of the pill boxes, tank cubes and gun emplacement. Please supply a map showing their exact location.
12.3	Applicant	You propose that the three pill boxes remain in situ along with the gun emplacement and a buffer zone of seawall around each of the structures will be included as part of the

No.	Question to:	Question Subject Matter
		scheduling of each structure; will this form a separate work no. in the draft DCO?
12.4	Applicant	If the tank cubes and collapsed pill box are to be re-located, will CADW be consulted as to their re-location?
12.5	Applicant	What contingencies will you put in place to deal with below ground structures associated with these WWII artefacts that may be disturbed during the construction operation?
13.0		**COMPULSORY ACQUISITION OF LAND / RIGHTS OVER LAND**
13.1	Applicant and Crown Estate	a) Given the provisions of s135(2) of PA 2008, has the consent of the appropriate Crown authority been obtained for the inclusion of Article 51? b) If not how could the development proceed under an Order from which Article 51 had been deleted?
13.2	Applicant	Given that articles in relation to streets (9 to 12); supplementary powers (13 to 15); tidal works (16 to 22) and a number of miscellaneous and general articles (36 to 51) all engage to a greater or lesser degree, compulsory acquisition powers and tests. a) Where are the powers that would be granted under these articles identified in the Book of Reference and over which parcels of land would the powers under any of these articles be exercised and specifically which of these powers within the proposed articles would be exercised over which plots of land? b) The applicant is requested to list the relevant powers as rights over land applied for in the Book of Reference or to confirm that the Book of Reference already lists all rights over land that would be sought under these articles?

No.	Question to:	Question Subject Matter
13.3	Applicant	The Statement of Reasons does not give reasons in relation to each of the following areas (streets, supplementary powers, tidal works, miscellaneous and general) why these powers are needed and refers generally to a justification for rights over land. The applicant is requested to clarify why these powers, that engage compulsory acquisition tests, are required.
13.4	Applicant and LAs	Under the paragraph 25 of Part 2 of the Schedule to Infrastructure Planning (Miscellaneous Prescribed Provisions) Regulations 2010, the LAs' consent is required in Wales for the inclusion within an Order, of powers to regulate traffic under the Road Traffic Regulations Act 1984.Have the LAs granted this consent?
13.5	LAs and WG	Do the LAs or WG object to or have comments upon any of the proposed powers to be acquired over streets in articles 9 to 12 (or upon the articles that would grant supplementary, tidal works and miscellaneous and general powers over land) through the proposed DCO?
13.6	Applicant	Why is it necessary to have the power to stop up not only the streets in Column 2 of Schedule 3 but also the footpaths diverted from those streets as stated in the latter phrases of proposed article 10(3)?
13.7	DCWW, WG, NRW and LAs	Does Welsh Water, the WG, the LAs or NRW object to any of the powers proposed to be acquired in relation to drains and watercourses in proposed article 13?
		Whether adequate funding is likely to be available
13.8	Applicant	As referred to in paragraph 9 of Guidance Related to procedures for the Compulsory Acquisition of Land (DCLG Guidance September 2013);

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		a) What evidence can the applicant provide the Panel with to demonstrate that there is a reasonable prospect of funding for the compulsory acquisition costs being available? b) What evidence can the applicant provide the Panel with to demonstrate funding being in place, prior to any grant of development consent, to execute the project? c) Can the applicant provide evidence for example, of any offers of funding subject to the grant of development consent?
13.9	Applicant	Given the companies referred to in the Funding Statement, can the ultimate company that will be liable for the costs of Compulsory Acquisition be confirmed as either Tidal Lagoon Power Limited or Tidal Lagoon (Swansea Bay) plc (described as a special purpose vehicle)? The applicant is requested to provide the most recently published audited annual accounts of the company that will bear the compulsory acquisition liability and to indicate where in the accounts any amounts are safeguarded or to be safeguarded to meet such liabilities.
13.10	Applicant	The Funding Statement refers to the total proposed Compulsory Acquisition liability as amounting to £10.5Million. a) How has this been calculated? b) How is the figure independently verified? c) Has the District Valuer or other independent source been used to inform this figure?

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		d) What additional sum is assumed to be required for leasing rights in Crown Land?
13.11	Applicant	Paragraph 4.5 of the Funding Statement states that "TLSB considers that the actual capital costs of land acquisition are likely to be significantly less than the above sum [£10.5M]". a) What is the rationale for this statement? b) Are the actual costs of acquisition referred to in this sentence assumed to include or exclude the costs of the proposed lease from the Crown Estate?
13.12	Applicant	a) Given there is no funding in place to discharge the Compulsory Acquisition liabilities, on what basis could any compulsory powers be granted? b) Given that future project revenue income referred to in the Funding Statement is a speculative assumption how can this be relied upon to guarantee compensation to those whose land and rights would be compulsorily removed from them?
13.13	Applicant and LAs	If it were proposed that the relevant planning authority should, through enforcement of a Requirement, certify that sufficient funds were in place before any powers of compulsory acquisition were exercised, what form of words should be added to the draft DCO and where?
13.14	Applicant	In the light of the DCLG 'Guidance related to procedures for compulsory acquisition' (CA Guidance), paragraph 20; a) How can the Panel be assured that all reasonable alternatives to compulsory acquisition including modifications to the scheme) have been explored?

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		b) In particular, what assessment/comparison has been made of the alternatives to the proposed acquisition of land or interests therein in each case?
13.15	Applicant	Paragraph 4.4 of the Funding Statement refers to the applicant being in negotiation with 7 landowners. Given the importance of exploring all reasonable alternatives to Compulsory Acquisition (paragraph 8 of CA Guidance) are there any affected landowners with which the applicant is not negotiating and if so why not? The applicant is requested to provide a summary table indicating the degree of advancement and state of play in relation to negotiations with all affected persons listed in Part 1 of the Book of Reference.
13.16	Applicant	a) What account has been taken of responses to pre-application consultation (both in relation to statutory and non-statutory consultation) in considering whether there are reasonable alternatives to compulsory acquisition? b) Where (if anywhere) are these referenced in the Statement of Reasons and/or Consultation Report?
		Whether the purposes of the proposed compulsory acquisition justify interfering with the human rights of those with an interest in the land affected
13.17	Applicant	What regard has been had to the provisions of Article 1 of the First Protocol and Article 8of the European Convention on Human Rights?
13.18	Applicant	a) What degree of importance can be attributed to the existing uses of the land proposed to be acquired?

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		b) The Statement of Reasons, at paragraph 9.5, indicates that the applicant has weighed the potential infringement of Convention rights against the potential public benefits if the Order is made. Explain more precisely the factors which have been placed in the balance (including references to any national or local documents), the weight attributed to them and how this exercise has actually been undertaken?
13.19	Applicant	With regard to s126 PA2008 does the proposed DCO seek to modify any compensation provision?
13.20	LAs and WG	With regard to the need for there to be a compelling case in the public interest for land to be compulsorily acquired (s122(3) PA2008) the applicant states, in its Statement of Reasons (paragraph 5.9), that the proposal would be in the public interest because it would fulfil the objectives set out in the UK Government's 2007 Energy White Paper and the Climate Change Act 2008. Do the LAs and does the WG agree that the proposed development presents a compelling case in the public interest with reference to this policy and this Act?
13.21	LAs, Applicant and WG	For the avoidance of doubt, what are all the factors that are regarded as constituting evidence of a compelling case in the public interest for the compulsory acquisition powers sought and where (if anywhere), giving specific paragraph references, are these set out in the Statement of Reasons?
13.22	Applicant	Section 9 of the Statement of Reasons refers to the Human Rights Act 1998. Specifically which of the proposed powers of compulsory acquisition in the DCO, in relation to which plots, would or might engage Article 1 and which would or might engage Article 8 of the Convention?
13.23	Applicant	With reference to Table 1 in the Statement of Reasons and specifically the bottom row of

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		the table, where in Schedule 1 of the proposed DCO would "Provision of working, laydown area and construction site" be authorised?
13.24	Applicant	In reference to • "Work No1b(a) oyster spatting ponds"; • "(a) viewing areas; and (b) siting location(s) and mounting facilities for public works of art" incorporated into Work Nos 1a, 1b and 2a; • onshore facilities "(a) one or more buildings; (b) visitor information and boating facilities; (c) a hatchery(ies) and laboratories" incorporated into proposed Work No. 6a/b, and • "Work No 11(b) a visitor/information point to serve Crymlyn Burrows SSSI" all in Schedule 1 of the proposed DCO, the applicant is requested to set out clearly how these facilities are required for the proposed development and why the full extent of the relevant plots of land to be compulsory acquired are required for these purposes. (The applicant is requested in its answer to identify through an updated Table 1 from the Statement of Reasons specifically which plots the above works and facilities would occupy).
13.25	Applicant	Given that even allowing for micrositing cable connection corridors are typically less than 100metres wide, why is it proposed in paragraph 7.26 of the Statement of Reasons that a corridor of 350metres in width is acquired?
		Open space land
		Acquisition of rights over open space land
13.26	Applicant	Paragraph 8.10 of the Statement of Reasons states that permanent rights are proposed to be acquired over 6 parcels of open space land listed in table 2. Table 2 lists 7 parcels of

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		open space land over permanent rights are proposed to be acquired. The applicant is requested to provide a revised Table 2 showing over which parcels/plot numbers of open space land it is proposed to acquire permanent rights and over which parcels it is proposed to seek temporary possession powers over. The applicant is requested in this table, for the avoidance of doubt, to state the parcels of land to which s131 and s132 PA 2008 apply respectively (bearing in mind the provision of s131(2)).
13.27	Applicant	With regard to the proposed exception in s132(3) that the applicant states, in paragraph 8.11 of the Statement of Reasons, applies, can the applicant clarify which provisions of the proposed DCO would provide for the restoration of the physical state of and of public access over the relevant plots and over what maximum timescale this will be done (especially given the proposed power to leave permanent works on the land in Article 33(1)(c))?
13.28	Applicant	Paragraph 8.12 of the Statement of Reasons draws a distinction between open space land to be used "for the footprint of the project" and other open space over which rights are proposed to be acquired however Table 2 does not show which plots would be affected in this way. The applicant, in producing a revised Table 2 is requested to identify which works would take place on each plot and which of the exceptions in subsections (3) to (5) of s132 PA2008 apply, in the applicant's view, to which plot.
13.29	Applicant	In relation to plots in Table 2 over which the "footprint of the development" would extend the applicant states that 120 years constitutes a "temporary (although possibly long lived) purpose" referred to in s132(4B)(c).

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		With reference to what comparable case law, precedent Orders or decisions can 120 years be considered "temporary (although possibly long lived)"?
		Acquisition of open space land (s131)
13.30	Applicant	With regard to the proposed exception in s131(4B) that the applicant states, in paragraph 8.8 of the Statement of Reasons, applies, can the applicant clarify which provisions of the proposed DCO would provide for the restoration of the physical state of and of public access over the relevant plots and over what maximum timescale?
13.31	Applicant	Given that plots of open space land are proposed to be acquired permanently, what permanent safeguards exist to prevent the applicant/a future undertaker denying access to the relevant open space land in future, whether or not the purpose for which it was acquired has been concluded or not?
		Rights and Apparatus of Statutory Undertakers (s138)
13.32	Applicant	Why does Article 35 of the proposed DCO introduce sections of the Town and Country Planning Act 1990 (TCPA1990) that would replace and change the provisions in s138 PA2008 for dealing with statutory undertakers rights/apparatus. Given that such replacement provisions would introduce the need for a separate and additional Order (required to be made under s271(6)(b) of the TCPA1990) when s138 PA 2008 would instead enable the rights/apparatus to be dealt with within the DCO already applied for by appropriately drafted Articles and protective provisions ? It is also noted that the proposed DCO would not disapply the provisions of s138 PA2008.
13.33	Applicant and Statutory Undertakers	Which rights and/or apparatus belonging to statutory undertakers would be compulsorily acquired/interfered with/require removal under the powers in the proposed DCO and where are these detailed in the Book of Reference?

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13.34	Applicant and Statutory Undertakers	a) Is it intended that the proposed DCO should contain powers to compulsorily acquire land belonging to statutory undertakers or to create new rights over land belonging to statutory undertakers so as to engage s127 of the PA 2008? b) If so where is this land or the rights identified in the Book of Reference?
		Authority to override easements (draft Arts 25 and 25)
13.35	Applicant	a) It appears that draft Articles 24 and 25 have the same purpose and duplicate each other; the applicant is requested to explain why two such articles are both required? b) What does article 25 provide for that article 24 could not?
13.36	Applicant	Article 33(1) lists works that may be carried out on land of which temporary possession is proposed to be taken and refers to Schedule 5 which also lists works that would be carried out on land of which temporary possession is proposed to be taken. The applicant is requested to amend the article to remove descriptions of works to the Schedule or vice-versa.
13.37	Applicant	What permanent works is it proposed to leave on land of which temporary possession is taken as provided for in Article 33(1)(c) and should the word "permanent" be deleted from this article?
13.38	Applicant	Would the lagoon wall walkway/roadway become public highway, if not what would its legal status be?
13.39	Applicant and LAs	Why would existing criminal law and existing statute which contain powers granted to the local authority not be sufficient for regulating "the maintenance of order" and "the conduct of persons" on and about the authorised development and why would byelaws be

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		required? Should the local authorities be consulted prior to the publication of any notice of intention to apply for byelaws as proposed in article 44(5)?
13.40	LAs and WG	Does the WG or LAs object to any of the proposed powers to make the byelaws listed in proposed article 44(2)(a) to (f) or to any other parts of the proposed article?
13.41	Applicant and Crown Estate	Why is it necessary to acquire compulsory rights over the full extent of the parcels of land consisting of the bay, such as plot 05005, given that no works are proposed over the greater proportion of these plots?
13.42	Applicant and Crown Estate	a) Why, in relation to plot 05005, does the land plan 2.1.7 sheet 5 of 18 indicate that this plot of land would be compulsorily acquired when it is not possible to acquire land compulsorily from the Crown? b) Should Article 23 of the draft DCO be amended so that the words "..excluding any Crown land" are added at the end of the Article?
13.43	Applicant	Are all parcels of land in the land plans correctly shaded and referred to consistently with the Book of Reference? The applicant is required to provide any amended Land Plans that may be necessary.
13.44	Applicant	Can the applicant confirm that all affected persons have been consulted with reference to the correct land plans and Book of Reference entries in respect of land in which they have an interest?
13.45	Applicant	Why are all rights over and interests in the full extent of plot 05030 proposed to be compulsorily acquired given that no physical works are proposed over the greater proportion of the plot and given that part of the plot is proposed to be occupied by a visitor centre/building which may not be considered incidental to the proposed generating

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		station under s122(b) PA 2008?
13.46	Applicant	Why, in relation to plot 05041, is the full extent of the plot required given that its acquisition is proposed to be for an access road occupying only a small proportion of this plot?
14.0		**OTHER DCO MATTERS**
14.1	Applicant, LAs	Draft Article 4 would apply s96A TCPA1990 to the DCO which would allow the LAs to approve non material changes to the DCO including imposing new requirements and removing existing requirements, rather than the applicant having to use the procedure prescribed under the PA 2008 (s153 and Schedule 6) and the Infrastructure Planning (Changes to and Revocation of Development Consent Orders) Regulations 2011 for non-material changes to DCOs. This appears to circumvent the statutory process under the PA 2008 which has been put in place specifically to deal with non-material changes to DCOs. The applicant is invited to consider replacing these draft provisions with reliance upon PA 2008.
14.2	Applicant	Article 8: NPS policy encourages the defence to proceedings in respect of statutory nuisance to be granted only in relation to specific and identified expected nuisances that cannot be avoided. What nuisance does the applicant anticipate being unable to avoid causing and can draft Article 8 be worded to apply only to such nuisances?
14.3	Applicant	Given the provisions relating to development consent obligations in s174 PA 2008 (amending s106 TCPA1990) why is Article 42 necessary, given also that the proposed article is more restrictive than the provisions for development consent obligations in s106 TCPA1990?
14.4	Applicant	Work No. 2a is listed in the proposed DCO however a work no. 2a is shown on Works Plan 2.2.8 sheet 7 of 9 (although a work "2…(a)" is listed). Please explain and provide any

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		necessary amendment to the DCO.
14.5	Applicant	a) Why is a decommissioning programme only proposed to be prepared in relation to work no. 2a (which is unclear but may refer to sub-work (a) under No. 2 a "switch room") and not to the scheme as a whole? b) Has any other Order been made that fails to include a decommissioning programme for the works as a whole and if so what precedent Orders does the applicant wish the Panel to consider in his regard?
14.6	Applicant	The applicant is requested provide and maintain an up to date list of all the plans, drawings and documents to be certified under the Order to be listed within proposed Article 46 prior to completion of the examination.
14.7	Applicant	Can the applicant explain why Article 46, extending the boundary of the City and County of Swansea, is necessary?
14.8	WG and LAs	Do the WG/LAs have comments they wish to make upon the proposed extension of the county boundary?
14.9	Applicant	In the proposed DCO Works 5a to 5d inclusive, 5h, 5i, 5j are high voltage cables the construction of which, overhead or underground is not specified and the proposed wording would appear to permit either option. Therefore since overhead cables are likely to have the greatest impact in terms of the Rochdale envelope what elevations section and other drawings have been prepared of these overhead cables and what assessment of the impacts of overhead cables has been carried out?
14.10	Applicant	The applicant is requested to justify how the development that it intends to include, under the subheadings of 'further development' meet the criteria of 'enhancements and

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		mitigation'.
14.11	Applicant	The applicant is requested to provide clarification on how the works under 'further development' have been fully assessed in the ES and how consultees were made aware of what may constitute 'further development'.
14.12	Applicant	The applicant is requested to provide an explanation as to why each of the works to be included under the sub-headings of 'further development' are not presented in the DCO as an individual identified works.
		Requirements - Schedule 1 part 3
14.13	Applicant	Draft requirement 1(2) as currently worded would allow for development to be approved that fell outside the scope of what had been assessed in the Environmental Statement and approved under the Order. Would The applicant is invited to consider, as an alternative, the wording usually applied in DCOs i.e. that all works "must fall within the scope of the works assessed by the environmental statement."
14.14	Applicant	The applicant is invited to consider inserting the words "which fall within the scope of the works assessed by the environmental statement" before the word "including—(a)…." in the final paragraph of Part 1 of Schedule 1.
14.15	Applicant	Draft requirement 3 appears to conflict with all other draft requirements which begin "no authorised development shall commence until…" because it would provide for requirements not to be discharged until later phases of the development take place. The word details appears to carry a slightly different meaning in draft requirement 3(2) as compared with 3(1). No definition is given as to what details would need to be provided for any phase to commence. The draft is imprecise and potentially unenforceable, in the panel's initial view. The applicant is invited to consider identifying, in consultation with LAs (and any other authority that may discharge requirements) which requirements must be

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		discharged before any works commence and which may be subject to phased discharge and to redraft aspects of this and other requirements accordingly.
14.16	Applicant	In draft requirement 4 no definition is provided of "approved development plans", nor of "approved plans" in draft requirement 5, the applicant is invited to consider redrafting this wording or provide a definition.
14.17	Applicant	The listing of drawings in a requirement would not establish whether they were certified under the Order or not and thus listing in this way would be imprecise and unenforceable. Plans approved through DCOs would be "certified" by the SSECC under article 46. The applicant is invited to consider, in accordance with the former model provisions, the Planning Drawings submitted with the application and listed in draft requirement 5 should rather be listed in article 46 to be certified and any reference to them in the requirements should be to "the certified Planning Drawings".
14.18	Applicant	The tailpiece used with the DCO "unless otherwise approved in writing by the relevant planning authority". As stated by the Judge in Mid-counties Co-operative ltd, R (on the application of Wyre Forest DC [2009] EWHC, such tailpieces risk making "hopelessly uncertain what is permitted [and] sidesteps the whole of the statutory process for the grant of permission and the variation of conditions." Circular 11/95 (now partially cancelled) also advises against such tailpieces. Would The applicant consider removing them from draft requirements 6(2), 6(4), 8(2), 8(3), 12(3), 16(1), 19(2), 21(2), 22(2), 23(2), 24(3), 25(3), 26(3), 27(3), 28(3), 29(3) and 31(3) or to set out in any case where the discharge of the requirement does not go to the heart of the scheme as permitted, compelling reasons why such a tailpiece would be lawful and meet the tests for conditions in Planning Policy Wales that requirements must be precise and enforceable.

No.	Question to:	Question Subject Matter
14.19	Applicant	The word "substantially" in draft requirements 6(1), 22 and 23 renders the whole of these requirements imprecise and the Panel invites the applicant to consider deleting the word.
14.20	Applicant	In draft requirement 8(4) what is meant by "commencement of the authorised development"?
14.21	Applicant	In draft requirement 8(4) the Panel suggests inserting after "planting" the words "and maintenance of landscaping".
14.22	Applicant	In draft requirement 15 should an additional sub-para 3 be included to the effect that 'the scheme of management shall be implemented as proposed'?
14.23	Applicant	In draft Requirements 17 and 18 should an additional sentence be included to the effect that 'the scheme of work shall be implemented as approved'?
14.24	Applicant, WG, and LAs	As drafted, Schedule 6 would arguably fetter the quasi-judicial decision making processes of the Welsh Government. In addition the Schedule circumvents the process for planning appeals established under the TCPA1990 as usually inserted into Orders made under PA2008. Should the usual provisions for planning appeals as set out in the TCPA1990 be inserted into the draft DCO in place of draft Schedule 6.
15.0		**QUESTIONS IN RELATION TO DOCUMENTS SUBMITTED BY THE APPLICANT PRIOR TO THE PRELIMINARY MEETING**
15.1	Applicant	Please explain how the works under serial 25 of annex 2 fits under the heading of 'temporary construction works, including storage areas for rock armour'.
15.2	Applicant	Are there any further works that the applicant intends to include under the title of 'further development'?

No.	Question to:	Question Subject Matter
15.3	Applicant	Annex 2,section 25 identifies that Area C, the steelwork fabrication yard will include a turbine assembly building 15m high with a floor area of 3000m2 with overhead craneage. Please can the applicant:- a) Identify where in the ES the visual impact of this building has been assessed; b) Identify where in the ES the noise emissions associated with works around this building (in terms of its construction and its operational phases) have been assessed? c) Provide drawings showing both elevations and the design of the turbine construction building in the context of the area in which it will be situated; and; d) Explain when will this building be constructed and when will it be dismantled.
15.4	Applicant	The Panel requests the applicant to review figures 4.17 and 4.18. These figures were expected to be replicas of Plans 2.4.25 and 2.4.26 within the application documents. There appears to be some differences, please can the applicant explain why these are different and consequently the status of the latest figures.
15.5	Applicant	The Panel requests that the applicant confirm the status of figure 4.20. Reference is made to it being a replication of plan 2.2.15 in the application documents however this does not appear to be the case.
15.6	Applicant	The Panel requires the applicant to confirm as why there is extra information included in Figure 4.51 of the 3 June 2014 submission that is not contained in the original figure in the Environmental Statement. This is in relation to the level of the Piles to the left hand side of the figure.

No.	Question to:	Question Subject Matter
15.7	Applicant	The Panel requests the applicant to review figures 7.6 and 7.7 . These figures state that the reader should refer to figures 4.41 and 4.42 respectively however, there appears to be some differences, please can the applicant explain why these are different and consequently the status.
15.8	Applicant	Figure 9.24 is rather blurry, is the applicant able to rectify this?
15.9	Applicant	Figure 9.29 contains labels which are not present on the original figure in the application documents, the Panel requests the applicant to explain why these are different and consequently the status.

END

DEVELOPMENT MANAGEMENT & CONTROL COMMITTEE (72)

Councillors:

John C Bayliss	Andrea S Lewis
Peter M Black	David J Lewis
Nicholas S Bradley	Richard D Lewis
June E Burtonshaw	Clive E Lloyd
Mark C Child	Paul Lloyd
Bob A Clay	Keith E Marsh
Uta C Clay	Penny M Matthews
Anthony C S Colburn	Paul M Meara
David W Cole	Hazel M Morris
Ann M Cook	John Newbury
Sybil E Crouch	Byron G Owen
Jan P Curtice	Geraint Owens
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W John F Davies	Cheryl L Philpott
A Mike Day	Jennifer A Raynor
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Lynda James	Des W W Thomas
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