



Tidal Lagoon Swansea Bay: update and ongoing assessment work for future projects

Coastal Futures, 20th January 2016
Tim Carter, Head of Environment

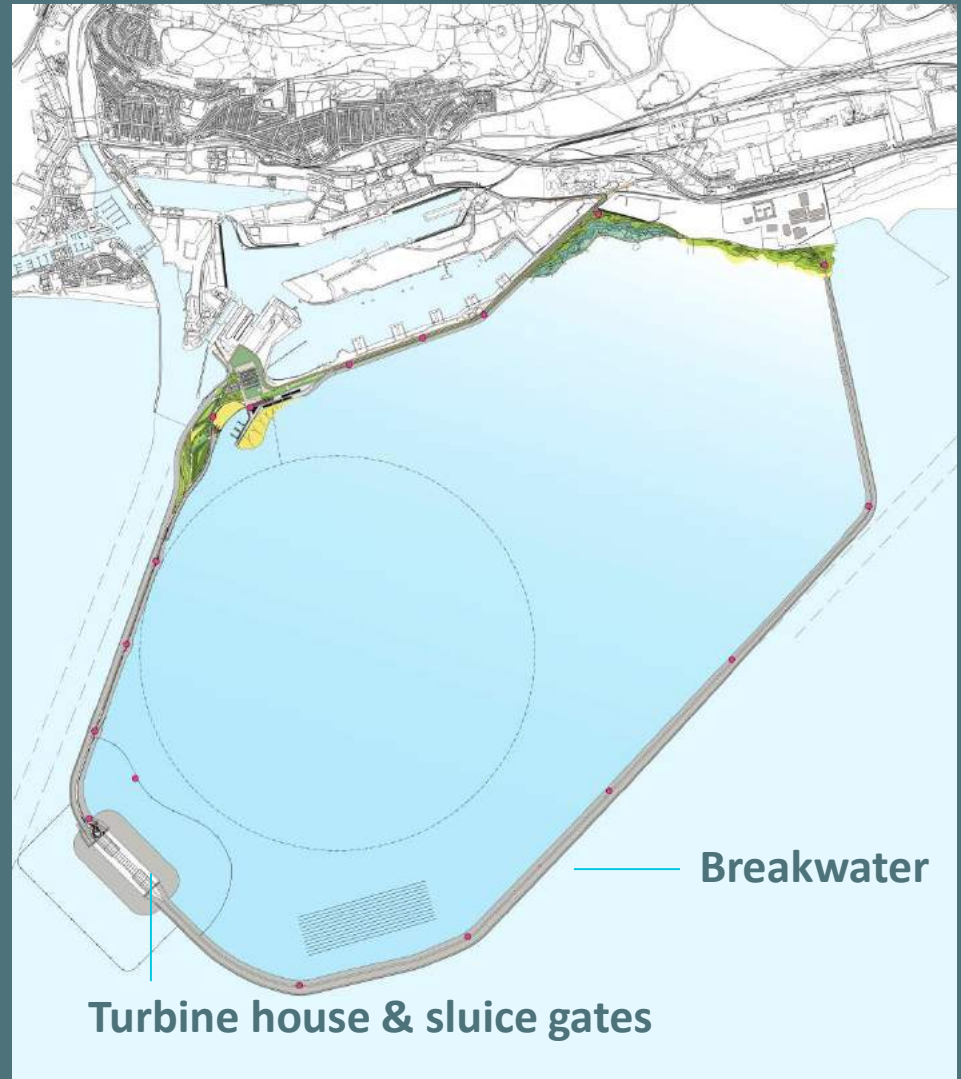
What are we going to cover?

- Tidal Lagoon Swansea Bay - introduction
- Consenting – update
- Turbine development
- Adaptive Environmental Management Plan (AEMP)
- Tidal Lagoon Cardiff - introduction
- Environmental Impact Assessment – initial surveys
- Ecosystems Enhancement Programme (EEP)



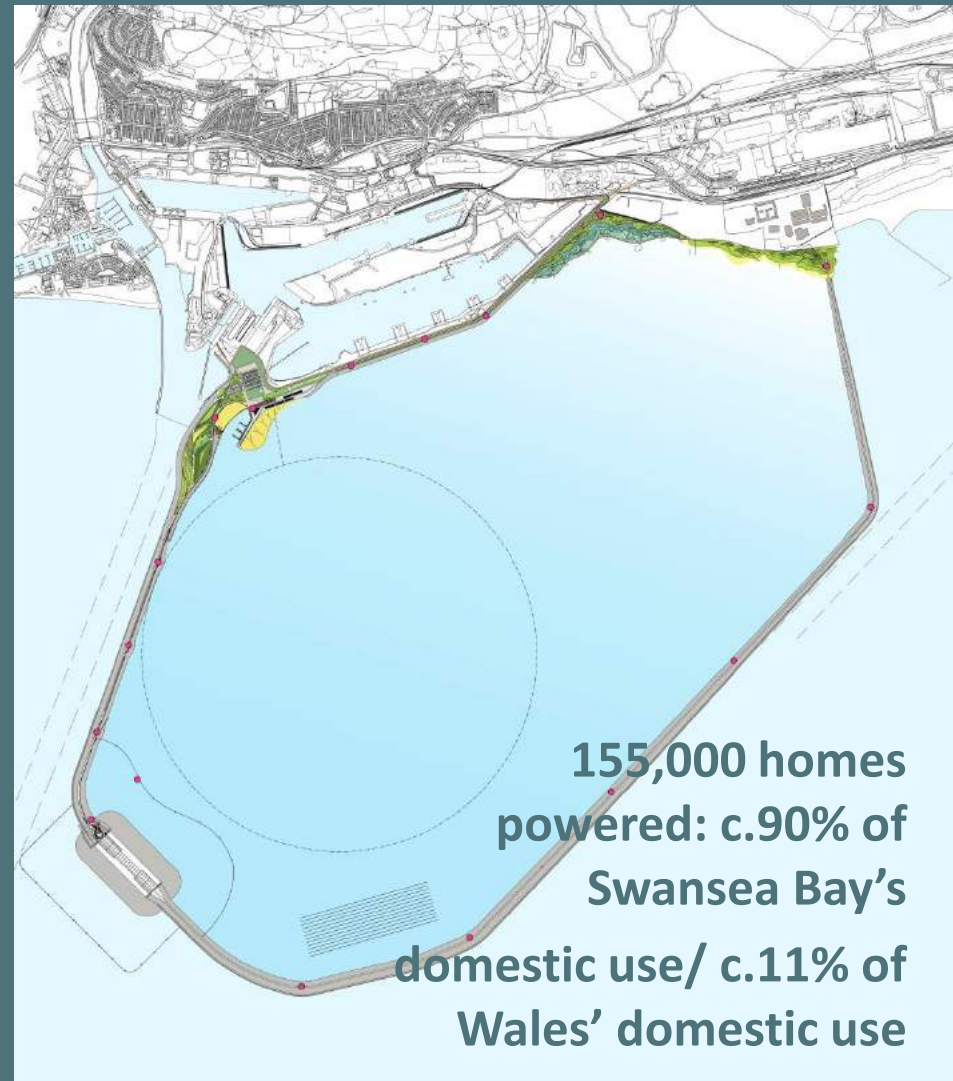
Tidal lagoon snapshot

- Large marine barrier with one ingress/egress
- Bidirectional Kaplan bulb turbines enabling generation on the ebb and flood tides
- Total power depends on:
 1. the tidal “head”; and
 2. surface area of the lagoon (scalable)
- Takes 4-5 years to build
- Design life is 120 years
- Lagoon interior “flushed” 4 x a day



Establishing a blueprint: Swansea Bay Tidal Lagoon

Wall length:	9.5km
Area:	11.5km ²
Rated capacity (@4.5m head):	240MW
Installed capacity:	320MW
Daily generating time:	14 hours
Annual output (net):	495GWh
Annual CO ² savings:	236,000 t
Design life:	120yrs
Height of wall:	5-20m
Wall above low water:	12m
Wall above high water:	3.5m
Tidal range Neaps:	4.1m
Tidal range Springs:	8.5m



Consents - update

- Development Consent Order (DCO) – granted 9 June 2015

We still need:

- Marine Licence – NRW Marine Licensing Team (MLT)
 - Potential effect on fish – Individual Behaviour Modelling (IBM) and STRIKER
- Harbour Revision Order (HRO) – port authorities
- Crown Estate – lease required
- Contract for Difference (CfD) – discussions ongoing
- Discharge of pre-commencement requirements – and Marine Licence conditions
- Detailed engineering design ongoing
- Start on land late 2016, marine works spring 2017

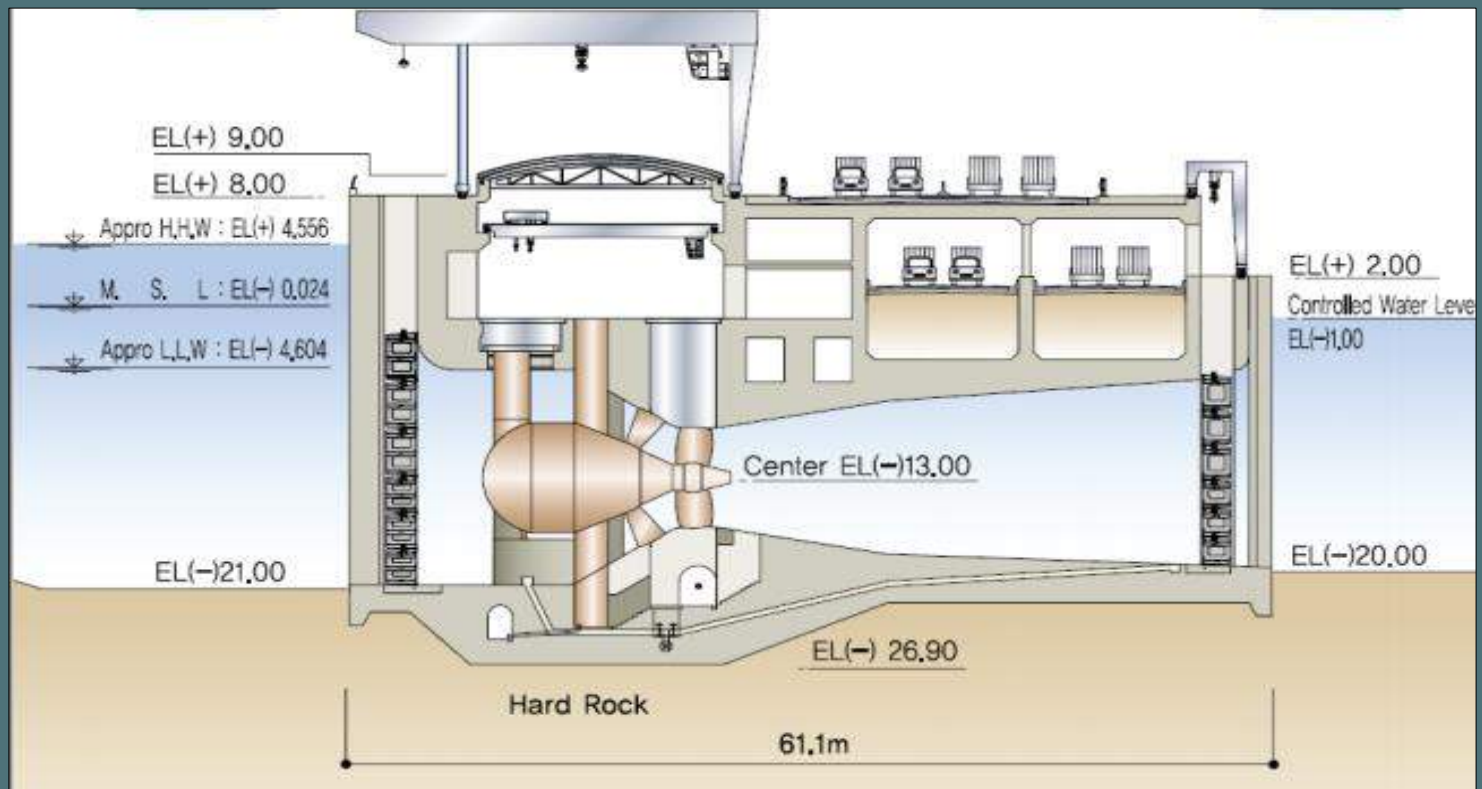
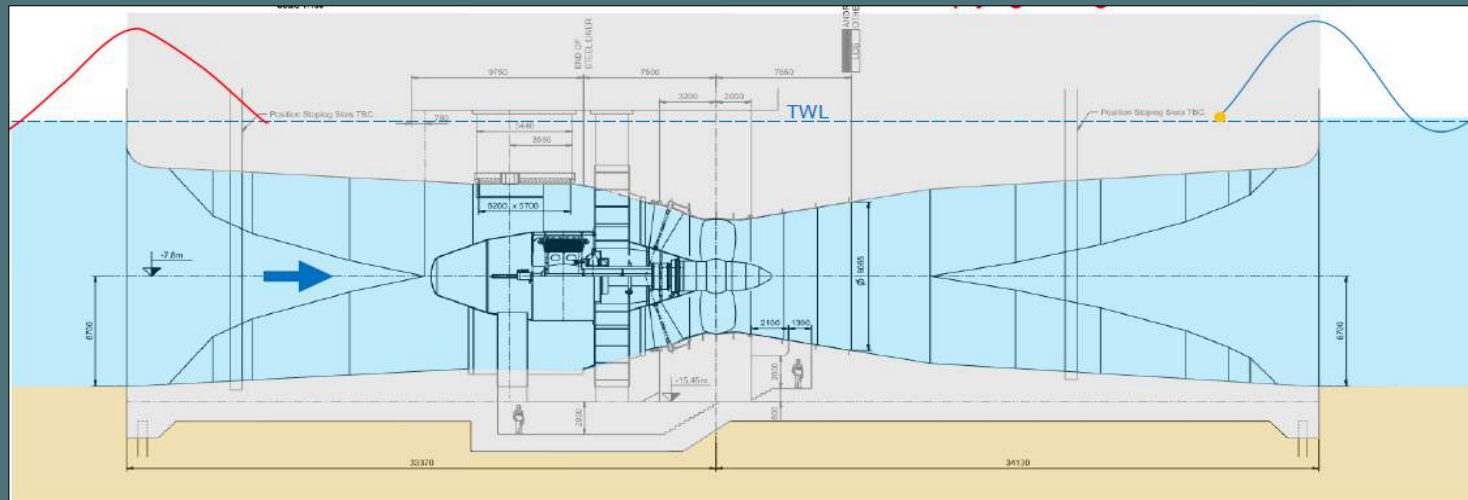


Reflections on the DCO made

Some elements removed:

- 'Associated Development' – all amenities & grid connection cable removed – separate planning applications required
- Changes to the jurisdictions of LPAs
- Changes to the jurisdictions of the Ports -
- Parcels of land from CA powers
- Some limits of deviation





Potential injury pathways for fish

Direct:

- Blade strike (blunt force impacts)
- Shear stress
- Barometric trauma
- Grind

Indirect:

- Post injury infection
- Injury related predation
- Disorientation leading to predation (indirect)



Reduce blade strike-increase runner sizing



Sihwa, South Korea – 5m runner

La Rance, France – year 1 (1966) and year 47 (2013) – 5m runner

Special design features- runner & guide vane stroke

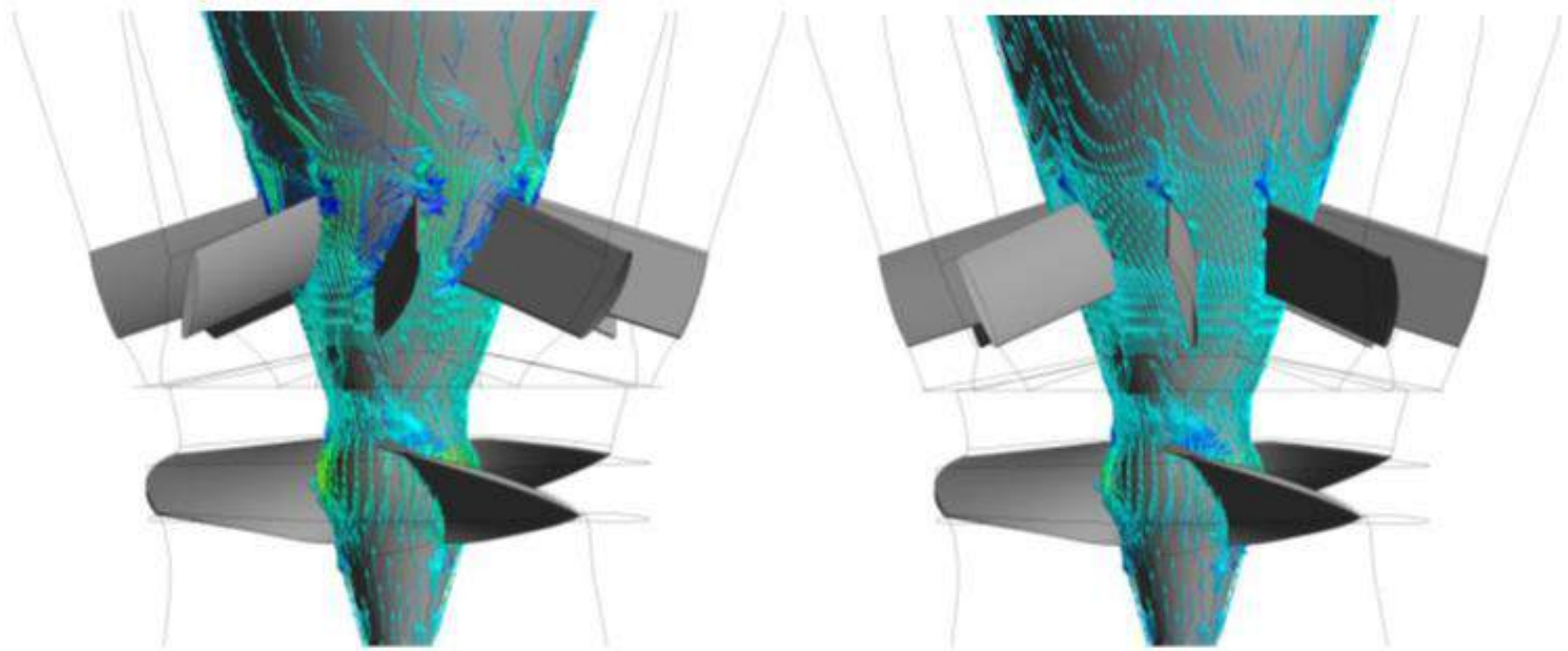
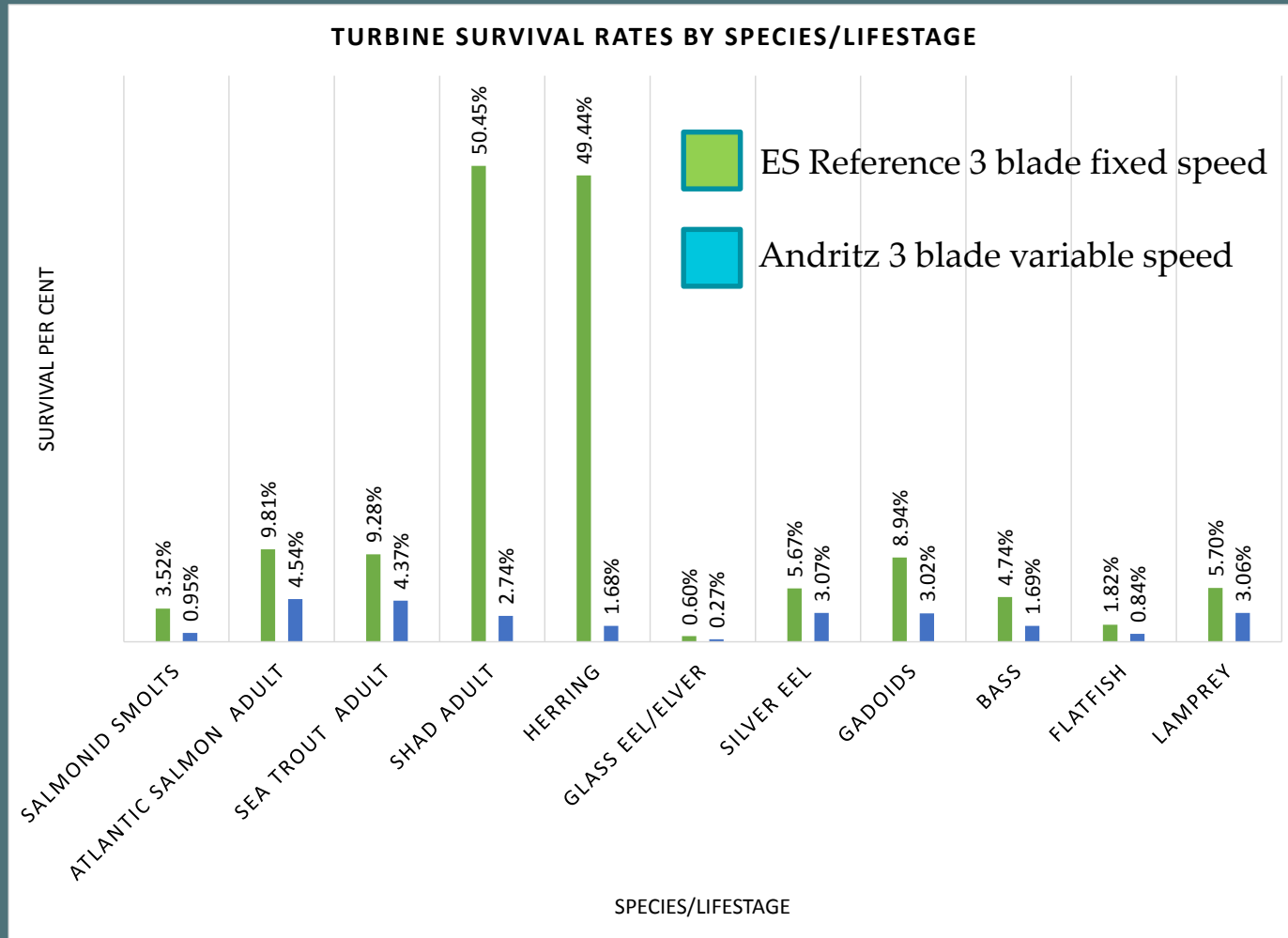


Fig3. CFD simulation showing improved flow conditions in reverse with 110° wicket gate stroke

Mitigation of effects – improved turbine design

Comparison of Fixed vs. Variable Speed Turbines



Managing uncertainty - Adaptive Environmental Management Plan (AEMP)



Adaptive Environmental Management Plan (AEMP)

Includes:

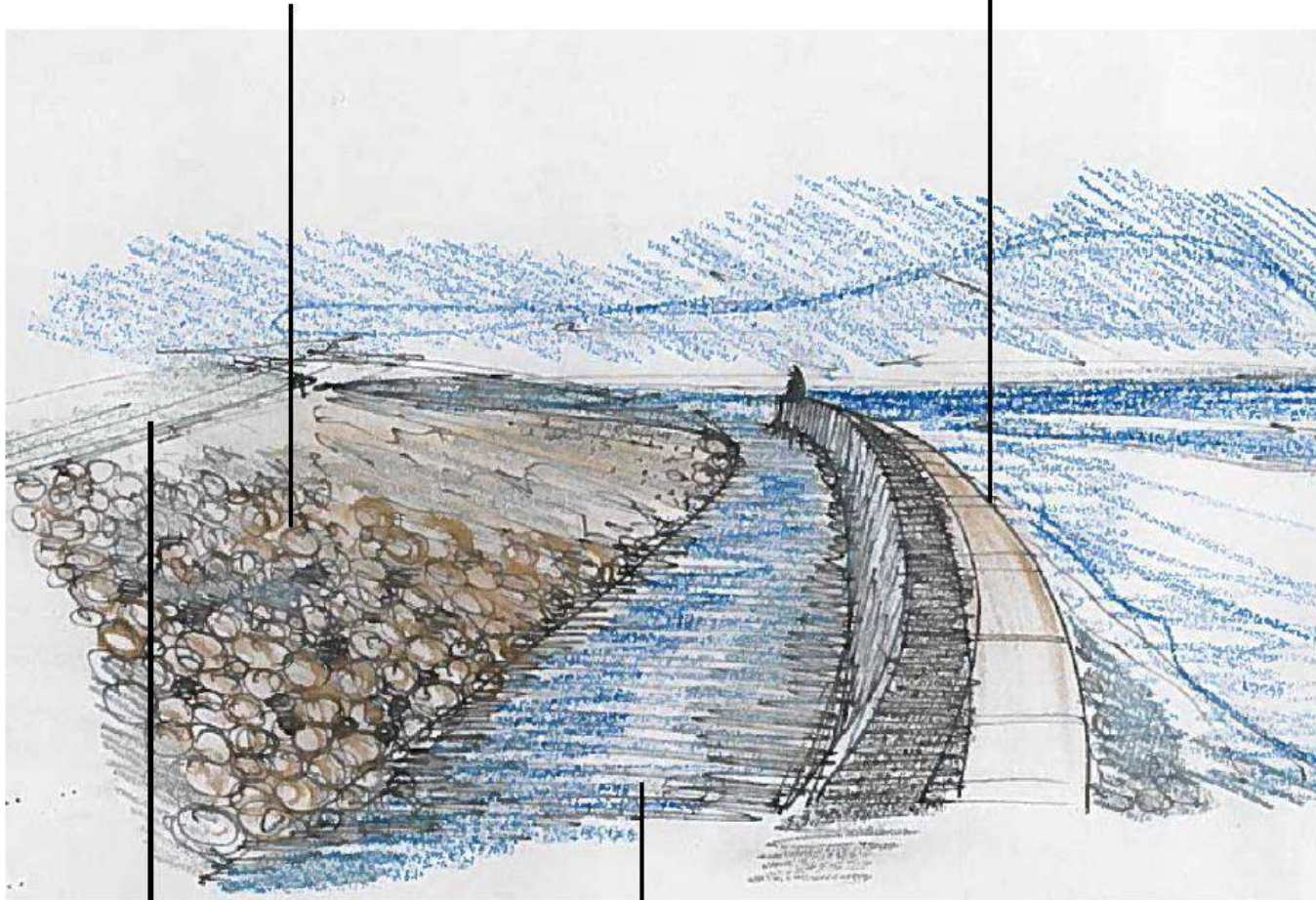
- Objectives – grouped by topic e.g. coastal processes, fish, birds
 - Confirm impacts predicted
 - Confirm effectiveness of mitigation measures
- Method statements and survey approaches – to meet the identified objective
- Review and reporting structure - results reviewed by Core Review Group – triggers reached?
 - Further monitoring/investigation
 - Management adapted



Detailed Design – Tidal Creek

Rock armour to be placed along 1 in 4 slope of the TLSB western breakwater. Fabricated rock-pool units to be integrated within rock and boulders. Different materials and size create different habitats.

Existing ABP eastern breakwater to be retained. Harbour light to be retained at end of breakwater.



Breakwater walkway with landscaped area adjacent.

Base of the creek to be lined with material from within the tidal lagoon with the aim of providing opportunities for seeding the breakwater with naturally colonised rock.

Tidal Lagoon Cardiff

Indicative design:

Breakwater:	22km
Area:	70km ²
Turbines:	60-90
Average tidal range:	9.21m
Installed capacity:	1,800MW-2,800MW
Annual output:	4TWh-6TWh p/a
Design life:	120 years
Generating power:	14 hours each day

Comfortably enough low carbon electricity to power every home in Wales *

*Average annual electricity consumption per Welsh household = 3,928 kWh. 1.319m Welsh households. Figures are based on DECC 2005 – 2013 electricity consumption statistics and average of 5TWh p/a.

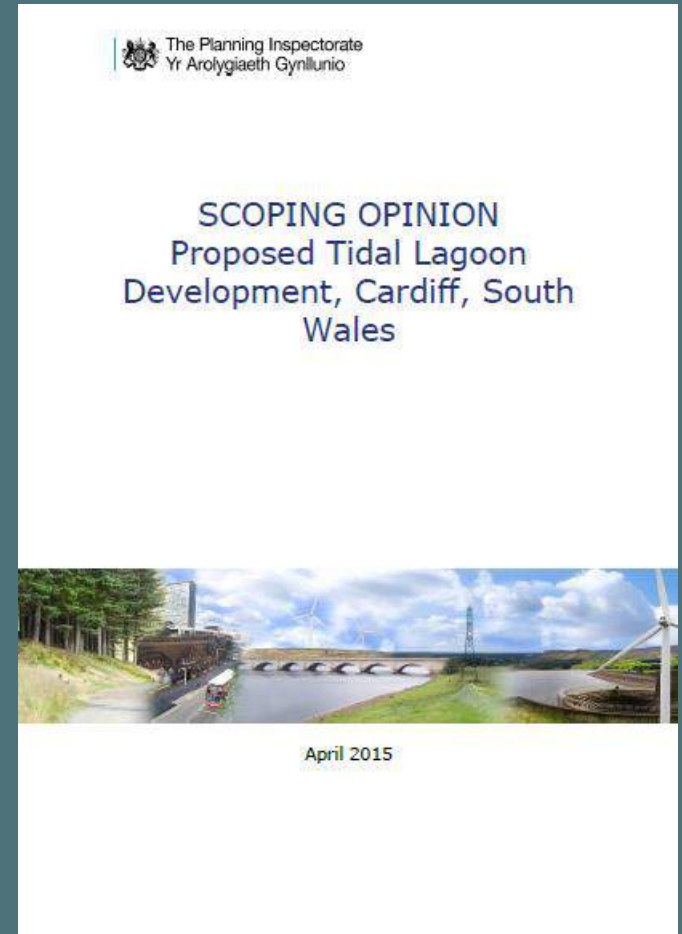


Figures are based on a single indicative design iteration and are not necessary representative of any scheme that may be developed

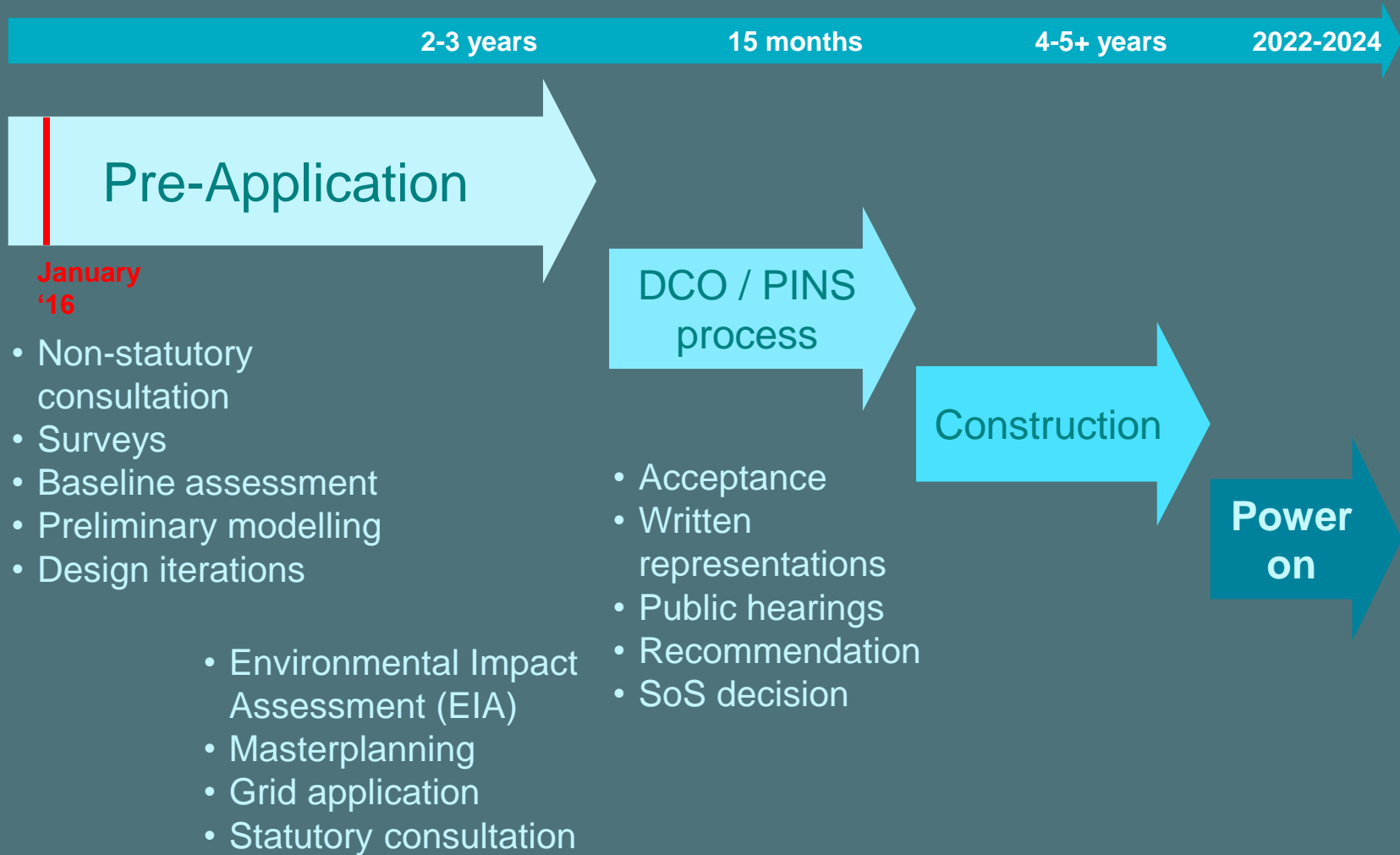
How are we addressing issues?

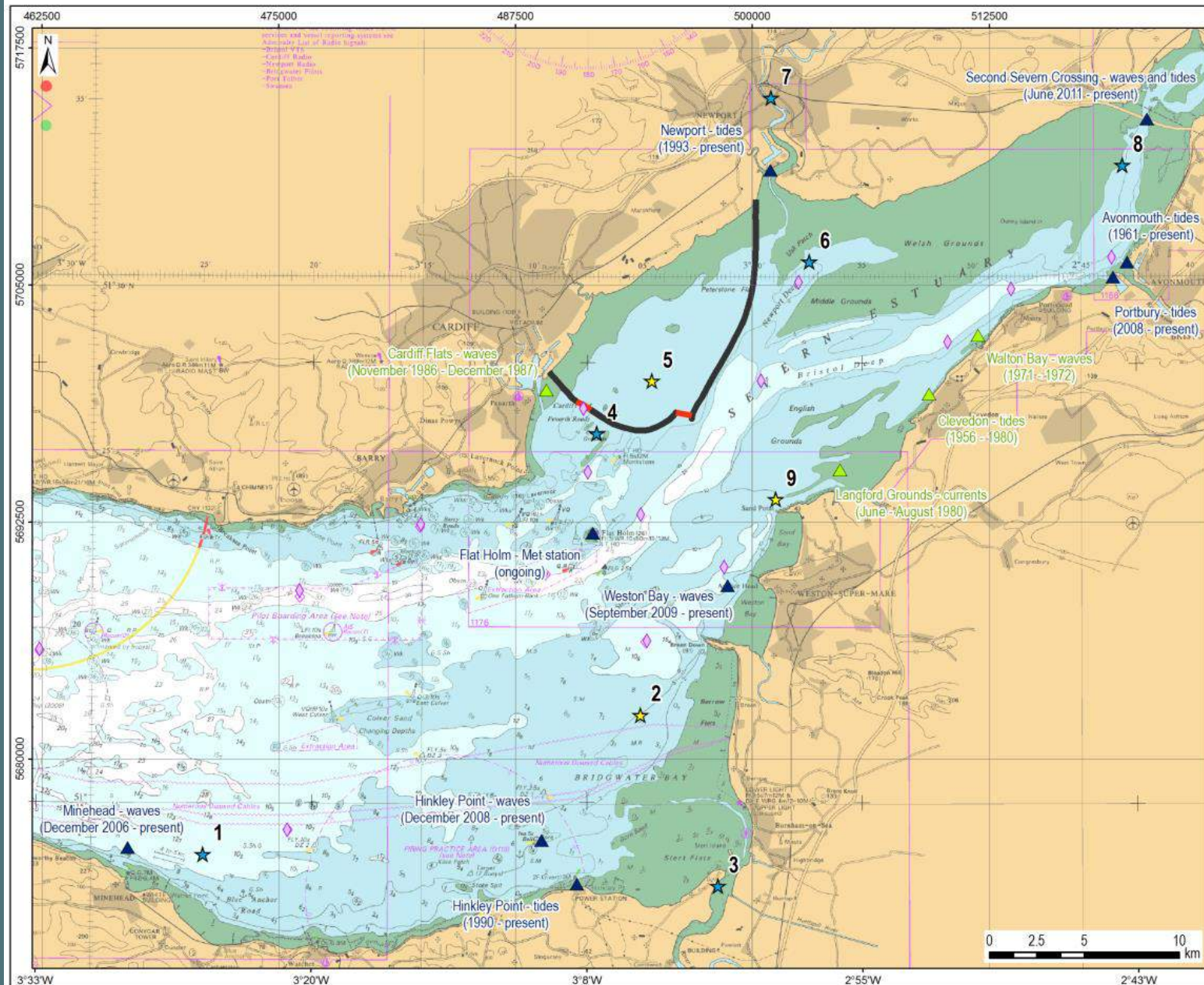
Evidence Plan Process - HRA

- Steering Group – NRW, EA, NE, MMO, PINS
- Expert Topic Groups
 - Coastal Processes
 - Modelling Work Plan
 - Data Plan
 - Primary Data
 - Previous Studies
- Water Quality
- Coastal Birds
- Fish
- Marine mammals
- Subtidal and intertidal habitats
- HRA/Compensation
- WFD



EIA programme





- Proposed lagoon location
- Sluice & turbine locations
- ◆ UKHO tidal stream

Titan deployments

- ★ 1 month
- ★ 6 months

Oceanographic survey

deployment locations (1 to 9):

2, 5 and 9 - deployed for 6 months

1, 3, 4, 6 to 8 - deployed for 1 month

- ▲ Ongoing monitoring
- ▲ Past measurements

Date	By	Size	Version
Sep 15	AMF	A4	1
Coordinate System			
WGS1984 UTM Zone 30N			
Projection			
Transverse Mercator			
Scale			
1:275,000			
QA			
WSC			
002_Fig_Location_Map_v4.mxd			
Produced by ABPmer			

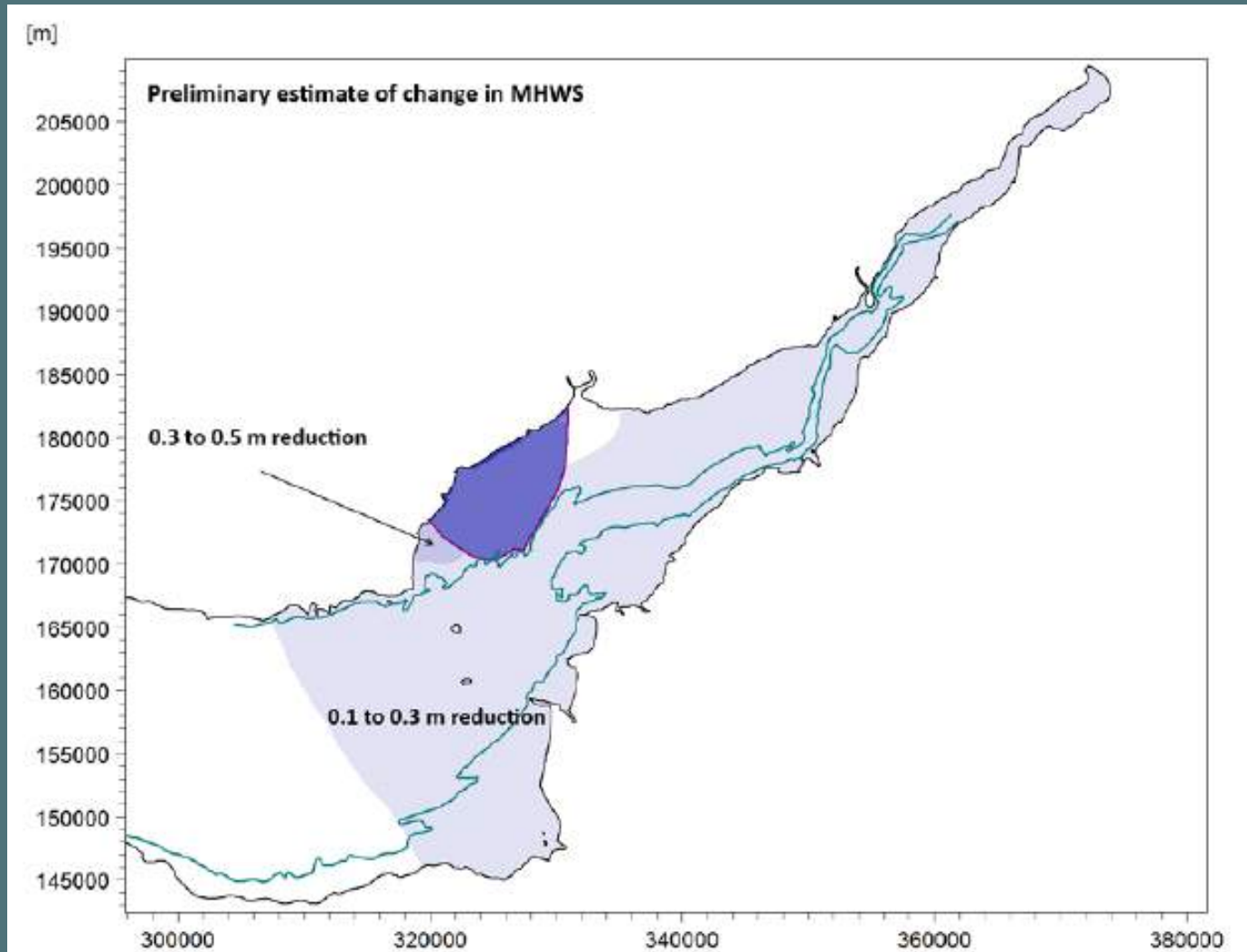
© ABPmer. All rights reserved, 2015
Charts obtained under licence from OceanWise
NOT TO BE USED FOR NAVIGATION



Study Area

Figure 8.1

Coastal Processes – Tidal Lagoon Cardiff: Water Level Changes



Coastal Processes – Tidal Lagoon Cardiff: Flow Speed Changes

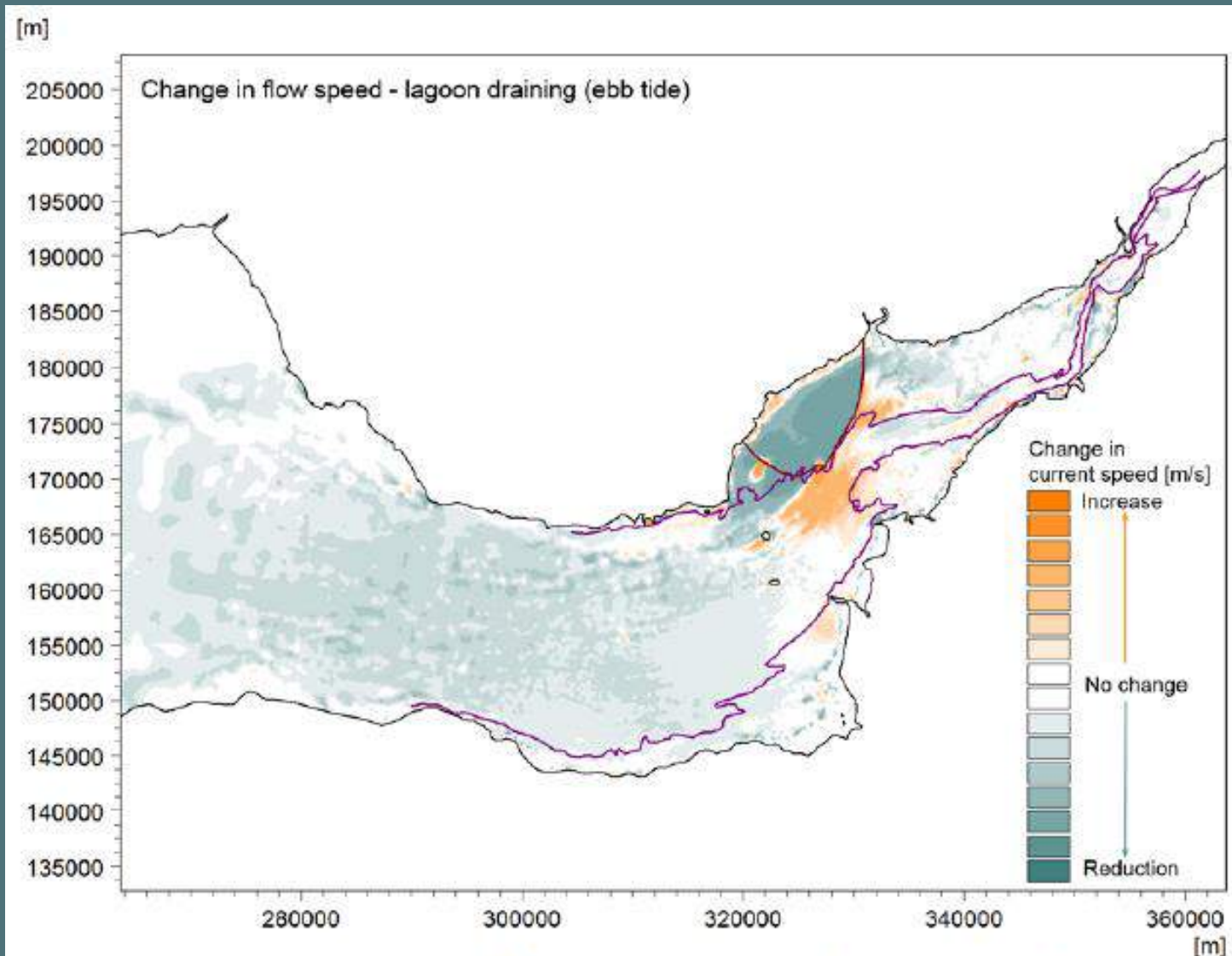
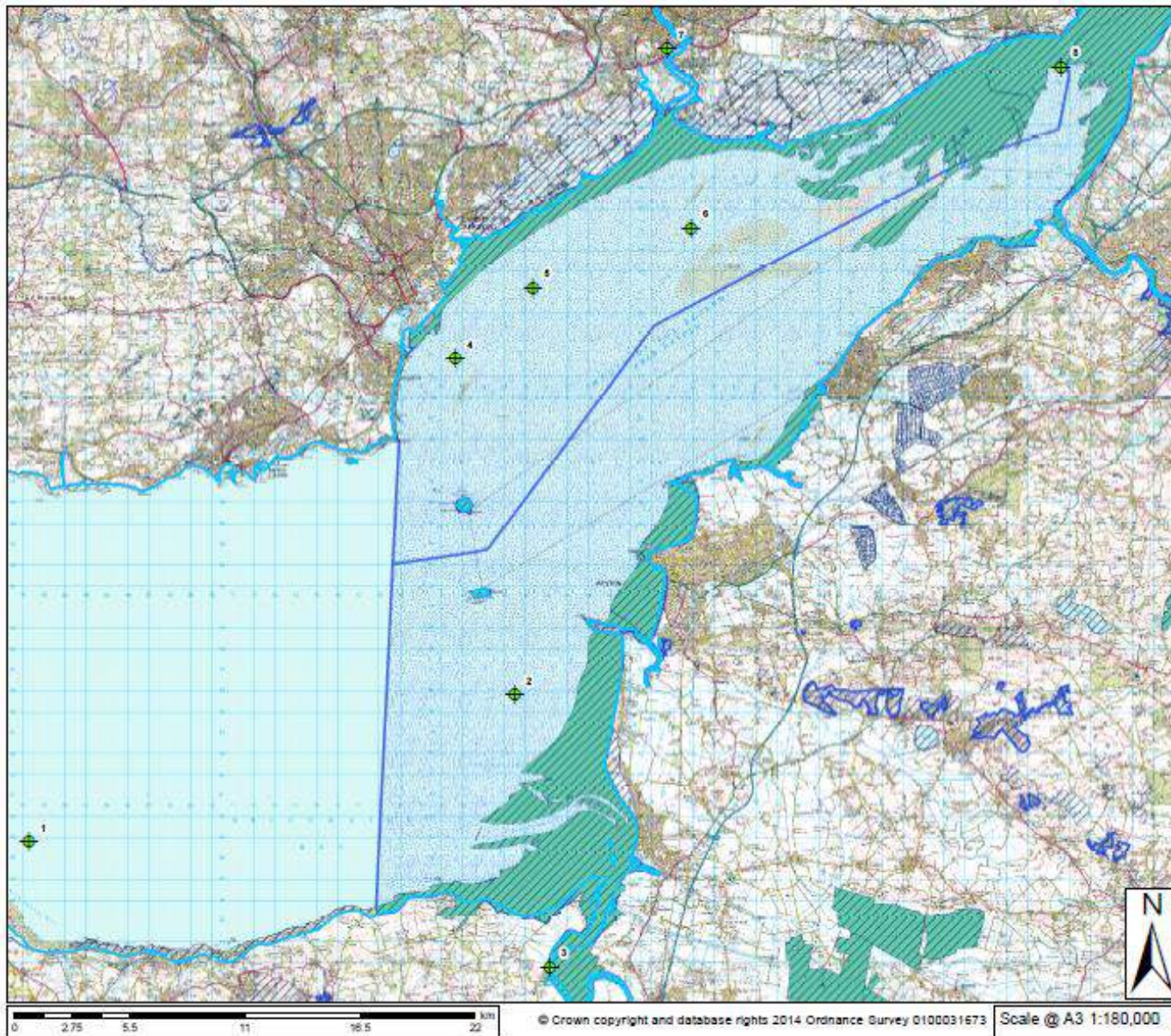


Figure 8.3 Preliminary estimate of predicted changes to flood and ebb flow speed from the Project.

Coastal Birds – SPA



- Deployment Site
- Mean High Water
- SSSI
- SPA
- SAC

SEVERN ESTUARY
ENVIRONMENTAL DESIGNATIONS

MARINE LICENCE SAMPLE LOCATIONS

Date DEC 2014	Drawn By SC
Drawing No. TLP-141201-B	Issue 1



© Crown copyright and database rights 2014 Ordnance Survey 0100031673

Scale @ A3 1:180,000

Coastal Birds

- **2014/15 - Survey of Cardiff and Newport** – Link Ecology – High tide, Mid tide, Low tide
- **2015/16 – Full survey of Severn SPA** (Cardiff, Newport and Bridgwater areas covered) – BTO/Link Ecology
- **2015/16 – Bird tagging and tracking study for Cardiff** – how do birds use the estuary/freshwater habitats? BTO/WWT
- **Benthic Invertebrates** – Sampling to inform Individual Based Modelling (IBM) – 200 locations throughout the estuary



Coastal Birds – SPA



Curlew (photo Lucy Wright, BTO)



Redshank (photo Emily Scragg, BTO)

Coastal Birds – SPA



- Curlew, redshank, shelduck, shoveler – tagging and ringing
- Dunlin – dye-marking



Coastal Birds – Curlew



Coastal Birds – Redshank



Coastal Birds – Shelduck

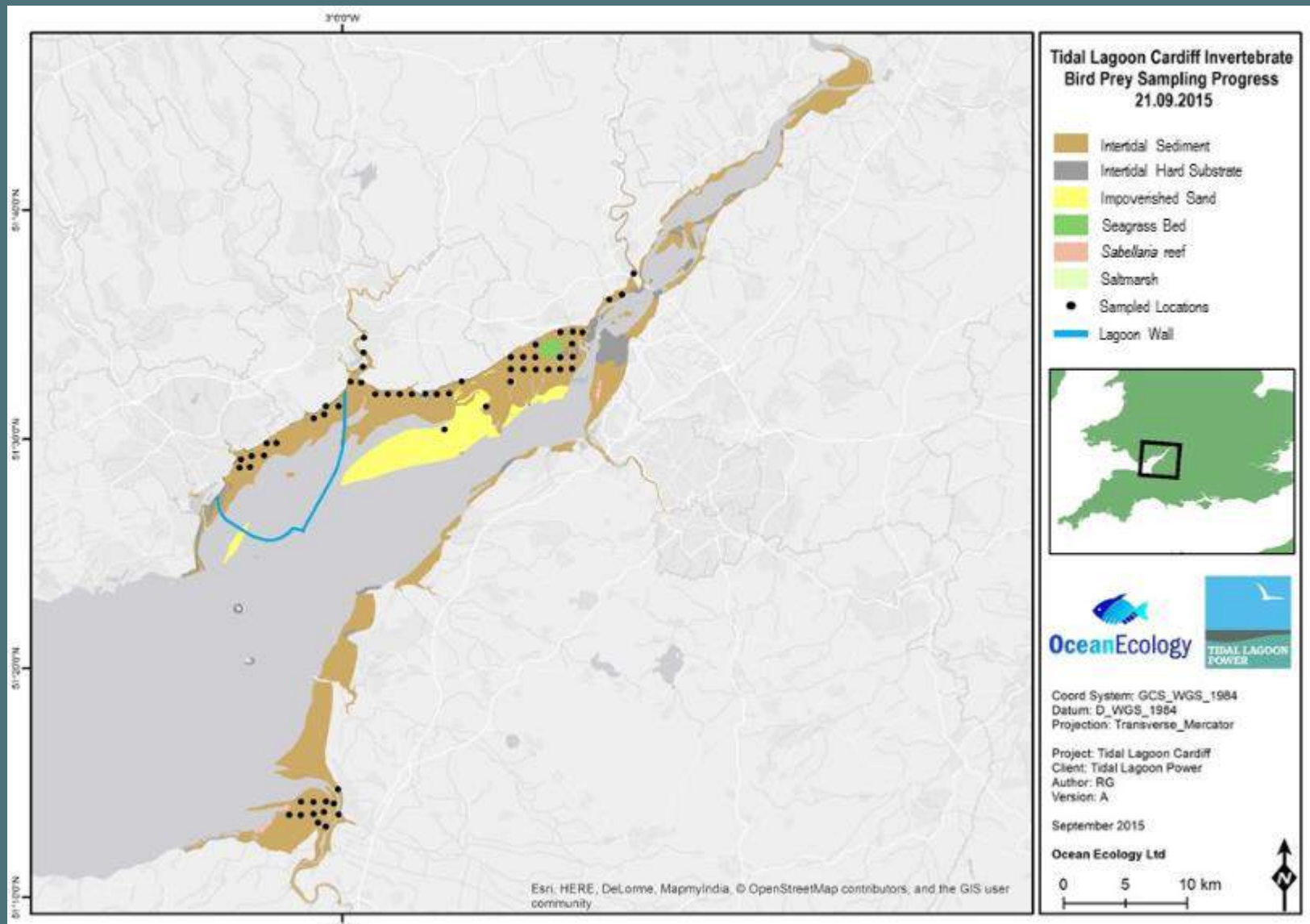


Fish, Benthic Invertebrates and Marine Mammals

- **Intertidal and subtidal fish surveys**
Quarterly surveys, beam and otter trawl - elver surveys, electrofishing key watercourses
- **Benthic Invertebrates** – April 2016, benthic invertebrate sampling (Water Framework Directive), Aerial photography biotope mapping Sept 2015
- **Marine mammals** – looking at aerial visual surveys and CPOD deployments (covering Severn Estuary) – approach to be agreed



Coastal birds – Invertebrate sampling 2015



Coastal birds – Invertebrate sampling 2015



Coastal birds – Invertebrate sampling 2015





ecosystems
enhancement
programme

Vision:

To have enhanced biodiversity, through a targeted nature conservation programme, alongside the generation of large-scale clean energy by 2030.

The EEP aims to:

- Have a net positive effect on biodiversity conservation.
- Address the compensation and ecosystem-scale mitigation requirements TLP anticipate will arise from tidal lagoon development.
- Foster innovative and collaborative partnerships to deliver conservation action in the UK, EU and globally.



Flocks of Wigeon and Common Teal flying over flooded marshes; Greylake RSPB reserve, Somerset Levels

EEP strategic objectives:

- A. Maintain and enhance the intertidal and subtidal resource in and associated with TLP's lagoons.
- B. Restore and create new wetland sites to maximise biodiversity and afford opportunities for climate adaptation, flood protection, the historic environment, tourism and education.
- C. Support restoration efforts for migratory and resident fish and birds through collaborative partnerships with local and global nature conservation organisations.
- D. Deliver targeted enhancement initiatives for relevant features listed under the Habitats Directive/IUCN Red List Species/UK BAP priority species, supporting local and European-scale biodiversity conservation.
- E. Enable changes in land management practices to support biodiversity and water quality improvements.
- F. Establish long term funding mechanisms to support the delivery of the EEP.



Wallasea Island (Alfleets Marsh) Managed Realignment

Thank you for listening!

<http://www.tidallagoonswanseabay.com>

<http://www.tidallagooncardiff.com/>

<http://www.tidallagoonpower.com/>

<http://www.tidallagoonswanseabay.com/the-project/film/107/>